LOW-LEVEL RADIATION

Biological Interactions, Risks, and Benefits

A Bibliography

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Hugh Kinser

Authorizing Official
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INTRODUCTION

In view of the controversial nature of the subject of low-level radiation effects, and the current public interest in environmental and occupational exposure to such radiation, it appeared appropriate to publish at this time a single document containing a relatively exhaustive listing of recent publications on the subject. Special impetus for preparing and issuing the bibliography came from the public interest expressed at the March 1978 and June 1978 public meetings held on the subject of the Options Study for the Western New York Nuclear Service Center.

The 3294 references in this bibliography were selected from the Department of Energy's computerized Energy Data Base (EDB) using the RECON on-line retrieval system.

The data base is maintained by the DOE Technical Information Center (TIC) and covers all aspects of energy. The subject of the search that yielded this bibliography was, generally, lower-level radiation effects on man, environmental radiation, and other biological interactions of radiation that appear to be applicable to the low-level radiation problem. It is realized that some of the references deal with higher-dose irradiation. In particular, references to publications concerned with radiation accidents were intentionally included in the bibliography, regardless of dose levels involved.

The bibliography contains only the most recent additions to the data base—those added since July 1976. Such limitation was necessary to keep the publication to a manageable size. It is estimated that there are over 40,000 references on this subject in computer-searchable files developed by, and available through TIC. However, many of these deal with higher-dose effects, as in side effects of radiotherapy, etc. These computer files contain worldwide coverage of the literature back to 1962, but contain abstracts for only the later entries. In addition, many hundreds of references on the subject can be located in the early issues of *Nuclear Science Abstracts*, a journal formerly published by TIC.

Arrangement of the references is in reverse order by date of publication, listing the more recent publications first.

Each bibliographic citation is followed by either an abstract or the subject descriptors used in indexing the publication; in some cases, a phrase or sentence is added to the descriptors to elaborate the title.

Four indexes are provided: Corporate, Author, Subject, and Report Number.

The Corporate Index is an alphabetic listing of the names of organizations or institutions responsible for issuing the reports. Each entry gives the report title and the citation number. Report numbers are given in parentheses at the end of the entry.

The Author Index is made up of an alphabetic listing of all authors of references. The authors' names are followed by the titles of the documents and citation numbers. For documents having multiple authors, the second and succeeding authors are referenced to the first author.

The Subject Index is an alphabetic listing of the more significant subject descriptors chosen to describe the document content. In most instances the subject descriptors are entered in pairs separated by a slash mark, and the second term has been selected to more specifically delineate the first. Each subject entry is then followed by the title of the document, the elaborating phrase, if used, and the citation number.

The Report Number Index is an alphanumeric listing of report numbers. The report numbers are followed by the citation numbers and by availability statements that include all known information related to the public availability and price of the reports.

Of related interest are the following two earlier bibliographies published by TIC. These publications are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161.

Occupational Health Aspects of Uranium--A Selected Bibliography
(TID-3352). (Contains 716 citations.)

Human Radiation Dose Studies--A Selected Bibliography (TID-3348).
(Contains 1010 references.)

If problems are encountered in obtaining journals or reports, assistance will be provided by the U. S. Department of Energy, Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

REFERENCES

- 1 ALTERATIONS IN WHOLE SALIVA FLOW RATE INDUCED BY FRACTIONATED RADIOTHERAPY. Wescott, W.B. (Veterans Administration Hospital, Houston, TX); Mira, J.G.; Starcke, E.N.; Shannon, I.L.; Thornby, J.L. *Am. J. Roentgenol.*; 130: 145-149 (Jan 1978).
Sequential changes in flow rate of whole saliva are detailed in 13 patients. Samples were collected without exogenous stimulation during a course of fractionated raditherapy involving major portions of the salivary glands. Flow rate decreased markedly during the initial 3 treatment days and gradually thereafter until a minimal flow rate was reached. Early in the treatment, variable degrees of recovery were seen on Mondays following a weekend (Friday-Sunday) without treatment. After a minimal flow rate was reached, no such recovery was observed. Radiation needed to produce minimal flow varied. Patients with higher initial flow rates required higher dosages to reach the minimum. No return of secretory function was noted after extended periods of time.
- 2 DOSE TO THE METAPHYSEAL GROWTH COMPLEXES IN CHILDREN UNDERGOING /SUP 99M/TC-EHDP BCNE SCANS. Thomas, S.R.; Gelfand, M.J.; Kerelakes, J.G.; Ascoli, F.A.; Maxon, H.R.; Saenger, E.L.; Feller, P.A.; Sodd, V.J.; Paras, P. (General Hospital, Cincinnati). *Radiology*; 126: No. 1, 193-195 (Jan 1978).
From 62. Scientific Assembly and Annual Meeting of the Radiological Society of North America; Chicago, IL, USA (14 Nov 1976).
The spatial and temporal distribution of radionuclides in children may differ greatly from that accepted for adults. Following injection of a bone-seeking agent (/sup 99m/Tc-EHDP), radioactivity in the metaphyseal growth complexes of the distal femur and proximal tibia was quantitated in a series of children 4 to 16 years of age, using a gamma camera/computer system. The dose to the growth plate was found to range from 0.8 to 4.7 rads when adjusted to an administered activity of 200 μ ci/kg, compared to approximately 0.6 rad to the adult skeleton for a corresponding study.
- 3 (DOCKET-50259--1001) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. IE INSPECTION REPORT NO. 76-23, -23, AND -21 (ROUTINE, UNANNOUNCED RE INFRACTIONS PER 10CFR50-B-XVI, TS 6.1.F, 6.3.D, AND 3.2.E); REPLIES; ACKNOWLEDGMENT. (Tennessee Valley Authority, Chattanooga (USA)). 23 Dec 1977. vp. (DOCKET-50260--766; DOCKET-50296--463).
Inspection of training, posting, labeling, control, instruments and equipment, radiation exposure control, start-up testing and CRDs.
- BROWNS FERRY-1 REACTOR; BROWNS FERRY-2 REACTOR; BROWNS FERRY-3 REACTOR; INSPECTION; CONTROL ELEMENTS; SCRAM; QUALITY ASSURANCE; RADIATION PROTECTION; PERSONNEL; EDUCATION; CONDENSATION CHAMBERS; ALARM SYSTEMS; FEEDWATER HEATERS; RADIATION MONITORS; MOISTURE; LEAKS; RADIATION DOSES; EQUIPMENT; CONTROL; REACTOR START-UP; CONTROL ROD DRIVES; TESTING
- 4 ONTOGENY OF THYMIC INDEPENDENT ANTIBODY RESPONSES IN VITRO IN NORMAL MICE AND MICE WITH AN X-LINKED B CELL DEFECT. Mosier, D.E.; Mond, J.J.; Goldings, E.A. (National Inst. of Health, Bethesda, MD). *J. Immunol.*; 119: No. 6, 1874-1878 (Dec 1977).
The primary in vitro antibody response of neonatal spleen cells to three thymic independent antigens has been examined. The time of onset of responsiveness to TNP-Brucella abortus and TNP-lipopolysaccharide was significantly earlier than the onset of responsiveness to TNP-Ficoll. This ontologic sequence was not affected by T cell depletion or antigen presentation on adult macrophages. In neonatal mice bearing the X-linked CBA/N defect, the response to TNP-Brucella abortus and TNP-lipopolysaccharide was much delayed and no response to TNP-Ficoll developed. We conclude that different thymic independent antigens address different subpopulations of B cells, one of which appears earlier in ontogeny than the other.
- 5 INFLUENCE OF BONE ON 45 MV PHOTON DOSE DISTRIBUTIONS. McLaren, J.R.; Kirchner, A.B.; McGinley, P.H. (Emory Univ. Clinic, Atlanta). *Radiology*; 125: No. 3, 817-820 (Dec 1977).
In an attempt to assess the perturbation of 45 MV depth dose curves by bone we have studied the dose distribution in a water phantom equipped with various thicknesses of bone-equivalent plastic. An increased dose was observed immediately behind the bone material and a reduced dose was found for points located greater than 5 cm behind the bone-equivalent plastic. The most significant change of the depth dose curve was produced by bone located in the dose build-up region.
- 6 SLIPPED FEMORAL CAPITAL EPIPHYSIS AS A SEQUELA TO CHILDHOOD IRRADIATION FOR MALIGNANT TUMORS. Wolf, E.L.; Berdon, W.E.; Cassady, J.R.; Baker, D.H.; Freiburger, R.; Pavlov, H. *Radiology*; 125: No. 3, 781-784 (Dec 1977).
Five cases of slipped femoral capital epiphysis were noted in children with prior irradiation for malignancy whose femoral head and neck had been included in the radiation portal. Three of the 5 were patients who had lymphoma. As a result of increasing survival rates for these types of patients, this

previously unrecognized radiation-related growth disturbance may be more likely to be seen in the future.

- 7 PRELIMINARY RESULTS USING TWICE-A-DAY FRACTIONATION IN THE RADIOTHERAPEUTIC MANAGEMENT OF ADVANCED CANCERS OF THE HEAD AND NECK. Jampolis, S.; Pipard, G.; Horict, J.C.; Bolla, M.; Le Dorze, C. (Centre Georges-Francois Leclerc, Dijon, France). Am. J. Roentgenol.; 129: No. 6, 1091-1093(Dec 1977).

Twenty-four cases of advanced T4 cancers of the head and neck were treated using a twice-a-day treatment fractionation delivering a 1,200 rad weekly tumor dose and 7,000 rad total tumor dose in 5 1/2 to 6 weeks. Acute normal mucosal reactions and skin reactions were plotted weekly and corresponded to reactions observed when delivering 1,000 rad per week in five treatment sessions. Chronic problems have been limited to severe neck fibrosis appearing in three of five patients who underwent a planned neck dissection 6 weeks after the completion of radiotherapy. Local control was observed in 14 of 23 patients (61%) and regional control in 22 of 23 patients (96%).

- 8 EVALUATION OF RADIATION THERAPY FOR BONE METASTASES: PAIN RELIEF AND QUALITY OF LIFE. Gilbert, H.A. (Southern California Permanente Medical Center, Los Angeles); Kagan, A.R.; Nussbaum, H.; Rao, A.R.; Satzman, J.; Chan, P.; Allen, B.; Forsythe, A. Am. J. Roentgenol.; 129: No. 6, 1095-1096(Dec 1977).

The records of 158 patients irradiated for bone metastases were reviewed to evaluate the effectiveness of pain relief and to judge the effect of treatment on overall quality of life. Within 3 months 73% of the sites treated had pain relief, with 55 to 65% having sustained relief up to 1 year or death. Of patients surviving more than 3 months, 63% maintained a satisfactory quality of life and were able to take care of most personal needs. The median survival of all patients was 1 year from initial treatment for bone metastasis. Radiation dose and the primary tumor site do not seem to be significant prognostic factors for initial pain relief or quality of life.

- 9 THYMIC IRRADIATION AND CHRONIC MYELOGENOUS LEUKEMIA. Shimaoka, K.; Sokal, J.E. (Roswell Park Memorial Inst., Buffalo). N.Y. State J. Med.; 2226-2230(Dec 1977).

Two cases of Ph positive chronic myelogenous leukemia with a history of thymic irradiation are presented. Both patients received radiation therapy from low voltage x-ray equipment at two to three months of age. Leukemia developed 18 and 22 years later. Presentation, response to antileukemic therapy, and clinical course did not differ from that of other patients with this disease treated in our department.

- 10 (DOCKET-50272--528) SALEM NUCLEAR GENERATING STATION, UNIT 1. IE CIRCULAR NO. 77-14: SEPARATION OF CONTAMINATED WATER SYSTEMS FROM NONCONTAMINATED PLANT SYSTEMS. (Public Service Electric and Gas Co., Newark, N.J. (USA)). 28 Nov 1977. vp.

IE circular 77-15: Separation of contaminated water systems from noncontaminated plant systems. SALEM-1 REACTOR; DRINKING WATER; CONTAMINATION; REACTOR COOLING SYSTEMS; PRIMARY COOLANT CIRCUITS; COOLANTS; STORAGE; TANKS; VALVES; DESIGN; ERRORS; PERSONNEL; RADIATION DOSES; TRITIUM; ACTIVITY LEVELS

- 11 (DOCKET-50395--151) VIRGIL C. SUMMER

NUCLEAR STATION, UNIT 1. IE CIRCULAR NO. 77-14: SEPARATION OF CONTAMINATED WATER SYSTEMS FROM NONCONTAMINATED PLANT SYSTEM. (South Carolina Electric and Gas Co., Columbia (USA)). 28 Nov 1977. vp.

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- 12 (DOCKET-50400--219) SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 1, 2, 3, AND 4. IE CIRCULAR NO. 77-14: SEPARATION OF CONTAMINATED WATER SYSTEMS FROM NONCONTAMINATED PLANT SYSTEM. (Carolina Power and Light Co., Raleigh, N.C. (USA)). 28 Nov 1977. vp. (DOCKET-50401--217; DOCKET-50402--215; DOCKET-50403--216).

IE circular 77-14: separation of contaminated water systems from noncontaminated plant system. HARRIS-1 REACTOR; HARRIS-2 REACTOR; HARRIS-3 REACTOR; HARRIS-4 REACTOR; DRINKING WATER; CONTAMINATION; TRITIUM; PERSONNEL; RADIATION DOSES; TANKS; ACTIVITY LEVELS; LOSS OF COOLANT; REACTOR ACCIDENTS; ECCS; ENVIRONMENT

- 13 (DOCKET-50409--596) LACROSSE BOILING WATER REACTOR. IE CIRCULAR NO. 77-14: SEPARATION OF CONTAMINATED WATER SYSTEMS FROM NONCONTAMINATED PLANT SYSTEM. (Dairyland Power Cooperative, La Crosse, Wis. (USA)). 28 Nov 1977. vp.

IE circular 77-14: separation of contaminated water systems from noncontaminated plant system. LACBWR REACTOR; DRINKING WATER; CONTAMINATION; REACTOR COOLING SYSTEMS; PRIMARY COOLANT CIRCUITS; COOLANTS; PERSONNEL; RADIATION DOSES; ACTIVITY LEVELS; STORAGE; TANKS; VALVES; DESIGN; ERRORS; TRITIUM

- 14 (DOCKET-50413--165) CATAWBA NUCLEAR STATION, UNITS 1 AND 2. IE CIRCULAR NO. 77-14: SEPARATION OF CONTAMINATED WATER SYSTEMS FROM NONCONTAMINATED PLANT SYSTEM. (Duke Power Co., Charlotte, N.C. (USA)). 28 Nov 1977. vp. (DOCKET-50414--162).

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- 15 (DOCKET-50416--233) GRAND GULF NUCLEAR STATION, UNITS 1 AND 2. IE CIRCULAR NO. 77-14: SEPARATION OF CONTAMINATED WATER SYSTEMS FROM NONCONTAMINATED PLANT SYSTEM. (Mississippi Power and Light Co., Jackson (USA)). 28 Nov 1977. vp. (DOCKET-50417--232).

IE circular 77-14: separation of contaminated water systems from noncontaminated plant system. GRAND GULF-1 REACTOR; GRAND GULF-2 REACTOR; DRINKING WATER; CONTAMINATION; PRIMARY COOLANT CIRCUITS; COOLANTS; TRITIUM; RADIATION DOSES; PERSONNEL; ACTIVITY LEVELS; TANKS; STORAGE; VALVES; OPERATION; DESIGN; ERRORS

- 16 (DOCKET-50424--130) ALVIN W. VOGTLE NUCLEAR PLANT, UNITS 1 AND 2. IE CIRCULAR NO. 77-14: SEPARATION OF CONTAMINATED WATER SYSTEMS FROM NONCONTAMINATED PLANT SYSTEM. (Georgia Power Co., Atlanta (USA)). 28 Nov 1977. vp. (DOCKET-50425--126).

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DRINKING WATER;CONTAMINATION;PRIMARY COOLANT
CIRCUITS;COOLANTS;TRITIUM;PERSONNEL;RADIATION
DOSES;ACTIVITY LEVELS;STORAGE;TANKS;VALVES;
DESIGN;ERRORS
- 17 (DOCKET-50425--1088) MILLSTONE NUCLEAR
POWER STATION, UNITS 1, 2, AND 3. IE CIRCULAR
NO. 77-14: SEPARATION OF CONTAMINATED WATER
SYSTEMS FROM NONCONTAMINATED PLANT SYSTEMS.
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819; DOCKET-50423--201).
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contaminated water systems from noncontaminated
plant systems. MILLSTONE-1 REACTOR;MILLSTONE-2
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COOLANT CIRCUITS;TANKS;VALVES;OPERATION;
PERSONNEL
- 18 (DOCKET-50456--151) BRAIDWOOD STATION,
UNITS 1 AND 2. IE CIRCULAR NO. 77-14:
SEPARATION OF CONTAMINATED WATER SYSTEMS FROM
NONCONTAMINATED PLANT SYSTEM. (Commonwealth
Edison Co., Chicago, Ill. (USA)). 28 Nov
1977. vp. (DOCKET-50457--151).
IE circular 77-14: separation of
contaminated water systems from noncontaminated
plant system. BRAIDWOOD-1 REACTOR;BRAIDWOOD-2
REACTOR;DRINKING WATER;CONTAMINATION;PRIMARY
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DESIGN;ERRORS;RADIATION DOSES;PERSONNEL;TRITIUM;
ACTIVITY LEVELS
- 19 (DOCKET-STN-50488--144) THOMAS L.
PERKINS NUCLEAR STATION, UNITS 1, 2, AND 3.
IE CIRCULAR NO. 77-14: SEPARATION OF
CONTAMINATED WATER SYSTEMS FROM NONCONTAMINATED
PLANT SYSTEM. (Duke Power Co., Charlotte,
N.C. (USA)). 28 Nov 1977. vp. (DOCKET-STN-
50489--142; DOCKET-STN-50490--141).
IE circular 77-14: Separation of
contaminated water systems from noncontaminated
plant system. PERKINS-1 REACTOR;PERKINS-2
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CONTAMINATION;PERSONNEL;RADIATION DOSES;TRITIUM;
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- 20 (DOCKET-STN-50491--152) CHEROKEE NUCLEAR
STATION, UNITS 1, 2, AND 3. IE CIRCULAR NO.
77-14: SEPARATION OF CONTAMINATED WATER
SYSTEMS FROM NONCONTAMINATED PLANT SYSTEM.
(Duke Power Co., Charlotte, N.C. (USA)). 28
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DOCKET-STN-50493--151).
IE circular 77-14: Separation of
contaminated water systems from noncontaminated
plant system. CHEROKEE-1 REACTOR;CHEROKEE-2
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- 21 (DOCKET-50458--136) RIVER BEND STATION,
UNITS 1 AND 2. IE CIRCULAR NO. 77-14:
SEPARATION OF CONTAMINATED WATER SYSTEMS FROM
NONCONTAMINATED PLANT SYSTEM. (Gulf States
Utilities Co., Beaumont, Tex. (USA)). 22 Nov
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IE circular 77-14: separation of
contaminated water systems from noncontaminated
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- ERRORS;TRITIUM;PERSONNEL;RADIATION DOSES;
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- 22 (DOCKET-50460--162) WPPSS NUCLEAR
PROJECT, NOS. 1 AND 2. IE CIRCULAR NO. 77-14:
SEPARATION OF CONTAMINATED WATER SYSTEMS FROM
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Public Power Supply System, Richland (USA)).
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CIRCUITS;COOLANTS;PERSONNEL;RADIATION DOSES;
TRITIUM;ACTIVITY LEVELS;TANKS;STORAGE;VALVES;
DESIGN;ERRORS
- 23 (DOCKET-STN-50482--215) WOLF CREEK
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77-14: SEPARATION OF CONTAMINATED WATER
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plant system. WOLF CREEK-1 REACTOR;DRINKING
WATER;CONTAMINATION;REACTOR COOLING SYSTEMS;
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- 24 (DOCKET-STN-50498--220) SOUTH TEXAS
PROJECT, UNITS 1 AND 2. IE CIRCULAR NO. 77-14:
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plant system. SOUTH TEXAS PROJECT-1 REACTOR;
SOUTH TEXAS PROJECT-2 REACTOR;DRINKING WATER;
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COOLANT CIRCUITS;RADIATION DOSES;PERSONNEL;
TRITIUM;ACTIVITY LEVELS
- 25 (DOCKET-50413--162) CATAWBA NUCLEAR
STATION, UNITS 1 AND 2. IE BULLETIN NO. 77-04:
CALCULATIONAL ERROR AFFECTING THE DESIGN
PERFORMANCE OF A SYSTEM FOR CONTROLLING PH OF
CONTAINMENT SUMP WATER FOLLOWING A LOCA.
(Duke Power Co., Charlotte, N.C. (USA)). 4
Nov 1977. vp. (DOCKET-50414--159).
IE bulletin 77-04: Calculational error
affecting the design performance of a system
for controlling pH of containment sump water
following a LOCA. CATAWBA-1 REACTOR;CATAWBA-2
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ACCIDENTS;LOSS OF COOLANT;CONTROL;SODIUM
PHOSPHATES;QUANTITY RATIO;VOLUME;PERSONNEL
- 26 (GJT--6) ENGINEERING ASSESSMENT OF
INACTIVE URANIUM MILL TAILINGS, DURANGO SITE,
DURANGO, COLORADO. PHASE II, TITLE I.
(Ford, Bacon and Davis Utah, Inc., Salt Lake
City (USA)). Nov 1977. Contract EY-76-C-13-
1658. 202p. Dep. NTIS, PC A10/MF A01.
Ford, Bacon and Davis Utah Inc. has
performed an engineering assessment of the
problems resulting from the existence of
radioactive uranium mill tailings at Durango,
Colorado. The Phase II, Title I services
include the preparation of topographic maps,
the performance of core drillings and
radiometric measurements sufficient to
determine areas and volumes of tailings and
other radium-contaminated materials, the
evaluation of resulting radiation exposures of

individuals and nearby populations, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the 1.555 million tons of tailings at the Durango site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The eight alternative actions presented range from vegetative stabilization (Option I), to contouring and stabilizing in-place with varying depths of cover material (Options II and III), to removal to an isolated long-term disposal site (Options V to VIII). All options include remedial action costs for offsite locations where tailings have been placed. Costs estimated for the eight options range from \$4,340,000 to \$13,590,000. Reprocessing the tailings for uranium is sufficiently economically attractive to justify reprocessing in conjunction with each of the options.

- 27 (GJT--6S) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, DURANGO SITE, DURANGO, COLORADO. A SUMMARY OF THE PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Nov 1977. Contract EY-76-C-13-1658. 56p. Dep. NTIS, PC A04/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Durango, Colorado. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the 1.555 million tons of tailings at the Durango site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The eight alternative actions presented range from vegetative stabilization (Option I), to contouring and stabilizing in-place with varying depths of cover material (Options II and III), to removal to an isolated long-term disposal site (Options V to VIII). All options include remedial action costs for offsite locations where tailings have been placed. Costs estimated for the eight options range from \$4,340,000 to \$13,590,000. Reprocessing the tailings for uranium is sufficiently economically attractive to justify reprocessing in conjunction with each of the options.

- 28 (GJT--8) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, NATURITA SITE, NATURITA, COLORADO. PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Nov 1977. Contract EY-76-C-13-1658. 153p. Dep. NTIS, PC A08/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Naturita, Colorado. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings sufficient to determine areas and volumes of tailings, the performance of radiometric measurements to determine the extent of radium contamination, the evaluation of resulting radiation exposures of individuals and nearby populations, the

investigation of site hydrology and meteorology, and the costing of alternative corrective actions. Radon gas release from the 704,000 tons of tailings at the Naturita site constitutes the most significant environmental impact although windblown tailings and external gamma radiation are also factors. Ranchers Exploration and Development Company has been licensed by the State of Colorado to reprocess the tailings at a location 3 mi from the present site where they will be stabilized for long-term storage. The remedial action options include remedial action for structures in Naturita and Nucla (Option I) at an estimated cost of \$270,000 and remedial action for structures and open land adjacent to the tailings site (Option II) at an estimated cost of \$950,000.

- 29 (GJT--8S) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, NATURITA SITE, NATURITA, COLORADO. A SUMMARY OF THE PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Nov 1977. Contract EY-76-C-13-1658. 51p. Dep. NTIS, PC A04/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Naturita, Colorado. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings sufficient to determine areas and volumes of tailings, the performance of radiometric measurements to determine the extent of radium contamination, the evaluation of resulting radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology, and the costing of alternative corrective actions. Radon gas release from the 704,000 tons of tailings at the Naturita site constitutes the most significant environmental impact although windblown tailings and external gamma radiation are also factors. Ranchers Exploration and Development Company has been licensed by the State of Colorado to reprocess the tailings at a location 3 mi from the present site where they will be stabilized for long-term storage. The remedial action options include remedial action for structures in Naturita and Nucla (Option I) at an estimated cost of \$270,000 and remedial action for structures and open land adjacent to the tailings site (Option II) at an estimated cost of \$950,000.

- 30 CURRENT STATUS OF CLINICAL PION RADIOTHERAPY. Kligerman, M.M.; Black, W.C.; Yuhas, J.M.; Doberneck, R.C.; Bradbury, J.N.; Kelsey, C.A. (Univ. of New Mexico, Albuquerque). Radiology; 125: No. 2, 489-492 (Nov 1977).

From 62. scientific assembly and annual meeting of the Radiological Society of North America on high LET radiation therapy; Chicago, IL, USA (14 Nov 1976).

An RBE for acute skin reaction to peak pions, for a specific fractionation scheme, has been established at 1.40 to 1.44. The time of development of acute skin reactions varied in 2 patients with 30 metastatic skin nodules treated with doses varying from 1,175 to 1,951 peak pions and 2,350 to 3,901 rads of 100 kVp x rays. The reactions reached their peak approximately one week apart at all dose levels with both forms of radiation. No untoward effects have been seen in epidermis or subcutaneous tissues as late as 169 days after the start of treatment. All nodules disappeared and have not returned 169 days after treatment. There is a strong suggestion that the response

of thick tumors is sensitive to the proportion of high LET radiation deposited at various levels in the tumor.

31 RADIOTHERAPY-INDUCED RIB OSTEOSARCOMA AFTER SUCCESSFUL TREATMENT OF LUNG CANCER.

Tewfik, H.; Tewfik, F.; Latourette, H.; Christie, J. (Univ. of Iowa Hospitals and Clinics, Iowa City). Radiology; 125: No. 2, 503-504(Nov 1977).

Radiation-induced osteogenic sarcoma is recognized as a long-term complication of radiation therapy. The authors report a case of rib osteosarcoma which developed after successful treatment of adenocarcinoma of the lung.

32 USE OF PHOTOGRAMMETRY IN TISSUE

COMPENSATOR DESIGN. I. PHOTOGRAMMETRIC DETERMINATION OF PATIENT TOPOGRAPHY. Renner, W.D.; O'Connor, T.P.; Amtey, S.R.; Reddi, P.R.; Bahr, G.; Kerelakes, J.G. (Community Hospital, Indianapolis). Radiology; 125: No. 2, 505-510(Nov 1977).

From 62. scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL, USA (14 Nov 1976).

The surface topography of a patient can be determined by photogrammetry before beginning radiotherapy. The source of light of the therapy unit or simulator is used to project a grid pattern onto the patient, and this is then photographed together with control points consisting of miniature light bulbs mounted on a frame suspended from the wedge slot of the therapy machine. When the photograph is projected onto a graphics terminal for data entry into a computer, the three-dimensional topography of the patient's surface can be reconstructed as a two-dimensional matrix of discrete points. A computer algorithm can then design a tissue compensator to fit the individual patient.

33 ONTOGENY OF B LYMPHOCYTE FUNCTION. IV.

KINETICS OF MATURATION OF B LYMPHOCYTES FROM FETAL AND NEONATAL MICE WHEN TRANSFERRED INTO ADULT IRRADIATED HOSTS. Sherr, D.; Szwczuk, M.R.; Siskind, G.W. (Cornell Univ. Medical Coll., New York). J. Immunol.; 119: No. 5, 1674-1679(Nov 1977).

Lethally irradiated mice reconstituted with adult T cells and neonatal or fetal B cells produce an anti-DNP response of restricted heterogeneity of affinity when compared with the response of mice reconstituted with T and B cells from adult donors. The capacity to reconstitute adult mice to give a heterogeneous response matures between 7 and 10 days after birth. The maturation of B cells from day-15 fetal or neonatal donors to produce a heterogeneous response was followed in the adult, cell transfer recipient by immunizing them at different times after cell transfer. It was found that B cells both from day-15 fetal mice and from neonatal mice acquire the capacity to produce a heterogeneous response within 3 days in the adult, cell transfer recipient. Thus, the B cell population matures more rapidly in the cell transfer recipient than in the intact donor. The kinetics of maturation in the adult recipient is the same for B cells from day-15 fetal and neonatal donors. The data imply that all information required to produce a fully heterogeneous response is already present in the day-15 fetus. In addition, the data strongly support the hypothesis that a factor in the adult mouse acts to induce this step in the maturation of the B lymphocyte population. Thus, the data seem to be inconsistent with the view that the

timing of the occurrence of this differentiation event is precoded in an internal cell clock in the B lymphocyte line. Clearly, B cells from day-15 fetal mice are already capable of differentiating in response to the inducing factor which is present in the adult animal.

34 HEPATIC UPTAKE OF TC-99M-LABELED

DIPHOSPHONATE IN AMYLOIDOSIS: CASE REPORT.

Vanek, J.A.; Cook, S.A.; Bukowski, R.M. (Cleveland Clinic). J. Nucl. Med.; 18: No. 11, 1086-1088(Nov 1977).

Hepatic uptake of a "bone-seeking" radionuclide, in a patient with biopsy-proven amyloidosis of the liver is described and discussed.

35 (DOCKET-50206--810) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. RESPONSES TO NRC RAI-CORRECTED TABLE RE CONTROL ROOM OPERATOR DOSES. (Southern California Edison Co., Rosemead (USA)). 26 Oct 1977. vp.

San Onofre Nuclear Generating Station, Unit 1, Responses to NRC RAI. SAN ONOFRE-1 REACTOR; CONTROL ROOMS; PERSONNEL; RADIATION DOSES; IODINE

36 STOMACH CANCER IN ATOMIC-BOMB SURVIVORS.

Nakamura, K. (Radiation Effects Research Foundation, Hiroshima and Nagasaki, Japan). Lancet; 2: No. 8043, 866-867(22 Oct 1977).

A-BOMB SURVIVORS; CARCINOGENESIS; DELAYED RADIATION EFFECTS; DOSE-RESPONSE RELATIONSHIPS; EPIDEMIOLOGY; HIROSHIMA; MORTALITY; NAGASAKI; NEOPLASMS; STOMACH; TIME DEPENDENCE; RADIOINDUCTION

37 (HASL--329) HEALTH AND SAFETY LABORATORY ENVIRONMENTAL QUARTERLY. FINAL TABULATION OF MONTHLY ⁹⁰Sr FALLOUT DATA: 1954--1976.

(Energy Research and Development Administration, New York (USA). Health and Safety Lab.). 1 Oct 1977. 405p. Dep. NTIS, PC A18/MF A01.

This report presents the monthly ⁹⁰Sr deposition data derived from a global network of stations started in 1954. This program was carried out to assess the distribution patterns and inventory the amount of fallout of radionuclides from atmospheric nuclear tests. In 1976, monthly deposition rates had diminished to the point where measurable levels of ⁹⁰Sr were rarely observed.

38 (GJT--7) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, SLICK ROCK SITES, SLICK ROCK, COLORADO. PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Oct 1977. Contract EY-76-C-13-1658. 196p. Dep. NTIS, PC A09/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the two millsites in Slick Rock, Colorado. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals residing nearby, the investigation of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. The Union Carbide site has 350,000 tons of tailings and the North Continent site now owned by Union Carbide has 37,000 tons of tailings. Both tailings piles have been stabilized in

accordance with regulations of the State of Colorado. Radon gas release from the tailings on the sites constitute the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The sparse population and relatively low radiation levels yield minimal immediate environmental impact. Hence the three alternative actions presented are directed towards restricting access to the sites (Option I), and returning the windblown tailings to the piles and stabilizing the piles with cover material (Option II), and consolidating the two piles on the UC site and stabilizing with 2 ft of cover (Option III). Fencing around the tailings piles is included in all options. Options II and III provide 2 ft of cover material on the tailings. Costs of the options range from \$370,000 to \$1,100,000. Reprocessing the tailings for uranium is not economically feasible.

- 39 (GJT--7S) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, SLICK ROCK SITES, SLICK ROCK, COLORADO. A SUMMARY OF THE PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Oct 1977. Contract EY-76-C-13-1658. 58p. Dep. NTIS, PC A04/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the two millsites in Slick Rock, Colorado. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals residing nearby, the investigation of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. The Union Carbide site has 350,000 tons of tailings and the North Continent site now owned by Union Carbide has 37,000 tons of tailings. Both tailings piles have been stabilized in accordance with regulations of the State of Colorado. Radon gas release from the tailings on the sites constitute the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The sparse population and relatively low radiation levels yield minimal immediate environmental impact. Hence the three alternative actions presented are directed towards restricting access to the sites (Option I), and returning the windblown tailings to the piles and stabilizing the piles with cover material (Option II), and consolidating the two piles on the UC site and stabilizing with 2 ft of cover (Option III). Fencing around the tailings piles is included in all options. Options II and III provide 2 ft of cover material on the tailings. Costs of the options range from \$370,000 to \$1,100,000. Reprocessing the tailings for uranium is not economically feasible.

- 40 (GJT--9) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, GRAND JUNCTION SITE, GRAND JUNCTION, COLORADO. PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Oct 1977. Contract EY-76-C-13-1658. 196p. Dep. NTIS, PC A09/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Grand Junction, Colorado. The Phase II, Title I

services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the 1.9 million tons of tailings at the Grand Junction site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The eight alternative actions presented range from millsite decontamination (Option I), to adding various depths of stabilization cover material (Options II and III), to removal of the tailings to long-term storage sites and decontamination of the present site (Options IV through VIII). Cost estimates for the eight options range from \$470,000 to \$18,130,000. Reprocessing the tailings for uranium recovery does not appear to be economically attractive at present.

- 41 (GJT--9S) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, GRAND JUNCTION SITE, GRAND JUNCTION, COLORADO. A SUMMARY OF THE PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Oct 1977. Contract EY-76-C-13-1658. 57p. Dep. NTIS, PC A04/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Grand Junction, Colorado. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. Radon gas release from the 1.9 million tons of tailings at the Grand Junction site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The eight alternative actions presented range from millsite decontamination (Option I), to adding various depths of stabilization cover material (Options II and III), to removal of the tailings to long-term storage sites and decontamination of the present site (Options IV through VIII). Cost estimates for the eight options range from \$470,000 to \$18,130,000. Reprocessing the tailings for uranium recovery does not appear to be economically attractive at present.

- 42 EFFECTS OF WHOLE- AND PARTIAL-BODY IRRADIATION ON CIRCULATING ANTERIOR PITUITARY HORMONES AND TESTOSTERONE AND THE RELATIONSHIP OF THESE HORMONES TO DRUG-METABOLIZING ENZYMES IN THE LIVER. McTaggart, J.; Wills, E.D. (Medical College of St. Bartholomew's Hospital, London). Radiat. Res.; 72: No. 1, 122-133 (Oct 1977).

Doses within the range of 850 to 1500 rad given to the whole body, head, or lower-trunk region of male rats cause a marked depression in the rate of oxidative demethylation of drugs in the liver endoplasmic reticulum, 3 to 4 days after the irradiation. The V_{max} of the enzyme system is depressed and the K_{m} increased. Irradiation to the whole body, head, or lower trunk also causes a fall in the circulating levels of testosterone and luteinizing hormone (LH) and the concentrations of these hormones are markedly reduced 3 to 4

days after the irradiation. Injections of testosterone or anterior pituitary extract effectively restore the activity of the liver enzyme system after irradiation of the head or lower trunk. It is concluded that whole-body irradiation causes inhibition of drug-metabolizing enzymes in the liver by a complex series of interrelated effects on the testis, anterior pituitary, and possibly the hypothalamus.

- 43 S₁ NUCLEASE FROM ASPERGILLUS ORYZAE FOR THE DETECTION OF DNA DAMAGE AND REPAIR IN THE GAMMA-IRRADIATED INTRACEREBRAL RAT GLIOSARCOMA 9L. Gutin, P.H.; Hilton, J.; Fein, V.J.; Allen, A.E.; Walker, M.D. (Baltimore Cancer Research Center). Radiat. Res.; 72: No. 1, 100-106 (Oct 1977).

DNA damage and repair in a rat brain tumor following irradiation in vivo were measured by analysis of the rate of strand separation of the tumor DNA in alkali. Tumors were removed after irradiation and mechanically dissociated to a cellular suspension. Tumor cells were injected into alkali (pH 12) for 20 min at 22°C. The fraction of tumor DNA remaining double-stranded after this exposure to alkali was determined by its resistance to S₁ nuclease from *Aspergillus oryzae*. Double-stranded DNA remains (after enzyme exposure) acid-precipitable for fluorescent assay. The double-stranded fraction after exposure to alkali decreases with increasing radiation dose following first-order kinetics. DNA from tumors excised at intervals after irradiation showed a greater double-stranded fraction in alkali than that from tumors excised immediately, indicating repair of single-strand breaks. Repair of damage produced by 600 rad proceeded with a half-time of approximately 15 min.

- 44 (NUREG--0322) NINTH ANNUAL OCCUPATIONAL RADIATION EXPOSURE REPORT, 1976. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Management Information and Program Control). Oct 1977. 41p. NTIS \$4.50.

Data are summarized on the occupational radiation exposure of personnel of U. S. nuclear facilities during 1976. The data on external and internal exposure to airborne radioactive materials were obtained from reports submitted by all NCR licensees. Brief descriptions of incidents leading to overexposures are included.

- 45 (ORNL/TM--5873) IN-PHANTOM SPECTROMETRY OF MEDICAL DIAGNOSTIC X RAYS. Stansbury, P.S. (Oak Ridge National Lab., Tenn. (USA)). Oct 1977. Contract W-7405-ENG-26. 235p. Dep. NTIS, PC A11/MF A01.

A program of measurements was made to determine the spectral fluence distributions at locations of significance in a heterogeneous, hominoid phantom exposed to x rays in a manner simulating medical diagnostic radiology. The measurements were made with a specially constructed NaI(Tl) scintillation detector. The detector had a spherically shaped active volume 0.6 cm in diameter. The resolution of this detector was five times worse than that of a more conventional NaI(Tl) spectrometer. Resolution broadening and other distortions were removed from the observed pulse height spectra with a computer-coded, iterative unfolding technique. The performance of the spectrometer and the unfolding scheme was assessed by comparing, in a few cases, the unfolded NaI(Tl) spectra with spectra determined with a high resolution Ge(Li) spectrometer. The measurements were made in a physical model of an idealized representation

of an average adult patient.

- 46 GENETIC AND ENVIRONMENTAL INTERACTIONS. Strong, L.C. (Univ. of Texas, Houston). Cancer, Suppl.; 40: No. 4, 1861-1866 (Oct 1977).

From International workshop on multiple primary cancers; New York, NY, USA (7 Oct 1976).

Cancer may result from a multistage process occurring over a long period of time. Presumably, initial and progressive stages of carcinogenesis may be modified by both genetic and environmental factors. Theoretically, genetic factors may alter susceptibility to the carcinogenic effects of an environmental agent at the initial exposure due to variation in metabolism of the carcinogen or variation in specific target cell response to the active carcinogen, or during the latent phase due to numerous factors that might increase the probability of tumor expression, including growth-promoting factors or immunodeficiency states. Observed genetic and environmental interactions in carcinogenesis include an association between genetically determined inducibility of aryl hydrocarbon hydroxylase and smoking-related cancers, familial susceptibility to certain environmental carcinogens, an association between hereditary disorders of mutagenesis and carcinogenesis, and enhancement of tissue-specific, dominantly inherited tumor predisposition by radiation. Multiple primary tumors occur frequently in genetically predisposed individuals. Specific markers for susceptibility must be sought in order that high-risk individuals be identified and appropriate measures taken for early cancer detection or prevention. Study of the nature of the genetically determined susceptibility and interactions with environmental agents may be revealing in the understanding of carcinogenesis in general.

- 47 PATTERNS OF SECOND MALIGNANT NEOPLASMS IN CHILDREN. Meadows, A.T. (Children's Hospital of Philadelphia); D'Angio, G.J.; Mike, V.; Banfi, A.; Harris, C.; Jenkin, R.D.T.; Schwartz, A. Cancer, Suppl.; 40: No. 4, 1903-1911 (Oct 1977).

From International workshop on multiple primary cancers; New York, NY, USA (7 Oct 1977).

A search of the records of 10 pediatric oncology centers revealed 102 children with more than one malignant neoplasm. In this group of 102 patients, all pediatric cancers were seen as initial lesions, but Wilms' tumor and retinoblastoma were over-represented and leukemia and brain tumors underrepresented. Survival variation as well as tumor susceptibility may be responsible for this disproportion. Osteosarcomas and chondrosarcomas were the most frequent second malignant neoplasms (SMN). Embryonal tumors were rare as SMN and adult-type tumors (carcinomas) appeared at earlier than expected ages, whether arising after irradiation or not related to that form of therapy. Radiation was associated with 69 SMN, genetic disease accounted for 27 SMN and both conditions were noted in 15 SMN. In the group of 21 patients for whom neither radiation nor a known genetic disorder could be implicated, there were three with colon carcinoma and glioma and five with leukemia or lymphoma and glioma. These combinations may reflect new tissue-specific hereditary cancer syndromes.

- 48 RISK OF NEW CANCERS IN PATIENTS WITH HODGKINS'S DISEASE. Arseneau, J.C. (Univ.

of Rochester Cancer Center, NY); Canellos, G.P.; Johnson, R.; DeVita, V.T. Jr. Cancer, Suppl.; 40: No. 4, 1912-1916(Oct 1977).

From International workshop on multiple primary cancers; New York, NY, USA (7 Oct 1977).

An assessment of the risk of new cancers in patients with Hodgkin's disease (HD) requires consideration of potential intrinsic and extrinsic factors. Because series of untreated patients with HD do not exist, the true intrinsic risk of development of new cancers cannot be assessed, although the immunologic abnormalities associated with active HD are a potential contributory factor. In recent years, reports of new cancers occurring in patients with HD have considered the role of extrinsic factors in the form of therapeutic intervention. Exposure to ionizing radiation, a known carcinogen in humans, has been suggested as a possible explanation of increasing reports of cases of acute nonlymphocytic leukemia (ANLL) complicating HD. Studies from the National Cancer Institute have shown a highly significant increase in incidence of new cancers (including ANLL) in intensively treated HD patients, and suggested the possibility of a synergistic carcinogenic effect of combined exposure to ionizing radiation and cytotoxic drugs. While the mechanism of induction of second malignant tumors in patients with HD is not clear, it is probably complex, and may relate to interactions between immunosuppressive factors associated with the disease and further immunosuppression and direct cellular damage produced by radiation, cytotoxic drugs, or combinations of both. Further efforts to investigate long term complications of cancer therapy and to design therapeutic programs that will minimize these complications are most important, in view of the improved survival in a number of malignant diseases, which may be anticipated with modern multimodal anticancer therapy.

- 49 MULTIPLE PRIMARY CANCER RISK AFTER THERAPY FOR HODGKIN'S DISEASE. Brody, R.S.; Schottenfeld, D.; Reid, A. (Memorial Sloan-Kettering Cancer Center, New York). Cancer, Suppl.; 40: No. 4, 1917-1926(Oct 1977).

From International workshop on multiple primary cancers; New York, NY, USA (7 Oct 1977).

Forty-four antecedent, synchronous, and metachronous multiple primary cancers were identified among 41 patients who constituted 4.0% of 1028 patients initially treated for Hodgkin's disease during the years 1950-1954, 1960-1964, and 1968-1972. At 5 years post-therapy the cumulative probabilities of developing a multiple primary cancer for patients treated in 1950-1954, 1960-1964, and 1968-1972, were 1.14%, 1.48%, and 4.43%, respectively. At 10 years the cumulative probability of a multiple primary cancer was 2.54% for the 1950-1954 treatment group and 6.52% for the 1960-1964 treatment group. Among those patients 16-39 years of age, initially treated during the period 1960-1964, who had survived 6-10 years after receiving radiation plus single agent chemotherapy, we observed a significant 18-fold increase in the number of multiple primary cancers. A significant occurrence of two multiple primary cancers in a relatively small group of patients treated with chemotherapy only during the period 1968-1972 was also noted. Continued surveillance of patients extensively treated with combination chemotherapy and radiotherapy will enable assessment of the oncogenic potential of these modern therapeutic approaches to the management of Hodgkin's disease.

- 50 PRELIMINARY CLINICAL RESULTS FROM U.S. FAST NEUTRON TELETHERAPY STUDIES. Parker, R.G. (Univ. of Washington Hospital, Seattle); Berry, H.C.; Caderao, J.B.; Gerdes, A.J.; Hussey, D.H.; Ornitz, R.; Rogers, C.C. Cancer; 40: No. 4, 1434-1438(Oct 1977).

Over 700 patients with cancer have been treated with fast neutron beams since 1972 in three U.S. programs at the M.D. Anderson-TAMVEC (Houston and College Station, Texas), University of Washington (Seattle, Washington), and MANTA (Naval Research Laboratory, Washington, D.C.). Clinical applications are about to start at the Fermilab (Batavia, Illinois) and Cleveland Clinic-NASA (Cleveland, Ohio). To date, studies have included: (1) effects of different treatment patterns and doses; (2) responses of several tumor types at many anatomic sites; and (3) acute and long-term normal tissue tolerances. Responses of several cancers, such as extensive epidermoid carcinoma of the cervix and "fixed" metastatic cervical adenopathy, have been encouraging. In patients with glioblastoma multiforme, good tumor responses have not lengthened survival compared with that following conventional radiation therapy. Both local tumor control and "cure" have been compromised by the inclusion of patients with very extensive cancers. In general, treatment has been well tolerated. These preliminary studies provide the bases for planned clinical trials.

- 51 BREAST CARCINOMA FOLLOWING RADIOTHERAPY OF METASTATIC WILMS' TUMOR. Reimer, R.R. (National Inst. of Health, Bethesda, MD); Fraumeni, J.F. Jr.; Reddick, R.; Moorhead, E.L. II. Cancer; 40: No. 4, 1450-1452(Oct 1977).

A 22-year-old woman developed breast cancer 15 years after radiotherapy to the lung for metastatic Wilms' tumor. Her 32-year-old mother died of bilateral breast cancer, suggesting a genetic predisposition to radiogenic cancer. Recent improvements in the survival of children with certain cancers necessitate long-term surveillance for iatrogenic neoplasia, particularly when familial susceptibility is evident.

- 52 INDIUM-111-LABELED CELLULAR BLOOD COMPONENTS: MECHANISM OF LABELING AND INTRACELLULAR LOCATION IN HUMAN NEUTROPHILS. Thakur, M.L.; Segal, A.W.; Louis, L.; Welch, M.J.; Hopkins, J.; Peters, T.J. (Hammersmith Hospital, London). J. Nucl. Med.; 18: No. 10, 1022-1026(Oct 1977).

Human neutrophils were labeled with In-111 oxine by incubation at room temperature, and the fate of the oxine and the intracellular location of the In-111 were determined. Neutral (1:3) In-111 oxine complex diffuses rapidly across the cell membrane and then dissociates. Some of the oxine leaves the cell and the In-111 binds intracellularly. After short periods of incubation the label is distributed mostly to four soluble components, a small proportion of which had a distribution similar to that of specific and azurophil granules. After longer incubation periods there was relatively less radioactivity with the soluble components and probably more attached to the particulate material. A small peak of radioactivity also appeared in the region of DNA distribution, but no confirmation could be obtained for the association of the In-111 radioactivity with DNA.

- 53 BRONCHOPULMONARY LAVAGE. Brightwell, J. (National Radiological Protection Board,

Harwell (UK)). Radiol. Prot. Bull.; No. 21, 20-24(Oct 1977).

Techniques of bronchopulmonary lavage are reviewed. Lavage is used in man for successful treatment for obstructive lung disease; the toxic effects of the associated multiple anaesthesia may be the major hazard. Volume-controlled lavage of dogs and baboons has proved a relatively safe procedure, but the small size of rodents' lungs requires a modified technique of successive instillation and withdrawal of the lavage fluid. Lavage has been used as a means of removing insoluble radioactive particles from the lungs of animals. The rate of removal was much higher than the normal physiological lung clearance rate. There has been only one human case of lavage treatment for accidental exposure to radioactive aerosols. The optimum treatment regime for removal of particles has yet to be defined.

- 54 (DOCKET-50220--885) NINE MILE POINT NUCLEAR STATION, UNIT 1. RESPONSES TO NRC RAI RE SPENT FUEL POOL MODIFICATION. (Niagara Mohawk Power Corp., Syracuse, N.Y. (USA)). 29 Sep 1977. vp.

Spent fuel pool modification; responses to NRC RAI. NINE MILE POINT-1 REACTOR; FUEL POOLS; MODIFICATIONS; SPENT FUEL STORAGE; BURNUP; RADIATION DOSES; PERSONNEL; RADIOACTIVE EFFLUENTS; MECHANICAL STRUCTURES; SOLID WASTES; VOLUME; FILTERS; ACTIVITY LEVELS

- 55 (DOCKET-50206--785) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. RESPONSES TO NRC RAI RE CONTROL ROOM OPERATOR DOSES. (Southern California Edison Co., Rosemead (USA)). 22 Sep 1977. vp.

Control room operator doses; responses to NRC RAI. SAN ONOFRE-1 REACTOR; CONTROL ROOMS; PERSONNEL; RADIATION DOSES; RESPIRATORS; LOSS OF COOLANT; RADIATION ACCIDENTS; REACTOR OPERATION

- 56 (DOCKET-50344--549) TROJAN NUCLEAR PLANT. NRC REQUEST FOR AN AMENDMENT APPLICATION TO CHANGE TS RE ANNUAL OPERATING REPORT AND MONTHLY OPERATING REPORT. (Portland General Electric Co., Oreg. (USA)). 16 Sep 1977. vp.

NRC request for an amendment application to change TS re Annual Operating Report and Monthly Operating Report. TROJAN REACTOR; REACTOR OPERATION; DOCUMENTATION; SPECIFICATIONS; PERSONNEL; RADIATION DOSES; MODIFICATIONS

- 57 HIROSHIMA - THE EFFECTS OF THE ATOM BOMB. McClelland, M. (Ipswich Health District (UK)). N.Z. Eng.; 145: No. 9, 19-22(1 Sep 1977).

The author, a nurse, describes her personal impressions of a visit to Hiroshima in 1977 and of the medical and nursing facilities available for atomic bomb survivors in Japan. The findings of the Radiation Effects Research Foundation are briefly summarized. Hiroshima's Red Cross Hospital, recently re-built, cares for some of the survivors. The problems of discrimination against the survivors in employment and in society are discussed.

- 58 (BNWL--2086) GUIDE TO GOOD PRACTICES AT PLUTONIUM FACILITIES. Faust, L.G.; Brackenbush, L.W.; Carter, L.A.; Endres, G.W.R.; Glenn, R.D.; Jech, J.J.; Selby, J.M.; Smith, R.C.; Waite, D.A.; Walsh, W.P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1977. Contract EY-76-C-06-1830. 216p. Dep. NTIS, PC A10/MF A01.

This manual establishes guidelines and

principles for use in setting up a sound radiation protection program for work with plutonium. The guidance presented is based on the experiences of Energy Research and Development Administration (ERDA) contractors and those portions of private industry concerned with the operation of plutonium facilities, specifically with the fabrication of mixed oxide reactor fuel. The manual is directed primarily to those facilities which have as their sole purpose the handling of large quantities of plutonium for military or industrial uses. It is not intended for use by facilities engaged in reactor or chemical separation operations nor for partial or occasional use by analytical laboratories; while these facilities would find the manual beneficial, it would be incomplete for their needs. The manual addresses good practices that should be observed by management, staff and designers, since the benefits of a good radiation protection program are the result of their joint efforts. Methods for the diagnostic evaluation of internally deposited Pu are included.

- 59 (ERDA--1545-D(Vol.2)(App.)) ROCKY FLATS PLANT SITE, GOLDEN, COLORADO. VOLUME 2. APPENDICES. DRAFT ENVIRONMENTAL IMPACT STATEMENT. (Energy Research and Development Administration, Washington, D.C. (USA)). Sep 1977. vp. ERDA, Washington, DC.

Data pertinent to the evaluation of the environmental impact of the Rocky Flats Plant are summarized. Included are lists of plants and wild animals; meteorological data; data on the geology, seismology, and hydrology; radiation dose calculations; Pu toxicity; personnel injuries, and radiation accident probabilities.

- 60 ABSOLUTE MEASUREMENT OF TOTAL-BODY CALCIUM BY THE ³⁷AR METHOD. PRELIMINARY RESULTS: CONCISE COMMUNICATION. Lewellen, T.K.; Nelp, W.B.; Murano, R.; Hinn, G.M.; Chesnut, C.H. III. (Univ. of Washington School of Medicine, Seattle). J. Nucl. Med.; 18: No. 9, 929-932(Sep 1977).

Measurements of exhaled Ar-37 produced by total-body neutron irradiation of Ca-40, were used to determine total-body calcium in ten human subjects. There was a good correlation between the Ar-37 yield and total-body calcium determined by measurement of Ca-49.

- 61 CHARACTERIZATION AND RADIOBIOLOGIC PARAMETERS OF MEDULLOBLASTOMA IN VITRO. Weichselbaum, R.R.; Liszczak, T.M.; Phillips, J.P.; Little, J.B.; Epstein, J.; Kornblith, P.L. (Harvard Univ., Boston). Cancer; 40: No. 3, 1087-1096(Sep 1977).

Cultured cells from human medulloblastomas were demonstrated to have distinctive features and a "glial" potential from the morphological and ultrastructural parameters. The in vitro radiobiological survival curve parameters of cultured human medulloblastoma and non-malignant skin fibroblasts obtained under the same conditions of exponential growth were similar. In vitro conditions may underestimate the shoulder region of the survival curve. Since the shoulder region is the most important in clinical fractionated radiotherapy, multiple dose experiments might be useful in examining this portion of the survival curve more closely.

- 62 EFFECT OF RADIATION AND CONTRAST MEDIA ON CHROMOSOMES. Adams, F.H.; Norman, A.; Mello, R.S.; Bass, D. (Univ. of California, Los

Angeles). Radiology; 124: No. 3, 823-826(Sep 1977).

Measurements of chromosome aberrations or micronuclei in lymphocytes obtained from 7 patients indicate that angiocardiology produced chromosome damage corresponding to an average absorbed dose of about 50 rads. This is an order of magnitude larger than was estimated from the exposure rate. Experiments on lymphocytes suspended in solutions of methylglucamine and sodium diatrizoate (Renografin) or sodium diatrizoate alone (Hypaque) indicate that the chromosome damage observed in the patients is due in large part to two effects: (a) an increased absorption of x rays as compared to blood and (b) a breakage of chromosomes even in the absence of x rays.

- 63 BREAST CANCER INCIDENCE AMONG ATOMIC BOMB SURVIVORS, HIROSHIMA AND NAGASAKI, 1950--1969. McGregor, D.H. (Radiation Effects Research Foundation, Hiroshima); Land, C.E.; Chci, K.; Tokuoka, S.; Liu, P.I.; Wakabayashi, T.; Beebe, G.W. J. Natl. Cancer Inst.; 59: No. 3, 799-811(Sep 1977).

For the period 1950-69, 231 cases of breast cancer were identified among 63,275 female atomic bomb survivors and nonexposed controls; 187 were among survivors for whom dose estimates were available. The estimated absolute risk per rad was 1.9 excess cases per 10⁶ person-years at risk over this period for women who were 10 years old or older at the time of bombing (ATB), substantially less than published estimates largely based on X-ray and fluoroscopy data from smaller samples of younger North American women. The Hiroshima and Nagasaki dose-response curves were similar, which suggested approximate equivalence of neutron and gamma radiations in their carcinogenic effect on breast tissue, and were consistent with a linear model. An identifiable radiation effect was evident before 1955. For women of comparable ages ATB, the time from 1945 to diagnosis did not vary by dose, nor was there evidence that radiation caused breast cancer to develop in these women at earlier ages than usual. No breast cancers were found up to 1969 among atomic bomb survivors under age 10 ATB, nor were any substantial numbers observed until 1960 in those 10-19 years old ATB. By 1965-69, however, the cohort 10-19 years old ATB exposed to high or medium doses was experiencing a much greater excess of breast cancer than was observed in women 35 years old or older ATB who were exposed to any dose level. This suggests that the breast tissues of adolescent females may be more sensitive than those of older women to the effects of ionizing radiation. Finally, for each age-ATB interval (10-19, 20-34, 35-49, and 50+ yr), women exposed to 100+ rads had, by 1969, already approximated or exceeded their lifetime expectations (after 1950) of breast cancer as calculated from Japanese cancer registry data.

- 64 N.R.P.B.'S NEW RECORD-KEEPING SERVICE AND THERMOLUMINESCENT DOSEMETER. Dennis, J.A.; Marshall, T.O.; Shaw, K.B.; Kendall, G.M. (National Radiological Protection Board, Harwell (UK)). Br. J. Non-Destr. Test.; 19: No. 5, 234-238(Sep 1977).

With the approval of the Health and Safety Executive the National Radiological Protection Board is introducing a radiation dose record keeping service in association with a thermoluminescent dosimeter. This service will relieve employers of the responsibility for maintaining and keeping dose records. Both the record keeping and dosimeter systems are described, including the documents which will

be produced for employers. The thermoluminescent dosimeter is more accurate and less sensitive to environmental factors than the film dosimeter, which it replaces. It also reduces the consumption of materials and, with automated processing, is labour saving.

- 65 NEUTRON DOSES TO PATIENTS IN HIGH ENERGY X-RAY THERAPY. Stranden, E. (State Institute of Radiation Hygiene, Osteras (Norway)). Phys. Med. Biol.; 22: No. 5, 1011-1013(Sep 1977).

Neutrons are released from the accelerator material when high energy x-rays are used in therapy. Measurements have been made of the magnitude of this undesirable neutron dose. Neutron fluxes and energy distributions were estimated from the activity induced in irradiated foils. The neutron fluence was measured at ten positions in the therapy room. The total fluence varied from 1.9×10^5 to 8.0×10^3 n cm⁻² per rad of x-ray dose for the betatron investigated. The thermal fluence was nearly isotropic throughout the room. Calculations of the maximum dose equivalent at the therapy table (1 m from target), and the dose equivalent to critical organs for a 10 x 10 cm field of 200 rad to the thorax demonstrated that the neutrons were contributing significantly to the total gonad dose compared to the dose from scattered x-irradiation.

- 66 FRACTIONATION AND PROTECTION IN THE INTRACAVITARY LOCAL IRRADIATION OF GYNECOLOGICAL TUMORS. Frischkorn, R. (Goettingen Univ. (Germany, F.R.). Frauenklinik und Poliklinik). Strahlentherapie; 153: No. 9, 598-600(Sep 1977). (In German).

The difficulties of dosage and temporary adaptation of the short time afterloading therapy to an optimal healing result combined with a minimum of side effects in radiotherapy of gynecological tumors are still not solved yet. Only a therapy scheme which parts from the good results of the long term radium therapy in combination with an adequately dosed and distributed deep therapy has a chance to replace the radium therapy of gynecological tumors in the long run.

- 67 HIGH-DOSE RATE INTRACAVITARY RADIATION THERAPY FOR ADVANCED HEAD AND NECK TUMORS. Akanuma, A. (Tokyo Univ. Hospital, Hongo). Cancer; 40: No. 3, 1071-1076(Sep 1977).

Fifty-seven treatments were performed on 27 head and neck patients with recurrent or residual tumors on a high dose rate, remote controlled afterloading unit: There were 16 cases of maxillary sinus tumors, 6 epipharynx, 3 alveolar ridge, 1 hard palate and 1 floor of mouth. All patients have been followed up more than 2 years except one. Five patients are alive without local recurrence for more than 2 years. In 13 patients local tumors disappeared once and normal mucosa covered the tumor sites. Two patients died from local bleeding. In six patients this method failed to destroy tumors. Our purpose was palliative local control: therefore, in two-thirds of cases treated we were successful with this easy method of nonfractionated acute intracavitary radiation. This result is favorable, considering that all cases treated here were failures following full dose external radiation, although the treatment had to be repeated more than twice in 15 cases. Relief of symptoms is excellent when this therapy is used.

- 68 COMPARATIVE STUDY OF TWO PREOPERATIVE RADIATION REGIMENS WITH CYSTECTOMY FOR BLADDER

CANCER. Whitmore, W.F. Jr.; Batata, M.A.; Hilaris, B.S.; Reddy, G.N.; Unal, A.; Ghoneim, M.A.; Grabstald, H.; Chu, F. (Memorial Sloan-Kettering Cancer Center, New York). Cancer; 40: No. 3, 1077-1086 (Sep 1977).

From American Society of Therapeutic Radiologists annual meeting; San Francisco, CA, USA (8 Oct 1975).

This report surveys the results of two programs of preoperative irradiation with radical cystectomy for bladder cancer in 205 patients. Irradiating the true pelvis to 4000 rads in 4 weeks with radical cystectomy after 6 weeks was implemented in 119 patients (Group 1) from 1959 to 1965; 2000 rads given in 1 week to the true pelvis and radical cystectomy within the following week was implemented in 86 patients (Group 2) from 1966 to 1970. Determinate survival without evidence of recurrence at 5 years was 43% in Group 1 and 42% in Group 2. Mortality with recurrence of bladder cancer in 5 or more years was 44% in Group 1 and 42% in Group 2. Pelvic complications occurred in 13% of Group 1 and 9% of Group 2.

- 69 LYMPOPHENIA CAUSED BY CRANIAL IRRADIATION IN CHILDREN RECEIVING CRANIOSPINAL RADIOTHERAPY. Harisiadis, L.; Kopelson, G.; Chang, C.H. (Columbia-Presbyterian Medical Center, New York). Cancer; 40: No. 3, 1102-1108 (Sep 1977).

The peripheral blood changes were studied in 67 children who received craniospinal irradiation for posterior fossa tumors. At the completion of a cranial dose of about 3500 rad to the whole brain port, the lymphocytes were reduced to 858/mm³ from 3084/mm³ preoperatively. The counts of the remaining leukocytes stayed at a level somewhat higher than preoperatively; the eosinophils rose to 288/mm³ from 125/mm³. With the initiation of the spinal field irradiation, which included a large proportion of the total bone marrow, the numbers of all the leukocytes decreased rapidly; the observed leukopenia was mainly secondary to neutropenia. A mechanism that was operating to restore the number of leukocytes became manifest immediately after the completion of radiotherapy, though the number of lymphocytes had not been totally restored to the preoperative level 6 years later. Irradiation of the lymphocytes that circulate through the vascular bed can explain the lymphopenia observed during cranial radiotherapy. Mild leukopenia observed in patients receiving radiotherapy through a relatively small port may be secondary to lymphopenia, and this does not necessarily indicate impaired bone marrow reserves.

- 70 EXPERIMENTAL INVESTIGATIONS ON THE IMMUNITY DEVELOPMENT IN IRRADIATED MICE AFTER LOCAL AND PARENTERAL IMMUNIZATION WITH TETANUS-TOXOID. Baljer, G.; Schaller, M.; Schick, P.; Sailer, J.; Messerschmidt, O.; Mayr, A. (Muenchen Univ. (Germany, F.R.). Inst. fuer Medizinische Mikrobiologie, Infektions- und Seuchenmedizin; Laboratorium fuer Experimentelle Radiologie, Neuherberg/Muenchen (Germany, F.R.)). Strahlentherapie; 153: No. 9, 638-644 (Sep 1977). (In German).

Using the 'tetanus-mouse' model the differences in immunity development between animals exposed to irradiation (300 R and 400 R) and animals not exposed to irradiation after nasal and subcutaneous vaccination was investigated. Immunization was carried out 1, 3, 6, and 10 days before and after exposure to irradiation. Efficacy of immunization was tested by challenge with 10 x LD₅₀ tetanus-toxin and by antitoxin determination with L+

method. The degree of the immune response was dependent on 1) the irradiation dose, 2) the interval between active immunization and the ensuing or preceding irradiation, 3) the mode of vaccination (local or parenteral), and 4) the vaccination dose.

- 71 EFFECTS OF FRACTIONATED WHOLE-BODY X IRRADIATION ON THE CNS OF FETAL MOUSE. TOPOGRAPHIC AND QUANTITATIVE MICROMORPHOLOGIC CHARACTERISATION. Schmahl, W.; Kriegel, H.; Ostertag, B. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Abt. fuer Nuklearbiologie). Strahlentherapie; 153: No. 9, 630-637 (Sep 1977). (In German).

Whole-body x irradiation of pregnant NMRI-mice between day 11 to 13 after conception results in pathological morphogenesis of the CNS. These effects are reduction of dimensions of forebrain, desorganization of structure and occurrence of spherical cell arrangements, the so called rosettes. These can be especially found in dorsal parts of the hemispheres and have been registered qualitatively by its number and dimension in the dose range between 3 x 110 R and 3 x 120 R. A clear correlation between the number of rosettes and the reduction of thickness of the hemisphere-walls can be demonstrated. These results will be fundamental for further studies concerning with reparation processes of the irradiation damage in postnatal stages.

- 72 EFFECT OF PHOTON IRRADIATION ON BLOOD--BRAIN BARRIER PERMEABILITY TO METHOTREXATE IN MICE. Griffin, T.W. (Univ. of Washington Hospital, Seattle); Rasey, J.S.; Bleyer, W.A. Cancer; 40: No. 3, 1109-1111 (Sep 1977).

Methotrexate was administered by intraperitoneal injection (100 mg/kg) to unirradiated mice, and to mice receiving varying doses of cranial irradiation. The animals were sacrificed 24 hours after injection, and methotrexate assays were performed on brain tissue. No methotrexate was detected in the brains of the unirradiated animals. Detectable levels of methotrexate were present after 2000 rad cranial irradiation, but not after 500 rad, 1000 rad, or 1500 rad. The implications of these findings are discussed.

- 73 (NUREG--G332(Draft)) HEALTH EFFECTS ATTRIBUTABLE TO COAL AND NUCLEAR FUEL CYCLE ALTERNATIVES. Gotchy, R.L. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Reactor Regulation). Sep 1977. 31p. Nuclear Regulatory Commission, Washington, DC.

Estimates of mortality and morbidity are presented based on present-day knowledge of health effects resulting from current component designs and operations of the fuel cycles, and anticipated emission rates and occupational exposure for the various fuel cycle facilities expected to go into operation in approximately the 1975-1985 period. It was concluded that, although there are large uncertainties in the estimates of potential health effects, the coal fuel cycle alternative has a greater health impact on man than the uranium fuel cycle. However, the increased risk of health effects for either fuel cycle represents a very small incremental risk to the average individual in the public.

- 74 (GEFR--00257) INHALATION DOSE CONVERSION FACTORS FOR VARIOUS RADIONUCLIDES ASSOCIATED WITH LIQUID METAL FAST BREEDER REACTORS. PART 2. Teresi, J.D. (General Electric Co.,

Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Sep 1977. Contract EY-76-C-03-0893-015. 27p. AT.

This report presents the values of the inhalation dose conversion factors (F-factors) in Rem per curie inhaled for 30 important LMFBR radionuclides. In addition, an example of a parametric analysis is presented in the calculation of ^{99}Mo F-factors for seven particle sizes and three clearance classes for each particle size.

- 75 LONG-TERM RADIUM RETENTION IN CONTAMINATED DIAL PAINTERS. Cosandey, M. (Gymnase de Chamblandes, Pully-Lausanne (Switzerland)); Wenger, P. Health Phys.; 33: No. 3, 221-225 (Sep 1977).

The ^{226}Ra body burdens have been measured for about 10 yr in 41 contaminated dial painters. Experimental data have been compared with predictions from ICRP model. The agreement is satisfactory in 83% of the known cases.

- 76 WHOLE BODY RETENTION FOLLOWING AN INTRAVENOUS INJECTION OF ^{75}Se AS SELENOMETHIONINE. Johnson, J.R. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Health Phys.; 33: No. 3, 250-251 (Sep 1977).

ABDOMEN; BIOLOGICAL HALF-LIFE; BODY BURDEN; INTERNAL IRRADIATION; INTRAVENOUS INJECTION; LABELLED COMPOUNDS; MAN; METHIONINE; RADIATION DOSES; RADIONUCLIDE KINETICS; RETENTION; SELENIUM COMPOUNDS; SELENIUM 75; WHOLE-BODY COUNTING; TISSUE DISTRIBUTION

- 77 MATCHING SAMPLER PENETRATION CURVES TO DEFINITIONS OF RESPIRABLE FRACTION. Mercer, T.T. (Rochester Univ., N.Y. (USA). Dept. of Radiation Biology and Biophysics). Health Phys.; 33: No. 3, 259-264 (Sep 1977).

A formal definition of 'respirable fraction' (the probability that a particle of a given size will deposit in the alveolar regions of the lung if inhaled) is useful only if there is a method of sorting out airborne contamination approximately in accordance with the definition. The matching of the definitions adopted by different organizations to the penetration curves of various types of sample is discussed.

- 78 REMOVAL OF INHALED RADIOACTIVE PARTICLES BY LUNG LAVAGE. A REVIEW. Muggenburg, B.A.; Felicetti, S.A.; Silbaugh, S.A. (Lovelace Biomedical and Environmental Research Institute, Albuquerque, N.Mex. (USA). Inhalation Toxicology Research Inst.). Health Phys.; 33: No. 3, 213-220 (Sep 1977).

Lung lavage effectively removed inhaled radioactive particles from the lungs in a variety of animal experiments. Several types of lung lavage procedures were used. The removal of several different radionuclides has been studied, including ^{95}Zr - ^{95}Nb , ^{144}Ce , ^{239}Pu , ^{238}Pu , and ^{241}Am . A single lung lavage in a beagle dog removed about 12% of the initial lung burden (ILB) of the inhaled material. Multiple lung lavages have removed up to 50% of the ILB. A single lung lavage in beagle dogs performed between 2 and 196 days after a single inhalation exposure removed the same percentage of the existing lung burden of ^{144}Ce particles. It was also found that inhaled material with a short lung retention time is poorly removed from the lungs by lavage. The removal of radioactive particles with long lung retention times was similar for beagle dogs, baboons, and one human. Lung

lavage and chelating agents were found effective when used together. In one experiment, the use of lung lavage removed substantial amounts of ^{144}Ce in fused aluminosilicate particles from beagle dogs and prevented the clinical appearance of radiation pneumonitis to 18 months after exposure, whereas, other dogs exposed to the same amounts of ^{144}Ce , but not given lung lavages, died in less than 9 months.

- 79 SELECTION OF CHEMOTHERAPY FOR METASTATIC MAMMARY CANCER BY EFFECT ON ^{131}I UPTAKE. Ferguson, D.J.; Harper, P.V. (Univ. of Chicago). Cancer; 40: No. 3, 977-986 (Sep 1977).

Cesium-131 was administered intravenously to 39 patients with superficial metastases of mammary carcinoma and the concentration in tumor was compared with that in normal tissue by application of a detector in vivo, before and after 1 to 5 days of chemotherapy with cyclophosphamide (CP), 5-fluorouracil (FU), or diethylstilbestrol. A change of the cesium concentration ratio (tumor/normal tissue) greater than 15% after brief treatment correctly predicted the therapeutic effect after 1 to 39 months on the tumors that were tested in 30 of 33 tests. No reliable correlation could be made in the remaining 21 tests in which the change of ratio was less than 15%. The concentration of cesium-131 in the skin, fat, and skeletal muscle of mice was not appreciably altered by treatment for 5 days with CP or FU.

- 80 HIROSHIMA AND NAGASAKI: THE SURVIVORS. THE RECKONING. Barnaby, F. (Stockholm International Peace Research Inst. (Sweden)). New Sci.; 75: No. 1066, 472-475 (25 Aug 1977).

At a recently held meeting of 44 scientists from 14 countries organised by the International Peace Bureau a great deal of information on the physical, biological, medical, genetic, social and psychological effects of the atomic bombs was made specially available by Japanese scientists including the results of comprehensive surveys of the personal and social disabilities of the survivors. The immediate fire, blast and radiation effects are here summarized and the causes of death up to the end of 1945 are considered. The delayed effects are perhaps the most terrifying and these are examined.

- 81 HIROSHIMA AND NAGASAKI: THE SURVIVORS. THE PUZZLE OF ABSENT EFFECTS. Rotblat, J. New Sci.; 75: No. 1066, 475-476 (25 Aug 1977).

It is argued that the method of basing estimates of the risks of populations exposed to radiation under normal, peace-time activities, on the results obtained from A-bomb survivors may not be justified. Among the survivors there is a definite dose-related increase in the number of malignancies but other radiation effects such as increase in the incidence of leukaemia in children exposed in utero, genetic effects in children conceived by survivors and general increase in mortality, are conspicuously absent. It is felt that estimates of radiation effects on survivors indicate a difference in response to radiation, as far as leukaemia is concerned, between persons exposed to radiation alone, and those who were also subject to mechanical injuries and heat burns. Together with the absence of other expected effects of radiation, and the lower cancer incidence, this indicates that A-bomb victims cannot be assumed a priori to behave in response to radiation in the same way as those exposed to radiation alone, without

accompanying physical, psychological and social traumata. Estimates of radiation risk based on observations on the A-bomb survivors may thus turn out to be too low, by a considerable margin.

82 DOSE DISPENSER FOR RADIOACTIVE GAS.

Horwitz, N.H.; Gutkowski, R.E. US Patent 4,041,994. 16 Aug 1977. Filed date 22 Sep 1975. 8p.

An activity metering apparatus for metering predetermined activities of radioactive gas from a supply ampul to dose vials is described. The apparatus includes a shielded ampul housing, a fine metering valve communicating with the ampul housing chamber, a shielded vial housing and a hypodermic needle communicating with the metering valve and received through an opening in the vial housing. A Geiger-Muller tube is adjustably supported opposite an opening in the vial housing, whereby the activity of the radioactive gas dispensed to a partially evacuated vial within the vial chamber may be read directly by a standard laboratory rate meter.

83 IONIZING RADIATION CAUSING A RISK OF CANCER IN MAN. A SHORT REVIEW AND A DISCUSSION.

Fichardt, T.; Sandison, A.G.; Savage, D.J. S. Afr. Med. J.; 52: No. 8, 321-327(13 Aug 1977).

An attempt has been made to present, in short review, the most important carcinogens that have been implicated in the development of cancer in the various organ sites of the human body and to demonstrate the relatively minor role played by ionizing radiation, especially radiotherapy, in causing a risk of cancer in man.

84 (COO--1156-90) RADIOECOLOGY OF NATURAL SYSTEMS. THREE YEAR SUMMARY REPORT, MAY 1, 1974--JULY 31, 1977.

Whicker, F.W. (Colorado State Univ., Fort Collins (USA)). Dept. of Radiology and Radiation Biology). 1 Aug 1977. Contract EY-76-S-02-1156. 13p. Dep. NTIS, PC A02/MF A01.

This report is intended to provide a general summary of the progress and findings of studies during the period May 1, 1974 through July 31, 1977 on the distribution, transport, characterization and ecological consequences of plutonium in the terrestrial environs of the Rocky Flats nuclear weapons plant near Denver, Colorado. The contamination of a portion of the terrestrial environs of Rocky Flats with substantial quantities of plutonium provided the opportunity to search for possible ecological effects resulting from the presence of the element. Comparisons were made of various biological measurements and pathological data between ecologically similar study areas of widely varying plutonium levels. Soil in the principal study areas ranged from 100 to over 20,000 dpm $^{239}\text{Pu/g}$ in the upper 3 cm (2 to 400 $\mu\text{Ci/m}^2$). In addition, comparative data were obtained from control areas, containing only world-wide fallout plutonium of the order of 0.1 dpm/g (0.002 $\mu\text{Ci/m}^2$). Biological measurements such as vegetation community structure and biomass; litter mass; arthropod community structure and biomass; and small mammal species occurrence, population density, biomass, reproduction, and physical size of whole carcass and organs were made. In addition, pathological examinations of small mammals, including x-ray for skeletal sarcomas, microscopy for lung tumors, and necropsy for general pathology and parasite occurrence were carried out. While minor differences in certain biological attributes between study areas were

observed, none could be related to plutonium levels.

85 (DOCKET-50010--797) DRESDEN NUCLEAR POWER STATION, UNITS 1, 2, AND 3. RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION EXPOSURE: JANUARY--JUNE 1977 (PART 2 OF SEMIANNUAL REPORT). (Commonwealth Edison Co., Chicago, Ill. (USA)). Aug 1977. vp. (DOCKET-50237--1357; DOCKET-50249--1154).

Radioactive waste, environmental monitoring and occupational personnel radiation exposure: January--June 1977 (part 2 of semiannual report). DRESDEN-1 REACTOR; DRESDEN-2 REACTOR; DRESDEN-3 REACTOR; RADIOACTIVE EFFLUENTS; ACTIVITY LEVELS; ENVIRONMENT; PERSONNEL; RADIATION DOSES; SOLID WASTES; METEOROLOGY; RADIATION MONITORING

86 RESULTS OF THE ALARA PROGRAM AT THE OCONEE NUCLEAR STATION. Yongue, C.T. (Duke Power Co., Seneca, SC); Futrell, R.C.; Lewis, L. Trans. Am. Nucl. Soc., Suppl.; 26: No. 1, 71(Aug 1977).

From Transactions of the American Nuclear Society conference on reactor operating experience; Chattanooga, TN, USA (7 Aug 1977).

OCONEE-1 REACTOR; OCONEE-2 REACTOR; OCONEE-3 REACTOR; RADIATION MONITORING; RADIATION DOSES; PERSONNEL; RADIOACTIVE EFFLUENTS

87 (ORNL--5310) APPLIED HEALTH PHYSICS AND SAFETY ANNUAL REPORT FOR 1976. Auxier, J.A.; Davis, D.M. (Oak Ridge National Lab., Tenn. (USA)). Aug 1977. 78p. Dep. NTIS, PC A05/MF A01.

Progress is reported in the following areas of research: personnel monitoring; health physics instrumentation; atmospheric monitoring; water monitoring; radiation background measurements; soil samples; laboratory operations monitoring; radiation incidents; laundry monitoring; accident analysis; and industrial safety. (HLW)

88 HOW LETHAL ARE EXPLOSIONS AND TOXIC ESCAPES. Marshall, V.C. (Bradford Univ. (UK)). Chem. Eng. (London); 573-577(Aug 1977).

The number of fatalities likely to arise from the realization of the hazards of explosives, toxic releases, and clouds of flammable vapours may be predicted from a study of past incidents and a mortality index is developed for a number of agents. For accidental explosions of conventional explosives the mortality index (mean number of fatalities per ton) declines as the size of the incident increases and appears to be a function of the inverse square of the mass. Attention is called to the bias in the statistics arising from the relatively large number of small incidents which pass unrecorded, especially if not attended by fatal results. The bias is in the direction of exaggerating the mortality index for small incidents.

89 (EPA--520/4-77-005) RADIATION PROTECTION ACTIVITIES, 1976. (Environmental Protection Agency, Washington, D.C. (USA)). Office of Radiation Programs). Aug 1977. 169p. Environmental Protection Agency, Washington, DC.

Separate abstracts were prepared for seven sections of this report. A list of radiation protection publications during 1976 is included.

- 90 (ERDA--77-101) RADIATION PROTECTION ENROLLMENTS AND DEGREES, 1976. (Oak Ridge Associated Universities, Inc., Tenn. (USA). Manpower Development Div.). Aug 1977. Contract EY-76-C-05-0033. 48p. Dep. NTIS, PC A03/MF A01.
- This is a report on the sixth annual survey of radiation protection enrollments and degrees of 52 US institutions that reported degrees and enrollments during 1976. The survey is sent to institutions offering educational programs in radiation protection (health physics, radiation health and safety, radiological health, and similar programs), graduates of which would be qualified to be responsible for some major phase of a program for the evaluation and control of radiation hazards.
- 91 (HASL--313) RESPONSE OF LIF THERMOLUMINESCENCE DOSIMETERS TO NATURAL ENVIRONMENTAL RADIATION. Lowder, W.M.; de Planque, G. (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). Aug 1977. 27p. Dep. NTIS, PC A03/MF A01.
- The calibration of the response of Lif thermoluminescence dosimeters to cosmic-ray charged particles and to photons from naturally-occurring radionuclides in the environment is obtained by modifying the measured response to a corrected response that is proportional to mean absorbed dose in the detector medium. The constant of proportionality is determined from irradiation by ^{137}Cs photons. An experiment in an 8 GeV muon beam at the BNL Alternating Gradient Synchrotron indicates that the same constant of proportionality applies to irradiation by high-energy charged particles and that cavity theory is applicable to the interpretation of the response in terms of absorbed dose in free air or particle fluence. Comparisons of TLD and pressurized argon ionization chamber measurements of absorbed dose in free air at environmental locations and a well shielded one within HASL show agreement to within the estimated uncertainties of several percent in the various calibration factors. The discrimination between photon and charged particle responses permits a calibration of these responses in terms of human organ doses to an accuracy of ± 10 percent.
- 92 (EPA--520/4-77-005, pp 127-138) COMPREHENSIVE EXECUTIVE ACTIVITIES. Aug 1977. Radiation protection activities, 1976. Radiation protection activities related to the marine disposal of radioactive wastes are reviewed. Research programs on the biological effects of low levels of environmental radiation are summarized.
- 93 KINETIC STUDY OF [^{131}I] IODIDE AND [$^{99\text{m}}\text{Tc}$] PERTECHNETATE IN THYROID CARCINOMA TO EXPLAIN A SCAN DISCREPANCY: CASE REPORT. O'Connor, M.K.; Cullen, M.J.; Malone, J.F. (Coll. of Tech., Dublin). J. Nucl. Med.; 18: No. 8, 796-798 (Aug 1977).
- A study of unusual ^{131}I and [$^{99\text{m}}\text{Tc}$] pertechnetate kinetics was carried out in a case of thyroid carcinoma. A major discrepancy in the handling of iodide, probably resulting from a deficient iodine organification process, was shown.
- 94 CHORD OPERATORS FOR CELL-SURVIVAL MODELS AND INSULT ASSESSMENT TO ACTIVE BONE MARROW. Jones, T.D. (Oak Ridge National Lab., TN). Radiat. Res.; 71: No. 2, 269-283 (Aug 1977).
- Critical Human Organ Radiation Dosimetry (CHORD) probability density functions for A--P (anterior-posterior), P--A (posterior-anterior), bilateral, rotational, and isotropic radiation environments serve as insult-attenuation operators for cell-survival models based on target theory or the prediction of primary lesions according to the dual theory of radiation action. CHORD distributions plus simple depth-dose data also permit the rapid estimation of the insult profile and the mean insult to the active bone-marrow system of a mathematical analog of the ICRP Reference Man. The CHORD concept follows the variations in the microscopic processes of absorption, attenuation, and scattering on a macroscopic level so that it is not necessary to attempt detailed original calculations for each and every case of interest. Similar techniques have been applied to reactor-criticality calculations and the general logic of the CHORD process can be applied to any cause-response type situation which can be described in terms of variation with distance in the medium of interest. Doses to active bone marrow from exposures to photons and neutrons are presented and excellent agreement is shown with the available experimental results.
- 95 (BNL--23150) RATIONALE FOR NONLINEAR DOSE RESPONSE FUNCTIONS OF POWER GREATER OR LESS THAN ONE. Baum, J.W. (Brookhaven National Lab., Upton, N.Y. (USA)). Aug 1977. Contract EY-76-C-02-0016. 8p. (CONF-770663--1). Dep. NTIS, PC A02/MF A01.
- From Workshop on repair mechanisms and exposure standards; Oak Ridge, TN, USA (28 Jun 1977).
- Risk estimates and radiation protection standards are generally made using a nonthreshold premise and linear extrapolations from existing data to estimate biological radiation effects at lower doses and at lower dose rates. This seems reasonable in light of the variety of shapes of dose-effect relations which have been observed both in animal studies and in human epidemiological studies. An unexplained observation in several studies was a response which followed a power function of dose with exponent less than one. One explanation offered for this type of response in humans was a postulated population of heterogeneous sensitivity. An alternate, though related, way of considering this question is in terms of multiple-stresses, and this postulate is discussed.
- 96 (EPA--520/4-77-005, pp 25-43) MEDICAL RADIATION EXPOSURE. Aug 1977. Radiation protection activities, 1976. Data are summarized on efforts by a number of Federal Agencies to reduce the radiation dose to patients undergoing diagnostic radiographic and nuclear medicine procedures.
- 97 (EPA--520/4-77-005, pp 84-89) OTHER NUCLEAR SOURCES. Aug 1977. Radiation protection activities, 1976. Measures to protect the public from fallout from nuclear detonations, nuclear powered surface ships and submarines, radioactive materials in nuclear powered pacemakers, and radiation from electronic products are reviewed.
- 98 (EPA--520/4-77-005, pp 90-109) PROTECTION FROM NONIONIZING RADIATION. Aug 1977. Radiation protection activities, 1976.

Standards for protection of the public against sources of nonionizing radiation are discussed. Sources include radio and television broadcast stations; radar; satellite communication system earth terminals; microwave communication systems; mobile communication systems; microwave ovens; and industrial heating equipment.

99 (EPA--520/4-77-005, pp 110-126)

OCCUPATIONAL EXPOSURE. Aug 1977.

Radiation protection activities, 1976.

Federal responsibilities related to the radiation exposure of personnel are categorized by agencies. A list of workers in some 66 professions who may be exposed to ionizing radiations indicates the diversity of occupational exposure and of the activities of Federal agencies which regulate it. Sources of exposure include external exposure and internal exposure resulting from inhalation or ingestion of radioactive materials. Personnel monitoring activities are reviewed.

100 (FDA--77-8034) REPORT OF STATE AND LOCAL RADIOLOGICAL HEALTH PROGRAMS, FISCAL YEAR 1976. Miller, L.A. (Bureau of Radiological Health, Rockville, Md. (USA)). Aug 1977. 47p. BRH Technical Information Staff, Rockville, Md.

This report is the sixteenth of a series based on data collected during fiscal year reviews of 53 State and local radiological health programs. The resources and activities of State and local radiological health programs are presented and summarized from data collected as of June 30, 1976. Summary data are included for fiscal years 1974 through 1976. Resources include data on personnel, funds, and equipment. The program activity areas are basic planning and administration, x-ray survey and control environmental surveillance, radioactive materials, nonionizing radiation, and other radiological health activities.

101 (UCRL--79428) TRANSNATIONAL AIR QUALITY: THE CASE FOR THE STRATOSPHERE. Knox, J.B.; Dickerson, M.H.; Lange, R.; Peterson, K.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1977. Contract W-7405-ENG-48. 28p. (CONF-770934--1). Dep. NTIS, PC A03/MF A01.

From 8. international technical meeting on air pollution modeling and its application; Louvain-la-Neuve, Belgium (20 Sep 1977).

The new Concorde flight corridors will be at approximately the same height as the debris cloud trajectories of recent high yield Chinese weapons tests. In response to this perception, the FAA with other U.S. agencies is formulating a concept for a Stratospheric Environmental Assessment Capability (SEAC) whose objective is to furnish timely and accurate predictions of in-cabin environmental radiation dose-to-man estimates in the event of future nuclear tests. Modeling elements of the proposed SEAC are illustrated on the high yield Chinese test of November 17, 1976, wherein the debris cloud intersected the North Atlantic flight corridors several days after detonation and resulted in whole-body gamma dose rates of about 1 millirem per hour above background. Had the flight levels been a few kilometres higher, the estimated dose would have been 30 percent higher. The potential exposures on stratospheric flight corridors of the Pacific were estimated to be about 200 to 300 mr/hr, a level warranting diversion of some flight paths. The technical basis and modeling capabilities involved in SEAC will be reviewed along with perceptions of transferrable

experience in the stratosphere to other transnational air quality problems.

102 RECOMMENDATIONS OF STANDARDIZATION OF X-RAY EXAMINATIONS OF THE ESOPHAGUS, STOMACH AND SMALL INTESTINE IN INFANCY. Nitz, I.; Preuss, H.J.; Redlich, F.H. (Gesellschaft fuer Medizinische Radiologie (German Democratic Republic); Gesellschaft fuer Paediatric (German Democratic Republic)). Dtsch. Gesundheitswes.; 32: No. 34, 1597-1600(Aug 1977). (In German).

The working group Children's Radiology of the Societies for Medical Radiology and Paediatrics in the GDR has formulated recommendations for standardization of x-ray examinations of the esophagus, stomach and small intestine in infancy. Indications for these examinations and the methods are described with special regard to meeting radiation protection requirements. The recommendations strive for a unitary approach in institutions fitted with different x-ray units for diagnostics.

103 REDUCED RADIATION LOAD IN MEDICINE. Archimedes (Pretoria); 19: No. 3, 36-37(Aug 1977).

Published in summary form only.

CATALYSIS;DIAGNOSIS;IODINE 129;IODINE 131; MEDICINE;RADIATION DOSES;PATIENTS;RADIOACTIVITY

104 MISUSE OF THE TERM 'SPECIFIC ACTIVITY'. Buchanan, J.D. Health Phys.; 33: No. 2, 155(Aug 1977).

Letter to the editor.

DOSE COMMITMENTS;DOSE EQUIVALENTS;DOSE LIMITS;INFORMATION NEEDS;RADIATION DOSE UNITS; REACTOR ACCIDENTS;RECOMMENDATIONS;SITE SELECTION

105 MAN-REM SITING CRITERIA. Crites, T.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Health Phys.; 33: No. 2, 155(Aug 1977).

Letter to the editor.

RADIOACTIVITY;RECOMMENDATIONS;STANDARDIZED TERMINOLOGY

106 RESTRICTED APPLICABILITY OF THE 'TEN-DAY RULE'. Osborn, S.B. (King's Coll. Hospital, London (UK)). Br. J. Radiol.; 50: No. 596, 606(Aug 1977).

Letter to the editor.

BIOMEDICAL RADIOGRAPHY;RADIATION HAZARDS; FETUSES;PREGNANCY;TEMPORAL DOSE DISTRIBUTIONS

107 CALIBRATION OF DOSE RATE ACCORDING TO SECTION 13 OF THE X-RAY ORDINANCE WITH THE AID OF THERMOLUMINESCENT DOSEMETERS. Ewen, K.; Fischer, P.G. (Gewerbeaufsicht des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.). Zentralstelle fuer Sicherheitstechnik, Strahlenschutz und Kerntechnik). Roentgenpraxis; 30: No. 8, 215-217(Aug 1977). (In German).

The proposal is made to make use of LiF thermoluminescent dosimeters for the half-yearly routine calibrations for X-ray therapy facilities required according to sub-section 1 of section 13 of the X-ray Ordinance instead of employing the ionization chamber system which is much more complicated in many respects. At a secondary standard facility, recognized by the authorities, the dependence of the calibration factor on the radiation quality customary in practice was determined.

- 108 PENDULUM IRRADIATION OF THE MIDDLE PART OF THE ESOPHAGUS WITH FAST ELECTRONS AND ULTRAHARD X RAYS. Kuttig, H.; Schnabel, K.; Bark, R. (Heidelberg Univ. (Germany, F.R.). Strahlenklinik; Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Inst. fuer Nuklearmedizin). Strahlentherapie; 153: No. 8, 533-537 (Aug 1977). (In German).

In order to find out whether the moving field irradiation with fast electrons and ultrahard x rays of a 42 MeV betatron is suitable for the radiotherapy of the esophagus carcinoma, we took measurements on the Alderson phantom. By both methods - irradiation with rapid electrons as well as mono-axial pendulum irradiation with ultra-hard x rays - we did not achieve a satisfactory dose distribution because lung segments of different sizes or the spinal marrow were reached by a relative dose which was too high. The bisegmental pendulum irradiation is the only one which leads to a dose distribution producing a good concentration in the target volume and sparing the surrounding tissues.

- 109 PREGNANCY INTERRUPTION AFTER MEDICAL RADIATION EXPOSURE. Bundesgesundheitsblatt; 20: No. 16, 227 (Aug 1977). (In German).
ABORTION; BIOLOGICAL RADIATION EFFECTS; EXTERNAL IRRADIATION; PREGNANCY; PRENATAL IRRADIATION; RADIOACTIVE MATERIALS; SIDE EFFECTS; X RADIATION; RADIOTHERAPY; RADIOINDUCTION; PATIENTS; WOMEN

- 110 SYNERGISTIC TUMORIGENIC EFFECT OF PROCARBAZINE AND IONIZING RADIATION IN (BALB/C X DBA/2)F₁ MICE. Arseneau, J.C. (Univ. of Rochester, NY); Fowler, E.; Bakemeier, R.F. J. Natl. Cancer Inst.; 59: No. 2, 423-425 (Aug 1977).

From American Association for Cancer Research meeting; San Diego, CA, USA (7 May 1975).

Female (BALB/c x DBA/2)F₁ (CD2F₁) mice were treated with procarbazine (PCB) and ionizing radiation at different times to determine whether any synergistic carcinogenic effect could be demonstrated with the combined treatment. The incidence of pulmonary adenomas in groups of mice receiving both PCB and radiation increased significantly, when compared with mice given PCB alone. The incidence of thymomas also increased significantly in groups of mice given PCB 3 days before or after radiation treatment. Two cases of adenocarcinoma apparently arising from the lacrimal gland were also observed in mice from the groups receiving the combined treatment. This tumor had not previously been associated with PCB administration in mice. The results of this experiment indicated a potentiation of the tumorigenic action of PCB by ionizing radiation in CD2F₁ mice.

- 111 MODIFICATION OF IMMUNOLOGICAL POTENTIAL BY ULTRAVIOLET RADIATION. I. IMMUNE STATUS OF SHORT-TERM UV-IRRADIATED MICE. Spellman, C.W.; Woodward, J.G.; Daynes, R.A. (Univ. of Utah, Salt Lake City). Transplantation; 24: No. 2, 112-119 (Aug 1977).

C3Hf/HeN mice support the progressive growth of most transplanted syngeneic ultraviolet (uv) light-induced tumors following short-term uv exposure whereas nonexposed mice reject these tumors. Because an immunosuppressive role in uv-mediated tumor susceptibility might be suggested by these observations, a comparison of several immunological parameters has been conducted. These include antibody production,

proliferation in response to antigenic and mitogenic stimulation, and the generation of cytotoxic effector cells by normal or short-term uv-exposed mice. The results indicate that short-term uv irradiation of mice does not result in any readily detectable alterations of the host's immune system other than the consistent loss of the antitumor response mediating rejection of the transplanted uv-induced tumor.

- 112 MODIFICATION OF IMMUNOLOGICAL POTENTIAL BY ULTRAVIOLET RADIATION. II. GENERATION OF SUPPRESSOR CELLS IN SHORT-TERM UV-IRRADIATED MICE. Spellman, C.W.; Daynes, R.A. (Univ. of Utah, Salt Lake City). Transplantation; 24: No. 2, 120-126 (Aug 1977).

When normal mice are exposed for short periods to ultraviolet light (uv), they support the progressive growth of transplanted syngeneic uv-induced tumors. Normal nonirradiated mice almost always reject these tumor implants. The uv-mediated suppression of the antitumor response can be adoptively transferred to normal syngeneic mice with lymphoid cells derived from short-term uv-irradiated donors. Transfer of the suppressive effect is dosage dependent and also appears to require the presence of viable T lymphocytes. Suppressive activity was observed in both the spleen and thymus of uv-irradiated donors. In the preceding paper we have established that uv irradiation does not cause a general depression of testable immune functions. Collectively these data suggest that short-term uv irradiation of mice leads to an increase in suppressor cell activity, thereby causing an inhibition in the host's ability to respond to an antigenic uv-induced tumor. The possible role of this phenomenon in the mechanism of uv carcinogenesis is discussed.

- 113 TYPES AND RATE OF CATARACT DEVELOPMENT IN MICE IRRADIATED AT DIFFERENT AGES. Gajewski, A.K. (National Inst. of Hygiene, Warsaw); Majewska, K.; Slowikowska, M.G.; Chomiczewski, K.; Kulig, A. Radiat. Res.; 71: No. 2, 471-480 (Aug 1977).

The effect of age on the development of radiation cataract has been investigated in an inbred A strain of mice and, as a result, the patterns of age dependence and senile mice cataract development were obtained. In general, the lenses of mice 1 to 3 days old were the most sensitive to radiation; the maximum resistance was noted in 5-day-old mice, and from this age up to 3 to 7 weeks of life there was a period of increasing sensitivity. In older animals the lens sensitivity tends to level off. The early stages of cataract occurred in all irradiated groups at a younger age than in the control group, but the late stages occurred in irradiated groups at the same age as the senile cataract occurred in the control group. Two types of cataract were observed. One was typical for young irradiated mice 1 to 5 days of age and the other was typical for all remaining irradiated groups and for a control group. Also, an attempt was made to correlate the obtained results with the cell kinetics in normal lens epithelium.

- 114 EFFECTS OF ANCESTRAL X IRRADIATION FOLLOWED BY RANDOM MATING ON BODY WEIGHT OF RATS. Gianola, D.; Chapman, A.B.; Rutledge, J.J. (Univ. of Wisconsin, Madison). Genetics; 86: No. 4, 849-860 (Aug 1977).

Effects of nine generations of 450R per generation of ancestral spermatogonial x irradiation of inbred rats on body weight were examined. After six generations of random

- mating (avoiding inbreeding) following the termination of irradiation, descendants of irradiated males (R) were significantly lighter than their controls (C) at 3 and 6 weeks, but not at 10 weeks of age. However, differences in growth between R and C populations were small. Among-litter and within-litter variance estimates were generally larger in the R lines than in the C lines, suggesting that selection responses would be greater in R than in C lines. In conjunction with previous evidence--obtained during the irradiation phase of the experiment--this suggested that more rapid response to selection for 6-week body weight, in particular, might accrue in the R lines.
- 115 ESTIMATES OF GENETIC PARAMETERS OF BODY WEIGHT IN DESCENDANTS OF X-IRRADIATED RAT SPERMATOGONIA. Gianola, D.; Chapman, A.B.; Rutledge, J.J. (Univ. of Wisconsin, Madison). Genetics; 86: No. 4, 861-883(Aug 1977).
Effects of nine generations of 450 R per generation of ancestral spermatogonial x irradiation of inbred rats on genetic parameters of body weight at 3, 6 and 10 weeks of age and of weight gains between these periods were studied. Covariances among relatives were estimated by mixed model and regression techniques in randomly selected lines with (R) and without (C) radiation history. Analyses of the data were based on five linear genetic models combining additive direct, additive indirect (maternal), dominance and environmental effects. Parameters in these models were estimated by generalized least-squares. A model including direct and indirect genetic effects fit more closely to the data in both R and C lines. Overdominance of induced mutations did not seem to be present. Ancestral irradiation increased maternal additive genetic variances of body weights and gains but not direct genetic variances. Theoretically, due to a negative direct-maternal genetic correlation, within full-sib family selection would be ineffective in increasing body weight at six weeks in both R and C lines. However, progress from mass selection would be expected to be faster in the R lines.
- 116 MUTATION FREQUENCIES IN FEMALE MICE AND THE ESTIMATION OF GENETIC HAZARDS OF RADIATION IN WOMEN. Russell, W.L. (Oak Ridge National Lab., TN). Proc. Natl. Acad. Sci. U.S.A.; 74: No. 8, 3523-3527(Aug 1977).
The female germ cell stage of primary importance in radiation genetic hazards is the immature, arrested oocyte. In the mouse, this stage has a near zero or zero sensitivity to mutation induction by radiation. However, the application of these mouse results to women has been questioned on the ground that the mouse arrested oocytes are highly sensitive to killing by radiation, while the human cells are not; and, furthermore, that the mature and maturing oocytes in the mouse, which are resistant to killing, are sensitive to mutation induction. The present results have a 2-fold bearing on this problem. First, a more detailed analysis of oocyte-stage sensitivity to killing and mutation induction shows that there is no consistent correlation, either negative or positive, between the two. This indicates that the sensitivity to cell killing of the mouse immature oocyte may not be sufficient reason to prevent its use in predicting the mutational response of the human immature oocyte. Second, if the much more cautious assumption is made that the human arrested oocyte might be as mutationally sensitive as the most sensitive of all oocyte stages in the mouse, namely the maturing and mature ones, then the present data on the duration of these stages permit more accurate estimates than were heretofore possible on the mutational response of these stages to chronic irradiation.
- 117 CLEARANCE OF RADIOACTIVE TANTALUM FROM THE HUMAN LUNG AFTER ACCIDENTAL INHALATION. Newton, D. (Atomic Energy Research Establishment, Harwell, Eng.). Am. J. Roentgenol.; 129: No. 2, 327-328(Aug 1977).
Techniques of body radioactivity measurement were used to study the clearance of activated tantalum oxide accidentally inhaled by three reactor workers. The whole-body retention after 7 days was about 1% of the initial deposit. In one subject studied for a further 424 days the residual activity in the thorax was cleared with a biological half-life of about 1,400 days. The results support indications from other studies that tantalum powder administered in aerosol bronchography may be subject to prolonged alveolar retention.
- 118 (DOCKET-50338--732) NORTH ANNA POWER STATION, UNITS 1 AND 2. REPORTABLE DEFICIENCY REPORT--FINAL RE POSSIBLE EXCESSIVE DOSE RATE INSIDE THE REACTOR CONTAINMENT PERSONNEL AIR LOCK. (Virginia Electric and Power Co., Richmond (USA)). 29 Jul 1977. vp. (DOCKET-50339--699).
Excessive dose rate inside the reactor containment personnel air lock. NORTH ANNA-1 REACTOR; NORTH ANNA-2 REACTOR; CONTAINMENT; PERSONNEL; OPENINGS; RADIATION DOSES; PRESSURE VESSELS; SUPPORTS; SHIELDING
- 119 (UCRL--51939) TRANSFER COEFFICIENTS FOR THE PREDICTION OF THE DOSE TO MAN VIA THE FORAGE-COW-MILK PATHWAY FROM RADIONUCLIDES RELEASED TO THE BIOSPHERE. Ng, Y.C.; Colsher, C.S.; Quinn, D.J.; Thompson, S.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Jul 1977. Contract W-7405-ENG-48. 146p. Dep. NTIS, PC A07/MF A01.
This document presents tables of diet-to-milk transfer coefficients for radioactive and stable isotopes in the cow. The values are based on an extensive literature review of the secretion of radioisotopes in milk and the concentrations of radioactive or stable isotopes in milk and feed. Transfer coefficients were compiled and tabulated for isotopes of more than 70 elements. The values are summarized in a table of elemental transfer coefficients and also organized into separate tables that reveal their elemental systematics and the effects of physical and chemical form.
- 120 (DOCKET-50245--1041) MILLSTONE NUCLEAR POWER STATION, UNITS 1 AND 2. IE INSPECTION REPORT NOS. 77-15 AND -11 (ROUTINE, UNANNOUNCED) RE RADIATION PROTECTION PROGRAM (PERSONNEL, PROCEDURES, EXPOSURE CONTROL AREA AND MATERIAL CONTROL, SURVEYS). (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 12 Jul 1977. vp. (DOCKET-50336--749).
Inspection of radiation protection program. MILLSTONE-1 REACTOR; MILLSTONE-2 REACTOR; INSPECTION; RADIATION PROTECTION; RADIATION DOSES; PERSONNEL; STEAM GENERATORS; EDDY CURRENT TESTING; RADIATION MONITORING
- 121 (DOCKET-50010--789) DRESDEN NUCLEAR POWER STATION, UNITS 1, 2, AND 3. IE INSPECTION REPORT NOS. 77-17, -16, -16 RE OBSERVATION OF DRILL CONDUCTED BY EMERGENCY MEDICAL CONTRACTOR. (Commonwealth Edison Co., Chicago, Ill. (USA)). 7 Jul 1977. vp. (DOCKET-50237--1345; DOCKET-50249--1143).
Inspection of emergency plan observation at

St. Joseph Hospital at Joliet, Ill. DRESDEN-1 REACTOR; DRESDEN-2 REACTOR; INSPECTION; EMERGENCY PLAN; PERSONNEL; CONTAMINATION; RADIATION DOSES; HOSPITALS; CONTROL ROOMS

- 122 (DOCKET-50263--856) MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1. IE INSPECTION REPORT NO. 77-10 (ROUTINE, UNANNOUNCED) RE RADIATION PROTECTION PROGRAM, INFRACTION PER TS 6.5. (Northern States Power Co., Minneapolis, Minn. (USA)). 6 Jul 1977. vp.

Inspection of radiation protection program. MONTICELLO REACTOR; INSPECTION; RADIATION PROTECTION; DOSEMETERS; CALIBRATION; TIME DEPENDENCE; PERSONNEL; EDUCATION; RADIATION MONITORING; RADIATION SOURCES; LEAK TESTING; WHOLE-BODY COUNTING; RADIATION DOSES; CALIBRATION; RESPIRATORS; FILTERS; TESTING

- 123 (ORNL/NUREG/TM--7) CORRELATION OF RADIOACTIVE WASTE TREATMENT COSTS AND THE ENVIRONMENTAL IMPACT OF WASTE EFFLUENTS IN THE NUCLEAR FUEL CYCLE: CONVERSION OF YELLOW CAKE TO URANIUM HEXAFLUORIDE. PART I. THE FLUORINATION-FRACTIONATION PROCESS. Sears, M.B.; Blanco, R.E.; Finney, B.C.; Hill, G.S.; Moore, R.E.; Witherspoon, J.P. (Oak Ridge National Lab., Tenn. (USA)). Jul 1977. Contract W-7405-ENG-26. 332p. Dep. NTIS, PC A15/MF A01.

A cost/benefit study was made to determine the cost and effectiveness of radioactive waste (radwaste) treatment systems for decreasing the release of radioactive materials and chemicals from a model uranium hexafluoride (UF₆) production plant using the fluorination-fractionation (dry hydrofluor) process, and to evaluate the radiological impact (dose commitment) of the released materials on the environment. This study is designed to assist in defining the term as low as is reasonably achievable (ALARA) in relation to limiting the release of radioactive materials from nuclear facilities. The model plant processes 10,000 metric tons of uranium per year. Base-case waste treatment is the minimum necessary to operate the process. Effluents meet the radiological requirements listed in the Code of Federal Regulations, Title 10, Part 20 (10 CFR 20), Appendix B, Table II, but may not be acceptable chemically at all sites. Additional radwaste treatment techniques are applied to the base-case plant in a series of case studies to decrease the amounts of radioactive materials released and to reduce the radiological dose commitment to the population in the surrounding area. The costs for the added waste treatment operations and the corresponding dose commitment are calculated for each case. In the final analysis, radiological dose is plotted vs the annual cost for treatment of the radwastes. The status of the radwaste treatment methods used in the case studies is discussed. Much of the technology used in the advanced cases will require development and demonstration or else is proprietary and unavailable for immediate use. The methodology and assumptions for the radiological doses are found in ORNL-4992.

- 124 PLANS FOR A REDUCTION OF THE RADIATION EXPOSURE IN NUCLEAR POWER PLANTS. APPLICATION OF MODELS FOR PLANNING, MAINTENANCE AND REPAIR. von Dobschuetz, P.; Herrmann, H.J. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Atomwirtsch., Atomtech.; 22: No. 7, 421-423 (Jul 1977). (In German).

In order to reduce the radiation exposure of the personnel engaged in maintenance and repair jobs in future nuclear installations a study

has been carried out to investigate whether planning new facilities on the basis of models could open up possibilities to improve the radiological protection of workers. It has been found that planning, construction, operation and dismantling of nuclear facilities can be carried out much more effectively on the basis of three-dimensional models than by mere two-dimensional drawings. However, it is necessary to align the sizes of the models and their details to the needs of nuclear technology.

- 125 (LA--6898-PR, pp 55-98) ECOLOGICAL STUDIES. Rea, K.H.; Dahl, D.A.; Stoker, A.K. Jul 1977.

Biomedical and Environmental Research program of the LASL Health Division. Progress report, January--December 1976.

Studies were conducted on the ecological consequences of geothermal energy, oils, plutonium, uranium, radioactive effluents, and trace elements from coal utilization. Studies included vegetative stabilization, measurement of radiation exposures in rodents, measurement of radon-222 flux from inactive uranium mill tailings piles, chemical quality of effluents, and others. (HLW)

- 126 MAXIMUM PERMISSIBLE CONCENTRATION (MPC) VALUES FOR SPONTANEOUSLY FISSIONING RADIONUCLIDES. Ford, M.R.; Snyder, W.S.; Dillman, L.T.; Watson, S.B. (Oak Ridge National Lab., Tenn. (USA)). Health Phys.; 33: No. 1, 35-43 (Jul 1977).

Maximum permissible concentration (MPC) values in air and water for spontaneously fissioning radionuclides in use at present are given in Title 10, Code of Federal Regulations, Part 20. In the work reported here these MPC values have been computed using (1) more recent decay data, (2) revised metabolic models, and (3) dosimetry techniques developed during the intervening years. The method of Dillman and Jones (Health Phys.; 29:111 (1975)) is used to obtain the energy released in spontaneous fission and to compute the subsequent dose to body organs from the various radiations. The deposition and retention patterns in the respiratory tract and other body organs are taken principally from ICRP Publication 19, and the gastrointestinal model is from Eve (Health Phys.; 12:131 (1966)). The new values are generally within a factor of 2 or 3 of the limits now in use, although in a few cases factors of 5 to 20 are found.

- 127 (BNWL--2089) RADIOCHEMICAL ANALYSES OF GAME BIRDS COLLECTED FROM THE HANFORD ENVIRONS, 1971--1975. Fix, J.J.; Blumer, P.J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1977. Contract EY-76-C-06-1830. 34p. Dep. NTIS, PC A03/MF A01.

Game birds were collected routinely on the Hanford Site as a way of monitoring radionuclide concentrations potentially attributable to Hanford operations. In general, radionuclide concentrations attributable to Hanford operations were only slightly greater than or indistinguishable from expected levels attributed to worldwide fallout. An exception was that ¹³⁷Cs concentrations, primarily in ducks and coots, were higher than levels attributable to fallout. Only two observations, a ⁹⁰Sr concentration of 0.08 pCi/g and a ¹³⁷Cs concentration of 5.6 pCi/g in pheasants were attributed to Hanford operations. Only ⁶⁵Zn activity observed in geese during 1971 and 1972 was attributed to Hanford operations. Assuming a hunter ingested 5 kilograms of goose meat containing the maximum observed ⁶⁵Zn, 1.3 pCi/g, and ¹³⁷Cs, 1.0 pCi/g concentrations, a 50-

- year internal dose commitment to the total body of 0.05 mrem from ^{65}Zn and 0.3 mrem from ^{137}Cs would be incurred. The duck data were separated into two components for analysis: ducks collected from the Columbia River, and ducks collected from onsite ponds. With the exception of ^{65}Zn , the maximum observed concentrations of ^{60}Co , ^{90}Sr , and ^{137}Cs were for ducks collected from onsite ponds. The maximum ^{65}Zn concentrations were for ducks collected during 1971 from near the Columbia River. Livers from ducks collected from certain onsite ponds were analyzed for U and Pu activity. The majority of the analyses were positive. Only 11 coots were collected from 1971 through 1975, all from onsite ponds; but because coots are less migratory than ducks and may therefore take in more activity from Hanford process ponds, the available data were analyzed. Generally, a much larger fraction of the coots analyzed showed positive analysis for ^{90}Sr and ^{137}Cs activity as compared to ducks collected from along the Columbia River.
- 128 (ANL/ES--58) GREAT LAKES WATERS: RADIATION DOSE COMMITMENTS, POTENTIAL HEALTH EFFECTS, AND COST-BENEFIT CONSIDERATIONS. Ainsworth, E.J. (Argonne National Lab., Ill. (USA)). Jul 1977. Contract W-31-109-ENG-38. 53p. Dep. NTIS, PC A04/MF A01.
- In 1972, a Great Lakes Water Quality Agreement was signed by the United States and Canadian Governments. It was stipulated that the operation and effectiveness of the agreement were to be reviewed comprehensively in 1977. Aspects of the agreement concern nondegradation of Great Lakes waters and maintenance of levels of radioactivity or other potential pollutants at levels considered as low as practicable. A refined radioactivity objective of one millirem is proposed in the Water Quality Agreement. The implications of adoption of this objective are not known fully. The Division of Environmental Impact Studies was commissioned by ERDA's Division of Technology Overview to summarize the information available on the current levels of radioactivity in Great Lakes waters, compute radiation-dose commitment (integrated dose over 50 years after consumption of 2.2 liters of water of one year), and to comment on the feasibility and cost-benefit considerations associated with the refined one-millirem objective. Current levels of radioactivity in the waters of Lakes Michigan, Ontario, Erie, and Huron result in dose commitments in excess of 1 mrem for whole body and 6 mrem for bone. Future projections of isotope concentrations in Great Lakes water indicate similar dose commitments for drinking water in the year 2050. Reduction of the levels of radioactivity in Great Lakes waters is not feasible, but cost-benefit considerations support removal of ^{226}Ra and ^{90}Sr through interceptive technology before water consumption. Adoption of the one-millirem objective is not propitious.
- 129 (LA--6898-PR, pp 123-125) DEVELOPMENT OF FLOW-SYSTEMS INSTRUMENTATION FOR RAPID CELL ANALYSIS AND SORTING. Steinkamp, J.A.; Hansen, K.M.; Wilson, J.S.; Salzman, G.C. Jul 1977.
- Biomedical and Environmental Research program of the LASL Health Division. Progress report, January--December 1976.
- Progress is reported on the following studies: flow analysis and separation of respiratory cells of hamsters; analytical support for flow systems; computer codes for life-cycle analysis and histogram comparison; and statistical analysis of response of rats to negative pions. (HLW)
- 130 SCINTIGRAPHIC PATTERNS OF GALLIUM-67 UPTAKE IN THE BREAST. Kim, Y.C.; Brown, M.L.; Thrall, J.H. (Univ. of Michigan Medical Center, Ann Arbor). Radiology; 124: No. 1, 169-175(Jul 1977).
- A review of 542 ^{67}Ga scans was undertaken to determine the incidence of ^{67}Ga uptake in the normal breast, to establish factors modifying the uptake of ^{67}Ga , and to define patterns of normal vs. pathologic accumulation. Nonpathologic uptake of ^{67}Ga was demonstrated in 29 patients (12 percent of female patients) and was most often associated with conditions stimulating prolactin production or related to estrogenic hormone administration. This type of uptake was symmetrical but of varying pattern depending on the underlying stimulus. Pathologic uptake of ^{67}Ga was demonstrated in 3 cases and always resulted in asymmetrical appearance of the breasts.
- 131 GALLIUM-67 DEPOSITION IN THE HUMAN GASTRO-INTESTINAL TRACT. Newstead, G.; Taylor, D.M.; McCready, V.R.; Bettelheim, R. (Royal Marsden Hospital, Sutton (UK)). Int. J. Nucl. Med. Biol.; 4: No. 2, 109-112(Jul 1977).
- Brief note.
- BILE; BIOLOGICAL LOCALIZATION; CITRATES; COMPARATIVE EVALUATIONS; EXCRETION; FECES; GALLIUM COMPOUNDS; GALLIUM 67; GASTROINTESTINAL TRACT; MAN; NEOPLASMS; QUANTITY RATIO; RADIONUCLIDE KINETICS; RADIOPHARMACEUTICALS; TIME DEPENDENCE; TISSUES; UPTAKE
- 132 CORRELATION OF STRUCTURAL ALTERATIONS WITH FUNCTIONAL VARIATIONS OF RAT LIVER UDPG-DEHYDROGENASE EXPOSED TO γ RADIATION. Kelkar, S.M.; Nadkarni, G.B. (Bhabha Atomic Research Centre, Bombay). Radiat. Res.; 71: No. 1, 225-232(Jul 1977).
- Exposure of dilute solutions of rat liver uridine diphosphoglucose (UDPG)-dehydrogenase to γ radiation caused progressive loss in activity with increasing dose, with complete inactivation at 25 kR. The regulatory function was measured as susceptibility to UDP-xylose; an allosteric inhibitor was abolished at 10 kR. The loss of the allosteric function could be correlated with structural alterations accompanied by the disaggregation of the protein. The resulting components could be separated both by Sephadex G-200 gel filtration and polyacrylamide disk gel electrophoresis. The addition of UDPG, UDP-xylose, and cysteamine afforded protection to the enzyme from radiation inactivation. The coenzyme seemed to provide only partial protection to these functions.
- 133 IMMUNOLOGICAL REACTION OF UV-INDUCED RADIATION DAMAGE IN COLIPHAGE DNA. Fink, A.; Hotz, G. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Genetik und fuer Toxikologie von Spaltstoffen). Z. Naturforsch., c; 32: No. 7, 544-549(Jul 1977).
- Denatured DNA of coliphage T1, poly-dT and dTpT were UV-irradiated (2537 Å) and conjugated to methylated bovine serum albumin. These molecules act as haptens after injection into rabbits. Antibodies are predominantly formed against UV-induced cyclobutane-type of cis-syn-thymine dimers. They belong to the IgG-type of antibody molecules. Antigen-antibody complexes were detected by means of the CsCl-density gradient method. Denaturation of the DNA strongly influences the amount of specific antibodies bound to the antigen. In native DNA thymine dimers are masked concerning their

reaction with antibodies. Photoproducts of UV-irradiated dTTP induce a specific production of antibody. Our results indicate that the cyclobutane type of thymine dimers is the relevant antigenic determinant group in UV-irradiated DNA.

- 134 RESPONSE OF TISSUES TO MULTIPLE SMALL DOSE FRACTIONS. Withers, H.R. (Univ. of Texas, Houston). Radiat. Res.; 71: No. 1, 24-33(Jul 1977).

From Joint annual scientific meeting of the Radiation Research Society and the Health Physics Society; San Francisco, CA, USA (29 Jun 1976).

Conventional radiotherapy uses multiple fractional doses each of which is small enough that cell killing occurs predominantly through "single events". If cellular survival from each fraction were plotted on a single dose-survival curve, it would be within the shoulder region. The initial slope, and the dose range over which survival begins decreasing more rapidly due to lethality from accumulated sublethal events, are the dose-survival parameters most relevant to radiotherapy. Several methods are used to quantify the response of tissues to doses in the range used clinically. At present, such dose-response parameters are subject to considerable uncertainty, but at least they provide a basis for improved understanding of tissue responses to radiation and a framework for further experimentation and, ultimately, for selecting optimum-sized dose fractions.

- 135 EVALUATION OF BENEFITS AND RISKS OF BREAST CANCER SCREENING. Gur, D.; Sashin, D. (Univ. of Pittsburgh). Radiology; 124: No. 1, 261-262(Jul 1977).

Benefit/risk ratios derived by another study group for a population screened at a breast cancer detection center during the first year of operation are analyzed. The authors of the present paper look at the problem in a somewhat different manner. Benefit/risk ratios derived using this approach are significantly lower than those reported in the previous study. The results of the present study indicate that annual mass screening of women under the age of 50 is of questionable value.

- 136 SHAPE OF THE DOSE-RESPONSE CURVE FOR RADIATION CARCINOGENESIS. EXTRAPOLATION TO LOW DOSES. Brown, J.M. (Stanford Univ., CA). Radiat. Res.; 71: No. 1, 34-50(Jul 1977).

From Joint annual scientific meeting of the Radiation Research Society and the Health Physics Society; San Francisco, CA, USA (29 Jun 1976).

It follows from microdosimetric principles that biological effects which require for their production the interaction of two independent sublesions will have both a linear and a quadratic term in their dose-response relationship. Thus the incidence, I , of these effects will be related to the dose, D , of radiation by the equation: $I = \alpha D + \beta D^2$, where α and β are constants. Part of the justification for this equation is that there is a high-LET component to all low-LET radiation. It therefore follows that if the initial part of the dose-response curve for cancer induction by high-LET radiation is linear and is independent of dose rate, then the same must be true for low-LET radiation. This initial linear portion of the curve will underestimate the true response by a factor of 2 at a radiation dose equal to α/β , and by progressively more at higher doses. A review of

the values of α/β from dose-response curves for chromosome aberrations and mutations following low-LET radiation shows that these values are related to the amount of DNA in the genome, and that for mammalian cells this dose is approximately 100 rad. (The geometric mean of 16 values is 127 rad with a 95 percent confidence interval from 85 to 190 rad.) This suggests that if the initial radiation lesion triggering a human cancer is a mutational or cytogenetic event, risk estimates derived from doses of 100 rad will overestimate the cancer risk at low doses and/or low dose rates by a factor of 2 or less. An analysis of risk estimates for radiation-induced cancers in humans supports this prediction.

- 137 RADIOBIOLOGICAL EFFECTS OF LOW DOSES. IMPLICATIONS FOR RADIOLOGICAL PROTECTION. Upton, A.C. (State Univ. of New York, Stony Brook). Radiat. Res.; 71: No. 1, 51-74(Jul 1977).

From Joint annual scientific meeting of the Radiation Research Society and the Health Physics Society; San Francisco, CA, USA (29 Jun 1976).

For most biological effects that are relevant to radiobiological protection under conditions of low-level irradiation--namely, the induction of mutations, chromosome aberrations, cell killing, teratogenic effects, and the induction of neoplasms--the effectiveness per rad of low-LET radiation is reduced at low doses and low dose rates, whereas that of high-LET radiation is relatively less dose and dose rate dependent. The variations with dose, dose rate, and LET differ, however, from one type of effect to another, and in few instances have they been defined well enough to enable confident extrapolations in the exposure levels associated with occupational or natural background irradiation. It is clear that risk estimates based on the linear hypothesis, involving single linear interpolation on dose from effects observed at higher doses and dose rates without allowance for the influence of the aforementioned variables, are more likely than not to err on the conservative side. For more precise estimates of the risks of low-level irradiation, better understanding of the radiobiological mechanisms and more comprehensive knowledge of the response relationships for various types of biological effects are called for. In the interim, to allow for the generally reduced effectiveness per rad of low-LET radiation at low doses and low dose rates, a linear-quadratic function is recommended, in preference to a simple linear function, as a basis for estimating the overall risks of late somatic effects and genetic effects, under conditions of whole-body, low-level, low-LET irradiation. It is not suggested, however, that this function be used with high-LET radiation, where a linear relationship may generally be more appropriate, or with low-LET radiation for those specific effects where some other function is more consistent with the available dose-incidence data.

- 138 RISK VERSUS BENEFIT IN MAMMOGRAPHY. Lester, R.G. (Univ. of Texas Health Science Center, Houston). Radiology; 124: No. 1, 1-6(Jul 1977).

From 62. scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL, USA (14 Nov 1976).

Controversy surrounds the use of mammography in asymptomatic women 35 to 49 years of age. There is agreement that routine mammography is useful beyond 50 years. By extrapolating data

from relatively high radiation exposures, a radiation carcinogenic risk at diagnostic levels has been calculated by some workers. Benefit for asymptomatic women in the 35 to 49 year age group has been questioned. This paper presents evidence that significant numbers of breast cancers are found in this age period on the basis of x-ray examination alone. Data also indicate absorbed dose from modern-day mammography is half to one quarter of that previously assumed. Based on these data, mammography is recommended as a tool for diagnosis of nonpalpable carcinomas of the breast.

Prot. Bull.; No. 20, 5-9(Jul 1977).

Diagnostic nuclear medicine is now a routine procedure in United Kingdom hospitals. The associated radiation hazards are classified into direct radiation doses to patients and staff, containment hazards, environmental hazards and hazards to third parties. Hazards to the patient or volunteer under study are excluded from further consideration. The isotopes of iodine represent the greatest contamination problem, although many other radionuclides are used. The facilities normally available for their manipulation in UK hospital departments are described. A closed trolley is usually ready equipped to deal with any accidental spills. The importance of staff training in decontamination techniques is emphasized. Radionuclide generators, permitting on-site preparation of short-lived nuclides from long-lived precursors, are supplied and used within their own radiation shielding, thus minimizing radiation hazards to staff. There are problems in limiting the finger dose associated with intravenous injections of radionuclides. The development of short-lived nuclides such as ^{99m}Tc and ^{113m}In allowed the administration to patients of larger amounts of radioactivity. Any increase in staff exposure has been kept to a minimum by improved designs of imaging equipment. Although diagnostic nuclear medicine is potentially hazardous, the actual radiation dose typically received is but a small fraction of the maximum permissible dose for a radiation worker, and there is no record in the UK of any harm having accrued to any worker in this field as a result of radiation exposure.

- 139 CONSIDERATION OF THE VOLUME DEPENDENCE OF TOLERANCE DOSES. Gremmel, H.; Wendhausen, H. (Kiel Univ. (Germany, F.R.). Radiologische Klinik). Strahlentherapie; 153: No. 7, 462-466(Jul 1977). (In German).

A general formula for consideration of the dependence of tolerance doses upon volume is obtained by mathematical evaluation of known skin tolerance doses. The validity for different organs is verified using available data of literature. It is recommended to introduce the volume dependence into the Ellis-formula for tolerance doses.

- 140 'RADIAL' SCANNING OF TRABECULAR BONE: CONSIDERATION OF THE PROBABILITY DISTRIBUTIONS OF PATH LENGTHS THROUGH CAVITIES AND TRABECULAE. Spiers, F.W.; Beddoe, A.H. (Cookridge Hospital, Leeds (UK)). Phys. Med. Biol.; 22: No. 4, 670-680(Jul 1977).

Previous methods of dosimetry for radionuclides deposited in trabecular bone have been based on probability distributions of random path lengths through the trabeculae and marrow cavities. These distributions have been measured by a technique in which thin bone sections are effectively scanned along sets of parallel grid lines. A new technique is described in this paper, in which all scan lines pass through a selected point in the section scanned, so that they effectively radiate from the point (or focus) in the manner in which particles emerge isotropically from a radioactive atom. By scanning from a number of foci a 'radial-random' distribution can be obtained for a whole bone, and this distribution compared with that obtained from 'parallel' scanning. Differences between the two types of distribution have been observed, especially where the bone exhibits structural anisotropy, the mean path lengths being up to 13% longer for the radial scanning mode. The effect on the calculated dose factors is not great; based on radial scanning, the factors for a lumbar vertebra are from 5 to 12% less than those for parallel scanning, depending on particle energy. The differences are very small for bones with more uniform trabecular structures, so that for the skeleton as a whole the differences will be smaller than those quoted.

- 141 COMMENTS ON 'A SURVEY OF LUMINESCENT CLOCKS IN HOUSEHOLDS'. Moghissi, A.A.; Carter, M.W. (Georgia Inst. of Tech., Atlanta (USA). Office of Interdisciplinary Programs). Health Phys.; 33: No. 1, 107-108(Jul 1977).

Letter to the editor.

ACCURACY; HUMAN POPULATIONS; RADIATION HAZARDS; LUMINOUS PAINTS; RADIATION DOSES; RADIUM

- 142 PROTECTION PROBLEMS IN THE USE OF RADIOACTIVE MATERIALS IN MEDICAL DIAGNOSIS. Williams, E.S. (Middlesex Hospital, London (UK). Inst. of Nuclear Medicine). Radiol.

- 143 CYTOKINETICS OF REGENERATION IN BETA-IRRADIATED GUINEA PIG EPIDERMIS. Etoh, H.; Taguchi, Y.H.; Tabachnick, J. (Albert Einstein Medical Center, Philadelphia). Radiat. Res.; 71: No. 1, 109-118(Jul 1977).

We studied the time course of depopulation and repopulation of epidermal cells in guinea-pig skin after β irradiation from a ^{90}Sr - ^{90}Y sealed source. Immediately after clipping, one site on each flank was locally irradiated with 1000, 2200, 3000, or 5000 rad (six sites per animal). The changes in number of basal cells, labeling index (LI), and the appearance of clusters of ^3H -thymidine-labeled basal cells (two or more pulse-labeled cells in direct contact) were observed. Maximum cell loss of recognizable basal cells of 20 percent on Day 8, 60 percent on Day 12, and 75 percent on Day 15 occurred after irradiation with 1000, 2200, and 3000 rad, respectively. The data for 5000 rad was similar to that in 3000-rad-irradiated epidermis. Repopulation (as evidenced by increase in LI and clusters of labeled cells) at all doses began on about the day of maximal cell loss. Regeneration occurred from survivors within the irradiated area after 1000 and 2200 rad, and was completed in 5 days (i.e., on Days 13 and 17, respectively). Reepithelization from the radiation margins occurred after 3000 and 5000 rad β irradiation beginning on about Day 15 and was completed in about 7 days. Labeled cells in clusters were rarely seen in nonirradiated epidermis. In irradiated tissue, however, clusters paralleled the rise in LI and reached peaks at about the time of maximal cell loss and then returned to control level at Days 23 and 27 after 1000 and 2200 rad. They remained somewhat above the control level to the 33rd day after 3000 rad (three clusters/mm). There was no hyperplasia after 1000 rad, but a long-lived hyperplastic epidermis resulted after higher doses.

- 144 CHEMICAL PROTECTION AGAINST THE LONG-TERM EFFECTS OF A SINGLE WHOLE-BODY EXPOSURE OF MICE TO IONIZING RADIATION. I. LIFE SHORTENING. Maisin, J.R.; Mattelin, G.; Lambiet-Collier, M. (CEN/SCK, Mol, Belgium). Radiat. Res.; 71: No. 1, 119-131 (Jul 1977).

A systematic study has been made of the advantages gained by treatment with combined radiochemical protectors for long-term survival of mice exposed to a single dose of ionizing radiation. Our results demonstrate that mixtures of radioprotectors increase the degree of protection compared with that obtained with each substance given separately. The dose-effect curves for the long-term survival obtained for irradiated untreated mice and for mice treated with a mixture of radioprotectors are not parallel. Thus the dose-reduction factor (DRF) varies with the X-ray dose administered. The optimum DRF obtained for long-term survival of BALB/c⁺ mice (2.5) was very close to that obtained against acute effects of ionizing radiation (2.8).

- 145 (LA--6898-PR, pp 42-50) DETERMINATION OF PLUTONIUM IN MAN. McInroy, J.F.; Boyd, H.A.; Eutsler, B.C.; Steward, M.W.; Tietjen, G.L. Jul 1977.

Biomedical and Environmental Research program of the LASL Health Division. Progress report, January--December 1976.

Progress is reported on the following studies: particle size distribution in the lung of an individual exposed occupationally to ²³⁹Pu; plutonium in the tissues of the general population; analysis of special samples; health of Los Alamos plutonium workers; epidemiology of plutonium workers; and analysis of the human health and ecological consequences of plutonium and other transuranics. (HLW)

- 146 THEORY OF THE INDUCTION OF BONE CANCER BY ALPHA RADIATION. Marshall, J.H.; Groer, P.G. (Argonne National Lab., IL). Radiat. Res.; 71: No. 1, 149-192 (Jul 1977).

A theory of the induction of osteosarcoma by α particles fits the data for radium in man and dog over the entire dose-time-response surface. The theory postulates that an endosteal cell near bone surface is transformed by three events. Two initiation events, each with a probability of 4×10^{-6} /rad (an effective target diameter of 100 Å), are produced in a single cell by two α particles. A promotion event then occurs at a rate of 10^{-2} /year, not related to radiation, but proportional to the rate of bone remodeling. In competition with these events is the killing of any endosteal cell by an α particle with a probability of 10^{-2} /rad. Killed endosteal cells are assumed to be replaced by stem cells at a rate of 10^{-1} /day. Postulated tumor growth takes 3 to 6 years. These values for man are preliminary. The probability per rad per cell of each initiation appears to be approximately 10 times larger in dog than in man. A new method of three-dimensional analysis provides a compact way to report more fully the data for internal emitters and eliminates competing risks from comparisons between theory and experiment. The theory provides an explanation for latent period, for the protraction effect for ²²⁴Ra in man, for the scarcity of tumors in compact bone, for the narrow time distribution of tumors in dog, for the wide time distribution of tumors in man, for the plateau in cumulative incidence at 17 to 31 percent observed so far for ²²⁶Ra--²²⁸Ra in man, for the much higher plateau in dog (92 percent), and for the steep decrease of tumor rate with decreasing dose below the plateau. Tumor rate P is shown to be a function of endosteal dose D, and, at less

than 1 rad/day, to be independent of endosteal dose rate F. At low doses, P is proportional to D². At high doses, P plateaus and becomes independent of D. The onset of the plateau occurs at 140 rad and is governed by the mean lethal dose to endosteal cells.

- 147 (LA--6898-PR) BIOMEDICAL AND ENVIRONMENTAL RESEARCH PROGRAM OF THE LASL HEALTH DIVISION. PROGRESS REPORT, JANUARY--DECEMBER 1976. Petersen, D.F.; Sullivan, E.M. (comps.). (Los Alamos Scientific Lab., N.Mex. (USA)). Jul 1977. Contract W-7405-ENG-36. 172p. Dep. NTIS, PC A08/MF A01.

Separate abstracts were prepared for 20 sections of the report. (HLW)

- 148 (LA--6898-PR, pp 10-29) HOT PARTICLE PROGRAM. Anderson, E.C.; Holland, L.M.; Prine, J.R.; Smith, D.M.; Thomas, R.G. Jul 1977.

Biomedical and Environmental Research program of the LASL Health Division. Progress report, January--December 1976.

Progress is reported on the following studies: comparative tumorigenicity of localized and diffuse lung irradiation in hamsters using ²¹⁰Po, ²³⁸Pu, ²³⁹Pu, and ¹⁴⁷Pm; ferric oxide and Pu/ZrO₂-induced pulmonary carcinogenesis; the MUMPS (Massachusetts General Hospital Utility Multi-Programming System) animal data system; chromosome aberrations in hamster lung cells by inhaled ²³⁸PuO₂/ZrO₂ particles; and dosimetry of ²¹⁰Po instillations. (HLW)

- 149 EXPERIENCE WITH INTAKES OF TRITIUM FROM VARIOUS PROCESSES. Brodsky, A. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). Health Phys.; 33: No. 1, 94-98 (Jul 1977).

Empirical data which have been gathered from the literature and from visits to various types of industrial, academic and medical institutions, in order to estimate the overall range of probabilities (or fractions) of intake of tritium in various forms and in various types of processes are presented. This work has been carried out as part of a study of factors involved in the development of tritium bioassay standards, but the empirical findings should be of more general interest in planning and evaluating safety programs. The findings are summarized in tabular form and include an overall estimate of the fraction of tritium entering the plant or facility that finds its way into workers. The need for this type of information for realistic hazard evaluation and design of safe facilities, equipment and procedures is emphasized.

- 150 RETENTION OF ALKALINE EARTH ELEMENTS IN MAN, WITH SPECIAL REFERENCE TO BARIUM. Newton, D.; Rundo, J.; Harrison, G.E. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Health Phys.; 33: No. 1, 45-53 (Jul 1977).

The retention of ¹³³Ba has been determined over a period of 10 yr after intravenous injection into a 60 yr old man. Approximately 84% of the injected dose was excreted during the first 6 days, predominantly in feces. After 6 days, the retention could be represented by a four-component exponential function of time after injection, indicating biological half-lives of 3.5 days (22.6% of the dose), 35.1 days (4.2%), 741 days (3.9%) and 8000 +- 4900 days (1.6%). Comparison with data on the retention of ⁴⁵Ca, ⁸⁵Sr and ²²³Ra in the same subject suggests that the turnover rates

- of all four elements bound in bone are similar, and that differences in their long-term retention occur because of the differences in their excretory plasma clearance rates and in the proportions of the injected dose which are cleared from labile body pools in the early stages. The data for ^{133}Ba are examined in terms of the model developed by the ICRP Task Group on Alkaline Earth Metabolism. This analysis supports their assumption of a ratio of four between the turnover rates of cancellous and compact bone, but, compared with the Task Group's assumptions, the actual rates appeared to be 35% higher, and the power function slope for barium retention was 27% lower.
- 151 INCORPORATION OF TRITIATED-THYMIDINE INTO CULTURED LEUKOCYTES. COMPARISON BETWEEN HUMAN AND RAT CELLS. Morimoto, K.; Koizumi, A. (Tokyo Univ. (Japan). Faculty of Medicine). *Radioisotopes* (Tokyo); 26: No. 7, 465-468 (Jul 1977).
CELL CULTURES; COMPARATIVE EVALUATIONS; LEUKOCYTES; MAN; RADIATION INJURIES; RATS; THYMIDINE; TIME DEPENDENCE; TRITIUM COMPOUNDS; UPTAKE; RADIONUCLIDE KINETICS
- 152 (LA--6898-PR, pp 4-7) TRACE ELEMENT METABOLISM. Thomas, R.G.; Anderson, E.C.; Richmond, C.R. Jul 1977.
Biomedical and Environmental Research program of the LASL Health Division. Progress report, January--December 1976.
Studies on trace element metabolism consisted of the following: retention of ^{109}Cd in mice, rats, monkeys, and dogs; and ^{137}Cs whole-body content in a normal New Mexico population. (HLW)
- 153 NEW RADIATION PROTECTION ORDINANCE. Bartholdy, V. (Bundesministerium des Innern, Bonn (Germany, F.R.)). *Atomwirtsch., Atomtech.*; 22: No. 7, 396-401 (Jul 1977). (In German).
The new Radiation Protection Ordinance promulgated October 13, 1976, will combine the provisions of the older First and Second Radiation Protection Ordinances and thereby define uniform rules for the whole field of radiation protection law through concentration, harmonization and the publication of amendments. Recommendations by international agencies and the recent Basic Euratom Standards were taken into account. The new provisions concentrate on the extension of the technical scope of validity and the general principle of radiation protection, the three levels of government supervision, the establishment of a permissible incident planning dose for nuclear power plants, rules on radiological protection at work and the protection of the public and the environment, and the disposal of radioactive waste.
- 154 ELECTRON DOSE FROM IMMERSION IN A SEMI-INFINITE PHOTON-EMITTING CLOUD. Unnikrishnan, K. (BARC Hospital, Bombay (India)). *Health Phys.*; 33: No. 1, 89-91 (Jul 1977).
Estimates of absorbed dose in a reference man immersed in a semi-infinite cloud of air, uniformly contaminated with radioactivity, which provides useful basic data for assessing the potential hazard from the release of radioactive materials into air, normally refer only to photons, and the dose delivered by the associated electron flux produced by the interactions of photons in air is not evaluated. Since dose to the basal layer of the skin may be a crucial factor in many cases of external exposure, it is desirable to have estimates of dose from this additional source as well. Such a calculation is here described, from which it is seen that the electron dose rate can by no means be ignored.
- 155 BILATERAL PROTRUSIO ACETABULI FOLLOWING PELVIC IRRADIATION. Hasselbacher, P.; Schumacher, H.R. (Univ. of Pennsylvania, Philadelphia). *J. Rheumatol.*; 4: No. 2, 189-196 (Sum 1977).
A 77 year old man developed bilateral protrusio acetabuli three years following pelvic irradiation for transitional cell carcinoma of the prostatic urethra. There was no evidence of metastasis or coexistent systemic arthritis. Aseptic necrosis of acetabular bone is the postulated etiology. Gross and pathologic evidence of aseptic necrosis of both femoral heads was observed. Vascular fibrosis was a prominent pathologic finding, as was eosinophilia of the synovial fluid and joint tissue. Protrusio appears to be an infrequently described complication of pelvic irradiation.
- 156 (DOCKET-50220--829) NINE MILE POINT NUCLEAR STATION, UNIT 1. PERSONNEL RADIATION EXPOSURE SUMMARY FOR 1976. (Niagara Mohawk Power Corp., Syracuse, N.Y. (USA)). 30 Jun 1977. vp.
Personnel radiation exposure summary for 1976. NINE MILE POINT-1 REACTOR; PERSONNEL; RADIATION DOSES
- 157 BOMB ^{14}C AS A BIOLOGICAL TRACER. Stenhouse, M.J.; Baxter, M.S. (Glasgow Univ. (UK). Dept. of Chemistry). *Nature* (London); 267: No. 5614, 828-832 (30 Jun 1977).
Residence times of atmospheric $^{14}\text{CO}_2$ in dietary and human tissue samples have been determined. Using data on the dietary and environmental ^{14}C content, a comprehensive survey of dietary habits of the UK population has been performed to evaluate percentages of protein, lipid and carbohydrate supplied by different commodities. The predicted ^{14}C content of mature tissues, of tissues under growth, and of arterial lipid deposits all for the years 1953-1973 were computed, from which estimates of the turnover times of liver, kidney, spleen, heart, muscle, lung, brain, testes/ovaries, pancreas and thyroid were obtained. It is stressed that the turnover values determined here are representative of each tissue in its entirety, or at least of its protein-lipid fractions. The possible pathogenesis or timescale of treatment of atherosclerosis as suggested by these studies is discussed.
- 158 BOMB ^{14}C AND HUMAN RADIATION BURDEN. Stenhouse, M.K.; Baxter, M.S. (Glasgow Univ. (UK). Dept. of Chemistry). *Nature* (London); 267: No. 5614, 825-827 (30 Jun 1977).
Following the publication (Stenhouse and Baxter, *Nature*; 267:828 (1977)) of the levels of bomb ^{14}C and the residence times of carbon in the human body, excess radiation burdens from this radioisotope are evaluated under the assumption that no radiation dose, however small, can be regarded as entirely harmless biologically. The estimated annual absorbed dose attributable to ^{14}C both natural and man-made for 1953-1973 and similar predicted figures for 1975-2025 are shown graphically. The cumulated doses to gonads (over 30 yr) and to bone marrow and bone-lining cells (over 60 yr) and also estimates of the biological damage to reproductive cells from ^{14}C β -irradiation

- (30 yr accumulated dose) are presented. It is concluded from both genetic and somatic considerations, that the potential human radiation burden due to artificially produced ^{14}C calculated using the assumptions stated is certainly significant and, therefore, cannot be dismissed. However, relative to the world population and in view of the time span over which this dose is delivered, some three to four generations, the conclusion of this study must be that such effects will occur unnoticed.
- 159 (DOCKET-50267--789) FORT ST. VRAIN NUCLEAR GENERATING STATION. IE INSPECTION REPORT NO. 77-08 (ROUTINE, UNANNOUNCED) RE QUALIFICATION OF HEALTH PHYSICS STAFF, RADIATION PROTECTION (AUDITS, PROCEDURE CHANGES), HEALTH PHYSICS INSTRUMENTS AND EQUIPMENT, ETC., INFRACTION PER TS 7.4.D REPLY. (Public Service Co. of Colorado, Denver (USA)). 22 Jun 1977. vp.
Inspection of HP staff qualification, radiation protection, instrument calibration, and radiation training. VRAIN REACTOR; INSPECTION; RADIATION PROTECTION; PERSONNEL; DOCUMENTATION; RADIATION DETECTORS; CALIBRATION; EDUCATION; RADIATION DOSES; RADIOACTIVE EFFLUENTS; GASEOUS WASTES
- 160 (DOCKET-50206--731) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. IE INSPECTION REPORT NO. 77-09 (ROUTINE, UNANNOUNCED) RE RADIATION PROTECTION PROGRAM, RADIOACTIVE WASTE MANAGEMENT, SF PACKAGING AND SHIPPING, EMERGENCY PLANNING, ROS, INFRACTION PER 10CFR101(B); REPLY; ACKNOWLEDGMENT. (Southern California Edison Co., Rosemead (USA)). 21 Jun 1977. vp.
Inspection of radiation protection program. SAN ONOFRE-1 REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES; WHOLE-BODY IRRADIATION; TRANSPORT; RADIOACTIVE EFFLUENTS; RADIOACTIVE WASTE MANAGEMENT; SOLID WASTES; PACKAGING; EMERGENCY PLAN
- 161 (DOCKET-50206--746) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. NRC REQUESTS FOR ADDITIONAL INFORMATION RE CONTROL ROOM OPERATOR DOSE ESTIMATES. (Southern California Edison Co., Rosemead (USA)). 16 Jun 1977. vp.
Control room operator dose estimates. SAN ONOFRE-1 REACTOR; PERSONNEL; RADIATION DOSES
- 162 (DOCKET-50255--1023) PALISADES NUCLEAR PLANT. IE INSPECTION REPORT NO. 77-04 (ROUTINE, UNANNOUNCED) RE RADIATION PROTECTION PROGRAM. (Consumers Power Co., Jackson, Mich. (USA)). 15 Jun 1977. vp.
Inspection of radiation protection program, qualifications, training, procedures, equipment, exposure control, and notifications. PALISADES-1 REACTOR; INSPECTION; PERSONNEL; WHOLE-BODY COUNTING; RADIATION PROTECTION; PERSONNEL; EQUIPMENT; RADIATION DOSES; RADIATION MONITORS
- 163 BENIGN TRANSIENT EOSINOPHILIA FOLLOWING INTRAVENOUS UROGRAPHY. Vincent, M.E.; Gerzof, S.G.; Robbins, A.H. (Boston Veterans Administration Hospital). J. Am. Med. Assoc.; 237: No. 24, 2629(13 Jun 1977).
Eosinophilia, a component of the allergic response, may occur after the use of iodinated radiographic contrast media for intravenous urography. A benign transient elevation in differential eosinophil count was seen in 21 of 101 patients following the injection of iodinated contrast agents for that purpose.
- 164 (DOCKET-50245--1068) MILLSTONE NUCLEAR POWER STATION, UNITS 1 AND 2. ANNUAL PERSONNEL RADIATION EXPOSURE SUMMARY. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 10 Jun 1977. vp. (DOCKET-50336--805).
Annual personnel radiation exposure summary. MILLSTONE-1 REACTOR; MILLSTONE-2 REACTOR; PERSONNEL; RADIATION DOSES; ACTIVITY LEVELS
- 165 (DOCKET-50409--522) LACROSSE BOILING WATER REACTOR. IE INSPECTION REPORT NO. 77-08 (ROUTINE, UNANNOUNCED) RE RADIATION PROTECTION PRACTICES DURING REFUELING. (Dairyland Power Cooperative, La Crosse, Wis. (USA)). 5 Jun 1977. vp.
Inspection of radiation protection program during refueling. LACBWR REACTOR; INSPECTION; RADIATION PROTECTION; REACTOR FUELING; PERSONNEL; EDUCATION; REACTOR MAINTENANCE; RADIATION DOSES
- 166 (UCRL--51879(Pt.5)) DOSE ASSESSMENT AT BIKINI ATOLL. Robison, W.L.; Phillips, W.A.; Colsher, C.S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Jun 1977. Contract W-7405-ENG-48. 51p. Dep. NTIS, PC A04/MF A01.
Bikini Atoll is one of two sites in the northern Marshall Islands that was used by the United States as testing grounds for the nuclear weapons program from 1946 to 1958. In 1969 a general cleanup began at Bikini Atoll. Subsistence crops, coconut and Pandanus fruit, were planted on Bikini and Eneu Islands, and housing was constructed on Bikini Island. A second phase of housing was planned for the interior of Bikini Island. Preliminary data indicated that external gamma doses in the interior of the island might be higher than in other parts of the island. Therefore, to select a second site for housing on the island with minimum external exposure, a survey of Bikini Atoll was conducted in June 1975. External gamma measurements were made on Bikini and Eneu Islands, and soil and vegetation samples collected to evaluate the potential doses via terrestrial food chains and inhalation. Estimates of potential dose via the marine food chain were based upon data collected on previous trips to the atoll. The terrestrial pathway contributes the greater percentage, external gamma exposure contributes the next highest, and inhalation and marine pathways contribute minor fractions of the total whole body and bone marrow doses. The radionuclides contributing the major fraction of the dose are ^{90}Sr and ^{137}Cs . All living patterns involving Bikini Island exceed federal guidelines for 30-yr population doses. The Eneu Island living pattern leads to doses that are slightly less than federal guidelines. All patterns evaluated for Bikini Atoll lead to higher doses than those on the southern islands at Enewetak Atoll.
- 167 (DOCKET-50244--726) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. LICENSE NO. DPR-18, APPLICATION FOR AMENDMENT: TS PROPOSED CHANGES RE ADDITIONAL MEANS FOR PROVIDING RADIATION MONITORING IN HIGH RADIATION AREAS. (Rochester Gas and Electric Corp., N.Y. (USA)). 3 Jun 1977. vp.
Additional means for providing radiation monitoring in high radiation areas. GINNA-1 REACTOR; RADIATION MONITORING; PERSONNEL; EDUCATION; STANDARDS; RADIATION MONITORS; RADIATION DOSES; RADIATION PROTECTION
- 168 IMPACT OF SMALL PIPE WELD TYPES ON PERSONNEL EXPOSURE. Carlton, R.E.; Walt, T.D.

(Bechtel Power Corp., San Francisco). Trans. Am. Nucl. Soc.; 26: 489(Jun 1977).

From Transactions of the American Nuclear Society 1977 annual meeting; New York, NY, USA (12 Jun 1977).

NUCLEAR POWER PLANTS; RADIATION PROTECTION; REACTOR MAINTENANCE; WELDED JOINTS; RADIATION DOSES; PERSONNEL; COMPARATIVE EVALUATIONS; PIPES

mild enzymatic and morphological changes observed in the lung suggest an inert behavior of the monazite dust toward this tissue. However, biochemical alterations in liver and kidney indicate slight dissolution of some constituents of this naturally occurring mineral from the pulmonary tissue to other body organs.

- 169 IMAGE QUALITY IN FILM AND XERO-MAMMOGRAPHY. I. RENDERING OF LOW CONTRAST VALUES. Saebel, M.; Paterok, E.M.; Weishaar, J.; Willgeroth, F. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Abt. fuer Gynaekologische Radiologie). Fortschr. Geb. Roentgenstr. Nuklearmed.; 126: No. 6, 529-536(Jun 1977). (In German).

The rendering of low contrast values by various mammographic imaging systems was investigated by a semi-objective procedure. Test exposures of a line raster with variable line widths were evaluated visually. Significantly better results were achieved by a xero-radio-graphic method. This was better than non-screen mammographic film in terms of object size, lower sensitivity to scatter and better resolution. The use of a tungsten rotating anode, with about 0.5 mm. Al filter, in xeromammography provided a satisfactory compromise between image quality and radiation dose in the rendering of low contrast studies.

- 170 (ORNL--5315) RADIOLOGICAL IMPACT OF AIRBORNE EFFLUENTS OF COAL-FIRED AND NUCLEAR POWER PLANTS. McBride, J.P.; Moore, R.E.; Witherspoon, J.P.; Blanco, R.E. (Oak Ridge National Lab., Tenn. (USA)). Jun 1977. Contract W-7405-ENG-26. 43p. Dep. NTIS, PC A04/MF A01.

Radiological impact of naturally occurring radionuclides in airborne effluents of a model coal-fired steam plant is evaluated assuming a release to the atmosphere of 1 percent of the ash in the coal burned and compared with the impact of radioactive materials in the airborne effluents of model light-water reactors. The principal exposure pathway for radioactive materials released from both types of plants is ingestion of contaminated foodstuffs. For nuclear plants immersion in the airborne effluents is also a significant factor in the dose commitment. Assuming that the coal burned contains 1 ppm uranium and 2 ppm thorium together with their decay products and using the same impact analysis methods used in evaluating nuclear facilities, the maximum individual dose commitments from the coal plant for the whole body and most organs (except the thyroid) are shown to be greater than those from a pressurized-water reactor (PWR) and, with the exception of the bone and kidney doses, less than those from a boiling-water reactor (BWR). With the exception of the bone dose, the maximum individual dose commitments from the coal plant are less than the numerical design guideline limits listed for light-water reactors (LWRs). Population dose commitments from the coal plant are higher than those from either nuclear plant.

- 171 EFFECT OF MONAZITE ON BODY ORGANS OF RATS. Tandon, S.K.; Gaur, J.S.; Behari, J.; Mathur, A.K.; Singh, G.B. (Industrial Toxicology Research Centre, Lucknow, India). Environ. Res.; 13: No. 3, 347-357(Jun 1977).

Biochemical and histological alterations in lungs, liver, and kidney of albino rats at different time intervals after an intratracheal administration of monazite, the chief source of thorium and some rare earth elements of industrial significance, were investigated. The

- 172 (NUREG--0301) REGULATION OF NATURALLY OCCURRING AND ACCELERATOR-PRODUCED RADIOACTIVE MATERIALS. A TASK FORCE REVIEW. Nussbaumer, D.A.; Lubenau, J.O.; Cool, W.S.; Cunningham, L.J.; Mapes, J.R.; Schwartz, S.A.; Smith, D.A. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Material Safety and Safeguards). Jun 1977. 74p. Dep. NTIS, PC A05/MF A01.

The use of accelerator-produced radioisotopes (NARM), particularly in medicine, is growing rapidly. One NARM radioisotope, ^{226}Ra , is one of the most hazardous of radioactive materials, and ^{226}Ra is used by about $1/5$ of all radioactive material users. Also, there are about 85,000 medical treatments using ^{226}Ra each year. All of the 25 Agreement States and 5 non-Agreement States have licensing programs covering NARM users. The Agreement States' programs for regulating NARM are comparable to their programs for regulating byproduct, source, and special nuclear materials under agreements with NRC. But there are 7 states who exercise no regulatory control over NARM users, and the remaining States have control programs which are variable in scope. There are no national, uniformly applied programs to regulate the design, fabrication and quality of sources and devices containing NARM or consumer products containing NARM which are distributed in interstate commerce. Naturally occurring radioactive material (except source material) associated with the nuclear fuel cycle is only partially subject to NRC regulation, i.e., when it is associated with source or special nuclear material being used under an active NRC license. The Task Force recommends that the NRC seek legislative authority to regulate naturally occurring and accelerator-produced radioactive materials for the reason that these materials present significant radiation exposure potential and present controls are fragmentary and non-uniform at both the State and Federal level.

- 173 (PB--268358) ALLEGED INJURIES INVOLVING USE OF ULTRAVIOLET RADIATION IN DENTISTRY. INTERIM REPORT. Mills, L.F. (Bureau of Radiological Health, Rockville, Md. (USA). Div. of Biological Effects). Jun 1977. 11p. (FDA/BRH--77/124). NTIS PC A02/MF A01.

Two hundred and nine reports of alleged injury associated with the use of ultraviolet photopolymerization in the oral cavity were reviewed and tabulated. More than half of the 232 injured persons were dentists. Eye injuries were the most frequent. The injuries reported in this review are not representative of a comprehensive effort at casefinding. Instead, they are typical reports submitted by dentists to the manufacturer. The injuries reported appear to reflect the nature of dental practice, and the exposure sites are consistent with the three types of persons involved in the dental procedure.

- 174 ESTIMATION AND CONTROL OF POPULATION DOSE WITHIN BUILDINGS. Moeller, D.W.; Underhill, D.W.; Gulezian, G.V. (Harvard School of Public Health, Boston). Trans. Am. Nucl. Soc.; 26: 117(Jun 1977).

From Transactions of the American Nuclear

- Society 1977 annual meeting; New York, NY, USA (12 Jun 1977).
RADIATION DOSES;DOSIMETRY;HUMAN POPULATIONS; BUILDINGS;RADIATION PROTECTION
- 175 RADIATION DOSIMETRY: A PROPOSED METHOD FOR DEFINING DOSAGES. Quisenberry, D.R. (Mercer Univ., Macon, GA). Ga. J. Sci.; 35: No. 3, 140-150(Jun 1977).
Many of the inadequacies of the system presently used for surveying environments containing ionizing radiation arise from the problem of defining a radiation parameter which is additive, measurable and closely related to peak dose equivalent in the body. Many of the present conceptual difficulties could be eliminated if surveys were made in terms of quantity "equivalent dose factor" defined as the sum of the peak dose equivalents generated by all the components of the field if each were incident normally to the front of an appropriate phantom. Equivalent dose factor is related to the quantity measured by existing instruments is both additive and measurable, and can be rigorously related to primary radiation field quantities. It is always greater than peak dose equivalent in the body, and could be used to define an exposure period during which a given dose equivalent could not be exceeded. The dose to specific parts of the body would then be estimated by personal dosimetry. Fields of low energy radiation could continue to be surveyed in terms of dose to specific superficial organs. Equivalent dose factor, which corresponds to the instrumental measurement, exceeds dose equivalent index, an indication of peak dose equivalent in the body, by a factor which can be as large as four.
- 176 SURVEY OF RADIATION DOSES TO PATIENTS FROM THE DIAGNOSTIC USE OF X-RAYS. Atom (London); No. 248, 116-118(Jun 1977).
The National Radiological Protection Board is to carry out a survey of doses received by patients from the diagnostic use of x rays, beginning in June 1977, and carried out at over 100 National Health Service hospitals. Details are given of the reasons for carrying out the survey and the survey objectives. The survey working methods are discussed, together with methods of calculation of the genetically significant dose. The radiation doses will be measured by a thermoluminescent dosimeter developed specially for the survey.
- 177 HUMAN EXPOSURE TO IONIZING RADIATION FOR MEDICAL REASONS. Thomas, R.H.; Busick, D.D. (Univ. of California, Berkeley). Am. Ind. Hyg. Assoc. J.; 38: No. 6, 295-297(Jun 1977).
The central issue in this debate is not whether there is a threshold dose below which deleterious effects in humans occur nor whether the dose-effect relationship is linear or curvilinear. The central issue is whether there is merit in a continuing effort to reduce radiation exposures to patients no matter at what level. This should be determined by a careful balancing of potential risks against expected benefits. It is this element of risk-benefit analysis that is absent in Morgan's philosophy. A good example of the changing nature on the risk-benefit balance is that of the use of mass radiography programs to diagnose tuberculosis. Before the Second World War this disease was a terrible scourge of the poor who could ill-afford adequate medical care. The use of mass radiography programs have played a large part in the elimination of this disease.
- 178 IMPORTANCE OF HIGH-SPEED SCREEN-FILM-COMBINATIONS FOR CORONARY ANGIOGRAPHY. Bardach, G. (Vienna Univ. (Austria). Roentgenstation). Roentgen Bl.; 30: No. 6, 320-324(Jun 1977). (In German).
Radiographs are shown which demonstrate the importance of recently marketed high speed intensifying screens for coronary angiography. The angiograms done with this technique are compared with 1) single frames of a 35 mm cinerecording 2) 70 mm image intensifier spot films 3) Film changer angiograms using conventional calcium-tungstate screen combinations. The author shows the advantages of short exposure times made possible by the high-speed screens and the reduced radiation exposure of the patient and of the examiner.
- 179 RADIATION EXPOSURES ASSOCIATED WITH SURFACE MINING OF URANIUM. Miller, H.T. (Gulf Science and Technology Co., Pittsburgh, Pa. (USA). Medical Div.). Health Phys.; 32: No. 6, 523-527(Jun 1977).
Measurements of external gamma radiation, radon and radon progeny, and air-borne uranium aerosols were made at an operating open-pit mining operation using readily available field survey techniques and instruments. Measurement techniques are discussed. Radiation exposure to various occupational categories, such as excavation equipment operators, truck drivers, equipment maintenance personnel, ore control personnel, and to the engineering staff, is estimated. These estimates are compared to the results of film badge dosimetry. While the average exposure rate was found to be in the order of 0.5 mR/hr $\pm$ 0.5 mR/hr, it was noted that higher exposures (up to 10 mR/hr) were measured in the vicinity of ore bodies containing uranium in the percent range. Some contamination of earth-moving equipment by uranium-bearing dusts were also noted.
- 180 RADIATION PROTECTION AND THE 'NEW' SYSTEM OF UNITS. Brundelius, F. (Branddirektion Stuttgart (Germany, F.R.)). Brandschutz; 31: No. 6, 160-161(Jun 1977). (In German).
Consequences of the SI units for the practical work of the fire brigade: Limits and dose constants would have to be calculated anew, and new exclusion areas would have to be established. New readings would be required for all pointer instruments. The only things kept constant would be dose or dose rate indicators which give acoustic and/or optical warning when a certain threshold has been reached, and film dosimeters. It is a slight consolation that hours and minutes, at least, are still valid units.
- 181 WIDE MARGIN OF IMPLICIT BUILT-IN SAFETY FACTORS IN CURRENT RADIATION PROTECTION STANDARDS. Kahan, R.S.; Feige, Y. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Health Phys.; 32: No. 6, 509-521(Jun 1977).
The lowest doses and dose rates at which radiation damage has been detected are summarized, and also the doses and dose rates for which no known effects could be demonstrated. The lack of relevant experimental data at low doses was the main justification for a linear extrapolation of the damage effects observed at relatively high doses back to low and near-zero doses and dose rates. Evidence is reviewed of non-linear dose-effect relationships that frequently fit available data. It is proposed that man-made radioactivity, of the magnitude of local variations in the natural background activity (a few tenths of mrem/yr), be treated as

insignificant. It is misleading to treat as factual the numerical death estimates derived from radiation protection guides. There is no objective justification to reduce these standards of permissible exposure to man-made radiation to levels below those recommended by ICRP.

- 182 RECOMMENDATIONS OF THE 'COMMITTEE 17' ON ENVIRONMENTAL MUTAGENESIS: IMPLICATIONS TO RADIATION SAFETY. Murthy, M.S.S. (Bhabha Atomic Research Centre, Bombay (India)). Health Phys.; 32: No. 6, 567-569 (Jun 1977).

Brief note.

MAXIMUM PERMISSIBLE EXPOSURE; MUTAGENESIS; RADIATION DOSE UNITS; RADIATION PROTECTION; RECOMMENDATIONS

- 183 COMPARISON OF THE EFFECTIVENESS OF CONTEMPORARY OPHTHALMIC LENSES AGAINST BETA RADIATION. Dunlap, J.H.; Harvey, P.W.; Schwing, R.L. (Air Force Hospital, Kirtland AFB, N. Mex. (USA)). Radiological Health Section. Health Phys.; 32: No. 6, 555-559 (Jun 1977).

As part of a study intended to identify the lens material and type that provides maximum eye protection against beta radiation, the effectiveness of contemporary ophthalmic lenses has been evaluated. From the calculations and measurements presented it is evident that safety glasses with crown glass ophthalmic lenses afford the eye the greatest protection against beta radiation, whereas street glasses with plastic ophthalmic lenses afford the eye very little protection. It is to be noted that glass street lenses (approximately 2.2 mm thick) provide greater protection than plastic safety lenses (approximately 3.5 mm thick). A warning is given against the use of safety lenses containing a large percentage of thorium.

- 184 SECONDARY RADIATION FROM SUPERVOLTAGE ACCELERATORS - ITS IMPLICATIONS IN PATIENT PROTECTION. Bhatnagar, J.P. (Boston Univ., Mass. (USA)). School of Medicine. Br. J. Radiol.; 50: No. 594, 449-450 (Jun 1977).

If the collimator and compensator of a supervoltage accelerator are made of high atomic number material they will tend to interact with the high energy photon beam predominantly by pair production. Associated with pair-production is a cascade formation resulting in a variety of radiations which may be serious from the point of view of patient protection, particularly if the field of treatment is close to some superficially located critical organ such as the lens of the eye or the gonads. Gonadal doses of about 15% of the mid-depth dose were measured on a young male patient undergoing treatment of the prostate by a 42MV x-ray beam from a Siemens betatron. A lead block 1.5 cm thick placed over the patient's thighs covering the scrotum reduced the gonadal dose to less than 2% of the mid-depth dose. A similar set of measurements made on a specially constructed scrotum-penis phantom confirmed these results, and showed that the lead block must be placed close to the phantom to be effective. Comparative measurements made just outside a cobalt 60 beam showed that the doses were far smaller than those outside the 42MeV x-ray beam. Recommendations are therefore made for the thickness and positioning of lead shielding required to protect critical organs from secondary radiation in radiotherapy.

CONCEPTS OF RADIATION BEAM DOSAGE. Brewin, T.B. (Institute of Radiotherapeutics and Oncology, Glasgow (UK)). Br. J. Radiol.; 50: No. 594, 430-434 (Jun 1977).

The difficulty that many trainees, including those medically qualified, have in achieving a sound working grasp of certain basic principles of radiation beam dosage is often underestimated. Since any failure of understanding may seriously impair the efficiency of the team treating the patient, the discussion of these problems (and especially the monitoring of the results of such discussion by means of oral and written tests) deserves a high priority. Contrary to traditional practice, there would seem to be no good reason why teaching of radiation beam dosage, and the effect on dose-rate of changes in the treatment distance or in the amount of scattered radiation, should not begin in the very first week of training and be immediately integrated with discussion of the dose-rate information available at every radiotherapy unit when the patient is treated. A preliminary course of physics lectures does not usually make the understanding of these principles any easier and can be done either concurrently or later. For many radiotherapy trainees and for many doctors in other fields, comparison with drug dosage and with the brightness and scatter of ordinary light beams, avoiding technical terms so far as possible, may achieve a better initial understanding of basic principles than is achieved by mathematical equations and theoretical physics.

- 186 MAMMOGRAPHY WITH MINIMAL RADIATION DOSE. COMPARATIVE INVESTIGATIONS OF VARIOUS IMAGING SYSTEMS. Weissleder, H.; Kiefer, H. (Deutsche Klinik fuer Diagnostik, Wiesbaden (Germany, F.R.)). Sektion Radiologie. Fortschr. Geb. Roentgenstr. Nuklearmed.; 126: No. 6, 520-528 (Jun 1977). (In German).

Using an MR-film-screen combination for mammography, only 8% of the usual radiation dose was found to be necessary. This corresponds with an average skin dose of 0.55 R per exposure. The new technique resulted in visible improvement of contrast. Some loss of detail affected in particular the recognition of microcalcification. As the sole method for the early diagnosis of occult carcinomas of the breast, it will therefore be necessary to improve image quality. The system is suitable for control examinations and investigation of special problems. The use of the MR system with non-screen film in two planes is discussed in relation to dose reduction.

- 187 TISSUE TOLERANCE UNDER THE COMBINATION TREATMENT OF MAXILLARY CANCER. Egawa, J. (Teikyo Univ., Tokyo (Japan)). Faculty of Medicine; Ono, I.; Suzuki, K.; Takeda, C.; Ebihara, S. Gan No Rinsho; 23: No. 8, 805-809 (Jun 1977). (In Japanese).

The tissue tolerance doses of the maxillary sinus structures were estimated when they were subjected to treatment for maxillary cancer by the usual combination of surgery, radiotherapy, and regional arterial infusion of 5-fluorouracil. Equivalent single dose calculation was applied with irreversible tissue damage as an indicator. The retardation of epithelialization of the maxillary sinus operated upon appeared to be correlated with the dose delivered. The study indicated that 2,200 rad expressed by equivalent single dose is a safe dose level for sufficient epithelialization. The safety dose level for the bony structure, exposed by surgery, seemed to be at 1,800 rad.

- 185 WHEN AND HOW SHOULD WE TEACH THE BASIC

- 188 ELECTRON MICROSCOPICAL STUDY OF HUMAN SUBMANDIBULAR SALIVARY GLANDS. ABOUT THE DAMAGE OF IRRADIATION THERAPY. Isonc, K. (Osaka Univ. (Japan). School of Dentistry). Osaka Daigaku Shigaku Zasshi; 22: No. 1, 46-70 (Jun 1977). (In Japanese).

All the patients in the group treated by interstitial radiotherapy suffered from carcinoma of tongue. The surgical specimens obtained over a month after Ir-192 needling, were morphologically similar with two exceptions to those in the non-irradiated group. In the externally irradiated group given over 3,000 rad, there was a tendency to increase destruction and fibrosis of acini in proportion to radiation dose and the period of time between irradiation and operation. In the surgical specimens on 6 months after 3,000 to 4,000 rad and 2 months after 7,000 to 8,000 rad, the alveolar architecture showed remarkable degenerative changes. Acinous cells were more easily destroyed than duct cells. Serous cells in particular were usually destroyed earlier than mucous cells. In the materials taken out over 6 months after 3,000 to 4,000 rad and 2 months after 7,000 to 8,000 rad, mucous cells completely disappeared. Showing various changes, however, serous cells were still present in some of the glands and a few of them contained secretory granules. Myoepithelial cells and basement membranes were remarkably resistant to radiation. Acini, surrounded by myoepithelial cells and basement membrane, showed various kinds of vacuolar degeneration. In the materials, however, taken out over 6 months after 3,000 to 4,000 rad, and over 2 months after 7,000 to 8,000 rad, secretory cells showing various changes or other cells of which origins could not be determined showed great resistance to radiation. Secretory granules in serous cells showed various changes in appearance and/or structure, affected by radiation dose or the length of time from radiation therapy.

- 189 LONG-TERM EFFECTS OF RADIUM EXPOSURE IN FEMALE DIAL WORKERS: SERUM PROTEINS.

Polednak, A.P. (Argonne National Lab., IL). Environ. Res.; 13: No. 3, 396-406 (Jun 1977).

Serum protein levels were examined in 367 women first employed before 1930 in the radium dial industry. Mean levels were compared by age (55 to 64, 65 to 74, and 75 to 84 years) and initial intake of radium (<0.20, 0.20 to 0.99, greater than or equal to 1.00, and greater than or equal to 5.00 $\mu\text{Ci/kg}$). Few differences were statistically significant. In the 65 to 74 year-olds, α -2-globulin was significantly higher in the highest-dose group than in the lowest-dose group. In the small sample of 75 to 84 year-olds, the mean γ -globulin level was significantly lower in the high-dose (greater than or equal to 1.00 $\mu\text{Ci/kg}$) than in the low-dose (<0.20 $\mu\text{Ci/kg}$) group. Multiple linear regression analysis, excluding persons with diagnosed cancer, showed significant contributions of age at examination and age at first exposure to prediction of α -2-globulin in the higher-dose groups. These cross-sectional data suggest greater increases in α -2-globulin with age in the higher-dose groups, and could indicate direct or indirect effects of radium exposure. More detailed, longitudinal studies are needed.

- 190 (ORO--754, pp 41-46) ANIMAL EFFECTS. Noonan, T.R. Jun 1977.

Comparative Animal Research Laboratory. Progress report, 1974--1977.

Studies on mammalian genetics and reproduction included: effects of fission

neutrons and x-rays on the mouse embryo; radiation dosimetry in the developing pig fetus; effects of continuous prenatal gamma radiation on the pig and rat; and late effects of ^{60}Co gamma radiation on the bovine oocyte as reflected by oocyte survival, follicular development, and reproductive performance. Studies on mammalian cytogenetics included: effects of gamma radiation on the stem and differentiating spermatogonia of the rat; sister chromatid exchanges in large animal leukocytes; chromosome aberrations in swine leukocytes induced by half-body and whole-body irradiation; and peripheral blood cell damage and recovery in chronically irradiated swine. Studies on late somatic effects included: late effects of whole-body gamma radiation on hemograms of female cattle; effects of gamma radiation on lifespan and disease in cattle; and late somatic effects of whole-body gamma radiation on burros. (HLW)

- 191 PERIODICAL COMPENSATION RESPONSES OF THE MOUSE BRAIN IN THE COURSE OF POSTNATAL GROWTH FOLLOWING FRACTIONATED X IRRADIATION DURING EMBRYOGENESIS. Konermann, G. (Freiburg Univ. (Germany, F.R.). Inst. fuer Biophysik und Strahlenbiologie). Strahlentherapie; 153: No. 6, 399-414 (Jun 1977). (In German).

Following daily fractionated irradiations (10 R/d to 80 R/d) the compensability of a growth deficit in brain is the less the later exposures during germ development have been performed. Irradiations during fetogenesis (14th to 18th day p.c.) or during organogenesis (6th to 13th day p.c.) induce a long-term growth retardation, even if survival is not impaired. In the case of an increased lethality rate most pronounced retardation effects are produced in the course of late embryogenesis (11th to 15th day p.c.). Daily fractionated irradiations during early embryogenesis (6th to 10th day p.c.) or blastogenesis (first to 5th day p.c.) however do not exclude a complete disappearance of the deficit in brain weight as compared with the controls, even if germ lethality simultaneously amounts to about 50%. At the neonatal age, incorporation of ^3H -thymidine into the DNA of brain is diminished in most experimental groups, but towards the end of the first and the end of the second week after birth it is intensified as compared with nonirradiated animals. During the second stimulation phase the activity of incorporation generally increases the more the heavier the radiation insults have been and the stronger the brains are retarded in their growth. The intensity and duration of proliferation responses, therefore, are not accordant with the disappearance of the deficit in weight. The enhanced proliferation responses together with a high degree of retardation and a constant deficit in weight are regarded as an overdriven uncoordinated process of recovery, in the course of which the formation of precursors to microneurons and glia cells, specific for early postnatal stages of development, is stimulated, whereas the cellular growth of the neurons is inhibited.

- 192 RBE VALUES OF D(16) + BE AND D(50) + BE NEUTRONS FOR CHROMOSOME REARRANGEMENTS INDUCED IN MOUSE SPERMATOGONIA. Pecrot, M.; Leonard, A.; Wambersie, A.; Meulders, J.P. (Louvain Univ. (Belgium). Lab. de Radiobiologie). Strahlentherapie; 153: No. 6, 423-430 (Jun 1977).

The rate of reciprocal translocations induced in mouse spermatogonia by exposure to X-rays and to neutrons produced by 16 and 50 MeV deuterons has been estimated by scoring multivalent configurations in the descendant

spermatocytes. In the X-irradiated group the yield of translocations increases from 2.1 per 100 cells after exposure to 100 rad to 5.7 after exposure to 300 rad. The dose-response relationship shows no statistical departure from linearity. After exposure to 50, 100 or 150 rad of $d(16) + Be$ and $d(50) + Be$ neutrons, the yield of translocations displays a humped curve. Up to this dose the RBE value decreases with absorbed dose and neutron energy.

- 193 RADIATION-INDUCED ERYTHROLEUKEMIA IN THE BEAGLE DOG. Tolle, D.V.; Fritz, T.E.; Norris, W.P. Am. J. Pathol.; 87: No. 3, 499-510 (Jun 1977).

Eleven cases of myeloproliferative disease occurred in a group of 24 beagle dogs placed in a ^{60}Co γ -ray field at about 13 months of age and irradiated at an exposure rate of 5 R/22-hour day for duration of life. Of these 11 dogs, 5 were diagnosed as having erythroleukemia. The bone marrow showed marked erythroblastic hyperplasia, with maturation arrest of the erythroid elements, and increased numbers of myeloblasts and promyelocytes. The terminal peripheral blood was characterized by marked anemia and thrombocytopenia, with circulating erythrocytic precursors and abnormal erythrocyte morphology. Splenomegaly and hepatomegaly occurred in 4 of the 5 animals. In the spleens and livers of all 5, there was extensive leukemic infiltration and proliferation. The extent of leukemic involvement in other tissues and organs varied in individual dogs.

- 194 COMBINED EFFECTS OF X-IRRADIATION AND BLEOMYCIN ON THE PROLIFERATION OF ISOPROTERENOL-STIMULATED MOUSE PAROTID GLANDS. Sheju, M. (Osaka Univ. (Japan). School of Dentistry). Osaka Daigaku Shigaku Zasshi; 22: No. 1, 195-204 (Jun 1977). (In Japanese).

Effects of x irradiation and bleomycin (BLM) on DNA synthesis in isoproterenol (IPR)-stimulated mouse parotid glands were investigated. The incorporation of thymidine- 3H into DNA in parotid glands increased remarkably in 16 hours with a peak at 22 hours after the injection of IPR. When x irradiation (250 rads) was given at 1 hour after IPR (early G_1 phase), the stimulation of DNA synthesis was inhibited by about 50%, and the beginning of DNA synthesis was delayed nearly 6 hours. BLM injected in the early G_1 phase was also effective in inhibiting DNA synthesis. However, the injection of BLM in the late G_1 or S phase did not interfere with DNA synthesis. Combined x irradiation and BLM inhibited DNA synthesis and delayed the beginning of the S phase far more strikingly than did x irradiation alone. When BLM was injected at various intervals before and after x irradiation, the greatest inhibition was found just after irradiation. Therefore, a longer interval between x irradiation and BLM injection had a tendency to decrease the rate of inhibiting DNA synthesis. These findings were confirmed by measuring the labeling index and the mitotic index in the acinar cells of the mouse parotid gland. These results suggest that simultaneous application of x irradiation and BLM has the greatest effect.

- 195 (HEDL-TME--76-98) PROCEDURE FOR HAZARDS ANALYSIS OF PLUTONIUM GLOVEBOXES USED IN ANALYTICAL CHEMISTRY OPERATIONS. Delvin, W.L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1977. Contract EY-76-C-14-2170. 31p. Dep. NTIS, PC A03/MF A01.

A procedure is presented to identify and

assess hazards associated with gloveboxes used for analytical chemistry operations involving plutonium. This procedure is based upon analytic tree methodology and it has been adapted from the US Energy Research and Development Administration's safety program, the Management Oversight and Risk Tree (MORT).

- 196 DOSE CALCULATIONS DUE TO THE INHALATION OF ^{222}Rn , ^{220}Rn AND THEIR DAUGHTERS. Pohl, E. (Salzburg Univ. (Austria). Lehrkanzel fuer Physik); Pohl-Rueling, J. Health Phys.; 32: No. 6, 552-555 (Jun 1977).

A method of calculating the mean annual doses to the most critical organs and tissues of man due to the inhalation of radon and its daughters is presented. The calculations take into account the time a person spends at various locations and on statistically significant mean concentrations of each radionuclide in the atmosphere at these locations. The mean inhalation rates, dependent on sex, age and the physical activity of each individual, are considered.

- 197 GENERAL PHANTOM PROCEDURE FOR CALIBRATING INHALED ^{212}Pb BODY BURDENS. Gonzales, D.E. Health Phys.; 32: No. 6, 493-503 (Jun 1977).

A whole-body counting procedure for phantom calibration of inhaled ^{212}Pb body burdens is developed. The 2.62 MeV photons from the associated ^{208}Tl serve as an indicator of internal ^{212}Pb contamination, and the spectra of uncontaminated volunteers are used to ascertain the existence and scale the magnitude of body burdens possessed by individuals of different effective thickness. Based on metabolic considerations, a quasi-uniform ^{212}Pb - ^{212}Bi corporal distribution is assumed to be established 15 to 24 hr after inhalation, and a calibration phantom is accordingly constructed, details of which are given. The calibration relation constructed by comparing the individual's measured ^{208}Tl counting rate with that of a compatible theoretical phantom of known ^{228}Th activity was applied to whole-body counting of workers from a Brazilian gas mantle (ThO_2) factory, and shown to provide reasonable agreement with measured airborne ^{212}Pb activity there. Finally, sources of error in the calibration scheme are discussed, and suggestions for future improvements are presented.

- 198 GENETIC DAMAGE FROM DIAGNOSTIC RADIATION. Bross, I.D.J.; Natarajan, N. (Roswell Park Memorial Inst., Buffalo). J. Am. Med. Assoc.; 237: No. 22, 2399-2401 (30 May 1977).

Using the data from the Tri-State Leukemia Survey and a mathematical model, the hypothesis that low levels of diagnostic radiation produce severe genetic damage that is expressed in the child of the exposed person as leukemia and other diseases is tested. It is estimated that for about 1% of the exposed persons who are affected by radiation, there is a 50-fold increase in the risk of leukemia and a five-fold increase in certain other diseases.

- 199 RADIONUCLIDE CYSTOGRAPHY IN THE INVESTIGATION OF VESICoureteric REFLUX IN CHILDREN. Rothwell, D.L.; Constable, A.R.; Albrecht, M. (Institute of Urology, London (UK)). Lancet; 1: No. 8021, 1072-1074 (21 May 1977).

50 children with urinary-tract infection and vesicoureteric reflux were investigated by direct radionuclide cystography (R.N.C.). Recent micturating cystourethrograms (M.C.U.) were used as controls. In 37 patients the

results of both tests corresponded, 9 patients were M.C.U. positive only, and 4 were R.N.C. positive only. R.N.C. is associated with a considerably lower radiation dose than M.C.U.s and intravenous urograms, it provides an accurate measurement of residual urine, and is simple to apply with equipment which is readily available. R.N.C. is a useful investigation in the diagnosis and management of reflux and a valuable complement to standard radiographic methods.

200 (DOCKET-50133--542) HUMBOLDT BAY POWER PLANT, UNIT 3. IE INSPECTION REPORT: NOTICE OF VIOLATIONS PER 10CFR20.101(B) AND 10CFR20.401(B); PROPOSED CIVIL PENALTIES; INSPECTION FINDINGS FOR FEBRUARY 1974--APRIL 1977. (Pacific Gas and Electric Co., San Francisco, Calif. (USA)). 16 May 1977. vp. Inspection of radiation exposures and penalty for violations amounting to \$7,500. HUMBOLDT BAY REACTOR; INSPECTION; PERSONNEL; RADIATION PROTECTION; RADIATION DOSES; CIVIL LIABILITY; EDUCATION

201 (DOCKET-50280--794) SURRY POWER STATION, UNITS 1 AND 2. REPLY TO IE INSPECTION REPORT NOS. 77-05 AND -05 RE INFRACTION PER 10CFR20.401(A). (Virginia Electric and Power Co., Richmond (USA)). 16 May 1977. vp. (DOCKET-50281--703). Reply to IE inspection report 77-05 and -05 re infraction per 10CFR20.401(a) re radiation inspection records. SURRY-1 REACTOR; INSPECTION; RADIATION DOSES; PERSONNEL; DOCUMENTATION; NEUTRONS

202 (DOCKET-50155--705) BIG ROCK POINT NUCLEAR PLANT. REPLY TO IE INSPECTION REPORT NO. 77-04 RE VENTILATION PATTERNS AND SITE EMERGENCY PLAN; ACKNOWLEDGMENT. (Consumers Power Co., Jackson, Mich. (USA)). 11 May 1977. vp. Reply to IE inspection report 77-04 re ventilation patterns and site emergency plan. BIG ROCK POINT REACTOR; INSPECTION; VENTILATION; RADIATION DOSES; EMERGENCY PLAN; PERSONNEL; DECONTAMINATION

203 STUDY OF THE EFFECT OF ULTRAVIOLET LIGHT ON BIOMEMBRANES. 6. INCREASE IN THE ION PERMEABILITY OF MITOCHONDRIAL AND ARTIFICIAL LIPID MEMBRANES. Putvinskii, A.V.; Potapenko, A.Ya.; Puchkov, E.G.; Roshchupkin, D.I.; Vladimirov, Yu.A. (2. Pirogov Medical Institute, Moscow (USSR)). Stud. Biophys.; 64: No. 1, 17-32 (10 May 1977).

The effect of uv-light on the ion permeability of mitochondrial membranes and artificial membranes prepared from mitochondrial lipids has been studied. By the pH-pulse method the proton permeability is shown to increase under exposure to uncoupling uv-radiation doses. These doses also increased potassium permeability. This is testified by the results of an investigation of the active (energy-dependent) swelling of mitochondria and of their K⁺ ion content. With a view to approaching an understanding of the mechanism of uncoupling of oxidative phosphorylation at the uv-irradiation of mitochondria, the role of photoperoxidation of unsaturated fatty acids and of destruction of SH-group in enhancing the ion permeability of mitochondria has been examined. The ion permeability was shown to increase at uv-irradiation of artificial lipid membranes. The contribution of the damage of the lipid component to UV-induced enhancement of the permeability of mitochondrial membranes has been analysed.

204 RADIATION EXPOSURE AND THYROID CANCER. Greenspan, F.S. (Univ. California, San Francisco). J. Am. Med. Assoc.; 237: No. 19, 2089-2091 (9 May 1977).

There are abundant experimental and clinical data to associate radiation exposure and thyroid cancer. The incidence of thyroid cancer increases with increasing doses of thyroidal radiation from 6.5 rads to 1,500 rads, but higher doses tend to destroy the gland and are associated with hypothyroidism rather than cancer. The peak occurrence of thyroid tumors is between five and 30 years after exposure, but a person may develop thyroid tumors as long as 50 years after irradiation. Multiple thyroidal lesions or disorders, including adenomas, thyroiditis, and hypothyroidism as well as malignant neoplasms, can occur after radiation exposure. It is imperative, therefore, to study carefully all patients with a history of radiation exposure to the gland and to observe them carefully for life. Suggestions are made for the management of thyroid disease in these patients.

205 (RFP-ENV--76) ANNUAL ENVIRONMENTAL MONITORING REPORT, JANUARY--DECEMBER 1976. (Atoms International Div., Golden, Colo. (USA). Rocky Flats Plant). 6 May 1977. Contract EY-76-C-04-3533. 44p. Dep. NTIS, PC A05/MF A01.

Data are presented from the environmental monitoring program at Rocky Flats Plant during 1976. Data are included on the radioactivity in air samples, the content of Pu, Am, U, and tritium in water samples, and Pu in soil samples from various locations. Chemical and biological constituents in sewage treatment plant effluents are reported. The public radiation dose was approximately 0.11 millirem/yr at the Plant perimeter.

206 (DOCKET-50321--815) EDWIN I. HATCH NUCLEAR PLANT, UNIT 1. IE INSPECTION REPORT NO. 77-04 (ROUTINE, UNANNOUNCED) RE INFRACTIONS PER 10CFR50-B-VII, 20.201; DEFICIENCIES PER 10CFR50-B-IX; REPLY; ACKNOWLEDGMENT. (Georgia Power Co., Atlanta (USA)). 5 May 1977. vp. Inspection of procedures, procurement, refueling, operations, ISI, and radiation protection. HATCH-1 REACTOR; INSPECTION; WELDING; ELECTRODES; RADIATION PROTECTION; REACTOR FUELING; DOCUMENTATION; RADIATION MONITORING; IODINE; SAMPLING; RADIATION MONITORS; CALIBRATION; PERSONNEL; RADIATION DOSES; IN-SERVICE INSPECTION; BYPASSES; PIPELINES; CRACKS; FEEDWATER; SPARGERS; MODIFICATIONS; CONDENSATION CHAMBERS

207 (DOCKET-50133--511) HUMBOLDT BAY POWER PLANT, UNIT 3. ANALYSIS OF A REFUELING ACCIDENT INSIDE THE REFUELING BUILDING CONTAINMENT. (Pacific Gas and Electric Co., San Francisco, Calif. (USA)). 3 May 1977. 2p.

Analysis of a refueling accident inside the refueling building containment. HUMBOLDT BAY REACTOR; REACTOR FUELING; ACCIDENTS; RADIATION DOSES; PERSONNEL

208 (Y/UB--6) ENVIRONMENTAL MONITORING REPORT: UNITED STATES ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, OAK RIDGE FACILITIES, CALENDAR YEAR 1976. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1 May 1977. Contract W-7405-ENG-26. 58p. Dep. NTIS, PC A04/MF A01.

The Environmental Monitoring Program for the Oak Ridge area includes sampling and analysis

of air, water from surface streams, several food products, vegetation, and soil for both radioactive and nonradioactive materials. This report presents a summary of the results of the program for calendar year 1976. Surveillance of radioactivity in the Oak Ridge environs indicates that atmospheric concentrations of radioactivity were not significantly different from other areas in East Tennessee.

Concentrations of radioactivity in the Clinch River and in fish collected from the river were less than 8.1 percent of the permissible concentration and intake guides for individuals in the offsite environment. While some radioactivity was released to the environment from plant operations, the concentrations in all of the media sampled were well below established standards. The total body dose to a hypothetical maximum exposed individual at the site boundary was calculated to be 7.2 mrem/yr which is 1.4 percent of the ERDA Manual Chapter 0524 standard. The maximum 50-year dose commitment to the critical organs of an individual from the aquatic food chain was calculated to be 150 millirem to the bone which is 10 percent of the allowable annual standard. The maximum dose commitment to individuals living nearest the site boundary from airborne releases, assuming continuous residence, was 0.4 millirem to the total body and 7.4 millirem to the lung. These doses are 0.08 percent and 0.5 percent, respectively, of the annual standards. The average total body dose to an Oak Ridge resident was estimated to be 0.05 millirem as compared to approximately 100 mrem/yr from natural background radiation; the average dose commitment to the lung of an Oak Ridge resident was 0.7 millirem. The cumulative total body dose to the population within a 50-mile radius of the Oak Ridge facilities resulting from 1976 effluents was calculated to be 5.3 man-rem.

- 205 EXAMINATION OF STRUCTURE, EQUIPMENT AND ORGANIZATION OF PERSONNEL CARRYING OUT IN-SERVICE TESTS, AND MAINTENANCE AND REPAIR WORK IN THE CONTROL AREAS OF NUCLEAR POWER PLANTS. Noack, J. (Lahmeyer International G.m.b.H., Frankfurt am Main (Germany, F.R.)). VGB Kraftwerkstechnik; 57: No. 5, 315-318 (May 1977). (In German).

Detailed information on personnel in various European nuclear power plants was obtained by questionnaires. The questions referred to: Number, radiation exposure, education/training, type, and origin. Data of seven nuclear power plants were evaluated.

- 210 (DP--1455, pp 183-186) COMPARISON OF CURVED TRAJECTORY ATMOSPHERIC TRANSPORT VS. ASSUMED STRAIGHT-LINE TRANSPORT. Cooper, R.E. (Savannah River Lab., Aiken, SC). May 1977.

Savannah River Laboratory environmental transport and effects research. Annual report, 1976.

The Dose-to-Man program as currently being implemented at the Savannah River Laboratory provides estimates of the environmental effects of Savannah River Plant operations. These estimates utilize a polar grid structure and assume straight-line transport of materials released to the atmosphere to distances beyond grid boundaries. The assumption of straight-line transport is standard for such estimates and greatly simplifies the computations involved in providing estimates of effects. Generally, the atmospheric transport trajectory will be curved; and, for distances out to 100 km or so, the assumption may lead to significant error. Therefore, a computer code was constructed to provide an estimate of the curved trajectory transport relative to

straight-line transport over an extended time period.

- 211 (DP--1455, pp 193-198) MEASURING ⁸⁵Kr CONCENTRATIONS AROUND A NUCLEAR FUEL REPROCESSING FACILITY. Craft, R.C.; McMillan, W.G. (Savannah River Lab., Aiken, SC). May 1977.

Savannah River Laboratory environmental transport and effects research. Annual report, 1976.

In the spring of 1974, Savannah River Laboratory (SRL) personnel began a cooperative research project to improve calculations of the transport and dispersion of materials released to the atmosphere. ⁸⁵Kr, a noble gas, is ideal for tracing the path of released materials because (a) it does not react chemically with other substances in the air or on the ground, and (b) it is radioactive and very small quantities can be measured with special instruments. This report documents a small portion of the overall project: the collection of the samples, and an estimation of the individual exposure rates at the sample locations. Approximations of the dispersal of the ⁸⁵Kr are given in two diagrams. The exposure rates indicate that no significant individual doses are probable. Samples will continue to be collected through September of 1977.

- 212 (SSI--1977-004) IONIZING RADIATION IN DWELLINGS RELATED TO THE BUILDING MATERIALS. Swedjemark, G.A. (Statens Stralskyddsinstitut, Stockholm (Sweden)). May 1977. 5p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Experimentally determined values were used to investigate the absorbed dose or concentration of radon and daughter products. The exposure rates, the concentrations of radon and daughter products and the ventilation rates have been determined in seven groups of houses built in the early 1970s in central Sweden. The activity concentrations in the building materials used at the time for building the houses were measured earlier. The absorbed dose in the gonads was, as expected, found to be lower than the theoretical value, 1.5mGy/y. For the multi-family houses the values were about 1.0 mGy/y and for the single-family houses about half that value. The concentrations of radon in equilibrium with the daughter products normalized to one air change per hour and to the maximum concentration of radium-226 in the building material were found to be about 100Bq/m³, for the multi-family houses. No significant difference from this value was found for the single-family houses despite the fact that the amounts of stony building materials were less than in the multi-family houses.

- 213 (ORNL--5269) DIFFUSION-TYPE MODEL OF THE GLOBAL CARBON CYCLE FOR THE ESTIMATION OF DOSE TO THE WORLD POPULATION FROM RELEASES OF CARBON-14 TO THE ATMOSPHERE. Killough, G.G. (Oak Ridge National Lab., Tenn. (USA)). May 1977. Contract W-7405-ENG-26. 56p. Dep. NTIS, PC A05/MF A01.

A nonlinear dynamic model of the exchange of carbon among the atmosphere, terrestrial biosphere, and ocean is described and applied to estimating the radiation dose to the world's population from the release of ¹⁴C to the atmosphere from the nuclear power industry. A computer implementation of the model, written in the IBM Continuous System Modeling Program III (CSMP III) simulation language, is presented. The model treats the ocean as a diffusive medium with respect to vertical

transport of carbon, and the nonlinear variation of CO₂ partial pressure with the total inorganic carbon concentration in surface waters is taken into account in calculating the transfer rate from ocean to atmosphere. Transfers between the atmosphere and terrestrial biosphere are represented by nonlinear equations which consider CO₂ fertilization and impose a constraint on the ultimate total carbon mass in the biosphere.

- 214 NORMAL DISTRIBUTION OF ¹¹¹IN CHLORIDE ON SCINTIGRAM. Oyama, K.; Machida, K.; Hayashi, S.; Watari, T.; Akaike, A. (Tokyo Univ., Japan). Radioisotopes (Tokyo); 26: No. 5, 302-307(May 1977). (In Japanese).

Indium-111-chloride (¹¹¹InCl₃) was used as a bone marrow imaging and a tumor-localizing agent in 38 patients (46 scintigrams), who were suspected of, or diagnosed as, having malignant disease, and who were irradiated for malignant disease. The regions of suspected malignant disease, of abnormally accumulated on scintigrams, and the target irradiated, were excluded to estimate the normal distribution of ¹¹¹InCl₃. Scintigrams were taken 48 hrs after intravenous injection of ¹¹¹InCl₃ 1 to 3 mCi. The percent and score distribution of ¹¹¹InCl₃ were noted in 23 regions. As the liver showed the highest accumulation of ¹¹¹In on all scintigrams, the liver was designated as 2+. Comparing with the radioactivity in the liver, other regions had similar (2+), moderately decreased (+), or severely decreased (-) accumulation on scintigram. The score is given one for 2+, 0.5 for +, 0 for -. The score and percentage distributions were: liver 100 (100%), lumbar vertebra 58.5 (100%), mediastinum 55 (100%), nasopharynx 50 (100%), testis 47.5 (59%), heart 44.5 (89%), and pelvis 43.5 (78%). Comparing this study with a previous study of ¹¹¹In-BLM, score distribution in lumbar vertebra, pelvis, and skull were similar. ¹¹¹In-BLM is excreted rapidly after injection, but little ¹¹¹InCl₃ is excreted. Accumulation of ¹¹¹In in bone marrow depends upon the amount of ¹¹¹In-transferrin in blood. High accumulation in the lumbar vertebra and pelvis shows that ¹¹¹InCl₃ would be effective as a bone marrow imaging agent.

- 215 REPRODUCTIVE SURVIVAL AND HYPOXIC PROTECTION AS A FUNCTION OF RADIATION IONIZATION DENSITY. FURTHER STUDIES WITH MURINE LEUKEMIA CELLS IRRADIATED IN VITRO WITH MONOENERGETIC ACCELERATED CHARGED PARTICLES AND ASSAYED IN VIVO. Berry, R.J. (MRC Radiobiology Unit, Harwell, Eng.). Radiat. Res.; 70: No. 2, 355-361(May 1977).

Murine lymphocytic leukemia P-388 cells have been irradiated in vitro under aerobic or hypoxic conditions with monoenergetic track segments of beams of accelerated helium or boron ions, and survival of their reproductive capacity assessed in vivo. These cells showed a maximum cell killing per rad at a relatively low ionization density (ca. 60--80 keV/μm) and their response ceased to depend on the presence or absence of oxygen at all LET values above ca. 100 keV/μm. This is similar to the LET dependence of cell killing reported recently for human lymphocytes which die a nonreproductive interphase death, and differs from the response of human kidney-derived cells which have been studied in vitro by other workers. The significance of these differences in predicting the response of cells and tissues to radiations such as fast neutrons or pi-mesons which produce wide spectra of ionization densities is discussed briefly.

- 216 MODIFICATION OF RADIATION DAMAGE IN CHO CELLS BY HYPERTHERMIA AT 40 AND 45°C. Henle, K.J.; Leeper, D.B. (Thomas Jefferson University Hospital, Philadelphia). Radiat. Res.; 70: No. 2, 415-424(May 1977).

Low hyperthermia at 40°C either before or after X irradiation did not alter the slope of the radiation dose-cell survival curve but reduced the D/sub q/ from 145 to 41 or to 0 rad for a pre- or postirradiation incubation period of 2 hr at 40°C, respectively. In contrast, hyperthermia at 45°C increased the slope of the radiation survival curve by a factor of 1.7 for a radiation pretreatment of 10 min at 45°C, but only by 1.3 for the same treatment immediately after irradiation. The corresponding D/sub q/'s were 262 and 138 rad, respectively. A combination of 45 and 40°C hyperthermia (10 min at 45°C + 2 hr at 40°C + X) resulted in a superposition of the individual effects of 45 or 40°C hyperthermia on the radiation survival curve. In addition, the radiation survival curve was shifted downward by a factor of three due to the potentiation of 45°C hyperthermia damage by postincubation at 40°C. Repair of sublethal radiation damage was completely suppressed during incubation at 40 following hyperthermia at 45°C. However, when cells were returned to 37°C, even after 6 hr at 40 following 45°C hyperthermia, the capacity to accumulate and repair sublethal radiation damage was immediately restored. These findings imply that the hyperthermia damage from low or high temperatures interacts differentially with radiation damage. Low hyperthermia at 40°C may affect principally the radiation repair system, whereas 45°C hyperthermia probably alters the radiation target more severely than the repair system.

- 217 (KFK--2433) ANNUAL REPORT 1976. Kiefer, H.; Koelzer, W. (eds.). (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). May 1977. 150p. (In German). Dep. NTIS (US Sales Only), PC A07/MF A01.

The Safety Officer of the GfK is responsible for radiation protection and technical safety, both conventional and nuclear, within the company. To fulfill his functions he relies on the assistance of the Radiation Protection and Safety Department. His duties cover tasks relative to radiation protection and safety on behalf of the institutes and departments of GfK and environmental monitoring for the whole Nuclear Research Center, on the one hand, and own research and development work, most of which is carried out under the PNS, on the other hand. These activities concentrate on radiation protection methods of measurement and personnel dosimetry, theoretical and experimental studies of the diffusion behavior of gases and aerosols in the atmosphere, the amount and consequences of radioactive and thermal emissions from large nuclear plants. This report gives details of the different duties, indicates the results of 1976 routine measurements, and reports about new results of investigations and developments of the working groups of the department.

- 218 (N--77-23045) IMPLICATIONS OF OUTER-ZONE RADIATIONS ON OPERATIONS IN THE GEOSTATIONARY REGION UTILIZING THE AE4 ENVIRONMENTAL MODEL. Wilson, J.W.; Denn, F.M. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). May 1977. 70p. (NASA-TN-D--8416; L--11280). NTIS PC A04/MF A01.

The radiation exposure in the region of geostationary orbits is examined in search for means of optimizing human performance. It is

found that the use of slightly inclined circular orbits is one means by which exposure and spacesuit thickness requirements can be reduced. Another effective technique is to limit the extravehicular activity to those days when the short term fluctuations result in low exposure. Space-suit shielding approaching 1/2 sq cm or less may be possible by utilizing work stoppages and inclined orbits. If aluminum and other low-atomic-number materials are used to construct the habitat, then excessive wall thicknesses are required. If special bremsstrahlung shielding is used, then the habitat shield may be reduced to as low as 2 g/sq cm. Numerous tables and graphs are presented for future analysis of dose in the geostationary region.

- 219 (SAAS--212) RECOMMENDATIONS CONCERNING THE EQUIPMENT OF UNITARY STOMATOLOGIC X-RAY WORKING PLACES. Wiltshcke, F.; Rother, M.; Taschner, P.; Weinhold, G.; Tonne, E.; Kuehling, U.; Nennig, K. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). May 1977. 13p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

Due to the ever-increasing requirements imposed on stomatologic X-ray diagnostics it is urgently necessary to standardize the working places for stomatologic X-ray examinations. According to the various tasks to be fulfilled 6 different types of working places are presented including their constructional parameters and technical equipment.

- 220 RADIATION RISKS WITH DIAGNOSTIC X-RAYS. Gregg, E.C. (Case Western Reserve Univ., Cleveland). Radiology; 123: No. 2, 447-453(May 1977).

Calculations are presented which correlate the risk of carcinogenesis with various diagnostic radiological procedures. Even though "worst case" conditions are assumed, such as a linear non-threshold dose-response relationship, most of the radiographic procedures appeared to be quite conservative in terms of carcinogenic risk. This was not true, however, for mammography of younger women.

- 221 OER AT LOW DOSE-RATES. Hall, E.J. (Columbia Univ., New York (USA). Radiological Research Lab.). Br. J. Radiol.; 50: No. 593, 373-374(May 1977).

The author comments on a letter (Kal, H.B., and Barendsen, G.W., 1976, Br. J. Radiol., vol. 49, 1049) reviewing published values of the OER for low dose-rate γ -rays. Artefacts of the system may have been responsible for one very low OER value taken from work carried out in the early 1960s, but later work in which these problems were eliminated still yielded OER values significantly lower than for acute X- or γ -ray exposures. Consideration is given to significance of this reduction in OER for γ -rays at the low dose-rates characteristic of interstitial implants. The performance of these interstitial implants may be comparable with the most sophisticated and expensive pion or heavy ion treatments.

- 222 SOME RESULTS ON RADIATION EXPOSURE OF THE ITALIAN POPULATION DUE TO MEDICAL DIAGNOSTIC EXAMINATION IN 1974. Benassai, S.; Dobici, F.; Susanna, A. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)); Indovina, P.L.; Pugliani, L.; Salvadori, P.; Prozzo, E. Health Phys.; 32: No. 5, 403-413(May 1977).

The genetically significant dose received by the Italian population in 1974 due to

diagnostic X-ray examination and radiopharmaceuticals has been investigated and the preliminary results are presented. A rough estimation of the dose gives about 30 mrem, in good agreement with the values obtained from other authors in various industrialized countries. These studies are being carried out in order to reveal eventual abuses of diagnostic sources and to take adequate corrective measures.

- 223 DEVELOPMENT OF A WASHING POWDER FOR THE DECONTAMINATION OF TEXTILES. Kunze, S. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (Germany, F.R.)); Henning, K. (Hakawerk W. Scholz und H. Kunz G.m.b.H., Waldenbuch (Germany, F.R.)). At. Strom; 23: No. 3, 71-75(May 1977). (In German).

For the removal of contamination from operators' clothing washing media are required which, in addition to a high decontamination effect and adequate washing properties, does not present any problems in the processing of the radioactive waste. For these reasons test were made with various commercial 95°C, 60°C, and 30°C, washing media as well as with the media used so far in decontamination laundries. Since satisfactory results were obtained with none of the products tested a composite product was developed in the Karlsruhe nuclear research centre.

- 224 IRRADIATION OF CANCER OF THE UTERINE CERVIX AND IMMUNOLOGICAL MECHANISM. Inoue, T.; Chihara, T.; Tashiro, K.; Kuzuya, K.; Masaki, K. (Aichi Cancer Center, Nagoya (Japan)). Sangyo Igaku; 34: No. 5, 612-617(May 1977). (In Japanese).

The movement of lymphocytes in blood, the cellular immunity by the reaction of a tuberculin test, and the change of productivity of specific antibody by anti-DNA antibody were examined in 29 cases of cancer of the uterine cervix which had received radiotherapy. Blood sedimentation rate at one hour was accelerated by irradiation. It seemed that blood sedimentation rate did not correlate with the total amount of protein in blood, and some changes should occur in blood. Lymphocytes which were cells in charge of immunity showed marked decrease by irradiation in peripheral blood. In spite of marked decrease of lymphocytes in blood, the reaction of a tuberculin test was hardly influenced. There were various kinds of immunoglobulin which were decreased by irradiation. Above-mentioned changes were recognized similarly in the cases irradiated after the operation, in which tumor cells were extremely few. One case, in which anti-DNA antibody was positive, showed a rise in its antibody titer by irradiation. It was presumed that fall of various kinds of immunological functions by irradiation was relative one by decrease of the total number of lymphocytes, and cellular immunity to specific antibody stimulation, and antibody productivity would be preserved in various lymphatic tissues outside irradiation fields.

- 225 BILATERAL FEMORAL NECK FRACTURES FOLLOWING PELVIC IRRADIATION. Mitsuda, K.; Nishi, H.; Oba, H. (National Oji Hospital, Tokyo (Japan)). Iryo; 31: No. 5, 455-458(May 1977). (In Japanese).

Over 300 cases of femoral neck fractures following radiotherapy for intrapelvic malignant tumor have been reported in various countries since Baensch reported this disease in 1927. In Japan, 40 cases or so have been reported, and cases of bilateral femoral neck fractures have not reached to ten cases. The

authors experienced a case of a 75 year-old female who received radiotherapy for cancer of the uterus, and suffered from right femoral neck fracture 3 months after and left femoral neck fracture one year and half after. As clinical symptoms, she had not previous history of trauma in bilateral femurs, but she complained of a pain in a hip joint and of gait disturbance. The pain in left femoral neck continued for about one month before fracture was recognized with roentgenogram. As histopathological findings, increase of fat marrow, decrease of bone trabeculae, and its marked degeneration were recognized. Proliferation of some blood vessels was found out, but thickness of the internal membrane and thrombogenesis were not recognized. Treatment should be performed according to degree of displacement of fractures. In this case, artificial joint replacement surgery was performed to the side of fracture of this time, because this case was bilateral femoral neck fractures and the patient had received artificial head replacement surgery in the other side of fracture formerly.

- 226 TREATMENT PLAN OF ACUTE RADIATION-INDUCED SKIN INJURIES WITH SPECIAL REFERENCE TO AN ACCIDENTALLY EXPOSED CASE. Yashizawa, Y.; Kusama, T. (Tokyo Univ. (Japan). Faculty of Medicine). Nishi Nippon Hifuka; No. 2769, 27-29 (May 1977). (In Japanese).

Description was made as to clinical course of one case of acute radiation-induced skin injury and practical use of medical treatment plan for radiation-induced skin injuries. The accident occurred during the working (5 o'clock in the afternoon) on development of x-ray tube for x-ray fluorescent analysis apparatus. The condition of x-ray exposure was 50 KeV and 10 mA, and the window of x-ray tube was Be 0.3 mm in thickness. The exposure time was about 5 seconds, and the exposure dose on the palm of the right hand which was the maximum was estimated at 10,000 rads. In the next morning after the exposure, the patient complained of extension feeling and edema in the palm of the right hand, and redness and blister appeared. On 11 days after the exposure, blister and edematous swelling grew to the greatest, and pain was emphasized. On 15 days after the exposure, tendency of cure appeared, and on 20 days after, pigmentation became marked. Main symptoms of local findings of one year and half after the exposure were skin atrophy, dilatation of capillary vessels, and depigmentation. The strict local rest, the protection from stimulations outside, the use of medicines for external application in which additives were small in quantity, the frequent and detailed local observation and detailed life guidance were mentioned as basic policies in the early treatment. Avoidance of the skin dryness, local observation with proper frequency, protection from stimulations outside, and life guidance were mentioned as basic policies during the period while the symptoms were fixed. In case of acute exposure, the importance of early treatment and necessity of endeavour of preventing delayed disturbances such as chronic ulcer and carcinogenesis were mentioned.

- 227 DIFFERENTIAL RADIOSENSITIVITY OF MOUSE EMBRYONIC NEURONS AND GLIA IN CELL CULTURE. Damberg, R.; Kidson, C. (Univ. of Queensland, Brisbane). J. Neuropathol. Exp. Neurol.; 36: No. 3, 576-585 (May 1977).

The responses of neurons and glial cells to ultraviolet and γ -radiation were studied in cell cultures of embryonic mouse brains. A decrease in the ratio of glia to neurons

occurred after both forms of irradiation. [^3H]thymidine labelling followed by autoradiography revealed that all glia were capable of replication, whereas 70 percent of neurons were non-replicating under the conditions of the study. Ultraviolet radiation caused a decrease in the proportion of replicating neurons but did not affect the proportion of replicating glia, whereas γ -radiation caused a decrease in DNA replication in both cell types. Levels of ultraviolet radiation-induced unscheduled DNA synthesis were lower in neurons than in glia. It is concluded that sensitivity to both ionizing and ultraviolet radiation of neurons and glial cells in embryonic brain cultures is determined primarily by the capacity for and state of DNA replication. Neurons which have already reached the stage of terminal differentiation are more resistant than replicating neurons of glial cells.

- 228 PROTECTION OF MOUSE INTESTINE AGAINST GAMMA IRRADIATION BY 2-MERCAPTOPROPIONYLGLYCINE (MPG). Devi, P.U. (Rajasthan Univ., Jaipur (India). Radiation Biology Lab.). J. Radiat. Res.; 18: No. 2, 160-163 (May 1977).

In a preliminary attempt to investigate the protective action of MPG on the tissues of mammals exposed to high doses of ionizing radiation, adult Swiss albino mice were subjected to 1,200 R of gamma rays from a Co-60 source 30 minutes after a single intraperitoneal injection of 20 mg/kg body weight of the drug. The histopathological changes in the intestinal villi were studied at postirradiation intervals of 2, 5, 14 and 28 days and were compared with observations of mice irradiated in the absence of MPG. Severe damage was observed in the villi of the animals receiving no protective drug, whereas in the MPG injected group the villi were protected to some extent, and an early recovery was effected with the result that the normal structure was restored by the last interval studied.

- 229 CUMULATIVE DOSE CALCULATIONS FOR CLINICAL AND DIAGNOSTIC RADIONUCLIDES. Singh, D.R. (Bhabha Atomic Research Centre, Bombay (India). Div. of Radiation Protection). Health Phys.; 32: No. 5, 443-445 (May 1977).

The cumulative dose estimates for isotopes of medical interest (^3H , ^{14}C , ^{22}Na , ^{32}P , ^{35}S , ^{59}Fe , ^{131}I and ^{198}Au) obtained from their retention equations are presented graphically. Using this information it is possible to calculate the cumulative dose for any length of period by a single multiplication of cumulative dose index with initial dose. The method as applied to urinalysis of ^3H , ^{32}P , ^{35}S and ^{131}I is discussed.

- 230 HAZARDS FROM PLUTONIUM TOXICITY. Cohen, B.L. (Pittsburgh Univ., Pa. (USA)). Health Phys.; 32: No. 5, 359-379 (May 1977).

By use of standard models and theories, the number of cancer fatalities caused by dispersal of plutonium is estimated. This process includes development of estimates of Pu toxicity for inhalation and ingestion, calculation of meteorological dispersal using the Gaussian plume model, estimates of resuspension effects from empirical models, and estimation of very long term effects from a comparison with natural uranium in soil. The conclusions on Pu toxicity are that one cancer may be expected for each 200 μg of reactor-Pu (2.5 g/Ci) inhaled or for each 1.0 g ingested. For dispersal in a city, about one eventual fatality may be expected per 18 g of reactor-Pu dispersed; this effect is dominated by

inhalation from the initial cloud, with early resuspension effects somewhat less important and long-term effects essentially negligible.

plutonium only.

- 231 (BNWL--2100(Pt.1), pp 17-21) DCSE-EFFECT STUDIES WITH INHALED PLUTONIUM OXIDE IN BEAGLES. Park, J.F.; Buschbom, R.L.; Case, A.C. May 1977.

Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.

Beagle dogs given a single exposure to $^{239}\text{PuO}_2$ or $^{238}\text{PuO}_2$ aerosols are being observed for life-span dose-effect relationships. The ^{239}Pu body burden of the nine dogs that died of pulmonary fibrosis-induced respiratory insufficiency during the first 3 yr after exposure was 1 to 12 μCi . One of these dogs had a pulmonary tumor. Five additional dogs with body burdens of 0.7 to 1.8 μCi died due to pulmonary neoplasia 3 to 5 yr after exposure. None of the dogs exposed to ^{238}Pu have died during the first 3 postexposure yr. Lymphocytopenia was the earliest observed effect after inhalation of $^{239}\text{PuO}_2$ or $^{238}\text{PuO}_2$, occurring 0.5 to 2 yr after deposition of greater than or equal to 80 nCi plutonium in the lungs.

- 232 (BNWL--2100(Pt.1), pp 25-27) INHALED PLUTONIUM NITRATE IN DOGS. Dagle, G.E.; Cannon, W.C.; Ragan, H.A.; Watson, C.R.; Stevens, D.L.; Cross, F.T.; Dionne, P.J.; Harrington, T.P. May 1977.

Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.

Beagle dogs given a single inhalation exposure to $^{239}\text{Pu}(\text{NO}_3)_4$ are being observed for life-span dose-effect relationships. Over half of the dogs planned for $^{239}\text{Pu}(\text{NO}_3)_4$ exposure have been exposed and the remaining dogs will be exposed as they reach adult age.

- 233 (BNWL--2100(Pt.1), pp 31-32) ROLE OF PROTRACTED EXPOSURE ON THE TOXICOLOGY OF INHALED $^{239}\text{PuO}_2$. Sanders, C.L. May 1977.

Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.

Studies were initiated to examine in rats the effects of a protracted exposure to inhaled $^{239}\text{PuO}_2$. Graphs are presented to show effect of multiple exposures to $^{239}\text{PuO}_2$ on the deposition and clearance of ^{239}Pu in the alveoli.

- 234 (BNWL--2100(Pt.1), pp 33-35) COCARCINOGENESIS OF INHALED PLUTONIUM DIOXIDE AND BERYLLIUM OXIDE. Sanders, C.L.; Fowers, G.J. May 1977.

Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.

Inhaled beryllium oxide results in impaired alveolar clearance of inhaled $^{239}\text{PuO}_2$ and induces an inflammatory reaction in the lung. However, only one of 184 rats exposed to beryllium developed a lung tumor; none of 128 unexposed rats developed a lung tumor. Fifty-six lung tumors were induced in 181 rats exposed to plutonium. A total of 37 lung tumors were found in 119 rats given combined exposures to beryllium and plutonium. Only in rats given the highest levels of both beryllium and plutonium was there an incidence of lung tumors greater than that seen with exposure to

- 235 (BNWL--2100(Pt.1), pp 35-37) LATE EFFECTS OF INHALED $\text{Pu}(\text{NO}_3)_4$ IN RATS. Ballou, J.E.; Dagle, G.E.; McDonald, K.E. May 1977. Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.

Rats that inhaled $^{239}\text{Pu}(\text{NO}_3)_4$ or $^{238}\text{Pu}(\text{NO}_3)_4$ developed lung tumors and bone tumors. Lung tumors were clearly associated with Pu inhalation (accumulated dose to lung, 1 rad to 5000 rads); bone tumors could not be unequivocally related to the radiation insult.

- 236 (BNWL--2100(Pt.1), pp 40-42) QUANTITATIVE AUTORADIOGRAPHY OF INHALED $^{239}\text{PuO}_2$ IN THE LUNG. Rhoads, K.; Moon, D.; Sanders, C.L. May 1977.

Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.

PuO_2 particles behaved similarly in the lungs of rat and hamster. The relative concentrations of PuO_2 up to 1-yr postexposure were 1.0 for lung parenchyma, 1.3 for subpleural areas, 0.5 for peribronchiolar regions and 0.2 for perivascular regions in the lungs.

- 237 (BNWL--2100(Pt.1), pp 52-55) NON-NEOPLASTIC PULMONARY DISEASE FROM INHALED RADON DAUGHTERS WITH URANIUM ORE DUST IN BEAGLE DOGS. Filipy, R.E.; Palmer, R.F.; Stuart, B.O. May 1977.

Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.

Daily exposures of adult beagle dogs to inhaled radon daughters plus uranium ore dust, with and without concurrent cigarette smoking, for 2 to 5-1/2 yr have produced massive pulmonary fibrosis and severe emphysema. The cumulative exposure doses are similar to those associated with a 5-fold or greater increase in death rate of uranium miners due to chronic respiratory insufficiency, including pneumoconiosis, pulmonary fibrosis, and emphysema.

- 238 (BNWL--2100(Pt.1), pp 101-103) EFFECTS OF ^{239}Pu ADMINISTERED AT 9 DAYS OF GESTATION ON HEMATOLOGIC DEVELOPMENT OF THE RAT. Joshima, H.; Hackett, P.L.; Kujawa, M.J.; Doctor, P.G.; Sikov, M.R. May 1977.

Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.

Injection of pregnant rats with monomeric ^{239}Pu after 9 days of gestation decreased their leukocyte and reticulocyte counts at 5 and 10 days postexposure. Most of the fetal hematologic enumerative values were unaffected by injection of monomeric ^{239}Pu . There was, however, a major change in the maturation of the cells of the erythroid series, as indicated by a difference in the distribution between cell types. The weight of the yolk sac and fetal liver, and the cellularity of the fetal spleen were decreased.

- 239 (BNWL--2100(Pt.1), pp 108-109) LATE EFFECTS OF ^{239}Pu ADMINISTERED AT REPRESENTATIVE STAGES OF GESTATION. Andrew, F.D.; Sikov, M.R. May 1977.

Pacific Northwest Laboratory annual report

- for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical sciences.
- The protocol for a systematic comprehensive study of the influence of prenatal exposure on the tumorigenic and other adverse effects of ^{239}Pu is described. The study has been initiated, all animals have been weaned, and postnatal function is being evaluated, although results are not yet available.
- 240 (BNWL--2100(Pt.1), pp 133-136) PREVENTION OF DEATH FROM INGESTED RUTHENIUM-106 BY COLECTOMY. Sullivan, M.F.; Beamer, J.L.; Karagianes, M.T. May 1977.
- Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical sciences.
- Two dogs were given 3.0 mCi/kg body weight of ^{106}Ru - ^{106}Rh and two were given 4.0 mCi/kg. At 5 days after treatment, one dog from each dose level was colectomized. The dog given the larger dose but not surgically treated was killed in extremis due to acute lower bowel injury at 18 days. The other dog, given 3.0 mCi/kg but not surgically treated, was killed in a moribund condition at 145 days after dosing. The rectum had perforated. The colectomized dogs recovered from intestinal injury and showed no radiation damage at the termination of the study.
- 241 (BNWL--2100(Pt.1), pp 229-230) CULTURE OF CELLS FROM BEAGLES WITH BRONCHIOALVEOLAR CARCINOMA. Frazier, M.E.; Andrews, T.K. May 1977.
- Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical sciences.
- Cell cultures were prepared from lung tumors occurring in beagles following exposure to inhaled plutonium. Morphologic and growth characteristics of two of these cell lines are described.
- 242 (BNWL--2100(Pt.1), pp 238-239) DIFFERENTIATION OF PERIPHERAL LYMPHOCYTE POPULATION IN PU-EXPOSED BEAGLE DOGS. Morris, J.E. May 1977.
- Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical sciences.
- The percentage of peripheral lymphocytes binding fluorescent-labeled anticanine antibodies was measured in plutonium-oxide-exposed and unexposed beagle dogs. With this assay system, there was a significant decrease in the percentage of lymphocytes binding the labeled antibody in exposed animals compared to control animals.
- 243 (BNWL--2100(Pt.1), pp 240-241) HEMATOLOGIC EFFECTS OF $^{239}\text{PuO}_2$ IN RATS. Ragan, H.A. May 1977.
- Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical sciences.
- Rats exposed to approximately 200 nCi deep lung deposition of $^{239}\text{PuO}_2$ developed a mild, transient lymphopenia 4 weeks later. A trend to concurrent neutrophilia was evident along with a significant increase in lung weights.
- 244 INHALATION TOXICLOGY OF $^{239}\text{PuO}_2$ AND $^{239}\text{PuO}_2$ IN SYRIAN GOLDEN HAMSTERS. Sanders, C.L. (Battelle Pacific Northwest Labs., Richland, WA). Radiat. Res.; 70: No. 2, 334-344(May 1977).
- Male and female, young adult, Syrian golden hamsters were exposed to high-fired, freshly prepared, aerosols of $^{239}\text{PuO}_2$ or $^{239}\text{PuO}_2$. Initial alveolar depositions of plutonium ranged from about 3 to 200 nCi. The fate of inhaled PuO_2 in the hamster was similar to that previously described in the rat. Only in male hamsters exposed to large amounts of $^{239}\text{PuO}_2$ was there significant shortening of life span. The incidence of adenomatous metaplasia in the lung was as high as 16% in unexposed controls and increased with increasing radiation dose to a maximum of 58% at the highest deposition of plutonium. Only three hamsters developed malignant tumors in the lung, all adenocarcinomas, and all at initial alveolar depositions greater than 160 nCi. It was concluded that the hamster was resistant to the induction of lung tumors following inhalation of insoluble particles containing α -emitting radionuclides.
- 245 PROBLEMS IN THE DETERMINATION OF PLUTONIUM IN BIOASSAY AND ENVIRONMENTAL ANALYSIS. Veselsky, J.C. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Anal. Chim. Acta; 90: No. 1, 1-14(May 1977).
- 129 refs., 3 tables.
- The methods available for plutonium determination in bioassay and environmental analysis are reviewed with special emphasis on urine and soil samples. The individual steps in techniques based on precipitation, solvent extraction, glass-fibre adsorption and ion exchange are discussed. The problems connected with α -counting are also considered briefly.
- 246 EFFECT OF TIME ON THE DETERMINATION OF THE CLEARANCE RATES OF INSOLUBLE PLUTONIUM $^{239}\text{OXIDE}$. Metivier, H.; Masse, R.; Nolibe, D.; Lafuma, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Health Phys.; 32: No. 5, 447-449(May 1977).
- It is shown that when measurements of plutonium lung burdens are carried out by external counting methods difficulties can arise. Moreover when half-time values are greater than 500 days, it is difficult to give accurate results if the duration of measurements is too short. On the other hand there are no theoretical and physiological grounds for a 3-compartment model rather than for a model with any number of compartments. From the data presented here it is argued that there is a continuous decrease of the particle excretion rate. Comparison of non-toxic particles (^{51}Cr labelled latex particles) and high toxic $^{239}\text{PuO}_2$ particles shows that in both cases a very slowly excreted compartment exists in the deep lung independently of the particle toxicity. Occurrence of an intermediate phase between this compartment and the rapidly cleared out tracheobronchial one cannot be denied. It is also demonstrated that this phase is cleared by dose-dependent mechanisms.
- 247 CONFIRMATION OF IN VIVO URANIUM-IN-CHEST SURVEY BY ANALYSIS OF AUTOPSY SPECIMENS. Roberts, A.M.; Coulston, D.J.; Bates, T.H. (British Nuclear Fuels Ltd., Risley). Health Phys.; 32: No. 5, 435-437(May 1977).
- The results of radiochemical analyses of samples of lung, mediastinum, kidney, liver, sternum, rib and vertebrae taken at autopsy of a man who had worked for 22 months with UO_2 powder and who subsequently died suddenly from a coronary thrombosis are here compared with

- the results of a routine in vivo uranium-in-chest count carried out on the same worker only three months before death and after which he carried out no work involving UO_2 . Methods of Whole Body Counting and radiochemical analysis employed are described. It is concluded that the results from organs taken at autopsy broadly confirm the in vivo chest survey result.
- 248 MEDICAL WOUND MEASURING POINT FOR LOCALIZING PLUTONIUM IN WOUNDS. Fromhein, O. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Datenverarbeitung und Instrumentierung). Arbeitsmed., Sozialmed., Praeventivmed.; 12: No. 5, 116-117 (May 1977). (In German).
3 figs. Short communication only.
CONTAMINATION; BIOLOGICAL LOCALIZATION; GAMMA DETECTION; PLUTONIUM 239; PROBES; SOLID SCINTILLATION DETECTORS; WOUNDS
- 249 BEHAVIOUR OF THE RADIOACTIVE NOXIOUS SUBSTANCES OF NUCLEAR INDUSTRY IN THE ORGANISM. Seidel, A. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Genetik und fuer Toxikologie von Spaltstoffen). Chem. Ztg.; 101: No. 5, 248-259 (May 1977). (In German).
In the present publication, the behaviour of important radionuclides, occurring in nuclear industry, is described. An understanding of their behaviour, whose phenomena generally are well known, is a prerequisite for understanding the principles of radiation protection measures as well as a base for a discussion of the biological effects of radionuclides, which, however, are not described in this paper. The biological behaviour is characterized by the ways of resorption of the nuclides, their distribution and retention in the organs and their excretion pattern. An essential question is concerned with differences between animal species and with the extrapolation of animal data to man. The behaviour of some of the radionuclides in man is already well known; in the other cases, typical data from animal experiments will be given in order to characterize the biological behaviour.
- 250 (BNWL--2100(Pt.1), pp 73-77) ACCUMULATION AND DISTRIBUTION OF ^{85}Kr IN RATS EXPOSED TO ^{85}Kr ATMOSPHERES. Willard, D.H.; Ballou, J.E. May 1977.
Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.
Retention kinetics and tissue partition coefficients for ^{85}Kr were determined in rats exposed to known concentrations of ^{85}Kr gas. The tissue partition coefficients were used to calculate the relative tissue radiation dose, assuming exposure conditions equivalent to the maximum permissible concentration in air (MPC)a. The estimated radiation dose was highest in adrenals and body fat, about twice the dose estimated for the next highest tissue, ovaries. Saturation and desaturation curves show that the contents of the large intestines have a prolonged desaturation time compared to other samples analyzed.
- 251 (BNWL--2100(Pt.1), pp 94-95) LONG-TERM EFFECTS OF INHALED URANYL NITRATE IN RATS. Ballou, J.E.; Gies, R.A.; Ryan, J.L. May 1977.
Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical Sciences.
- Rats were exposed to aerosols of ^{233}U and ^{232}U nitrate in a study of the long-term biological effects. Preliminary radiation dose estimates show lung > skeleton > kidney in each dose group.
- 252 (BNWL--2100(Pt.1), pp 123-125) GASTROINTESTINAL ABSORPTION OF TRANSURANIC ELEMENTS BY RATS. Sullivan, M.F. May 1977.
Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 1. Biomedical sciences.
Absorption of "organically bound" ^{233}U and ^{241}Am from gastrointestinal tracts of adult rats was twice that of the inorganic nitrate form. There was no difference between transport of ^{232}U and ^{233}U by adult rats, but ^{232}U absorption by newborn rats was four times that of ^{233}U . Absorption of ^{238}Pu nitrate through the gut of the newborn is relatively insensitive to dose but incorporation in the gut mucosa saturates at high dose levels. Absorption of ^{238}Pu is greater at 4 hr of age than at 24 hr.
- 253 DISTRIBUTION OF PLUTONIUM IN THE MOUSE OVARY. Green, D.; Howells, G.; Vennart, J.; Watts, R. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). Int. J. Appl. Radiat. Isot.; 28: No. 5, 497-501 (May 1977).
Twelve-week old female CBA mice were injected intravenously with an ultra-filtered solution of ^{239}Pu in 1% trisodium citrate and were killed at intervals up to 180 days. The plutonium in the ovaries was measured radiochemically and autoradiographically. The fractional content of injected activity and daily absorbed dose showed no significant variation with time after injection. At early times after injection, α -tracks from the ^{239}Pu were randomly distributed over all the tissues, with concentrations of tracks occurring over some atretic follicles. By 180 days, the random distribution of tracks was much reduced, and discrete clusters of tracks were in evidence. The possible risk of genetic damage is discussed.
- 254 (DOCKET-50250--726) TURKEY POINT PLANT, UNITS 3 AND 4. IE INSPECTION REPORT NOS. 77-04 AND -04; REPLY. (Florida Power and Light Co., Miami (USA)). 29 Apr 1977. vp. (DOCKET-50251--716).
Inspection of operations, ROs, IE circulars, SG performance, aircraft overflight, and personnel radiation exposures. TURKEY POINT-3 REACTOR; INSPECTION; TURKEY POINT-4 REACTOR; REACTOR OPERATION; OPERATION; AIRCRAFT; RADIATION DOSES; PERSONNEL; STEAM GENERATORS; PERFORMANCE; DOCUMENTATION; CIRCUIT BREAKERS; DIESEL ENGINES; FAILURES; DIESEL FUELS; SECONDARY COOLANT CIRCUITS; WATER CHEMISTRY; EMERGENCY PLAN; SEISMIC EFFECTS; MONITORING; RADIATION MONITORS; METEOROLOGY; EQUIPMENT; COMMUNICATIONS; EDUCATION; FIRE PREVENTION
- 255 (DOCKET-50010--730) DRESDEN NUCLEAR POWER STATION, UNITS 1, 2, AND 3. IE INSPECTION REPORT NOS. 77-07, -07, AND -07 (ROUTINE, UNANNOUNCED RE OPERATIONAL RADIATION PROTECTION--INFRACTION PER 10CFR20.201(B) AND DEFICIENCIES PER 10CFR20.408 AND 20.409(B)). (Commonwealth Edison Co., Chicago, Ill. (USA)). 22 Apr 1977. vp. (DOCKET-50237--1275; DOCKET-50249--1084).
Inspection of operational radiation protection program. DRESDEN-1 REACTOR; DRESDEN-2 REACTOR; DRESDEN-3 REACTOR; INSPECTION; RADIATION

PROTECTION; REACTOR OPERATION; PERSONNEL;
RADIATION DOSES; DOCUMENTATION; CALIBRATION;
NEUTRON MONITORS; CONTAMINATION; DISPLAY DEVICES;
QUALITY ASSURANCE; EDUCATION; EQUIPMENT;
RESPIRATORS; FUEL POOLS; DECONTAMINATION

SAFEGUARDS. QUAD CITIES-1 REACTOR; QUAD CITIES-2
REACTOR; PERSONNEL; RADIATION EFFECTS; SAFETY; WORK;
COMMUNICATIONS

- 256 (DOCKET-50220--790) NINE MILE POINT
NUCLEAR STATION, UNIT 1. IE INSPECTION REPORT
NO. 77-08 (ROUTINE, UNANNOUNCED). (Niagara
Mohawk Power Corp., Syracuse, N.Y. (USA)). 22
Apr 1977. vp.

Inspection of radiation protection during
refueling. NINE MILE POINT-1 REACTOR; INSPECTION;
RADIATION PROTECTION; REACTOR FUELING; PERSONNEL;
EDUCATION; FEEDWATER; SPARGERS; NOZZLES; RADIATION
DOSES; RADIATION MONITORING; CONTAMINATION;
CONTROL

- 257 (DOCKET-50133--513) HUMBOLDT BAY POWER
PLANT, UNIT 3. REPORT OF WHOLE BODY RADIATION
EXPOSURE FOR ONE INDIVIDUAL IN EXCESS OF 3 REM/
QUARTER LIMIT. (Pacific Gas and Electric Co.,
San Francisco, Calif. (USA)). 20 Apr 1977.
4p.

Whole body radiation exposure for one
individual in excess of 3 REM/quarter limit.
HUMBOLDT BAY REACTOR; PERSONNEL; WHOLE-BODY
IRRADIATION; RADIATION DOSES; SEISMIC EFFECTS;
MODIFICATIONS; CONSTRUCTION

- 258 (DOCKET-50233--794) JAMES A.
FITZPATRICK NUCLEAR POWER PLANT. IE
INSPECTION REPORT NO. 77-02 (ROUTINE,
UNANNOUNCED RE INFRACTIONS PER ETS 5.4.1,
5.4.2); REPLY; ACKNOWLEDGMENT. (Power
Authority of the State of New York (USA)). 18
Apr 1977. vp.

Inspection of radiological safety.
FITZPATRICK REACTOR; INSPECTION; RADIATION
PROTECTION; SAMPLING; RADIOCHEMISTRY; RADIOACTIVE
WASTES; PERSONNEL; EDUCATION; FISSION PRODUCT
RELEASE; ACTIVITY LEVELS; RESPIRATORS; RADIATION
MONITORS; CALIBRATION; EQUIPMENT; DOCUMENTATION;
CONTROL; RADIOACTIVE WASTE MANAGEMENT;
RADIOACTIVE MATERIALS; TRANSPORT; RADIATION DOSES

- 259 (RFP--2570) WOUND-COUNTING SYSTEMS FOR
THE MEASUREMENT AND ISOLATION OF PLUTONIUM AND
AMERICIUM. Tyree, W.H.; Bell, T.H.; Lane,
R.L.; Macaluso, J.B. (Atoms International
Div., Golden, Colo. (USA). Rocky Flats Plant).
16 Apr 1977. Contract EY-76-C-04-3533. 14p.
Dep. NTIS, PC A04/MF A01.

Described are newly developed wound-counting
systems which provide a high sensitivity for
the detection and quantification of X-ray
emissions from wounds contaminated with
plutonium or americium; and for the location of
deposition of radioactive material within a
wound, as required by surgery. The systems are
used in the medical facility at the Rocky Flats
Plant. Work efforts over the past 20 years have
concentrated on improving detection limits by
reducing and stabilizing the background
counting rate. The developments over the last
three years have resulted in a family of
instruments with excellent operational
characteristics, complementary package design,
easy maintenance, and reliable operation. A 13-
stage photomultiplier tube system is used.

- 260 (DOCKET-50254--1050) QUAD-CITIES
STATION, UNITS 1 AND 2. NRC NOTICE TO
EMPLOYEES RE DIRECT COMMUNICATION ABOUT WORK
QUALITY, RADIOLOGICAL SAFETY, AND SAFEGUARDS.
(Commonwealth Edison Co., Chicago, Ill. (USA)).
15 Apr 1977. vp. (DOCKET-50265--1012).
NRC notice to employees re communication
about work quality, radiological safety, and

- 261 HIGH-LET RADIATIONS INDUCE A LARGE
PROPORTION OF NON-REJOINING DNA BREAKS.
Ritter, M.A.; Cleaver, J.E. (California Univ.,
San Francisco (USA). Lab. of Radiobiology);
Tobias, C.A. Nature (London); 266: No. 5603,
653-655 (14 Apr 1977).

It is stated that the mechanisms by which
mammalian cells are killed by ionising
radiation have not been explained at the
molecular level, but it is thought that
irradiation with high linear energy transfer
(LET) radiation, such as neutrons, π -mesons,
and low energy heavy ions, could provide an
important tool for investigating these
mechanisms. High-LET radiations are being
considered for use in cancer radiation therapy,
and a thorough understanding of their
biological effects is necessary for them to be
used with advantage clinically. Studies are
reported that show that over an LET range of 1
to 1953 keV/ μ m there is good correlation
between the efficiency of exponential (single
hit) cell killing and the induction of non-
rejoining DNA strand breaks, as measured on
alkaline sucrose gradients. This correlation
implies that non-rejoined breaks are a cause of
cell death. DNA strand break induction and
rejoining were measured in Chinese hamster
cells. X-rays and low energy heavy ions from
the Lawrence Berkeley Laboratory 88-inch
cyclotron and heavy ion linear accelerator were
used in the studies. Results are discussed.
Some studies on human kidney cells and human
liver cells and E. coli are also mentioned,
which are in agreement with the present
results. The implication is that non-rejoining
DNA breaks cause single hit irreversible cell
death, and if this is true then non-rejoining
breaks would constitute the predominant lethal
lesion of high LET radiations. There are also
indications that non-rejoining breaks in
parental DNA serve as permanent barriers to
synthesis of daughter DNA, again suggesting
that non-rejoining DNA breaks are lethal
lesions. It was not possible to determine the
exact nature of the non-rejoining breaks
detected in the study, using the alkaline
sucrose gradient technique, but it was
indicated that two or more radiation-target
interactions are required to induce the effect.

- 262 (DOCKET-50298--814) COOPER NUCLEAR
STATION. NRC NOTICE TO EMPLOYEES RE DIRECT
COMMUNICATION ABOUT WORK QUALITY, SAFETY, AND
SAFEGUARDS. (Nebraska Public Power District,
Columbus (USA)). 5 Apr 1977. vp.
Notice to employees re direct communication
about work quality, safety, and safeguards.
COOPER REACTOR; SAFETY; WORK; PERSONNEL; RADIATION
DOSES; COMMUNICATIONS

- 263 (DOCKET-50409--517) LACROSSE BOILING
WATER REACTOR. REPLY TO IE INSPECTION REPORT
NO. 77-03 (RE INFRACTION A PER 10CFR20.103(A)
AND (B); ACKNOWLEDGMENT. (Dairyland Power
Cooperative, La Crosse, Wis. (USA)). 1 Apr
1977. vp.

Reply to IE inspection report 77-03 re
radiation protection. LACBWR REACTOR; RADIATION
PROTECTION; RADIOACTIVE EFFLUENTS; GASEOUS WASTES;
AIR SAMPLERS; RADIATION DOSES; PERSONNEL

- 264 (HASL--318) HEALTH AND SAFETY
LABORATORY ENVIRONMENTAL QUARTERLY, DECEMBER 1,
1976--MARCH 1, 1977. Hardy, E.P. Jr.
(Energy Research and Development

Administration, New York (USA). Health and Safety Lab.). 1 Apr 1977. 198p. Dep. NTIS, PC A12/MF A01.

Separate abstracts were prepared for four sections of this report that gives data on fallout radioactivity in environmental samples from throughout the world, Pb content in surface air samples, Pu deposits at the Rocky Flats plant, and chemical effects of SF₆ and Freon-II in the stratosphere. (CH)

- 265 (HASL--318, pp I.3-I.28) INTERNAL RADIATION DOSE COMMITMENTS IN THE NORTHERN TEMPERATE ZONE FROM ⁹⁰Sr, ¹⁴⁰Ba, ¹³¹I AND ¹³⁷Cs PRODUCED IN NUCLEAR TESTS. O'Brien, E.J. (Inst. of Nuclear Sciences, Lower Hutt, New Zealand). 1 Apr 1977.

Health and Safety Laboratory environmental quarterly, December 1, 1976--March 1, 1977.

The radiation dose commitments for human populations from the ingestion in milk of ⁹⁰Sr, ¹⁴⁰Ba, ¹³¹I and ¹³⁷Cs produced in atmospheric nuclear tests have been determined from the measured activities of ¹³⁷Cs, ⁹⁰Sr, ¹⁴⁰Ba and ¹³¹I in pasteurized milk at some 63 cities in the United States between 1961 and 1965. The data have also been used to determine fallout/milk transfer coefficients for these radionuclides. The resulting dose commitments for adult populations in the northern temperate zone for nuclear test up to 1975 are 5.3, 0.36, 0.0055, 34 and 0.011 mrad from ¹³⁷Cs, ⁹⁰Sr, ¹⁴⁰Ba, ¹³¹I and ¹³⁷Cs respectively.

- 266 (ORNL/NUREG/TM--37) CORRELATION OF RADIOACTIVE WASTE TREATMENT COSTS AND THE ENVIRONMENTAL IMPACT OF WASTE EFFLUENTS IN THE NUCLEAR FUEL CYCLE: CONVERSION OF RECYCLE URANIUM TO UF₆. Roddy, J.W.; Blanco, R.E.; Finney, B.C.; Hill, G.S.; Moore, R.E.; Witherspoon, J.P. (Oak Ridge National Lab., Tenn. (USA)). Apr 1977. Contract W-7405-ENG-26. 126p. Dep. NTIS, PC A07/MF A01.

A cost/benefit study was made to determine the cost and effectiveness of various radioactive waste (radwaste) treatment systems for decreasing the amount of radioactive materials released from a model recycle uranium conversion and uranium hexafluoride (UF₆) production plant and to determine the radiological impact (dose commitment) of the released radioactive materials on the environment. This study is designed to assist the US NRC in defining the term "as low as reasonably achievable" as it applies to these nuclear facilities. The base case model plant is representative of a licensable UF₆ production plant and has an annual capacity of 1500 metric tons of uranium. Additional radwaste treatment systems are added to the base case plant in a series of case studies to decrease the amounts of radioactive materials released and to reduce the radiological dose commitment to the population in the surrounding area. The cost for the added waste treatment operations and the corresponding dose commitments is calculated for each case. In the final analysis, radiological dose is plotted vs the annual cost for treatment of the radwastes. The status of the radwaste treatment methods used in the case studies is discussed. The methodology used in estimating the costs is presented. (34 tables, 11 figs.)

- 267 EXPERIENCE WITH LEAK TESTING OF SEALED RADIATION SOURCES. Gruen, W.; Jost, E. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Isotopenpraxis; 13: No. 4, 145-147 (Apr 1977). (In German).

The feasibility of the Rules for Testing

Sealed Radiation Sources was tested in practice using sealed sources applied to control engineering. It could be shown that the methods provided by the Rules are sufficient and that radiation doses to the testing personnel are below 500 mrem per yr.

- 268 (HEDL-TI--75001-1) FSAR Q₁ RESPONSES SUPPLEMENT 7. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Apr 1977. Contract EY-76-C-14-2170. 5p. AT.

Information is presented concerning hazardous materials, control room radiation exposures, and radiation protection procedures.

- 269 (WAPD-TM--1273) MODEL TO ESTIMATE THE LOCAL RADIATION DOSES TO MAN FROM THE ATMOSPHERIC RELEASE OF RADIONUCLIDES (LWBR DEVELOPMENT PROGRAM). Rider, J.L.; Beal, S.K. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). Apr 1977. Contract EY-76-C-11-0014. 41p. Dep. NTIS, PC A03/MF A01.

A model was developed to estimate the radiation dose commitments received by people in the vicinity of a facility that releases radionuclides into the atmosphere. This model considers dose commitments resulting from immersion in the plume, ingestion of contaminated food, inhalation of gaseous and suspended radioactivity, and exposure to ground deposits. The dose commitments from each of these pathways is explicitly considered for each radionuclide released into the atmosphere and for each daughter of each released nuclide. Using the release rate of only the parent radionuclide, the air and ground concentrations of each daughter are calculated for each position of interest. This is considered to be a significant improvement over other models in which the concentrations of daughter radionuclides must be approximated by separate releases.

- 270 COSTS AND BENEFITS OF RARE EARTH SCREENS. Taylor, F.E. (National Radiological Protection Board, Harwell (UK)). Br. J. Radiol.; 50: No. 592, 294 (Apr 1977).

The British Institute of Radiology has submitted evidence (Royal Commission on Environmental Pollution, 1976, Sixth Report, Nuclear Power and the Environment. Cmnd 6618, HMSO, London) leading to the conclusion that the introduction of rare earth screens in medical radiography is not financially practical at present in the U.K. This conclusion is questioned. The cost of reducing the genetic dose from medical radiography should be compared with the costs of reducing that from other sources such as nuclear power wastes, since the risks are to future generations in both cases. The cost of reducing public exposure by the use of rare earth screens in U.K. hospitals is calculated to be about Pound1 per man-rad; a total annual genetic collective dose of nearly 300,000 man-rad could be saved. An anomalous situation is presented by the great discrepancies between this cost, and published estimates both of the cost of the detriment associated with the genetic collective dose and of the value incorporated into the design objective for nuclear reactors.

- 271 (BNL--22627) 1976 ENVIRONMENTAL MONITORING REPORT. Naidu, J.R. (comp.). (Brookhaven National Lab., Upton, N.Y. (USA)). Apr 1977. Contract EY-76-C-02-0016. 90p. Dep. NTIS, PC A05/MF A01.

The environmental levels of radioactivity and other environmental pollutants found in the

- vicinity of Brookhaven National Laboratory during 1976 are summarized. As an aid in the interpretation of the data, the amounts of radioactivity and other pollutants released in airborne and liquid effluents from Laboratory facilities to the environment are also indicated. The environmental data includes external radiation levels; radioactive air particulates; tritium and iodine concentrations; the amounts and concentrations of radioactivity in precipitation; the amounts and concentrations of radioactivity in and the quality of the stream into which liquid effluents are released; the concentrations of radioactivity in sediments and biota from the stream; the concentrations of radioactivity in and the quality of ground waters underlying the Laboratory; and concentrations of radioactivity in milk, grass, and soil samples obtained in the vicinity of the Laboratory. The external radiation level for 1976 at the north boundary of the Laboratory attributable to an ecology forest irradiation source was 74.4 mrem, or 14 percent of the applicable Radiation Protection Standard.
- 272 (LA--6801-MS) ENVIRONMENTAL SURVEILLANCE AT LOS ALAMOS DURING 1976. (Los Alamos Scientific Lab., N.Mex. (USA)). Apr 1977. Contract W-7405-ENG-36. 65p. Dep. NTIS, PC A04/MF A01.
This report documents the environmental monitoring program at the Los Alamos Scientific Laboratory (LASL) in 1976. Data are presented for concentrations of radioactivity measured in air, ground and surface waters, sediments, soils, and foodstuffs, and are compared with relevant U.S. Energy Research and Development Administration guides and/or data from other reporting periods. Levels of external penetrating radiation measured in the LASL environs are given. The average whole-body radiation dose to residents of Los Alamos County resulting from LASL operations is calculated. Chemical qualities of surface and ground waters in the LASL environs have been determined and compared to applicable standards. Results of related environmental studies are summarized.
- 273 (ORNL/TM--5830) COMPILATION OF DOCUMENTED COMPUTER CODES APPLICABLE TO ENVIRONMENTAL ASSESSMENT OF RADIOACTIVITY RELEASES. Hoffman, F.O.; Miller, C.W.; Shaeffer, D.L.; Garten, C.T. Jr.; Shor, R.W.; Ensminger, J.T. (Oak Ridge National Lab., Tenn. (USA)). Apr 1977. Contract W-7405-ENG-26. 83p. Dep. NTIS, PC A05/MF A01.
The objective of this paper is to present a compilation of computer codes for the assessment of accidental or routine releases of radioactivity to the environment from nuclear power facilities. The capabilities of 83 computer codes in the areas of environmental transport and radiation dosimetry are summarized in tabular form. This preliminary analysis clearly indicates that the initial efforts in assessment methodology development have concentrated on atmospheric dispersion, external dosimetry, and internal dosimetry via inhalation. The incorporation of terrestrial and aquatic food chain pathways has been a more recent development and reflects the current requirements of environmental legislation and the needs of regulatory agencies. The characteristics of the conceptual models employed by these codes are reviewed. The appendixes include abstracts of the codes and indexes by author, key words, publication description, and title.
- 274 (SAND--77-0616) ENVIRONMENTAL MONITORING REPORT: SANDIA LABORATORIES, 1976. Simmons, T.N. (Sandia Labs., Albuquerque, N.Mex. (USA)). Apr 1977. Contract EY-76-C-04-0789. 23p. Dep. NTIS, PC A02/MF A01.
Water and vegetation are monitored to determine Sandia Laboratories impact on the surrounding environment. Nonradioactive pollutants released are reported. Radioactive effluents are also reported and their person-rem contribution to the Albuquerque population is calculated. The environmental monitoring for calendar year 1976 shows that concentrations of radioactive materials in the Albuquerque area are typical of natural background for the area. An exception is a single onsite location where slightly abnormal uranium concentrations are expected. An estimated 0.044 person-rem Albuquerque area (80 km radius) population dose commitment results from calculated Sandia Laboratories releases. Over the same area 57,000 person-rem is accumulated from natural background. There were no measurable offsite radioactive effluent releases in CY 1976.
- 275 (UCRL--52000-77-4, pp 21-29) TRACKING THE DEBRIS CLOUD FROM A CHINESE NUCLEAR TEST. Peterson, K.R. Apr 1977.
Energy and technology review.
As the radioactive debris cloud from a Chinese nuclear test on September 26, 1976 began drifting eastward, the Laboratory's computational facilities were pressed into service to predict the possible environmental effects. ERDA asked us to calculate cloud trajectories and to estimate the fallout dose. The FAA asked us to provide dose estimates both for commercial aircraft flights within the U.S. and for transatlantic flights of the Concorde SST. Our dose estimates, calculated with 2BPUFF, a large-cloud diffusion code, proved to be accurate predictions, correlating well with later observations. At FAA and ERDA request, we also worked with EG and G to measure cabin dose rates in some transatlantic SST and subsonic flights while the debris cloud moved out over the Atlantic Ocean.
- 276 NEED FOR RADIATION CONTROLS IN THE PHOSPHATE AND RELATED INDUSTRIES. Boothe, G.F. (Department of Health and Welfare, Boise, Idaho (USA). Radiation Control Section). Health Phys.; 32: No. 4, 285-290 (Apr 1977).
Significant radioactivity is entering Idaho's environment from the activities of phosphate and related industries. Preliminary radiation surveillance data indicate a need for further radiological assessment and the imposition of radiological controls on phosphate mining activities, phosphate processing plants, slag-crushing operations and the commercial use of slag.
- 277 SCINTIGRAPHIC ABSCESS LOCALIZATION WITH SUP(99m)TC-LABELLED LEUKOCYTES IN COMPARISON WITH ⁶⁷GA-CITRATE. Hagemann, J.; Montz, R.; Kuegler, S. (Hamburg Univ. (Germany, F.R.). Abt. fuer Nuklearmedizin). Radiol. Diagn.; 18: No. 2, 231-237 (Apr 1977). (In German).
A new approach to abscess localization in body cavities with sup(99m)Tc-labelled leukocytes is presented and compared with early experiences with ⁶⁷Ga-citrate. Leukocytes were labelled by phagocytosis of sup(99m)Tc-sulfur-colloid in vitro. Large body regions of seriously sick patients could be well examined in short time. The diagnostic sensitivity and accuracy of both procedures are not significantly different. Radiation exposure to patients is comparable.

- 278 RADIATION-INDUCED DNA SINGLE-STRAND SCISSION AND ITS REJOINING IN SPERMATOGENIA AND SPERMATOZOIA OF MOUSE. Gno, T.; Okada, S. (Tokyo Univ. (Japan). Faculty of Medicine). *Mutat. Res.*; 43: No. 1, 25-36 (Apr 1977).

Gamma-ray-induced DNA single-strand scissions and the ability to repair the scissions in spermatogonia from young mice and in spermatozoa from adult mice were studied quantitatively by an alkaline sucrose density-gradient centrifugation method. The average size of DNAs in non-irradiated spermatogonia was 2.6 to 3.0×10^6 daltons, similar to those of a spermatid-rich population, and the size of DNA in non-irradiated spermatozoa was 1.2×10^6 daltons. In spermatogonia, the radiosensitivity of DNA was 0.42 single-strand breaks/ 10^{12} daltons of DNA/rad in oxic conditions and only 0.24 under anoxic conditions. In spermatozoa the break efficiency of DNA was 0.22 single-strand breaks/ 10^{12} daltons of DNA/rad under oxic conditions and altered little under anoxic irradiation. The DNA scissions were efficiently repaired in spermatogonia within 10 min, whereas the breaks in spermatozoa were not rejoined at all even after two days of post-irradiation time. The radiosensitivities of DNA, repair capability and non- and/or slow-reparable DNA scissions were compared in spermatogonium-rich, spermatid-rich and spermatozoan-rich populations.

- 279 CHROMOSOMAL ABERRATIONS IN PIG LYMPHOCYTES AFTER NEUTRON IRRADIATION IN VITRO. Haag, J.; Brenot, J.; Parmentier, N. (CEA, Fontenay-aux-Roses, France). *Radiat. Res.*; 70: No. 1, 187-197 (Apr 1977).

Pig lymphocytes were irradiated in vitro with ^{60}Co γ rays and with neutron beams: moderated fission neutrons of maximum energy 1.35 MeV, cyclotron neutrons of maximum energy 16 , 33 , and 50 MeV. Results of the distributions of dicentric, for dose-effect curves, and for the relative biological effectiveness (RBE) of neutrons versus γ rays are presented. Dosimetry and microdosimetry have been performed for the neutron beams; also, an attempt is made to relate the physics studies to the radiobiological results. Using a biophysical model to explain the formation of dicentric in pig lymphocytes, i.e., the microdosimetric model, one deduces that this formation can be realized in the state of the diameter of which is about $0.7 \mu\text{m}$.

- 280 HYPERTHERMIA AND RADIATION RESPONSE OF PLATEAU PHASE CELLS. POTENTIATION AND RADIATION DAMAGE REPAIR. Murthy, A.K.; Harris, J.R.; Belli, J.A. (Harvard Medical School, Boston). *Radiat. Res.*; 70: No. 1, 241-247 (Apr 1977).

Hyperthermia (41°C for 1 hr) before or after irradiation of plateau phase V79 Chinese hamster cells potentiated radiation effect. This effect was characterized primarily by a decreased width of the survival curve. However, the repair of potentially lethal or sublethal damage was not suppressed by preirradiation hyperthermia. It is suggested that hyperthermic potentiation of radiation effect in plateau phase cells may not depend upon inhibition of damage repair.

- 281 EFFECT OF DOSE FRACTIONATION ON GAMMA-RADIATION INDUCED MUTATIONS IN MAMMALIAN CELLS. Asquith, J.C. (AERE, Harwell, Oxfordshire (UK). Environmental and Medical Sciences Div.). *Mutat. Res.*; 43: No. 1, 91-100 (Apr 1977).

The lethal and mutagenic effects of single and fractionated doses of γ -radiation were

studied in V79-4 Chinese hamster cells, as dose fractionation is of interest in radiation protection studies. The results show that the induction of 8-azaguanine resistant mutants has a non-linear dose-response curve following single doses of radiation. The lethal and mutagenic effects of fractionated doses were always less than if the radiation was given in a single dose. Any change in treatment which led to an increase in survival also led to a decrease in induced mutation frequency. There was a relationship between mutation and survival which was independent of the number of fractions in which the radiation was given. This could be of consequence in radiological protection.

- 282 REPAIR OF UV-INDUCED DNA LESIONS IN PERIPHERAL LYMPHOCYTES FROM HEALTHY SUBJECTS OF VARIOUS AGES, INDIVIDUALS WITH DOWN'S SYNDROME AND PATIENTS WITH ACTINIC KERATOSIS. Lambert, B.; Ringborg, U.; Swanbeck, G. (Karolinska Sjukhuset, Stockholm (Sweden)). *Mutat. Res.*; 46: No. 2, 133-134 (Apr 1977).

From 2. International workshop; Noordwijkerhout, Netherlands (2 May 1976).

Published in summary form only.

AGE GROUPS; BIOLOGICAL RADIATION EFFECTS; BIOLOGICAL REPAIR; DNA; DOWN'S SYNDROME; LEUKOCYTES; MAN; PATIENTS; SKIN DISEASES; ULTRAVIOLET RADIATION

- 283 LONG-TERM EFFECTS OF RADIUM EXPOSURE IN FEMALE DIAL WORKERS. Polednak, A.P. (Argonne National Lab., IL). *Environ. Res.*; 13: No. 2, 237-249 (Apr 1977).

Hematocrit readings and systolic and diastolic blood pressure were analyzed in women first employed as radium dial workers in 1913-1929 and in 1930-1954. Internal comparisons on these variables were made by dose groups, using average skeletal dose estimated some years after exposure to radium, and external comparisons were made using normative data from the U. S. National Health Survey. In women exposed from 1913 to 1929, a possible long-term effect of high-dose radium exposure on hematocrit was evident. Statistically significant results were obtained using univariate and multivariate (multiple regression) analyses for women aged 65-84. This effect appeared to be greatest in the highest-dose groups (especially $1000 +$ rad), but did not involve a higher frequency of "low" hematocrit suggestive of anemia. No association between dose and blood pressure was evident in the women exposed in 1913-1929. In women exposed in 1930-1954, dose was a significant predictor of systolic blood pressure in those 45-54 years old but not in those 55-64 years old. Analysis of longitudinal data on these populations will be required.

- 284 (CEGB-RD/B/N--4006) HANDLING OF RADIATION ACCIDENTS. IMPRESSIONS OF A RECENT INTERNATIONAL SYMPOSIUM HELD VIENNA, 28 FEBRUARY--4 MARCH 1977. Macdonald, H.F.; Orchard, H.C.; Walker, C.W. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1977. 18p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Some of the more interesting and important contributions to a recent International Symposium on the Handling of Radiation Accidents are discussed and personal comments on many of the papers presented are included. The principal conclusion of the Symposium was that although the nuclear industry has an excellent safety record, there is no room for complacency. Continuing attention to emergency planning and exercising are essential in order

to maintain this position. A full list of the papers presented at the Symposium is included as an Appendix.

- 285 (CONF-760744-- pp 359-367) ISSUES IN PLUTONIUM TOXICITY. Cohen, B.L. (Univ. of Pittsburgh). Apr 1977.

From Conference on energy sources of the future; Oak Ridge, TN, USA (5 Jul 1976).

Energy sources for the future.

The cancer risk due to exposure to plutonium alpha-emitting isotopes is discussed. Results of calculations are given that are based on determination of the dose in rem to each exposed body organ using ICRP data, use of BEIR estimates of cancer risk per rem vs age, and averaging over ages. The hot-particle theory and criticisms of it are briefly reviewed. Plutonium is principally dangerous as an inhalant and the consequences are investigated of a dispersal of PuO_2 powder in a populated area. The calculations are done with the Gaussian Plume Model, in which the dust cloud moves with the wind dispersing as a gaussian distribution in the downwind, cross-wind, and vertical directions. The results are presented as curves giving the area within which various fractions of the dispersed Pu are inhaled. Perspectives are given on dangers of Pu dispersal, dangers from terrorist use of Pu, and Pu leakage from low-level waste burial grounds.

- 286 (FDA--77-8021) 8TH ANNUAL NATIONAL CONFERENCE ON RADIATION CONTROL. RADIATION BENEFITS AND RISKS: FACTS, ISSUES, AND OPTIONS. (Bureau of Radiological Health, Rockville, Md. (USA)). Apr 1977. 428p. (CONF-7605156--). BRH Technical Information, Rockville, MD.

From 8. annual national conference on radiation control; Springfield, IL, USA (2 May 1976).

This publication contains the proceedings of the Eighth Annual National Conference on Radiation Control--Radiation Benefits and Risks: Facts, Issues, and Options, held May 2-7, 1976, in Springfield, Illinois. Participants representing State and major local radiation control programs, as well as Federal agencies, discussed mutual radiation control programs. The formal presentations and the reports of the various task forces and workshops are included in these proceedings.

- 287 (ORAU/IEA(0)--77-11) REPAIR AND DOSE-RESPONSE AT LOW DOSES. Totter, J.R.; Weinberg, A.M. (Institute for Energy Analysis, Oak Ridge, Tenn. (USA)). Apr 1977. Contract EY-76-C-05-0033. 15p. Dep. NTIS, PC A02/MF A01.

The DNA of each individual is subject to formation of some $2-4 \times 10^{14}$ ion pairs during the first 30 years of life from background radiation. If a single hit is sufficient to cause cancer, as is implicit in the linear, no-threshold theories, it is unclear why all individuals do not succumb to cancer, unless repair mechanisms operate to remove the damage. We describe a simple model in which the exposed population displays a distribution of repair thresholds. The dose-response at low dose is shown to depend on the shape of the threshold distribution at low thresholds. If the probability of zero threshold is zero, the response at low dose is quadratic. The model is used to resolve a longstanding discrepancy between observed incidence of leukemia at Nagasaki and the predictions of the usual linear hypothesis.

- 288 (PB--267741) PATIENT EXPOSURE FROM DIAGNOSTIC X RAYS: AN ANALYSIS OF 1972-1974 NEXT DATA. FINAL REPORT 1 OCT 72--30 AUG 74. Wocho, J.F.; Cameron, J.R. (Wisconsin Univ., Madison (USA). Dept. of Radiology). Apr 1977. 45p. NTIS PC A03/MF A01.

The Nationwide Evaluation of X-Ray Trends (NEXT) program has obtained data from various States on the physical factors related to patient radiation exposure from 12 common diagnostic radiological projections. Survey data from October 1, 1972 to September 30, 1974 were analyzed ($n = 5345$). All data were collected before the effective date of the FDA Standards regulating medical x-ray machines. For each projection, data were examined for exposure, beam area/film area, and exposure area product delivered to a standard patient. These values were examined for significant differences among various types of facilities and classes of operators.

- 289 (PB--270284) STUDY OF THE CAPABILITY FOR RAPID WARNINGS OF SOLAR FLARE RADIATION HAZARDS TO AIRCRAFT. PART I. FORECASTS AND WARNINGS OF SOLAR FLARE RADIATION HAZARDS. PART II. AN FAA POLAR FLIGHT SOLAR COSMIC RADIATION FORECAST/WARNING COMMUNICATION SYSTEM STUDY. TECHNICAL MEMO. Sauer, H.H.; Stonehocker, G.H. (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA). Space Environment Lab.). Apr 1977. Contract DOT-FA72WAI-320. 88p. (NOAA-TM-ERL-SEL--46). NTIS PC A05/MF A01.

The first part of the report provides background information on the occurrence of solar activity and the consequent sporadic production of electromagnetic and particle emissions from the sun. A summary is given of the current procedures for the forecasting of solar activity together with procedures used to verify these forecasts as currently available. A summary of current forecasting of radiation hazards as provided in support of the Concorde SST program is also given. The second part of the report describes a forecast message distribution system developed in conjunction with solar cosmic radiation forecasts and warnings of the Space Environment Laboratory of NOAA for the Federal Aviation Administration's (FAA) Office of Aviation Medicine. The study analyzes the currently available and future aeronautical telecommunication system facilities to determine an optimum system to distribute forecasts to the preflight planning centers in the international flight service stations for polar-flying subsonic and supersonic transport (SST) type aircraft. Also recommended for the system are timely and reliable distribution of warnings to individual in-flight aircraft in polar areas by the responsible air traffic control authority.

- 290 OCCUPATIONAL EXPOSURE TO RADIATION AS A CANCER HAZARD. Archer, V.E. Cancer, Suppl.; 39: No. 4, 1802-1806 (Apr 1977).

From National Cancer Institute conference on cancer epidemiology and the clinician; Boston, MA, USA (23 Oct 1975).

There are much experimental data which indicate that ionizing radiation is a very potent carcinogenic agent. Most types of carcinoma can be produced by radiation. Carcinoma is apparently induced through a single or a series of mutations in somatic cells. Radiologists have excess leukemia and other malignancy from external x-ray; uranium and other miners have excess lung cancer from internal alpha radiation; luminous dial painters have excess osteogenic sarcomas; and uranium mill workers appear to have excess

lymphomas. A large number of persons are now exposed occupationally to radiation from nuclear reactors, and from various uses of radioisotopes. For the induction of most types of cancers from radiation it appears that the risk is between 0.5 and 2 cancers per rem per million person years. Epidemiological techniques are essential in determining risks of this low magnitude. Other agents may inhibit or enhance the carcinogenicity of radiation.

- 291 LEUKEMIA AND OTHER CANCERS FOLLOWING RADIATION TREATMENT OF PELVIC DISEASE. Smith, P.G. (Oxford Univ.). Cancer, Suppl.; 39: No. 4, 1901-1905(Apr 1977).

From National Cancer Institute conference on cancer epidemiology and the clinician; Boston, MA, USA (23 Oct 1975).

Follow-up studies of patients treated for cancer of the cervix with radiotherapy have shown such women to be at little or no increased risk of leukemia subsequent to the radiation exposure. However, women exposed to lower doses of radiation in the pelvic area, in the induction of an artificial menopause, appear to show increased risks of both leukemia and cancers of those sites directly in the radiation field. The studies of these two types of radiation exposure are reviewed. The findings may possibly be reconciled with each other on the basis of the distribution of radiation dose to the bone marrow. Irradiation for cancer of the cervix delivers radiation doses to a small portion of the marrow which are probably lethal for most marrow cells. The mean dose to cells distant from the cervix may be too small to produce a detectable increase in leukemia incidence. The lower and more uniformly distributed radiation dose used to induce an artificial menopause will be less lethal for marrow cells and may consequently deliver a higher 'effective' marrow dose to surviving cells, resulting in an increased leukemia risk.

- 292 RADIATION INJURY: SOME ASPECTS OF THE ONCOGENIC EFFECTS. Fry, R.J.M.; Ainsworth, E.J. (Argonne National Lab., IL). Fed. Proc.; 36: No. 5, 1703-1707(Apr 1977).

The late effects of irradiation stem from cell killing, mutation, and malignant transformation. Cancer is the major stochastic late effect of exposure to low dose levels of radiation, and estimates of risk of cancer in man after irradiation are based entirely on human experience. The data for dose-response relationships for the induction of tumors by external irradiation in man have been obtained from a single exposure or a small number of exposures delivered at high dose rates. In contrast, exposure to environmental irradiation is mainly protracted over a long period of time and is delivered at a low dose rate. As yet no allowance has been made for the effect of protraction of the exposure time in estimating the risk of cancer, although an adjustment has been made in the case of estimates of genetic risk. Incidence of tumors has been the only parameter used for risk estimates, but latent period and degree of malignancy, which are probably both dose and dose-rate dependent, influence the nature of the risk from radiation. As the knowledge about the effects of low-level radiation has been accumulated and assimilated over the last 70 years, so has the concern for reasonable standards of safety. There are still problems in the estimation of radiation risks, but at least many of the relevant questions can now be framed. The problems of estimating risks for chemical carcinogens are clearly greater, but the experience gained from radiation studies should

help in the design of the necessary experiments.

- 293 OVEREXPOSURE OF A RADIOGRAPHER ON A CONSTRUCTION SITE. Dixon, D.W. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 19, 22-23(Apr 1977).

An industrial radiographer was inspecting pipe line welds with γ radiography equipment under conditions of restricted movement. The radiographic technique had been changed from a manual to a remote operating exposure system to reduce the radiation exposure to the radiographer. After completing two radiographs, the radiographer picked up a small metal object and loaded it into his van together with the rest of his equipment. This object was recognised as the 'source pencil' when the radiographer delivered his exposed films to the mobile dark room. The radiographer's film badge recorded 20 rems (confirmed by a chromosome aberration count on a blood sample) and a higher hand dose. Inspection of the radiographs, together with those taken the previous day, indicated that the source pencil has been loose within the guide tube and did not return to the exposure container at the end of the previous day. All the equipment was kept in the van overnight, with the source exposed. This over-exposure resulted primarily from a malfunction of the equipment, although lack of experience was a major contributory factor. The radiographer had selected the correct equipment, but he should have been aware of the potential hazards. Normal monitoring procedures, or a personal alarm monitor, would have immediately indicated the existence of an abnormally high dose rate. Working and monitoring procedures should be based on the principles embodied in the Code of Practice for Site Radiography (Kluwer-Harrap Handbook, 1975).

- 294 ENVIRONMENTAL MODELLING IN RADIOLOGICAL PROTECTION. Bryant, P.M. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 19, 7-9(Apr 1977).

Primary radiation protection standards are expressed in terms of whole body or organ doses to individual persons or average individuals in a group, but some form of modelling of the behaviour in the environment of radionuclides is required before these doses can be estimated. Secondary protection standards, usually called 'derived working limits (DWLs)' in the UK, are expressed in terms of the levels of radiation dose rate or radioactivity in environmental materials, and are derived from the primary standards. The general problems and limitations of the models selected to define the relationship between these primary and secondary standards are briefly discussed. The environment is treated as a set of interconnected compartments which are considered to be independent well-mixed reservoirs with transfers of radioactivity from one compartment to an adjacent one. Three examples of the use of environmental modelling are described, and the differing types of conclusion reached are noted.

- 295 CONES FOR DENTAL RADIOGRAPHY. Butler, M.J. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 19, 24-27(Apr 1977).

Dental radiographic techniques are summarized. The advantages and disadvantages of the use of both the conventional plastic pointer cone and the open-ended cylinders or divergent cones favoured both by the ICRP (Protection against Ionizing Radiation from

- External Sources, Oxford, Pergamon Press, 1973, ICRP Publication 15), and in the Code of Practice for the Protection of Persons against Ionizing Radiation arising from Medical and Dental Use (1972, 3rd edition, London, HMSO) are discussed. The use of the word 'should' in these recommendations to signify a desirable requirement, not an essential one, is noted. This wording is currently of interest both nationally and internationally in relation to regulations, standards and notes for guidance. The National Radiological Protection Board (NRPB) has been reviewing the position, and has concluded that open-ended cones have disadvantages which may sometimes outweigh their advantages. Although open-ended cones are preferable under some circumstances, the recommendation that they should be used ought not to be followed without an understanding of the issues involved. The hazards associated with the use of interchangeable cones are considered. The NRPB now proposes that the requirement for the replacement of pointer cones (for both new and existing equipment) should be withdrawn.
- 296 SURVEY OF THE RADIATION DOSES TO PATIENTS FROM DIAGNOSTIC RADIOLOGY. Rae, S. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 19, 10-13(Apr 1977).
The medical use of radiation is the largest man-made component of the radiation dose received by the population. In the UK, the genetically significant dose (GSD) from medical radiation is currently judged sufficiently low for the genetic penalty on future generations to be acceptable. Continuing appraisal of the magnitude of the UK GSD is however required to detect and limit any future increases. The medical contribution to the population dose needed reassessment both to update to available information and to satisfy one of the requirements of the Council of the European Communities (Directive of June 1, 1976, Article 12). Descriptions are given of the objectives of the survey being undertaken, methods of calculation of the GSD and of sampling of hospital diagnostic radiology departments, and the working methods of the survey. The results will be reported in the open literature after prior consultation with contributing hospitals.
- 297 THYROID DISEASE FOLLOWING IRRADIATION FOR BENIGN CONDITIONS. Sweistad, J.; Scanlon, E.F.; Murphy, E.D.; Garces, R.; Khandekar, J.D. (Evanston Hospital, IL). Arch. Surg. (Chicago); 112: No. 4, 380-383(Apr 1977).
One hundred twenty-five patients with a history of prior irradiation to the head and neck region for benign disease underwent thyroidectomies between 1967 and 1976 at Evanston Hospital. One hundred twenty-four had a palpable abnormality. Forty-two had carcinoma, and nine of these had nodal metastases. Palpation was found to be more accurate than thyroid isotope scan in finding carcinoma within an abnormal gland. Some form of irradiation thyroiditis was found in one half of the resected specimens.
- 298 CANCER-CAUSING RADIATION. Ullrich, R.L.; Holland, J.M.; Storer, J.B. (Oak Ridge National Lab., TN). Chemistry; 50: No. 3, 7-11(Apr 1977).
Radiation causes cancer. That simple fact was known by the early 1900s. Further, radiation can induce cancer in almost any tissue in animals and humans. But the cancer-causing dose may vary by 20-fold for different tissues in animals. Such variation is also seen in people who are exposed, typically, to low radiation doses. Hence, the minimum dose that causes human cancer is not known. Thus, the crucial question becomes what factors, including amount of exposure, trigger cancer. Radiation is divided into two types, ionizing and nonionizing. Of the two, ionizing radiation involves higher energies. Thus by ejecting electrons from molecules, charged particles called ion pairs are formed. They are short-lived, and often break down to form highly reactive free radicals, which are molecular fragments containing unpaired electrons. Nonionizing radiation, which involves ultraviolet light and micro- and radiowaves, causes molecular excitations such as vibrations and electron movement, but produces no ions. And though ultraviolet light causes skin cancer, ionizing radiation is, by far, the more potent carcinogen.
- 299 EYE DOSE MEASUREMENTS USING CONVENTIONAL AND RARE-EARTH SCREENS DURING TOMOGRAPHY OF THE PARA-NASAL SINUSES. Eddleston, B.; Moores, B.M.; Walker, A. (Christie Hospital and Holt Radium Inst., Manchester (UK)). Br. J. Radiol.; 50: No. 592, 266-270(Apr 1977).
Eye dose measurements have been performed when using medium speed conventional and rare-earth screen-film combinations during tomography of the para-nasal sinuses. The measurements showed that using conventional intensifying screens with the A.P. view a total eye dose of about 20 rad may be given during an examination. This eye dose can be reduced by 98% using the P.A. position. If rare-earth screen/film combinations were employed the eye dose measured in the A.P. view was reduced by 75% of that obtained with conventional screens without detectable loss of image quality. A total eye dose reduction of about 59.5% was measured in the P.A. view with the rare-earth systems.
- 300 RECONSTRUCTION AND DOSE-RATE CALCULATION OF RADIUM NEEDLE IMPLANTS. Vickery, B.L.; Redpath, A.T. (Western General Hospital, Edinburgh (UK)). Br. J. Radiol.; 50: No. 592, 280-285(Apr 1977).
A comprehensive computer program has been developed for carrying out the various tasks associated with radium needle implants. Data input for the program were obtained by digitizing an orthogonal pair of radiographs with an analogue tracing system. Corresponding needles in the two radiographs were automatically located, and the implant could be rotated to any desired position in three dimensional space, at the same time presenting a view of the rotation on a storage oscilloscope. Automatic determination of the mean plane of a planar implant was possible, and the dose-rate distribution could be calculated in any specified plane. A Paterson-Parker exposure rate calculation could be performed with a biological dose and treatment time correction incorporated. The program is written in Fortran and runs on a small interactive computer system.
- 301 PROTECTING MINERS FROM RADIATION. S. Afr. Min. Eng. J.; 88: No. 4127, 73(Apr 1977).
Short communication only.
MINERS; RADIATION HAZARDS; RADIATION PROTECTION; RADIOACTIVITY; RADON; VENTILATION
- 302 X-RAY INDUCED CHROMOSOME ABERRATIONS IN ATAXIA TELANGIECTASIA: AN INDICATION OF A DEFECT IN DNA REPAIR. Taylor, A.M.R.; Metcalfe, J.A.; Oxford, J.M.; Harnden, D.G. (Birmingham Univ. (UK). Medical School).

Mutat. Res.; 46: No. 2, 161-162(Apr 1977).
 From 2. International workshop;
 Noordwijkerhout, Netherlands (2 May 1976).
 Published in summary form only.
 BIOLOGICAL REPAIR; CELL CYCLE; CHROMOSOMAL
 ABERRATIONS; DNA; FIBROBLASTS; LYMPHOCYTES;
 PATIENTS; RADIOINDUCTION; X RADIATION

- 303 ¹⁹²IR CVER-EXPOSURE IN INDUSTRIAL RADIOGRAPHY. Jacobson, A.; Wilson, E.M.; Banks, T.E.; Scott, R.M. (Louisville Univ., Ky. (USA)). Health Phys.; 32: No. 4, 291-293(Apr 1977).

An accidental over-exposure to an ¹⁹²Ir industrial radiography source is described. Dose estimation efforts and clinical evaluation of radiation injury are included in this description. Several meaningful recommendations are offered with a view toward improving industrial radiography radiation safety.

- 304 DOSES WHILE TRAVELLING UNDER WELL ESTABLISHED PLUMES. Martin, J.A. Jr. (Nuclear Regulatory Commission, Washington, D.C. (USA)). Health Phys.; 32: No. 4, 305-307(Apr 1977).

Doses which could be received while evacuating a nuclear facility following an accident involving atmospheric releases of radionuclides from irradiated fuel are estimated. The cases of travelling under a well established plume both when moving downwind and when moving across wind are considered. The theory is applicable both to radioactive and chemical pollutant cases.

- 305 PROBLEM OF CANCER INDUCTION BY LOW-LEVEL RADIATION. Fuchs, G. (Internationales Institut fuer den Frieden, Vienna (Austria)). Radiobiol. Radiother.; 18: No. 2, 151-155(Apr 1977). (In German).

From 19. congress of the Gesellschaft fuer Medizinische Radiologie der Deutschen Demokratischen Republik; Karl-Marx-Stadt, German Democratic Republic (29 Sep - 2 Oct 1976).

During the last years there were again discussion about late effects of low-level radiation. Interest has focused on cancerogenic, leukemogenic, and genetic effects. The term 'low doses' applies to the doses of x ray diagnostics as well as to the doses considered permissible by the I.C.R.P. and other expert bodies. The American authors Gofman and Tamplin are the spokesmen of a movement which declares even these small doses as extremely dangerous. Their calculations and inferences are open to criticism. The statements of the mentioned authors confuse the patients and bear implications on the field of social politics by backing up the antinuclear campaign in the western countries. Careful analysis of the figures available to us suggests that the doses presently considered permissible do not carry any cancerogenic or leukemogenic effects.

- 306 COSTAL OSTEORADIONECROSIS AS RARE COMPLICATION IN CONVENTIONAL DEEP THERAPY OF MAMMA CARCINOMA. FOLLOW-UP STUDY OF 1,000 PATIENTS. Schaefer, W.; Giesecke, R.; Rahn, H.; Schumann, E. (Medizinische Akademie, Erfurt (German Democratic Republic)). Radiobiol. Radiother.; 18: No. 2, 143-149(Apr 1977). (In German).

One thousand patients irradiated for mammary carcinoma during the last 10 years were screened for possible osteoradionecroses of the ribs. In order to estimate the effective dose

to the bone measurements were made with a wax phantom. These measurements were based on routine irradiation planning. A maximum dose of about 9250 rads was measured in the axillar region between the anterior and posterior axillar line. In 5 cases osteoradionecrosis was found in the area between the 2nd and the 4th rib. It is concluded that the occasional occurrence of such avoidable radiation-induced changes should not lead to the application of underdoses.

- 307 STUDY ON ANTITUSSIVE EFFECTS OF EPRAZINONE DIHYDROCHLORIDE ON RADIATION--INDUCED INFLAMMATION OF UPPER RESPIRATORY TRACT DUE TO POSTOPERATIVE IRRADIATION OF BREAST CANCER. Taoya, K. (National Hospital of Yokohama (Japan)). Rinsho Hoshasen; 22: No. 4, 409-411(Apr 1977). (In Japanese).

Discussion was made of the antitussive effects of Eprazinone hydrochloride (Resplen) on radiation-induced inflammation of the upper respiratory tract in 15 cases irradiated after an operation of breast cancer. Depth dose at 3 cm was 200 rads/day, and 5000 rad/25 times/5 weeks was irradiated with telecobalt. Mainly abnormal sensation and pain in the throat and cough appeared and patients complained of suffering from a common cold, because a part of irradiation field included the throat, trachea, and esophagus. At the same time as manifestation of symptoms, 120 mg/day of Eprazinone Dihydrochloride was administered. In 8 cases, other drugs were added to, or irradiation schedule was changed because the symptoms were not improved or were exaggerated. The symptoms disappeared up to 5000 rad irradiation in one case, up to 4000 to 5000 rad irradiation in 4 cases, and up to 4000 rad irradiation in 2 cases. It is impossible to decide effective rate of this drug because of shortage of clinical cases, but it is suggested that there is a significance to increase cases treated successively with this drug in future.

- 308 CLINICAL STUDIES ON GASTRIC CANCER AND BREAST CANCER AMONG A-BOMB SURVIVORS. Yamagata, S.; Ohya, M.; Nagusa, Y.; Harada, T.; Tani, T. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Hiroshima Igaku; 30: No. 4, 394-402(Apr 1977). (In Japanese).

Fifty-five cases of gastric cancer and 14 cases of breast cancer among A-Bomb survivors, which had been treated at Dept. of Surgery, Research Institute for Nuclear Medicine and Biology of Hiroshima Univ., were discussed. Both gastric cancer and breast cancer were recognized more in A-Bomb survivors of advanced age. Particularly, the number of gastric cancer in A-Bomb survivors of over 65-year old was about double the number of unexposed persons. Ratio of male to female in A-Bomb survivors with gastric cancer was 1.6:1, and the ratio of female was higher as compared to the ratio in unexposed persons (2.6:1). Gastric cancer of stage III and IV in A-Bomb survivors was 54.5%, and advanced cancer was comparatively few in A-Bomb survivors as compared to in unexposed persons (78.2%). Similarly, comparatively early stage breast cancer of stage I and II was recognized more in A-Bomb survivors. Particularly, T₁ and T₂ in which tumor was small in size showed very high percentage of 92.9% in A-Bomb survivors. In gastric cancer in A-Bomb survivors, poorly differentiated adenocarcinoma showed the highest percentage of 34.5%. However, there was no significant difference according to the exposure conditions. As to histological type of breast cancer, medullary tubular adenocarcinoma abounds mostly in both A-Bomb survivors (71.4%)

and unexposed persons (75.9%). As the influence of operation, anemia was recognized before operation strongly in A-Bomb survivors with gastric cancer of over 65-year old. After the operation, transient rise of GOT and GPT was recognized in A-Bomb survivors of advanced age with gastric cancer. However, there was no difference in postoperative complications between A-Bomb survivors and unexposed persons.

309 (AD-A--039271) VARIABLES AFFECTING RADIATION-INDUCED PERFORMANCE DECREMENTS.

INTERIM REPORT, JUNE 1975--AUGUST 1976. Brown, G.C.; Yochmowitz, M.G.; Patrick, R.F.; Hardy, K.A. (School of Aerospace Medicine, Brooks AFB, Tex. (USA)). Apr 1977. 59p. (SAM-TR--77-3). NTIS PC A04/MF A01.

A discrete behavioral task was initiated to study the effects of a 300-rad variable dose rate protracted-exposure profile upon positively (food reward) and negatively (shock) reinforced groups of primates. Subjects performed the task for 12 hours. Among the 8 shock and 7 food subjects, effects noted were performance decrements in 2 shock and 2 food subjects, delayed reaction-times in 3 shock and 3 food subjects, and emesis in 1 shock and 4 food subjects. Such information is important to military planners who need accurate nuclear vulnerability and survivability assessments for aircrew.

310 (CONF-760744--), pp 389-401) GENETIC EFFECTS OF RADIATION. Selby, P.B. (Oak Ridge National Lab., TN). Apr 1977.

From Conference on energy sources of the future; Oak Ridge, TN, USA (5 Jul 1976). Energy sources for the future.

Many of the most important findings concerning the genetic effects of radiation have been obtained in the Biology Division of Oak Ridge National Laboratory. The paper focuses on some of the major discoveries made in the Biology Division and on a new method of research that assesses damage to the skeletons of mice whose fathers were irradiated. The results discussed have considerable influence upon estimates of genetic risk in humans from radiation, and an attempt is made to put the estimated amount of genetic damage caused by projected nuclear power development into its proper perspective.

311 SENSITIZATION OF MOUSE SKIN TO X IRRADIATION BY MODERATE HEATING. Stewart, F.A.; Denekamp, J. (Mount Vernon Hospital, Middlesex, Eng.). Radiology; 123: No. 1, 195-200 (Apr 1977).

The combined effects of heat and x irradiation have been studied on mouse skin using skin reactions on the feet. The skin was heated for one hour by immersion in a water bath at temperatures ranging from 25.5 to 43.5°C. When the x irradiation was in the middle of this heating period a thermal sensitization to the x-ray damage was observed. The effect increased with temperature above 39.5°C and doubled the effectiveness of the x rays at 43.5°C. When the heating and irradiation were not concurrent the timing and sequence of treatments were important. Heat before irradiation was more effective than heat after irradiation, particularly if the interval was three hours or greater.

312 INTERACTION OF NEONATAL IRRADIATION AND SINGLE-GENES UPON GROWTH AND BEHAVIOR IN MICE. Nash, D.J. (Colorado State Univ., Fort Collins (USA)). Physiol. Behav.; 18: No. 4, 563-565 (Apr 1977).

Postnatal growth and behavior following neonatal irradiation were studied in congenic strains of mice. Mice were genetically similar except for single-gene substitutions at either the steel or dominant spotting loci. Adult behavior was measured by locomotion and elimination in the open field and by spontaneous activity in exercise wheels. In general, neonatal irradiation caused a decrease in body weight, activity in exercise wheels, and elimination in the open field, but an increase in locomotion in the open field. Significant differences due to genotype and sex were observed for locomotion and body weight. Differential responses of the genotypes to neonatal irradiation were observed in body weight and in activity in exercise wheels. The genotypes, in order of increasing sensitivity, were +/+, Wsup(a)/+, and Slup(gb)/+.

313 EYE ABNORMALITIES IN THE MOUSE FETUSES AND POSTNATAL MICE CAUSED BY 150R OF X-RADIATION ON DAY 7 OF GESTATION. Hashimoto, N. (Nagoya City Univ. (Japan). Faculty of Medicine). Nishi Nippon Hifuka; 28: No. 4, 587-594 (Apr 1977). (In Japanese).

Pregnant ddN mice were subjected to a single whole-body x radiation at a dose of 150 R on day 7 of pregnancy. The offspring were examined on day 18 of gestation or at the age of 4 weeks. In the fetuses on day 18 of gestation, microphthalmus, aphakia, faulty closure of the fetal fissure, corneal abnormalities, and corneo-lenticular adhesion were found. 4-week old mice (4W-M), developed microphthalmus, congenital corneal opacity, choroidal coloboma, corneolenticular adhesion, iris coloboma, retinal dysplasia and anophthalmus. Congenital corneal opacity in 4W-M by gross examination showed microscopically the corneal epithelial plug penetrated through a discontinuous corneal stroma. The corneal abnormalities in the 18-day fetuses (18-F) showed the same findings. Corneolenticular adhesion in the fetuses and 4W-M had the same pathological findings. Projection from the anterior surface of the lens extended into the stromal gap and the lens fibers penetrated the proximal region of the projection. Choroidal coloboma with microphthalmus in 4W-M had the same pathological findings as typical coloboma seen in humans. Thus, choroidal coloboma in mice may be caused by faulty closure of the fetal fissure as typical coloboma in human. Some cases of microphthalmus in 4W-M had the same pathological findings as the clinically so-called "Retinal dysplasia". It was suspected if they were caused by faulty closure of the fetal fissure. It may be that on day 18 fetuses with microphthalmus had pathological findings, i.e., retinal folding, retinal eversion, choroidal coloboma caused by faulty closure of the fetal fissure, and excessive persistent primary vitreous. Incidence of microphthalmus in 18-F was almost the same as that in 4W-M. Anophthalmus was secondary anophthalmus, which showed some remnants of ocular tissue.

314 EPILATION IN RATS AFTER SINGLE AND MULTIFRACTIONATED GAMMA-RAY EXPOSURE. Masuda, Kouji; Reid, B.O.; Withers, H.R. (Anderson (M.D.) Hospital and Tumor Inst., Houston, Tex. (USA)). Nippon Igaku Hoshasen Gakkai Zasshi; 37: No. 4, 387-394 (Apr 1977). (In Japanese).

The response of the hair of rats to single and multifractionated gamma rays was studied using an arbitrary scale of epilation as an endpoint. The dose response relationships for single and multifractionated treatments were analyzed. This analysis suggests that the single-dose survival curve for telogen follicle cells bends downwards continuously between

doses of 500 and 2300 rads. When the total doses for minimal definite epilation were plotted on a log-log scale as a function of overall time, the slope increased from 0.08 to 0.30, with an increase in number of fractions from 2 to 8. This suggests that Ellis' formula for a time-dose relationship can not be applied to the data in this paper.

- 315 CHANGES OF THE EXCRETION OF BOTH ^{125}I -O-IODOBENZOIC ACID AND ITS CONJUGATES IN IRRADIATED RATS. Pulpanova, J.; Ledvina, M. (Karlova Universita, Hradec Kralove (Czechoslovakia). Lekarska Fakulta). Radiobiol. Radiother.; 18: No. 2, 165-171 (Apr 1977). (In German).

^{125}I -o-iodobenzoic acid was used for investigating the detoxication mechanism after irradiation with 500 R. Three compounds were detected in urine of both the controls and experimental rats after i.p. administration of o-iodobenzoic acid: o-iodobenzoic glucuronate, o-iodohippuric acid, and unchanged o-iodobenzoic acid. As compared with the control group, the excretion of the conjugates was found to be lower. The values increase slowly almost to normal ones during the next days. On the other hand, the o-iodobenzoic acid excretion increases in the irradiated rats. The course of elimination is similar to that of the conjugates, but in the inverse sense; the minimum values were also found on the 3rd day.

- 316 (ORNL--5245) AIRDOS-II COMPUTER CODE FOR ESTIMATING RADIATION DOSE TO MAN FROM AIRBORNE RADIONUCLIDES IN AREAS SURROUNDING NUCLEAR FACILITIES. Moore, R.E. (Oak Ridge National Lab., Tenn. (USA)). Apr 1977. Contract W-7405-ENG-26. 159p. Dep. NTIS, PC A08/MF A01.

The AIRDOS-II computer code estimates individual and population doses resulting from the simultaneous atmospheric release of as many as 36 radionuclides from a nuclear facility. This report describes the meteorological and environmental models used in the code, their computer implementation, and the applicability of the code to assessments of radiological impact. Atmospheric dispersion and surface deposition of released radionuclides are estimated as a function of direction and distance from a nuclear power plant or fuel-cycle facility, and doses to man through inhalation, air immersion, exposure to contaminated ground, food ingestion, and water immersion are estimated in the surrounding area. Annual doses are estimated for total body, GI tract, bone, thyroid, lungs, muscle, kidneys, liver, spleen, testes, and ovaries. Either the annual population doses (man-rems/year) or the highest annual individual doses in the assessment area (rems/year), whichever are applicable, are summarized in output tables in several ways--by nuclides, modes of exposure, and organs. The location of the highest individual doses for each reference organ estimated for the area is specified in the output data.

- 317 CRITERIA FOR SAFE WORKING WITH IODINE-125. Linsley, G.S. (National Radiological Protection Board, Harwell (UK)). Radiography; 43: No. 508, 91-93 (Apr 1977).

Radioimmunoassay and other saturation assay tests involving the use of iodine-125 are finding wide application for the determination of hormone concentrations in biological fluids. In such tests, iodinations involving concentrations of a millicurie per microlitre are common. Iodine-125 presents a problem from the monitoring standpoint because of its low

energy photon emission (27 and 35 keV). Iodine is preferentially taken up by the thyroid gland and work involving moderate amounts of radiiodine may give rise to a significant hazard in an accident situation. The general precautions which should be taken in work with unsealed radioactive substances are briefly summarized, working limits for iodine-125 are identified, and methods of personal protection and monitoring in an emergency situation described.

- 318 WORK OF THE BOARD'S LOW-BACKGROUND LABORATORY. O'Riordan, M.C. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 19, 19-21 (Apr 1977).

A description is given of some of the work being undertaken using the National Radiological Protection Board's new low-background facilities. In vivo body monitoring is carried out following requests from users of unsealed radioactive materials anxious about accidental intakes, and an exploratory series of measurements is being undertaken to establish how representative these requests are. A realistic and robust chest phantom is being developed to facilitate calibration and comparisons between laboratories of measurements of low-energy photon emitters such as plutonium. An intercomparison of the determination of uranium in lung is being organised. Studies of the retention and translocation of radioactivity in animals and in man use the detector systems. Environmental monitoring of a wide range of materials provides data for the calculation of dose commitments to the public in the UK. Complex radiochemical procedures are often required. There is considerable international interest in devising a radiation protection standard for building materials, and systematic measurements are being completed of the potassium, radium and thorium contents of established building materials. It is anticipated that increasing interest in the effects of the nuclear power programme will require the evaluation of long-lived radionuclides in various environmental media.

- 319 COMMENTS ON 'ESTIMATE OF NATURAL INTERNAL RADIATION DOSE TO MAN'. Holtzman, R.B. (Argonne National Lab., Ill. (USA)). Health Phys.; 32: No. 4, 324-325 (Apr 1977).

Reference is made to a paper by Manocha and Mohindra (Health Phys.; 30: 485 (1976)) entitled 'Estimate of Natural Internal Radiation Dose to Man' in which, it is here claimed, a distorted view of the state of knowledge of the dose to man from internally deposited radionuclides is given. It is stated that the major deficiencies of this paper are that the concentrations of several nuclides that contribute significantly to the dose are grossly in error and, even more serious, the contributions to the dose from the radioactive decay products of ^{90}Sr , ^{210}Pb , ^{226}Ra and ^{228}Ra are ignored. A more realistic compilation of the significant concentrations and mean whole-body dose-equivalent rates in the view of the present author is shown tabulated.

- 320 PRENATAL EFFECTS OF ^{35}S IN MICE. Satyanarayana Reddy, K.; Reddy, P.P.; Reddi, O.S. (Osmania Univ., Hyderabad (India). Dept. of Genetics). Indian J. Exp. Biol.; 15: No. 4, 310-311 (Apr 1977).

ANIMAL GROWTH; BIOLOGICAL RADIATION EFFECTS; INJECTION; MICE; MORTALITY; PREGNANCY; PRENATAL IRRADIATION; PROGENY; SULFUR 35; FETUSES

- 321 ⁹⁰Sr IN THE HUMAN BONE. Bauman, A.; Franic, N.; Baumstark, M.; Popovic, V. (Yugoslav Academy of Sciences and Arts, Zagreb. Inst. for Medical Research). Health Phys.; 32: No. 4, 318-321 (Apr 1977).

The result of analyses of human femur specimens for ⁹⁰Sr content in the bones of children, adults, males and females undertaken at the Institute for Medical Research, Yugoslavia are presented covering a part of southern Europe which has not been included in the world bone network. The results do not differ much from world data, despite the fact that only a small number of femur samples was processed. They show a good correlation with other results obtained in vertebrae (Alstad et al. Health Phys.; 28: 677 (1975) Bennet. HASL-297, I-21 (1975)) since the ⁹⁰Sr concentration in the bones of children and adolescents are higher than in adults. The maximal value for adolescents was 7.63 pCi ⁹⁰Sr/g Ca and the peak concentration was 3 yr later than stated by Bennet. The highest value for all groups amounted to 10.49 pCi ⁹⁰Sr/g Ca for a 26 yr old male.

- 322 DOSIMETRY OF ZINC RADIONUCLIDES.

Berkley, L.W. (Anderson (M.D.) Hospital and Tumor Inst., Houston, Tex. (USA)); Logan, K.W.; Siegel, E. Health Phys.; 32: No. 4, 303-305 (Apr 1977).

Based on a study of the uptake and retention of ⁶⁵Zn in various organs of man, permissible body burdens for ⁶⁵Zn or sup(69m)Zn zinc isotopes are re-evaluated. The results show that due to a high concentration of zinc by the liver and spleen, the old standards are too liberal with respect to these organs. Concerning the possible use of zinc for radioisotope in vivo distribution scanning, additional calculations are made of the absorbed dose resulting from a single administration of ⁶⁵Zn and sup(69m)Zn.

- 323 EFFECT OF INHALED PLUTONIUM DIOXIDE ON DEVELOPMENT OF URETHANE-INDUCED PULMONARY ADENOMAS. Brightwell, J.; Heppleston, A.G. (Newcastle upon Tyne Univ. (UK)). Br. J. Cancer; 35: No. 4, 433-438 (Apr 1977).

Mice were exposed to plutonium dioxide (PuO₂) aerosols 2 weeks before or after urethane injection. Both exposures reduced the number and size of adenomas. The incidence of arrested metaphases showed no consistently significant differences between plutonium-exposed and mock-exposed animals. The results are discussed in relation to recent electron microscopic evidence of degenerative changes in the type II epithelial cells of the mouse lung following PuO₂ inhalation. It is concluded that damage at the cellular level may account for the observed reduction in growth of pulmonary adenomas in mice whose lungs contained plutonium particles.

- 324 IODINE-129: LIMITS TO RADIOLOGIC DOSE.

Book, S.A. (California Univ., Davis (USA). Radiobiology Lab.). Health Phys.; 32: No. 4, 321-324 (Apr 1977).

To determine the impact of ¹²⁹I on iodine metabolism and to further evaluate the extent of possible radiologic effects associated with exposure to ¹²⁹I, 14 4-month-old beagle dogs of both sexes were administered varying amounts of the radionuclide. Single oral doses of 0, 0.45, 1.13, 2.5 and 5 mg ¹²⁹I (corresponding to 0, 0.07, 0.2, 0.4 and 0.8 µCi, respectively) containing 14% ¹²⁷I as a contaminant were given as NaI. In addition, 7 µCi ¹³¹I was administered to each pup as a tracer for external whole-body and thyroidal monitoring

over the subsequent 2-week period. Each ¹³¹I dosage was equivalent to about 60 pg iodine. The dietary intake of stable iodine was approx 0.2 mg/day. It was found that the radiologic hazard associated with ¹²⁹I appears inherently limited, resulting from its low specific activity and from biologic mechanisms which serve to control the amount of intra- and extrathyroidal iodine. Although the risk to human health from long-term, low-level exposure to ¹²⁹I is yet to be defined, it may be expected to be restricted by these physical and physiologic constraints.

- 325 DOSE: RESPONSE ANALYSIS OF CADMIUM-INDUCED TUBULAR PROTEINURIA. Kjellstrom, T. (Karolinska Inst., Stockholm); Evrin, P.E.; Rahnster, E. Environ. Res.; 13: No. 2, 303-317 (Apr 1977).

The study covered 240 male and female workers exposed to cadmium oxide and nickel hydroxide dust in a Swedish battery factory. The control group comprised 87 unexposed males. Air samples from the plant showed the present exposure level to be about 50 µg Cd/m³ air. Cadmium-induced effects were studied by measuring urinary β₂-microglobulin excretion. Urinary β₂-microglobulin concentration followed a log-normal distribution in the reference group with a geometric mean of 84 µg/liter (adjusted to a specific gravity of 1.023). In the group of 185 persons continuously exposed to cadmium dust in the work environment, the prevalence of increased urinary β₂-microglobulin excretion increased with employment time. The prevalence was 19 percent for the workers with 6 to 12 years of exposure to about 50 µg Cd/m³ as compared to 3 percent for those in the reference group. Smokers had about three times higher prevalence than nonsmokers.

- 326 (LA--6758-C, pp 115-141) ANALYSIS OF DISEASE INCIDENCE DATA FROM SURVIVAL EXPERIMENTS. Mitchell, T.J. (Union Carbide Corp., Oak Ridge, TN). Apr 1977.

From 2. ERDA statistical symposium; Oak Ridge, TN, USA (25 Oct 1976).

Proceedings of the second ERDA statistical symposium.

The statistical analysis of disease incidence data obtained at death from animals subjected to various treatments depends on the designation of the disease as "lethal" or "nonlethal," the analysis being different in each case. In practice, problems arise because diseases are neither strictly lethal nor strictly nonlethal. 8 tables.

- 327 (GJT--2) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, SHIPROCK SITE, SHIPROCK, NEW MEXICO. PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). 31 Mar 1977. Contract EY-76-C-13-1658. 209p. Dep. NTIS, PC A10/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Shiprock, New Mexico. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the 1.7 million tons of tailings at the Shiprock

site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The 11 alternative actions presented range from completion of the present ongoing EPA site decontamination plan (Option I), to stabilizing in-place with varying depths of cover material (Options II-IV), to removal to an isolated long-term disposal site (Options V-XI). All options include remedial action costs for off-site locations where tailings have been placed. Costs estimates for the 11 options range from \$540,000 to \$12,500,000. Reprocessing the tailings for uranium is not economically feasible.

impact, although windblown tailings and external gamma radiation are also factors. The sparse population and relatively low radiation levels yield minimal immediate environmental impact; hence, the two alternative actions presented are directed towards restricting access to the site (Options I and II), and returning the windblown tailings to the pile and stabilizing the pile with 2 ft of cover material (Option II). Both options include remedial action costs for offsite locations where tailings have been placed. Cost estimates for the two options are \$585,000 and \$1,165,000. Reprocessing the tailings for uranium is not economically feasible.

- 328 (GJT--3S) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, MEXICAN HAT SITE, MEXICAN HAT, UTAH. A SUMMARY OF THE PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). 31 Mar 1977. Contract EY-76-C-13-1658. 52p. Dep. NTIS, PC A04/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Mexican Hat millsite in Utah. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals residing nearby, the investigation of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. Radon gas release from the 2,200,000 tons of tailings on the site constitutes the most significant environmental impact. The six alternative actions presented are directed towards restricting access to the site (Option I), returning the windblown tailings to the piles and stabilizing the piles with cover material (Options II, III, and IV), and consolidating the two piles into one pile and stabilizing it with cover material (Options V and VI). Fencing around the site or the tailings and the decontamination of mill buildings is included in all options. Options II and V provide 2 ft of cover material on the tailings, Options III, IV, and VI provide 4 ft, 13 ft, and 10 ft of cover, respectively. Costs of the options range from \$370,000 to \$4,390,000. Reprocessing the tailings for uranium is not feasible at present.

- 329 (GJT--4S) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, MONUMENT VALLEY SITE, MONUMENT VALLEY, ARIZONA. A SUMMARY OF THE PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). 31 Mar 1977. Contract EY-76-C-13-1658. 50p. Dep. NTIS, PC A03/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Monument Valley millsite in Arizona. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals residing nearby, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the tailings on the site constitutes the most significant environmental

- 330 (GJT--5) ENGINEERING ASSESSMENT OF INACTIVE URANIUM MILL TAILINGS, TUBA CITY SITE, TUBA CITY, ARIZONA. PHASE II, TITLE I. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). 31 Mar 1977. Contract EY-76-C-13-1658. 175p. Dep. NTIS, PC A08/MF A01.

Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Tuba City millsite in Arizona. The Phase II, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals residing nearby, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the tailings on the site constitutes the most significant environmental impact to the inhabited area near the site. In the downwind direction, to the northeast of the site, airborne radioactivity is greater than Federal guidelines but there are no dwellings in that direction in the area of concern. Gamma radiation is significant over the tailings but is near background levels in the housing area. The sparse population and relatively low radiation levels yield minimal immediate environmental impact; hence, the four alternative actions presented are directed towards restricting access to the site (Option I), and returning the windblown tailings to the pile and stabilizing the pile with cover material (Options II, III, and IV). Fencing around the site or the tailings pile and the removal or decontamination of mill buildings is included in all options. Option II provides 2 ft of cover material on the tailings, Option III provides 4 ft of cover, and Option IV provides 13 ft of cover. Costs of the options range from \$671,000 to \$2,904,000. Reprocessing the tailings for uranium is only marginally feasible and would require a more detailed economic evaluation before any action was taken.

- 331 (DOCKET-50289--881) THREE MILE ISLAND NUCLEAR STATION, UNIT 1. IE INSPECTION REPORT NO. 77-07 (ROUTINE, UNANNOUNCED). (Metropolitan Edison Co., Reading, Pa. (USA)). 31 Mar 1977. vp.

Inspection of radiation protection program, preparations for refueling, and corrective actions. THREE MILE ISLAND-1 REACTOR; INSPECTION; RADIATION PROTECTION; REACTOR FUELING; PERSONNEL; RADIATION DOSES; DOCUMENTATION; EDUCATION; MONITORING

- 332 (DOCKET-50334--486) BEAVER VALLEY POWER STATION, UNIT 1. IE INSPECTION REPORT NO. 77-09 (ROUTINE, UNANNOUNCED RE RADIATION

PROTECTION PROGRAM INFRACTIONS PER TS 6.13);
REPLY; ACKNOWLEDGMENT. (Duquesne Light Co.,
Pittsburgh, Pa. (USA)). 31 Mar 1977. vp.

Inspection of radiation protection program
for operation. BEAVER VALLEY-1 REACTOR;
INSPECTION; RADIATION PROTECTION; REACTOR
OPERATION; DOCUMENTATION; CONTROL; PERSONNEL;
IODINE; SAMPLING; RESPIRATORS; NEUTRONS; RADIATION
DOSES; RADIOACTIVE WASTE MANAGEMENT; HCSES

- 333 (COO--119-252, pp 272-287) ²²⁴Ra
TOXICITY FROM A PILOT STUDY IN BEAGLES. Mays,
C.W.; Llydy, R.D.; Taylor, G.N.; Atherton, D.R.
31 Mar 1977.

Research in radiobiology. Annual report of
work in progress in the internal irradiation
program.

Toxicity data are reported for 20 beagles
given single intravenous injections of ²²⁴Ra in
1963 or 1968. The injection of 1 µCi ²²⁴Ra/kg
gave an average skeletal dose of about 54 rad
in young adult beagles. Two dogs died of acute
radiation sickness, 6 with bone sarcomas, 6
from other causes, and 6 were still alive on 31
March 1977. The acutely lethal dosage (LD/sub
50/30) for a single injection of ²²⁴Ra in
young adult beagles seems to lie between 10 and
20 µCi ²²⁴Ra/kg, with an average skeletal dose
between 500 and 1000 rad.

- 334 (DOCKET-50269--751) OCONEE NUCLEAR
STATION, UNITS 1, 2, AND 3. ANNUAL OPERATING
REPORT FOR 1976, VOLUME 1: NONRADIOLOGICAL
ENVIRONMENTAL SURVEILLANCE REPORT; II: SUMMARY
OF OPERATIONS. (Duke Power Co., Charlotte,
N.C. (USA)). 30 Mar 1977. vp. (DOCKET-
50270--712; DOCKET-50287--637).

The non-radiological environmental
surveillance program including thermal and
chemical effluents, water quality, fish
populations, benthos, fish impingement, gas-
bubble disease, and plankton, fish larvae and
fish egg entrainment is described. Information
is also presented concerning operations,
personnel radiation exposures, and fuel
examinations. (FS)

- 335 TUMOURS AND VIRUSES IN MICE INJECTED WITH
PLUTONIUM. Loutit, J.F. (Medical Research
Council, Harwell (UK). Radiobiological Research
Unit); Lloyd, E.L. Nature (London); 266: No.
5600, 355-357 (24 Mar 1977).

Some experiments are reported with the
object of comparing the effects of Pu in mice
with those of Ra. Questions considered were -
(a) do Pu-induced tumours contain viruses; (b)
does sex affect the viral status or incidence
of tumours; (c) are Pu-induced tumours similar
to those induced by Ra; and (d) are the tumours
variable with dose and time or different in
radiation chimerae. Pu citrate solution was
injected intraperitoneally, and the
distribution and type of tumours in various
groups of the animals are shown graphically, as
a function of time after injection. Details
are also given on the viral status of ²³⁹Pu-
induced tumours.

- 336 (DOCKET-50312--452) RANCHO SECO NUCLEAR
GENERATING STATION, UNIT 1. REPORTABLE
OCCURRENCE REPORT NO. 77-03 RE DISCOVERY OF THE
PARTIALLY COLLAPSED RCS DRAIN TANK ON FEBRUARY
16, 1977. (Sacramento Municipal Utility
District, Calif. (USA)). 23 Mar 1977. vp.

Partially collapsed RCS drain tank on
February 16, 1977. RANCHO SECO-1 REACTOR;
REACTOR COOLING SYSTEMS; TANKS; DAMAGE; PIPELINES;
CRACKS; GASEOUS WASTES; RADIATION MONITORS;
SAMPLING; RADIOACTIVE EFFLUENTS; BYPASSES;
OPERATION; PERSONNEL; RADIATION DOSES; ACTIVITY

LEVELS; FISSION PRODUCT RELEASE

- 337 (DOCKET-50029--802) YANKEE NUCLEAR
POWER STATION. IE INSPECTION REPORT NO. 77-06
(ROUTINE, UNANNOUNCED). (Yankee Atomic
Electric Co., Westboro, Mass. (USA)). 22 Mar
1977. 11p.

Inspection of radiation protection program.
ROWE YANKEE REACTOR; INSPECTION; RADIATION
PROTECTION; RADIATION DOSES; DOCUMENTATION;
PERSONNEL; EDUCATION

- 338 (DOCKET-50206--699) SAN ONOFRE NUCLEAR
GENERATING STATION, UNIT 1. RESPONSES TO NRC
REQUESTS FOR ADDITIONAL INFORMATION RE
ELECTRICAL AND CONTROLS ASPECTS OF MODIFICATION
TO BE DONE DURING 1976 REFUELING OUTAGE.
(Southern California Edison Co., Rosemead
(USA)). 21 Mar 1977. 18p.

Electrical and controls aspects of
modification to be done during 1976 refueling
outage. SAN ONOFRE-1 REACTOR; MODIFICATIONS;
REACTOR FUELING; RADIATION DOSES; PUMPS; LEAKS;
VALVES; REACTOR COOLING SYSTEMS; RELIEF VALVES;
IODINE; RELEASE LIMITS; PIPELINES; SODIUM
PHOSPHATES; HYDRAZINE; OPERATION; PERSONNEL; PH
VALUE; INTERLOCKS

- 339 (DOCKET-50259--1004) BROWNS FERRY
NUCLEAR POWER STATION, UNITS 1, 2, AND 3. IE
INSPECTION REPORT NO. 77-03, -03, AND -
03 (ROUTINE, UNANNOUNCED RE DEFICIENCY PER
10CFR20.408); REPLY; ACKNOWLEDGMENT.
(Tennessee Valley Authority, Chattanooga
(USA)). 18 Mar 1977. vp. (DOCKET-50260--
769; DOCKET-50296--466).

Inspection of core monitoring, calibrations,
start-up, radiation protection radioactive
waste management, and coolant water chemistry.
BROWNS FERRY-1 REACTOR; BROWNS FERRY-2 REACTOR;
BROWNS FERRY-3 REACTOR; INSPECTION; RADIATION
PROTECTION; PERSONNEL; RADIATION DOSES; CORE SPRAY
SYSTEMS; PRESSURE MEASUREMENT; PERSONNEL;
EDUCATION; REACTOR CORES; MONITORING; IN CORE
INSTRUMENTS; CALIBRATION; ON LINE SYSTEMS;
COMPUTERS; REACTOR START-UP; RADIOACTIVE WASTE
MANAGEMENT; COOLANTS; WATER CHEMISTRY

- 340 (NUREG--0090-6) REPORT TO CONGRESS ON
ABNORMAL OCCURRENCES, OCTOBER--DECEMBER 1976.
(Nuclear Regulatory Commission, Washington,
D.C. (USA). Office of Management Information
and Program Control). 15 Mar 1977. 27p.
Dep. NTIS \$4.00.

Section 208 of the Energy Reorganization Act
of 1974 identifies an abnormal occurrence as an
unscheduled incident or event which the Nuclear
Regulatory Commission determines to be
significant from the standpoint of public
health or safety and requires a quarterly
report of such events to be made to Congress.
This report, the seventh in the series, covers
the period from October 1 to December 31, 1976.
The NRC has determined that during this period:
(1) There were two abnormal occurrences at the
63 nuclear power plants licensed to operate.
One event involved improper control rod
withdrawals resulting in an unplanned reactor
criticality. The second is a generic event
pertaining to feedwater nozzle cracking in
Boiling Water Reactors. The incidents had no
actual impact on public health or safety. (2)
There were five abnormal occurrences at other
licensee facilities. The occurrences involved
overexposures to radiography personnel; one
event also involved high radiation levels in
unrestricted areas. This report also contains
information updating previously reported
abnormal occurrences. This report does not
contain information on activities in these

states which have entered into agreements with the NRC for the assumption of certain regulatory authority pursuant to Section 274 of the Atomic Energy Act, as amended. Future reports will include Agreement State licensee activities as soon as procedures can be implemented.

irradiation with 1,200 R and injection of $1C^{14}$ -acetate. The rate of exchange of cholesterol between the organelles isolated from liver cells of exposed rats has been found to increase and that of phosphatidylcholine and phosphatidylethanolamine, to decrease.

- 341 (AD-A--038872) NUCLEAR EMULSION MEASUREMENTS OF THE DOSE CONTRIBUTION FROM TISSUE DISINTEGRATION STARS ON THE APOLLO-SOYUZ MISSION. TECHNICAL REPORT NO. 2, JUL 76--MAR 77. Schaefer, H.J. (West Florida Univ., Pensacola (USA)). 15 Mar 1977. Contract NO0014-76-C-0544. 15p. NTIS PCA02/MF A01.

Analysis of the prong number distribution of a population of disintegration stars in nuclear emulsion allows a quantitative estimate of the fraction of stars originating in the gelatin matrix and thereby an assessment of the tissue-equivalent dose from stars. 996 stars were prong-counted in two 100 micron Ilford K2 emulsions from the dosimeter of the Docking Pilot on Apollo-Soyuz and furnished a tissue star dose of 7.8 millirad or 45 millirem. Since star-produced neutrons do not leave visible prongs in emulsion, their dose contribution is not included. Nuclear theory as well as earlier measurements of galactic radiation in the Earth's atmosphere indicate that the dose equivalent from neutrons is about equal to the one from all ionizing secondaries from stars. This would set the total tissue star dose for Apollo-Soyuz at approximately 90 millirem. (Author)

- 342 BENIGN TUMORS OF THE DIGESTIVE TRACT AMONG ATOMIC BOMB SURVIVORS, 1961-1970 HIROSHIMA. Yamamoto, T. (Atomic Bomb Casualty Commission, Hijiya, Hiroshima); Kato, H.; Smith, G.S. Gann; 66: No. 6, 623-630 (15 Mar 1977).

The occurrence of benign tumors and diverticula of the digestive tract was investigated in an autopsy study of a fixed population of 100,000 samples in Hiroshima and Nagasaki. There were 664 benign tumors and 40 diverticula. Polyps were the most frequent tumor, were found more often in older people, occurred as single pedunculated well-differentiated adenomatous tumors, and most were less than 5 mm in greatest dimension. Larger polyps tended to have more atypism, but none showed definite premalignant change. No transition from benign to malignant polyps was seen. Polyps were found most frequently in the large intestine and in a large number (21 percent) and, when cancer of the large intestine was present, benign polyps were also found. Far more polyps are found when special intensive search is made for them. Comparison of the occurrence of benign polyps in different geographic areas must be adjusted for age and method of search as well as for other features such as histological type, dysplasia, etc. There was no evidence that the occurrence of benign tumors or diverticula was related to prior exposure to ionizing radiation.

- 343 ACTION OF IONIZING RADIATION ON THE INTERMEMBRANE PHOSPHOLIPID AND CHOLESTEROL EXCHANGE. Kolomitseva, I.K.; Kuzin, A.M. (AN SSSR, Pushchino-na-Oke. Inst. Biologicheskoy Fiziki). Stud. Biophys.; 63: No. 1, 41-44 (15 Mar 1977).

The exchange of cholesterol, phosphatidylcholine and phosphatidylethanolamine between the microsomes and mitochondria, and microsomes and nuclei of the liver cells of rats has been studied normally and 60 min after total-body

- 344 RADIATION-INDUCED BREAST CANCER. Price, J.L. (Hammersmith Hospital, London (UK). Postgraduate Medical School). Br. Med. J.; 1: No. 6062, 709-710 (12 Mar 1977).

Concern is expressed over a recent U.K. newspaper report (The Times, 21 January 1977, 5) on the possible hazards of mammography, as women may over-react to the extent of refusing mammography. The problems of radiation risk estimates, particularly at low dose levels, are very briefly reviewed. Recent improvements in mammography techniques have minimised the radiation hazard. Conflicting reports of the mortality rates following mammography screening programmes are discussed. In England and Wales, breast cancer is the commonest cause of death in women aged 35 to 54, and it would be unfortunate if the possible benefits of screening were denied to this age group before the latest mammographic techniques have been fully evaluated.

- 345 (DOCKET-50344--442) TROJAN NUCLEAR PLANT. INSPECTION REPORT NO. 77-02 (SPECIAL, UNANNOUNCED RE UNPLANNED RELEASE OF RADIOACTIVE GAS FROM A HOLDUP TANK IN FEBRUARY 1977. (Portland General Electric Co., Greg. (USA)). 11 Mar 1977. vp.

Inspection of buckling and rupture of tank and unplanned radioactive gas release. TROJAN REACTOR; INSPECTION; TANKS; RUPTURES; GASEOUS WASTES; FISSION PRODUCT RELEASE; RARE GASES; PERSONNEL; RADIATION DOSES; DEFORMATION

- 346 (DOCKET-50281--687) SURRY POWER STATION, UNIT 2. NRC REQUEST FOR ADDITIONAL INFORMATION RE INSPECTION PROGRAM. (Virginia Electric and Power Co., Richmond (USA)). 10 Mar 1977. 3p.

NRC request for additional information re inspection program for steam generator repair. SURRY-2 REACTOR; STEAM GENERATORS; REPAIR; INSPECTION; TUBES; EDDY CURRENT TESTING; RADIATION DOSES; PERSONNEL

- 347 (DOCKET-50029--791) YANKEE NUCLEAR POWER STATION. LICENSE NO. DPR-3, APPLICATION FOR AMENDMENT: TS PROPOSED CHANGE 140 RE ENTRIES INTO HIGH RADIATION AREAS. (Yankee Atomic Electric Co., Westboro, Mass. (USA)). 9 Mar 1977. 3p.

Entries into high radiation areas. ROWE YANKEE REACTOR; PERSONNEL; RADIATION PROTECTION; SIGNALS; SPECIFICATIONS; DOSEMETERS; RADIATION DOSES; RADIATION MONITORS

- 348 (DOCKET-50206--688) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 01. NRC REQUEST FOR DETERMINATION OF INDIVIDUALS QUALIFIED IN RADIATION PROTECTION PROCEDURES; CRITERIA. (Southern California Edison Co., Rosemead (USA)). 9 Mar 1977. 4p.

NRC request for determination of individuals qualified in radiation protection procedures; criteria. SAN ONOFRE-1 REACTOR; PERSONNEL; RADIATION PROTECTION; RADIATION MONITORING; MANAGEMENT; CONTROL; RADIATION DOSES; RELEASE LIMITS; PROTECTIVE CLOTHING

- 349 (DOCKET-50206--697) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. IE INSPECTION

- REPORT NO. 77-04 (ROUTINE, UNANNOUNCED); (Southern California Edison Co., Rosemead (USA)). 9 Mar 1977. 12p.
Inspection of radiation safety and compliance to NRC rules. SAN ONOFRE-1 REACTOR; INSPECTION; RADIATION PROTECTION; SAFETY; PERSONNEL; RADIATION DOSES; RESPIRATORS; MEASURING INSTRUMENTS; EQUIPMENT
- 350 (DOCKET-50003--628) INDIAN POINT STATION, UNITS 1, 2, AND 3. ANNUAL OPERATING REPORT FOR 1976. (Consolidated Edison Co. of New York, Inc., New York (USA)). 1 Mar 1977. 258p. (DOCKET-50247--889; DOCKET-50286--590).
Unit 1 remained in a shutdown condition pending a decision by the Company on the installation of an ECCS as required by NRC. Net electrical power generated by Unit 2 was 2,267,654 MWH with the unit on line 3,056.45 hrs. Unit 3 generated 1,872,947 MWH and was on line 2,286.01 hrs. Information is presented concerning operations, reportable events, corrective maintenance, fuel performance, radioactivity releases, shutdowns, primary coolant chemistry, and occupational radiation exposures. (FS)
- 351 (DOCKET-50250--694) TURKEY POINT PLANT, UNITS 3 AND 4. ANNUAL OPERATING REPORT FOR 1976. (Florida Power and Light Co., Miami (USA)). 1 Mar 1977. vp. (DOCKET-50251--683). Dep. NTIS, PC A04/MF A01.
Both units were essentially base loaded at rated power. Unit 4 was removed from service for its second refueling on April 10, and returned to service June 6. Unit 3 was removed from service on November 14 for its third refueling and returned to service January 16, 1977. Information is presented concerning operations, maintenance, power reductions, radiation exposures, failed fuel, eddy current tests, ultrasonic tests, and visual examinations. (FS)
- 352 (DOCKET-50298--785) COOPER NUCLEAR STATION. ANNUAL OPERATING REPORT: JANUARY--DECEMBER 1976. (Nebraska Public Power District, Columbus (USA)). 1 Mar 1977. 40p.
Plant operations including a chronological summary and a summary of plant outages and power reductions are described. Information is also presented concerning fuel performance, vessel transient condition events, facility changes, maintenance, and personnel radiation exposure. (FS)
- 353 (DOCKET-50344--436) TROJAN NUCLEAR PLANT. 1976 ANNUAL OPERATING REPORT. (Portland General Electric Co., Greg. (USA)). 1 Mar 1977. vp.
Net electrical energy generated was 2,102,986 MWH with the generator on line 3144.4 hours. Information is presented concerning operations, tests, corrective maintenance, auxiliary feedwater pump modifications, main generator fault, fuel performance, shutdowns and power outages, radiation exposure of personnel, radioactive and chemical effluents, and environmental surveillance. (FS)
- 354 (COO--2968-1) DETERMINATION OF PU-239, 240 TISSUE CONCENTRATIONS IN NON-OCCUPATIONALLY EXPOSED RESIDENTS OF NEW YORK CITY. Wrenn, M.E.; Cohen, N. (New York Univ., N.Y. (USA). Inst. of Environmental Medicine). 1 Mar 1977. Contract EY-76-S-02-2968. 46p. Dep. NTIS, PC A03/MF A01.
The study reports on the Pu-239, 240 concentrations in various tissues obtained from individuals residing in New York City. Twenty-six tissue samples have been analyzed for their Pu-239, 240 content, which include sections from the right lung, the liver, bone (4th and 5th vertebrae) and the kidney. The tissues were obtained at autopsy from a selected population not occupationally exposed to plutonium and whose deaths were the result of causes other than metabolic disorders. A detailed description is presented of the radiochemical procedures employed to separate Pu and electrochemically deposit plutonium isotopes prior to alpha spectrometry with Si surface-barrier detectors. Results of these measurements are given as activity per gram wet weight and activity per gram of calcium in the individual tissue. All results have been compared to similar measurements made at other laboratories and with estimates of concentration based on metabolic models. To date, the magnitudes and the distribution of the measured values are consistent with the values inferred from the ICRP lung model and measured concentrations of air.
- 355 COMPARABILITY OF THE NATURAL RADIATION EXPOSURE WITH THE RADIATION EXPOSURE CAUSED BY NUCLEAR FACILITIES. Umwelt; No. 54, 14-18 (Mar 1977). (In German).
The biological effect of the different types of radiation from natural and man-made radiation sources is based on the same biophysical mechanisms. External or internal irradiation from man-made sources with equal dose equivalent, i.e. if radiation type and energy, dose rate, and, if necessary, microscopic dose distribution are taken into account, has, besides the space-averaged energy dose, practically the same effect as irradiation from natural sources. With respect to these factors, there are no relevant differences between external natural radiation exposure and the external γ -irradiation by man-made radioactive material occurring in the emissions from nuclear power plants. For incorporation of the relevant radionuclides there are no pertinent differences either. The Commission for Radiological Protection (SSK) states that in radiological protection the dose equivalent is a reliable, sufficiently exact measure of comparison for different radiation exposures. The dose equivalents caused by the natural radiation exposure of man and their variations in time and space form a suitable system of reference for the estimation and evaluation of the radiation exposure from nuclear facilities.
- 356 (DOCKET-50171--218) PEACH BOTTOM ATOMIC POWER STATION, UNIT 1. DECOMMISSION REPORT NO. 3, 1 JULY--31 DECEMBER 1976. (Philadelphia Electric Co., Pa. (USA)). Mar 1977. 14p.
Decommission report No. 3, 1 July--31 December 1976. PEACH BOTTOM-1 REACTOR; REACTOR DECOMMISSIONING; RADIOACTIVE EFFLUENTS; LIQUID WASTES; QUANTITY RATIO; RADIOISOTOPES; PERSONNEL; RADIATION DOSES; SPENT FUEL ELEMENTS; TRANSPORT; FUEL POOLS; LEAKS; TRITIUM; ACTIVITY LEVELS; GASEOUS WASTES; SOLID WASTES; FISSION PRODUCT RELEASE; HEAT EXCHANGERS; CESIUM 134; CESIUM 137; STRONTIUM 90; COBALT 60; ZINC 65; IRON 59; SODIUM 24
- 357 (NRPB/RandD--1, pp 126-127) QUANTITATIVE ASSESSMENT OF THE BIOLOGICAL CONSEQUENCES FOLLOWING THE RELEASE OF RADIOACTIVITY FROM A REACTOR ACCIDENT. Smith, H.; Stather, J.W. Mar 1977.
Annual research and development report 1976. BIOLOGICAL RADIATION EFFECTS; CONTAMINATION;

ENVIRONMENT;FISSION PRODUCT RELEASE;HUMAN
POPULATIONS;RADIATION HAZARDS;RADIOACTIVITY;
REACTOR ACCIDENTS

and the environmental surveillance program.

- 358 (ANL--77-13) ENVIRONMENTAL MONITORING AT ARGONNE NATIONAL LABORATORY. ANNUAL REPORT FOR 1976. Golchert, N.W.; Duffy, T.L.; Sedlet, J. (Argonne National Lab., Ill. (USA)). Mar 1977. Contract W-31-109-ENG-38. 86p. Dep. NTIS, PC A05/MF A01.

The results of the environmental monitoring program at Argonne National Laboratory for 1976 are presented and discussed. To evaluate the effect of Argonne operations on the environment, measurements were made for a variety of radionuclides in air, surface water, Argonne effluent water, soil, grass, bottom sediment, and foodstuffs; for a variety of chemical constituents in surface and Argonne effluent water; and of the environmental penetrating radiation dose. Sample collections and measurements were made at the site boundary and off the Argonne site for comparison purposes. Some on-site measurements were made to aid in the interpretation of the boundary and off-site data. The results of the program are interpreted in terms of the sources and origin of the radioactive and chemical substances (natural, fallout, Argonne, and other) and are compared with accepted environmental quality standards. The potential radiation dose to off-site population groups is also estimated.

- 359 (ERDA--77-24) GUIDE FOR ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE AT ERDA INSTALLATIONS. Corley, J.P.; Denham, D.H.; Michels, D.E.; Olsen, A.R.; Waite, D.A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Mar 1977. Contract EY-76-C-06-1830. 218p. Dep. NTIS, PC A10/MF A01.

This Guide is intended to: Provide recommended methods, procedures, and performance criteria to bring greater comparability to ERDA environmental monitoring and reporting systems; provide ERDA management, particularly the Headquarters' Division of Safety, Standards, and Compliance (SSC) and field offices, with a broad review of accepted radiological surveillance practices for use in the evaluation of environmental surveillance programs at ERDA facilities; and delineate the capabilities and limitations of the various environmental monitoring systems for radioactivity currently used at ERDA sites, including technical areas where there is either an inadequate basis for procedural selection or where further developmental work may be warranted. The discussion of equipment, measurement techniques, and quality control procedures, although believed to represent current technology, is subject to continuing change as technological improvements become available. (235 references)

- 360 (LBL--6405) ANNUAL ENVIRONMENTAL MONITORING REPORT OF THE LAWRENCE BERKELEY LABORATORY. Stephens, L.D. (ed.). (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1977. Contract W-7405-ENG-48. 40p. Dep. NTIS, PC A05/MF A01.

The data obtained from the Environmental Monitoring Program of the Lawrence Berkeley Laboratory for the calendar year 1976 are described and general trends are discussed. Reference is made to LBL-4678, the 1976 annual report that discusses in detail the modeling used to determine the population dose equivalent due to laboratory operations and describes natural background radiation, geological features, climate and meteorology,

- 361 (ORNL/EIS--91/V8) ENVIRONMENTAL ASPECTS OF THE TRANSURANICS: A SELECTED, ANNOTATED BIBLIOGRAPHY. Ensminger, J.T.; Martin, F.M.; Fore, C.S. (comps.). (Oak Ridge National Lab., Tenn. (USA)). Mar 1977. Contract W-7405-ENG-26. 211p. (NVO-AEIC--77-1). Dep. NTIS, PC A10/MF A01.

This eighth published bibliography of 427 references is compiled from the Nevada Applied Ecology Information Center's Data Base on the Environmental Aspects of the Transuranics. The data base was built to provide information support to the Nevada Applied Ecology Group (NAEG) of ERDA's Nevada Operations Office. The general scope covers environmental aspects of uranium and the transuranic elements, with emphasis on plutonium. This bibliography highlights literature on plutonium 238 and 239 and americium in the critical organs of man and animals. Supporting information on ecology of the Nevada Test Site and reviews and summarizing literature on other radionuclides have been included at the request of the NAEG. The references are arranged by subject category with leading authors appearing alphabetically in each category. Indexes are provided for author(s), geographic location, keyword(s), taxon, title, and publication description.

- 362 (SAND--76-0746) CONDITIONAL PROBABILITY OF INTENSE RAINFALL PRODUCING HIGH GROUND CONCENTRATIONS FROM RADIOACTIVE PLUMES. Wayland, J.R. (Sandia Labs., Albuquerque, N.Mex. (USA)). Mar 1977. Contract EY-76-C-04-0789. 16p. Dep. NTIS, PC A02/MF A01.

The overlap of the expanding plume of radioactive material from a hypothetical nuclear accident with rainstorms over dense population areas is considered. The conditional probability of the occurrence of hot spots from intense cellular rainfall is presented.

- 363 TECHNETIUM-99m--PYROPHOSPHATE BONE SCANS IN HYPERPARATHYROIDISM. Wiegmann, T.; Rosenthal, L.; Kaye, M. (Montreal General Hospital, Quebec). J. Nucl. Med.; 18: No. 3, 231-235(Mar 1977).

Most patients with primary hyperparathyroidism have normal 5-hr bone-to-soft-tissue ratios for ^{99m}Tc-pyrophosphate. In contrast, all five patients with advanced secondary hyperparathyroidism in this study showed significant (p less than 0.001) increases of bone uptake. In the early period after parathyroidectomy, there was no quantitative or qualitative change in uptake. A limited decrease of bone uptake was observed only after prolonged periods of observation. In itself, parathyroid activity seems to have little direct influence on bone uptake of ^{99m}Tc-pyrophosphate.

- 364 POLYFUNCTIONAL RADIOSENSITIZERS. III. EFFECT OF THE BIRADICAL (RO-03-6061) IN COMBINATION WITH OTHER RADIOSENSITIZERS ON THE SURVIVAL OF HYPOXIC V-79 CELLS. Millar, B.C. (Inst. of Cancer Research, Surrey, Eng.); Fielden, E.M.; Smith, C.E. Radiat. Res.; 69: No. 3, 489-499(Mar 1977).

The biradical Ro-03-6061 removes the shoulder from the survival curve of hypoxic V-79 whereas both NPPN and PNAP are dose-modifying sensitizers like oxygen. When hypoxic cells were irradiated in the presence of a combination of NPPN and the biradical at equivalent radical concentrations, the survival curve was similar to that for cells irradiated in the presence of NPPN alone. When a

combination of PNAP and the biradical were used at a concentration where the number of electron affinic (PNAP) molecules was equal to the number of free radical moieties, the resultant D_0 value was similar to that for PNAP alone, but the shoulder of the curve was not completely restored. In experiments where the biradical was used in combination with diamide the effect was additive. Cell kill was exponential even at low doses when 0.05 mM diamide was used in combination with 0.1 mM biradical; the extrapolation number was 1.0 and the D_0 was 240 rad. The results suggest mechanistic differences between electron affinic, free radical, and sulfhydryl-binding radiosensitizers, and also differences between monofunctional and polyfunctional sensitizers.

- 365 COMPARISON OF SINGLE-STRAND BREAKS IN THE DNA OF RAT THYMOCYTES INDUCED BY IRRADIATED HISTIDINE AND γ RAYS. Ueno, A.M.; Matsudaira, H. (National Inst. of Radiological Sciences, Anagawa, Japan). Radiat. Res.; 69: No. 3, 541-552(Mar 1977).

Single-strand breaks in the DNA of rat thymocytes induced by γ rays and irradiated histidine were studied using alkaline sucrose gradient centrifugation. γ -ray-induced DNA breaks were found to be random in nature with their number increasing linearly with increasing dose. These breaks were produced with an efficiency estimated to be 84.5 eV per break and were rejoined partially during postirradiation incubation. Treatment of the cells at 20°C with irradiated histidine, however, produced the appearance of two distinct peaks of smaller DNA. The molecular weights of these species of DNA were estimated to be 3 to 4×10^6 and 6×10^7 daltons, respectively, compared to 6×10^8 daltons in untreated cells. Increasing the radiation dose given the histidine resulted in an increase in the proportion of the 6×10^7 daltons DNA species but failed to decrease further the molecular size. Posttreatment of γ -irradiated cells with irradiated histidine at 20°C induced further breaks in the DNA. This phenomenon was not observed, however, when the radiation dosage exceeded 30 krad. Rejoining of induced breaks was not observed during incubation at 37°C of irradiated histidine-treated cells. Treatment of the cells with three sulfhydryl-binding reagents produced results similar to those produced by irradiated histidine. Moreover, both irradiated histidine and sulfhydryl agents apparently inhibited the rejoining of γ -ray-induced DNA strand breaks. It is concluded that irradiated histidine and sulfhydryl-binding agents induce specific DNA breakage, possibly the dissociation of large DNA molecules into certain subunits. The possible involvement of sulfhydryl groups in the structure of cellular DNA of high molecular weight is discussed.

- 366 RADIOSENSITIZATION OF MOUSE SPERMATOGENIC STEM CELLS BY RO-07-0582. Suzuki, N.; Withers, R.; Hunter, N. (Univ. of Texas, Houston). Radiat. Res.; 69: No. 3, 598-601(Mar 1977).

The hypoxic character of the spermatogenic stem cells of the mouse testis was investigated by measuring the effect on radiosensitivity of treatment with the hypoxic cell radiosensitizer, Ro-07-0582 or hyperbaric oxygen (30 psi). The D_0 values obtained were 181 (161-207) rad for irradiation alone, 140 (133-148) rad for irradiation after treatment with Ro-07-0582, and about 100 rad for irradiation in the presence of hyperbaric oxygen. Ro-07-0582 alone was slightly cytotoxic. The results demonstrate that mouse

spermatogenic stem cells are radiosensitized by Ro-07-0582 or hyperbaric oxygen and are not as well oxygenated as other normal tissues.

- 367 DERIVATION OF SURVIVAL KINETIC PARAMETERS FOR CELL POPULATIONS BY COMPUTER SIMULATION OF RADIOBIOLOGICAL DATA. Cohen, L.; Redpath, J.L. (Michael Reese Medical Center, Chicago). Radiat. Res.; 69: No. 3, 387-401(Mar 1977).

From 23. annual meeting of the Radiation Research Society; Miami Beach, FL, USA (11 May 1975).

The single-hit multitarget cellular lethality model requires four to six parameters in order to simulate a complete course of fractionated radiation therapy and derives an estimate of the cellular-surviving fraction for a given treatment scheme. These parameters are the mean cellular lethal dose, the extrapolation number, the ratio of sublethal to irreparable events, the regeneration rate, and, in some instances, the repopulation limit (cell cycles), and a field-size or tumor-volume factor. If a number of different fractionation schemes yield similar reactions, the surviving fractions are presumed to be about equal in each instance. Under these circumstances, an equivalent number of simultaneous equations can be set up and the unknown parameters then derived by iterative numerical methods. A computer program was designed for this purpose and tested on available clinical and experimental data. Parameters were derived for skin tolerance and cure of epidermoid cancer in man, for radiation reactions in pig skin, rat spinal cord, various mouse tissues, and for control of mouse mammary carcinoma irradiated in situ. In some systems analogous parameters could be obtained for both X rays and neutrons, thus providing the coefficients required to calculate neutron RBE's for these tissues.

- 368 SURVIVAL OF SYNCHRONIZED CULTURED HUMAN LIVER CELLS FOLLOWING SINGLE AND FRACTIONATED EXPOSURES TO ULTRAVIOLET LIGHT. Todd, P.; Dalen, H.; Schroy, C.B. (Pennsylvania State Univ., University Park). Radiat. Res.; 69: No. 3, 573-582(Mar 1977).

Experiments were designed to determine whether or not cultured human cells recover from sublethal ultraviolet light injury during DNA-synthesis (S) phase as rodent cells do. Human liver (Chang) cells were synchronized by 2.5 mM thymidine or hydroxyurea blockage of DNA synthesis or by mitotic selection of cells previously blocked by excess thymidine. Cell survival was determined on the basis of colony formation. Following all three synchrony methods cell survival increased from the early S phase to the end of the division cycle. Cells irradiated in the G_1 phase and allowed to progress through the ensuing prolonged (about 30 hr) S phase survived subsequent irradiation as if they had not been irradiated. It was concluded that Chang liver cells recover from sublethal injury inflicted by ultraviolet light.

- 369 INHIBITION OF REPAIR IN UV IRRADIATED HUMAN CELLS. Collins, A.R.S.; Schor, S.L.; Johnson, R.T. (Cambridge Univ. (UK). Dept. of Zoology). Mutat. Res.; 42: No. 3, 413-432(Mar 1977).

Three different assay procedures are used to determine the effects of hydroxyurea on excision repair in UV-irradiated HeLa cells. At the cytological level, incubation of UV-irradiated metaphase cells with hydroxyurea caused chromosome decondensation. Using a modified alkaline sucrose gradient sedimentation technique involving minimal lysis

before centrifugation, a marked retardation was found in the sedimentation of DNA from UV-irradiated cells incubated for a short period with hydroxyurea. The effect of hydroxyurea on the incorporation of [^3H]thymidine by UV-irradiated G1 cells was found to depend on the concentration of thymidine present in the medium. The results point to an inhibition of repair DNA synthesis by hydroxyurea (or deoxyadenosine), at the level of the supply of DNA precursors, i.e. in the same way that these agents inhibit semiconservative DNA synthesis. In the presence of these inhibitors, single-strand gaps accumulate in the DNA.

- 370 EFFECT OF X-RAY INDUCED MITOTIC DELAY ON CHROMOSOME ABERRATION YIELDS IN HUMAN LYMPHOCYTES. Lloyd, D.G.; Dolphin, G.W.; Purrott, R.J.; Tipper, P.A. (National Radiological Protection Board, Harwell (UK)). Mutat. Res.; 42: No. 3, 401-411(Mar 1977).

The extent to which X-ray induced mitotic delay at 150 and 400 rad influences chromosome aberration yields was examined in human peripheral blood lymphocytes. The dicentric was used as a marker and aberration yields were obtained for mixed cultures prepared from equal numbers of normal and irradiated cells. The cultures were terminated following incubation times of 36-120 h. Greater mitotic delay of the order of a few hours was observed at the higher dose. However most reduction in the numbers of lymphocytes arriving at metaphase by 48 h may be ascribed to interphase death or failure to transform. Analysis of the dicentric distributions which were expected to follow Poisson statistics indicated that cells containing dicentrics were delayed relative to irradiated but aberration-free cells. Cells with one dicentric moved more easily through the first cell cycle than cells containing two dicentrics. Following accidental partial body irradiation, selection in culture favouring the unirradiated lymphocytes does not distort the aberration yield sufficiently to warrant incubation times in excess of the standard 48-52 h.

- 371 CHROMOSOME ABERRATIONS IN THE LEUKOCYTES OF PIGS AFTER HALF-BODY OR WHOLE-BODY IRRADIATION. McFee, A.F. (Comparative Animal Research Lab., Oak Ridge, Tenn. (USA)). Mutat. Res.; 42: No. 3, 395-399(Mar 1977).

Chromosome aberrations were scored in 48-h leukocyte cultures from pigs subjected to whole-body or half-body gamma irradiation with 100, 150, 200, 300, or 400 R. Half-body irradiation resulted in the recovery of approximately half as many aberrations as did equivalent whole-body exposures at levels of 200 R or less. Higher exposures yielded proportionally fewer anomalies in half-body irradiated subjects. These lower levels apparently resulted from the selective disadvantage of irradiated cells in coming to mitosis but did not seem to be related to the amount of chromosome damage sustained by the cell. When adjustments were made for effective dose to the in vivo cells, the dose-response pattern showed good agreement with published values for mixtures of normal and in vitro-irradiated human lymphocytes.

- 372 (CEA-R--4830) RETENTION OF INHALED PLUTONIUM OXIDE. ELIMINATION PROCEDURES BY PULMONARY LAVAGE AND EFFECT OF THE ALVEOLAR MACROPHAGE. Nolibe, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection; Paris-6 Univ., 75 (France)). Mar 1977. 220p. (In French). Dep. NTIS (US Sales Only), PC A10/MF A01.

Thesis.

A large fraction of the plutonium particles, reaching the deeper lung are retained in the alveolar macrophages during several months. Cell function changes were measured in vivo and in vitro. Stimulation of macrophage mobility and phagocytosis or natural clearance processes were ineffective on PuO_2 excretion. In vivo pulmonary lavage was the only effective therapy. The procedures of in toto pulmonary lavage in order to obtain the highest number of macrophages are described. A study of the physiological and histological consequences showed no long-term pathology, lesions observed during 48 h after lavage were restored quickly. A single lavage eliminated 12 to 25% only of the lung burden. A procedure of ten repeated lavages (1 per week) eliminated 60 to 90% of the lung burden. The action of lavage seemed twofold: direct elimination in the rinsing liquid and faster pulmonary clearance with low lymph node overload. Survivals in treated animals kept for long-term observations were compatible with the lung burdens remaining after treatment. Demonstration of an inhibiting effect on pulmonary fibrosis should indicate a larger utilization.

- 373 (NRPB/RandD--1, pp 115) DOSES TO INFANTS FROM X-RAY DIAGNOSTIC PROCEDURES INVOLVING FLUOROSCOPY. Lloyd, D.C.; Cooper, S.J. Mar 1977.

Annual research and development report 1976. CHROMOSOMAL ABERRATIONS; COMPARATIVE EVALUATIONS; FLUOROSCOPY; INFANTS; LYMPHOCYTES; RADIATION DOSES; THERMOLUMINESCENT DOSEMETERS; X RADIATION

- 374 (NRPB/RandD--1, pp 122-123) CANCER MORTALITIES FOLLOWING A RELEASE OF RADIOACTIVE MATERIAL INTO THE ENVIRONMENT. Kay, P.; Reissland, J.A. Mar 1977.

Annual research and development report 1976. CONTAMINATION; DEATH; ENVIRONMENT; HUMAN POPULATIONS; MORTALITY; NEOPLASMS; PROBABILITY; RADIOACTIVITY

- 375 (NRPB/RandD--1, pp 114) WHOLE BODY DOSES FROM IODINE-131 USED TO TREAT THYROID CANCER. Lloyd, D.C.; Purrott, R.J.; Bolton, L.D.; White, C.M. Mar 1977.

Annual research and development report 1976. CHROMOSOMAL ABERRATIONS; COMPARATIVE EVALUATIONS; DOSIMETRY; IODINE 131; LYMPHOCYTES; NEOPLASMS; RADIATION DOSES; RADIOTHERAPY; THYROID; PATIENTS

- 376 (NRPB/RandD--1, pp 116) SURVEYS OF CHROMOSOME ABERRATIONS IN RADIATION WORKERS. Lloyd, D.C.; Bolton, L.D.; Cooper, S.J.; Reeder, E. Mar 1977.

Annual research and development report 1976. CHROMOSOMAL ABERRATIONS; COMPARATIVE EVALUATIONS; DATA COMPILATION; DOSIMETRY; NUCLEAR FACILITIES; OCCUPATIONS; PERSONNEL; BIOLOGICAL RADIATION EFFECTS; RADIOINDUCTION; PLUTONIUM; RADIATION DOSES; URINE

- 377 (NRPB/RandD--1, pp 107) ACCIDENT DOSIMETRY SERVICE. Lloyd, D.C.; Purrott, R.J.; Prosser, J.S.; Bolton, D.; Cooper, S.; Reeder, E.; Stephenson, B.; Tipper, P.; White, C. Mar 1977.

Annual research and development report 1976. BIOLOGICAL INDICATORS; CHROMOSOMAL ABERRATIONS; DOSE-RESPONSE RELATIONSHIPS; DOSIMETRY; LYMPHOCYTES; RADIATION ACCIDENTS

- 378 (NRPE/RandD--1, pp 146-147) NATIONAL

- REGISTRY FOR RADIATION WORKERS. Creasey, F.L.; Kay, P.; Reissland, J.A. Mar 1977.
Annual research and development report 1976. BUILDUP; DATA COMPILATION; IONIZING RADIATIONS; MATHEMATICAL MODELS; OCCUPATIONS; RADIOLOGICAL PERSONNEL; PERSONNEL MONITORING; RADIATION DOSES; STATISTICS
- 379 (NRPB/RandD--1, pp 117-118) SURVEY OF DOSES TO PATIENTS ARISING FROM DIAGNOSTIC RADIOLOGY. Wall, B.F.; Fisher, E.S. Mar 1977.
Annual research and development report 1976. BIOMEDICAL RADIOGRAPHY; DATA COMPILATION; HOSPITALS; HUMAN POPULATIONS; PATIENTS; PHANTOMS; RADIATION DOSES; RADIOLOGY; THERMOLUMINESCENT DOSEMETERS
- 380 RISKS OF MAMMOGRAMS. Swartz, H.M.; Reichling, B.A. (Scripps Clinic and Research Foundation, La Jolla, CA). J. Am. Med. Assoc.; 237: No. 10, 965-966 (Mar 1977).
In summary, the following practical guidelines for mammography are offered: 1. Any woman, regardless of age, with signs or symptoms that indicate breast cancer should have a mammogram. 2. A woman who has a high risk for breast cancer (e.g., strong family history, no pregnancy before 30 years of age, or a previous breast cancer) should receive periodic screening examinations, including mammography. 3. Periodic screening for asymptomatic women over the age of 50 is indicated. 4. The value of periodic screening for asymptomatic women who are not considered to be at high risk and are under the age of 50 years is not established. Such screening should be carried out only when useful data can be collected on the benefits and risks of this procedure. 5. For any individual woman, the risk of inducing breast cancer by mammography is very low. 6. Mammograms should be made only with modern equipment and techniques designed to provide optimum information with minimal dose (i.e., less than 1 to 2 rads).
- 381 HIGH KILOVOLTAGE TECHNIQUES AND THE CHOICE OF OPTIMAL FILTRATION IN XERORADIOGRAPHY. Davis, R. (Royal Marsden Hospital, London (UK)); Stacey, A.J. Br. J. Radiol.; 50: No. 591, 234 (Mar 1977).
Attention is drawn to the ways by which patient exposure can be lowered in xeroradiography by applying high kilovoltage techniques and also by placing heavier filtration in the X-ray beam. Equipment operating at tube voltages of up to 200 kV (nominal) has been shown to give the expected reductions in incident skin exposures, which were further reduced by the use of additional filtration. There was no loss of diagnostic quality in the xeroradiographs, and for some examinations the modification of the 'edge-enhancement' associated with higher filtration was advantageous. Those centres with the necessary equipment should therefore assess these parameters for minimal patient dose together with optimal image formation.
- 382 COMPARATIVE STUDY OF TIME FACTOR IN CONTINUOUS AND FRACTIONATED IRRADIATION. Larra, F.; Dixon, B.; Tigori, J. (Centre de Lutte contre le Cancer Paul-Papin, 49 - Angers (France)); Ccuette, J.E.; Robillard, J. (Centre Regional de Lutte contre le Cancer, 14 - Caen (France)); Delouche; Bachelot (Centre de Lutte contre le Cancer Rene Huguenin, 92 - Saint-Cloud (France)). J. Radiol., Electrcl., Med. Nucl.; 58: No. 3, 245 (Mar 1977). (In French).
- Published in summary form only.
CHRONIC IRRADIATION; FRACTIONATED IRRADIATION; RADIOTHERAPY; TEMPORAL DOSE DISTRIBUTIONS
- 383 CHROMOSOME ABERRATION YIELDS INDUCED IN HUMAN LYMPHOCYTES BY 15 MEV ELECTRONS GIVEN AT A CONVENTIONAL DOSE-RATE AND IN MICROSECOND PULSES. Purrott, R.J.; Reeder, E.J. (National Radiological Protection Board, Harwell (UK)); Lovell, S. Int. J. Radiat. Biol.; 31: No. 3, 251-256 (Mar 1977).
Yields of unstable chromosome aberrations were analysed in human lymphocytes after in vitro exposure to 15 MeV electrons. Two dose-effect curves were prepared. In one, doses of 44 to 742 rad were given at 100 rad/min, and in the other doses of 53 to 764 rad were each delivered in single microsecond pulses. No significant difference could be found between the two sets of data when analysed in terms of the quadratic model of aberration production. Good agreement was observed with other dose-response studies in this laboratory, in which human lymphocytes were exposed to 250 kVp X-rays and ^{60}Co γ -rays at conventional rates of 100 and 50 rad/min, respectively. Comparison with the results of a low-LET dose-rate experiment shows that the yield of dicentric aberration remains constant over a wide range, i.e. 25 to 6×10^9 , 100 to 1.5×10^{10} , and 150 to 3×10^{10} rad/min, respectively, for doses of 100, 250 and 500 rad. Radiochemical consumption of oxygen occurring in the lymphocytes during the single microsecond exposures may amount to less than 5 per cent of the total oxygen present in the blood samples, immediately before irradiation. The data also indicated that the ultra-high dose-rates currently available are insufficient to overcome the therapeutic problem of hypoxic radioresistant tumour cells.
- 384 CONTROL OF RADIOACTIVE MATERIALS ON THE MEDICAL SCIENCE CAMPUS. Thompson, C.H.; Vandergrift, J.F. (Arkansas Univ., Little Rock (USA). Medical Center); Slayden, S.A.; Dalrymple, G.V. Health Phys.; 32: No. 3, 179-184 (Mar 1977).
There are persistent and difficult control problems associated with the large scale use of radionuclides: nowhere are these more apparent than in a large university medical center. If a safe environment is to be maintained with respect to employees, students, patients, and the general public, a program must be devised for effective supervision and control of radioactive sources. An automated system has been developed for the inventory and control of radioactive materials that has proven a valuable asset in a large institution. The reports generated have assisted in making responsible judgements, as well as assuring the continuation of single licensure for the medical science campus.
- 385 ALPHA PARTICLE DOSE TO RESPIRATORY AIRWAY EPITHELIUM. Desrosiers, A.E. (Harvard School of Public Health, Boston, Mass. (USA)). Health Phys.; 32: No. 3, 192-195 (Mar 1977).
Reference is made to the important calculations of the dose to epithelial cell nuclei in respiratory airways and particularly to two which are significantly greater than others when compared on the basis of deposited radioactivity. In these two reports (Haque and Collinson. Health Phys.; 13:431 (1967) and Nelson et al. Public Health Service Report. CPE 69-131 (1969)) the calculations are based on the same figures for the energy imparted at a point in the wall of a cylindrical tissue annulus when radon decay products are

homogeneously distributed on the inside surface. This energy is subsequently expressed as the equivalent number of alpha particles per square micron which deposit their entire original kinetic energy over a 1 μ m segment of track. This equivalent number is symbolized by $N_{sub}(eq)$. The observations in this note refer not to the manner in which $N_{sub}(eq)$ is calculated, but to the conversion of this quantity into units of absorbed dose. Calculations here presented indicate that the original workers considerably overestimated the absorbed doses when all other factors are constant.

from the radiological point of view have popular importance for medical radiation protection; this importance needs to be standardized in the haematological analysis of the findings. Practical advice for the rationalisation of haematologic findings is given in the final part.

- 386 TOTAL-BODY IRRADIATION AND MARROW TRANSPLANTATION. Storb, R. (Univ. of Washington, Seattle). Transplant. Proc.; 9: No. 1, 1113-1119 (Mar 1977).

From 6. international congress of the Transplantation Society proceedings; New York, NY, USA (22 Aug 1976).

Data are reviewed from a number of studies on patients with hematologic malignancies treated with transplanted bone marrow cells following total-body irradiation. The fact that increasing numbers of disease-free marrow graft recipients following total-body irradiation have survived for years indicates the feasibility of the treatment, especially since the patients had reached the terminal phase of their leukemia at the time of grafting. (CH)

- 387 INDICATIONS AND GUIDELINES FOR MAMMOGRAPHIC EXAMINATIONS. Kalisher, L.; Schaffer, D. (Massachusetts General Hospital, Boston). Am. J. Surg.; 133: No. 3, 326-330 (Mar 1977).

The value of mammography in evaluating the asymptomatic patient has been clearly demonstrated by the HIP program, as well as the National Cancer Institute's breast demonstration projects. A one-third reduction in mortality from breast cancer in mammographically screened women has been substantiated. Nonetheless, questions concerning the long-term effects of repeated radiation exposure associated with mammography have been raised, and for this reason judicious selection of women is urged. In general, women who are asymptomatic or at high risk for breast carcinoma should be evaluated with a planned regimen. Mammographic guidelines and recommendations for attaining the greatest benefit at the lowest possible risk are suggested.

- 388 HEMATOLOGICAL GUIDELINES FOR THE MONITORING OF PERSONS EXPOSED TO RADIATION. Chone, B. (Heidelberg Univ. (Germany, F.R.). Radiologisches Zentrum). Therapiewoche; 27: No. 11, 2020-2030 (Mar 1977). (In German).

The incorporation of functional examination parameters into the haematologic surveillance scale of radiation patients and of persons exposed to radiation brings a gain in information which is also of practical importance for clinical radiology. Starting from the present state of development of radiation haematology, a brief survey of the useful practice of radiation-haematological examinations is given; the effective examination methods to determine peripheral alterations in the blood picture after radiation effects are characterised. As a suitable cell system for course examinations and for automation of the findings we are offered the leucocytes category, particularly with regard to the electronical cell volume determination with determination of the cell volume maximum. The examination results gained

- 389 Strahleninduzierte Teratogenese - Zusammenstellung der am Menschen beobachteten Schaden. (RADIATION-INDUCED TERATOGENESIS - A COMPILATION OF DAMAGES OBSERVED IN MAN). Roedler-Vogelsang, T. Berlin, Germany, F.R.; Bundesgesundheitsamt (Mar 1977). 73p. (In German).

This report is comprised of known, radiation-induced damages in man collected from bibliographies. It is divided into categories of radiation effects from X-ray examinations and -therapy, Radium-therapy, as well as diagnostics and therapy with unsealed radioactive substances. Descriptions concerning the application of ionizing radiation during pregnancy without damaging results were not taken under consideration. Also, the effects of prenatal exposure during the atomic bomb explosions of Hiroshima and Nagasaki are not mentioned in this compilation. They have been collected in a supplement to Vol. 16 of the Journal of Radiation Research (1975). The present study is intended to provide a clearly outlined view of hitherto described cases of radiation-induced teratogenesis and, in addition, to make the physician aware of damages which can, possibly, be attributed to radiation exposure in utero. In particular, this kind of observation may provide new knowledge concerning the effect of small doses and may thus close another radiation-biological gap.

- 390 POTENTIAL HAZARDS OF DIAGNOSTIC RADIATION. Houston, C.S.; Shokeir, M.H. (Univ. Hospital, Saskatoon, Saskatchewan). J. Can. Assoc. Radiol.; 28: No. 1, 62-68 (Mar 1977).

There are no precise data for determining the extent of somatic damage from small doses of radiation used in diagnostic radiology. Diagnostic radiation given to pregnant women, knowingly or unknowingly, should rarely reach teratogenic levels causing brain and eye abnormalities. Evidence suggests that it does increase the risk of childhood malignancy, especially leukemia. Although rapidly growing tissues seem most susceptible, all radiation probably carries a very small risk of carcinogenesis. Genetic damage is equally difficult to estimate. Diagnostic radiation of females, even in childhood, may be related to an increased incidence of Down's syndrome in older mothers. Radiation also causes point mutations, which may explain the increase of some genetic abnormalities in progeny of older fathers. Whenever an abdominal or pelvic radiograph is ordered before the end of the reproductive period, there must be a potential benefit to balance the small risk involved.

- 391 RADIOGRAPHIC DETERMINATION OF URINARY BLADDER VOLUME AND RESIDUAL URINE VOLUME. Klumair, J. (Krankenhaus der Stadt Wien-Lainz (Austria). Zentralroentgeninstitut). Roentgen Ber.; 6: No. 1, 70-76 (Mar 1977). (In German).

In the course of a long study the author has tested most of the methods for determination of urinary bladder volume. A radiographic method which can state bladder volume exactly in cc's is attainable only with great time and effort. In the author's experience, however, it is

possible, by means of a pattern in connection with a IVP, to estimate residual urine volume from a post-void picture of the bladder with sufficient accuracy for practical purposes. An account is given of the production of this pattern and of two relatively simple calculations for residual volume based on AP and lateral views of circular- and ellipsoid-shaped bladders. Also discussed is the radiation exposure which varies with the radiographic methods used. In male patients, the radiation exposure appears to be negligible, especially when the testicles are protected by a radiation shield. In female patients - which make up only a small fraction of all patients -, radiation exposure is higher but must be accepted.

- 392 RADIATION EXPOSURE IN X-RAY EXAMINATIONS OF THE PELVIS. Kainberger, F. (Krankenhaus der Barmherzigen Brüder, Salzburg (Austria). Roentgeninstitut). Roentgenpraxis; 30: No. 3, 61-66(Mar 1977). (In German).

From 14. meeting of the Oesterreichische Roentgengesellschaft; Baden/Vienna, Austria (2 Jun 1976).

The article reports on radiation exposure during x-ray treatment of the pelvis of children. Special attention is paid to genetical radiation exposure. Generally a dose of 100 mR is assumed to be taken up if no adequate shielding is provided. In order to be able to judge the value of a shielding with suitable lead-equivalent values, measurements were carried out on a phantom. These measurements showed that the dosage can be reduced by at least a factor of 100 by using a lead shielding. When doing this, the lead equivalent value must be 1 mm. The form of gonad protection also has great importance for the shielding efficiency.

- 393 MEAN BONE MARROW DOSE OF ATOMIC BOMB SURVIVORS IN HIROSHIMA AND NAGASAKI. Hashizume, T.; Maruyama, T.; Nishizawa, K.; Fukuhisa, K. (National Inst. of Radiological Sciences, Chiba (Japan)). J. Radiat. Res.; 18: No. 1, 67-83(Mar 1977).

The ratio of the mean bone-marrow dose to in-air tissue absorbed dose for survivors in Hiroshima and Nagasaki has been calculated with the aid of the Synder mathematical phantom, using depth dose curves in phantom. From this ratio, the mean bone-marrow dose has been estimated as a function of the distance from the hypocenter. The ratios were corrected for the angular distribution of atomic bomb radiation. The resultant ratios were tabulated as a function of incident angles on an adult and a child (3 to 7 years old) survivor for gamma rays and neutrons. As an example of the resultant mean bone-marrow dose, the adult survivors who were standing straight in open field at 1000m from the Hiroshima hypocenter have been estimated to be exposed to 165 rads of initial gamma rays, 32 rads of recoil protons, 14 rads of gamma rays from $^1\text{H}(n, \gamma)^2\text{D}$ reaction and 0.9 rads of protons from the $^{14}\text{N}(n, p)^{14}\text{C}$ reaction.

- 394 RADIATION HYGIENE PROBLEMS OF RADIOPHARMACEUTICAL PREPARATION AT NUCLEAR MEDICINE UNITS. Pekarek, J. (Krajska Nemocnice a Polikliniku, Ostrava (Czechoslovakia)); Kukacka, R. (Krajska Hygienicka Stanice, Ostrava (Czechoslovakia)). Cesk. Farm.; 26: No. 2, 69-71(Mar 1977). (In Czech).

The problems of magistral radiopharmaceuticals preparation are indicated and the layout of a unit for the magistral

preparation of radiopharmaceuticals is described. The results are briefly reported of a study of radiation load of laboratory personnel preparing radiopharmaceuticals as against doctors actually applying them. It was found that the exposure of hands to ionizing radiation represents the highest hazard for the laboratory personnel. The most important radiation protection principles are pointed out, such as the use of protective clothing, regular preventive medical examinations, appropriately shielded radionuclides and radionuclide generators to be supplied by manufacturers, and a more frequent rotation of personnel working with active and nonactive preparations.

- 395 (SAAS--208) METHOD FOR DETERMINING THE BIOLOGICAL EFFECTIVENESS OF IONIZING RADIATION BY EVALUATING THE MITOTIC INHIBITION OF EHRlich ASCITES TUMOR CELLS. Merkle, K.; Schmidt, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Mar 1977. 10p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

The mitotic response of mouse ascites tumor cells to in vivo ^{60}Co γ -irradiation (50, 100, 200, and 300 rad) was investigated on the fourth day after inoculation at 1 hour postirradiation. In the dose range applied the relationship between the mitotic index (MI) and the gamma dose (D, in rad) could be represented by $\text{MI} = -35.07 \lg D + 105.57$.

- 396 EFFECTS OF FAST NEUTRONS AND X RAYS ON THE SUBEPENDYMAL LAYER OF THE RAT BRAIN. Chauser, B.; Morris, C.; Field, S.B.; Lewis, P.D.; Path, M.R.C. (Medical Research Council, London). Radiology; 122: No. 3, 821-823(Mar 1977).

Some effects of irradiation of rat brain with single doses of x rays or fast neutrons have been measured. This was done by estimating the total number of cells in the subependymal layer at various times after irradiation. The gross response to x rays and neutrons was somewhat different, and the results suggest that the two histologically distinguishable cell types in the subependymal layer have different values of RBE.

- 397 CHROMOSOMAL RADIOSENSITIVITY AND KARYOTYPE IN MICE USING CULTURED PERIPHERAL BLOOD LYMPHOCYTES, AND COMPARISON WITH THIS SYSTEM IN MAN. de Boer, P.; van Beek, R.; van der Hoeven, F.A. (Landbouwhogeschool Wageningen (Netherlands). Lab. voor Erfelijkheidsleer); van Buul, P.P.W. (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese); Natarajan, A.T. (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese; Cohen (J.A.) Instituut voor Radiopathologie en Stralenbescherming, Leiden (Netherlands)). Mutat. Res.; 42: No. 3, 379-394(Mar 1977).

The frequencies were studied of X-ray-induced dicentric chromosomes and deletions in peripheral blood lymphocytes of mouse and man, cultured in vitro. After doses of 100 and 200 rad, (a) the mouse was equally sensitive as man to the induction of dicentrics, and (b) the frequency of deletions was higher in the mouse, reaching statistical significance at the 200 rad level only. At the 200 rad level, the mouse with normal karyotype was compared with the T(1;13)70H translocation heterozygote and the Ts(1³)70H tertiary trisomic of normal appearance. No differences were found either with respect to dicentrics or to deletions. At the 100 rad level, the normal mouse was compared with the tertiary trisomic mouse of

the affected phenotype and with the tobacco mouse. The frequency of dicentric was significantly higher in the phenotypically abnormal trisomics, whereas the deletion frequency was higher in the tobacco mice. C-banding of the slides enabled the locating of breaks in constitutive heterochromatin and euchromatin.

- 398 RESPONSE OF THE DEVELOPING RAT BRAIN TO VARYING DOSES AND DOSE-RATES OF γ -RADIATION. Martin, P.G. (Comparative Animal Research Lab., Oak Ridge, TN). Growth; 41: No. 1, 41-49 (Mar 1977).

Pregnant rats were irradiated on day 18 of gestation at doses of 40, 80, 160, 200 and 240 rads delivered at 1, 3, 10 and 47 rads/min. Postnatal growth patterns were followed by changes in weight, DNA, protein and RNA in the cerebral hemispheres (cortex) and rest-of-brain (RB) at birth, 21, 63 and 160 days of age. Reductions in the parameters studied were independent of dose-rate at 40 and 80 rads in both the cortex and RB. At the higher doses, as dose-rate increased, brain size decreased (1 greater than 3 greater than 10 and 47 rads/min). Comparisons are made between effects produced by prenatal irradiation in rat and man during a comparable developmental stage.

- 399 RADIOSENSITIVITY OF LYMPHOCYTE STIMULATION. III. LYMPHOCYTE STIMULATION, A MODEL FOR RADIOBIOLOGICAL INVESTIGATIONS OF THE STIMULATED PROLIFERATION: CONCLUSIONS FROM THE EXPERIMENTAL RESULTS. Renner, H. (Medizinische Hochschule Hannover (Germany, F.R.). Abt. fuer Strahlentherapie und Spezielle Onkologie). Strahlentherapie; 153: No. 3, 171-177 (Mar 1977). (In German).

With refs..

The radiosensitivity of lymphocyte stimulation was analyzed in vivo and in vitro with particular regard to model characteristics. As a model for lymphocyte stimulation, the model of PHA-stimulation of T-lymphocytes in vitro and in vivo was used with preference, while in completing the DNS-synthesis determination in vitro that of the PWM-stimulation of T- and B-lymphocytes was chosen. The clearing of the methodical questions also helped to analyze information in literature which has seemed to be contradictory. The results of the experiments described in the two previous contributions are analysed and discussed in a summary.

- 400 EFFECT OF LOW DOSE X-RAY IRRADIATION ON DEVELOPMENT AND DIFFERENTIATION OF THE CEREBRAL CORTEX. VIII. EARLY CHANGE OF THE UNDIFFERENTIATED NERVOUS CELLS IN THE BRAIN IN THE EXPOSED MOUSE EMBRYO OF 15TH DAY OF VIVIPARITY. Hayashi, Y.; Hoshino, K.; Kameyama, Y. (Nagoya Univ. (Japan). Research Inst. of Environmental medicine). Nagoya Daigaku Kankyo Igaku Kenkyusho Nempo; 28: 197-198 (Mar 1977). (In Japanese).

CF-1 mice in the 15th day of pregnancy were given 25 or 100 rads of a whole body x-ray irradiation, and the brain mantle of the embryo exposed within the uterus was observed by optical and electron microscope 1 to 5 hours after the exposure. Optical microscopic observation revealed that the incidence of dense bodies (cytorrhocytes) and pyknotic cells increased at 5 hours after the irradiation in the 25 rads exposed group. In the 100 rads exposed group, the incidence of pyknotic cells elevated at 5 hours after the irradiation. Electron microscopic observation showed that the dense bodies observed at 5 hours after the exposure changed to phagocytized necrotic

cells.

- 401 EFFECT OF LOW DOSE X-RAY IRRADIATION ON DEVELOPMENT AND DIFFERENTIATION OF THE CEREBRAL CORTEX. VI. OBSERVATION ON CELL CYCLE AND OF MATRIX CELLS OF THE ENDBRAIN IN THE EXPOSED MOUSE EMBRYO OF THE 15TH DAY OF VIVIPARITY. Hoshino, K.; Hayashi, Y.; Ito, Y.; Kameyama, Y. (Nagoya Univ. (Japan). Research Inst. of Environmental Medicine). Nagoya Daigaku Kankyo Igaku Kenkyusho Nempo; 28: 193-194 (Mar 1977). (In Japanese).

Twenty-five or 100 rads of x ray was irradiated to CF-1 mice in the 15th day of pregnancy, and ^3H -thymidine was injected immediately after the exposure. The embryos were collected at intervals of 1 hour to prepare autoradiogram of continuous sections of the endbrain of the embryo. Cell cycle and length of each period were obtained from the measurement of the graph, on which labelled rate of mitotic cells in the endbrain matrix was plotted at various times. The incidence of pyknosis was examined by the observation on about 2000 nervous cells in the endbrain mantle. Changes of cell cycle of matrix cells in the endbrain included prolongation of G_2 and M period and shortening of S and G_1 period. However, the degree of the changes was as same as or slightly lower than that of the exposed group of the 13th day of viviparity. A peak of the incidence of pyknosis reached about 3 per cents in the 25 rads exposed group, and about 35 per cents in the 100 rads exposed group. The incidence of both groups was lower than that of the exposed group of the 13th day of viviparity. Considering the changes of cell cycle and the incidence of pyknosis as indices, radiosensitivity of matrix cells in the endbrain was slightly lower in the exposed mice embryos of the 15th day than that in the exposed group of the 13th day, but was higher than that in the exposed group of the 10th day.

- 402 EFFECT OF LOW DOSE X-RAY IRRADIATION ON DEVELOPMENT AND DIFFERENTIATION OF THE CEREBRAL CORTEX. VI. DOSE EFFECT ON THE CHANGE OF CELL CYCLE OF MATRIX CELLS IN THE ENDBRAIN IN THE EXPOSED MOUSE EMBRYO OF THE 13TH OF VIVIPARITY. Hoshino, K.; Hayashi, Y.; Kameyama, Y. (Nagoya Univ. (Japan). Research Inst. of Environmental Medicine). Nagoya Daigaku Kankyo Igaku Kenkyusho Nempo; 28: 195-196 (Mar 1977). (In Japanese).

Ten, 25, 100, or 150 rads of x ray was irradiated to CF-1 mice in the 13th day of pregnancy, and ^3H -thymidine was injected immediately after the exposure. The embryos were collected 1 hour after the injection at intervals of 30 minutes to prepare autoradiogram of continuous sections of the endbrain of the embryo. The period until the labelled rate reached 50 per cents was determined as the length of $G_2 + \text{M}/2$ on the graph, on which labelled rate of mitotic cells in the endbrain matrix was plotted at various times. $G_2 + \text{M}/2$ was 1.6 hour in the control group, 1.9 hour in the 10 rads exposed group, 2.5 hours in the 25 rads exposed group, 3.5 hours in the 100 rads exposed group, and 4.0 hours in the 150 rads exposed group, which showed that $G_2 + \text{M}/2$ prolonged according to the radiation dose. The graph, on which the prolongation time (delay of mitosis) of $G_2 + \text{M}/2$ was plotted against logarithm of dose, revealed that the time had linear relation to the dose and that threshold dose was slightly lower than 10 rads, when the prolongation of $G_2 + \text{M}/2$ was considered as an index.

- 403 (AAEC/E--395) MICROSCOPIC STUDY OF THE

ACTION OF URANYL ACETATE ON THE ERYTHROCYTE AT VARYING MOLARITY AND TOXICITY. Wyatt, J.H. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1977. 23p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Phase contrast and dark field microphotographs were made to record variation of the shape and size changes seen when human erythrocytes are exposed in a number of ways to uranyl acetate in vitro. The degree of hemolysis produced by varying the toxicity of the uranyl acetate solutions was measured, and the results are discussed with particular reference to the possible influence of pH.

- 404 APPLICATION OF THE 'TEN-DAY RULE' IN RADIOPHARMACEUTICAL INVESTIGATIONS. A REPORT OF A WORKING PARTY OF THE M.R.C. ISOTOPE ADVISORY PANEL. Ellis, R.E.; Nordin, B.E.C. (Leeds Univ. (UK)); Tothill, P.; Veall, N. Br. J. Radiol.; 50: No. 591, 200-202(Mar 1977).

The working party first classified subjects who are investigated using radiopharmaceuticals into three groups, being (a) patients and other subjects who are asked to volunteer as controls for research studies, (b) patients on whom research investigations are being conducted which are relevant to their clinical condition but which are not strictly necessary for their management, and (c) patients on whom investigations are required for their proper management. The application of the 'ten-day rule' in relation to the use of radiopharmaceuticals is complicated by the fact that the total radiation dose is received over a time given by the effective life of the radiopharmaceutical in the organ, which may be a substantial part or even longer of the menstrual cycle. The activities of the radiopharmaceuticals normally administered are tabulated together with their effective half-lives and resulting gonad doses, and those radiopharmaceuticals requiring consideration of the implementation of the 'ten-day rule' for patients in groups (b) and (c) are identified. When the administration of therapeutic quantities of radiopharmaceuticals is being contemplated it is particularly important to take into account the applicability or otherwise of the 'ten-day rule'. It is recommended that the 'ten-day rule' should be strictly applied to all radiopharmaceutical administrations to women of child-bearing age who are volunteers for research purposes (group(a)).

- 405 SUMMARIZATION: ASSESSMENT OF CURRENT STATUS OF AVAILABLE METHODOLOGIES TO UTILIZE RADIOACTIVE DRUG METABOLISM STUDIES FOR DETERMINING SAFETY OF ANIMALS. Huber, W.G. (Washington State Univ., Pullman). J. Toxicol. Environ. Health; 2: No. 4, 913-915(Mar 1977).

Industry is not encouraged to commit time and energy to the development of new drugs for animal use because a reasonable return on the investment would not be earned. The best scientific interactions from the regulatory, industrial, and academic sectors must be obtained if the United States and other countries are to achieve the goal of maximally efficient production of food and fiber and minimal harm to the consumer. The dimensions of the problem created by residual radioactivity are not well defined. The differences between first- and second-species exposure must be considered since a consumer does not ingest the parent animal health drug when eating meat. Dose-effect relationships for metabolites also require attention. (HLW)

- 406 CHROMOSOME ABERRATIONS INDUCED IN SYRIAN HAMSTER LUNG CELLS BY INHALED $^{238}\text{PuO}_2$ -ZRO₂ PARTICLES. Stroud, A.N. (Los Alamos Scientific Lab., NM). Radiat. Res.; 69: No. 3, 583-590(Mar 1977).

Chromosome aberrations induced by $^{238}\text{PuO}_2$ -ZrO₂ microspheres after inhalation have been observed in Syrian hamsters (*Mesocricetus auratus*). The animals had initial lung burdens of approximately 140 nCi of ^{238}Pu . Twenty-four hours after exposure to the particles in an inhalation chamber, the lungs were removed and placed in tissue culture for chromosome analysis. The incidence of chromosome aberrations 63 and 138 hr after cell cultivation increased (0.18 and 0.24 aberration per cell, respectively) above controls. Growth rate and mitotic indices were depressed greatly 1 and 3 weeks later, compared to 63 and 138 hr after culture. Autoradiographs of the cultured cells at these times demonstrated many star clusters from alpha tracks of the microspheres, indicating an abundance of microspheres retained in the lungs which caused continuous irradiation during the culture period.

- 407 THYROIDAL BURDENS OF ^{129}I FROM VARIOUS DIETARY SOURCES. Book, S.A. (California Univ., Davis (USA). Radiobiology Lab.); Garner, R.J.; Soldat, J.K.; Bustad, L.K. Health Phys.; 32: No. 3, 143-148(Mar 1977).

Thyroidal burdens of ^{129}I were calculated for 1-, 4- and 14-yr-olds, and adults, using available dietary data. Milk and milk products contributed 63, 57, 54 and 33% of the total thyroidal ^{129}I burden of the four respective age groups. As the contribution from dairy products decreased, that from meat increased from about 12% for 1-yr-olds to 35% for adults, while that from leafy vegetables remained relatively stable, from 17 to 21%. From ingested foods produced in air assumed to contain 1 pCi ^{129}I per m³, daily dietary ^{129}I intakes of 1.3, 1.2, 1.7 and 1.5 nCi were computed for the 1-, 4-, and 14-yr-old child and adult, respectively. For each nCi ingested daily, thyroidal dose rates for the respective age groups were calculated to be 4.9, 2.1, 1.7 and 2.6 rem/yr, with the altered dose rates reflecting age-related differences in thyroid gland size and iodine kinetics.

- 408 APPARATUS FOR THE ADMINISTRATION BY INHALATION OF RADIOACTIVE PARTICLES TO HUMAN SUBJECTS FOR STUDIES OF DEPOSITION AND CLEARANCE. Walsh, M.; Black, A.; Foord, N. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). J. Aerosol Sci.; 8: No. 2, 83-90(Mar 1977).

Also available as AERE-R-8221.

An apparatus is described for the administration of radioactive aerosols to human subjects by inhalation. It is used in studies of total and regional deposition. Separation of inhaled and exhaled airstreams is effected automatically by a solenoid driven valve operated by a pressure transducer responding to the small pressure changes in the mouthpiece caused by the subject's breathing. The respiratory rate and tidal volume of the subject are recorded. Techniques used for the estimation of the amount of aerosol inhaled and exhaled are described. Factors affecting the decay of aerosol concentration in the chamber and their effect on the maximum particle size which can be usefully employed in the apparatus are discussed.

- 409 DEPOSITION AND LOCALIZATION OF POLONIUM-

210 INTRATRACHEALLY INSTILLED IN THE HAMSTER LUNG AS DETERMINED BY AUTORADIOGRAPHY OF FREEZE-DRIED SECTIONS. Kennedy, A.R.; Worcester, J.; Little, J.B. (Harvard School of Public Health, Boston). Radiat. Res.; 69: No. 3, 553-572(Mar 1977).

Freeze-dry autoradiography was used to study the deposition, localization, and clearance mechanisms of ^{210}Po in the lungs of Syrian golden hamsters following single or multiple intratracheal instillations. This method of exposure to ^{210}Po resulted in a relatively uniform dose of α radiation to the entire peripheral lung, including alveoli, respiratory, and terminal bronchioles. Relatively little radiation dose was delivered to the tracheal and bronchial epithelium. Most of the ^{210}Po was originally deposited in the alveolar region; however, clearance, via the airways and bloodstream, began immediately after instillation. Single or multiple intratracheal instillations of ^{210}Po in saline are appropriate methods of delivering a relatively uniform dose of α radiation to the bronchiolar--alveolar region of small experimental animals, particularly when compared to localized doses which result from the administration of ^{210}Po on particles.

410 EFFECT OF DOSE LEVEL ON SKELETAL RETENTION OF $^{239}\text{Pu}(\text{IV})$ IN THE BEAGLE. Stover, B.J. (Univ. of North Carolina, Chapel Hill); Atherton, D.R.; Stevens, W.; Buster, D.S.; Bruenger, F.W. Radiat. Res.; 69: No. 3, 442-458(Mar 1977).

When $^{239}\text{Pu}(\text{IV})$ is injected intravenously, its fractional retention in the skeleton of the beagle decreases and then approaches an approximately constant value. The initial fractional deposition of ^{239}Pu is independent of dose level, but the long term fractional retention is less at the lower dose levels (0.0055 to 0.095 $\mu\text{Ci/kg}$) than at the high dose levels (0.30 to 2.9 $\mu\text{Ci/kg}$). These findings are in contrast with results on the retention of $^{239}\text{Pu}(\text{IV})$ in the liver of the beagle. The rate of decrease in hepatic retention of ^{239}Pu diminishes with decreasing dose level. These opposing effects result from cellular necrosis which is an effect of the α irradiation from ^{239}Pu . Skeletal retention equations are presented for each of the three higher dose levels of ^{239}Pu and for the group of lower dose levels. These equations and those previously reported for the liver are used to calculate cumulative average radiation doses to the skeleton including marrow, and to the liver throughout the observed lives of the beagles, which were injected in young adulthood at six dose levels of $^{239}\text{Pu}(\text{IV})$ ranging from 0.016 to 2.9 $\mu\text{Ci/kg}$. In the skeletal dose calculations an experimentally determined value of (7.5 $\pm$ 1.0) percent for skeletal weight relative to body weight at injection is used. The concentration of plutonium in plasma has been measured from 1 min to 12.5 years following injection. A sum of four exponentials has been fit to the data. Samples were obtained from dogs at six dose levels, and from well, ill, and terminal dogs.

411 TISSUE DISTRIBUTION OF ^{87}Sc GENERATED BY DECAY OF ^{87}Ca IN VIVO. Freed, B.R. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). Health Phys.; 32: No. 3, 165-178(Mar 1977).

The tissue distribution of ^{87}Sc , the radioactive daughter of ^{87}Ca , generated by decay of the parent nuclide in vivo was investigated in adult mice. Chemically separated parent activity was injected, the mice sacrificed in groups of four from 0.05 to

42 days later, and several bones and soft tissues from each assayed for both nuclides. To assess the effect of translocation of daughter activity, the quantity of ^{87}Sc generated in situ by decay of ^{87}Ca was calculated for each tissue studied. It was found that the daughter content of several soft tissues, including blood, was largely influenced by redistribution. The total soft tissue ^{87}Sc burden, however, was at most 3% of the injected ^{87}Ca activity at 1 day after injection, so that the bulk of radiation dose due to internally generated daughter was delivered to bone. Although a significant release of ^{87}Sc generated in bone was indicated in the first few hours after injection, for most of the 42 day period, retention of daughter nuclide in bone was greater than or equal to that of the parent. From 1 to 11 days, loss of ^{87}Sc from tibia and femur was slower than loss of ^{87}Ca . Subsequent rate of loss of daughter approached that of the parent, suggesting removal of ^{87}Ca -deficient bone by active resorption.

412 (DOCKET-50255--951) PALISADES NUCLEAR PLANT. ANNUAL OPERATING REPORT: JANUARY--DECEMBER 1976. (Consumers Power Co., Jackson, Mich. (USA)). 28 Feb 1977. 77p.

Net electrical power generated was 2,847,033 MWh with the reactor on line 4,850.4 hrs. Information is presented concerning operations, corrective maintenance, eddy current steam generator testing, inservice inspection, containment leak testing, fuel shuffling, power generation, shutdowns, and occupational radiation exposures. (FS)

413 (DOCKET-50263--811) MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1. ANNUAL OPERATING REPORT NO. 11: JANUARY--DECEMBER 1976. (Northern States Power Co., Minneapolis, Minn. (USA)). 28 Feb 1977. 34p.

Information is presented concerning operation, outages, forced power reductions, occupational radiation exposures, fuel performance, maintenance, changes, tests, and experiments. (FS)

414 (DOCKET-50267--685) FORT ST. VRAIN NUCLEAR GENERATING STATION. ANNUAL OPERATING REPORT: JANUARY--DECEMBER 1976. (Public Service Co. of Colorado, Denver (USA)). 28 Feb 1977. 60p.

The plant was shut down for the first six months. Information is presented concerning operations, maintenance, outages, reductions in power, radiation exposures, and fuel examination. (FS)

415 (DOCKET-50271--916) VERMONT YANKEE NUCLEAR POWER STATION. EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT FOR RADIOLOGICAL IMPACT ON MAN: THIRD AND FOURTH QUARTERS 1976. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 28 Feb 1977. 45p.

Effluent and waste disposal semiannual report for radiological impact on man: third and fourth quarters 1976. VERMONT YANKEE REACTOR; RADIOACTIVE WASTE DISPOSAL; RADIOACTIVE EFFLUENTS; ACTIVITY LEVELS; MAN; RADIATION EFFECTS; RADIATION DOSES; PERSONNEL; GASEOUS WASTES; LIQUID WASTES; METEOROLOGY; DATA; FISSION PRODUCT RELEASE; TRITIUM; RARE GASES; BACKGROUND RADIATION; RAIN; IODINE 131; PARTICLES; AEROSOLS; STRONTIUM 89; STRONTIUM 90; CESIUM 134; CESIUM 137; COBALT 60; ZINC 65; MANGANESE 54; COBALT 57; ANTIMONY 124; XENON 133; XENON 135; CHROMIUM 51; COBALT 58; THYROID; WHOLE-BODY IRRADIATION

416 (DOCKET-50271--917) VERMONT YANKEE NUCLEAR POWER STATION. ANNUAL OPERATING REPORT: JANUARY--DECEMBER 1976. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 28 Feb 1977. 2p.

Net electrical energy generated was 3,260,016 MWh with the facility on line for 6,776 hrs. Information is presented concerning operation, procedure changes, tests, experiments, plant changes, corrective maintenance, license event reports, forced power reductions, shutdowns, personnel radiation exposures, use of chemicals, plant discharges, cooling tower blowdown, traveling screens, fish impingement, reactor start-up, scram reports, and primary coolant chemistry. (FS)

417 (DOCKET-50272--395) SALEM NUCLEAR GENERATING STATION, UNIT 1. ANNUAL OPERATING REPORT FOR 1976. (Public Service Electric and Gas Co., Newark, N.J. (USA)). 28 Feb 1977. 108p.

Initial reactor criticality was achieved 12/11/76 and power generation began 12/25/76. Information is presented concerning operation, maintenance, procedure and specification changes, power generation, unit shutdowns and forced power reductions, testing, and personnel radiation exposures. (FS)

418 (DOCKET-50285--702) FORT CALHOUN STATION, UNIT 1. ANNUAL OPERATING REPORT FOR 1976 (INCLUDING SEMIANNUAL ENVIRONMENTAL OPERATING SUMMARY: JULY--DECEMBER 1976). (Omaha Public Power District, Nebr. (USA)). 28 Feb 1977. 389p.

Annual operating report for 1976 (including semiannual environmental operating summary: July--December 1976. CALHOUN-1 REACTOR; REACTOR OPERATION; REACTOR MAINTENANCE; PERFORMANCE TESTING; LEAK TESTING; PERSONNEL; RADIATION DOSES; RADIOACTIVE EFFLUENTS; RADIATION MONITORING; ENVIRONMENT; MONITORING

419 (DOCKET-50289--856) THREE MILE ISLAND NUCLEAR STATION, UNIT 1. 1976 ANNUAL OPERATING REPORT. (Metropolitan Edison Co., Reading, Pa. (USA)). 28 Feb 1977. 60p.

Net electrical power generated was 4,335,625 MWh with the reactor on line 5,747.5 hrs. Information is presented concerning operations; specification, procedures, and FSAR changes; corrective maintenance; irradiated fuel examinations; radioactive effluent releases; personnel radiation exposures; shutdowns; and forced power reductions. (FS)

420 (DOCKET-50315--720) DONALD C. COCK NUCLEAR POWER PLANT, UNIT 1. ANNUAL OPERATING REPORT FOR 1976. (Indiana and Michigan Power Co., New York (USA)). 28 Feb 1977. 78p.

The unit was paralleled to the grid 83.1 percent of the time and 7,073,200 MWh gross was generated. There were six scheduled outages and 14 forced outages/load reductions. Information is presented concerning operations, shutdowns, power reductions, inservice maintenance, personnel radiation exposures, fuel history, and facility changes. (FS)

421 (DOCKET-50321--801) EDWIN I. HATCH NUCLEAR PLANT, UNIT 1. ANNUAL OPERATING REPORT FOR 1976. (Georgia Power Co., Atlanta (USA)). 28 Feb 1977. Sp.

The unit operated at approximately 80 percent power until a scheduled outage beginning March 26 to implement a LPCI

modification. The reactor was started up on April 22. On May 20 the first indication of leaking fuel was noticed. Following a shutdown for maintenance on May 29, the B recirculation pump motor generator was damaged and a new motor was located and installed. The plant operated without incident during the summer, however, the high temperature caused problems with the condenser vacuum. The remainder of the year the unit was base loaded at an average of 90 percent power. Information is presented concerning design and procedure changes, corrective maintenance, reportable occurrences, fuel performance, occupational personnel radiation exposure, leak testing, and coolant chemistry. (FS)

422 (DOCKET-50409--494) LACROSSE BOILING WATER REACTOR. ANNUAL OPERATING REPORT FOR 1976. (Dairyland Power Cooperative, La Crosse, Wis. (USA)). 28 Feb 1977. vp.

Net electrical power generated was 173,061 MWh with the generator on line 4,179.1 hr. Information is presented concerning operations; power generation; maintenance; changes in specifications, facilities, and procedures; testing main steam relief valves, ECCS actuation, and containment; fuel performance; shutdowns and power reductions; and radiation doses to personnel. (FS)

423 (DOCKET-50409--516) LACROSSE BOILING WATER REACTOR. IE INSPECTION REPORT NO. 77-03 (ROUTINE, UNANNOUNCED) RE RADIATION PROTECTION--INSTRUMENTATION AND EQUIPMENT, RESPIRATORY PROTECTION, RADIATION SAFETY EVALUATIONS, BYPRODUCT MATERIAL INVENTORY, SEALED SOURCE LEAK TESTS; INFRACTIONS PER 10CFR20.201(B). (Dairyland Power Cooperative, La Crosse, Wis. (USA)). 28 Feb 1977. vp.

Inspection of radiation protection program and nuclear materials management. LACBWR REACTOR; INSPECTION; RADIATION PROTECTION; RESPIRATORS; EQUIPMENT; NUCLEAR MATERIALS MANAGEMENT; RADIOACTIVE EFFLUENTS; RADIATION DOSES; RADIATION MONITORS; WHOLE-BODY COUNTERS; CALIBRATION; PERSONNEL; GASEOUS WASTES

424 SOME ASPECTS OF RADIATION-INDUCED STRAND BREAKAGE IN EUKARYOTIC CELLS. Hartwig, M. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Molekularbiologie). Stud. Biophys.; 61: 1-3 (28 Feb 1977).

From Symposium on cell damage and DNA repair; Neubrandenburg, German Democratic Republic (3 Oct 1976).

Published in summary form only.

ANIMAL CELLS; DNA; GAMMA RADIATION; HAMSTERS; STRAND BREAKS; X RADIATION; RADIOINDUCTION

425 RELATIONSHIP BETWEEN CAFFEINE SENSITIVE AND RESISTANT DNA REPAIR, CELL LETHALITY AND MUTAGENESIS IN MAMMALIAN CELLS AFTER X IRRADIATION AND ALKYLATING AGENTS. Fox, M.; McMillan, S. (Christie Hospital and Holt Radium Inst., Manchester (UK). Paterson Labs.). Stud. Biophys.; 61: 71-79 (28 Feb 1977).

From Symposium on cell damage and DNA repair; Neubrandenburg, German Democratic Republic (3 Oct 1976).

In two mammalian cell lines using two different genetic markers Tk- and HGPRT- linear relationships between induced mutation frequency and dose were obtained for a number of mutagens. Induced mutant frequencies were similar for a variety of agents when comparisons were made in terms of induced lethality. Post-treatment of mutagenised cells with caffeine (0.75 mM 24 hr) markedly potentiated cell killing except after x

radiation. No effect of caffeine on induced mutant frequencies was detected. This latter observation provides evidence for the existence of a caffeine insensitive 'error prone' repair pathway in mammalian cells.

- 426 CELL INACTIVATION AND DNA STRAND BREAKS AT DIFFERENT OXYGEN CONCENTRATIONS AFTER SINGLE RADIATION PULSES. Stolley, P.; Rakow, A.; Handschack, W.; Abel, H. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Molekularbiologie). Stud. Biophys.; 61: 45-52(28 Feb 1977).

From Symposium on cell damage and DNA repair; Neubrandenburg, German Democratic Republic (3 Oct 1976).

Comparative radiation biological experiments on Chin. hamster cells V79/4 have shown a higher survival rate ($2.1 \times 10^{-2} \pm 20\%$) for pulsed electron irradiation (pulse length 1 μ s) under low oxygen concentration ($0.4\% C_2$) at doses of 2 krd than at continuous irradiation ($0.6 \times 10^{-2} \pm 20\%$). Radiation-induced single-strand breaks at an oxygen concentration of 7% have shown a higher response (by the factor $1.24 \pm 10\%$) for continuous irradiation than for pulsed irradiation. These experiments have confirmed the pulse oxygen effect also at the molecular level of mammalian cells, in a dose range according to the G-value for the radiation-induced oxygen depletion. So this effect has no practical advantage in radiation therapy. The G-value for the radiation-induced oxygen depletion in Eagle's minimal essential medium (+ phosphate buffer, pH 7) was measured to be $0.2\% O_2/\text{krd}$ at continuous radiation.

- 427 DNA SINGLE STRAND BREAKS INDUCED BY IONIZING RADIATION IN MAMMALIAN CELLS AND THE KINETICS OF REPAIR PROCESSES. Voiculescu, N.; Stoian, M.; Tudor, M.; Sandulescu, T.; Stan, M. (Oncological Institute, Bucharest (Romania)). Stud. Biophys.; 61: 9-16(28 Feb 1977).

From Symposium on cell damage and DNA repair; Neubrandenburg, German Democratic Republic (3 Oct 1976).

The induction of DNA single-strand breaks by x rays was followed by sedimentation analysis (Chinese hamster cells) and the rate of alkaline DNA strand separation (Ehrlich ascites tumour cells). Using both methods, a linear dose-effect relation for the number of single strand breaks was obtained. The number of breaks appears to be $1.5 \text{ per } 10^{12} \text{ daltons per rad}$, this being equivalent to 75 eV per break. In 60 minutes of incubation, 85 to 90% of single strand breaks from both types of cells were rejoined independently of irradiation dose (1 to 30 krads). The ^3H -thymidine incorporation extent in ascites cells pretreated with hydroxyures was followed too. The repair kinetics of DNA breaks showed that Ehrlich ascites tumour cells have a similiary repair system as normal cells.

- 428 (DOCKET-50133--506) HUMBOLDT BAY POWER PLANT, UNIT 3. IE INSPECTION REPORT NO. 77-02 (SPECIAL, ANNOUNCED, RADIOLOGICAL); REPLY RE 10CFR20.101(E)(1) INFRACTION; ACKNOWLEDGMENT. (Pacific Gas and Electric Co., San Francisco, Calif. (USA)). 25 Feb 1977. 11p.

Inspection of radiological program and an overexposure of man working in the cleanup heat exchanger room. HUMBOLDT BAY REACTOR; INSPECTION; RADIATION DOSES; PERSONNEL; RADIATION EFFECTS; HEAT EXCHANGERS; PROTECTIVE CLOTHING; DOCUMENTATION

- 429 (DOCKET-50155--652) BIG ROCK POINT NUCLEAR PLANT. ANNUAL OPERATING REPORT FOR

1976. (Consumers Power Co., Jackson, Mich. (USA)). 25 Feb 1977. 81p.

Net electrical power generated was 244,492.9 MWH with the reactor on line 4,405 hrs. Information is presented concerning operations, power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, reportable occurrences, and fuel performance. (FS)

- 430 (DOCKET-50206--683) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. ANNUAL OPERATING REPORT FOR 1976. (Southern California Edison Co., Rosemead (USA)). 25 Feb 1977. 173p.

Gross electrical energy generated was 2,610,000 MWH with the generator on line 6,162.9 hrs. Information is presented concerning operations, power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, reportable occurrences, steam generator tube inspections, primary coolant chemistry, containment penetration leak tests, and radiological environmental monitoring. (FS)

- 431 (DOCKET-50244--663) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. ANNUAL REPORT NO. 12: JANUARY--DECEMBER 1976. (Rochester Gas and Electric Corp., N.Y. (USA)). 25 Feb 1977. 110p.

Net electrical power generated was 2,060,941 MWH with the generator on line 5,115 hrs. Information is presented concerning operations, power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, reportable occurrences, steam generator inspections, containment integrated leak tests, and environmental monitoring. (FS)

- 432 (DOCKET-50282--701) PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2. ANNUAL OPERATING REPORT NO. 6 FOR 1976. (Northern States Power Co., Minneapolis, Minn. (USA)). 25 Feb 1977. 46p. (DOCKET-50306--568).

Information is presented concerning operating experience, outages and forced power reductions, personnel radiation exposures, fuel performance, changes, tests, experiments, and maintenance. (FS)

- 433 (DOCKET-50220--714) NINE MILE POINT NUCLEAR STATION, UNIT 1. ANNUAL REPORT OF OPERATION: JANUARY--DECEMBER 1976. (Niagara Mohawk Power Corp., Syracuse, N.Y. (USA)). 24 Feb 1977. 50p.

Net electrical power generated was 4,112,827 MWH with the reactor on line 7,727.67 hrs. Information is presented concerning operations, power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, reportable occurrences, and fuel performance. (FS)

- 434 BREAST CANCER INDUCED BY RADIATION. RELATION TO MAMMOGRAPHY AND TREATMENT OF ACNE. Simon, N. J. Am. Med. Assoc.; 237: No. 8, 789-790(21 Feb 1977).

A report is given of cases of 16 women in whom cancer of the breast developed after radiation therapy for acne or hirsutism, suggesting another group at higher risk than is generally expected for cancer of the breast. It is prudent to regard the carcinogenic effect of

radiation on the breast as proportional to dose without a threshold. Mammography in young women should be ordered only selectively, not for screening.

- 435 (DOCKET-50206--694) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. REPORTS OF THE OVEREXPOSURE OF THE FILM BADGES OF TWO CONTRACTOR PERSONNEL DURING FOURTH QUARTER OF 1976. (Southern California Edison Co., Rosemead (USA)). 18 Feb 1977. 8p.

Overexposure of the film badges of two contractor personnel during fourth quarter of 1976. SAN ONOFRE-1 REACTOR; PERSONNEL; PHOTOGRAPHIC FILM DOSEMEASUREMENTS; RADIATION DOSES; ACTIVITY LEVELS; WHOLE-BODY IRRADIATION; RADIATION PROTECTION

- 436 (DOCKET-50271--905) VERMONT YANKEE NUCLEAR POWER STATION. CORRECTION OF ERROR IN LETTER (WVY 77-5) VYNPC TO USNRC (12 JAN 1977). (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 17 Feb 1977. 1p.

Correction of error in letter (WVY 77-5) VYNPC TO USNRC (12 JAN 1977). VERMONT YANKEE REACTOR; CONTROL; MECHANICAL STRUCTURES; PERSONNEL; CONTROLLED ATMOSPHERES; RADIATION DOSES; REACTOR OPERATION; VENTILATION

- 437 (DOCKET-50304--774) ZION NUCLEAR PLANT, UNIT 2. IE INSPECTION REPORT NO. 77-02 (ROUTINE, UNANNOUNCED RE RADIATION PROTECTION, REFUELING). (Commonwealth Edison Co., Chicago, Ill. (USA)). 16 Feb 1977. 8p.

Inspection of radiation protection during refueling. ZION-2 REACTOR; INSPECTION; REACTOR FUELING; RADIATION PROTECTION; RADIOACTIVE EFFLUENTS; GASEOUS WASTES; PERSONNEL; RADIATION DOSES; RADIOCHEMISTRY; EDUCATION; WHOLE-BODY COUNTING; RADIATION MONITORING

- 438 (DOCKET-50213--665) HADDAM NECK PLANT. LICENSE NO. DPR-61, APPLICATION FOR AMENDMENT: IS PROPOSED CHANGES RE ENTRANCE INTO A HIGH RADIATION AREA. (Connecticut Yankee Atomic Power Co., Hartford (USA)). 15 Feb 1977. 5p.

Changes re entrance into a high radiation area. CONNECTICUT YANKEE REACTOR; SPECIFICATIONS; RADIATION PROTECTION; CONTROL; RADIATION DOSES; PERSONNEL; RADIATIONS; ACTIVITY LEVELS; RADIATION MONITORING

- 439 (UCLA--34P230X1) CHRONIC IRRADIATION AND BRAIN DEVELOPMENT. PROGRESS REPORT, FEBRUARY 15, 1976--FEBRUARY 15, 1977. Zamenhof, S. (California Univ., Los Angeles (USA)). 15 Feb 1977. Contract EY-76-S-03-0034-230. 14p. Dep. NTIS, PC A01; MF A01.

Tritiated water (^3HCH) ingested by the female rats in the dose as low as 3 $\mu\text{Ci/ml}$ drinking water (69 $\mu\text{Ci/day}$) produced highly significant decreases in body weight, cerebral weight, cerebral DNA (cell number), and cerebral protein, of the offspring at birth. These effects of such a low dose on fetal brain development were not demonstrated before. Administration of ^3HOH before mating (and during pregnancy) seemed to be necessary for this damage; a disturbance of ovarian maturation is implicated. Chronic administration of ^3HCH until birth of F_2 generation did not result in more damage in F_2 than in F_1 ; high mortality and a selection of individuals less susceptible to radiation may be implicated.

- D. Br. Med. J.; 1: No. 6058, 445 (12 Feb 1977).

Following on the suggestion (Simon, N., and Silverstone, S.M., Bulletin of the New York Academy of Medicine, 52: 741 (1976)) that repeated mammography should be avoided in fit women with a life expectancy greater than 20 years, it is suggested that it should also be avoided in breasts in which the malignant potentiality of the epithelium is known to be relatively high. The best example is the opposite breast following the development of carcinoma in one breast, a situation in which regular follow-up mammography was once regarded as particularly indicated. The same theoretical considerations are an argument against the treatment of carcinoma of the breast by excision of the lump and radiotherapy to the remaining breast tissue.

- 441 DIFFERENTIAL CHROMOSOMAL RADIOSENSITIVITY WITHIN THE FIRST G1-PHASE OF THE CELL CYCLE OF EARLY-DIVIDING HUMAN LEUKOCYTES IN VITRO AFTER STIMULATION WITH PHA. Beek, B.; Obe, G. (Freie Univ., Berlin). Hum. Genet.; 35: No. 2, 209-218 (11 Feb 1977).

Human leukocyte cultures were irradiated with 200 R X rays before the addition of phytohemagglutinin (PHA) in the Go-stage and at different times up to 25 h within the first G1-phase of the cell cycle after the addition of PHA. The results of the analysis of chromosomal aberrations show that the frequencies of dicentric chromosomes increase significantly when leukocytes leave the Go-stage, reaching a minimum yield of aberrations about halfway through the first G1-phase. After that, toward the end of the G1-phase, the frequencies of dicentric chromosomes decrease again to a level similar to that found in the Go-stage. Different possible explanations for the differential chromosomal radiosensitivity of human leukocytes within the first post-stimulation G1-phase are discussed.

- 442 (DOCKET-50245--943) MILLSTONE NUCLEAR POWER STATION, UNIT 1. IE INSPECTION REPORT NO. 76-32 (SPECIAL, UNANNOUNCED). (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 8 Feb 1977. 29p.

Inspection of incident of 11/12/76 re shutdown margin test and control rod operation, radiological consequences, reactor fuel data, and corrective actions. MILLSTONE-1 REACTOR; INSPECTION; CORRECTIONS; CONTROL ELEMENTS; OPERATION; REACTOR SHUTDOWN; TESTING; RADIATION EFFECTS; REACTOR FUELING; DOCUMENTATION; RADIATION MONITORS; CALIBRATION; RADIATION DOSES; PERSONNEL; REACTOR OPERATION; EDUCATION; REMOTE HANDLING; CRITICALITY

- 443 (DOCKET-50278--890) PEACH BOTTOM ATOMIC POWER STATION, UNIT 3. IE INSPECTION REPORT NO. 77-06 (SPECIAL RE INFRACTIONS PER TS 6.13.1.A); REPLY; ACKNOWLEDGMENT. (Philadelphia Electric Co., Pa. (USA)). 8 Feb 1977. vp.

Inspection of health physics practices used in conjunction with torus modifications. PEACH BOTTOM-3 REACTOR; INSPECTION; RADIATION PROTECTION; RADIATION DOSES; CONDENSATION CHAMBERS; PERSONNEL; MODIFICATIONS; DOCUMENTATION

- 444 (DOCKET-50305--566) KEWAUNEE NUCLEAR POWER PLANT, UNIT 1. IE INSPECTION REPORT NO. 77-01 (ROUTINE, UNANNOUNCED RE RADIATION PROTECTION). (Wisconsin Public Service Corp., Green Bay (USA)). 8 Feb 1977. 13p.

Inspection of radiation protection. KEWAUNEE REACTOR; INSPECTION; RADIATION PROTECTION;

- 440 RADIATION-INDUCED BREAST CANCER. Patey,

RADIATION DOSES;PERSONNEL;CALIBRATION;GASEOUS WASTES;RADIOACTIVE EFFLUENTS;RADIATION MONITORS; RARE GASES;QUALITY ASSURANCE;RESPIRATORS; EDUCATION

INVOLVED IN VETERINARY X-RAY DIAGNOSIS.

Rothe, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Mon. Not. R. Astron. Soc.; 32: No. 3, 107-109(1 Feb 1977). (In German).

An account is given of radiation protection in the context of X-ray examination of small and big animals on the premises of seven reviewed veterinary centres. Also reported are the dosimetric results obtained from holding personnel involved in X-ray diagnosis of 319 big and 4,047 small animals. Infringement of valid regulations was quite often observed, in that animals are held in position in an inadequate way and by unauthorised persons. The measured results, however, have shown that the radiation exposure of vocationally exposed persons can be kept far below the maximum permissible equivalent doses, provided that all applicable rules of radiation protection are observed by those on duty.

445 (DOCKET-50369--223) MCGUIRE NUCLEAR STATION, UNITS 1 AND 2. REVISED PAGES TO "EVALUATION OF COMPLIANCE WITH 10CFR50, APPENDIX I AND SUPPORTING INFORMATION". (Duke Power Co., Charlotte, N.C. (USA)). 7 Feb 1977. Sp. (DOCKET-50370--220).

"Evaluation of compliance with 10CFR50, appendix I and supporting information" re activity levels of radioactive effluents. MC GUIRE-1 REACTOR;MC GUIRE-2 REACTOR;RADIOACTIVE EFFLUENTS;ACTIVITY LEVELS;COWS;RADIATION DOSES; GOATS;INFANTS;THYROID;IODINE 131

446 DIAGNOSTIC RADIATION AND CHROMOSOME ABERRATIONS. Mole, R.H.; Papworth, D.G. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). Lancet; 1: No. 8006, 315(5 Feb 1977).

The author questions the soundness of the conclusion (Patil, S.R. et al, 1977, Lancet, Jan. 15, No. 8003, i, 151) that diagnostic radiation of the female abdomen and/or pelvis in the year before conception and up to the third lunar month of pregnancy significantly increased the frequency of chromosome aberrations in offspring. If the data given in the published table for women not irradiated, and women given radiation only to regions other than the abdomen and pelvis, are not pooled, then the P value does not reach conventional levels of significance. In fact there were only 3 mothers with chromosomally aberrant children after exposure of abdomen and pelvis. This was a very small sample on which to base important conclusions, especially when the provenance of the cells examined for aberrations was not given and when the mechanism for the appearance of aberrations, if any, must be quite different depending on whether irradiation preceded or succeeded conception.

447 (UCRL--52138) COMPUTER CODE FOR CALCULATING PERSONNEL DOSES DUE TO TRITIUM EXPOSURES. Graham, C.L.; Parlagreco, J.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Feb 1977. Contract W-7405-ENG-48. 30p. Dep. NTIS, PC A03/MF A01.

This report describes a computer code written in LLL modified Fortran IV that can be used on a CDC 7600 for calculating personnel doses due to exposures to tritium. The critical organ is body water. The code is capable of handling various exposure situations, and is also capable of detecting a large variety of data input errors that would lead to errors in the dose assessment.

448 (UCRL--52138(Rev.1)) COMPUTER CODE FOR CALCULATING PERSONNEL DOSES DUE TO TRITIUM EXPOSURES. Graham, C.L.; Parlagreco, J.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Feb 1977. Contract W-7405-ENG-48. 3Sp. Dep. NTIS, PC A03/MF A01.

This report describes a computer code written in LLL modified Fortran IV that can be used on a CDC 7600 for calculating personnel doses due to internal exposures to tritium. The code is capable of handling various exposure situations and is also capable of detecting a large variety of data input errors that would lead to errors in the dose assessment. The critical organ is the body water.

449 RADIATION EXPOSURE OF HOLDING PERSONNEL

450 (PB--264186) ASSESSMENT OF POTENTIAL RADIOLOGICAL POPULATION HEALTH EFFECTS FROM RADON IN LIQUEFIED PETROLEUM GAS. Gesell, T.F.; Johnson, R.H. Jr; Bernhardt, D.E. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). Feb 1977. 64p. (EPA--520-1-75/002). NTIS, PC A04/MF A01.

Liquefied petroleum gas (LPG) contains varying amounts of radon-222 which becomes dispersed within homes when LPG is used in unvented appliances. Radon-222 decays to alpha-emitting daughter products which are associated with increased lung cancer when inhaled and deposited in the respiratory system. The average dose equivalents to the bronchial epithelium from the use of LPG in unvented kitchen ranges and space heaters are estimated to be about 0.9 and 4.0 mrem/year, respectively. When extrapolated to the United States population at risk, the estimated tracheobronchial dose equivalents are about 20,000 and 10,000 person-rems/year for these appliances, or a total of about 30,000 person-rems/year. These doses are very small compared to other natural and man-made sources of ionizing radiation. It is estimated that these low doses would result in less than one lung cancer a year for the total U.S. population. Consequently, the use of LPG containing radon-222 does not contribute significantly to the incidence of lung cancer in the United States.

451 RADIATION EXPOSURE IN URANIUM MINING. Chem. Ztg.; 101: No. 2, 100-102(Feb 1977). (In German).

The article gives a summary of the radiation exposure of workmen in the underground mining of uranium, in particular due to inhalation of ²²²Rn-daughter products. The concept of working place concentration x month ('working level month' = WLM) is explained in detail. The statistics of cases of carcinoma in the respiratory tract of workmen in Colorado mines shows no increase in cases of carcinoma with an exposure of < 120 WLM in comparison with national average. There are no internationally binding rules about ²²²Rn-MZC (air) of U-mines; the ICRP recommends 30 pCi²²²Rn/l (with daughter products), correspondingly 3.6 WLM/a. Most countries recommend 4 WLM/a.

452 (DOCKET-50010--678) DRESDEN NUCLEAR POWER STATION, UNITS 1, 2, AND 3. RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION EXPOSURE: JANUARY THRU DECEMBER 1976. (Commonwealth Edison Co., Chicago, Ill. (USA)). Feb 1977. 99p. (DOCKET-50237--1205; DOCKET-50245--

1021).

Radioactive waste, environmental monitoring and occupational personnel radiation exposure: January through December 1976. DRESDEN-1 REACTOR; DRESDEN-2 REACTOR; DRESDEN-3 REACTOR; MONITORING; ENVIRONMENT; RADIOACTIVE EFFLUENTS; SOLID WASTES; PERSONNEL; RADIATION DOSES; METEOROLOGY; RADIATION MONITORING; GAMMA RADIATION; IODINE 131; WATER; MILK; GRASS; PLANTS; RAIN; SOILS; VEGETABLES; GROUND WATER

- 453 (DOCKET-50254--1008) QUAD-CITIES STATION, UNITS 1 AND 2. RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION EXPOSURE; JULY--DECEMBER 1976. (Commonwealth Edison Co., Chicago, Ill. (USA)). Feb 1977. 82p. (DOCKET-50265--977).

Radioactive waste, environmental monitoring and occupational personnel radiation exposure; July--December 1976. QUAD CITIES-1 REACTOR; QUAD CITIES-2 REACTOR; RADIOACTIVE EFFLUENTS; LIQUID WASTES; GASEOUS WASTES; SOLID WASTES; RADIATION DOSES; PERSONNEL; METEOROLOGY; ENVIRONMENT; RADIATION MONITORING; ENVIRONMENT; ACTIVITY LEVELS; IODINE 131; GROUND WATER; PLANTS; RAIN; SNOW; SOILS; MILK

- 454 (DOCKET-STN-50556--140) BLACK FOX STATION, UNITS 1 AND 2. NRC FINAL ENVIRONMENTAL STATEMENT (NUREG-0176). (Public Service Co. of Oklahoma, Tulsa (USA)). Feb 1977. vp. (DOCKET-STN-50557--137).

NRC final environmental statement (NUREG-0176). BLACK FOX-1 REACTOR; BLACK FOX-2 REACTOR; ENVIRONMENTAL IMPACT STATEMENTS; REACTOR SITES; WATER; LAND USE; GEOLOGY; SEISMOLOGY; GROUND WATER; HYDROLOGY; SURFACE WATERS; WATER QUALITY; METEOROLOGY; ECOLOGY; TERRESTRIAL ECOSYSTEMS; AQUATIC ECOSYSTEMS; POPULATION DENSITY; ARCHAEOLOGY; HEAT TRANSFER; AUXILIARY WATER SYSTEMS; COOLING TOWERS; RADIOACTIVE WASTE MANAGEMENT; LIQUID WASTES; GASEOUS WASTES; SOLID WASTES; POWER TRANSMISSION LINES; RADIATION DOSES; CONSTRUCTION; PERSONNEL; SOCIO-ECONOMIC FACTORS; HEAT SINKS; RADIATION MONITORING; MONITORING; REACTOR ACCIDENTS; RADIATION ACCIDENTS; TRANSPORT; POWER DEMAND; POWER GENERATION; ENERGY SOURCES; SITE SELECTION; COST; COST BENEFIT ANALYSIS

- 455 ENVIRONMENTAL ASPECTS OF NUCLEAR POWER STATIONS. Biesold, H.; Handge, P.; Meurin, G. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Chem. Ztg.; 101: No. 2, 91-100 (Feb 1977). (In German).

The aim of this article is to summarize the environmental aspects of nuclear power production in a condensed form and to review the potential public health problems. Radioactive material discharged to the air and into water may cause an external or internal radiation exposure to man. It is shown that the population is exposed to ionizing radiation originating from nuclear power plants to an extent which is very small compared to the natural background. Special attention is given to the use of river water for cooling purposes and the resulting heating-up of rivers. The environmental influence of cooling towers is restricted to the immediate vicinity of the site. - On the basis of this review it can be stated that, compared to other industries, nuclear power plants have only a small impact on the environment.

- 456 (INIS-rt--3625) SMALL CHANCES: GREAT CONSEQUENCES OR THE CONSEQUENCES OF A LARGE-SCALE ACCIDENT IN A NUCLEAR POWER PLANT. van Dijk, G.; Smit, W.A. (Technische Hogeschool Twente, Enschede (Netherlands)). Feb 1977.

201p. (In Dutch). Dep. NTIS (US Sales Only), PC A10/MF A01.

A sequel is presented to the previous Boerderijcahier (no. 7502) which discussed long-term effects of soil contamination in case of a nuclear power plant accident. In this report the short-term health effects are discussed. Models describing the local consequences of a severe accident are developed, taking into account the possible weather conditions (meteorological model), the evacuation possibilities and the inhabitability of certain areas. In each case long-term and short-term effects are discussed. The safety studies by various departments of the Netherlands' government and the Rasmussen report are commented on.

- 457 (ANL/ES--26) ARGONNE RADIOLOGICAL IMPACT PROGRAM (ARIP). PART II. MONITOR: A PROGRAM AND DATA BASE FOR RETRIEVAL AND UTILIZATION OF POLLUTANT MONITORING DATA. Eckerman, K.F.; Stowe, R.S.; Frigerio, N.A. (Argonne National Lab., Ill. (USA)). Feb 1977. Contract W-31-109-ENG-38. 116p. Dep. NTIS, PC A06/MF A01.

The Argonne Radiological Impact Program (ARIP) is an ongoing project that aims at developing methodologies for assessing the carcinogenic hazards associated with nuclear power development. The current report (Part II) treats the storage and access of available data on radiation and radioactivity levels in the U.S. A computer code (the MONITOR program) is presented, which can serve as a ready-access data bank for all monitoring data acquired over the past two decades. The MONITOR program currently stores data on monitoring locations, types of monitoring efforts, and types of monitoring data reported in Radiation Data and Reports by the various state and federal networks; expansion of this data base to include nuclear power facilities in operation or on order is on-going. The MONITOR code retrieves information within a search radius, or rectangle, circumscribed by parameters of latitude and longitude, and lists or maps the data as requested. The code, with examples, is given in full in the report.

- 458 (SAAS--207) EARLY REHABILITATION OF OCCUPATIONALLY EXPOSED PERSONS IN THE STAATLICHES AMT FUER ATOMISCHERHEIT UND STRAHLENSCHUTZ DER DDR. 2. REPORT ON CLINICAL EXPERIENCE. Arndt, D.; Lenz, U.; Rothe, E.; Schuettmann, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Feb 1977. 14p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

Within the frame of a 3-year pilot study relating to the problem of early rehabilitation of occupationally exposed persons, 178 patients with 189 cases of illness were attended dermatologically and/or internally. Due to the high rate of improvement (67.7 %) the radiation fitness of the patients could be recovered or preserved in several cases, this being of great national economic benefit because of the high level of qualification to be found in this category of persons. The described prophylactic method of early rehabilitation is strongly recommended to the responsible medical officers as a means of optimizing their supervision activity.

- 459 RADIOSENSITIVITY OF LYMPHOCYTE STIMULATION. II. EXPERIMENTS ON THE SENSITIVITY OF DNA SYNTHESIS. Renner, H. (Medizinische Hochschule Hannover (Germany, F.R.)). Abt. fuer Strahlentherapie und Spezielle

Onkologie). Strahlentherapie; 153: No. 2, 106-116(Feb 1977). (In German).

8 figs.; 4 tabs..

This 2nd report gives a description of many experiments on the radiosensitivity of DNA synthesis. The findings are shortly discussed. A summary discussion of all findings will follow in the 3rd report.

- 460 (AD-A--038171) NUCLEAR RADIATION DOSE COMPARISONS OF SMAUG TO AIR TRANSPORT RESULTS BASED ON THE DLC-31 CROSS SECTIONS. FINAL REPORT. Burgio, J.J. (Air Force Weapons Lab., Kirtland AFB, N.Mex. (USA)). Feb 1977. 37p. (AFWL-TR--76-313). NTIS, PC A03/MF A01.

This report presents comparisons of results obtained from the SMAUG computer code to recently published infinite homogeneous air transport data generated by the ANISN one-dimensional discrete-ordinates computer code, using the DLC-31 cross sections. The comparisons are for 4 P: (R)(R) tissue dose from a fission and thermonuclear neutron source and a prompt gamma source over the range of 1 to 600 grams/sq. cm. From 10 to 300 grams/sq. cm the SMAUG neutron tissue dose from a fission source was higher and the resulting secondary gamma tissue dose was lower. For the thermonuclear source both the SMAUG neutron and secondary gamma tissue doses were higher. For the prompt gamma source SMAUG results are lower for ranges less than 100 grams/sq.cm, about equal between 100 and 150 grams/sq. cm, and higher for ranges greater than 150 grams/sq. cm. (Author)

- 461 RADIATION EXPOSURE IN RADIOGRAPHIC EXAMINATIONS OF THE NEWBORN. Wesenberg, R.L.; Rossi, R.P.; Hendee, W.R. (Univ. of Colorado, Denver). Radiology; 122: No. 2, 499-504(Feb 1977).

Radiation exposure of the newborn during routine chest and abdominal radiographic examinations has been determined. The exposure has been measured at sites representing the entrance and exit chest, entrance, midline, and exit abdomen, the gonads, and the thyroid. Results of these measurements are reported as a function of kVp and in terms of mR received at the anatomical site per mR output of the generator at 24 in. (61 cm). This reporting procedure facilitates application of the results to exposure estimates under similar conditions at other institutions.

- 462 FEVER AS A COMPLICATION OF LOW DOSE IRRADIATION. Callen, J.P.; Keskey, K. (Michigan Univ., Ann Arbor (USA). Dept. of Internal Medicine). Br. J. Radiol.; 50: No. 590, 146-147(Feb 1977).

A case history is described of a 12-year-old white male treated for kidney transplant rejection with low dose pelvic irradiation (150 rad of γ rays on alternate days). Each of four irradiations was followed by severe prostration and fever in approximately two to four hours, yet cultures of blood, urine, throat and stool failed to reveal any pathogenic organisms. Renal biopsy revealed changes of rejection but no marked tissue necrosis. The more frequent side effects of nausea and vomiting were not present. Chromosomal studies were attempted but an adequate number of cells could not be cultured. This patient represents a previously unreported manifestation of low dose irradiation, as opposed to supralethal exposures where hyperthermia is a frequent component of radiation sickness. A possible mechanism is discussed.

- 463 SOME ASPECTS OF RADIATION PROTECTION FOR HIGH-ENERGY PROTON ACCELERATORS. Tuyn, J.W.N. (European Organization for Nuclear Research, Geneva (Switzerland)). Ned. Tijdschr. Natuurkd.; 43: No. 1, 36-39(Feb 1977). (In Dutch).

This article discusses some aspects of radiation protection for high energy proton accelerators, specifically the Cern SPS Synchrotron. It discusses the dangers of the radiation, their origin, environmental aspects, and the protection and shielding steps taken by Cern.

- 464 COMPUTERIZED RADIATION SAFETY SYSTEM. Chu, W.K.; Raeside, D.E.; Adams, G.D. (Oklahoma Univ., Oklahoma City (US)). Health Phys.; 32: No. 2, 116-117(Feb 1977).

This note describes the computer-based radiation-safety system at the Oklahoma Health Center (OHC). In use since the summer of 1975, the system allows the OHC radiation safety office to store, update and retrieve necessary information regarding each project approved under five by-product material licenses issued by the Nuclear Regulatory Commission (NRC). The block diagram of the system is shown.

- 465 QUALITY OF DISTURBED RADIATION TO THE OVARIES DURING DIAGNOSTIC X-RAY EXAMINATIONS. Ewen, K.; Fischer, P.G. (Zentralstelle fuer Sicherheitstechnik, Duesseldorf (Germany, F.R.)); Fiebach, B.J.O.; Loehr, E. (Essen Univ. (Gesamthochschule) (Germany, F.R.)). Roentgendiagnostisches Zentralinstitut. Fortschr. Geb. Roentgenstr. Nuklearmed.; 126: No. 2, 165-168(Feb 1977). (In German).

Dose measurements and analysis of disturbed spectra have shown that protection of the ovaries against disturbed radiation is worth while, although its effectiveness decreases with higher tube voltages. Increasing tube voltage increases disturbed radiation to the ovaries; the quality of the disturbed radiation is largely independent of the amount of filtration.

- 466 RATING THE LOW DOSE IRRADIATION EFFECTS ON THE BASIS OF THE CONCEPT OF BIOLOGICAL RISK. Denisenko, V.G.; Margulis, U.Y.; Klemm, A.I. At. Energ. (USSR); 42: No. 2, 120-122(Feb 1977). (In Russian).

For English translation see the journal Sov. At. Energy.

A statistical assessment of a maximum permissible dose to an irradiated population group has been established, by determining a total yield of unfavourable occasions for a large group of people. According to the concept adopted for any population group, a degree of a biological radiation effect is permissible if the number of unfavourable occasions cannot be identified through a statistical treatment of data concerning dynamics of the same disease caused by naturally adopted risks. A dependence of the permissible dose on population group size is derived. A case is considered of the dose rating when external gamma radiation of a whole body is applied.

- 467 RADIATION EXPOSURE TO RADIOLOGICAL PERSONNEL DURING X-RAY EXAMINATION OF THE GASTROINTESTINAL TRACT. Rothe, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Radiol. Diagn.; 18: No. 1, 125-131(Feb 1977). (In German).

In a comprehensive study the radiation exposure to radiological personnel carrying out

fluoroscopic examinations of the gastrointestinal tract was determined. The measurements were performed with LiF thermoluminescent dosimeters for the gonads, crystalline lenses, back and hands. Furthermore, screening times were registered. The values determined were processed by variance analysis. There were no significant differences neither for different screening times nor for the radiation doses per examination between the application of conventional fluoroscopic technique and imageconverter television technique. After classification in different groups of physicians significant differences could be demonstrated for different screening times but not for radiation doses. For colon contrast enemas the radiation dose is always significantly higher to assisting persons than to the physicians altogether. In both groups the dose to the hands is highest. The observance of radiation protection regulations is assessed considered sufficient.

- 468 INTERVAL ESTIMATION OF ABSORBED DOSE BY MEANS OF THE LINEAR PROGRAMMING METHOD. Volkov, N.G.; Lyapidevskii, V.K.; Malakhov, Y.I. *At. Energ. (USSR)*; 42: No. 2, 138-139 (Feb 1977). (In Russian).
ALGORITHMS; COMPARATIVE EVALUATIONS; COMPUTER CALCULATIONS; DOSIMETRY; DOSE RATES; ERRORS; GAMMA RADIATION; LINEAR PROGRAMMING; RADIATION DOSES

- 469 RADIATION-INDUCED SKIN CANCER OF THE HAND. REPORT OF 2 CASES. Mural, T.; Ohki, I.; Kaminuma, S.; Akizuki, S.; Hayashi, T. (*Jichi Medical School, Tochigi (Japan). School of Medicine*). *Kanzo*; 8: No. 1, 39-42 (Feb 1977). (In Japanese).

Two cases of radiation-induced skin cancer of the hand and some literature survey were mentioned. A 56-year old male bonesetter suffered from sclerosis of the skin 10 years after frequent redressment under the fluoroscope, suffered from intractable ulcer in the middle finger of the left hand 18 years after, and was diagnosed as spinocellular carcinoma as the result of exploratory excision. A 52-year old woman received x-ray irradiation to ringworm in both hands when she was 12 years old. Dose and period of irradiation were not clarified. When she was 22 years old, sclerosis of the skin of both hands was recognized, and she suffered from pain and swelling in the middle finger of the right hand and the index finger of the left hand when she was 52 years old. As the result of exploratory excision, she was diagnosed as spinocellular carcinoma of both hands. As to radiation-induced skin cancer reported in literatures, the classification whether it is occupational or postradiotherapeutic and the study of sex, age, prevalent site irradiation period, number of treatment days, latent period, histopathological findings, metastasis, prognosis, and treatment were mentioned.

- 470 (LA-6716-MS) COMPARATIVE RESPONSE OF DOGS AND MONKEYS TO SUBLETHAL ACUTE AND CONTINUOUS LOW DOSE-RATE GAMMA-RAY EXPOSURE. Spalding, J.F.; Holland, L.M.; Johnson, G.S.; LaBauve, P.M.; London, J.E.; Prine, J.R.; Vigil, E.A. (Los Alamos Scientific Lab., N.Mex. (USA)). Feb 1977. Contract W-7405-ENG-36. Sp. Dep. NTIS \$3.50.

Monkeys (*Macaca mulatta*) and dogs (beagle) were given thirteen 100-rad gamma-ray doses at 28-day intervals. The comparative response (injury and recovery) of the hematopoietic system of the two species was observed at 7-day intervals during the exposure regime. At 84

days after the thirteenth gamma-ray dose, the 1300-rad conditioned and control dogs and monkeys were challenged continuously with 35 R/day until death to determine the amount of radiation-induced injury remaining in conditioned animals as a reduction in mean survival time. Dogs (50 percent) and monkeys (8 percent) died from injury incurred during the conditioning exposures. Thus, the comparative response of dogs and monkeys to dose protraction by acute dose fractionation was similar to what might be expected from a single acute dose. Mean survival times for nonconditioned dogs and monkeys during continuous exposure at 35 R/day were the same (approximately 1400 h). Thus, hematopoietic response of the two species by this method of dose protraction was not significantly different. Mean survival times of conditioned dogs and monkeys during the continuous 35 R/day gamma-ray challenge exposure were greater than for their control counterparts. Thus, the long-term radiation-induced injury was not measurable by this method. Conditioning doses of more than four times the acute LD₅₀₋₃₀ in dogs and approximately two times that of monkeys served only to increase both mean survival time and variance in a gamma-ray stress environment with a dose rate of 35 R/day.

- 471 GENETIC EFFECTS OF ACUTE SPERMATOGENIAL X-IRRADIATION OF THE LABORATORY RAT. Chambers, J.R.; Chapman, A.B. (*Univ. of Wisconsin, Madison*). *Genetics*; 85: No. 2, 309-317 (Feb 1977).

The genetic effects of one generation of spermatogonial x-irradiation in rats, by a single dose of 600 r in one experiment and by a fractionated dose of 450 r in another, were measured in three generations of their descendants. Estimates of dominant lethal mutation rates, $(2 \text{ to } 3) \times 10^{-4}/\text{gamete/r}$, from litter size differences between irradiated and nonirradiated stock were consistent with previous estimates from rats and mice. Similar consistency was found for estimates of sex-linked recessive mutation rates, $(1 \text{ to } 2) \times 10^{-4}$ chromosome/r, from male proportions within strains; however, when measured in crossbreds the proportion of males was higher in the irradiated than in the nonirradiated lines. This inconsistency in results is in keeping with the contradictory results reported for recessive sex-linked lethal mutation rates in mice. The effects used to estimate recessive lethal mutation rates which were unusually high, $(2 \text{ to } 14) \times 10^{-4}/\text{gamete/r}$, were not significant. Other factors that could have contributed to the observed effects are postulated.

- 472 EFFECTS OF RADIATION ON THE VISUAL APPEARANCE AND MECHANICAL PROPERTIES OF MOUSE SKIN. Burlin, T.E.; Challoner, A.V.J.; Hutton, W.C.; Magnus, I.A.; Ranu, H.S.; Spittle, M. (*Saint John's Hospital for Diseases of the Skin, London (UK)*). *Br. J. Radiol.*; 50: No. 590, 123-128 (Feb 1977).

A study of the long term effects of radiation on the visual appearance and mechanical properties of mouse skin is presented. The effects associated with the hair follicle (greying and alopecia) increased monotonically with exposure. Other effects (load, extension and stress at rupture and scarring of the skin) all showed a reversal at the highest exposures. The skin thickness changed little with exposure, while the skin stiffness exhibited a shoulder on the response curve. Possible mechanisms underlying these effects are discussed.

- 73 ENHANCED ANTIBODY AFFINITY IN SUBLETHALLY IRRADIATED MICE AND BONE MARROW CHIMERAS. Doria, G.; Gorini, G.; Di Michele, A. (CNEN-EURATOM, Cassica, Italy). Proc. Natl. Acad. Sci. U.S.A.; 74: No. 2, 707-710 (Feb 1977).

Sublethally irradiated mice primed with dinitrophenyl (Dnp)-keyhole limpet hemocyanin immediately after irradiation or 30 days later and subsequently boosted with a second injection of antigen displayed a secondary response to Dnp characterized by antibody affinity greater than that in unirradiated controls. Also, in radiation chimeras primed with Dnp-keyhole limpet hemocyanin 120 days after syngeneic or allogeneic bone marrow transplantation the antibodies against Dnp produced after boosting were of higher affinity than the antibodies raised in normal mice. These findings are tentatively attributed to lack of suppressor thymus-derived lymphocytes (T cells) in sublethally irradiated mice and bone marrow chimeras, in which the enhanced ability to produce antibodies of high affinity may compensate for quantitative defects of the immune system.

- 474 INFLUENCE OF IRRADIATION WITH ^{60}Co -GAMMA RAY ON RABBIT'S SUBMANDIBULAR GLAND. USING ANGIOGRAM, SIALOGRAM AND RI. Yamagata, I. (Nippon Dental Coll., Tokyo). Shigaku; 64: No. 5, 1015-1029 (Feb 1977). (In Japanese).

Fractionated irradiation of 7000 rads with ^{60}Co γ ray was given to the submandibular glands of rabbits for continuous 2 days. After exposure, morphological changes were examined by sialography and angiography, functional changes were examined with $\text{sup}(99\text{m})\text{TcO}_4^-$ and ^{131}I -albumin, and pathohistological changes and changes of secreted particles were totally studied for 56 days. Until the 7th day after the irradiation, the duct system was dilated, snake-like flow of the vascular system was markedly observed, and inflammatory changes were found. Until the 14th day, split of the duct system, decrease of the number of the vascular system, and mild inflammatory changes were continuously observed. After the 28th day, the findings were almost the same as those of healthy control group. The examination with simultaneous administration of $\text{sup}(99\text{m})\text{TcO}_4^-$ and ^{131}I -albumin revealed that the function of the glands and the blood flow volume increased at the 1st day after the exposure, and that the function of the glands continued to be enhanced. However, poor change was found in both from the 7th day and the function was almost the same as that of the control group after the 14th day. Although inflammatory finding was slightly found until the 7th day, the finding was almost the same as that of the control group after the 14th day. Although the number of the particles rapidly dropped after the exposure, it gradually recovered from the 7th day, and the finding was almost the same as that of the control group after the 28th day. Total comparison of the above findings revealed that both functional and morphological changes in the submandibular glands appeared in early period after the exposure, but that the changes recovered relatively earlier in the functional aspect.

- 475 GLIAL RECOVERY PATTERNS IN RAT CORPUS CALLOSUM AFTER X IRRADIATION DURING INFANCY. Bayer, S.A. (Purdue Univ., West Lafayette, IN). Exp. Neurol.; 54: No. 2, 209-216 (Feb 1977).

Beginning on Day 2 after birth the head region containing the corpus callosum in three groups of male rat pups was exposed two (2X),

four (4X) or eight (8X) times to low-dosage x radiation (150 to 200 R) on successive or alternate days. A fourth group of male rat pups was started on a series of eight exposures on Day 8 (L8X). The effects of irradiation-induced interference with glial cell accumulation were assessed at 30, 60, 120, and 200 days of age by determining the number of cells per unit area, total area, and total number of cells in anatomically matched sagittal sections. The 2X and 4X groups had control values in all parameters at 30 and 60 days, which tended to decrease by 120 and 200 days. In contrast, a marked reduction in all parameters was seen in both 8X and L8X groups at 30 days. By either 60 (8X) or 120 (L8X) days, there was recovery to control values in cells per unit area. Both total area and total number of cells showed only partial recovery in the 8X groups. The initial effect on only the 8X groups is due to the exposures extending into the third week when gliogenesis is at its peak. The delayed effect in all groups may be a suppression of the normal increase in glial cells of the corpus callosum which occurs during the adult period.

- 476 (BNWL--2209) USER GUIDE FOR COMPUTER PROGRAM FOOD. Baker, D.A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Feb 1977. Contract EY-76-C-06-1830. 45p. Dep. NTIS, PC A03/MF A01.

An interactive code, FOOD, has been written in BASIC for the UNIVAC 1108 to facilitate calculation of internal radiation doses to man from radionuclides in food products. In the dose model, vegetation may be contaminated by either air or irrigation water containing radionuclides. The model considers two mechanisms for radionuclide contamination of vegetation: direct deposition of leaves, and uptake from soil through the root system. The user may select up to 14 food categories with corresponding consumption rates, growing periods, and either irrigation rates or atmospheric deposition rates. These foods include various kinds of produce, grains, and animal products. At present, doses may be calculated for the total body and six internal organs from 186 radionuclides. Dose summaries can be displayed at the local terminal. Further details on percent contribution to dose by nuclide and by food type are available from an auxiliary high-speed printer. This output also includes estimated radionuclide concentrations in soil, plants, and animal products.

- 477 ADULT HEIGHT AND WEIGHT OF FEMALE RADIUM DIAL PAINTERS, WITH ANALYSIS OF RADIATION EFFECT ON GROWTH. Polednak, A.P. (Argonne National Lab., IL). Hum. Biol.; 49: No. 1, 1-10 (Feb 1977).

The relationship between exposure to internal radiation and adult height and weight was considered in a group of 556 females who worked as radium dial painters. These persons were first exposed at age 14--29 years, and height and weight were measured at age 46--80. Univariate and multivariate (multiple regression) analysis disclosed no significant overall effect of age at first exposure, or average skeletal dose, on height and weight. Possible effects of radiation on growth were assessed. For persons in the earliest birth cohort (1900--09) who were 14--17 and 18--21 years old at first exposure, skeletal dose in rads received from first exposure to age 21 was estimated and height and weight compared by dose group (0--9, 10--99 and 100 + rads). There was no evidence for an effect of dose, or age-at-first-exposure, on adult height, in agreement with findings on Japanese atomic bomb

survivors exposed to external radiation at age 12--17 years.

478 ¹²⁵I-UDR INDUCED DIVISION DELAY.

Schneiderman, M.H. (Thomas Jefferson Univ., Philadelphia); Kimler, B.F.; Kirschner, A.S.; Leeper, D.B.; Hofer, K.G. Biophys. J.; 17: No. 2, 199-202(Feb 1977).

Mitotic selection for cell cycle analysis was used to investigate the effects of ³H and ¹²⁵I, incorporated into DNA, on the cell cycle progression of Chinese hamster ovary (CHO) cells. The results indicate that S-phase cells were delayed and G₂ cells were not.

479 BIOCHEMICAL EFFECTS OF INHALED ²³⁹PuO₂ ON LUNG LIPIDS. Tombropoulos, E.G. (Food and Drug Administration, Washington, D.C. (USA)); Hadley, J.G.; Thomas, J.M.; Craig, D.K. Health Phys.; 32: No. 2, 111-113(Feb 1977).

Results of experiments carried out to assess the effect of ²³⁹Pu α irradiation on lung lipid biosynthesis and to determine the lungs ability to incorporate palmitate into lavage lecithin and its turnover are reported. The experiments were carried out on rats which had inhaled ²³⁹PuO₂ particles. The study of palmitate incorporation into lipids shows conclusively that for medium (23 to 42 nCi) or high (more than 100 nCi) lung depositions the incorporation by isolated mitochondria is significantly (P < 0.05 or P < 0.06) enhanced at 1 day postexposure. Further, at very low doses (less than 2 nCi) a similar conclusion seems indicated (but not substantiated) because four out of five experiments show enhanced lung mitochondrial lipid biosynthesis and exhibit probabilities less than 0.50. Animals which inhaled ²³⁹PuO₂ were positive, with respect to controls in 8 of 10 instances, when measured following the label of palmitate in lung lavage lecithin. The interpretation of the significant result (P < 0.05) is that: (1) initial and/or final lecithin pool sizes were different, (2) transfer rates were affected between blood and lung, or (3) rates of degradation of lung lavage lecithin were affected.

480 (BNWL-SA--5881) ROLE OF ANIMAL TOXICITY STUDIES IN THE EVALUATION OF HUMAN HEALTH RISKS FROM INTERNALLY DEPOSITED TRANSURANICS. Thompson, R.C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Feb 1977. Contract EY-76-C-06-1830. 5p. (CONF-770409--7). Dep. NTIS, PC A02/MF A01.

From 4. congress of the International Radiation Protection Agency; Paris, France (24 Apr 1977).

The extrapolation of animal data to man has always been a problem for those concerned with human biology. Especially if one is interested in the effects of toxicants, opportunities for direct observation in man are usually limited, and approval of planned experiments employing human subjects is difficult to obtain. In no case are these limitations more restrictive than for transuranic elements, for which no life-threatening effects have yet been demonstrated in man. This lack of human experience is coupled with a massive public concern over possible future effects of transuranics, which contrasts sharply with the general public apathy toward a multitude of present environmental pollutants of clearly established toxicity. This concern for the transuranics, especially ²³⁹Pu, and for other radionuclides has prompted the expenditure of many millions of dollars (and francs and marks and pounds and roubles) on studies to investigate their toxicity in animals. Results

of these studies are extensive, and still accumulating, but in many quarters there is now a reluctance to accept these results as relevant to the prediction of human effects.

481 DIAPLACENTAL PASSAGE. INCORPORATION OF RADIOACTIVE COMPOUNDS IN THE PRENATAL PHASE. BIBLIOGRAPHIC LIST OF RADIONUCLIDES RELEVANT FOR DEVELOPMENTAL PHYSIOLOGY. Ahrens, E.; Stieve, F.E.; Mahn, U.; Roedler-Vogelsang, T.; Werner, U. Berlin, Germany, F.R.; Bundesgesundheitsamt (Feb 1977). 32p. (In German).

After a short introduction, this bibliography lists the literature citations, classified according to citations of general content and to citations dealing with individual radionuclides. The 37 most important radionuclides are dealt with.

482 UPTAKE, EXCRETION, AND RADIATION HAZARDS OF TRITIATED THYMIDINE IN HUMANS. Straus, M.J.; Straus, S.E.; Battiste, L.; Krezoski, S. (National Cancer Inst., Washington, DC). Cancer Res.; 37: No. 2, 610-618(Feb 1977).

Nine patients with malignant disease were given iv injections of tritiated thymidine, 0.2 mCi/kg, for tumor cell kinetics studies. Serial plasma, urine, saliva, and air vapor samples were collected variously for up to 79 days, and tritium activity was measured. The initial half-life of plasma activity was rapid. After 1 day, the activity decayed with a half-life of 10.8 days, indicating equilibration of activity with the total body water. Urine activity was over 100 times the plasma activity within 1 hr, with equilibration approaching the plasma activity after 2 days, and then decayed at a similar rate. Saliva and air vapor activity increased to plasma levels and then decayed at the same rate as did plasma activity. In the first 24 hr, approximately one-third of the total injected activity was excreted in the urine. During the first 12 days there were 54.2% urinary and 10.6% insensible losses. Maximum losses determined by extrapolation of observed data were 68% urinary and 19.5% insensible losses, or a total of 87.5%. Approximately 7% of the injected activity may represent material initially incorporated into DNA but later metabolized and excreted. The radiation dose from total body water is estimated at 0.69 rad. The estimated dose absorbed by cell nuclei from incorporated material is a maximum of 20.5 rads. These radiation doses would not seem to contraindicate injection of 0.2 mCi tritiated thymidine per kg to patients in this clinical and experimental setting. Measurements of activity in personnel and room air indicate that the use of such doses is not hazardous if appropriate precautions are followed.

483 (DOCKET-50334--454) BEAVER VALLEY POWER STATION, UNIT 1. IE INSPECTION REPORT NO. 76-28 (ROUTINE, UNANNOUNCED); REPLY RE INFRACTION PER 10CFR2.201; ACKNOWLEDGMENT. (Duquesne Light Co., Pittsburgh, Pa. (USA)). 31 Jan 1977. 13p.

Inspection of radiation protection and health physics procedures. BEAVER VALLEY-1 REACTOR; INSPECTION; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES

484 (DOCKET-50376--141) NORTH COAST NUCLEAR PLANT, UNIT 1. PUERTO RICO WATER RESOURCES AUTHORITY RESPONSES TO COMMENT ON DES. (Puerto Rico Water Resources Authority, San Juan). 31 Jan 1977. 31p.

Puerto Rico Water Resources Authority responses to comment on DES. NORTH COAST-1

REACTOR;METEOROLOGY;HURRICANES;ENVIRONMENTAL EFFECTS;EROSION;RADIATION DOSES;REACTOR COOLING SYSTEMS;INTAKE CANALS;DISCHARGE CANALS;FLOODS; ENVIRONMENT;RADIATION MONITORING;RADIOACTIVE WASTE MANAGEMENT;OILS;USES;SHORES;SEAWATER; WATER;REMOVAL;AQUIFERS;HYDRAULICS;SOILS;PLANTS; EXCAVATION;LAND USE;PERSONNEL;ROADS;TRANSPORT; POWER TRANSMISSION LINES;GEOLOGY;MINERALS; TERRESTRIAL ECOSYSTEMS;MONITORING;ENTRAINMENT; CHEMICAL EFFLUENTS;SOCIO-ECONOMIC FACTORS; THERMAL EFFLUENTS;RADIATION EFFECTS;REACTOR DECOMMISSIONING

485 (DOCKET-50245--939) MILLSTONE NUCLEAR POWER STATION, UNIT 1. LETTER RE NONREPORTABLE INHALATION EXPOSURE. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 27 Jan 1977. 1p.

Nonreportable inhalation exposure. MILLSTONE-1 REACTOR;PERSONNEL;RADIATION DOSES

486 (DOCKET-50272--368) SALEM NUCLEAR GENERATING STATION, UNIT 1. IE INSPECTION REPORT NO. 77-01 (SPECIAL UNANNOUNCED). (Public Service Electric and Gas Co., Newark, N.J. (USA)). 26 Jan 1977. 11p.

Inspection of release of primary coolant into the containment building 1/3/77 due to failure of vent line on letdown piping. SALEM-1 REACTOR;INSPECTION;RESPIRATORS;PERSONNEL; EDUCATION;PIPELINES;SUPPORTS;VENTS;CONTAINMENT BUILDINGS;COOLANTS;PRIMARY COOLANT CIRCUITS; VALVES;CLOSURES;PUMPS;OPERATION;LEAKS;RUPTURES; REPAIR;SURFACES;CONTAMINATION;ACTIVITY LEVELS; RADIATION DOSES;ACTIVITY LEVELS;PERSONNEL

487 (DOCKET-50245--983) MILLSTONE NUCLEAR POWER STATION, UNITS 1 AND 2. IE INSPECTION REPORT NO. 76-37 AND -26 (ROUTINE, UNANNOUNCED). (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 21 Jan 1977. 10p. (DOCKET-50336--700).

Inspection of radioactive waste management and responses to IE circulars. MILLSTONE-1 REACTOR;MILLSTONE-2 REACTOR;INSPECTION; RADIOACTIVE WASTE MANAGEMENT;RADIATION MONITORING;FISSION PRODUCT RELEASE;FUEL POOLS; GASEOUS WASTES;PERSONNEL;RADIATION DOSES;RESINS; RADIATION PROTECTION

488 (UCRL--51879(Pt.4)) EVALUATION OF THE RADIOLOGICAL QUALITY OF THE WATER ON BIKINI AND ENEU ISLANDS IN 1975: DOSE ASSESSMENT BASED ON INITIAL SAMPLING. Noshkin, V.E.; Robison, W.L.; Wong, K.M.; Eagle, R.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Jan 1977. Contract W-7405-ENG-48. 27p. Dep. NTIS \$4.00.

This report describes the radiological quality of the groundwater on the two main islands (Eneu and Bikini) of Bikini Atoll during June 1975 (from data obtained from water samples collected at old and new well sites on both islands) and the cistern water on Bikini Island. Based on analyses of these samples, we found that the cistern water from Bikini Island is both chemically and radiologically acceptable as drinking water in accordance with standard limits established by the U.S. Public Health Service. However, on both islands the quality of the groundwater varied from one site to another. At some wells both chemical and radiological quality are acceptable; at others one or both are unacceptable according to U.S. Public Health Standards. The doses we predict from consumption of both cistern and groundwater are acceptable under federal guidelines. However, doses predicted from consumption of groundwater are high enough to warrant careful evaluation of other potential

exposure pathways.

489 (DOCKET-50003--618) INDIAN POINT STATION, UNITS 1, 2, AND 3. IE INSPECTION REPORT NO. 76-12, -25 AND -27: SPECIAL INSPECTION OF HEALTH PHYSICS PROGRAM. (Consolidated Edison Co. of New York, Inc., New York (USA)). 20 Jan 1977. 24p. (DOCKET-50247--879; DOCKET-50286--580).

Inspection of health physics program. INDIAN POINT-1 REACTOR;INDIAN POINT-2 REACTOR;INDIAN POINT-3 REACTOR;INSPECTION;ACTIVITY LEVELS; RADIATION PROTECTION;DOSEMETERS;DOCUMENTATION; RADIATION DOSES;RADIATION MONITORS;STEAM GENERATORS;TUBES;PROTECTIVE CLOTHING;PERSONNEL; CONTAMINATION;CONTROL

490 COMMON PRECURSOR PATHWAYS OF HERPES DNA AND OF REPAIR SYNTHESIS IN ULTRAVIOLET IRRADIATED CELLS. Coppey, J. (Institut du Radium, 75 - Paris (France). Lab. Curie). Nature (London); 265: No. 5591, 260-262(20 Jan 1977).

Some studies are reported that indicate that metabolic pathways are common to host cells and to Herpes DNA synthesis. If this is so there may be a correlation between residual ability to support DNA replication and the extent of repair synthesis in different uv-irradiated cell lines. This possibility is being investigated.

491 (DOCKET-50003--614) INDIAN POINT STATION, UNIT 1. NRC TRANSMITTAL LETTER RE FEDERAL REGISTER NOTICE OF CITIZEN'S REQUEST FOR ACTION BY ALL NPR WITH OLS RE LIMITING RELEASES FROM A REFUELING ACCIDENT INSIDE CONTAINMENT. (Consolidated Edison Co. of New York, Inc., New York (USA)). 17 Jan 1977. 3p.

Federal Register notice of citizen's request for action by all NPR with OLS re limiting releases from a refueling accident inside containment. INDIAN POINT-1 REACTOR;INDIAN POINT-2 REACTOR;INDIAN POINT-3 REACTOR;REACTOR FUELING;SPENT FUEL ELEMENTS;CONTAINMENT; ACCIDENTS;FISSION PRODUCT RELEASE;ACTIVITY LEVELS;RADIATION DOSES;PERSONNEL

492 (DOCKET-50261--762) H. B. ROBINSON PLANT, UNIT 2. NRC TRANSMITTAL LETTER FOR FEDERAL REGISTER NOTICE FOR REQUEST FOR ACTION. (Carolina Power and Light Co., Raleigh, N.C. (USA)). 17 Jan 1977. 2p.

Federal Register notice for request for action re refueling accident within the containment building. ROBINSON-2 REACTOR; CONTAINMENT BUILDINGS;REACTOR FUELING;ACCIDENTS; SPENT FUEL ELEMENTS;FUEL ASSEMBLIES;RADIATION DOSES;PERSONNEL

493 (DOCKET-50500--93) DAVIS--BESSE NUCLEAR POWER STATION, UNITS 2 AND 3. NRC REQUEST FOR ADDITIONAL INFORMATION RE PLANT DESIGN TO COMPLETE SER. (Toledo Edison Co., Ohio (USA)). 17 Jan 1977. 23p. (DOCKET-50501--93).

NRC request for additional information re plant design to complete SER. DAVIS BESSE-2 REACTOR;DAVIS BESSE-3 REACTOR;DESIGN;REACTOR SAFETY;TURBOGENERATORS;MISSILE PROTECTION; RADIATION DOSES;LOSS OF COOLANT;REACTOR ACCIDENTS;CONTAINMENT SPRAY SYSTEMS;POPULATION DENSITY;TORNADOES;REACTOR COMPONENTS;HYDROLOGY; METEOROLOGY;REACTOR SITES;AUXILIARY SYSTEMS; STEAM SYSTEMS;HEAT SINKS;PUMPS;PERSONNEL; CONTAINMENT;PIPELINES;SLEEVES;REACTOR COOLING SYSTEMS;ENGINEERED SAFETY SYSTEMS;RECOMBINERS; HYDROGEN;QUALITY ASSURANCE;OFF-GAS SYSTEMS;

OXYGEN METERS; OPERATION; RADIOACTIVE EFFLUENTS;
PIPELINES; ACCELEROMETERS; SEISMIC EFFECTS;
ELECTRICAL EQUIPMENT

Personnel radiation exposure report. TURKEY
POINT-4 REACTOR; PERSONNEL; RADIATION DOSES;
DOSEMETERS; DEFECTS

- 494 RADIOPROTECTIVE ACTION OF CYSTEAMINE.
PRIMARY DNA LESIONS, CELL SURVIVAL AND MUTATION
FREQUENCY. Pitra, C.; Hartwig, M.; Koerner,
I.J.; Malz, W. (Akademie der Wissenschaften der
DDR, Berlin. Zentralinstitut fuer
Molekularbiologie). Stud. Biophys.; 62: No.
1, 31-43 (15 Jan 1977).

The addition of cysteamine (50 mM) protects
DNA molecules of logarithmically growing
Chinese hamster cells against x-radiation-
induced single-strand breaks, double-strand
breaks and nucleotide damage. The rejoining of
radiation-induced DNA single-strand breaks was
not inhibited by cysteamine. Cysteamine
protects the cells to the same extent against
both mutation induction and cell killing after
x irradiation. These results are discussed in
terms of the possibility that damage to DNA is
responsible for the lethal and mutagenic
effects of x rays in Chinese hamster cells, and
that cysteamine decreased the DNA damage which
is responsible for these effects.

- 495 DIAGNOSTIC RADIATION AND CHROMOSOME
ABERRATIONS. Patil, S.R.; Hecht, F. (Dept. of
Pediatrics, Child Development and
Rehabilitation Center, Univ. of Oregon Health
Sciences Center, Portland, Oregon (USA)); Lubs,
H.A.; Kimberling, W.; Brown, J.; Gerald, P.S.;
Summitt, R.L. Lancet; 1: No. 8003, 151 (15
Jan 1977).

Some evidence is presented suggesting that
diagnostic X-rays may be important in the
origin of a new chromosomal abnormality other
than Down syndrome. Chromosome analyses have
been carried out on 4342 children, seven or
eight years old. Maternal diagnostic
irradiation in the year before conception and
up to third lunar month of the index pregnancy
was recorded, before the chromosome study
began, together with a large amount of family
and clinical data. Information on X-ray
exposure was supplied by the mothers, so
radiation dosage could not be estimated. 21
children (including a pair of twins and a pair
of siblings) born to 19 mothers had chromosomal
aberrations. The mothers of six children with
inherited translocations, rearrangements and
XYY karyotypes were excluded, and 3 (23%) of
the remaining 13 mothers had received abdominal
and pelvic X-ray exposures. In the whole
sample, however, only 6% of the mothers had
diagnostic irradiation. Two of these mothers,
aged sixteen and twenty, gave birth to a child
each with de-novo autosomal translocations, and
the third mother, aged thirty-two, had a child
with a complex mosaicism involving one X
chromosome. Although the sample size of the
mothers with chromosomally abnormal children is
small, the results are significant.

- 496 (DOCKET-50244--644) ROBERT EMMETT GINNA
NUCLEAR POWER PLANT, UNIT 1. FEDERAL REGISTER
NOTICE OF CITIZEN'S REQUEST FOR ACTION BY ALL
NPR WITH OLS. (Rochester Gas and Electric
Corp., N.Y. (USA)). 14 Jan 1977. 13p.

Federal Register notice of citizen's request
for action by all NPR with OLS; re refueling
accident in the containment. GINNA-1 REACTOR;
CONTAINMENT; REACTOR FUELING; ACCIDENTS; RADIATION
DOSES; PERSONNEL; SPENT FUEL ELEMENTS

- 497 (DOCKET-50251--668) TURKEY POINT PLANT,
UNIT 4. PERSONNEL RADIATION EXPOSURE REPORT.
(Florida Power and Light Co., Miami (USA)).
14 Jan 1977. 3p.

- 498 (DOCKET-50369--216) MCGUIRE NUCLEAR
STATION, UNITS 1 AND 2. NRC REQUEST FOR
ADDITIONAL INFORMATION RE ADULT-COW-MILK
PATHWAY. (Duke Power Co., Charlotte, N.C.
(USA)). 14 Jan 1977. 2p. (DOCKET-50370--
214).

NRC request for additional information re
adult-cow-milk pathway. MC GUIRE-1 REACTOR; MC
GUIRE-2 REACTOR; RADIOACTIVE WASTES; RADIATION
DOSES; MILK; ADULTS; INFANTS

- 499 RADIATION-INDUCED NONDISJUNCTION OF
OOCYTES OF AGED MICE. Uchida, I.A.; Freeman,
C.P.V. (McMaster Univ., Hamilton, Ontario
(Canada)). Nature (London); 265: No. 5590,
186-187 (13 Jan 1977).

It is stated that some human epidemiological
studies suggest that there may be an
association between chromosomal nondisjunction
and pre-conception abdominal exposure to X-rays
in women, and that this appears to increase
with age. In order to test this, some
experimental evidence was sought by studying
second metaphase chromosomes of cultured
oocytes of mice. It had previously been found
that abnormal segregation was induced in young
mice by exposing them to a low dose of whole
body ¹³⁷Cs γ-radiation. The new studies
confirmed that this radiosensitivity increases
with age. The radiation dose was kept low to
minimize chromosome breakage. The results
indicated that abnormal segregation may be
induced during first meiotic division by in
vivo exposure of mouse ovaries to low radiation
doses, and that this radiosensitivity appears
to increase markedly with age. This supports a
suggestion that the risk of producing trisomic
off-spring in humans is increased with exposure
of the abdomen to diagnostic X-rays, and that
this increases with age.

- 500 (DOCKET-50003--606) INDIAN POINT
STATION, UNITS 1, 2, AND 3. NRC LETTER RE
CORPORATE MANAGEMENT MEETING ON 13 DECEMBER
1976 TO DISCUSS IE INSPECTION REPORT NOS. 76-
15, -34, AND -33. (Consolidated Edison Co. of
New York, Inc., New York (USA)). 7 Jan 1977.
5p. (DOCKET-50247--838; DOCKET-50286--549).

Meeting on 13 December 1976 to discuss IE
inspection report Nos. 76-15, -34, and -33
reported. INDIAN POINT-1 REACTOR; INDIAN POINT-2
REACTOR; INDIAN POINT-3 REACTOR; INSPECTION;
MEETINGS; RADIATION PROTECTION; EMERGENCY PLAN;
RADIATION DOSES; PERSONNEL; HANDS

- 501 (DOCKET-STN-50553--118) PHIPPS BEND
NUCLEAR PLANT, UNITS 1 AND 2. TVA RESPONSES
TO COMMENTS ON DES. (Tennessee Valley
Authority, Knoxville (USA)). 6 Jan 1977.
4p. (DOCKET-STN-50554--114).

TVA responses to comments on DES. PHIPPS
BEND-1 REACTOR; PHIPPS BEND-2 REACTOR;
ENVIRONMENTAL EFFECTS; KRYPTON 85; STEAM
CONDENSERS; OFF-GAS SYSTEMS; CARBON 14; TRITIUM;
PERSONNEL; RADIATION DOSES

- 502 PRODUCTION AND REPAIR OF DOUBLE STRAND
BREAKS IN CELLS FROM NORMAL HUMANS AND PATIENTS
WITH ATAXIA TELANGIECTASIA. Lehman, A.R.;
Stevens, S. (Sussex Univ., Brighton (UK)).
M.R.C. Cell Mutation Unit). Blochim. Biophys.
Acta; 474: No. 1, 49-60 (3 Jan 1977).

The production and repair of double strand
breaks induced by γ-rays in the DNA of human
fibroblasts have been measured by sedimentation

in sucrose gradients under non-denaturing conditions. Unirradiated DNA formed a rapidly sedimenting gel. Low doses of radiation released freely sedimenting DNA molecules from this gel. Higher doses reduced the rate of sedimentation of the free DNA due to the introduction of double strand breaks. The breakage efficiency was 1 break/ 1.3×10^{10} daltons of DNA/krad. Postirradiation incubation after a high dose of radiation resulted in an increase in molecular weight of the free DNA molecules, and after a low dose the rapidly-sedimenting gel was reformed. These data suggest that double strand breaks are repaired in human fibroblasts. No significant differences were found between fibroblasts from two normal donors and four patients with the radiosensitive disorder, ataxia telangiectasia, in either the production or repair of double strand breaks.

Five years of successful nuclear power plant operation can be reported today. Some 23 milliards kWh electrical power were generated. This means for NWK and HEW a proportion of 25% and 15% resp. with regard to the electric power used in the service area. Thus, it was possible to have a stabilizing influence on electricity prices, in particular when in the autumn of 1973 the primary energy costs rose steeply. The average number of full-load operating hours during the first five years of operation amounts to 7,340 hours per year, which means that the expectations put in nuclear engineering have been fully met.

- 503 IMPROVED RADIOIMMUNOELECTROPHORETIC ASSAY OF HUMAN SERUM THYROXINE-BINDING GLOBULIN. Durr, W.A.; Ramsden, D.B. (Birmingham Univ. (UK). Dept. of Medicine). J. Chromatogr.; 143: No. 1, 109-111(1 Jan 1977).

AUTORADIOGRAPHY;BLOOD SERUM;BUFFERS;CHEMICAL ANALYSIS;ELECTROPHORESIS;GLOBULINS-ALPHA;IODINE 125;LABELLING;MAN;THYROXINE;RADIOIMMUNOASSAY

- 504 (NUREG--0129) BEAR CREEK PROJECT (CONVERSE COUNTY, WYOMING). DRAFT ENVIRONMENTAL STATEMENT. DOCKET NO. 40-8452. (Nuclear Regulatory Commission, Washington, D.C. (USA); Department of the Interior, Washington, D.C. (USA); Department of Agriculture, Washington, D.C. (USA)). Jan 1977. 331p. Dep. NTIS \$10.00.

The Bear Creek Project consists of certain mining and milling operations involving uranium ore deposits located in Converse County, Wyoming. Mining of uranium from six known ore bodies will take place over a period of ten years (estimated); a mill with a nominal capacity of 1000 tons per day of ore will be constructed and operated as long as ore is available. The waste material (tailings) from the mill, also produced at a rate of about 1000 tons per day, will be stored onsite in an impoundment. The project would convert about 2700 acres from grazing use to mining and milling activities for a period of about ten years. Mining activities would disturb (and remove vegetation from) a total of about 1600 acres but, because of ongoing reclamation efforts, max acreage disturbed at any one time would be about 1000 acres, with the average about 650 acres. An estimated 185 acres of highwalls and water remaining after reclamation would be lost to agricultural production. The milling activities would disturb about 430 acres; 330 of these would be reclaimed after operations cease, but the 100-acre tailings area must be considered unavailable for further productive use. Water will be removed from aquifers at about 1000 gpm (range 600 to 2000 gpm) by mine dewatering and mill operations. Long-term effects on groundwater are expected to be minor. Surface water will not be affected by normal operations. There will be no discharge of liquid or solid effluents from the mill. Discharges to air will be small and the effects negligible. The total dose rate to the bone is 1.1 mrem/y, and the whole-body-dose rate is computed to be 0.04 mrem/y. (DLC)

- 506 CONTROL OF RADIATION EXPOSURES AT CANDU NUCLEAR POWER STATIONS. LeSurr, J.E. J. Br. Nucl. Energy Soc.; 16: No. 1, 53-61(Jan 1977).

Measures now being applied to Candu type nuclear power stations to ensure that the radiation dose to workers at current and future stations is as low as possible are considered. Improvements already made in coolant chemistry, coolant purification, decontamination, and other areas, are discussed. Modelling studies of activity transport and improvements resulting from taking man-rem into consideration at the design stage of a station are described. Also under investigation are detailed cost-benefit appraisals, studies on tritium control, and also fission product transport and removal.

- 507 (Juel--1381) DOSE FACTORS TO CALCULATE THE RADIATION EXPOSURE DUE TO RADIOACTIVE WASTE AIR FROM NUCLEAR FACILITIES. Brenk, H.D.; Vogt, K.J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Strahlenschutz; Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Reaktortechnik). Jan 1977. 42p. (In German). Dep. NTIS (US Sales Only), PC A03/MF A01.

An evaluation of the environmental impact of nuclear plants according to paragraph 45 of the Radiation Protection Directive of the Federal Republic of Germany requires the calculation of dose conversion factors indicating the correlation between the contaminated medium and individual radiation exposure. The present study is to be conceived as a contribution to discussion on this subject. For the determination of radiation exposure caused by the waste air of nuclear plants, models are being specified for computing the dose conversion factors for the external exposure pathways of β -submersion, γ -submersion and γ -radiation from contaminated ground as well as the internal exposure pathways of inhalation and ingestion, which further elaborate and improve the models previously applied, especially as far as the ingestion pathway is concerned, which distinguishes between 6 major food categories. The computer models are applied to those radionuclides which are significant for nuclear emitters, in particular nuclear light-water power stations. The results obtained for the individual exposure pathways and affected organs are specified in the form of tables. For this purpose, calculations were first of all carried out for the so-called 'reference man'. The results can be transferred to population groups with different consumption habits (e.g. vegetarians) by the application of correction factors. The models are capable of being extended with a view to covering other age groups.

- 505 KERNKRAFTWERK STADE - FIVE YEARS OF SUCCESSFUL OPERATION. Cramer, H. Energiewirtschaft. Tagesfragen; 27: No. 1, 20-24(Jan 1977). (In German). 6 figs..

- 508 (SSI--1976-038) SUMMARY OF PERSONNEL DOSES AND DISCHARGE OF RADIOACTIVITY AT SWEDISH NUCLEAR POWER PLANTS 1971-1975. Malmqvist, L.;

Persson, Aa. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Jan 1977. 13p. (In Swedish). Dep. NTIS (US Sales Only), PC A02/MF A01.

The report is a summary of personnel doses and activity discharges from Swedish nuclear power plants during the first five years of electric power production by nuclear plants. The personnel doses for the Swedish plants are lower than the corresponding values for American plants. The highest Swedish value is 0.13 manrem per MWE and year. The discharge of radioactivity to the atmosphere from the Swedish plants has been for below the maximum permissible limits. The discharge of radioactivity to the water recipients was less than 1 % of what is permissible.

- 509 Allgemeine Berechnungsgrundlagen fuer die Bestimmung der Strahlenexposition durch radioaktive Einleitungen in Oberflaechengewasser. T. 1. Fliessgewasser. (GENERAL FUNDAMENTALS OF CALCULATION FOR DETERMINING THE RADIATION EXPOSURE DUE TO RADIOACTIVE DISCHARGE INTO SURFACE WATERS. I. FLOWING WATERS). Koeln, Germany, F.R.; GRS (Jan 1977). 60p. (In German).

The paper describes a mathematical model for estimating the internal radiation exposure via different exposure pathways through radioactive discharges from nuclear facilities (paragraph 45, rad. prot. law) into rivers. The connections between the compartments of an ecological system are shown in their main types. Not all exposure pathways described are relevant for all cases; the experts have to carry out the evaluation using their knowledge of the local circumstances. The model is only valid for running waters above the tidal limit with the plant operating according to the rules.

- 510 (GEFR--00029) RISK ANALYSIS APPLICATION TO FFTF: SECOND CYCLE. Feller, K.G.; Hurd, D.E. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Jan 1977. Contract EY-76-C-03-0893-013. vp. AT.

This report documents work performed under Subtask B, Risk Analysis Application to FFTF--Second Cycle, of the LMFBR Risk Assessment Methods Task. The objective of the study was to improve the credibility of the First Cycle Assessment by developing and applying probabilistic analytical and numerical procedures in areas of the First Cycle where estimates were made by judgement. The report presents the models, results, and conclusions of the study.

- 511 (RISO-M--1905) CALCULATION OF INDIVIDUAL AND POPULATION DOSES ON DANISH TERRITORY RESULTING FROM HYPOTHETICAL CORE-MELT ACCIDENTS AT THE BARSEBAECK REACTOR. (Research Establishment Risoe, Roskilde (Denmark)). Jan 1977. 117p. (In Danish). NTIS (US Sales Only).

35 refs..

Individual and population doses within Danish territory are calculated from hypothetical, severe core-melt accidents at the Swedish nuclear plant at Barsebaeck. The fission product inventory of the Barsebaeck reactor is calculated. The release fractions for the accidents are taken from WASH-1400. Based on parametric studies, doses are calculated for very unfavourable, but not incredible weather conditions. The probability of such conditions in combination with wind direction towards Danish territory is estimated. Doses to bone marrow, lungs, GI-tract and thyroid are calculated based on dose

models developed at Risoe. These doses are found to be consistent with doses calculated with the models used in WASH-1400.

- 512 RADIOECOLOGICAL ASPECTS OF NUCLEAR WARFARE. Edvardson, K. (Swedish Defence Research Inst., Stockholm). Strojirenstvi; 7: No. 1, 56-60 (Jan-Feb 1977).

Radioactive fallout, one of the major effects of nuclear warfare, will cause acute radiation sickness within the close-in or intermediate areas downwind from surface bursts. Global fallout from high yield explosions will be fairly evenly distributed in the hemisphere where the explosions occur, and will cause irradiation from ground deposit, inhaled material and contaminated food. Estimates of collective doses and the approximate number of late casualties from the global contamination are presented for a given total explosion yield.

- 513 SIGNIFICANT DIFFERENCES AMONG THE /SUP 99M/TC-POLYPHOSPHATES, /SUP 99M/TC-PYROPHOSPHATES, AND /SUP 99M/TC-DIPHOSPHONATES FOR BONE IMAGING. Weber, D.A. (Univ. of Rochester School of Medicine and Dentistry, NY); Keyes, J.W. Jr.; Wilson, G.A. CRC Crit. Rev. Clin. Radiol. Nucl. Med.; 8: No. 4, 369-390 (Jan 1977).

The technetium-labeled phosphate and diphosphonate complexes are the primary radiopharmaceuticals currently used for diagnostic bone imaging. Replacing the radioisotopes of strontium and fluorine, these labeled complexes provide significantly improved bone image quality for diagnostic studies. Furthermore, imaging times are shorter and the radiation dose to the patient is generally less. This has resulted in a dramatic increase in the use of bone imaging as a diagnostic screening procedure. Investigations of the comparative clearance of these labeled compounds, in both experimental animal and patient studies, have shown that distribution characteristics can be affected by the following: (1) The time of imaging post-administration, (2) the delay between preparation and administration, and (3) the particular phosphate or diphosphonate preparation used. A review of these observations and their significance is correlated with the clinical application of the bone imaging procedure.

- 514 REPAIR OF X-RAY INDUCED CHROMOSOMAL DAMAGE IN TRISOMY 2- AND NORMAL DIPLOID LYMPHOCYTES. Countryman, P.I.; Heddle, J.A.; Crawford, E. (York Univ., Downsview, Ont.). Cancer Res.; 37: No. 1, 52-58 (Jan 1977).

The frequency of chromosomal aberrations produced by x-rays is greater in lymphocytes cultured from trisomy 21 patients (Down's syndrome) than from normal diploid donors. This increase, which can be detected by a micronucleus assay for chromosomal damage, was postulated by us to result from a defect in the rejoining system which repairs chromosomal breaks. The postulated defect would result in a longer rejoining time, thereby permitting more movement of broken ends and thus enhancing the frequency of exchanges. To test this possibility, the time required for the rejoining (repair) of chromosome breaks was measured in lymphocytes from five Down's syndrome (four trisomy 21 and one D/G translocation partial trisomy 21) donors, from a monosomy 21 donor, and from five diploid donors. The rejoining time was reduced in the Down's syndrome lymphocytes in comparison to the normal diploid and monosomy 21 lymphocytes.

Thus the repair of chromosome breaks, far from being defective as evidenced by a longer rejoining time in Down's syndrome cells, occurred more rapidly than in normal cells.

natural background for which the annual per capita whole body and bone marrow dose in the United States is approximately 130 and 86 mrad, respectively.

- 515 PLASMA THYROGLOBULIN IN DETECTING THYROID CARCINOMA AFTER CHILDHOOD HEAD AND NECK IRRADIATION. Schneider, A.B.; Favus, M.J.; Stachura, M.E.; Arnold, J.E.; Ryo, U.Y.; Pinsky, S.; Colman, M.; Arnold, M.J.; Frohman, L.A. (Michael Reese Hospital, Chicago). Ann. Intern. Med.; 86: No. 1, 29-34 (Jan 1977).

The level of thyroglobulin in plasma was measured in 904 subjects with a history of head and neck irradiation during childhood to evaluate its potential value in screening for and differentiating thyroid neoplasms. Mean plasma thyroglobulin level was significantly elevated in subjects with nodular thyroid disease versus those without evidence of nodules (49.8 versus 27.0 ng/ml). However, the overlap with normal subjects does not allow thyroglobulin assays to serve as the only screening procedure. The mean levels in subjects with benign and malignant thyroid nodules were indistinguishable (48.8 versus 53.9 ng/ml). Thirteen percent of otherwise normal-appearing subjects had elevated values that may represent clinically inapparent thyroid disease. It is concluded that in screening large numbers of persons at risk for thyroid neoplasia, thyroglobulin assays are useful in combination with other modes of evaluation. The assay is without value in distinguishing benign from malignant disease.

- 516 (FDA--77-8013) MEAN ACTIVE BONE MARROW DOSE TO THE ADULT POPULATION OF THE UNITED STATES FROM DIAGNOSTIC RADIOLOGY. Shleien, B.; Tucker, T.T.; Johnson, D.W. (Department of Health, Education, and Welfare, Rockville, Md. (USA)). Jan 1977. 42p. GPO.

Estimates, based on an empirical model and computer program (Ellis, Healy, Shleien and Tucker, HEW publication (FDA)76-8015), have been calculated and are presented on the mean active bone marrow dose to adults from diagnostic radiography, fluoroscopy, and dental radiography as practiced in the United States in 1970. The annual per capita mean active bone marrow dose in 1970 to adults from the above practices is estimated to have been 103 mrad; 77 percent, 20 percent, and 3 percent from radiographic, fluoroscopic and dental examinations, respectively. Examinations of the upper and lower abdomen contribute approximately 39 percent each to the total mean active bone marrow dose for adults; those of the pelvis, 4 percent; the thorax, 12 percent; and head and neck examinations (including dental) contribute about 6 percent. The per capita mean active bone marrow dose for various age groups is discussed. Contributions to the dose within a given age group from different examinations indicate that in the 15 to 34 year age group lumbar and lumbosacral spine examinations contribute most to the mean active bone marrow dose. Thereafter upper GI series and barium enemas are the highest contributors. Mean active bone marrow doses for children are not estimated in this presentation due to insufficient data. However, the lower rate of use of diagnostic x rays (except dental) in children would reduce the annual per capita mean active bone marrow dose for the entire population to approximately a maximum of 77 mrad. The results may be viewed relative to several surveys of radiation doses from diagnostic radiology performed in other countries which reported annual per capita mean active bone marrow doses varying from 30 to 189 mrad for their entire populations, and with

- 517 (NRPB-R--57) DOSES IN RADIATION ACCIDENTS INVESTIGATED BY CHROMOSOME ABERRATION ANALYSIS. 7. A REVIEW OF CASES INVESTIGATED, 1976. Lloyd, D.C.; Purrott, R.J.; Prosser, J.S.; Dolphin, G.W.; Tipper, P.A.; Reeder, E.J.; White, C.M.; Cooper, S.J.; Stephenson, B.D. (National Radiological Protection Board, Harwell (UK)). Jan 1977. 25p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Results from cytogenetic investigations into 66 cases of suspected over-exposure to radiation during 1976 are reviewed. This report is the sixth in an annual series which together contain data on 272 studies. Previous results were published in NRPB-R5, R10, R23, R35 and R41. Results from all investigations have been pooled for general analysis. Brief accounts are given in an appendix of the circumstances behind the past year's investigations and, where possible, physical estimates of dose have been included for comparison. A short review is given of the laboratory's recently published dose response data for several energies of neutron radiation. A description is also given of the group's collaboration in an international experiment in which comparisons were made between a variety of dosimeters exposed to a controlled criticality pulse. In a second appendix two experiments are described in which inter- and intra-donor effects on chromosome aberration yields were examined. It was found that differences in dicentric yields were small whereas acentric aberrations were more variable.

- 518 (SAAS--205) STATE AND TENDENCIES OF CHEMICAL PROTECTION AGAINST IONIZING RADIATION. A LITERATURE SURVEY 1975. Siegel, G.; Tapp, E.; Haehn, J.; Hannig, H.; Dlaske, R.; Martinek, K. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Jan 1977. 80p. (In German). Dep. NTIS (US Sales Only), PC A05/MF A01.

Papers published in 1975 in the field of chemical protection against ionizing radiation are reviewed. Protection studies in vitro and in vivo, the biochemical, pharmacological and toxic effects, the mechanisms of protection of radioprotective agents and the trends in this field of research are described.

- 519 (SSI--1977-006) PATIENT AND PERSONNEL DOSE MEASUREMENTS AT SELECTIVE CORONARANGIOGRAPHY. Maripuu, E. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Jan 1977. 22p. (In Swedish). Dep. NTIS (US Sales Only), PC A02/MF A01.

During 1975 dose measurements were performed on patients and doctors at the thoraxradiologic department of the Caroline Hospital in Stockholm, Sweden. The doses were measured during angiography. Skin doses are listed in tables. Also the doses to the bone marrow was estimated. LiF-dosimeters were used for the measurements. Calibration of the dosimeters and errors in the measurements are discussed.

- 520 FATAL RADIATION PNEUMONIA FOLLOWING SUBCLINICAL BUSULFAN INJURY. Soble, A.R.; Perry, H. (Sinai Hospital of Detroit). Am. J. Roentgenol.; 128: No. 1, 15-18 (Jan 1977). A patient with polycythemia vera received a moderate dose (480 mg) of busulfan intermittently over a 6 year period and later

developed Hodgkin's disease. Following split-course upper mantle, chest irradiation, he developed rapidly progressive, fatal pneumonia and bone marrow hypoplasia. It is postulated that the hyperacute organ failures (lung and bone marrow) resulted from augmentation of subclinical busulfan-induced damage of these organs by additive radiation effect. It is recommended that in patients who have had antineoplastic chemotherapy, major radiotherapy to the cervicothoracic region be accompanied by careful monitoring of respiratory and hematopoietic function, both before and during radiotherapy.

- 521 SI UNITS IN RADIOLOGY. Spiers, F.W. (Cookridge Hospital, Leeds (UK)). Radiol. Prot. Bull.; No. 18, 4-8 (Jan 1977).

Consideration is given to the problems and advantages associated with the use of the basic and derived units of the International System of Units (SI) in radiology and radiation protection. These units have already been adopted in science generally, and in laboratory medicine in particular, and the transition to the application of SI units in radiology and radiation protection will make these fields consistent with the whole of the rest of science. Not all the problems associated with the transition to the new units in laboratory medicine have been entirely solved, and experience here may well be relevant to the field of radiology. The SI unit of absorbed dose is the gray, 1 J kg^{-1} , and of activity is 1 nuclear transformation per second. The gray is also the name of the SI units of specific energy imparted, kerma, absorbed dose and absorbed dose index. The numerical factors required for the transition to the SI units are discussed, and the problems associated with the change-over considered. There will be ultimate gains in both consistency and convenience when the new system is established and familiar. There is still considerable debate on SI units for exposure and dose equivalent. A sound theoretical basis for a system of quantities and units in radiology was formulated by ICRU (International Commission on Radiation Units and Measurements, Radiation Quantities and Units, Washington, D.C., ICRU Report No.19, Part I (1971)).

- 522 SURVEY OF RADIOLOGICAL SAFETY IN DENTAL PRACTICE. Gill, J.R. (UKAEA Health and Safety Branch, London); Hudson, A.P. Radiol. Prot. Bull.; No. 18, 14-15 (Jan 1977).

A pilot survey of radiological protection in dental practice in Great Britain has been requested by the Health and Safety Executive and is now in progress. The survey should provide more precise data on the use of X-ray equipment. There are approximately 13,000 dentists in Great Britain using X-ray apparatus, and some 600 of these have been selected, on a statistical basis, to be invited to make use of a postal survey over a six month period. The postal survey technique to be used has already been developed as a service following requests from individual dentists. The dentist receives a questionnaire and three initial films to test the timer, then two special cassettes incorporating film and filters. Film badges are worn over a 12 week period by the dentist and by any staff who assist in radiography. Follow-up visits to discuss the survey will be made to one in ten of the selected dentists. The results will give the individual dentists, without cost, assurance of the efficient functioning of their equipment, and advice, should any remedial measures be necessary. Concurrently, the resulting statistics will give an indication of

how many, if any, practices fall short of the recommendations of the Code of Practice for the Protection of Persons against Ionizing Radiations arising from Medical and Dental Use. Further action in respect of the Health and Safety at Work Act will be determined in the light of the survey.

- 523 MEDICAL STANDARDS FOR RADIATION WORKERS. Rae, S. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 18, 11-13 (Jan 1977).

The Council of the European Communities in its Directive of June 1, 1976 has laid down revised basic safety standards for the health protection of the general public and workers against the danger of ionising radiation. The Directive requires each Member State of the Community 'for the guidance of medical practitioners....to draw up a list, which need not be exhaustive, of the criteria which should be taken into account when judging a worker's fitness to be exposed to ionising radiation'. Medical officers with current responsibility for radiation workers in the U.K. therefore met recently for informal exploratory discussion at the National Radiological Protection Board's headquarters, and an account is given of the views expressed there about the composition of the required 'list', and the possibility of standardizing the procedure adopted. Consideration was given to the objectives of medical examinations, the form of examination, and specific conditions which may give rise to difficulty in making a fitness assessment. These conditions are skin abnormalities, blood abnormalities, cataract, pregnancy, and psychological and psychiatric conditions. It was concluded that the medical examination of radiation workers, including blood examinations, are of value to the extent that they form part of any good general occupational health practice. The promulgation of the Euratom Directive has provided an opportunity for reviewing and standardising procedures for medical surveillance in the light of current knowledge concerning average occupational radiation doses and dose-response relationships.

- 524 CUMULATIVE RADIATION EFFECT. VI. SIMPLE NOMOGRAPHIC AND TABULAR METHODS FOR THE SOLUTION OF PRACTICAL PROBLEMS. Kirk, J. (Western Regional Hospital Board, Glasgow (UK)). Dept. of Clinical Physics and Bio-Engineering; Gray, W.M.; Watson, E.R. Clin. Radiol.; 28: No. 1, 29-74 (Jan 1977).

In five previous papers, the concept of Cumulative Radiation Effect (CRE) has been presented as a scale of accumulative sub-tolerance radiation damage, with a unique value of the CRE describing a specific level of radiation effect. Simple nomographic and tabular methods for the solution of practical problems in radiotherapy are now described. An essential feature of solving a CRE problem is firstly to present it in a concise and readily appreciated form, and, to do this, nomenclature has been introduced to describe schedules and regimes as compactly as possible. Simple algebraic equations have been derived to describe the CRE achieved by multi-schedule regimes. In these equations, the equivalence conditions existing at the junctions between schedules are not explicit and the equations are based on the CREs of the constituent schedules assessed individually without reference to their context in the regime as a whole. This independent evaluation of CREs for each schedule has resulted in a considerable simplification in the calculation of complex problems. The calculations are further

simplified by the use of suitable tables and nomograms, so that the mathematics involved is reduced to simple arithmetical operations which require at the most the use of a slide rule but can be done by hand. The order of procedure in the presentation and calculation of CRE problems can be summarised in an evaluation procedure sheet. The resulting simple methods for solving practical problems of any complexity on the CRE-system are demonstrated by a number of examples.

- 525 CUMULATIVE RADIATION EFFECT. VII. COMPUTER CALCULATIONS AND APPLICATIONS IN CLINICAL PRACTICE. Kirk, J.; Cain, O. (Western Regional Hospital Board, Glasgow (UK). Dept. of Clinical Physics and Bio-Engineering); Gray, W.M. Clin. Radiol. ; 28: No. 1, 75-92 (Jan 1977).

Cumulative Radiation Effect (CRE) represents a scale of accumulative sub-tolerance radiation damage, with a unique value of the CRE describing a specific level of radiation effect. Computer calculations have been used to simplify the evaluation of problems associated with the applications of the CRE-system in radiotherapy. In a general appraisal of the applications of computers to the CRE-system, the various problems encountered in clinical radiotherapy have been categorised into those involving the evaluation of a CRE at a point in tissue and those involving the calculation of CRE distributions. As a general guide, the computer techniques adopted at the Glasgow Institute of Radiotherapeutics for the solution of CRE problems are presented, and consist basically of a package of three interactive programs for point CRE calculations and a Fortran program which calculates CRE distributions for iso-effect treatment planning. Many examples are given to demonstrate the applications of these programs, and special emphasis has been laid on the problem of treating a point in tissue with different doses per fraction on alternate treatment days. The wide range of possible clinical applications of the CRE-system has been outlined and described under the categories of routine clinical applications, retrospective and prospective surveys of patient treatment, and experimental and theoretical research. Some of these applications such as the results of surveys and studies of time optimisation of treatment schedules could have far-reaching consequences and lead to significant improvements in treatment and cure rates with the minimum damage to normal tissue.

- 526 BRACHIAL EDEMA AFTER TREATMENT OF MAMMARY CARCINOMA. SIGNIFICANCE OF PHLEBOGRAPHY. Botsch, H.; Soerensen, R. (Freie Univ. Berlin (Germany, F.R.). Klinik fuer Radiologie, Nuklearmedizin und Physikalische Therapie). Strahlentherapie; 153: No. 1, 17-20 (Jan 1977). (In German).

2 figs.; 9 refs..

The frequency of thromboses or of obstacles to the venous flow in brachial or axillary regions has been examined by a phlebographic survey of 102 patients who were treated surgically and radiotherapeutically because of cancers of the breast. Thromboses or venous obstruction were found in the 86 patients with brachial edema. Ten of the patients with brachial edema had thromboses. Further 15 suffered from an obstruction to the venous flow. The results are discussed in detail, and compared with the rather contradictory data in literature. As a consequence of this study an indication for brachial phlebography would be justified on a larger scale with patients

having been treated surgically because of mammary carcinoma.

- 527 AMERICAN INVESTIGATION CONCERNING EXPECTED DAMAGE IN THE CASE OF NUCLEAR ATTACK. Noodzaak; 26: No. 1, 16-20 (Jan 1977). (In Dutch).

Risk analysis and computation of damages, especially the numbers of victims, both dead and wounded, on the basis of a plotted nuclear attack, has been made by various authorities in the USA. The results are discussed and compared, although comparison is difficult because different models and different parameters and starting points are used.

- 528 NUCLEAR ENERGY AND THE ENVIRONMENT. Meyer, P. (Bayerisches Landesamt fuer Umweltschutz, Muenchen (Germany, F.R.)). Kerntechnik; 19: No. 1, 9-13 (Jan 1977). (In German).

2 figs.; 3 tabs.; 11 refs..

The use of nuclear energy, like any other industrial activity, is potentially detrimental to man and his environment. This necessitates the detection and measurement of radioactive emission and immissions, and adequate provisions for the orderly disposal of radioactive wastes. Appropriate measures in this connection have been initiated from the early beginnings of use of nuclear fission. How successful these measures have been is best illustrated by the fact that the individual, dose load on the human population, attributable to the use of nuclear energy, amounts to only about 2 mrem/a whereas the load from natural sources amounts to 110 mrem/a.

- 529 COMPUTED TOMOGRAPHY OF THE WHOLE BODY AS A MEANS OF RADIATION PLANNING. Schnabel, K.; Guillaume, R.; Hermann, H.J.; Schlegel, W.; Zabel, H.J. (Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Inst. fuer Nuklearmedizin; Heidelberg Univ. (Germany, F.R.). Strahlenklinik). Strahlentherapie; 153: No. 1, 51-56 (Jan 1977). (In German).

12 figs.; 15 refs..

Computed tomography of the whole body offers the first possibility to obtain individual tomographs with high resolution and in correct scale from all regions of the body. Using the 'Sicograph', large-sized copies are obtained, which are therefore particularly useful for radiation planning. The size and location of tumors relative to critical organs can be determined exactly. The efficacy of radiation therapy in every individual case may be estimated on the basis of the controlled course (radiobiological information), [2, 4, 6, 11, 16, 17, 18, 24, 30], and the necessary modifications of the therapeutic schedule can be adopted early, allowing the complete utilization of the advantages of the shrinking field technique [8, 19, 26]. Since ultrasonic tomographs in many cases furnish additional information, we regard the combination of computed and ultrasonic tomography as the best way to obtain an accuracy of radiation planning previously unknown.

- 530 HIGH-LET PARTICLE EXPOSURE OF SKYLAB ASTRONAUTS. Benton, E.V.; Peterson, D.D. (San Francisco Univ., Calif. (USA). Dept. of Physics); Bailey, J.V.; Parnell, T. Health Phys.; 32: No. 1, 15-19 (Jan 1977).

High-LET particle radiation was registered in nuclear track recording plastic dosimeters worn on the wrists of Skylab astronauts and located in a heavily shielded film vault. The mission-average planar flux of high-LET

particles with LET ≥ 100 keV/micron . tissue has been determined to be 2.7 ± 0.6 particles/cm² . day . 2π sr and 0.34 ± 0.4 particles/cm² . day . 2π sr, respectively, for the nine astronauts and for the film vault. Comparison of results representative of a wide range of shielding depths reveals that the magnitude and slope of the integral LET spectrum of high-LET particles inside spacecraft are proportional to the amount of shielding.

531 MORPHOLOGICAL CHANGES IN THE THYROID FOLLOWING LOW-DOSE CHILDHOOD RADIATION.

Komorowski, R.A.; Hanson, G.A. Arch. Pathol. Lab. Med.; 101: No. 1, 36-39 (Jan 1977).

Surgically resected thyroid specimens were obtained from 18 patients who had received low-dose head and neck radiation during infancy or early childhood. Twelve of the eighteen patients had thyroid carcinoma, with six having lymph node metastases. In eight the malignancy was not found in the nodule that prompted the surgery but was discovered only after thorough examination of the entire specimen. Our patients showed a number of other histologic changes, not previously emphasized in the literature. They uniformly had marked multinodularity, extensive interstitial fibrosis, and in some cases lymphocytic thyroiditis.

532 EXPOSURE DOSES OF THE PATIENT AND THE MEDICAL STAFF DURING UROLOGICAL X-RAY EXAMENS. Vogel, H.; Loehr, H.; Haug, P.; Schuett, B. (Hamburg Univ. (Germany, F.R.). Abt. fuer Roentgendiagnostik). Roentgen Bl.; 30: No. 1, 39-50 (Jan 1977). (In German).

8 figs.; 7 tabs.; with refs..

During 32 intravenous urografies and 48 angiografies of the kidney and the suprarenal glands the X-ray doses at the patient's skin and gonades were determined. During the angiografies the doses were mesured at the hands, the gonades and the front (eyes) of the medical staff. The results are discussed. Because the X-ray doses are relatively high, the number of the pictures and the exposure time is to be reduced to the minimum. Clinical experience and special knowledge is the best X-ray protection.

533 GAMMACELL SAFETY PROGRAM. Miller, K.L.; Christensen, R.C. (Pennsylvania State Univ., Hershey (USA). Milton S. Hershey Medical Center). Health Phys.; 32: No. 1, 40-44 (Jan 1977).

Protection procedures that should be adopted to insure continued safe use of self-contained irradiation facilities, such as Gammacells, for the irradiation of small laboratory samples are discussed. Aspects considered include the siting of the facility, licensing requirements, receipt of unit, initial checkout and survey, operating procedures, user instructions and emergency procedures.

534 PRINCIPLES OF DIAGNOSTICS AND CLASSIFICATION OF RADIATION INJURIES. Vojen. Zdrav. Listy; 49: No. 1, 31-34 (Jan 1977). (In Czech).

Adapted from an article by Alekseev, G.Y. and Kruglov, A.N. in Voen.-Med. Zh. (1974) no. 9.

The principles are indicated of diagnosing acute radiation disease in soldiers in a nuclear war situation. The need is pointed out of accurate personnel dosimeters, both physical and biological. The acute radiation syndrome is classified into 5 groups according to the degree of irradiation, viz., single short-term

low-dose irradiation; Ist, IInd, IIIRD and IVth degree of radiation disease. The symptoms of the respective radiation disease degree are tabulated. The classification and diagnostics is based on an article published in a Soviet military medical journal.

535 IONIZING RADIATION HAZARDS AND ITS PROTECTION IN A RADIODIAGNOSTIC DEPARTMENT.

Sinha, R.P.; Rai, S.D. (P.M.C.H., Patna (India)). Rohre, Rohrleitungsbau Rohrleitungstransp.; 4: No. 1, 28-36 (Jan 1977).

After mentioning the contribution to gonadal dose from natural background and man-made radiation sources including those used in medical radiology, methods for minimising the radiation dose to the patients and staff in x-ray diagnostic department are discussed in brief.

536 CORRECTION OF THE RADIATION PROTECTION ORDINANCE. DATED JANUARY 21ST, 1977.

Bundesgesetzblatt, Teil 1; No. 6, 184-195 (Jan 1977). (In German).

The tables IV (free limits, derived limiting values of annual activity supply for inhalation and ingestion and derived limiting values of activity concentrations in the air) and some spelling, unit and term mistakes are corrected.

537 THYROID RADIATION DOSE DURING PANORAMIC AND CEPHALOMETRIC DENTAL X-RAY EXAMINATIONS. Block, A.J.; Goepp, R.A.; Mason, E.W. Angle Orthod.; 47: No. 1, 17-24 (Jan 1977).

Radiation exposure from panoramic equipment can be reduced significantly by use of smaller film, adjustment of the beam height to the height of the smaller film, and careful positioning of patients. These techniques have no adverse effect on the quality of the diagnostic information needed in dentistry. In addition to describing methods of reducing exposures from panoramic machines, this study demonstrates that the use of a barrier collar during static, cephalometric examinations can appreciably reduce thyroid exposure. Since the objective is to obtain diagnostic information from the film without irradiating the thyroid, the application of a lead-impregnated collar is a minor inconvenience, easily borne by the patient and operator. It should be noted that the use of the collar during panoramic examinations affords little or no protection since the relative motion of the panoramic machine places the axis of movement inside the head and neck of the patient. While the evolution of diagnostic radiology may have reached a high level of technical refinement of equipment and film, the clinician still must avoid unnecessary exposure for x-ray examinations and must carefully select the best type of examination to be used for each patient. For example, a complete panoramic examination to determine the position of a known unerupted third molar tooth is probably not an exercise of good judgment since other examinations, such as periapical, could yield the same information with less exposure. Decisions must be made with good judgment, value being placed on relative risks versus the benefits of diagnostic yield.

538 INVESTIGATION OF INTERNAL CONTAMINATION BY TRITIUM IN A-1 NUCLEAR POWER PLANT PERSONNEL IN 1974. Ondris, D.; Herchl, M.; Homolova, E. (Atomova Elektraren Bohunice, Jaslavske Bohunice (Czechoslovakia)). Prac. Lek.; 29: No. 1, 25-27 (Jan 1977). (In Slovak).

The results are presented of the 1974

personnel monitoring of the Bohunice A-1 nuclear power plant staff for internal contamination with tritium. Totally, 650 urine samples taken from 103 workers were analyzed using the recommended ICRP procedure. In routine examinations, the highest dose equivalent value of tritium incorporated within two weeks did not exceed 10 mrem, i.e., the maximum annual dose equivalent did not exceed 260 mrem. 8.5 μ Ci tritium per 1 litre urine was considered to be an alarm value. In a selected group of 21 high-risk persons analyses were conducted before and after each operation associated with tritium hazards. The limit dose was set to 5.8 μ Ci.l⁻¹, i.e., the tritium concentration equivalent to 10% of the maximum permissible annual intake. In 18 workers where tritium risk was of a more serious nature the biological half-life was followed up, with the average biological half-life being 8.5 days, with 5 days for the minimum and 12 days for the maximum values. The results show that in 1974 the tritium burden did not exceed 1/10 of the maximum permissible dose for any of the A-1 nuclear power plant workers.

- 539 AUTOPSY CASE OF MYELOFIBROSIS SEEN IN A PROXIMALLY EXPOSED SURVIVOR. Harada, T. (Nagasaki Univ. (Japan). School of Medicine); Matsuo, K.; Shikaya, T.; Takeshita, K.; Toyoda, S. *Saishin Igaku*; 32: No. 1, 134-141 (Jan 1977). (In Japanese).

An autopsy case of myelofibrosis is reported and is literarily discussed. The patient was a 30-year-old man and was exposed to sublethal dose of radiation at 1.1 km from the hypocenter at the time of the explosion in Nagasaki Prefecture, when he was 10 months old. Serious bone marrow disturbances were suspected. About 25 years after the exposure, clinical symptoms like aplastic anemia were shown and this disease developed. Hepatosplenomegaly was not clinically found until the late period. The liver weighed 3180 g and the spleen weighed 1540 g at autopsy. Blood examination revealed low value of neutrophilic alkaline phosphatase only at the late period, and no abnormal chromosome was seen in the peripheral blood. Reticulum-like cells were not histologically found at biopsy, but were found at autopsy. Extramedullary hematopoiesis, always accompanied with bleeding, was observed not only in the spleen, the liver and the lymphnodes, but also in the dura mater, the stomach, the renal pelvis and so on. It was the direct cause of death.

- 540 INVESTIGATION OF STOMACH DISEASES IN ATOMIC BOMB SURVIVORS. Ito, C.; Naito, Y.; Kumasawa, T. (Hiroshima A-Bomb Survivors Health Control Clinic (Japan)). *Hiroshima Igaku*; 30: No. 1, 73-80 (Jan 1977). (In Japanese).

Indirect gastroenterography was performed in 14890 of the survivors, in whom stool examination was positive for occult blood at time of general examinations during 3 years and 11 months from November 1971 to September 1975. The results were as follows. The rate of the survivors to whom precise examination was required was 20.8% in male, 14.0% in female and 16.7% in total at all ages. The rate was higher in male than in female. Precise examination was carried out in 80.1% in male and 83.1% in female, showing higher percentage in female. The rate of the survivors with abnormal findings was higher in male and aged people in both sexes. The rate was also higher in the direct exposed group at more than 2.1 km from hypocenter, settlers into the city after A-bomb explosion and other groups than in the direct exposed group within 2.0 km. The findings of 2024 precise examinations revealed that gastric

ulcer was more frequently found in male than in female and in the younger people than in the aged people. Gastric polyp was more frequently seen in female than in male, and in the aged people than in the younger people. The rate of estimated gastric carcinoma was 1.02% in male and 1.19% in female in the direct exposed group within 1.0 km, showing higher percentage than that in the direct exposed group more than 2.1 km, settlers group and other groups. The ratio of male-to-female reached almost 1 in proximally exposed survivors.

- 541 KERATOTIC PRECANCEROUS AND CANCEROUS CHANGES OBSERVED IN X-RAY TECHNICIANS. Tsujiguchi, Y.; Ishikawa, T.; Morishima, T. (Nihon Univ., Tokyo. School of Medicine). *Hifuka No Rinsho*; 19: No. 1, 3-8 (Jan 1977). (In Japanese).

Two cases of patients with occupational chronic radiation dermatitis, a pharmacist and a bone setter who had been engaged in such radiological occupation for a long time were studied and discussed with reference to the comparison between clinical and histological findings of keratotic, precancerous, and cancerous changes. In Case 1, erythematous lesion in the opisthen showed the pathological findings similar to Bowen's disease, and the lesion in the face showed the findings similar to keratosis senilis. Treatment with 5-FU ODT was effective in this case. Case 2 was extremely rare case in which carcinoma spinocellulare and epitherial tumor of the basal cells combined in the irradiated region.

- 542 (CEA-R--4810) QUANTITATIVE RADIOBIOLOGY: A METHOD OF IN VIVO STUDY OF GERM CELLS EXPOSED TO GAMMA AND NEUTRON RADIATION, DESCRIPTIVE MODELS. Lemaire, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection; Paris-5 Univ., 75 (France)). Jan 1977. 208p. (In French). Dep. NTIS (US Sales Only), PC A10/MF A01.

Thesis.
A technique of quantitative analysis of in vivo cell survival of the germ cells of male rats was developed from the gonadal weight loss observed after irradiation. This technique - both global and functional - of quantifying a cellular damage has several advantages: cell survival is completely studied in vivo; the dose range investigated is large; the results can be extended to man. The cell survival after γ and neutron exposure thus determined was investigated in the light of four cell survival theories: LEA's target theory; KELLERER and ROSSI's theory of dual action, CHADWICKS and LEENHOUT's molecular theory, and DELATTRE's general theory of transformation systems. The experimental results were well described by each theory. It was therefore concluded that the fundamental oneness of these theories should make it possible to include them all in a strict conceptual frame.

- 543 DOSE EFFECT RELATIONSHIP FOR EPILATION AND LATE EFFECTS ON SPINAL CORD IN RATS EXPOSED TO GAMMA RAYS. Masuda, K.; Reid, B.O.; Withers, H.R. (M.D. Anderson Hospital and Tumor Inst., Houston, TX). *Radiology*; 122: No. 1, 239-242 (Jan 1977).

The response of rat spinal cords exposed to single and multifractionated gamma-ray exposures revealed no significant differences between the threshold doses for 2 fractions given with a 24-hr interval and 2 fractions given with a 15-day interval. The latent period for spinal cord damage was about 190 days when the incidence of paralysis was high; it was less than this in animals with a lower

probability of paralysis. There was a marked sparing effect from dose fractionation: the initial part of a Strandqvist type of isoeffect curve had a slope of 0.44 for doses causing paralysis in 50 percent of the animals, and 0.36 for threshold doses. The level of epilation was not useful for predicting spinal cord damage.

- 544 COMPARISON OF TOTAL BODY AND LOCAL SPINAL CORD IRRADIATION IN EXPERIMENTAL ALLERGIC ENCEPHALOMYELITIS. Oldendorf, W.H. (Veterans Administration Center, Los Angeles); Cornford, E.M. J. Neuropathol. Exp. Neurol.; 36: No. 1, 50-61 (Jan 1977).

Spinal cord distribution spaces of ^3H -mannitol (M.W. 182) were measured to compare the effects of both total-body gamma irradiation and local (spinal cord) x-irradiation on the development of experimental allergic encephalomyelitis (EAE). Single doses of 700 R, 500 R, 300 R, 200 R and 100 R total body gamma irradiation, administered 6 to 8 days after EAE induction, appeared to delay the onset, reduce the severity, and hasten recovery of the disease. The magnitude of this effect was approximately proportional to the administered radiation dose. A single 1000 R x-irradiation dose, delivered to a 1 x 2 cm area in the thoracolumbar region of the spinal cord 7 or 10 days after induction appeared to increase the severity of EAE. Mannitol distribution spaces were mildly elevated in the thoracic regions and significantly elevated in the lumbar spinal cords of cord-irradiated animals. A marked exacerbation of the disease was observed in cord-irradiated rats treated with 5000 R, administered over a period of 5 days. Rats progressively lost weight during the normal course of EAE, and a simultaneous increase in wet weights of the spinal cords was seen. Slight changes in these two parameters were observed in cord-irradiated, but not in total-body irradiated, animals.

- 545 STATE OF SPERMATOGENESIS IN RATS FLOWN ABOARD THE BIOSATELLITE COSMOS-690. Plakhuta-Plakutina, G.I. (Inst. of Biomedical Problems, Moscow). Aviat., Space Environ. Med.; 48: No. 1, 12-15 (Jan 1977).

Testes of 30 rats flown aboard the biosatellite Cosmos-690 for 20.5 d and 30 rats kept in a ground-based experiment, which simulated all flight except weightlessness and acceleration, were examined morphologically. On the 10th experimental day the rats were exposed for 24 h to gamma irradiation from a ^{137}Cs source at doses of 220, 800, and 955 rad. Tests from 60 nonirradiated rats that remained in the vivarium were used as controls. On the 1st-2nd and 26-27th post-experimental days the animals showed a significant decrease in the weight of testes, post-radiation death of spermatogonia, and important structural changes in the spermatogenic epithelium, whose level depended on the dose of irradiation and the time elapsed after the exposure. No significant differences in the weight of testes, frequency of occurrence of individual components of the spermatogenic epithelium, and time of emergence of reparative processes were noted. No modifying effect of space flight factors on the development of radiation-induced changes in the spermatogenic epithelium of rats was found.

- 546 DISCUSSION OF THE COMBINED EFFECT OF WEIGHTLESSNESS AND IONIZING RADIATION ON THE MAMMALIAN BODY: MORPHOLOGICAL DATA. Portugalov, V.V.; Savina, E.A.; Kaplanskii, A.S.; Yakovleva, V.I.; Durnova, G.N.; Pankova, A.S.; Shvets, V.N.; Alekseev, E.I.; Katunyan,

P.I. (Inst. of Biomedical Problems, Moscow). Aviat., Space Environ. Med.; 48: No. 1, 33-36 (Jan 1977).

The combined effect of weightlessness and ionizing radiation, from the ^{137}Cs source at 800 rads for 24 h, on the animal body was studied. The morphological examination of organs and tissues of rats flown aboard the biosatellite Cosmos-690, kept in the ground-based simulation experiment, and kept in the vivarium, indicated prevalence of radiation-induced changes in both experimental groups of rats. An exposure of animals to space flight factors did not produce a substantial aggravation of radiation-induced effects. This is indicated by the lack of significant differences in the weight of testes, thymus, and spleen of flight and simulation rats. However, this exposure affected adversely the development of reparative processes in the hemopoietic tissue of bone marrow. Inflight irradiation aggravated weightlessness-induced changes. A combined effect of weightlessness and irradiation did not result in the summation of the effects exerted on skeletal muscles by either factor alone.

- 547 USEFULNESS OF ANATOMICAL VARIATIONS ON MOUSE FETUS AS A BIOLOGICAL INDICATOR OF RADIATION EFFECT. Ueda, K. (Tokyo Univ. (Japan). Faculty of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 37: No. 1, 15-26 (Jan 1977). (In Japanese).

The incidence of anatomical variations of vertebrae in fetuses irradiated with gamma rays from a cesium-137 source was investigated. The appearance rate of the cervical rib and lumbar rib, and the absence rate of the 13th rib, were used as biological indicators of radiation effects. A total of 494 pregnant mice of ddY strain and their 4203 fetuses were used. The day, when vaginal plugs were found, was considered to be day 0 in gestation ages. Pregnant mice were exposed to gamma rays on the 11th day of gestation except in experiments where mice of several gestation ages were irradiated with gamma rays for comparison of radiosensitivity at different gestation ages. On the 18th day, they were sacrificed, the fetuses were removed, and their bones were stained to observe three kinds of variations. The incidences of the cervical rib, the 13th rib and the lumbar rib were 34.1%, 0.4% and 1.1% respectively in controls. The incidence of the cervical rib were significantly higher in the groups treated on day 7 and 8 and were significantly lower in the groups treated on day 11 to 14 and the 16th day. The significant deficiency of the 13th rib was observed only in the fetuses irradiated on the 11th day and a high appearance rate of the lumbar rib was suggested in the group exposed on day 7 and 8. The appearance rate of cervical rib and the absence rate of the 13th rib were enhanced by increasing the radiation dose. However, no significant dose rate dependency was proved in any cases treated on day 11. The result of treatment with a combination of radiation and cadmium seemed to imply some potentiating effect in incidence of the cervical rib and the 13th rib. The data obtained in this study suggest that these three types of variations on ribs, especially the cervical and the 13th rib in case of exposure on the 11th day, are useful biological indicators of radiation effects.

- 548 ALLOTYPIC AND IDIOTYPIC SPECIFICITIES OF ANTI-SALMONELLA ABORTUS-EQUI (S.A.E.) ANTIBODIES PRODUCED BY RABBITS SUBJECTED TO SUCCESSIVE SUBLETHAL IRRADIATIONS. Bordenave, G.R. (Institut Pasteur, 75 - Paris (France)). Ann. Inst. Henri Poincaré, Sect. A; 128: No. ,

p. 169-171 (Jan-Mar 1977). (In French).

From International congress of immunology in French language; Quebec, Canada (11 - 15 Oct 1976).

Two months after priming rabbits were irradiated with 600 R every four months and received weekly injections of bacteria. They began to produce anti-S.a.e. antibodies around two weeks after irradiation. In some instances these antibodies were not precipitated by the antiallotypic sera of the a series but they inhibited the fixation, on the corresponding antisera, of IgG carrying the concerned allotypic pattern. After the second irradiation one of the rabbits produced high levels (60 mg/ml) of anti-S.a.e. antibodies showing a restricted spectrotypic. The serum of the bleeding made six weeks after this second irradiation showed cryoprecipitation properties. Some of the idiotypes revealed among the anti-S.a.e. antibodies produced after the first irradiation were not revealed after the second irradiation and vice versa, while some idiotypes remained unchanged during all the course of irradiation and immunization process.

Swedish). Dep. NTIS (US Sales Only), PC A02/MF A01.

Measurements of the ^{137}Cs content in a control group consisting of 20 to 30 persons have been carried out since 1959. Until 1966 the measurements were made in an 'open-both' type whole-body counter and after that in a three-crystal counter. Individual weighting factors for each member of the group is used to compensate for changes in the control group during the years. The calculation of the weighted mean of the cesium-137 level includes a correction for RaC contamination. During 1976 measurements were made on 24 members of the group, 14 men and 10 women. Measured content of potassium was 1.9 ± 0.3 g/kg body weight for the men and 1.6 ± 0.2 g/kg body weight for the women of the group. Tables show these results together with earlier results from the 'open-both' counter. The weighted mean and the highest and the lowest values within the group are indicated. The total error of the weighted mean and the highest value 1976 are about 15 percent and 12 percent respectively. For the last few years the cesium content has been below the detection limit, 10 to 15 pCi/gK, for some members of the group.

549 ASPECTS OF THE DOSIMETRY OF α -EMITTING RADIONUCLIDES IN BONE WITH PARTICULAR EMPHASIS ON ^{226}Ra AND ^{239}Pu . Thorne, M.C. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). Phys. Med. Biol.; 22: No. 1, 36-46 (Jan 1977).

The dosimetry of α -emitting radionuclides in bone is discussed. Results are presented for average dose rates to tissues close to endosteal surface and to haematopoietic bone marrow from thin plane sources of radionuclides buried to different depths in bone and emitting α -particles with energies in the range 3 to 8 MeV. These results have been used to demonstrate that on an activity basis ^{239}Pu is unlikely to be more than fifteen times as toxic as ^{226}Ra with respect to osteosarcoma and leukaemia induction in man.

550 PROBLEM OF RADIATION DOSAGE IN THE MEASUREMENT OF SKIN BLOOD FLOW BY XENON-133. Patterson, J.; Webster, M.H.C. (Canniesburn Hospital, Glasgow (UK)). Phys. Med. Biol.; 22: No. 1, 47-55 (Jan 1977).

The skin dose arising from the use of xenon-133 in the measurement of skin blood flow has been calculated for several situations. The results indicate the importance of prior assessment of radiation dose in any technique involving the use of radionuclides. Cases where particular care must be taken have been indicated and practical methods of reducing the dose are suggested.

551 TREATMENT OF ACROMEGALY BY YTTRIUM IMPLANTATION. Hibbert, J.; Shaheen, O.H. (Guy's Hospital, London). J. Laryngol. Otol.; 91: No. 1, 1-9 (Jan 1977).

Yttrium implantation is one of the many ways of treating acromegaly. The advantages are the minor nature of the procedure and the fact that pituitary replacement is not as commonly required as after hypophysectomy. Thus in young female patients menstruation may be resumed following treatment and pregnancy has occurred. The procedure is not as free from complications as external irradiation but the response is more satisfactory.

553 PROBLEMS WITH IODINE-125 IODINATION. Birchall, I. (Liverpool Univ. (UK)). Radiol. Prot. Bull.; No. 18, 19-21 (Jan 1977).

In the past two or three years there has been a considerable increase in the use of iodine-125 for immuno-assay work in universities. Thyroid uptake measurements have been made over a two year period on 30 personnel working in four departments at Liverpool University. The measurements consisted on monthly thyroid monitoring and routine film badge checks, and working levels varied between 0.5 mCi and 10.0 mCi/month. A correlation was found between mean thyroid counts and fume cupboard flow rate, normalized to a working level of 1 mCi/month. A significant number of films worn by personnel carrying out iodination procedures were found to be contaminated by the splashing of tiny droplets during the fairly vigorous reactions found with the chloramine T method. These tiny droplets would also contribute to the thyroid uptake. This contamination does not occur if the reaction is viewed through the fume hood glass. Some anomalously high results were explained by practices such as the switching off of noisy fans during iodination procedures, and nominally good fume cupboards being rendered inefficient by the storage of dangerous chemicals inside them. Recent results have shown a significant drop in thyroid uptakes resulting from a greater awareness of the problem, improved ventilation and improved utilization of fume cupboards. However, there still remains the occasional count rate in the region 20 to 50 c/sec, equivalent to an uptake of approximately 1 in 10^5 to 1 in 10^6 of the amount in use.

554 SOLUBILITY OF INHALED PARTICLES. Popplewell, D.S. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 18, 16-18 (Jan 1977).

The solubility of a solute is greater when in the finely divided state compared with the solubility in the massive state. The fundamental basis of classifying particles according to their solubility (the 'massive' solubility) could therefore be in error when applied to very small aerosol particles. It is postulated (Task Group on Lung Dynamics (Chairman, P.E. Morrow), 1966, Health Physics, vol.12, 173) that the rate of clearance of inhaled particulate matter from lung to blood

552 (SSI--1977-003) CESIUM-137 BODY BURDEN OF A CONTROL GROUP IN STOCKHOLM, 1976. Falk, R.; Eklund, G. (Statens Strålskyddsinstitut, Stockholm (Sweden)). Jan 1977. 8p. (In

depends primarily on the solubility of the particles. Thermo-dynamic grounds can be used to derive a theoretical relation between particle size, solubility and surface free energy of the material. There is no published value for the surface energy of plutonium dioxide, but the surface energy is related to the hardness, which is known. Values of the ratio (solubility of material of radius r): (massive solubility of material) have been calculated for values of r from 5 μm to 0.005 μm . The results show that particles greater than about 0.1 μm exhibit the massive solubility, particles of about 0.01 μm show enhanced solubilities of several orders of magnitude, and smaller particles show solubilities which are hardly credible even before the approach to molecular dimensions might be expected to render the formula invalid. It has been suggested that some other factors such as surface charge decreases the solubility of extremely small particles, but theory is still unable to describe adequately the solubility of these particles. Nevertheless, there is some justification, supported by experimental measurements, for questioning the solubility criterion for predicting the lung clearance of extremely small particles.

- 555 ^{90}Sr LEVEL IN TEETH OF SLOVAK POPULATION AND CORRELATION WITH RADIOACTIVE ENVIRONMENTAL CONTAMINATION. Cechvala, L.; Carach, J.; Viktory, D. (Krajska Hygienicka Stanica, Bratislava (Czechoslovakia)). Bratisl. Lek. Listy; 67: No. 1, 24-32 (Jan 1977). (In Slovak).

The problem was studied of the contamination of dental tissue with radionuclide ^{90}Sr . Due to the global fallout ^{90}Sr passes through the food chain, is deposited in the mineralized tissues and irradiates them. The results of 405 analyses are presented performed on samples of deciduous and permanent teeth extracted between 1967 and 1972 in two regions of Slovakia. The highest ^{90}Sr levels of $3.197 \text{ s}^{-1} \text{ g}^{-1} \text{ Ca}$ (5.33 pCi/g Ca) in deciduous teeth were found in the population group of children born in 1963, the period of the highest ^{90}Sr sedimentation rate. Dental tissue originating from northern regions showed ^{90}Sr levels twice higher than those found in southern regions. The results obtained were statistically evaluated. The interconnection of the ^{90}Sr chain was confirmed by the calculated correlation coefficients.

- 556 $G_2 + M$ ARREST OF CULTURED MAMMALIAN CELLS AFTER INCORPORATION OF TRITIUM-LABELED NUCLEOSIDES. Marz, R.; Zylka, J.M.; Plagemann, P.G.W.; Erbe, J.; Howard, R.; Sheppard, J.R. (Univ. of Minnesota, Minneapolis). J. Cell. Physiol.; 90: No. 1, 1-8 (Jan 1977).

Novikoff rat hepatoma cells were propagated in suspension cultures containing 0.5 to 10 μC of ^3H -methyl-thymidine, ^3H -5-uridine, ^3H -G-adenosine or ^3H -8-adenine. The presence of the ^3H -labeled precursors caused an inhibition of cell replication which was due to a delay or arrest of the cells in G_2 and M. The degree of inhibition was proportional to the amount of radioactivity incorporated into nucleic acids. Almost immediate and complete inhibition resulted from incubation with 10 μC ^3H -thymidine/ml. The presence of 0.5 μC ^3H -thymidine/ml caused a significant increase in the relative proportion of cells in $G_2 + M$, even though the population doubling time of the culture appeared to be unaltered.

MERCURY AND RADIATION EFFECTS ON NERVOUS SYSTEMS. Hupp, E.W.; Day, D.; Hardcastle, J.; Hines, J.; Minnich, J. (Texas Woman's Univ., Denton (USA)). Jan 1977. 133p. NTIS PC A07/MF A01.

The interaction between methyl mercury and ionizing radiation was investigated in a series of experiments using rats, hamsters, and squirrel monkeys to study the effects produced and possible mechanisms of action. Parameters evaluated included several measurements of behavior, brain electrical activity, lethality, blood-brain barrier permeability, neurotransmitter and mercury concentration in various brain areas, and brain histology. In some cases the effects of the co-insult were less than or at least no greater than at least one of the two insults applied alone. Possible mechanisms of action include opposite effects of the two insults on the blood-brain barrier, with radiation increasing permeability and methyl mercury decreasing it. Radiation may also elicit a proliferation of peroxisome-like organelles which protect against the effects of methyl mercury.

- 558 (FDA--77-8016) DIRECTORY OF PERSONNEL RESPONSIBLE FOR RADIOLOGICAL HEALTH PROGRAMS. (Department of Health, Education, and Welfare, Rockville, Md. (USA)). Jan 1977. 33p. GPO.

This is a directory of professional personnel who administer the radiological health program activities in state and local governmental agencies. Included in the directory is a listing of each state health officer or the head of the agency responsible for the radiological health program. The name, address, and telephone number of the radiological health personnel are listed, followed by the alternate contact who, in many instances, may be chief of a larger administrative unit of which the radiological health program is a subunit. The address for the program is also included if it differs from the official health department or agency. Generally, the titles of the personnel listed will indicate the administrative status of the radiological health program. The directory also includes a list of key professional personnel in the Bureau of Radiological Health, Radiation Operations Staff, Regional Radiological Health Representatives, Winchester Engineering and Analytical Center, Food and Drug Administration; Office of Radiation Programs, Regional Radiation Representatives, National Environmental Research Center, and Eastern Environmental Radiation Laboratory, Environmental Protection Agency; selected personnel in the U.S. Nuclear Regulatory Commission; and selected personnel in the National Bureau of Standards.

- 559 EVALUATION OF 'CRITERIA FOR FILM BADGE PERFORMANCE' ANSI N13.7-1972. Plato, P. (Univ. of Michigan, Ann Arbor). Am. Ind. Hyg. Assoc. J.; 38: No. 1, 41-45 (Jan 1977).

To determine if ANSI N13.7-1972 is a useful method to test the accuracy of film badge processors to measure radiation doses to workers in the nuclear industry, a set of exposed dose values is compared to several sets of typical, but imaginary, reported dose values. The ANSI Standard is found to be a complex procedure with no direct test for accuracy. Because of these and other limitations of the Standard, it is concluded that ANSI N13.7-1972 is unacceptable for routine testing of film badges.

WASTE TREATMENT ACTIVITIES AT THE KARLSRUHE NUCLEAR RESEARCH CENTRE. Schueller, W.; Huppert, K.L.; Baumgaertner, F.; Kroebel, R.; Baumgaertel, G. (International Atomic Energy Agency, Vienna (Austria)). 1977. 9p. (CONF-770505--29). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

An important basis for the planning and construction of a large 1400 t U/year reprocessing plant, scheduled for start-up around 1986, is the R and D work of the Karlsruhe Nuclear Research Centre and the experience gained from operation of the pilot reprocessing plant WAK at the same site. During the first 5 years of its operation since September 1971, the WAK plant, with a nominal capacity of 35 t U/year, has successfully demonstrated the feasibility of the PUREX technology for reprocessing of high burnup LWR-fuels. Substantial improvements have been achieved in fuel handling techniques, head-end treatment, performance of high activity extraction equipment, waste decrease by internal recycle, and iodine retention. Operating and maintenance experience has allowed a continuing reduction of radiation doses to plant personnel to a level as low as 13% of the maximum permissible limits. Future work will include retention of krypton-85 from dissolver off-gases and reprocessing of mixed-oxide-fuels from the German Plutonium-Recycle program. Development work on fuel reprocessing technology is aimed at the minimization of radioactive wastes, the minimization of environmental releases, and the increase of operational safety and reliability. Based on experience which has been gained by reprocessing campaigns with LWR fuels up to 37000 MWd/t and FBR fuel up to 61000 MWd/t in the MILLI facility and by 'cold' runs on the pilot plant scale, progress is reported on (1) improved procedures for off-gas treatment and purification, (2) dissolution and solvent extraction of high-burn-up fuels, (3) application of 'salt-free' procedures in U/Pu separation, Pu reoxidation and purification, absorbing construction material for criticality control.

561 (CONF-771008--5) RADIOLOGICAL ENVIRONMENTAL ASSESSMENT OF THE RECYCLE OF LMFBR ADVANCED FUELS. Tennery, V.J.; Bomar, E.S.; Till, J.E.; Morse, L.E.; Pobereskin, M.; Madia, W.J. (Oak Ridge National Lab., Tenn. (USA); Battelle Columbus Labs., Ohio (USA)). 1977. Contract W-7405-ENG-26. 21p. Dep. NTIS, PC A02/MF A01.

From International meeting on advanced LMFBR fuels; Tucson, AZ, USA (10 Oct 1977).

The environmental impact resulting from the release of radioactive material during reprocessing and refabrication of spent LMFBR advanced fuels was compared with that from similar treatment of reference oxide fuel. Candidate advanced fuels include carbide [(U,Pu)C] in addition to nitride [(U,Pu)N] with selected concentrations of ¹⁵N. Several techniques for preparing enriched ¹⁵N were reviewed and estimates were made of the cost of preparing nitrogen enriched to greater than 99 percent by each method. Core neutronics, fuel management, and designs appropriate for each fuel were used with the ORIGEN code to calculate the compositions of spent core and blanket fuel. The mass of fuel recycled annually was that providing 50 GW(e)-years of energy at the burnup attained by each fuel. Confinement factors for each isotope were identified for reprocessing and refabrication operations and were used to calculate source

terms describing isotopic release rates. These source terms were used in the AIRDOS-II code to estimate the 50-year dose to the maximally exposed individual and to both the local and world populations. Total body dose commitments to the maximally exposed individual for oxide and carbide fuels are about 2.8 millirem, while nitride fuel would result in a range of 59 to 3.4 millirem as the ¹⁴N content in fresh fuel is varied from 99.64 percent to zero.

562 (IAEA-CN--36/280) NEW APPROACHES TO DERIVING LIMITS OF THE RELEASE OF RADIOACTIVE MATERIAL INTO THE ENVIRONMENT. Lindell, B. (International Atomic Energy Agency, Vienna (Austria)). 1977. 17p. (CONF-770505--105). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

During the last few years, new principles have been developed for the limitation of the release of radioactive material into the environment. It is no longer considered appropriate to base the limitation on limits for the concentrations of the various radionuclides in air and water effluents. Such limits would not prevent large amounts of radioactive material from reaching the environment should effluent rates be high. A common practice has been to identify critical radionuclides and critical pathways and to base the limitation on authorized dose limits for local 'critical groups'. If this were the only limitation, however, larger releases could be permitted after installing either higher stacks or equipment to retain the more short-lived radionuclides for decay before release. Continued release at such limits would then lead to considerably higher exposure at a distance than if no such installation had been made. Accordingly there would be no immediate control of overlapping exposures from several sources, nor would the system guarantee control of the future situation. The new principles described in this paper take the future into account by limiting the annual dose commitments rather than the annual doses. They also offer means of controlling the global situation by limiting not only doses in critical groups but also global collective doses. Their objective is not only to ensure that individual dose limits will always be respected but also to meet the requirement that 'all doses be kept as low as reasonably achievable'. The new approach is based on the most recent recommendations by the ICRP and has been described in a report by an IAEA panel (Procedures for establishing limits for the release of radioactive material into the environment). It has been applied in the development of new Swedish release regulations, which illustrate some of the problems which arise in the practical application.

563 (IAEA-CN--36/292) METHODS OF ESTABLISHING LIMITS ON DISCHARGE TO THE ENVIRONMENT OF RADIOACTIVE MATERIAL EMERGING FROM THE FUEL CYCLE. Sitzlack, G.; Neumeister, K.; Rabold, H.; Krueger, F.W. (International Atomic Energy Agency, Vienna (Austria)). 1977. 11p. (CONF-770505--110). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

From all fuel cycle stages, small amounts of radioactive materials are released to the environment. In the phases of ore mining, milling and enrichment as well as of fuel element fabrication, mainly isotopes of the uranium decay series and uranium itself are

released. During reactor operation the discharges of fission products, especially of radioactive noble gases and ^{131}I as well as T , and of activated corrosion products are of major interest. In reprocessing, the isotopes ^{85}Kr , ^{129}I , ^{106}Ru , T and ^{131}I must be taken into account. The discharges can considerably be influenced by adequate design of systems for treatment of effluents and by the mode of operation. To determine discharge limits it is usual to develop exposure models. Taking into consideration the dispersion of radioactive substances and possible exposure pathways these models allow to calculate the radiation exposure of man to be expected due to given discharges. The calculating models for individual exposure pathways are largely standardized. By means of the exposure model the environmental capacity to receive radioactive materials can be determined, i.e. the discharge rate which will result in the maximum permissible radiation exposure of man. In general, with regard to the discharge limitation every radiation exposure is to be considered as noxious. Thus the environmental capacity calculated on the basis of internationally recommended maximum permissible limits for the somatic and genetic radiation exposure is only used as an upper limit which in no case may be exceeded. For the discharge limitation, further criteria from technical, economic and social fields are taken into consideration. These criteria can be quantified to a limited degree only and, depending on the economic importance of nuclear power use, on public acceptance and other factors, they are subject to national and possibly local influences.

- 564 (DP-MS--77-18) MODEL TO PROJECT DOSE-TO-MAN FROM BURIED SOLID WASTE. Wilhite, E.L. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). 1977. Contract EY-76-C-09-0001. 17p. (CONF-770512--10). Dep. NTIS, PC A02/MF A01.

From Symposium on management of low level radioactive waste; Atlanta, GA, USA (23 May 1977).

To plan for the postoperational surveillance and control of the Savannah River Plant solid waste burial site, a model is being developed to simulate movement of radionuclides from buried solid waste through the environment to man. Results from the study of the model will be used to validate current operating limits for burial and to establish criteria for future surveillance and control. A preliminary model has been formulated to estimate the rate and extent of ^{90}Sr movement through a set of aquatic (ground water, creeks, and river) and terrestrial (vegetation, animals, and dust) pathways. Estimates based on pessimistic assumptions show that drinking water from the shallow ground water table in the burial region is the critical pathway for dose-to-man. Current and planned experimental programs to refine model parameters will be presented.

- 565 (IAEA-CN--36/9) COLLECTIVE DOSE COMMITMENTS FROM NUCLEAR POWER PROGRAMMES. Beninson, D.; Bennett, B.; Webb, G. (International Atomic Energy Agency, Vienna (Austria)). 1977. 14p. (CONF-770505--113). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

The concepts of collective dose and collective dose commitment are discussed, particularly regarding their use to compare the relative importance of the exposure from several radiation sources and to predict future

annual doses from a continuing practice. The collective dose commitment contributions from occupational exposure and population exposure due to the different components of the nuclear power fuel cycle are evaluated. A special discussion is devoted to exposures delivered over a very long time by released radionuclides of long half-lives and to the use of the incomplete collective dose commitment. The maximum future annual "per caput" doses from present and projected nuclear power programmes are estimated.

- 566 (IAEA-CN--36/114) METHODS AND PRACTICE IN THE EVALUATION OF POTENTIAL RADIATION EXPOSURE AROUND NUCLEAR INSTALLATIONS IN THE FEDERAL REPUBLIC OF GERMANY. Becker, A.; Franzen, L.F.; Handge, P.; Meurin, G. (International Atomic Energy Agency, Vienna (Austria)). 1977. vp. (CONF-770505--56). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

The estimation and evaluation of potential radiation exposure around nuclear installations resulting from airborne and aquatic releases of radioactivity has always been included in the Nuclear Authorization Procedures (atomrechtliches Genehmigungsverfahren) in the Federal Republic of Germany. Basic investigations have shown that first of all the radiological burden is expected via the pathway of external radiation exposure. Since about 1970 the pasture - cow - milk - pathway has been accorded an increased importance by introducing a corresponding dose rate guideline for the thyroid burden. With the rapid increase of energy production from nuclear power plants, a detailed analysis of the environmental radiological burden possibly brought about by these facilities was inserted into the Nuclear Authorization Procedures. In order to estimate in detail the consequences resulting from the release of radioactivity, nowadays the potential radiation exposure for a site is evaluated for exposures resulting from airborne discharges and for exposures resulting from aquatic discharges. Furthermore, some other pathways of exposure depending on local characteristics are taken into account. Particularly, extensive inquiry is needed concerning the deposition of radionuclides and the reconcentration by food chains. The choice of appropriate parameters often is difficult as site-specific values are not available. The determination of critical population groups and critical persons and their behavioral or dietary habits results in comparable difficulties.

- 567 (IAEA-CN--36/205) DIFFERENTIAL COST-BENEFIT CONSIDERATIONS IN CONNECTION WITH GLOBAL COLLECTIVE DOSE COMMITMENTS FROM RELEASE OF LONG LIVED RADIO NUCLIDES. Gjoerup, H.L. (International Atomic Energy Agency, Vienna (Austria)). 1977. 12p. (CONF-770505--114). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

The concept of global collective dose commitment as a measure of total detriment from the release of radioactivity to the environment is outlined. Estimates are given of global collective dose commitments resulting from the release of ^{14}C and uranium daughter products in connection with the nuclear fuel cycle. Comparisons are made with similar estimates of global collective dose commitments resulting from the use of fossil fuels and certain fertilizers due to their content of uranium and

its daughter products. In the case of long-lived radio nuclides that remain in circulation in the biosphere, it is shown that the use of global collective dose commitments in differential cost-benefit analysis can lead to questionable results. In differential cost-benefit analysis it is suggested that population exposures should not simply be integrated irrespective of their time of occurrence, but that a certain discount rate should be applied for future doses. The reasonableness of this suggestion is examined.

- 568 (IAEA-CN--36/488) BASES FOR ESTABLISHING RADIATION EXPOSURE LIMITS. Pochin, E.E. (International Atomic Energy Agency, Vienna (Austria)). 1977. 9p. (CONF-770505--106). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

It is an essential requirement of good radiation protection that all unnecessary exposure of people should be avoided and that any necessary exposure, whether of workers or of members of the general public, should be minimised. It is, however, an additional requirement that such necessary exposures should not exceed certain stated limits. There is increasing quantitative evidence on the frequency on which harm, and particularly the induction of malignancies, may be caused in people exposed to radiation at high doses; and somewhat clearer bases than previously for inferring the possible frequencies at low doses. It is therefore easier to assess the degree of safety ensured by restricting radiation exposure to particular levels. The degree of safety which should be regarded as appropriate in different circumstances remains a matter for review, but suggestions are made as to levels which would be advocated by informed opinion, and the exposure limits which would correspond to these. Increasing epidemiological evidence is available on the relative sensitivity to radiation induction of malignancies in a number of organs, and to the apparently much lower sensitivity of other organs; and experimental evidence in animals allows a comparable estimate of the frequency of genetic harm resulting from irradiation of gonadal tissues.

- 569 (IAEA-CN--36/557) RADIOACTIVE EFFLUENTS AND PRESENT AND FUTURE RADIATION EXPOSURE TO THE POPULATION FROM NUCLEAR FACILITIES IN THE FEDERAL REPUBLIC OF GERMANY. Bonka, H.; Edelhauser, H.; Gans, I.; Wolter, R.; Huber, O.; Vogt, K.J. (International Atomic Energy Agency, Vienna (Austria)). 1977. vp. (CONF-770505--58). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

At this time ten light water cooled nuclear power plants are operated outside of nuclear research centers in the Federal Republic of Germany. A review of the releases of radioactivity in gaseous and liquid effluents shows that increasing operational experience and improved technology combined with restrictive licensing policy and comprehensive control systems have resulted in decreasing release rates. Therefore radiation exposure to the population and critical groups calculated from these release rates on a local scale via different exposure pathways have been low until now. Predictions of future radiation exposure are based on the energy program of the Federal Republic of Germany up to 1985 and continuing

forecasts for future energy demands, release rates of new reactor types and reprocessing plants being taken into account. In calculations of exposures to the population local models are combined with regional models superimposing contributions from sources in the Federal Republic and neighbouring countries and with a global multi-compartment model. If, with view to a continued development of the present state of science and technology in connection with major reprocessing plants, retention rates from 90-99% are assumed to be obtainable for H 3 and Kr 85, 99,5-99,9% for iodine and approximately 90% for C 14 from reprocessing plants, it can be demonstrated that also the future radiation exposure can be kept below the dose limits established in the Federal Republic of Germany.

- 570 (TID--3352) OCCUPATIONAL HEALTH ASPECTS OF URANIUM. A SELECTED BIBLIOGRAPHY. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). 1977. 129p. Dep. NTIS, PC A07/MF A01.

The bibliography contains 716 references selected from Volumes 1 through 33 (1948--1976) of Nuclear Science Abstracts. Citations of foreign and domestic research reports, journal articles, patents, conferences, and books are included. (JRD)

- 571 Atomsicherheit und Strahlenschutz. Vorschriften, Normative, Grenzwerte. (NUCLEAR SAFETY AND RADIATION PROTECTION. REGULATIONS, STANDARDS, LIMITING VALUES). Sitzlack, G. (ed.). Berlin; Staatsverlag der Deutschen Demokratischen Republik (1977). 464p. (In German).

The second edition of this compilation contains the full texts of GDR's regulations and standards in radiation protection and allied fields concerning the establishment of exclusion areas around nuclear plants, liability for radiation damages, nuclear materials control, nuclear plant licensing, construction of nuclear power plants with PWR, environmental monitoring, operation of x-ray machines, handling of sealed and unsealed radiation sources, transport of radioactive materials, prototype testing, testing of sealed radiation sources, construction and equipment of radioisotope laboratories and irradiation installations determination of surface contamination, radioactive waste management, personnel monitoring, medical surveillance, emergency procedures, therapy with ionizing radiation, and radiopharmaceuticals.

- 572 ECONOMICS OF DECONTAMINATION OF NUCLEAR POWER PLANTS. Synder, T.L. (Catalytic, Inc., Philadelphia); Alvarez, D.L.; Harrison, G.J. Trans. Am. Nucl. Soc.; 27: 842-843(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109--.

NUCLEAR POWER PLANTS; PRIMARY COOLANT CIRCUITS; DECONTAMINATION; COST; ECONOMICS; CORROSION PRODUCTS; ACTIVITY LEVELS; PERSONNEL; RADIATION DOSES

- 573 (IAEA-CN--36/233) PHENIX LIQUID METAL FAST BREEDER POWER PLANT. RADIOACTIVE EFFLUENTS RELEASE AND OPERATION TEAM IRRADIATION RESULTS AFTER TWO YEARS OF INDUSTRIAL OPERATION. Megy, J.; Conte, F.; Goddet, J. (International Atomic Energy Agency, Vienna (Austria)). 1977. 6p. (In French). (CONF-770505--84). NTIS (US Sales Only), PC

A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

The increasing number of nuclear power plants necessitates reduction to as low as possible the release of radioactive effluents. On the other hand, during operation, the operation teams undergo irradiation due to work on active components, particularly for repair or maintenance. For economic as well as general social reasons, it is important to reduce as much as possible these levels of irradiation. So far, the radioactive effluent releases and the radiation exposure levels are widely dependent upon the type of reactor. The design of the PHENIX LMFBR allowed the liquid effluents to be very small, low gaseous effluents, and low irradiation levels, due particularly to the pool design and the in-sodium fuel handling. After more than two years of normal industrial operation with high load factor, the results confirm predictions. The recorded figures.

- 574 (DOCKET-50259--970) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. RADIOLOGICAL IMPACT ASSESSMENT: JULY--DECEMBER 1976 (RH-77-1-BF-1). (Tennessee Valley Authority, Chattanooga (USA)). 1977. 29p. (DOCKET-50260--738; DOCKET-50296--430).

Radiological impact assessment: July--December 1976 (RH-77-1-BF-1). BROWNS FERRY-1 REACTOR; BROWNS FERRY-2 REACTOR; BROWNS FERRY-3 REACTOR; RADIATION DOSES; PERSONNEL; DATA; METEOROLOGY; RADIOACTIVE EFFLUENTS; STACK DISPOSAL; ACTIVITY LEVELS

- 575 (DOCKET-50259--971) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. ANNUAL OPERATING REPORT: JANUARY--DECEMBER 1976. (Tennessee Valley Authority, Chattanooga (USA)). 1977. 101p. (DOCKET-50260--739; DOCKET-50296--431).

Units 1 and 2 were down for the first half of the year caused by the fire of March 1975. Net electrical power generated by Unit 1 this year was 1,361,183 MWH with the generator on line 2,175.25 hrs. Unit 2 generated 1,567,170 MWH with the generator on line 2,548.73 hrs. Unit 3 began full power operation on November 20th and generated 1,416,891 MWH with the generator on line 2,058.20 hrs. Information is presented concerning operations, fuel performance, surveillance testing, containment leak testing, changes, power generation, shutdown and forced reductions, coolant chemistry, occupational radiation exposures, and maintenance. (FS)

- 576 (ZAED-tr--77/1) BASIC PRINCIPLES OF THE PREVENTION OF RADIATION EXPOSURE OF PERSONNEL AND POPULATION DURING NUCLEAR POWER PLANT ACCIDENTS. Turkin, A.D.; Sayapin, N.P.; Turovskii, V.D.; Luzanova, L.M. (Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Eggenstein-Leopoldshafen (Germany, F.R.)). 1977. 13p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

The developments in nuclear engineering and the erection of nuclear power plants in densely populated areas make it necessary to draw up and apply special measures for the protection of the operating personnel, the population and the environment during the various states of operation of a nuclear power plant. Safe operation of nuclear power plants without radiation hazards is guaranteed by intensive and complex technical, medical, and organisational measures. The paper points out the main tendencies for the protection of the

personnel exposed to radiation and of the population in cases of nuclear power plant accidents. These accidents fall into five categories which must be taken into consideration already in the planning stage and during power plant operation. Some questions of the application in practice of necessary accident prevention measures are dealt with. The reliability and unproblematic nature of existing nuclear power plants with regard to radiation hazards is stressed.

- 577 CONTROLLING OCCUPATIONAL RADIATION EXPOSURE AT OPERATING NUCLEAR POWER STATIONS. Dickson, H.W.; Oakes, T.W.; Shank, K.E. (Oak Ridge National Lab., TN). Nucl. Saf.; 18: No. 4, 492-501(1977).

The historical development of the philosophy of keeping the radiation exposure of workers at light-water reactors as low as reasonably achievable (ALARA) is presented. A review is made of some of the ALARA activities of the Nuclear Regulatory Commission, the Energy Research and Development Administration, and various nuclear installations. Data compiled by the NRC show that routine and special maintenance at light-water reactors accounts for 72 percent of all occupational exposure at these sites. The role that Oak Ridge National Laboratory has taken in ALARA research is presented, with emphasis placed on a study of valve malfunctions at light-water reactors. The valve study indicates a trend toward decreasing valve reliability over the past few years. Finally a cost--benefit analysis of radiation dose reduction is discussed. The rationale for assigning a cost per man-rem based on the radiation exposure level that is encountered is presented.

- 578 OCCUPATIONAL RADIATION EXPOSURES AT LICENSED FACILITIES, 1975. Brooks, B.G. Nucl. Saf.; 18: No. 4, 523-526(1977).

Personnel occupational radiation exposures for calendar year 1975 were obtained from annual and termination reports submitted by various types of Nuclear Regulatory Commission licensees, including nuclear power plants and industrial radiographers, as well as fuel and by-product processors, fabricators, and reproducers. Annual reports received from 387 licensees indicated that some 78,713 individuals, who incurred an average exposure of 0.36 rem, were monitored for exposure to radiation during 1975 and that 21,601 individuals terminated their employment or work assignment in 1975. The number of personnel overexposures reported in 1975 decreased from previous years.

- 579 SELECTED SAFETY-RELATED OCCURRENCES REPORTED IN MARCH AND APRIL 1977. Casto, W.R. (comp.). Nucl. Saf.; 18: No. 4, 548-552(1977).

The following occurrences are briefly reviewed: (1) a series of overexposures to personnel handling radiographic sources, (2) damage to a diesel during testing of emergency generators at Millstone-2, (3) a diesel generator fire at Zion-2, and (4) improper operation of the engineered safeguards actuation system at Millstone-2 due to faulty under-voltage trip logic. (DG)

- 580 FORECAST OF THE ATMOSPHERIC DIFFUSION OF POLLUTANTS AFTER HYPOTHETICAL ACCIDENTS AT NUCLEAR PLANTS. Vogt, S. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). Atomkernenergie; 29: No. 4, 282-286(1977).

(In German).

The forecast of atmospheric diffusion described here allows statements to be made about the size and location of the area in which maximum radiation burdens have to be expected from emission after an accident. If the source strength can be estimated from the course of the accident, the value of the maximum burden to be expected can be predicted in addition. Based on these statements, first effective actions can be taken to protect the population in case of serious hypothetical accidents.

581 OCCUPATIONAL RADIATION EXPOSURES AT LIGHT-WATER-COOLED POWER REACTORS, 1969--1975.

Murphy, T.D.; Dayem, N.J.; Bland, J.S.; Pasciak, W.J. (Nuclear Regulatory Commission, Washington, DC). Nucl. Saf.; 18: No. 3, 365-369(1977).

The article is a compilation of occupational radiation exposures at commercial light-water-cooled reactors (LWRs) from 1969 to 1975 and updates previous information that covered exposures through 1974. The information was derived from reports submitted to the Nuclear Regulatory Commission in accordance with requirements of individual plant technical specifications and the Code of Federal Regulations. The collective dose to personnel (man-rem per reactor per year) at LWRs was greater in 1975 than in 1974. Although the average exposure per individual remained at 0.8 rem/year, the average number of personnel receiving measurable exposures per reactor increased in 1975.

582 TVA'S SYSTEM FOR MANAGING OCCUPATIONAL EXPOSURE INFORMATION. Wilkie, W.H.; Kingery, E.V.; Hasseltine, M.T. (Tennessee Valley Authority, Chattanooga). Trans. Am. Nucl. Soc.; 27: 766(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109--.

NUCLEAR POWER PLANTS; PERSONNEL; RADIATION DOSES; TENNESSEE VALLEY AUTHORITY; PERSONNEL MONITORING; DATA COMPILATION

583 OCCUPATIONAL RADIATION EXPOSURE AT FRENCH POWER PLANTS: MEASUREMENT AND PREDICTION.

Beslu, P. (Cadarsache, Saint-Paul-Lez-Durance, France); Frejaville, G.; Jeanson, P. Trans. Am. Nucl. Soc.; 27: 766-767(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109--.

NUCLEAR POWER PLANTS; PERSONNEL; RADIATION DOSES; FRANCE; REACTOR COOLING SYSTEMS; ACTIVITY LEVELS

584 TECHNIQUES TO REDUCE OCCUPATIONAL RADIATION EXPOSURES. Lutz, R.J. Jr.

(Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc.; 27: 768-769(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109--.

PWR. PWR TYPE REACTORS; PERSONNEL; RADIATION DOSES; REACTOR MAINTENANCE; REACTOR FUELING; STEAM GENERATORS

585 TISSUE-SEQUESTERED GROUP III-A METALS: DILUTE, HIGH TEMPERATURE NH₄SCN FOR SIMULTANEOUS MEASUREMENT OF IN AND GA BY PHASE-SELECTIVE STRIPPING VOLTAMMETRY. Moorhead, E.D.; Doub, W.H. Jr. (Univ. of Kentucky, Lexington). Anal. Lett.; 10: No. 9, 673-684(1977).

Clinical studies have heavily relied on radioanalytical measurements to monitor ¹¹¹In tissue uptake and its cytotoxicity on malignant neoplasms, with substantially opposite analytical conclusions regarding the effect of this Group III-A element compared to the growth inhibiting influence displayed by tissue-sequestered ⁶⁷Ga. Evidence shown here would indicate that both Ga and In present at trace and ultratrace levels in prepared biological material are susceptible to precise, simultaneous measurement with rapid scan, phase-selective anodic stripping (PSAS) using novel conditions recently developed for producing electrochemically reversible Ga behavior without use of densely concentrated electrolytes.

586 (BNL--22307) HIGH EFFICIENCY MIXED SPECIES RADIOIODINE AIR SAMPLING, READOUT, AND DOSE ASSESSMENT SYSTEM. Distenfeld, C.H.; Klemish, J.R. Jr. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. EY-76-C-02-0016. 12p. (IAEA-SM--125/20; CONF-770220--3). Dep. NTIS, PC A02/MF A01.

From International symposium on the handling of radiation accidents; Vienna, Austria (2 Feb 1977).

Accidental releases of radioactivity from fission reactors will consist of active vapors or aerosols. Composition of the released plume will depend on the energy of release and fission product volatility. An apparatus is described that can efficiently (95 percent) collect organic or inorganic, particulate or gaseous ¹³¹I in the usual concentration range including that below stable atmospheric iodine, and under severe ambient conditions. Response to noble fission gases was reduced to less than 10⁻⁴ of an equal iodine airborne activity by heating the collector to approximately 120°C in clean purging air flowing at .14 m³/min for 11 min. Reliable sample size, ±5 percent, was achieved by using a sample air flow regulator. Thyroid dose commitment was mathematically and graphically related to the iodine isotope distribution expected in the environment and to the response of the Civil Defense CDV-700 instrument used to evaluate the sample. Sensitivity of the method allows dose assessment of 1-2 rads to a child's thyroid.

587 (DP-MS--77-116) ATMOSPHERIC TRANSPORT OF RADIONUCLIDES. Crawford, T.V. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA)). Savannah River Lab.). 1977. Contract EY-76-C-09-0001. 30p. Dep. NTIS, PC A03/MF A01.

The chairman and contributors are members of the Working Group on Atmospheric Dispersion, Deposition, and Resuspension. This group examined the mathematical approaches for determining the direct and indirect pathways to man of releases of pollutants to the atmosphere. The dose-to-man limitations promulgated by the Nuclear Regulatory Commission, the Environmental Protection Agency, and the Energy Research and Development Administration were presented. The present status of research was discussed, and recommendations for future work were made. Particular emphasis was placed on the need for additional experimental work to develop confidence limits leading to acceptable probability statements of critical pathways for determining the dose-to-man.

588 (SAND--77-0854C) SIMULATED ATMOSPHERIC DISPERSION OF RADIOACTIVE MATERIAL RELEASED IN AN URBAN AREA. Akins, R.E.; Church, H.W.; Tierney, M.S. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-

0789. 4p. (CONF-771113--5). Dep. NTIS, PC A02/MF A01.

From 4. joint conference on sensing of environmental pollutants; New Orleans, LA, USA (6 Nov 1977).

A combination of Gaussian plume and particle-in-cell techniques is used to simulate the atmospheric transport and dispersion of a puff release of radioactive material. The release is caused by an accident that is assumed to occur during the shipment of the radioactive material through central New York City. The simulation provides estimates of volumetric and surface concentrations of the dispersed material that are used to predict radiation doses incurred by the City's population in the event of an accidental release. In the simulation, the release point is arbitrary and the material is assumed to be either a gas or fine particles. The Gaussian plume model follows cloud concentrations from the release time until times when transport over distances up to 500 m has been achieved. The released cloud may stabilize at street level or above the mean buildings height; at a street intersection or in the middle of the block. The possibility of the formation of multiple clouds, owing to circumstances of wind flow direction and street geometry, is allowed.

589 COMPUTER CODES FOR THE ASSESSMENT OF RADIONUCLIDES RELEASED TO THE ENVIRONMENT. Hoffman, F.O. (Oak Ridge National Lab., TN); Miller, C.W.; Shaeffer, D.L.; Garten, C.T. Jr. Nucl. Saf.; 18: No. 3, 343-354(1977).

This article presents a compilation of computer codes that may be used for the assessment of accidental or routine releases of radioactivity to the environment from nuclear power facilities. The capabilities of 83 computer codes in the areas of environmental transport and radiation dosimetry are summarized in tabular form. This preliminary analysis clearly indicates that the initial efforts in assessment methodology development have concentrated on atmospheric dispersion, external dosimetry, and internal dosimetry via inhalation. The incorporation of terrestrial and aquatic food-chain pathways has been a more recent development and reflects the need for satisfying the current requirements of environmental legislation and the needs of regulatory agencies. The characteristics of the conceptual models employed by these codes are reviewed.

590 (CONF-770676--1) CONCENTRATIONS OF RADIONUCLIDES AND SELECTED STABLE ELEMENTS IN FRUITS AND VEGETABLES. Oakes, T.W.; Shank, K.E. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 16p. Dep. NTIS, PC A02/MF A01.

From 11. annual conference on trace substances in environmental health; Columbia, MO, USA (7 Jun 1977).

Twenty-two types of fruits and vegetables collected from two commercial supermarkets have been analyzed for their radionuclidic and stable-element composition. A specific gamma-emitting isotope analysis was performed on each sample for ^{40}K , ^{60}Co , $^{95}\text{Zr-Nb}$, ^{106}Ru , ^{137}Cs , ^{226}Ra , and ^{232}Th . The concentration of the stable elements in each sample were determined using multi-element neutron-activation analysis (Al, Ag, Au, As, Ba, Br, Ca, Ce, Cl, Co, Cr, Cs, Cu, Eu, Fe, Hf, I, K, La, Mn, Mo, Mg, Na, Rb, Sb, Sc, Se, Sr, Ta, Te, Th, Ti, Zn, Zr) and atomic absorption (Cd, Ni, Pb). Information on the composition of a typical diet is used to estimate the radiological dose to man subsequent to ingestion of these fruits and vegetables. The stable-elemental compositions

of the foodstuffs analyzed were compared with estimated values assuming foliar deposition and long-term buildup of effluents from a large modern coal-fired steam plant. It is tentatively concluded that for the general case of a precipitator-equipped, coal-fired steam plant, no toxic levels of trace elements in foodstuffs are expected as a result of the plant operation.

591 (DP-MS--76-89) ASSESSMENT OF POTENTIAL RADIATION DOSE-TO-MAN FROM AN ACUTE TRITIUM RELEASE INTO A FOREST ECOSYSTEM. Watts, J.R.; Murphy, C.E. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). 1977. Contract EY-76-C-09-001. 14p. (CONF-770720--3). Dep. NTIS, PC A02/MF A01.

From 22. annual meeting of the Health Physics Society; Atlanta, GA, USA (3 Jul 1977).

On May 2, 1974, 479,000 curies of tritium gas escaped from a Savannah River Plant exhaust stack. The tritium first reached the ground in a pine forested area and was partially assimilated into the ecosystem. Samples of vegetation collected and measured for a period of 70 days showed an increase in the levels of tritiated water. Cycling of the tritium retained in the forest ecosystem resulted in a higher concentration of tritiated water vapor in the air at breathing height near the forest floor than that calculated by the usual models used for predicting air concentration. In addition, the model for tritium cycling in the forest predicts a diurnal cycle of tritiated water vapor concentration with higher concentrations at night when air movement under the canopy is slower. The potential dose to the maximum individual because of inhalation and skin absorption of tritium as HTO after the release was calculated three ways: by using the body water model from the International Commission on Radiological Protection (ICRP) Publication 2 and assimilation during the passage of the puff; by using the body water model from the ICRP Publication 2 and assimilation during an extended exposure period to tritium determined by the experimental measurements; and by using a three-compartment dosimetry model with retention half times of 9, 30, and 450 days with the extended exposure period. The potential doses were 0.14, 0.80, and 0.89 mrem, respectively. These potential doses show the necessity of considering the interaction of radioactive material with the ecosystem for dose calculation.

592 (CONF-770409--11) PLUTONIUM AND AMERICIUM IN THE FOODCHAIN LICHEN-REINDEER-MAN. Jaakkola, T.; Hakanen, M.; Keinonen, M.; Mussalo, H.; Miettinen, J.K. (Helsinki Univ. (Finland). Dept. of Radiochemistry). 1977. Contract EY-76-C-02-3011. 4p. Dep. NTIS, PC A02/MF A01.

From 4. congress of the International Radiation Protection Agency; Paris, France (24 Apr 1977).

The atmospheric nuclear tests have produced a worldwide fallout of transuranium elements. In addition to plutonium measurable concentrations of americium are to be found in terrestrial and aquatic environments. The metabolism of plutonium in reindeer was investigated by analyzing plutonium in liver, bone, and lung collected during 1963-1976. To determine the distribution of plutonium in reindeer all tissues of four animals of different ages were analyzed. To estimate the uptake of plutonium from the gastrointestinal tract in reindeer, the tissue samples of elk were also analyzed. Elk which is of the same

genus as reindeer does not feed on lichen but mainly on deciduous plants, buds, young twigs, and leaves of trees and bushes. The composition of its feed corresponds fairly well to that of reindeer during the summer. Studies on behaviour of americium along the foodchain lichen-reindeer-man were started by determining the Am-241 concentrations in lichen and reindeer liver. The Am-241 results were compared with those of Pu-239,240. The plutonium contents of the southern Finns, whose diet does not contain reindeer tissues, were determined by analyzing autopsy tissue samples (liver, lung, and bone). The southern Finns form a control group to the Lapps consuming reindeer tissues. Plutonium analyses of the placenta, blood, and tooth samples of the Lapps were performed.

- 593 BIOLOGICAL AND SEROLOGICAL CHARACTERIZATION OF THE C-TYPE RNA VIRUSES ISOLATED FROM THE C57BL/KA STRAIN OF MICE; 2. INDUCTION AND PROPAGATION OF THE ISOLATES. Lieberman, M.; Decleve, A.; Gelmann, E.P.; Kaplan, H.S. (Stanford Univ., Calif. (USA). Dept. of Radiology). pp 231-246 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From Symposium on radiation-induced leukemogenesis and related viruses; Bordeaux, France (7 Dec 1976).

See CONF-761212--.

Several classes of C-type RNA viruses have been isolated from the tissues of C57BL/Ka mice. Normal lymphocytes and haemopoietic tissues, lymphoid tumors induced by x-rays or virus inoculation, and embryo fibroblast cultures have yielded an array of virus preparations with distinct biological and serological characteristics. The type of virus isolated depends on the cell of origin and on the procedures used for viral induction, isolation, and propagation. Parallel studies in vivo and in vitro indicate that some isolates are thymotropic and leukemogenic (TL+), while others which replicate well on fibroblastic cells in vitro (fibrotropism) lack TL activity in vivo. The thymotropic, leukemogenic isolates lose their TL activity, partially or totally, when passaged in fibroblastic cells, and the emerging virus has significantly different characteristics. This report describes the procedures of induction, isolation, and propagation which yield these two distinctively different classes of virus isolates, and characterizes their biological activities in vivo and in vitro.

- 594 BIOLOGICAL AND SEROLOGICAL CHARACTERIZATION OF THE C-TYPE RNA VIRUSES ISOLATED FROM THE C57BL/KA STRAIN OF MICE; 1. INFLUENCE OF SOME CHEMICAL AND PHYSICAL AGENTS ON THE QUANTITATION OF MURINE C-TYPE RNA VIRUSES IN VITRO. Niwa, O.; Decleve, A.; Kojola, J.; Kaplan, H.S. (Stanford Univ., Calif. (USA). Dept. of Radiology). pp 213-229 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From Symposium on radiation-induced leukemogenesis and related viruses; Bordeaux, France (7 Dec 1976).

See CONF-761212--.

Experiments reveal that several factors such as cell growth rate, initial cell number, adsorption time, thermal inactivation, uv and x-ray inactivation, and x-ray or IUDR treatment of host cells all exert significant effects on murine C-type RNA virus growth and quantitation in cell cultures in vitro. These data have firmly established the basis of the assay

systems developed by the authors and now commonly used in biological studies on virus isolates from the C57BL/Ka strain of mice. The RadLV was used in this strain of mice to render the BL/Ka(6) isolates.

- 595 EFFECT OF CYSTEAMINE ON REPAIR OF SINGLE-STRAND DNA BREAKS IN AN IRRADIATED CULTURE OF CHINESE HAMSTER FIBROBLASTS. Veksler, F.B.; Eidus, L.Kh.; Kondakova, N.V. (Inst. of Biological Physics, Pushchino, USSR). Radiobiology (USSR) (Engl. Transl.); 17: No. 2, 38-43(1977).

Translated from Radiobiologiya; 17: No. 2, 191-195(1977).

Studies were made of dynamics of repair of single-stranded DNA breaks in irradiated Chinese hamster cells, and effects of cysteamine. It was demonstrated that the rate of repair changes 10-15 min after radiation. In the case of intensive development of nonspecific reaction (pH 7.2-7.3) to cysteamine (5.10^{-2} M), the latter inhibits the repair process within the first minutes after radiation; at a pH of 6.8, i.e., with slow development of the nonspecific reaction, cysteamine does not affect repair. Reversibility of inhibited repair due to cysteamine was demonstrated by removal of the latter after treatment of cells for 20 or 45 min. The longer the time of prior cysteamine treatment, the slower the subsequent repair. The submitted data demonstrate a correlation between the effect of cysteamine and patterns of development of the nonspecific reaction.

- 596 (CONF-770337--1) RADIATION INDUCED CHROMOSOME ABERRATIONS IN SOMATIC AND GERM CELLS OF THE MALE MARMOSSET. Brewen, J.G.; Preston, R.J. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 13p. Dep. NTIS, PC A02/MF A01.

From Conference on marmosets in experimental medicine; Basel, Switzerland (16 Mar 1977).

The induction of chromosome aberrations by low LET radiations was studied in peripheral lymphocytes and spermatogonial stem cells of the male marmoset. The data showed that there was no significant difference in the sensitivity of the lymphocytes whether they were irradiated in vitro or in vivo, but the frequency of heritable translocations recovered in the primary spermatocytes was considerably lower than that calculated to occur in the lymphocytes. The data are used to make estimates of human genetic risk from radiation based on limited interspecific comparisons.

- 597 (CONF-770718--1) X-RAY-INDUCED CHROMOSOME ABERRATIONS IN THE LEUKOCYTES OF MOUSE AND MAN. Preston, R.J.; Brewen, J.G. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 16p. Dep. NTIS, PC A02/MF A01.

From Symposium on actions of physical and chemical mutagens on the somatic chromosomes of man; Edinburgh, UK (7 Jul 1977).

In our earlier studies we showed that the frequency of dicentrics induced by x-rays in human leukocytes was about twice that induced in mouse leukocytes. The frequencies of deletions were similar in both species. However, the mouse cultures were fixed at 60 hrs and the human cultures at 54 hrs. In both cases it was likely that some of the cells analyzed were in their second post-treatment mitosis. Further studies were carried out using fixation times of 48 hrs for both human and mouse cultures. The same relationships held here, namely twice as many dicentrics in human, and similar deletion frequencies in both. The

aberration frequencies observed were corrected to take account of second division cells, by assuming cells containing a dicentric without an accompanying fragment were in their second division. There were more such cells with the mouse. To further increase reliance on the conclusions, cultures were fixed at the earliest times that 300 cells per dose could be obtained--36 hrs for the mouse, 42 hrs for human. The frequencies of dicentrics were increased in both, and a relationship of about 2:1 for human to mouse was obtained. Deletion frequencies were similar in both. Three different human donors were used. Since no dicentrics without fragments were obtained, it appeared that aberration frequencies in first division cells only were being compared.

- 598 (CONF-770718--4) APPLICATION OF MAMMALIAN CYTOGENETICS TO MUTAGENICITY STUDIES. Brewen, J.G. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 11p. Dep. NTIS, PC A02/MF A01.

From Symposium on actions of physical and chemical mutagens on the somatic chromosomes of man; Edinburgh, UK (7 Jul 1977).

Studies on induction of chromosome damage in germ cells by triethylene melamine (TEM) included determination of frequencies of chromosomal aberrations observed in human leukocytes after treating different stages of the cell cycle with TEM, frequencies of chromatid aberrations in metaphase I oocytes and the female pronuclear chromosomes following treatment of female mice with TEM, and frequencies of labeled diplotene-diakinesis figures and chromosome aberrations at various intervals after treatment of primary spermatocytes with TEM and ^3H -thymidine. Studies on effects of low linear energy transfer radiation on mouse oocytes showed that the frequency of aberrations increased as a function of time and remained constant 8 to 9 days post-exposure. It was concluded that cytogenetic procedures were adequate to evaluate certain mutagenic end points. (HLW)

- 599 (ORO--2832-184) RADIATION AND BIOPHYSICAL STUDIES ON CELLS AND VIRUSES. PROGRESS REPORT, APRIL 1, 1976--JUNE 30, 1977. Cole, A. (Anderson (M.D.) Hospital and Tumor Inst., Houston, Tex. (USA)). 1977. Contract EY-76-S-05-2832. 67p. Dep. NTIS, PC A04/MF A01.

Progress is reported on the following research projects: genetic structure of DNA, chromosomes, and nucleoproteins; particle beam studies of radiosensitive sites; division delay in CHO cells induced by partly penetrating alpha particles; location of cellular sites for mutation induction; sites for radioinduced cell transformation using partly penetrating particle beams; gamma-ray and particle irradiation of nucleoproteins and other model systems; quantitation of surface antigens on normal and neoplastic cells by x-ray fluorescence; hyperthermic effects on cell survival and DNA repair mechanisms; and studies on radioinduced cell transformation. (HLW)

- 600 (ORO--4568-7) REPAIR AND CELL CYCLE RESPONSE IN CELLS EXPOSED TO ENVIRONMENTAL BIOHAZARDS. PROGRESS REPORT, FEBRUARY 1, 1976--MAY 31, 1977. Billen, D. (Tennessee Univ., Knoxville (USA)). 1977. Contract EY-76-S-05-4568. 7p. Dep. NTIS, PC A02/MF A01.

Progress is reported on the following research projects: DNA polymerase III dependent repair of x-ray damage in *Escherichia coli*; regulation of reinsertation of nucleotides by DNA ligase; DNA synthesis in permeabilized CHO

cells; measurement of damage to DNA in *Bacillus subtilis*; repair defect in rec A cells; inactivation of transforming DNA; and mutagenesis of transforming DNA. (HLW)

- 601 (ORO--4568-9) EFFECT OF ULTRAVIOLET LIGHT AND X-RAYS ON DNA SYNTHESIS IN PERMEABILIZED CHO CELLS. (Tennessee Univ., Oak Ridge (USA). Graduate School of Biomedical Sciences). 1977. Contract EY-76-S-05-4568. 4p. Dep. NTIS, PC A02/MF A01.

Studies were conducted to show that the decrease in incorporation shown by uv-irradiated hamster cells is the result of inhibition of elongation, while the x-ray and hold-induced decrease results from inhibition of initiation of replicons. Lysates were prepared from cells labeled with ^{14}C TdR and a figure is presented to show CsCl profiles of lysates. Results are consistent with the postulate that the lesions induced by uv interfere with the elongation of DNA chains while those induced by x-rays interfere with the initiation of synthesis in replicons. Cells labeled with ^3H -leucine were monitored for loss of acid-insoluble ^3H and this was compared to the acid-insoluble ^3H in the cell suspension before centrifugation. Results indicated that very little protein is released from cells in the 1X Tween 0.25M sucrose permeabilization solution, but that substantial loss of protein occurs when the cells are transferred from the Tween-sucrose into the reaction mixture. (HLW)

- 602 STUDY OF THE EFFECT OF INTERFERON ON RADIOSENSITIVITY OF CELLS. Val'ter, S.N.; Martynchik, Yu.F.; Sverdlov, A.G. (Inst. of Nuclear Physics, Leningrad). Radiobiology (USSR) (Engl. Transl.); 17: No. 1, 126-130(1977).

Translated from Radiobiologiya; 17: No. 1, 105-108(1977).

Interferon was obtained by injecting mice with virus-containing allantoic fluid from chick embryos. After incubation of L cells with interferon, they were exposed to gamma radiation. The results of experiments to determine the effect of interferon on share of aberrant cells as function of postradiation (300 R) time show that there are no differences in share of cells with aberrations between experimental and control findings for the 1st postradiation day. There is a sharp decrease in share of aberrant cells 25 to 26 hours after radiation in the control, whereas in the cultures with interferon this decline is slower. The difference between cultures with interferon and controls reaches a maximum 27 to 28 hours after radiation, with regard to share of aberrant cells ($P < 0.01$). Along with indications that interferon does not affect the cell cycle, there are data to the effect that interferon is capable of partially blocking L cells at the S phase of the cell cycle.

- 603 EFFECTS OF INSULIN ON THE SURVIVAL OF IRRADIATED CHINESE HAMSTER LUNG CELLS. Lin, P.S.; Kwok, L.; Heftner, K.; Wallach, D.F.H.; Brotman, R. (Tufts-New England Medical Center, Boston, Mass. (USA)). J. Mol. Struct.; 2: No. 1, 83-87(1977).

Insulin treatment (10^{-7} - 10^{-9} M) before γ irradiation (50 to 500 rads) increases the long term survival of Chinese hamster lung cells (DON). Our data indicates that the radioprotective effect of insulin is not due to a modulation of cyclic-adenosine-3',5'-monophosphate levels within these cells. The results suggest that the radiosensitive plasma membrane component postulated to be involved in the interphase death of thymocytes and

protected by insulin may have a counterpart in DON cells.

- 604 CHARACTERISTICS OF THE IN VITRO MONOCYTE-MACROPHAGE COLONY-FORMING CELLS DETECTED WITHIN MOUSE THYMUS AND LYMPH NODES. MacVittie, T.J.; Weatherly, T.L. (Armed Forces Radiobiology Research Inst., Bethesda, MD). pp 147-156 of Experimental hematology today. Baum, S.J.; Ledney, G.D. (eds.). New York; Springer-Verlag (1977).

From Proceedings of the International Society for Experimental Hematology; Washington, DC, USA (17 Aug 1976).

See CONF-760850--.

The enigmatic presence of in vitro colony-forming cells (CFC) within the thymus (T) and lymph node (LN) organs prompted us to determine additional characteristics of this cell population in an effort to examine their relationship to other colony-forming cells (CFC, CFU-c) derived from several hematopoietic sites. Their cluster-to-colony ratio, survival in the absence of colony-stimulating activity (CSA), radiosensitivity, drug sensitivity, and fraction in cell cycle were compared to the same parameters for CFU-c derived from bone marrow (BM), spleen (SPL), and peripheral blood leukocytes (PBL) and those CFC derived from thioglycollate-stimulated peritoneal exudate (PE). When compared with the parameters characteristic of CFU-c derived from BM, SPL, and PBL, the T-CFC and LN-CFC differed markedly in cluster-to-colony ratio, sensitivity to absence of pregnant mouse uterus extract (PMUE) in culture, and rate of appearance of colonies in culture. Similarities were observed in sensitivity to radiation (D_0 value) and cytotoxic drugs as well as the fraction in cell cycle. In comparison with the CFC derived from the peritoneal exudate, two similarities were observed; namely, the marked survival in the absence of CSA in culture and the same fraction in cell cycle. However, T-CFC and LN-CFC were significantly lower in cluster-to-colony ratio and more sensitive to ^{60}Co γ radiation than PE-CFC. Data are provided on the nature of a subpopulation of the ubiquitous monocyte-macrophage CFC located in the thymus and lymph nodes of the mouse. The results indicated that the CFC is a heterogeneous population in several respects and support the implication that the tissue microenvironment may alter the phenotypic expression of the resident CFC population.

- 605 GRAFT-VERSUS-LEUKEMIA, DONOR SELECTION FOR ADOPTIVE IMMUNOTHERAPY IN MICE. LeFeber, W.P.; Truitt, R.L.; Rose, W.C.; Bortin, M.M. (Mt. Sinai Medical Center, New York). pp 239-246 of Experimental hematology today. Baum, S.J.; Ledney, G.D. (eds.). New York; Springer-Verlag (1977).

From Proceedings of the International Society for Experimental Hematology; Washington, DC, USA (17 Aug 1976).

See CONF-760850--.

The optimal donor for adoptive immunotherapy would exhibit great antitumor reactivity and no antihost reactivity. Immunocompetent cells from 11 strains of mice were tested in vivo for their reactivity against a long-passage AKR acute lymphoblastic leukemia and against immunosuppressed nonleukemic AKR mice. Donor mice were syngeneic, unprimed H-2 compatible, primed H-2 compatible, congenic, or H-2 incompatible with AKR. Bioassays were used to evaluate the relative graft-vs.-leukemia (GvL) reactivity and the relative graft-vs.-host (GvH) reactivity of transplanted bone marrow and lymph-node cells from the panel of donors. No significant GvL reactivity was found when

cells from syngeneic, unprimed H-2 compatible, or congenic donors were tested. H-2 compatible donors that were immunized with γ -irradiated AKR leukemic spleen cells showed modest GvL reactivity, but associated with the immunization was a disproportionate increase in acute and delayed GvH mortality. Among the H-2 mismatched donors, mice of the SJL strain appeared to most closely approach the ideal because of least intense GvH reactivity and maximal GvL reactivity. As measured in these experiments there was no correlation between the severity of GvH disease and the efficacy of the GvL reaction; GvL reactivity in unprimed donors was always associated with H-2 incompatibility; disparity between donor and recipient at H-2 did not guarantee an effective GvL reaction; and the increase in GvL reactivity obtained by immunizing H-2 compatible donors was overshadowed by the increase in GvH disease.

- 606 EFFECT OF DELAY BETWEEN HEAT AND X-IRRADIATION ON THE SURVIVAL RESPONSE OF PLATEAU PHASE V-79 CELLS. Harris, J.R.; Murthy, A.K.; Belli, J.A. (Harvard Medical School, Boston). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 515-519(1977).

The effect of delay between hyperthermia (41°C for 1 hr) and irradiation was studied in plateau phase V-79 Chinese hamster cells. For irradiation preceding hyperthermia, a delay of 2 hr resulted in a complete loss of potentiation. In contrast, no significant loss of potentiation was seen for delay times of 1 to 2 hr for hyperthermia prior to irradiation. In this sequence, complete loss of potentiation was seen in 6 hr. These results suggest that the repair of sublethal heat damage is slower than that for radiation damage. For the clinical application of combined hyperthermia and irradiation, no loss of x-ray potentiation would be expected for delay times of 1 to 2 hr when heat is delivered first; it may not be necessary to heat tumor volumes during x-ray treatments.

- 607 RO-07-0582 AS A RADIOSENSITIZER AND CYTOTOXIC AGENT. Hall, E.J. (Coll. of Physicians and Surgeons of Columbia Univ., New York); Biaglow, J. Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 521-530(1977).

The electron affinic drugs, including the nitroimidazoles and the nitrofurans, were initially identified on the basis of their ability to mimic oxygen and differentially sensitize hypoxic cells. More recently, these drugs have been found to exhibit selective toxicity toward hypoxic cells. The radiosensitizing effect of the 2-nitroimidazole Ro-07-0582 is greatly enhanced if cells are pre-incubated in the presence of the drug for a period of hours prior to irradiation. In addition, the cytotoxicity of the drug is greatly increased at elevated temperatures. Both of these effects may be related to the metabolism of the drug, and it is clear that there is considerable room for maneuver in the time sequence of administering the drug and delivering the radiation dose as these potent and useful sensitizers begin to be used in the human.

- 608 BIOLOGICAL AND SEROLOGICAL CHARACTERIZATION OF THE C-TYPE RNA VIRUSES ISOLATED FROM THE C57BL/KA STRAIN OF MICE; 1. INFLUENCE OF SOME CHEMICAL AND PHYSICAL AGENTS ON THE QUANTITATION OF MURINE C-TYPE RNA VIRUSES IN VITRO. Niwa, O.; Decleve, A.; Kojola, J.; Kaplan, H.S. (Stanford Univ., Calif. (USA). Dept. of Radiology). pp 213-229

of Radiation-induced leukemogenesis and related viruses. Proceedings of the international symposium on radiation-induced leukemogenesis and related viruses, held in Bordeaux, 7-9 December 1976. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From INSERM symposium no. 4; Bordeaux, France (7 - 9 Dec 1976).

Experiments reveal that several factors such as cell growth rate, initial cell number, adsorption time, thermal inactivation, uv and x-ray inactivation, and x-ray or IUDR treatment of host cells all exert significant effects on murine C-type RNA virus growth and quantitation in cell cultures in vitro. These data have firmly established the basis of the assay systems developed by the authors and now commonly used in biological studies on virus isolates from the C57BL/Ka strain of mice. The RadLV was used in this strain of mice to render the BL/Ka(6) isolates.

- 609 SEROLOGICAL AND BIOLOGICAL CHARACTERIZATION OF ECOTROPIC MuLV EXPRESSION IN RADIATION-INDUCED LEUKEMIAS OF MICE. Ihle, J.N. (National Cancer Institute, Frederick, Md. (USA). Frederick Cancer Research Center). pp 265-274 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From INSERM symposium no. 4; Bordeaux, France (7 - 9 Dec 1976).

In the present studies, an attempt was made to examine the expression of MuLV (murine leukemia virus) after radiation by serological techniques as well as to examine the expression of MuLV antigens in thymic lymphomas to determine the influence of endogenous ecotropic viruses in pathogenesis. Although these results have demonstrated a lack of correlation between endogenous ecotropic viruses and radiation leukemia, they unfortunately do not shed any light on what the causative events or viruses might be. In many respects, the data suggest that radiation-induced leukemia in mice is comparable to 'spontaneous' leukemias in a variety of species including man for which there is no strong evidence for the involvement of C-type viruses. For this reason, the elucidation of the molecular mechanisms in radiation-induced leukemia in mice should be of particular importance as an extremely relevant experimental model of pathogenesis.

- 610 (BNL--22302) SHORT RADIOLOGICAL EMERGENCY RESPONSE TRAINING PROGRAM. Williams, R.D.; Greenhouse, N.A. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 10p. (IAEA-SM--125/25; CONF-770220--2). Dep. NTIS, PC A02/MF A01.

From International symposium on the handling of radiation accidents; Vienna, Austria (2 Feb 1977).

This paper presents an outline of a radiological emergency response training program conducted at Brookhaven National Laboratory by the health physics and safety training staff. This course is given to groups from local, county, state, and federal agencies and industrial organizations. It is normally three days in length, although the structure is flexible to accommodate individual needs and prior training. An important feature of the course is an emergency exercise utilizing a short lived radionuclide to better simulate real accident conditions. Groups are encouraged to use their own instruments to gain better familiarity with their operating characteristics under field conditions. Immediately following the exercise, a critical review of the students' performance is

conducted.

- 611 (BNL--22938) BIOLOGICAL IMPLICATIONS OF RADIATION. Bond, V.P. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 54p. (CONF-770357--1). Dep. NTIS, PC A04/MF A01.

From Conference on biological implications of nuclear energy; Providence, RI, USA (9 Mar 1977).

Some topics discussed are as follows: effects of diagnostic and therapeutic radiation on dividing cells, DNA, and blood cells; radiation sickness in relation to dose; early and late effects of radiation; effects of low dose irradiation; dose-effect curves; radioinduction of tumors in animals; and incidence of cancer in children following in utero exposure to diagnostic x rays. (HLW)

- 612 (CONF-770615--2) RADIATION SAFETY. Auxier, J.A. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 25p. NTIS, MF A01.

From National conference on campus safety on the University of Hawaii Campus; Honolulu, HI, USA (9 Jun 1977).

Data available on the biological effects of radiation on man are reviewed, with emphasis on dose response to low LET and high LET radiation sources, and the effects of dose rate. Existing guides for radiation protection were formulated largely on the basis of tumor induction in the bone of radium dial painters, but the ICRP/NCRP annual dose guides of 5 rem/yr are of the same general magnitude as the doses received in several parts of the world from the natural radiation environment. Because of the greater sensitivity of rapidly dividing cells and the assumption that radiation occupations would not begin before the age of eighteen, maximum exposure levels were set as 5 (N-18) rem/yr, where N is the exposed worker's age in years. However, in the case of the natural radiation environment, exposure commences, in a sense, with the exposure of the ovum of the individual's mother; and the ovum is formed during the fetal development of the mother. In occupational exposures, the professional health physicist has always practiced the as low as practical philosophy, and exposures have generally averaged far below the guidelines. The average annual exposure of the radiation worker in modern plants and laboratories is approximately equal to the average natural radiation environment exposure rate and far lower than the natural radiation environment in many parts of the world. There are numerous complications and uncertainties in quantifying radiation effects on humans, however, the greatest is that due to having to extrapolate from high dose levels at which effects have been measured and quantified, to low levels at which most exposures occur but at which no effects have been observed.

- 613 (IAEA-CN--36/232) PROBLEMS RAISED BY THE APPLICATION OF THE RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. Jammet, H.; Mechali, D. (International Atomic Energy Agency, Vienna (Austria)). 1977. 7p. (In French). (CONF-770505--104). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

Recommendations are regularly issued by the International Commission on Radiological Protection on the basic concepts of radiation protection and the general principles governing

their application in the field of occupational exposure, medical and other types of population exposures. Among these recommendations, some ones such as those concerning dose limits applying to individuals of the population can be directly taken up in national regulations, yet this is not the usual case and the practical application of protection principles will sometimes raise a number of problems difficult to solve. In particular, this is the case of the principle stating that all exposures shall be kept as low as is reasonably achievable, economical and social factors being taken into account. This problem is especially important as it governs the determination of authorized limits. The various approaches in order to solve it are examined.

- 614 (IAEA-CN--36/347) SOME APPROACHES TO THE PROBLEM OF DETERMINING STANDARDS FOR POPULATION IRRADIATION DUE TO RADIOACTIVE RELEASES FROM ATOMIC POWER STATIONS. Turkin, A.D.; Saurov, M.M.; Knizhnikov, V.A.; Gusev, D.I. (International Atomic Energy Agency, Vienna (Austria)). 1977. 12p. (In Russian). (CONF-770505--111). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

Available data on the low dose radiation effects on man make it possible to substantiate the acceptable risk and permissible doses of population exposure. Development and improvement of provisions for limiting radiation exposure of people were associated with development of the concepts based on cost-and-benefit analysis in the application of ionizing radiation and on the comparison between the risk of radiation exposure and other risks of everyday life (acceptable risk). The social, legal and moral aspects of these concepts involve some negative considerations and the practical use of these concepts in radiation protection is associated with certain difficulties. The report considers various aspects of these concepts in relation to their application for limiting radiation exposure of population and simultaneously discusses some new approaches, which are conventionally called the concepts of the impermissibility of actual risk and of the minimal risk. According to the concept of the impermissibility of actual risk which was discussed in 1974 (IAEA Seminar in Portoroz) the acceptable risk is such a risk of increasing mortality (morbidity) from malignant neoplasms which is within the limits of the statistical error of the index of mortality (morbidity) from "spontaneous" neoplasms. This approach was developed into the minimal risk-concept which is the main subject of the present report. The report presents mathematical expressions and actual values of the absolute, relative and integral risk of mortality from malignant neoplasms after irradiation of various groups of critical organs and defines the principle for determining the permissible mean individual radiation dose to the population (rem/year) on the base of the minimal risk concept.

- 615 (IAEA-CN--36/351) ESTIMATION, PREDICTION AND STANDARDIZATION OF RADIATION DOSE LEVELS TO THE POPULATION IN CONNECTION WITH NUCLEAR POWER STATION OPERATION IN THE USSR. Burnazyan, A.I.; Vorob'ev, E.I.; Il'in, L.A.; Kozlov, V.M.; Turkin, A.D.; Gusev, N.G.; Belyaev, V.A. (International Atomic Energy Agency, Vienna (Austria)). 1977. 15p. (In Russian). (CONF-770505--59). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear

power and its fuel cycles; Salzburg, Austria (2 May 1977).

The report presents values of the actual gas-aerosol releases from operating nuclear power stations in the USSR. Preliminary predicted evaluations of possible gas-aerosol releases from nuclear power stations under design are also made. Taking this as a basis and using a new calculation model there has been made an evaluation of the individual and population doses from releases of this kind, with an allowance for the metabolism of radioactive aerosols in the environment. The new model makes it also possible to consider population doses from foodstuff contaminated at the region of a nuclear station and then transported to other regions. Considering the ever growing number of ionizing radiation sources and in particular that of nuclear power stations this paper raises the problem of the necessity of an international agreement on the principles of regulating the population dose and on distributing the dose limit to the population from various radiation sources used in human activity and having a world-wide significance. As a matter for discussion the following distribution pattern of the dose limit to the population (in quota) is suggested: water-cooled and water-moderated reactors - 6%, single-circuit-grand-graphite reactors - 8%, gas-cooled reactors - 3%, fast reactors - 3%, experimental reactors - 5%, thermal nuclear stations - 4%, reactors of other types - 6%, fuel-reprocessing plants - 18%, the ore, hydrometallurgy, fuel elements production - 5%, radiation chemistry, irradiators - 2%, burial grounds of liquid and solid wastes - 4%, building materials - 5%, agricultural fertilizers - 4%, accelerators, X-ray tubes, television sets - 1%, reserve for other sources - 25%. It is suggested to enlarge the number of radionuclides attributed to the "world-wide" series considering their relatively high contribution to the population dose.

- 616 (IAEA-CN--36/395) PERSPECTIVE ON THE RADIATION PROTECTION PROBLEM AND RISK ANALYSIS FOR THE NUCLEAR ERA. Vohra, K.G. (International Atomic Energy Agency, Vienna (Austria)). 1977. 9p. (CONF-770505--112). NTIS (US Sales Only), PC A02/MF A01.

From International conference on nuclear power and its fuel cycles; Salzburg, Austria (2 May 1977).

The projected large scale use of nuclear energy and sources of ionizing radiations would involve the radiation exposure of larger numbers of occupational workers, individuals and groups in the population, and the population-at-large. There is an urgent need for projecting these exposures in a proper perspective, by comparing the associated risks with the risks from alternative energy sources, e.g. with those from the combustion products released by the fossil fuel plants. A comparative study of the risk of cancer mortality from radiations and airborne chemical pollutants has been presented. Radiation risk data is given in terms of cancer deaths per million per year for a given dose rate, based on the human experience. The lung cancer risks of the combined products of coal burning and a specific carcinogen benzo(a)pyrene have also been estimated, based on the extensive epidemiological data available for different countries. Using the dose-response data for radiation exposure at different annual dose rates, dose equivalents of chemical pollutants have been determined. Whereas the estimated risk for power reactor effluents is found to be only 1% of the risk at the ICRP dose limits for ionizing radiations, the current urban levels of benzo(a)pyrene (a product of fossil fuel

combustion) are already large enough to present a 100 fold higher risk, equivalent to that of the ICRP dose limit for ionizing radiations. Comparison shows that percentage contributions to the overall risk are 0.06, 5.5 and 19.0 for nuclear power, fossil fuel pollutant benzo(a)pyrene (per ng/m³) and total coal pollutants (per ton/capita consumption), respectively. Risk estimates for different stages of the nuclear fuel cycle, including the fast breeder reactor fuel cycle, are also presented.

- 617 (LA-UR--77-2080) DETECTABILITY IN THE PRESENCE OF COMPUTED TOMOGRAPHIC RECONSTRUCTION NOISE. Hanson, K.M. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 10p. (CONF-770942--1). Dep. NTIS, PC A02/MF A01.

From SPIE/SPSE conference on application of optical instrumentation in medicine; Boston, MA, USA (25 Sep 1977).

The multitude of commercial computed tomographic (CT) scanners which have recently been introduced for use in diagnostic radiology has given rise to a need to compare these different machines in terms of image quality and dose to the patient. It is therefore desirable to arrive at a figure of merit for a CT image which gives a measure of the diagnostic efficacy of that image. This figure of merit may well be dependent upon the specific visual task being performed. It is clearly important that the capabilities and deficiencies of the human observer as well as the interface between man and machine, namely the viewing system, be taken into account in formulating the figure of merit. Since the CT reconstruction is the result of computer processing, it is possible to use this processing to alter the characteristics of the displayed images. This image processing may improve or degrade the figure of merit.

- 618 (LA-UR--77-2385) APPLICATION OF PROTONS TO COMPUTER TOMOGRAPHY. Hanson, K.M.; Bradbury, J.N.; Cannon, T.M.; Hutson, R.L.; Laubacher, D.B.; Macek, R.; Paciotti, M.A.; Taylor, C.A. (Los Alamos Scientific Lab., N.Mex. (USA)). 1977. Contract W-7405-ENG-36. 5p. (CONF-771023--8). Dep. NTIS, PC A02/MF A01.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1977).

It was demonstrated that the application of protons to computed tomography can result in a significant dose advantage relative to x rays. Thus, at the same dose as is delivered by contemporary commercial x-ray scanners, a proton scanner could produce reconstructions with a factor of 2 or more improvement in density resolution. Whether such an improvement can result in significantly better diagnoses of human disease is an open question which can only be answered by the implementation of a proton scanner in a clinical situation.

- 619 (RS--II-4-517-318/6) TASKS AND ACTIVITIES OF THE FEDERAL MINISTER OF THE INTERIOR IN THE FIELD OF SETTING UP RADIATION PROTECTION GUIDELINES. Matting, A. (Sandia Labs., Livermore, Calif. (USA)). 1977. 17p. (In German). (CONF-770141--6). Dep. NTIS (US Sales Only), PC AXX/MF A01.

From Information meeting on rules and regulations for nuclear engineering; Mainz, F.R. Germany (24 Jan 1977).

Survey of radiation protection guidelines elaborated by the BMI and of regulations for the implementation of the Radiation Protection Ordinance still to be elaborated by the

Ministry, all guidelines and regulations referring to nuclear facilities and contributing to the statutory ordinances being carried out.

- 620 (SAAS--214, pp 2-15) POST-GRADUATE TRAINING IN RADIATION PROTECTION AND NUCLEAR SAFETY AT THE STAATLICHES AMT FUER ATOMSICHERHEIT UND STRAHLENSCHUTZ DER DDR. Neumeister, K. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1977. (In German).

Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

A summary outline is given of the topics of the various instructional fields as well as of the preliminary knowledge required.

- 621 (SAAS--214, pp 16-22) COURSES ON RADIATION PROTECTION PROVIDED BY THE SAAS FOR PROSPECTIVE RADIOLOGISTS. Neumeister, K.; Poulheim, K.F.; Edelmann, U.; Steuer, J. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1977. (In German).

Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

Prospective radiologists have to participate in courses on radiation protection given at the Staatliches Amt fuer Atomsicherheit und Strahlenschutz der DDR. The candidates are expected to be well grounded in mathematics, physics, radiobiology and radiation protection legislation. The experience gained in these courses during five years of conduct is outlined.

- 622 (SAAS--214) REPORT OF THE NATIONAL BOARD OF NUCLEAR SAFETY AND RADIATION PROTECTION OF THE GDR. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1977. vp. (In German). NTIS.

Separate abstracts were prepared for individual papers. (ERB)

- 623 (SAAS--216) OCCUPATIONAL RADIATION EXPOSURE IN THE GDR IN 1973. Koenig, W.; Larssen, A.; Rothe, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1977. 18p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

In 1973 a total of 36,481 occupationally exposed persons were monitored by the central film badge service of the National Board of Nuclear Safety and Radiation Protection. The monthly over-exposure (more than 0.4 rad) totalled 610. In 37 cases the quarterly dose (3 rad) was exceeded during one month and 29 of these records could be assessed as real over-exposures. Most of the over-exposure could be attributed to an insufficient application of safety regulations. The results were analysed according to type of institution as well as sex of employees.

- 624 (SAND--77-0844C) MODEL TO PREDICT THE RADIOLOGICAL CONSEQUENCES OF TRANSPORTATION OF RADIOACTIVE MATERIAL THROUGH AN URBAN ENVIRONMENT. Taylor, J.M.; Daniel, S.L.; DuCharme, A.R.; Finley, N.N. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 2p. (CONF-771113--6). Dep. NTIS, PC A02/MF A01.

From 4. joint conference on sensing of environmental pollutants; New Orleans, LA, USA (6 Nov 1977).

A model has been developed which predicts the radiological consequences of the transportation of radioactive material in and around urban environments. This discussion of the model includes discussion of the following general topics: health effects from radiation exposure, urban area characterization, computation of dose resulting from normal transportation, computation of dose resulting from vehicular accidents or sabotage, and preliminary results and conclusions.

- 625 (TID--27080) ICHIBAN: RADIATION DOSIMETRY FOR THE SURVIVORS OF THE BOMBINGS OF HIROSHIMA AND NAGASAKI. Auxier, J.A. (Oak Ridge National Lab., Tenn. (USA)). 1977. 128p. Dep. NTIS \$4.75.

One of the most important issues of the nuclear age concerns the effects of ionizing radiation on man. Immediately after the cessation of fighting in Japan in World War II, studies began which were aimed at learning as much as possible about radiation effects on the survivors of the Hiroshima and Nagasaki bombings. The most important factors were the immediate and long-term effects of the varying doses of radiation to the survivors. Although the medical studies commenced within months of the bombings, it was ten years before technology reached the stage at which it appeared possible to determine with any real reliability the effect the radiation doses had on these people. The U.S. Atomic Energy Commission and subsequently the Energy Research and Development Administration supported and strongly encouraged medical and dosimetry studies of the survivors until 1975 when the United States and Japan joined as full partners to carry on the studies far into the future. During the last few years, reliable doses for most of the individual survivors have been obtained, and the door was opened to a much better understanding of the effects of radiation on human beings. The dosimetry portion of these studies is recorded in this monograph. In this review the author presents an interesting mixture of historical highlights and scientific information without trying to cover either subject in great depth. The objective is to give the reader some insight and understanding into the overall program and to identify the original publications for those seeking an in-depth analysis.

- 626 (UR--3490-1072) BIOLOGICAL EFFECTS OF LOW LEVELS OF RADIATION EXPOSURE. Casarett, G.W. (Rochester Univ., N.Y. (USA). School of Medicine and Dentistry). 1977. Contract EY-76-C-02-3490. 29p. (CONF-770208--1). Dep. NTIS, PC A03/MF A01.

From Symposium on public health aspects of radioactivity in consumer products; Atlanta, GA, USA (2 Feb 1977).

Some general perspective is provided concerning the orders of radiation dose equivalent levels associated with exposure of human populations to ionizing radiations from consumer products. This is followed by considerations of the biological effects and risks of low levels of radiation exposure. Some consumer products emit low-LET (i.e., low linear energy transfer) radiations beyond their confines and these penetrating radiations can result virtually in whole-body irradiation, while in the case of other products the radiation to tissue consists mainly of the high-LET alpha particles which penetrate tissue only shallowly and close to the products. There are some radiation-emitting consumer products which are in such widespread use in the United States that large numbers of people are irradiated by them. Some of these products may irradiate on

the order of 10^6 to 10^8 people to average annual whole-body or gonadal dose equivalents varying over a range on the order of 1 to 10 millirem (mrem). These include television receivers, time pieces with radium-containing dials, gas and aerosol detectors, and building and road construction materials. On the order of 10^4 people may be irradiated by vacuum high voltage switches to 30 mrem or from electron microscopes to 300 mrem average annual whole-body or gonadal dose equivalent. Smaller annual whole-body or gonadal dose equivalents, of the order of less than 1 microrem (μ rem) to 1 mrem, may be received by many people from cold cathode gas discharge tubes, airport x-ray inspection systems, time pieces with dials containing tritium or ^{147}Pm , and other sources. Possible health hazards are discussed.

- 627 COLLECTIVE DOSES DUE TO RADIONUCLIDES FROM NUCLEAR FACILITIES. Bonka, H.; Schmidtlein, P.; Schwarz, G. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Reaktortechnik). pp 805-808 of Reaktortagung, Mannheim, 29.3-1.4.1977. Sektion 6: Bau und Betrieb von Kernenergieanlagen. Eggenstein-Leopoldshafen, Germany, F.R.; ZAED (1977). (In German) From Reactor congress 1977; Mannheim, Germany, F.R. (29 Mar 1977). 3 figs.; 6 tabs.; 4 refs. Short communication only. DOSE LIMITS;DOSE RATES;ENVIRONMENT;HUMAN POPULATIONS;NUCLEAR FACILITIES;OPERATION; RADIATION DOSES
- 628 WORK OF THE NRPB 1974/76. London; H.M. Stationery Office (1977). 73p. The report on the work of the (UK) National Radiological Protection Board is in sections entitled: functions and organisation; general survey (including activities relating to nuclear power, the newly established arrangements with the Health and Safety Commission, and International cooperation); the assessment of human exposure to ionising radiations; technical services (including personal monitoring, and assessment of radiation hazards in various incidents); instrumentation and equipment; research in biology; research in physics (including various projects on dosimetry); list of publications by Board Staff; Radiological Protection Bulletin 1974 to 1976 (contents).
- 629 RADIATION DOSES DUE TO USEFUL AND INTERFERING RADIATION IN COMPUTER TOMOGRAPHY. Ewen, K.; Fischer, P.G. (Zentralstelle fuer Sicherheitstechnik, Duesseldorf (Germany, F.R.)); Fiebach, B.J.O. (Essen Univ. (Gesamthochschule) (Germany, F.R.). Roentgendiagnostisches Zentralinstitut). Electromedica; 45: No. 1, 7-8(1977). (In German). 1 tab.; 4 refs. Short communication only. BIOMEDICAL RADIOGRAPHY;DIAGNOSTIC TECHNIQUES; PATIENTS;RADIATION DOSES;THERMOLUMINESCENT DOSIMETRY;TOMOGRAPHY

- 630 EYE LENS - SOME ASPECTS OF THE RADIATION DOSE AND PROTECTION OF THE PATIENTS AND THE PERSONNEL IN PEDIATRIC RADIOLOGY. Bergstroem, K.; Jorulf, H.; Loeftroth, P.O. Ann. Radiol.; 20: No. 1, 55-61(1977). From Colloquium of the European Society of Pediatric Radiology; Stockholm, Sweden (19 - 22 May 1976). The radiation dose to the eye lens in children during skull examination, pneumoencephalography and carotid angiography,

and the dose to the personnel in some of these and some other procedures, were measured. The values obtained indicate the use of eye lens protection for both the patient and the personnel in radiodiagnostic work as a complement to other protective means. The effect of protective glasses was also estimated. It was found that the use of specially constructed lead glasses, equivalent to 1 mm lead, by the patient can reduce the dose to about one-tenth, and a similar reduction can be obtained in the personnel by means of optically indifferent lead glasses equivalent to 0.25 mm lead.

- 631 COMPROMISE SCREENING STRATEGIES FOR CHRONIC DISEASE. Blumenson, L.E. (Roswell Park Memorial Inst., Buffalo). Math. Biosci.; 34: No. 1/2, 79-94(1977).

When the technology used to screen a large population for a chronic disease is potentially harmful in itself, it becomes necessary to consider alternative screening strategies. These alternatives are compromises, since although less people are exposed to the danger of the screening technology, some who would have benefited from the examination never receive it. A previously developed mathematical model for mass screening programs is used to evaluate one type of compromise screening strategy, namely, a two stage screening examination with the first stage a harmless, relatively inaccurate test and the second stage the more accurate, potentially harmful examination. The formulas are then used to calculate the effectiveness of a one stage screening examination for breast cancer using mammography, relative to a two stage screening examination for which the first stage measures the erythrocyte sedimentation rate and the second stage is a mammography examination. It is shown that the numerical values obtained are not too far from a conjecture made in an earlier paper. It is concluded that a two stage screening examination should be used in any program which uses mammography to screen a large population of asymptomatic women for breast cancer.

- 632 Strahlengefährdung und Strahlenschutz in der zahnärztlichen Roentgendiagnostik. Leitfaden fuer Studierende der Zahn-Mund-Kieferheilkunde und Zahnärzte. (RADIATION HAZARDS AND RADIATION PROTECTION IN DENTAL X-RAY DIAGNOSTICS. GUIDELINE FOR STUDENTS OF DENTISTRY, DENTAL ORTHOPEDICS AND DENTISTS). Kirsch, T. (ed.). Heidelberg, Germany, F.R.; Huethig (1977). 222p. (In German).

With figs., refs. and tabs. X-ray Ordinance appended.

Questions concerning technical-radiological-practical activities with regard to radiation hazards for patient and dentist as well as radiation protection measures are dealt with comprehensively. Recent findings in the field of radiation physics and radiation genetics are taken into account. The annex contains the text of the X-ray Ordinance.

- 633 Strahlenschutzverordnung. Kommentar zur Verordnung ueber den Schutz vor Schaedten durch ionisierende Strahlen. (RADIATION PROTECTION ORDINANCE. COMMENTARY ON THE ORDINANCE ON PROTECTION AGAINST DAMAGE CAUSED BY IONIZING RADIATION). Zerlett, G.; Kramer, R. (Rheinische Braunkohlenwerke A.G., Koeln (Germany, F.R.). Arbeitsmedizinisches Zentrum). Koeln, Germany, F.R.; Kohlhammer (1977). 342p. (In German).

With figs. and tabs..

The explanations also contain recent legal

regulations in other fields of law if they are relevant to the field of radiation protection, e.g. as in the case of the new ordinance on medicaments of August 24th, 1976 (BGBl I S. 2445), which is to enter into force on January 1st, 1978, or the act on administrative proceedings of May 25th, 1976 (BGBl I S. 1253), which is to take effect on the 1st of January, 1977. According to the overall subdivision of the Radiation Protection Ordinance into surveillance (sections 3 to 27) and protection regulations (sections 28 to 80), the explanations concerning the surveillance regulations pay more attention to the legal aspects of licensing, notification, and permit procedures, while the commentary on the protection regulations, the application of which is not so much a judicial problem, is concerned mainly with the technical, physical, and medical contents of these stipulations. The explanations do not aim at giving a judicially detailed commentary. The commentary is restricted mainly on presenting and explaining the legal basic principles and terms. It also refrains to a great extent from explaining technical, scientific, or medical elementary terms or relationships as the knowledge of these is taken for granted. The commentary of the protection regulations orientates itself instead at the necessity of putting these regulations into practice. Restraint was exercised in interpreting the Ordinance so as not to anticipate subsequent executive regulations or to provoke contradiction. Note: The 3rd amendments to the StrSchV have not been taken into account yet.

- 634 REVIEW OF NCRP RADIATION DOSE LIMIT FOR EMBRYO AND FETUS IN OCCUPATIONALLY-EXPOSED WOMEN. Washington, DC; National Council on Radiation and Measurements (1977). 46p. (NCRP--53).

On the basis of the current review, the NCRP has decided to make no change in the current recommendation of its radiation dose limit to the unborn. The NCRP recommendation is restated here as follows: During the entire gestation period, the maximum permissible dose equivalent to the embryo-fetus from occupational exposure of the expectant mother should be 0.5 rem. Since the preparation of the 1971 report there has been no new evidence concerning teratogenic or carcinogenic effects of irradiation of the embryo-fetus that would justify a change in the limit in either direction. It is implicit in this position and recommendation that women who can reasonably be expected to be pregnant should not, in certain instances, be exposed to the same radiation environment as women who are not considered fertile or as men. This applies particularly to conditions where radiation workers can receive dose equivalents of 0.5 rem or more in short periods.

- 635 TOTAL RADIATION DOSAGE FROM X-RAY EXAMINATIONS IN RHEUMATOID ARTHRITIS AND OTHER CHRONIC SKELETAL DISEASES. Baldursson, H.; Gustafsson, M. (Department of Orthopaedic Surgery and Radiation Physics, The University Hospital, Lund, Sweden). Acta Orthop. Scand.; 48: 138-142(1977).

Young patients with rheumatoid arthritis and other chronic diseases of the skeleton are increasingly being operated on with replacement of major joints. The great number of associated x ray examinations performed on these patients has caused some anxiety among orthopaedic surgeons. Two patients with juvenile rheumatoid arthritis have been studied. An attempt was made to calculate the total radiation dose to bone marrow and gonads. For lack of recommendations for the maximum permissible

radiation dose to patients, the dose calculated has been compared with the maximum permissible dose of radiation workers, and with the dose limit for non-occupational irradiation of individuals. The yearly absorbed dose in these two patients is much lower than the maximum permissible dose of radiation workers and only slightly higher than the dose limit for non-occupational exposure of individuals.

- 636 MEDICAL RADIATION EXPOSURE OF PREGNANT AND POTENTIALLY PREGNANT WOMEN. Washington, DC; National Council on Radiation Protection and Measurements (1977). 37p. (NCRP--54).

Sensitivity to ionizing radiation is greater during intrauterine stages of development than at other stages in the life of the mammalian organism. For this reason, the NCRP recommends special care in patient selection in certain cases of diagnostic radiology and nuclear medicine diagnostic procedures. For women of child-bearing capacity, the physician requesting a radiological or nuclear medicine examination involving the lower abdominal or pelvic region should ascertain whether the patient is, or could be, pregnant. Further, the NCRP recommends that physicians tell their premenopausal patients that, if they are likely to have nuclear medicine studies or x-ray examinations of the lower abdomen, it is generally advisable that they not run a risk of pregnancy until two months after the studies are carried out. Modification of an examination for dose reduction is warranted only if it reasonably can be done without significant jeopardy to the medical care of the patient and/or her unborn child.

- 637 RADIATION-INDUCED LEUKAEMIA IN MAN. Mole, R.H. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). pp 19-36 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From Symposium on radiation-induced leukemogenesis and related viruses; Bordeaux, France (7 Dec 1976).

See CDRF-761212--.

An excess frequency of leukemia has been found in many human populations exposed to ionizing radiation, medically, occupationally or in warfare. Antenatal diagnostic radiography provides direct evidence that small-dose, brief exposures are leukemogenic which is in agreement with the simplest possible carcinogenic hypothesis that the appropriate transformation of a single cell can be sufficient to initiate a clinically overt malignancy. Quantitative differences in numbers of irradiated marrow cells surviving exposure can explain why large and protracted doses received in radiotherapy may or may not be leukemogenic and why occupational X- or γ -ray exposure can be leukemogenic but irradiation by bone-seeking radionuclides like radium apparently not. Different types of leukemia may differ markedly in their sensitivity to induction according to dose and in Japanese bomb survivors according to quality of radiation.

- 638 RADIOBIOLOGICAL RESEARCH AND RADIOTHERAPY. REPORT ON THE INTERNATIONAL SYMPOSIUM HELD IN VIENNA FROM 22 TO 26 NOVEMBER 1976. Singh, B.B. (International Atomic Energy Agency, Vienna (Austria)). At. Energy Rev.; 15: No. 1, 109-113(1977).

BIOLOGICAL REPAIR;CHEMOTHERAPY;CHROMOSOMAL ABERRATIONS;COMPARATIVE EVALUATIONS;DELAYED RADIATION EFFECTS;FRACTIONATED IRRADIATION; GAMMA RADIATION;INHIBITION;IRRADIATION

PROCEDURES;LET;NEOPLASMS;RADIOSENSITIZERS; RADIOTHERAPY;THERMAL SHOCK

- 639 HANDLING OF RADIATION ACCIDENTS 1977. REPORT ON THE INTERNATIONAL SYMPOSIUM HELD IN VIENNA FROM 28 FEBRUARY TO 4 MARCH 1977. Dillon, G.B. (International Atomic Energy Agency, Vienna (Austria)). At. Energy Rev.; 15: No. 3, 501-508(1977).

A total of 42 papers were presented in 8 sessions covering the following topics: practical experience in the handling of radiation accidents, organization and planning, training and exercising in planned arrangements, accident situation detection and assessment, and accident situation analysis. Two panel discussions were included in the symposium, the first under the chairmanship of Dr. W.D. Rowe (USEPA, Washington) reviewed the scope and application of emergency planning procedures and the symposium was concluded by a panel discussion chaired by Mr. K.L. Cameron (Atomic Energy Control Board, Ottawa, Canada), which reviewed collective experience and endeavoured to identify aspects requiring further development. All are summarized.

- 640 CONTROL OF EXTERNAL RADIATION EXPOSURE. Lakey, J.R.A. (Royal Naval Coll., Greenwich (UK)). J. Inst. Nucl. Eng.; 18: No. 4, 119-122(1977).

Conditions employed by the health physicist in the control of personnel external radiation exposure are discussed. These include (a) sufficient distance between the working position and the radiation source; (b) the provision of adequate protective shielding between the working area and the source; (c) restriction of exposure time so that dose limits are not exceeded at working positions. It is emphasized that the designers of radiation protection facilities must be made aware of their crucial role in the task of controlling radiation exposure. The designer should assist the operator by (1) taking account of the movements of radiation workers and should predict exposure rates in all working spaces, (2) defining areas with high field gradients (those exceeding 20% per metre), (3) defining areas with abnormal radiation, (4) indicating possible instrument errors, (5) modifying the design to eliminate working areas with high field gradient or abnormal radiation.

- 641 PRACTICAL EXPERIMENTS FOR BIOPHYSICAL DOSE PLANNING IN RADIATION THERAPY. Gremmel, H.; Wendhausen, H. (Kiel Univ. (Germany, F.R.). Radiologische Klinik). Atomkernenergie; 30: No. 3, 169-174(1977).

By means of the volume-doubling time of solid tumors, description of irradiation effects on malignant cells with the aid of survival curves, and the establishment of tolerance limits of healthy tissue with isoeffect curves, methods of calculation for biophysical dose planning are established.

- 642 RADIATION DOSE TO THE GONADS DURING CYSTOURETHROGRAPHY IN CHILDREN. Hertz, M. (Sheba Medical Center, Tel Hashomer (Israel); Tel Aviv Univ. (Israel). Medical School); Werner, A. Isr. J. Med. Sci.; 13: No. 6, 614-616(1977).

The problem of the large amount of gonadal radiation during MCU in children is discussed. The authors found that the gonadal dose was much smaller in children examined with 70-mm photofluorography although the fluoroscopy time was about twice that of the spot-film technique

and that the number of exposures was four times as high. It is concluded that it is advisable to use photofluorography, particularly in voiding studies on girls.

- 643 RADIOTHERAPEUTIC ADVANCES IN THE TREATMENT OF NEOPLASTIC DISEASE. Kaplan, H.S. *Isr. J. Med. Sci.*; 13: No. 8, 808-814(1977).

This is a review of the advances made in the field of cancer radiotherapy during the last 25 years. The megavoltage era has led to a higher survival rate and a promising future lies ahead in cancer treatment.

- 644 IODINE AND COMMON SALT CONCENTRATIONS IN URINE FROM THE INHABITANTS AND EMPLOYEES AT THE OSKARSHAMN NUCLEAR POWER PLANT. Sjöberg, K.H. (Dept. of Internal Medicine, Oskarshamn Hospital (Sweden)); Gustavsson, R.; Geströling, G. (Västervik Hospital (Sweden)). *Läkarskr. Mater. Ikh. Primen.*; 74: No. 39, 3326-3328(1977). (In Swedish).

An investigation of the staff of the nuclear power station at Oskarshamn and the inhabitants of the immediate vicinity—5 km—a total of 222 adults indicate that the amount of iodine is satisfactory in terms of both prevention of goitre and the danger inherent in nuclear power. The most important source of iodine is the iodized salt but milk probably—at least during the dark season of the year—contributes a considerable amount. Fish seems to be of minor significance.

- 645 BLOOD LYMPHOCYTES IN BREAST CANCER PATIENTS FOLLOWING RADIOTHERAPY AND SURGERY. Baral, E. (Karolinska Hospital, Stockholm); Blomgren, H.; Petrini, B.; Wasserman, J. *Int. J. Radiat. Oncol., Biol. Phys.*; 2: No. 3/4, 289-295(1977).

Peripheral blood lymphocytes from 110 subjects with primary carcinoma of the breast were studied before and at various times after local radiotherapy and/or surgery. The results demonstrated that the recovery of the relative PPD (purified protein derivative) responses of the lymphocytes after radiotherapy progresses more rapidly than the repopulation of the total lymphocyte population.

- 646 REDUCTIONS OF RESPONDER AND STIMULATOR CAPACITIES OF PERIPHERAL LYMPHOID CELLS IN THE MIXED LYMPHOCYTE CULTURE FOLLOWING EXTERNAL RADIOTHERAPY. Blomgren, H. (Karolinska Hospital, Stockholm); Wasserman, J.; Edsmyr, F.; Baral, E.; Petrini, B. *Int. J. Radiat. Oncol., Biol. Phys.*; 2: No. 3/4, 297-305(1977).

The peripheral lymphoid cells of patients with primary cancers of the breast, urinary bladder or prostate were examined, before and after radiotherapy, for capacity to respond and stimulate in the mixed lymphocyte culture using lymphoid cells from healthy donors as allogeneic cells. Radiotherapy reduced both the responder and stimulator capacities of the peripheral lymphoid cells to approximately the same extent in the same individual. These reductions were not correlated to the extent of radiation induced lymphopenia. The results suggest a general defect of the peripheral lymphoid cell population after radiotherapy.

- 647 OPTIMIZATION OF EXTERNAL BEAM RADIATION THERAPY. McDonald, S.C.; Rubin, P. (Univ. of Rochester Cancer Center, NY). *Int. J. Radiat. Oncol., Biol. Phys.*; 2: No. 3/4, 307-317(1977).

A criterion for optimal external beam

radiation therapy and a method for generating the associated optimal dose distributions are presented. The optimal beam configuration is defined to be the one with a dose distribution which provides the best "least-squares fit" to the prescribed tumor contour, subject to constraints on the dose at nearby vulnerable sites. A FORTRAN program for the solution of this optimization problem has been constructed and several optimal treatment plans illustrating its application are given. In this program, a maximum of 72 coplanar beams may be accommodated with up to 4 different field sizes directed at a common axis from 18 different directions.

- 648 ADRIAMYCIN--IRRADIATION CUTANEOUS COMPLICATIONS. Aristizabal, S.A.; Miller, R.C.; Schlichtemeier, A.L.; Jones, S.E.; Boone, M.L.M. (Univ. of Arizona Coll. of Medicine, Tucson). *Int. J. Radiat. Oncol., Biol. Phys.*; 2: No. 3/4, 325-331(1977).

Four cases of abnormally severe skin reactions including an instance of skin necrosis occurred in patients with breast cancer who were treated with cyclophosphamide, adriamycin and irradiation concurrently following mastectomy. These unusual skin reactions apparently resulted from the interaction of radiation with adriamycin and prompted us to modify both the radiation dose and the timing of administration of chemotherapy. To date, no unusual or severe skin reactions have been observed in 14 patients who have received chemotherapy with adriamycin plus radiation in accord with this modified treatment plan.

- 649 BASIC CONSIDERATIONS IN SIMULATED TREATMENT PLANNING FOR THE STANFORD MEDICAL PION GENERATOR (SMPG). Pistenma, D.A.; Li, G.C.; Bagshaw, M.A. (Stanford Univ. School of Medicine, CA). *Int. J. Radiat. Oncol., Biol. Phys.*; 2: No. 3/4, 345-356(1977).

Recent interest in charged heavy particle irradiation is based upon expected improved local tumor control rates because of the greater precision in dose localization and the increased biological effectiveness of the high linear energy transfer ionization of particle beams in their stopping regions (Bragg peaks). A novel 60 beam cylindrical geometry pion spectrometer designed for a hospital-based pion therapy facility has been constructed at Stanford. In conjunction with the development and testing of the SMPG a program of simulated treatment planning is being conducted. This paper presents basic considerations in treatment planning for pions and other charged heavy particles. It also presents the status of simulated treatment planning calculations for the SMPG including a discussion of the principle of irradiation of hypothetical tumor volumes illustrated by examples of simplified treatment plans incorporating tissue density inhomogeneity corrections. Also presented are considerations for realistic simulated treatment planning calculations using computerized tomographic scan cross sections of actual patients and a conceptual plan for an integrated treatment planning and patient treatment system for the SMPG.

- 650 DIAPHRAGMATIC TREATMENT IN OVARIAN CARCINOMA: A NEW RADIOTHERAPEUTIC TECHNIQUE. Glatstein, E.; Fuks, Z.; Bagshaw, M.A. (Stanford Univ. Medical Center, CA). *Int. J. Radiat. Oncol., Biol. Phys.*; 2: No. 3/4, 357-362(1977).

Carcinoma of the ovary is a disease that frequently involves the diaphragm at

presentation. A new radiotherapeutic technique is described that is directed toward treatment, not only of the pelvis, but also of the para-aortic nodes and diaphragm. Dosimetry is presented.

of treatment schedules including daily treatment as well as fractionation at shorter and longer intervals; this provided a useful set of normal tissue tolerance limits for late effects.

- 651 RAPID METHOD TO DETERMINE THE MAXIMUM DOSE FROM PARALLEL OPPOSED FIELDS. Carleson-Bentel, G. (Duke Univ. Medical Center, Durham, NC). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 3/4, 367-368(1977).

A dose calculating method has been developed for rapid calculation of maximum dose for various energies and patient diameters as a result of parallel opposed field arrangements. A calculating wheel has been designed for practical use. By turning the wheel to the appropriate setting one will read in the window the ratio which when multiplied by the midplane dose results in the maximum dose.

- 652 BENEFICIAL AND DETRIMENTAL EFFECTS OF THERAPY ON IMMUNITY IN BREAST CANCER. Order, S.E. (John Hopkins Hospital, Baltimore). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 3/4, 377-380(1977).

An analysis of the therapy of breast cancer was conducted with regard to the following: the control of local and regional disease; the treatment of potential metastatic disease; the psychological impact of a treatment course; and the potential beneficial or detrimental effect of therapy on immunity. The data revealed that lymphopenia was induced by radiotherapy and the significance of this for immune responses is discussed. (HLW)

- 653 RADIO THERAPY IN BURKITT'S LYMPHOMA: CONVENTIONAL OR SUPERFRACTIONATED REGIME: EARLY RESULTS. Norin, T.; Onyango, J. (Kenyatta National Hospital, Nairobi, Kenya). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 399-406(1977).

Burkitt's lymphoma in an African population was treated by radiotherapy to 43 tumor sites with palpable or visible tumors. Early effects of the treatment are evaluated. In nine tumor sites the treatment was given with conventional fractionation (1 treatment per day) with a mean dose of 3100 rad in 17 fractions over 20 days. The results were disappointing. Only 1 of these tumors responded with complete regression. In light of the rapid cell turnover in Burkitt's tumor, the treatment regime was changed to superfractionated radiotherapy with 3 treatments per day. The treatment was given in this way in 34 tumor sites with a mean dose of 2900 rad for 13 days in 27 fractions. Complete regression was achieved in 25 of 34 tumors treated.

- 654 DOSE-TIME RELATIONSHIPS FOR POST-IRRADIATION CUTANEOUS TELANGIECTASIA. Cohen, L.; Ubaldi, S.E. (Michael Reese Medical Center, Chicago). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 421-426(1977).

Seventy-five patients who had received electron beam radiation a year or more previously were studied. The irradiated skin portals were photographed and late reactions graded in terms of the number and severity of telangiectatic lesions observed. The skin dose, number of fractions, overall treatment time and irradiated volume were recorded in each case. A Strandqvist-type iso-effect line was derived for this response. A multi-probit search program also was used to derive best-fitting cell population kinetic parameters for the same data. From these parameters a comprehensive iso-effect table could be computed for a wide range

- 655 "TOTAL" THERAPY FOR OAT CELL CARCINOMA OF THE LUNG. Kent, C.H.; Brereton, H.D.; Johnson, R.E. (National Cancer Inst., Bethesda, MD). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 427-432(1977).

Undifferentiated small cell (oat cell) carcinoma of the lung is almost predictably disseminated at the time of diagnosis, even in seemingly early clinical presentations. The need for combined modality therapy is mandatory when this aspect of the natural history of disease is appreciated. Between November 1974, and April 1976, 31 consecutive patients without prior treatment received simultaneous radiotherapy of bulk disease, prophylactic whole brain irradiation, and intensive systematic chemotherapy. Primary treatment was completed in 3 months, following which all patients were observed without maintenance therapy. Complete remissions were achieved in 29/31 cases (94%) and the median disease-free interval after termination of therapy was 9 months. The median survival (actuarial) exceeds 14 months, despite consideration of 4 deaths from treatment complications (no residual tumor identified at autopsy) as deaths caused by cancer. Most encouraging have been the sustained remissions for more than 1 year accompanied by resumption of normal activity in one-half of patients with regional clinical presentations (intrathoracic disease). The latter suggests that curative treatment may be potentially available using current therapeutic tools in a fraction of cases with oat cell carcinoma of the lung. Tolerance to the treatment program utilized could be correlated with the radiotherapy technique and the experience using three different fractionation schemes is described. Also reported are the substantial iatrogenic complications encountered with this combined modality regimen.

- 656 IMMUNOPROFILE STUDIES FOR PATIENTS WITH BRONCHOGENIC CARCINOMA. I. CORRELATION OF PRE-THERAPY STUDIES WITH STAGE OF DISEASES. Concannon, J.P.; Dalbow, M.H.; Eng, C.P.; Conway, J. (Allegheny General Hospital, Pittsburgh). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 447-454(1977).

Multiple parameters that contribute to the general immune competence were measured for 145 patients with bronchogenic carcinoma. These same parameters were measured for a group of healthy individuals to establish normal values for each of the tests of immunity. The immunoprofile data for the patients were analyzed on the basis of normal or abnormal measurements to determine the effects of stage of disease, histology, prior surgery and age of the patients on the immune system. A strong stage related correlation with immune impairment was observed in that an increased number of patients with perturbed immunity could be demonstrated for many of the parameters studied.

- 657 RADIATION RELATED TOXICITIES IN NATIONAL WILMS' TUMOR STUDY NUMBER 1. Tefft, M. (Rhode Island Hospital, Providence). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 455-463(1977).

Twenty-six of 359 patients randomized into the first National Wilms' Tumor Study developed soft tissue complications which could be

related to radiation. There were 15 instances of liver damage, 7 lung, 2 renal and 2 cardiac. Three additional patients with infection were recorded as having had radiation damage; however, the direct relationship to radiation and secondary infection is unclear in these patients. Signs and symptoms were transient in all but 3 patients; 1 of these required surgical intervention for esophageal varices, but remained well 4 years thereafter. Three patients have died, 2 from pulmonary fibrosis following high doses of radiation to the lungs, and 1 from cardiotoxicity which was recorded as related to concomitant adriamycin administration.

658 WHOLE LUNG IRRADIATION IN THE PEDIATRIC AGE GROUP: LOW-DOSE VS CONVENTIONAL FRACTIONATION WITH MULTI-DRUG CHEMOTHERAPY. Chabora, B.M.; Lattin, P.B.; Rosen, G.; Chu, F.C.H.; Herskovic, A. (Memorial Hospital, New York). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 465-474(1977).

Low-dose, whole-lung irradiation has been documented in the literature as an effective control of pulmonary metastases in the pediatric age group. Prior to January 1975, conventional dose fractions were used at Memorial Hospital for this patient group. However, combined with the multi-drug chemotherapy protocols so often used in this group, such treatments resulted in a high percentage of complications. Since January 1975, a radiation regimen of 100 rad per day, to a total dose of 1400 rad, has been used in these patients, encompassing one or both lung fields, as the clinical situation dictated. Ten patients have been treated and followed for a minimum of 10 months. Tumor response rate has been as good as that obtained with more conventional fractionations. However, complication rate was markedly lower in the group treated with daily fractions of 100 rad per day. A close correlation with time-dose factor (TDF) value of 16 appeared to represent a safe treatment course in this setting.

659 HYPOPHYSECTOMY AFTER IRRADIATION IN CHILDREN. Wara, W.M.; Richards, G.E.; Grumbach, M.M.; Kaplan, S.L.; Sheline, G.E.; Conte, F.A. (Univ. of California Medical Center, San Francisco). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 549-552(1977).

Nine children were referred to the University of California Medical Center, San Francisco, for growth evaluation. Each had received conventional radiation doses to the head for tumors not involving the hypothalamus or pituitary, and demonstrated clinical and laboratory evidence of hormonal deficiencies several years after treatment. Six had significant height retardation. Growth hormone deficiency was documented in all by lack of response to provocative insulin, arginine, and/or L-dopa stimulation. ACTH function was evaluated by plasma cortisol response to insulin hypoglycemia in 7; one had a subnormal response. Plasma gonadotropins were measured after lutenizing hormone releasing factor (LRF) in 7 patients; only one had an abnormal response for age and stage of sexual maturation. Foresight in treatment planning and careful follow-up of patients receiving irradiation to the head is critical, since hypothalamic-pituitary deficiencies which may occur insidiously over many years, can largely be compensated.

660 IMMUNOSUPPRESSION ASSOCIATED WITH RADIATION THERAPY. Wara, W.M. (Univ. of

California, San Francisco). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 5/6, 593-596(1977).

Studies are reviewed on suppression of immunity mediated by lymphocytes of the thymus gland and by bone marrow lymphocytes following irradiation. It was shown that high doses of radiation to anatomical sites that exclude the thymus gland usually produce suppression of the immune system. It is likely that the suppression results from irradiation of large blood volumes in the treatment fields. Data indicate that there is an increased proportion of null cells, lymphocytes with neither T- nor B-cell surface markers, after irradiation. (HLW)

661 (BNL--22463) AGING AND DNA REPAIR CAPABILITY. Tice, R.R. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 71p. Dep. NTIS \$4.50.

A review of the literature on DNA repair processes in relation to aging is presented under the following headings: DNA repair processes; age-related occurrence of unrepaired DNA lesions; DNA repair capability as a function of age; tissue-specific DNA repair capability; acceleration of the aging process by exposure to DNA damaging agents; human genetic syndromes; and longevity and DNA repair processes. (HLW)

662 (COO--3017-31) RADIATION CARCINOGENESIS. PROGRESS REPORT IV, 15 MARCH 1976--15 MAY 1977. Warren, S.; Gates, O. (New England Deaconess Hospital, Boston, Mass. (USA). Cancer Research Inst.). 1977. Contract EY-76-S-02-3017. 15p. Dep. NTIS, PC A02/MF A01.

The series of parabiont and irradiated rats has been completed, the lesions diagnosed and the data pertinent to tumors computerized and partly analyzed. The same series yielded 74 percent incidence of cataract in the irradiated partner following a whole-body dose of 1000 R with 0.2 percent in the shielded partner and also in controls. There was no abscopal effect. Other structures of the eye beside the lens, particularly the retina, showed extensive radiation damage. Parabiosis increased the incidence rate of leukemia from one percent in control single rats to five percent. Irradiation of one partner decreased the rate to 2.5 percent. Similar effects were noted for solid lymphoid tumors. A pilot study of prostatic cancer in irradiated parabiont rats demonstrated a tenfold increase in incidence. Experimental protocols bearing on cocarcinogenesis have been initiated in mice and rats, using radiation, asbestos and chemical carcinogens, but no results have been as yet obtained. We have obtained additional evidence suggesting the importance of prolactin as a cocarcinogen with radiation for induction of mammary tumors in the rat and are continuing our collaborative study of hormonal assays in the blood of parabiont rats.

663 (TID--26113-P2, pp 167-180) SMALL MAMMALS IN A GAMMA-IRRADIATED NORTHERN FOREST COMMUNITY. Buech, R.R. (North Central Forest Experiment Station, St. Paul). 1977. Enterprise Forest. Volume II. Radioecological studies.

Radiation exposure was measured on individual small mammals living around a 10,000-Ci ¹³⁷Cs gamma-radiation source at the Enterprise Radiation Forest located near Rhinelander, Wis. During the irradiation from May to October 1972, dosimeter returns were obtained from 67 individuals representing six

- different genera and seven species: *Tamias striatus* (30), *Peromyscus maniculatus* and *P. leucopus* (20), *Tamiasciurus hudsonicus* (13), *Clethrionomys gapperi* (2), *Glaucomys volans* (1), and *Eutamias minimus* (1). The dosimetry technique developed proved to be very satisfactory. Measurements obtained were subjected to regression techniques to estimate potential exposures from home range information. The relationships between measured and estimated potential exposure are discussed for *Tamias*, *Peromyscus*, and *Tamiasciurus*. A significant difference in body weight change was found between control and irradiated *Tamias* subadults. However, under the conditions of the experiment, body weight was generally not very sensitive to the radiation levels imposed on the site. Observations of external indicators of breeding condition and survival failed to produce evidence that either was affected by radiation.
- 664 EFFECTS OF LOW DOSES OF CHRONIC RADIATION ON RELATIONSHIP BETWEEN RADIORESISTANCE AND PHYSICAL DEVELOPMENT OF ANIMALS. Lisenkova, L.N. (Scientific Research Inst. of Radiation Hygiene, Leningrad). *Radiobiology (USSR)* (Engl. Transl.); 17: No. 1, 62-67(1977).
Translated from *Radiobiologiya*; 17: No. 1, 53-57(1977).
It has been shown that there is a change in degree and nature of correlation between radioresistance of mice and their physical development at the start of exposure to chronic radiation under the influence of chronic (1 to 15 months) irradiation in 6 to 7 hours daily in doses of 6, 17 and 50 mR.
- 665 RADIOPROTECTIVE PROPERTIES OF HYPOXIA AFTER ADMINISTRATION OF ANTIHYPOXIC AGENTS. Titov, B.A.; Zhrebchenko, P.G.; Znamenskii, V.V.; Terekhov, A.V. *Radiobiology (USSR)* (Engl. Transl.); 17: No. 1, 74-79(1977).
Translated from *Radiobiologiya*; 17: No. 1, 63-66(1977).
In experiments on mice, rats and dogs, it has been shown that antihypoxic agents--gutimin (guanyltiourea) and vitamin B₁₅--given separately or in combination do not lower the radioprotective effect of hypoxia, according to the postradiation survival test. However, separate or combined administration of gutimin and vitamin B₁₅ lowers the radioprotective efficacy of hypoxia in mice, according to the criterion of number of bone marrow karyocytes. The possible mechanisms of this inconsistency in action of antihypoxic agents are discussed.
- 666 LONG-TERM SEQUELAE OF COMBINED RADIATION WITH REFERENCE TO CHANGES IN CALCIUM, PHOSPHORUS, AND ALKALINE PHOSPHATASE CONTENT OF BLOOD. Istomina, G.N. *Radiobiology (USSR)* (Engl. Transl.); 17: No. 1, 119-120(1977).
Translated from *Radiobiologiya*; 17: No. 1, 100-101(1977).
Rats were exposed to whole-body gamma radiation in doses of 200 and 400 R and to beta radiation from a ⁹⁰Sr-⁹⁰Y source in doses of 1460 to 4000 rad. Radioactive iodine was administered intragastrically. Blood calcium level was not affected by gamma or beta radiation. Radioactive iodine caused a 50% decrease in blood calcium. Administration of parathormone 2 months later increased calcium content of the blood. The phosphorus content of the blood decreased with all forms of radiation. A 400 R dose of gamma radiation increased the activity of alkaline phosphatase. The activity was not affected by beta radiation, radiiodine, or a 200 R dose of gamma radiation. (HLW)
- 667 KINETICS OF COLONY FORMATION AND MIGRATION OF BONE MARROW CELLS OF (CBA X C57B1)F₁ HYBRID MICE AFTER ADMINISTRATION OF DEOXYCORTICOSTERONE. Tsyrolova, I.G.; Lozovoi, V.P.; Kozlov, V.A. (Inst. of Clinical and Experimental Medicine, Novosibirsk, USSR). *Radiobiology (USSR)* (Engl. Transl.); 17: No. 1, 131-133(1977).
Translated from *Radiobiologiya*; 17: No. 1, 108-110(1977).
Bone marrow cells were injected into x-irradiated and control mice following administration of deoxycorticosterone. Nine days later observations were made on endogenous and exogenous spleen colonies and on migration of bone marrow cells. Results showed that there was a decline in colony formation in the spleen and bone marrow of experimental animals. (HLW)
- 668 RADIOSENSITIVITY OF HEMOPOIETIC STEM CELLS OF MOUSE BONE MARROW IN THE COURSE OF PROLONGED EXPOSURE TO RADIATION. Shvets, V.N. *Radiobiology (USSR)* (Engl. Transl.); 17: No. 1, 134-138(1977).
Translated from *Radiobiologiya*; 17: No. 1, 110-115(1977).
Donor mice were exposed to gamma radiation in doses of 100 to 1800 R at a constant rate of 100 R/day and recipient mice were exposed to radiation in a dose of 900 to 950 R at a rate of 37 R/min. After transplantation of bone marrow cells, spleen colonies were counted. Results showed that an inflection occurred in the dose effect curve with different levels of CFU in bone marrow and was related to radiation dose rate, time, or accretion of radiation dose. Mechanisms for interpreting the nature of the biphasic response of CFU survival curve are discussed. (HLW)
- 669 EFFECT OF PARENTERAL FEEDING ON THE COURSE OF ACUTE RADIATION SICKNESS IN RATS WITH THE GASTROINTESTINAL SYNDROME. Moroz, B.B.; Ferorovskii, L.K.; Grozdov, S.P.; Lebedeva, G.A.; Vasil'evskaya, V.V.; Lyrshchikova, A.V.; Shcherbakova, T.A. *Radiobiology (USSR)* (Engl. Transl.); 17: No. 1, 143-147(1977).
Translated from *Radiobiologiya*; 17: No. 1, 118-122(1977).
Rats were exposed to gamma radiation and two days later parenteral feeding was begun by giving aminosol intraperitoneally, a glucose-vitamin-sodium solution subcutaneously, and an oil emulsion intravenously. Observations on 30-day survival showed that experimental rats survived longer than controls. The beneficial effect of parenteral feeding may be related to the lower functional load on the gastrointestinal tract or to more favorable metabolic conditions for recovery. (HLW)
- 670 CHANGES IN FUNCTION OF THE RAT GASTROINTESTINAL TRACT DURING THE PERIOD OF THE PRIMARY RADIATION REACTION. Gavriluk, D.M.; Krasnykh, I.G. *Radiobiology (USSR)* (Engl. Transl.); 17: No. 1, 148-152(1977).
Translated from *Radiobiologiya*; 17: No. 1, 122-125(1977).
Rats were exposed to gamma radiation in doses of 100 to 800 R and gastrointestinal function was studied by means of radiography. It was established that the functional changes in the rat's gastrointestinal tract during the period of the primary radiation are directly related to radiation dosage. With increase in dosage there was increase in duration of pylorospasm, increase in dystonic signs in the stomach and intestine, greater severity and duration of motor and evaculatory function, with

marked delay in propulsion of contrast medium. The relationship between these functional changes and time was phasic. Changes in physiological functions were demonstrable in the first few minutes after irradiation. They were the most distinct in rats exposed to 400 and 800 R. For the next 2 hours there was a tendency toward normalization in all groups. With exposure to 100 and 200 R, impaired functions were completely restored, whereas with 400 and 800 R recovery was not complete. (HLW)

- 671 CATARACT-INDUCING THRESHOLD DOSAGE OF FAST NEUTRONS. Medvedovskaya, Ts.P. Radiobiology (USSR) (Engl. Transl.); 17: No. 1, 153-157(1977).

Translated from Radiobiologiya; 17: No. 1, 126-129(1977).

Rabbits were exposed to fast neutrons in doses of 20 to 400 rad. An electrical ophthalmoscope and biomicroscopy were used for examining the lens. After 15 months the structure of the lens was severely impaired with fewer nuclear elements in the region of the germinative zone some of which were displaced to the posterior and some to the anterior cortex. The threshold dose for inducing cataract was about 100 rad. Six to 7 months after delivery of this dose clinically demonstrable opacities appeared in the lens which progressed appreciably and affected the function of the eye. Data showed that the rabbit lens is four times more sensitive to radiation than the human lens. (HLW)

- 672 DISTINCTIVE FEATURES IN POSTNATAL DEVELOPMENT OF RABBIT ADRENALS FOLLOWING INTRAUTERINE RADIATION. Moldavskii, M.I. (Inst. of Experimental and Clinical Oncology, Moscow). Radiobiology (USSR) (Engl. Transl.); 17: No. 1, 158-162(1977).

Translated from Radiobiologiya; 17: No. 1, 129-133(1977).

Following exposure of pregnant rabbits to radiation, biochemical and histological changes in the adrenal glands of the offspring were studied at intervals during postnatal development. Morphological changes in the medulla, cortex, and glomerular zone at various stages of development are described as well as changes in the content of lipid, ascorbic acid, and alkaline phosphatase. (HLW)

- 673 TOOTH-GERM DAMAGE BY IONIZING RADIATION. Sobkowiak, E.M.; Beetke, E.; Bienengraeber, V.; Heid, M. (Klinik und Poliklinik fuer Stomatologie, Rostock (German Democratic Republic)); Kittner, K.H. (Rostock Univ. (German Democratic Republic). Radiologisches Klinik). Zairyo; 65: No. 1, 19-24(1977). (In German).

Experiments on animals (four-week-old dogs) were conducted in an investigation made to study the possibility of dose-dependent tooth-germ damage produced by ionizing radiation. The individual doses were 50 R and 200 R, respectively, and they were administered once to three times at weekly intervals. Hyperemia and edemata could be observed on tooth-germ pulps from 150 R onward. Both of these conditions became more acute as the radiation dose increased (from 150 R to 600 R). Possible damage to both the dentin and enamel is pointed out.

- 674 LONG-TERM STORAGE OF MOUSE EMBRYOS AT -196°C: THE EFFECT OF BACKGROUND RADIATION. Whittingham, D.G. (Medical Research Council, London (UK)); Lyon, M.F.; Glenister, P.H.

Genet. Res.; 29: No. 2, 171-181(1977).

In order to test the feasibility of preservation of genetic stocks of mice by storage in liquid nitrogen, mouse embryos at the 8-cell stage, were frozen and stored in liquid nitrogen at -196°C under increased radiation exposures of 1.8 x, 9 x and 84 x background levels for periods of 6 to 8 months, 10 to 12 and 27 to 29 months, the 1.8 x level being regarded as a control. Their survival rates to the blastocyst stage, and after transfer to recipient females, to foetal or liveborn stages were then compared with those of unfrozen or short term frozen control embryos. The freezing process per se caused a marked loss of viability, in comparison with the unfrozen controls, but at the 1.8 x radiation level there was then no further loss in viability even at the longest storage time (27 to 29 months). Similarly, at the 9 x radiation level there was no loss of viability during storage up to 29 months, but at the 84 x level the proportions of implanted embryos and live foetuses were slightly reduced. It was not clear if this was a true effect of radiation, since it was not related to time of storage. Considering all groups, about 20 to 30% of the embryos originally frozen were recovered as foetuses or liveborn young. It is concluded that the preservation of genetic stocks by storage in liquid nitrogen is a feasible proposition.

- 675 MODIFICATIONS OF THYMIC BLAST CELLS DURING MURINE RADIOLEUKEMOGENESIS. Boniver, J.; Simar, L.J.; Courtoy, R.; Lepoint, A.; Beaumariage, M.L.; Delrez, M.; Betz, E.H. (Liege Univ. (Belgium). Inst. de Pathologie). pp 65-78 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977). From INSERM symposium no. 4; Bordeaux, France (7 - 9 Dec 1976).

Studies of thymic blast cell populations were carried out on C57BL mice strains from Liege University and Mol laboratories. The examination method using autoradiography for these cells in normal mice is outlined. The changes in morphology of the cells and in density of the population are reported for mice treated with fractionated whole body irradiation and for mice treated with bone marrow grafting after irradiation.

- 676 INTERACTION BETWEEN RADIATION AND VIRUSES IN THE INDUCTION OF MURINE THYMIC LYMPHOMAS AND LYMPHATIC LEUKEMIAS. Kaplan, H.S. (Stanford Univ., Calif. (USA). Dept. of Radiology). pp 1-18 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977). From INSERM symposium no. 4; Bordeaux, France (7 - 9 Dec 1976).

Among the components which are essential to the induction of lymphomas and leukemias in C57BL/Ka mice are: 1) the virus (RadLV); 2) susceptible target cells for neoplastic transformation; 3) the thymic microenvironment; and 4) a genetically susceptible and histocompatible host. In addition, tumor incidence can be significantly altered by exposure to ionizing radiation or to chemical agents such as urethan, and is also modulated by a number of constitutional factors, including strain, sex, age, nutrition, and hormonal balance. Recent evidence also suggests that alterations in the immunocompetence of the host during the course of viral infection may play an important role in the induction process. Finally, although of limited significance in the virus-induced disease, effects of radiation on the bone marrow clearly

have an important role in the development of radiation-induced thymic lymphomas. The available information to date on each of these component aspects of this tumor induction system are summarized in this section.

677 TARGET CELLS INVOLVED IN RADIATION AND RADIATION LEUKEMIA VIRUS LEUKEMOGENESIS.

Haran-Ghera, N. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Chemical Immunology). pp 79-89 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From INSERM symposium no. 4; Bordeaux, France (7 - 9 Dec 1976).

Comparative studies concerned with the induction and early proliferation phases of preleukemic cells in relation to host environments using radiation or radiation leukemia virus as the leukemogenic agents, indicated different developmental pathways. The lack of thymus in mice exposed to fractionated irradiation did not prevent preleukemic cell induction but did interfere with the incidence of RadLV induced preleukemic cells. Thymus removal within several days following RadLV inoculation prevented the establishment of preleukemic cells in the bone marrow. The radiation induced preleukemic cells in the bone marrow. The radiation induced preleukemic cells were not lysed by anti-Thy-1.2 serum treatment and guinea pig complement whereas the RadLV induced ones were lysed to different degrees. Elimination of Thy-1.2 bearing cells from the virus induced preleukemic population reduced the development of overt T leukemias of donor origin. The thymus seemed of essential importance for establishing the proliferation of RadLV induced preleukemic cells but not for those induced by fractionated irradiation.

678 EXPERIMENTAL RADIATION-INDUCED LEUKEMIA.

Upton, A.C. (State Univ. of New York, Stony Brook (USA). Dept. of Pathology). pp 37-50 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From Symposium on radiation-induced leukemogenesis and related viruses; Bordeaux, France (7 Dec 1976).

See CONF-761212--.

Of the various neoplasms induced by ionizing radiation in human and animal populations, leukemias and lymphomas were among the first to receive systematic study and have remained under intensive investigation up to the present time. The reticular tissue neoplasm that has been the most thoroughly studied is a lymphoma of the thymus which characteristically predominates in whole-body irradiated mice. Thanks to intensive research on this tumor, much is now known about its pathogenesis. The purpose of this report is to review the knowledge of pathogenesis of other types of radiation-induced leukemias and lymphomas, in an effort to assess the extent to which the comparative data for all such diseases can be integrated into a single unifying framework.

679 ACUTE AND LATE DAMAGE IN THE MOUSE SMALL INTESTINE FOLLOWING MULTIPLE FRACTIONATIONS OF NEUTRONS OR X-RAYS.

Geraci, J.P.; Jackson, K.L.; Christensen, G.M.; Thrower, P.D.; Weyer, B.J. (Univ. of Washington, Seattle). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 7/8, 693-696(1977).

The neutron RBE for acute intestinal damage as measured by decrease in the intestine DNA content and the LD/sub 50/5 day/ following whole-body exposure of mice is compared with

the RBE for late effects in this organ. Late damage, primarily fibrosis, ulceration, perforation, and obstruction, was produced by irradiating a segment of the intestine. A significant sparing effect of fractionation was observed for all forms of gut injury with neutrons and X-rays. However, there was less sparing with neutron-induced injury, resulting in an increase in RBE with fractionation. The RBE for late effects changed more rapidly than the RBE for acute effects. This resulted in a significantly larger RBE for late effects relative to acute effects as the neutron dose per fraction approached that used clinically.

680 LATE EFFECTS OF X-IRRADIATION ON THE ABILITY OF MOUSE BONE MARROW TO SUPPORT HEMATOPOIESIS. Nelson, D.F.; Chaffey, J.T.; Hellman, S. (Harvard Medical School, Boston). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 1/2, 39-45(1977).

A modified spleen colony method was used to measure the functional ability of the irradiated bone marrow to support CFU (Colony Forming Unit) proliferation. This was assayed with a two-step procedure. Mice, whose left lower extremities had been previously irradiated, were given whole body irradiation and bone marrow cells. After 8 days, the number of cells in the previously irradiated and non-irradiated limbs was counted and assayed for CFU content by injection into lethally irradiated secondary recipients. A shallow dose-related decrease in the ability of irradiated mouse bone marrow to support clonal growth was seen at all times after bone irradiation. The proliferation ratio did not decrease below 0.28 even when the bone marrow had received as much as 3000 rad. Recuperation of the ability of irradiated mouse bone marrow to support clonal growth was observed at intervals of 9 and 12 months.

681 QUANTITATIVE ESTIMATION OF HISTOLOGICAL CHANGES IN SUBCUTANEOUS VASCULATURE OF THE MOUSE AFTER X-IRRADIATION. Takahashi, M.; Kallman, R.F. (Stanford Univ., CA). Int. J. Radiat. Oncol., Biol. Phys.; 2: No. 1/2, 61-68(1977).

The right hind legs of mature female BALB/c mice were irradiated locally with single x-ray doses of 250 to 4000 rad (250 kV x-rays, half value layer (HVL) 1.3 mm Cu). Microangiography by intracardiac injection of India ink was performed at intervals between 1 and 12 weeks post-irradiation. Specimens of skin were fixed and sectioned serially at 50 µm; sections were stained with luxol fast-blue periodic acid Schiff (LFB--PAS). Four parameters were estimated by morphometric methods. Vascular volume increased significantly, reaching a peak at 4 weeks after 2000 or 4000 rad; for doses of 1000 rad or less, there were no changes in vascular volume during the 12 week period of observation. Vascular diameter increased roughly in parallel with vascular volume, but instead of peaking at the 4th week, diameter continued to increase up to the 12th week after 2000 and 4000 rad. Vascular surface area/unit volume of tissue remained essentially constant for 4 weeks, and then decreased to a minimum at 12 weeks. Vascular length/unit volume of tissue also decreased continuously until 12 weeks after 2000 or 4000 rad. No changes in these parameters were associated with doses of 1000 rad or less. The absence of effects of doses less than 2000 rad suggests that the observed radiation effects on the vasculature of the subcutis are part of an "all-or-nothing" phenomenon with a threshold between 1000 and 2000 rad. Because these changes are similar to those described in or around tumors by

others, it is likely that the "tumor bed effect" of irradiation is a direct consequence of radiation-induced vascular changes as well as a phenomenon involving a reduced capacity for neovascularization.

- 682 INVESTIGATIONS OF ACCELERATION OF DIFFERENTIATION AND AGING PROCESSES IN RATS AFTER X IRRADIATION. Rose, H.; Hecker, D.; Moldenhauer, H. (Humboldt-Universität, Berlin (German Democratic Republic). Bereich Medizin (Charité)). Z. Alternsforsch.; 32: No. 2, 105-119(1977). (In German).

On the basis of the hypothesis of a relation between the processes of differentiation and aging in connection with the assumption, that ionizing radiation accelerates the aging of organism, the authors investigated the changes in the cellular reaction in organ cultures of the spleen and the kidney, in the pattern of enzymes in the kidney and the liver and moreover the behaviour of the serum protein level. In dependence of the x-ray dose and the length of time after radiation an acceleration of the processes of maturation and differentiation could be observed with the three above mentioned methods. Changes could be found which were similar to those, observed in adult or senile rats. The latent phase of organ cultures was prolonged as well as the morphology of cells migrating out of the explants did not differ from that of senile donor animals. The chemical differentiation of the kidney is accelerated after radiation. The detected changes were similar to those in adult or senile rats. The increase in the albumin, haptoglobin and transferrin concentrations of juvenile rats following radiation mean an acceleration of development, for these concentrations are attained later during normal development. The authors discuss their results with reference to the existing theories of aging.

- 683 INTERACTION BETWEEN RADIATION AND VIRUSES IN THE INDUCTION OF MURINE THYMIC LYMPHOMAS AND LYMPHATIC LEUKEMIAS. Kaplan, H.S. (Stanford Univ., Calif. (USA). Dept. of Radiology). pp 1-18 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From Symposium on radiation-induced leukemogenesis and related viruses; Bordeaux, France (7 Dec 1976).

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- 684 TARGET CELLS INVOLVED IN RADIATION AND

RADIATION LEUKEMIA VIRUS LEUKEMOGENESIS. Haran-Ghera, N. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Chemical Immunology). pp 79-89 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

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- 685 SEROLOGICAL AND BIOLOGICAL CHARACTERIZATION OF ECOTROPIC MULV EXPRESSION IN RADIATION-INDUCED LEUKEMIAS OF MICE. Ihle, J.N. (National Cancer Institute, Frederick, Md. (USA). Frederick Cancer Research Center). pp 265-274 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

From Symposium on radiation-induced leukemogenesis and related viruses; Bordeaux, France (7 Dec 1976).

See CONF-761212--.

In the present studies, an attempt was made to examine the expression of MuLV (murine leukemia virus) after radiation by serological techniques as well as to examine the expression of MuLV antigens in thymic lymphomas to determine the influence of endogenous ecotropic viruses in pathogenesis. Although these results have demonstrated a lack of correlation between endogenous ecotropic viruses and radiation leukemia, they unfortunately do not shed any light on what the causative events or viruses might be. In many respects, the data suggest that radiation-induced leukemia in mice is comparable to 'spontaneous' leukemias in a variety of species including man for which there is no strong evidence for the involvement of C-type viruses. For this reason, the elucidation of the molecular mechanisms in radiation-induced leukemia in mice should be of particular importance as an extremely relevant experimental model of pathogenesis.

- 686 DUAL ROLE OF THE LYMPHOCYTE IN RADIATION LEUKEMOGENESIS. Yuhas, J.M. (New Mexico Univ., Albuquerque (USA). Cancer Research and Treatment Center; New Mexico Univ., Albuquerque (USA). Dept. of Radiology). pp 99-114 of Radiation-induced leukemogenesis and related viruses. Duplan, J.F. (ed.). Amsterdam, Netherlands; North-Holland (1977).

See CONF-761212.

Until recently it was believed that mice were tolerant of the leukemogenic viruses they

carried largely because the methodology available did not allow the demonstration of specific anti-viral antibodies in mouse serum. An attempt to determine whether malignant and non-malignant lesion occurred at random in experimental mouse populations gave the first suggestion that mice were immunologically responsive to leukemia virus antigens. The suggestion of a functionally significant murine antibody response against endogenous leukemia viruses was tested further in the laboratory and it was demonstrated that glomerulosclerotic lesions did contain virus specific antigen-antibody complexes. Both the glomerulosclerosis and specific antibody assays have yielded data which suggest that greater immunological reactivity against endogenous leukemia viruses is associated with a reduced risk of leukemia in untreated animals. The reduced risk is also observed in single-dose irradiated mice, but doses in excess of 100 rads inhibit the development of glomerulosclerosis. These observations were interpreted as indicating that inhibition of the immune reactions against endogenous leukemia viruses did contribute to the yield of leukemia, at least in the high single-dose range. Since fractionation of the dose would reduce its immunosuppressive effects, it was apparent that radiation effects in addition to immunosuppression had to be considered. Therefore, a model system was developed in which radiation alone did not produce leukemia, but the addition of extrinsic leukemia virus to the mice allowed the study of the effects of radiation on the lymphoid tissues. The data presented here compare the effects of acute versus chronic or fractionated irradiation on the sensitivity of mice to high and low leukemia virus burdens.

- 687 PHYSICAL SEPARATION OF THE CYCLING AND NONCYCLING COMPARTMENTS OF MURINE HEMOPOIETIC STEM CELLS. Visser, J.; van den Engh, G.; Williams, N.; Mulder, D. (Radiobiological Inst., Rijswijk, Netherlands). pp 21-27 of Experimental hematology today. Baum, S.J.; Ledney, G.D. (eds.). New York; Springer-Verlag (1977).

From Proceedings of the International Society for Experimental Hematology; Washington, DC, USA (17 Aug 1976).
See CONF-760850--.

Physical properties of the pluripotent hemopoietic stem cell of the mouse were studied by use of a combination of methods: spleen colony assay (CFU-s), equilibrium density centrifugation, velocity sedimentation at unit gravity, and thymidine cytocide. Normal bone marrow CFU-s from adult mice were found to have sedimentation rates and density distributions which did not correspond to distributions of a single cell type. It appeared that bone marrow CFU-s from mice recovering from radiation damage had a uniform density and sedimentation rate distribution. The heterogeneity of normal marrow CFU-s can be attributed to the existence of two subpopulations: a slowly sedimentating population of quiescent cells and a more rapidly sedimenting population of proliferating cells. The difference in sedimentation rates can be explained by a slight density increase (from 1.070 to 1.075 g/cm³) at the transition from the resting into the cycling state. The noncycling CFU-s are considered to be a homogeneous population with a diameter of 7.0 ± 0.4 μm. The subpopulation of cycling CFU-s is calculated to vary in diameter from 7.3 ± 0.4 μm to 9.2 ± 0.5 μm depending on their phase in the cell cycle.

- 688 CHARACTERIZATION OF BONE MARROW AND LYMPH NODE REPOPULATING CELLS BY TRANSPLANTING

MONONUCLEAR CELLS INTO RADIATED DOGS. Ross, W.M.; Koerbling, M.; Northdurft, W.; Calvo, W.; Flidner, T.M. (Univ. of Ulm, Ger.). pp 29-38 of Experimental hematology today. Baum, S.J.; Ledney, G.D. (eds.). New York; Springer-Verlag (1977).

From Proceedings of the International Society for Experimental Hematology; Washington, DC, USA (17 Aug 1976).

See CONF-760850--.

The present investigations deal with an attempt to identify and characterize the multipotential stem cell present in mononuclear cell (MNC) suspensions collected from the peripheral blood of dogs by leukocytapheresis; various morphologic and functional tests have been employed in an endeavor to accomplish this task. In an attempt to increase the yield of MNC and, in particular, of stem cells, the presence of which was assumed to be indicated by CFU-c (colony forming units in agar), dextran sulfate (DS) was administered i.v. (15 mg/kg) 30 min before the beginning of leukocytapheresis. DS has been found to be an effective CFU-c mobilizing agent, capable of increasing the number of CFU-c in peripheral blood by 7 to 10 times within 3 hr. During a 4 hr leukocytapheresis, about 6.5-14 x 10⁹ MNC were collected. To eliminate erythrocytes, a Ficoll-Isopaque gradient was employed. A discontinuous albumin gradient was prepared with 6 fractions (17 to 27 percent albumin, 350 mOsm) in an attempt to obtain a cell suspension with an improved ratio of CFU-c to PHA-reactive lymphocytes. Lymphocytes accumulated predominantly in fractions 4 to 6. CFU-c were found primarily in fraction 2; one cell out of 13 MNC was a CFU-c and 82 percent of the CFU-c was found here. In contrast, the majority of PHA-responsive cells was found in fractions 3 and 4.

- 689 STUDIES OF ERYTHROID INDUCTIVE MICROENVIRONMENT IN VITRO. van Zant, G.; Goldwasser, E. (Univ. of Chicago). pp 71-80 of Experimental hematology today. Baum, S.J.; Ledney, G.D. (eds.). New York; Springer-Verlag (1977).

From Proceedings of the International Society for Experimental Hematology; Washington, DC, USA (17 Aug 1976).

See CONF-760850--.

Spleen cells from radiated mice (XS), but not from normal mice (NS), when combined with mouse marrow cells in vitro, had two effects on hemoglobin synthesis: increased baseline and augmented erythropoietin-induced, hemoglobin formation. Spleen cells from normal and radiated rats caused increased hemoglobin synthesis by rat marrow cells in a dose-dependent manner. In addition, lung and thymus cells from radiated rats, but not from normal rats, caused increased hemoglobin synthesis by rat marrow cells. Rat NS augmented hemoglobin formation by mouse marrow, but neither mouse NS nor mouse XS had an effect on rat marrow. Medium from rat NS cultures stimulated hemoglobin synthesis when added to rat marrow cells. The increases in baseline, and in the response to erythropoietin, were dependent on the amount of "conditioned medium." The substance in the medium responsible for these effects was not erythropoietin.

- 690 BONE MARROW TRANSPLANTATION IMMUNOLOGY. Trentin, J.J.; Kiessling, R.; Wigzell, H.; Gallagher, M.T.; Datta, S.K.; Kulkarni, S.S. (Baylor Coll., Houston, TX). pp 179-183 of Experimental hematology today. Baum, S.J.; Ledney, G.D. (eds.). New York; Springer-Verlag (1977).

From Proceedings of the International

Society for Experimental Hematology;
Washington, DC, USA (17 Aug 1976).

See CONF-760850--.

Tests were made to determine whether genetic resistance (GR) to bone marrow transplantation represents a natural lymphoma-leukemia defense mechanism, as follows: (C57 x AKR) F₁ hybrid mice show GR to C57 parental bone marrow cells, but not to AKR parental bone marrow cells (C3H x AKR) F₁ hybrids show no GR to bone marrow transplantation from either parental strain. However, transplantation of AKR lymphoma cells into lethally irradiated "resistant" (C57 x AKR) F₁ and "nonresistant" (C3H x AKR) F₁ hybrids produced lymphomatous spleen colonies in "nonresistant" hybrids but not in "resistant" hybrids. Thus "resistant" (C57 x AKR) F₁ hybrids can recognize and reject AKR lymphoma cells, but not normal AKR bone marrow cells. A normal biologic role of leukemia-lymphoma surveillance was postulated for genetic resistance to marrow transplantation, directed at antigens which, like TL, are expressed on normal hemopoietic cells of some strains, but only on leukemic cells of other strains.

- 691 MECHANISM OF DONOR TO HOST TOLERANCE IN RAT BONE MARROW CHIMERAS. Tutschka, P.; Schwerdtfeger, R.; Slavin, R.; Santos, G. (Johns Hopkins Oncology Center, Baltimore). pp 191-197 of Experimental hematology today. Baum, S.J.; Ledney, G.D. (eds.). New York; Springer-Verlag (1977).

From Proceedings of the International Society for Experimental Hematology; Washington, DC, USA (17 Aug 1976).

See CONF-760850--.

Lewis rats were conditioned with cyclophosphamide and grafted with AgB incompatible bone marrow. They were examined 250 days after transplantation and demonstrated to be healthy complete chimeras. Marrow cells from these chimeras were infused into lethally irradiated ACI, Lewis and BN recipients. Graft-versus-host disease occurred only in the BN rats. Other chimeric rats were given no treatment, busulfan, CY, or total body irradiation prior to the infusion of normal ACI BM. GVHD occurred only in animals given CY or TBI. Normal Lewis rats were conditioned with TBI and given ACI BM. In addition, they received whole blood, irradiated blood, or serum from chimeric rats. GVHD developed in all animals except those given unirradiated chimeric blood. These studies suggest that suppressor cell populations, sensitive to immunosuppression, are likely the fundamental mechanism of recovery from GVHD.

- 692 CHANGES IN HUMAN BONE MARROW COLONY-FORMING CELLS FOLLOWING CHEMOTHERAPY USING AN AGAR DIFFUSION-CHAMBER TECHNIQUE. Gordon, M.Y. (Inst. for Cancer Research, Belmont, Eng.). pp 233-237 of Experimental hematology today. Baum, S.J.; Ledney, G.D. (eds.). New York; Springer-Verlag (1977).

From Proceedings of the International Society for Experimental Hematology; Washington, DC, USA (17 Aug 1976).

See CONF-760850--.

Studies have been made of the effects of cyclophosphamide on the early granulocytic precursor cells in the marrow of patients receiving intermittent high doses (5 g) of the drug. This study was designed to investigate the effect of a single cytotoxic agent on normal granulocytic precursor cells; measurements have been made of the initial cytotoxicity, recovery, and changes in proliferation rate. The growth of granulocytic colonies was assayed in agar diffusion

chambers. For this, bone marrow cells were suspended in semisolid agar medium, introduced into diffusion chambers for intraperitoneal incubation in radiated (900 rad ⁶⁰Co γ) mice. The colonies present in the agar were scored 8-9 days later. In addition to measuring the effect of treatment on the colony-forming capacity of the patients' marrow, full dose-response curves were obtained by injecting graded doses of cyclophosphamide into chamber-bearing mice--the method allows some account to be taken of the continuous changes in drug activity, which occurs during its degradation in vivo. Comparison of these results with measurements of the sensitivity of mouse femoral cells under the same conditions or exposed to cyclophosphamide in situ in the donor mouse has been used to detect any effect of the culture environment or the response of the cells. Following treatment with cyclophosphamide, the incidence of colony precursor cells in the patients' marrow has been monitored. Changes in the proliferation rate of these cells during the recovery period have also been estimated by measuring their sensitivity to the S-phase specific drug, cytosine arabinoside. Information on the timing of changes in the incidence and proliferation rate of granulocytic precursor cells may provide guidelines for improving schedules of treatment in an attempt to reduce the attendant bone marrow toxicity.

- 693 (ERDA-tr--285/2) RADIOBIOLOGY. Translation of Radiobiologiya; 17: No. 2, 163-320(1977). 199p. Dep. NTIS, PC E04/MF A01.

Available from NTIS for \$45.00 per year (six issues) as NTISUB C 120 002.

Separate abstracts were prepared for the 33 papers presented in this English translation of Radiobiologia. (HLW)

- 694 (BNWL-SA--5855) PLUTONIUM IN HUMAN LUNG IN THE HANFORD ENVIRONS. Nelson, I.C.; Thomas, V.W. Jr. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1977. Contract EY-76-C-06-1830. 8p. (CONF-770409--9). Dep. NTIS, PC A02/MF A01.

From 4. congress of the International Radiation Protection Agency; Paris, France (24 Apr 1977).

The measured and theoretical results compare closely. In most cases the average concentration of the set was within a factor of 5 of the theoretical estimate. The marked decrease in measured concentrations of plutonium in lung from 1966 to 1970 coincided with an approximate tenfold increase in tissue sample size. That period was also one in which fallout concentrations decreased. Caution should be used in developing conclusions from these results because many of the sample results during this time and earlier were "less than," and their true value may have been substantially less than that shown. The apparent increase in measured concentrations of plutonium in lung in the period 1971-1974 is not understood. The new alpha spectrometry procedure was used on these samples, and some systematic error in earlier work may be suggested. The possibility of a small contribution from Hanford facilities cannot be absolutely ruled out. The average concentration in lung over the period covered (assuming a "less than" value to be at detection limit) was 0.5 fCi/g of lung, and the average of the maximum values noted was 0.8 fCi/g. For comparison, the theoretical average value where it is assumed that each year since 1965 an individual is autopsied was 0.4 fCi/g. If Hanford facilities have contributed to the plutonium content of lungs in individuals

residing in the environs, that contribution would appear at most to be about that from worldwide fallout. But, more likely, the plutonium in lung derives almost totally from fallout, and the Hanford contribution is negligible by comparison.

- 695 (CONF-770409--3) DISTRIBUTION OF DOSE WITHIN THE BODY FROM A PHOTON EMITTER PRESENT IN AN ORGAN. Snyder, W.S.; Ford, M.R.; Warner, G.G. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 9p. Dep. NTIS, PC A02/MF A01.

From 4. congress of the International Radiation Protection Agency; Paris, France (24 Apr 1977).

A dosimetric system was developed which provides estimates of mean radiation dose to organs from photon sources distributed uniformly in one or more organs. Although the sources of photons are assumed to be distributed uniformly, it is not true that dose from these photons is uniformly distributed. In particular, when a source of photons is located in a particular organ, nearby tissues will be irradiated at doses which decrease markedly with distance from the source. The mean dose may give a poor approximation to the actual dose if the tissues over which dose is averaged are extensive, for example, the remainder of the body. A set of enveloping organs was devised for liver, lungs, etc., which give mean dose at distances from zero to one centimeter from the source organ, from one to two centimeters, etc. These can be used to yield estimates of the extent of inhomogeneity of the dose distribution from a source of photons located in the source organ.

- 696 (SAND--77-0853C) ASSESSMENT OF THE ENVIRONMENTAL IMPACTS PRODUCED BY THE TRANSPORT OF RADIOACTIVE MATERIALS THROUGH URBAN AREAS. DuCharme, A.R.; Taylor, J.M.; Tierney, M.S.; Finley, B.H. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 8p. (CONF-771113--4). Dep. NTIS, PC A02/MF A01.

From 4. joint conference on sensing of environmental pollutants; New Orleans, LA, USA (6 Nov 1977).

Sandia Laboratories is performing an environmental assessment for the Nuclear Regulatory Commission to ascertain the impacts produced by the transportation of radioactive materials near and through a large, densely populated area. Radiological, nonradiological and economic environmental impacts due to the transportation of all radioactive materials are considered, excepting those related to weapons, weapon components, or shipments on military vehicles. Although New York City is being studied initially to execute the methodology as a function of a real, complex urban environment, the assessment model developed is general in its basic content and is suitable for application to any urban area. Radiological consequences are being computed for cases involving "normal" and accident conditions. In the "normal" case, nothing unusual takes place, but small radiation doses are still received by nearby people. In the accident case, dispersion of possibly released material away from the accident site is considered. In addition, impacts due to deviations from quality assurance practices, as a result of human error, are being calculated using the assessment model in a special manner. Certain aspects of sabotage and diversion are also being investigated for an urban setting. Radiological consequences are being quantified in terms of human health effects and decontamination costs.

- 697 RADIATION EXPOSURE DUE TO ACTINIDES RELEASED FROM NUCLEAR FACILITIES. Hesel, D.; Bonka, H.; Schmidtlein, P. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Reaktortechnik). pp 809-812 of Reaktortagung, Mannheim, 29.3.-1.4.1977. Sektion 6: Bau und Betrieb von Kernenergieanlagen. Eggenstein-Leopoldshafen, Germany, F.R.; ZAED (1977). (In German) From Reactor congress 1977; Mannheim, Germany, F.R. (29 Mar 1977). 4 figs.; 4 tabs.; 4 refs. Short communication only. release rates and dose factors for inhalation according to the new lung model for U, Np, Pu, Am, Cm. AMERICIUM ISOTOPES;FISSION PRODUCT RELEASE;BIOLOGICAL MODELS;CURIUM ISOTOPES;ENVIRONMENT;ENVIRONMENTAL EXPOSURE PATHWAY;INHALATION;INTERNAL IRRADIATION;LUNGS;NEPTUNIUM ISOTOPES;NUCLEAR FACILITIES;OPERATION;PLUTONIUM ISOTOPES;RADIATION DOSES;URANIUM ISOTOPES

- 698 EFFECT OF STRONTIUM-90 ON BLOOD SERUM GLYCOPROTEINS OF SWINE. Yakovleva, V.P.; Burov, N.I. Radiobiology (USSR) (Engl. Transl.); 17: No. 2, 188-192(1977). Translated from Radiobiologiya; 17: No. 2, 312-316(1977). Oral administrations of ⁹⁰Sr were given daily to pigs from the first day after birth to the age of 3 months. The animals were killed at intervals up to 362 days and biochemical analyses were made on blood for glycoproteins, hexoses, and sialic acid. The nature and degree of changes in concentration of glycoproteins were related to the amount of isotope given, dose rate, and cumulative absorbed dose to the skeleton. The hexose and sialic acid content of blood serum increased in animals given ⁹⁰Sr. The significance of the results in relation to wound healing and repair of injured tissues is discussed. (HLW)

- 699 (BNWL-SA--5910) RESPIRATORY TRACT CARCINOGENESIS IN LARGE AND SMALL EXPERIMENTAL ANIMAL FOLLOWING DAILY INHALATION OF RADON DAUGHTERS AND URANIUM ORE DUST. Stuart, B.O.; Palmer, R.F.; Filipy, R.E.; Dagie, G.E.; McDonald, K.E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1977. Contract EY-76-C-06-1830. 5p. (CONF-770409--6). Dep. NTIS, PC A02/MF A01.

From 4. congress of the International Radiation Protection Agency; Paris, France (24 Apr 1977).

Uranium ore miners of the Colorado plateau suffer more than 6 times the normal incidence of lung cancer, and their mortality rates due to pneumoconiosis and emphysema are 5 times greater than in the general population. Inhalation exposures of beagle dogs and rodents to radon daughters and uranium ore dust were undertaken to determine which of these uranium mine air contaminants, and at what levels, are responsible for the high incidences of these diseases. Results are discussed.

- 700 CHANGES IN SOME BIOCHEMICAL INDICES OF BLOOD AND TISSUES AFTER INTAKE OF STRONTIUM-90 AND CALCIUM-45. Fedorova, A.F.; Zapol'skaya, N.A. (Scientific Research Inst. of Radiation Hygiene, Leningrad). Radiobiology (USSR) (Engl. Transl.); 17: No. 1, 111-115(1977). Translated from Radiobiologiya; 17: No. 1, 93-97(1977).

Strontium-90 and ⁴⁵Ca were given by mouth to two groups of rats and a third group of rats served as control. Blood and tissues were then

analyzed for histamine, acetylcholine, cholinesterase, and histaminase. Results showed that ^{90}Sr caused a rapid increase in free histamine in the blood while the influence of ^{45}Ca was less marked. The histamine content of the liver and intestine also increased with intake of ^{90}Sr but not with ^{45}Ca . Similar results were obtained with acetylcholine. With intake of ^{90}Sr the activity of cholinesterase and histaminase in the liver increased initially and then decreased. Enzyme activity was stimulated by ^{45}Ca . The effect of ^{90}Sr was 364 times greater than that of ^{45}Ca with regard to accumulation of metabolites in blood and tissues and changes in enzyme activity. (HLW)

- 701 QUANTITATIVE AUTORADIOGRAPHY FOR THE STUDY OF DOSE RATES IN BIOLOGICAL OBJECTS FOLLOWING ADMINISTRATION OF STRONTIUM-90. Sarapul'tsev, I.A.; Rasin, I.M. Radiobiology (USSR) (Engl. Transl.); 17: No. 1, 180-183(1977).

Translated from Radiobiologiya; 17: No. 1, 146-149(1977).

A method of quantitative autoradiography for examination of distribution of dose rates after administration of ^{90}Sr is described. It is based on the use of thick-layer preparations and comparison standards and results are reported for dose rates in bone tissues of dogs. The error of the method does not exceed 10% with reference to dose rates in bone tissue and it is due primarily to errors in determining concentration of activity in the comparison standards and interpretation of autoradiograms. The error factor increases to 20% when determining dose rates in soft tissues. (HLW)

- 702 (TID--27934) PROGRESS REPORT FOR STUDIES OF HEALTH OF PLUTONIUM WORKERS. (Rochester Univ., N.Y. (USA)). 1977. Contract EY-76-S-02-3501. 7p. Dep. NTIS, PC A02/MF A01.

Since the publication of a twenty-seven year study of selected plutonium Los Alamos Scientific Laboratory (LASL) workers in November 1973, the program involved with long-term toxicity in man has expanded. Re-examination of the 24 plutonium workers heavily exposed during World War II showed one of the 26 workers of this original group followed medically died of a coronary in 1952 and another died after being struck by an automobile in 1974. Of the surviving 24 workers, 22 returned to LASL during the period October 1976 to June 1977, for a complete medical study comparable to that conducted on 21 of the group in 1971 to 1972. Two radiographic bone lesions of interest (but of unknown significance) are asymptomatic Paget's disease (osteitis deformans) in a 63-year old man associated with high alkaline blood phosphatase and a benign appearing tumor in the pelvis which developed in adult bone. Review of old films showed that the Paget's lesions had progressed slowly since 1965 and that the other lesion was not present in 1960 films. Additional films are being taken. The results of assay of blood and urine for plutonium since 1971 and the plutonium content of tissues taken at autopsy of the worker who was killed are tabulated. Adding the plutonium contents of the organs that store the element gave a total body burden of 22.7 nCi, which compares favorably with an estimated burden of 18 nCi based on urine assay values in 1976.

and Measurements (1977). 65p. (NCRP--55).

A major protective action to be considered after a serious accident at a nuclear power facility involving the release of ^{131}I is the use of stable iodide as a thyroid blocking agent to prevent thyroid uptake of radioiodines. For greatest effectiveness, the blocking agent should be administered within a few hours after an accident. Since reliable radiation monitoring data may not be available that quickly, the decision to administer stable iodide should be based on a pre-planned estimate of the probable degree of contamination from the accident. For people beyond the immediate vicinity of the reactor, the decision to administer stable iodide, to instruct them to remain indoors, or to evacuate them would depend on the type of accident, on preplanned estimates of release, on wind direction and, later, on monitoring data as they become available. An extensive review of mass evacuation shows that masses of up to 150,000 persons have been evacuated safely in natural or potential man-made disasters. These evacuations have been carried out within hours without loss of life, panic or looting. Based on these experiences, urban as well as rural populations can be evacuated promptly and safely.

- 704 CESIUM-137 FROM THE ENVIRONMENT TO MAN: METABOLISM AND DOSE. Washington, DC: National Council on Radiation Protection and Measurements (1977). 53p. (NCRP--52).

Data on ^{137}Cs present in world-wide fallout are reviewed with reference to movement in the environment and food chains and its entry into humans. Seasonal fluctuations in deposition and in dietary levels, effects of soil type on the levels in vegetation, the early relations of these levels to deposition, and the later emergence of evidence of root uptake by plants and the time lag between deposition and dietary levels have been noted. Particular environments and ecosystems showing levels higher than usual have been indicated. In particular, estimates of ^{137}Cs in the pasture-cow-milk-man food chain appear to be reasonable. Several recent predictive studies now make it easier to follow a monitoring program and detect early changes that might indicate differences between various models of particular environmental circumstances. Dosimetric data obtained from studies of fallout and from laboratory experiments indicate that the elimination half-times for infants and children are significantly shorter than for normal adults. The same is true for the pregnant female, on the average, and for individuals subject to certain muscle wasting diseases. Also, the fraction of photon energy escaping from the body is somewhat larger for infants and children due to their smaller body sizes. Thus, the assumptions concerning the dose that would follow local deposition on pasture appear to be reasonable for the average adult. However, one would expect somewhat lower doses (on the average) for infants, pregnant women, and muscular dystrophy patients. The maximum permissible levels for concentrations of ^{137}Cs in air and water for occupational exposure do not differ significantly from previously recommended levels. A small number of studies of effects of ^{137}Cs on animals suggests that the whole body of the animal is substantially irradiated, and the results of these studies are in general agreement with other studies of effects of low-LET radiation.

- 703 PROTECTION OF THE THYROID GLAND IN THE EVENT OF RELEASES OF RADIOIODINE. Washington, DC: National Council on Radiation Protection

- 705 COMPARATIVE EVALUATION OF TOXICITY OF CERIUM-144 AND PROMETHIUM-147 IN RATS, ACCORDING TO BIOCHEMICAL INDICES. Fedorova,

A.V.; Zapol'skaya, N.A. (Leningrad Scientific Research Inst. of Radiation Hygiene). Radiobiology (USSR) (Engl. Transl.); 17: No. 2, 75-80(1977).

Translated from Radiobiologiya; 17: No. 2, 221-225(1977).

Studies were made of changes in the histamine-histaminase, acetylcholine-cholinesterase system. The results indicated that significant changes in these systems were observed in the intestine and liver following administration of cerium-144, and negligible changes were noted with administration of promethium-147. These differences are apparently related to the difference in energy of β -particles.

- 706 CHRONIC METHYLMERCURY EXPOSURE IN THE MONKEY (MACACA MULATTA). Luschei, E.; Mottet, N.K.; Shaw, C.M. Arch. Environ. Health; 32: No. 3, 126-131(1977).

Small daily doses of methylmercury hydroxide were administered to rhesus monkeys for periods of up to 17 months. Behavioral tests of peripheral vision and of the accuracy and rapidity of hand movements did not disclose any early subtle deficits preceding the onset of obvious signs of neurotoxicity. These signs appeared suddenly and involved reduced food intake (anorexia), clumsiness of jumping, loss of fine control of the digits, and uncoordinated mastication. With a constant daily dose of 0.1 mg/kg or less, blood concentration of mercury reached a peak after about 2 months, and then decreased to about half the peak value. Subsequently, increasing the daily dose level above 0.1 mg/kg (range of 0.12 to 0.21 mg/kg) produced an increase of blood concentration which tended to stabilize in the range of 2.0 to 2.5 ppm. After several months at these elevated concentrations all animals exhibited signs of neurotoxicity.

- 707 EFFECTS OF OZONE EXPOSURE IN CANADIANS AND SOUTHERN CALIFORNIANS. Hackney, J.D. (Rancho Los Amigos Hospital, Downey, CA); Linn, W.S.; Karuza, S.K.; Buckley, R.D.; Law, D.C.; Bates, D.V.; Hazucha, M.; Pengelly, L.D.; Silverman, F. Arch. Environ. Health; 32: No. 3, 110-116(1977).

Comparison of published reports on physiological effects of exposure to ozone (O_3) suggests that Canadians are more reactive than southern Californians. Responses of subjects and experimental methods were compared in a cooperative investigation of this apparent difference in reactivity. Four Canadians and four Californians were exposed to 0.37 ppm O_3 in purified air at 21°C and 50% relative humidity for 2 hours with intermittent light exercise. Exposures to purified air alone served as controls. Responses of subjects were similar to those observed previously: Canadians on the average showed greater clinical and physiological reactivity to exposure than did Californians who were no more than minimally reactive. Canadians also showed larger increases in erythrocyte fragility following exposure. No methodological differences sufficient to explain different results of previous studies were found. Although other possible explanations have not been ruled out entirely, adaptation of southern Californians to chronic ambient O_3 exposure is a rational hypothesis to explain these results.

- 708 (NCRP--50) ENVIRONMENTAL RADIATION MEASUREMENTS. (National Council on Radiation Protection and Measurements, Washington, D.C. (USA)). 27 Dec 1976. 252p. National Council on Radiation Protection and

Measurements, Washington, DC.

This report presents information on the properties of widely-distributed radionuclides and of typical radiation fields in the environment and on methods for their measurement. Emphasis is placed on the role of measurements in the realistic assessment of dose to man. Techniques applicable to routine monitoring programs during normal operation of nuclear facilities are described. Evaluations are made throughout the report of the available and developing measurement methods. Areas are identified where present knowledge is limited due to the lack of adequate measurement capabilities or systematic data collection and appraisal. The special requirements for monitoring abnormal occurrences such as large releases of radionuclides and for occupational radiation protection are not considered. 630 references.

- 709 CERVICAL ESOPHAGEAL INDENTATION. Nishitani, H.; Russell, W.J.; Tsukamoto, Y. (Atomic Bomb Casualty Commission, Hiroshima). Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 12, 1049-1062(25 Dec 1976).

This study demonstrated that upper esophageal webs are not as rare in Japan as previously regarded. Postcricoid impressions, though not previously reported in the Japanese literature, were found in 69 percent of 90 subjects. Concerning upper esophageal webs and postcricoid impressions, 7 of the 8 web patients were females and all web cases had average hemoglobin levels lower than those of postcricoid impressions. The latter did not differ from those of the other 90 subjects--suggesting a different etiologic basis for these two entities. Cricopharyngeal hypertrophy was present in 11 percent of the subjects. The esophagus was compressed by osteophytes in 67 percent of the cases. There were 7 cases of cricopharyngeal hypertrophy in whom compression by cervical osteophytes may have induced compensatory hypertrophy of this muscle.

- 710 ISOTOPIC CARDIAC PACEMAKER DURING PREGNANCY. THREE CASES. Laurens, P.; Gavelle, P.; Maurice, P. (Hopital Broussais, 75 - Paris (France)); Haiat, R.; Chiche, P. (Hopital Tenon, 75 - Paris (France)). Nouv. Presse Med.; 5: No. 44, 2997-3000(25 Dec 1976). (In French).

Three cases of full term pregnancies, without complications, in women with isotopic pacemakers are reported. The newborn infants were normal. In one case, pregnancy occurred in a patient who already had a pacemaker. In two cases, the pacemaker was inserted during pregnancy (at 1 and 1/2 and 5 months respectively), in the treatment of syncopal attacks due to paroxysmal atrioventricular block. This type of pacemaker using a radioactive source (plutonium 238) is, by virtue of the low degree of radiation, harmless and may be used in women of childbearing age. Under the least favourable conditions (pacemaker box in abdominal situation), the dose delivered during pregnancy (57 mrem) is approximately 20 times less than the authorized dose (1125 mrem).

- 711 RE-ANALYSIS OF RADIATION-INDUCED SPECIFIC LOCUS MUTATIONS IN THE MOUSE. Abrahamson, S. (Wisconsin Univ., Madison (USA). Dept. of Genetics); Wolff, S. Nature (London); 264: No. 5588, 715-719(23 Dec 1976).

It is stated that a re-analysis of published data on mouse mutation rates induced by x-and gamma rays suggests that the kinetics of induction can be analyzed by fitting that data

to a parabolic curve. This is interpreted to mean that a substantial proportion of the induced mutations results from gross chromosomal changes such as deletions, some of which are one-track and some of which are two-track. This analysis is based on the assumption that the shape of the dose curve, which in the female is concave upward, reflects the manner in which the mutations are induced rather than representing a one-track (linear) curve whose shape has been modified by differential repair.

- 712 (DOCKET-50280--723) SURRY POWER STATION, UNITS 1 AND 2. REPORT ON THE POSSIBLE OVEREXPOSURE OF AN INDIVIDUAL TO RADIATION. (Virginia Electric and Power Co., Richmond (USA)). 16 Dec 1976. 5p. (DOCKET-50281--639).

Possible overexposure of an individual to radiations. SURRY-1 REACTOR; SURRY-2 REACTOR; PERSONNEL; RADIATION DOSES

- 713 (DOCKET-50286--567) INDIAN POINT STATION, UNIT 3. REPORT OF APPARENT DISCREPANCY BETWEEN AN INDIVIDUAL'S MONTHLY FILM BADGE AND POCKET DOSIMETER. (Consolidated Edison Co. of New York, Inc., New York (USA)). 16 Dec 1976. 3p.

Discrepancy between an individual's monthly film badge and pocket dosimeter. INDIAN POINT-3 REACTOR; PERSONNEL; RADIATION DOSES; DOSEMETERS; PHOTOGRAPHIC FILM DOSEMETERS; COMPARATIVE EVALUATIONS

- 714 (DOCKET-50366--238) EDWIN I. HATCH NUCLEAR PLANT, UNIT 2. SUMMARY OF MEETING HELD ON 22 NOVEMBER 1976 TO DISCUSS EMERGENCY PLANNING COORDINATION WITH STATE OF GEORGIA. (Georgia Power Co., Atlanta (USA)). 14 Dec 1976. 33p.

Summary of meeting held on 22 November 1976 to discuss emergency planning coordination with State of Georgia. HATCH-1 REACTOR; MEETINGS; EMERGENCY PLAN; RADIATION MONITORING; FIRE PREVENTION; PERSONNEL; EDUCATION; RADIATION DOSES

- 715 (DOCKET-50254--961) QUAD-CITIES STATION, UNITS 1 AND 2. IE INSPECTION REPORT NO. 76-27 AND 76-27 (ROUTINE, UNANNOUNCED). (Commonwealth Edison Co., Chicago, Ill. (USA)). 7 Dec 1976. 14p. (DOCKET-50265--937).

Inspection of radwaste management records and procedures and process monitor calibrations. QUAD CITIES-1 REACTOR; QUAD CITIES-2 REACTOR; INSPECTION; RADIATION MONITORS; CALIBRATION; RADIOACTIVE WASTE MANAGEMENT; STACKS; SAMPLING; AEROSOLS; PARTICLES; SOLID WASTES; PACKAGING; DEMINERALIZERS; RESINS; MANAGEMENT; CONTROL; TRANSPORT; ERRORS; GASEOUS WASTES; RELEASE LIMITS; LIQUID WASTES; TANKS; STORAGE; OFF-GAS SYSTEMS; RADIOACTIVE WASTE FACILITIES; PERSONNEL; RADIATION DOSES; AIR SAMPLERS

- 716 (DOCKET-50271--857) VERMONT YANKEE NUCLEAR POWER STATION. NRC REQUEST FOR ADDITIONAL INFORMATION: CONTROL ROOM DOSE ANALYSIS. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 6 Dec 1976. 5p.

NRC request for additional information: control room dose analysis. VERMONT YANKEE REACTOR; CONTROL; MECHANICAL STRUCTURES; RADIATION DOSES; CONTAINMENT; CONTROLLED ATMOSPHERES; DILUTION; PERSONNEL

- 717 (INIS-mf--3620) CORRELATIVE STUDY ON THE FREQUENCIES OF RADIATION-INDUCED CHROMOSOME ABERRATIONS IN SOMATIC AND GERM CELLS OF MAMMALS. van Buul, P.P.W.

(Rijksuniversiteit Leiden (Netherlands)). 1 Dec 1976. 107p. Dep. NTIS (US Sales Only), PC A06/MF A01.

Thesis.

A series of investigations on the correlation between the frequencies of radiation-induced chromosome aberrations in somatic and germ cells of mouse and rhesus monkey is described. In the mouse the induction of reciprocal translocations in bone-marrow cells was compared with that in spermatogonia (as scored in the descending spermatocytes). In the rhesus monkey frequencies of radiation-induced chromosome aberrations in spermatogonia and peripheral blood lymphocytes were studied. Furthermore the effect of multigeneration irradiation (69 generations with 200 rads X-rays) on the sensitivity for translocation induction in spermatogonia of male mice was studied. Frequencies of dicentric chromosomes and chromosomal deletions in cultured peripheral blood lymphocytes of 5 different types of mice were determined following in vitro irradiation with doses of 100 and/or 200 rad X-rays. To obtain more insight into the processes underlying translocation induction in spermatogonia of the mouse, fractionation experiments were conducted.

- 718 RADIATION LEUKEMIA IN C57BL/6 MICE. I. LACK OF SEROLOGICAL EVIDENCE FOR THE ROLE OF ENDOGENOUS ECOTROPIC VIRUSES IN PATHOGENESIS. Ihle, J.N.; McEwan, R.; Bengali, K. (National Cancer Inst., Frederick, MD). J. Exp. Med.; 144: No. 6, 1391-1405 (1 Dec 1976).

The humoral immune response against endogenous ecotropic murine leukemia viruses (MuLV) was examined in irradiated and control C57BL/6 mice. Control mice developed antibodies against MuLV slowly throughout life. In contrast, within 2 to 3 months after irradiation 90 percent of irradiated C57BL/6 mice had developed detectable antibodies against MuLV. The characteristics of this immune response, however, were identical in control and irradiated mice in terms of peak titers, specificity for endogenous ecotropic MuLV, and reactivity against the ecotropic viruses' glycoprotein. The incidence of lymphoma was comparable in mice that developed no immune response; developed an immune response only transiently after irradiation; or developed an immune response which persisted until death from lymphoma. Moreover, experimental conditions that alter the ability of irradiation to induce leukemia, such as age, dose, or bone marrow reconstitution did so without significantly altering either the rate of appearance of a humoral immune response to MuLV or its peak titers. The results, therefore, fail to demonstrate any seroepidemiological relationship between endogenous ecotropic MuLV and radiation-induced leukemia.

- 719 RADIATION LEUKEMIA IN C57BL/6 MICE. II. LACK OF ECOTROPIC VIRUS EXPRESSION IN THE MAJORITY OF LYMPHOMAS. Ihle, J.N.; Joseph, D.R.; Pazmino, N.H. (National Cancer Inst., Frederick, MD). J. Exp. Med.; 144: No. 6, 1406-1423 (1 Dec 1976).

The expression of endogenous ecotropic viruses in radiation-induced thymomas of C57BL/6 mice was examined. Competition radioimmunoassays for AKR MuLV were used for viral antigen expression. Three of 40 lymphomas had readily detectable ecotropic at levels of 95 to 689 ng/mg protein; the remainder of the tumors had no detectable (less than 1.0 ng/mg protein). Thirty thymomas were characterized by the presence of MuLV at levels of 1 to 10 ng/mg protein, levels that were comparable to those

found in thymus extracts from age-matched, nonirradiated control. Ten tumors were characterized by having levels of 10 to 30 ng/mg protein. In one tumor significant levels of AKR MuLV were detectable. Since B-tropic and N-tropic viruses from C57BL/6 mice have glycoproteins indistinguishable from AKR MuLV and the N-tropic virus had a serologically identical to AKR MuLV, these results demonstrate that overt endogenous ecotropic virus expression is only rarely detectable in B-tropic virus was detectable in 2 of 40 thymomas and endogenous N-tropic virus was detectable in 1 of 40 thymomas. The lack of overt expression was also confirmed by cytotoxicity assays using monospecific antisera to these viral proteins. Radiation-induced lymphomas were also examined for the presence of reverse transcriptase after chromatography of tissue extracts on poly G-Sepharose. The results taken together demonstrate that overt endogenous ecotropic virus expression is only rarely detectable in radiation-induced thymomas of C57BL/6 mice.

- 720 (SAAS--204, pp 84-98) EXAMINATION ON THE RADIATION SITUATION AT A RESEARCH REACTOR AND IN ITS ENVIRONMENT. Scheler, R. (Staatliches Amt fuer Atomicherheit und Strahlenschutz, Berlin (German Democratic Republic)); Kneschke, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Dec 1976. (In German).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

Data are presented concerning the radiation exposure situation at a WWR-SM type research reactor and in the near vicinity of this plant which has been operating since 1957. The examination program included the indoor gamma and neutron radiation fields, the water contamination in the primary coolant circuit, the gas- and aerosol concentrations in indoor and chimney atmospheres, and the exposure to various professional groups as well as to the population within a distance of 10 km. The limiting values prescribed for occupationally exposed persons as well as for small population groups could also be observed after raising the reactor power output up to 10 MW. However, it must be emphasized that the exposure level is increasing with plant age owing to the increasing expenditure of time necessary for repair and reconstruction work. Thus, the present level of exposure to critical population groups has already reached a value that could turn out to be a limiting factor as to the further extension of the site.

- 721 (STH--15/76) STUDIES ON THE EXPOSURE PATHWAY-AIR-GRASS-COW-MILK FOR RADIOIODINE DUE TO RELEASE DURING NORMAL OPERATION FROM THE GUNDEMNINGEN NUCLEAR POWER STATION IN 1975. Riedel, H.; von Gadow, A. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Dec 1976. 38p. (In German). Dep. NTIS (US Sales Only), PC A03/MF A01.

The environmental aspects involved in the transport of ^{131}I are reviewed by means of calculation and measurement. On the basis of the release of ^{131}I in airborne effluent from

the plant during the grazing season 1975 and the dispersion factors and the air-milk-transfer-factor (including the ingestion factor of $8.8 \times 10^5 \text{ rem} \times \text{m}^3/\text{Ci} \times \text{s}$) the thyroid dose to the 'critical infant' has been calculated. The actual ^{131}I content in milk has been measured. Weekly environmental samples - 5 liters - have been taken. From the discharge via stack of 60 mCi of ^{131}I a value of 6.2 pCi/l has been calculated. The measurements showed no ^{131}I concentrations in milk higher than 0.54 pCi/l (3 sigma-detection limit) and 0.18 pCi/l (1 sigma-detection limit). These differences lead to the conclusion that either the ecological models in use today or the assumption that all the Iodine is elemental, overestimate the ingestion dose-factors and with this the radiation exposure to the thyroid of an infant. Similar differences between calculation and measurement were found at other nuclear power plants.

- 722 (N--77--17840) A PRELIMINARY AREA SURVEY OF NEUTRON RADIATION LEVELS ASSOCIATED WITH THE NASA VARIABLE ENERGY CYCLOTRON HORIZONTAL NEUTRON DELIVERY SYSTEM. Roberts, W.K.; Leonard, R. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Dec 1976. 14p. (NASA-TM-X--73577; E--9035). NTIS, PC A02/MF A01.

The 25 MeV deuteron beam from the NASA variable energy cyclotron incident on a thick beryllium target will deliver a tissue neutron dose rate of 2.14 rad/micron A-min at a source to skin distance of 125 cm. A neutron survey of the existing hallways with various shielding configurations made during operating of the horizontal neutron delivery system indicates that minimal amounts of additional neutron shielding material are required to provide a low level radiation environment within a self-contained neutron therapy control station. Measurements also indicate that the primary neutron distribution delivered by a planned vertical delivery system will be minimally perturbed by neutrons backscattered from the floor.

- 723 (STH--16/76) PROGRAMME SYSTEM FOR EVALUATING THE COLLECTED MEASUREMENTS FOR ACQUIRING THE PRESENT RADIATION EXPOSURE IN LIVING AND COMMON ROOMS IN THE FEDERAL REPUBLIC OF GERMANY. John, E. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Strahlenhygiene; Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Dec 1976. 100p. (In German). Dep. NTIS (US Sales Only), PC A05/MF A01.

The programme system for evaluating approx. 750,000 individual information results which are expected is presented in detail. The target of the evaluation is to find the average natural radiation exposure of the population in houses and in the open air, and to determine the influence of the type of houses and the building materials.

- 724 CLINICAL SIGNIFICANCE OF RENAL IMAGING IN BONE SCANS. Clorius, J.H.; Wedel, H.; Doll, J.; Janzik, W.D. (Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Inst. fuer Nuklearmedizin; Heidelberg Univ. (Germany, F.R.). Urologische Abt.). Nucl.-Med. (Stuttgart); 15: No. 6, 287-289 (Dec 1976). (In German).

1 fig.; 1 tab.; 6 refs..

The results of the examination of 62 patients who had undergone skeletal scintigraphy with ^{18}F , and an urologic

examination, were evaluated to determine whether the ^{18}F incorporation in the kidneys might indicate the presence of renal disease. Patients with and without renal disease demonstrated a similar ^{18}F incorporation in the kidneys. Our data indicate that a side different ^{18}F renal activity is without clinical significance.

- 725 PRODUCTION OF MICRONUCLEI FROM CHROMOSOME ABERRATIONS IN IRRADIATED CULTURES OF HUMAN LYMPHOCYTES. Countryman, P.I.; Heddle, J.A. (York Univ., Downsview, Ontario (Canada)). Depts. of Biology and Natural Science). Mutat. Res.; 41: No. 2, 321-331 (Dec 1976).

The characteristics of an assay for chromosomal damage - micronuclei produced in cultured human lymphocytes - are given together with the evidence that the assay accurately measures X-ray-induced chromosomal damage. In the experiments the response of lymphocytes from different donors was very uniform: (1) the increase in micronucleus frequency begins at the time of the first mitoses, 48 hours after the cultures are started, (2) the exponent of the dose response equation ($y = kD_{\text{sup}}(n)$) was 1.2 for micronuclei, (3) the frequency of micronuclei was decreased by a factor of about two when the dose was fractionated. The rejoining time for four of five donors was between 30 and 60 minutes, (4) the X-ray-induced micronucleus frequency in cells from people with Down's syndrome (trisomy-21) was twice that of control donors. Since the micronucleus assay reflects the aberration so well and is so fast, it is suitable for a rapid assessment of chromosomal damage.

- 726 (AGARD-AR--84) BIOPHYSICAL PROBLEMS IN AEROSPACE MEDICINE. (Advisory Group for Aerospace Research and Development, 92 - Neuilly-sur-Seine (France)). Dec 1976. 174p. NTIS \$6.75.

This publication contains papers prepared by an Aerospace Medical Panel Working Group. The five papers are as follows: Cosmic Radiation Doses at Aircraft Altitudes; Biological Studies of Cosmic Rays; Radiobiological Problems of High Altitude Flights; Nonionizing Electromagnetic Fields, Environmental Factors in Relation to Military Personnel; and Medical Aspects of Lasers and Laser Safety Problems.

- 727 (BNL--22279) RISE OF RADIATION PROTECTION: SCIENCE, MEDICINE AND TECHNOLOGY IN SOCIETY, 1896--1935. Serwer, D.P. (Brookhaven National Lab., Upton, N.Y. (USA)). Dec 1976. Contract EY-76-C-02-0016. 291p. Dep. NTIS, PC A13/MF A01.

The history of radiation protection before World War II is treated as a case study of interactions between science, medicine, and technology. The fundamental concerns include the following: are how medical and technical decisions with social impacts are made under conditions of uncertainty; how social pressures are brought to bear on the development of science, medicine, and technology; what it means for medicine or technology to be scientific; why professional groups seek international cooperation; and the roles various professionals and organizations play in controlling the harmful side effects of science, medicine, and technology. These questions are addressed in the specific context of protection from the biological effects of x-rays and radium in medical use.

- 728 (BNWL--2110) REDIQ: A COMPUTER PROGRAM FOR ESTIMATING HEALTH EFFECTS FROM INHALATION

AND INGESTION OF RADIONUCLIDES. Strenge, D.L.; Watson, E.C.; Kennedy, W.E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1976. Contract EY-76-C-06-1830. 164p. Dep. NTIS, PC A08/MF A01.

The computer program REDIQ calculates the risk equivalence of dosage from internally deposited radionuclides to dosage from external whole-body irradiation. The calculation gives an estimate of the microcurie intake per nuclide that would result in a risk equivalent to receiving 1 rem of external whole-body irradiation. The program allows for internal deposition resulting from either inhalation of radioactive aerosols or ingestion of contaminated food. The inhalation portion of REDIQ was taken from the computer program DACRIN, which uses the models of the respiratory tract adopted by the Task Group on Lung Dynamics. REDIQ also uses a simple exponential model for retention by an organ of interest, and the gastrointestinal tract model of the International Commission on Radiological Protection (ICRP). For each nuclide specified, the program first calculates the radiation dose per microcurie intake by inhalation or ingestion to any of 23 organs and tissues. A maximum of 10 organs may be specified for any one case. The values for dose per microcurie intake are then coupled with relative risk values for each organ being considered, to arrive at the estimated intake equivalent to 1 rem of external whole-body irradiation.

- 729 (CEA-N--1915) LASER RADIOLOGICAL PROTECTION. A BIBLIOGRAPHIC REVIEW. Ballereau, P. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Dec 1976. 47p. (In French). NTIS (US Sales Only), PC A03/MF A01.

Although being mostly concerned with ionizing radiations (X, γ radiation, neutrons, α , β particle) the health physicist must also be able to advise personnel on the effects of laser radiation. These new and intricate problems are briefly examined. The biological effects of the exposure of the various organs, eyes more particularly, to laser beams are briefly described and problems relating to the evaluation of risks (operational limits), the prevention and the methods developed for the protection of personnel are reviewed.

- 730 (EPA--520/5-76-014) RADIATION DOSE ESTIMATES TO PHOSPHATE INDUSTRY PERSONNEL. Windham, S.; Partridge, J.; Horton, T. (Eastern Environmental Radiation Facility, Montgomery, Ala. (USA)). Dec 1976. 33p. Environmental Protection Agency, Montgomery, AL.

Phosphate deposits throughout the world contain uranium and thorium as a natural constituent of the ore. Mining and processing of these ores redistributes much of this radioactive material among the various products, by-products, and wastes. To determine the radiological impact of the phosphate industry, an extensive study was made of the redistribution of this radioactivity. One task of this overall study was to evaluate the radiation exposure to phosphate industry workers. This report describes the efforts undertaken to measure the personnel exposures, describes the exposures encountered, and relates these findings to existing federal guides regarding personnel exposures. In determining the radiation dose equivalent received by phosphate industry workers only two pathways were felt to be potentially significant, the external radiation exposure from gamma radiation, and the dose received due to inhalation of airborne radionuclides.

- 731 (NRPB-R--54) COMPARISON OF THE OBSERVED AND THE EXPECTED CANCERS OF THE HEMATOPOIETIC AND LYMPHATIC SYSTEMS AMONG WORKERS AT WINDSCALE. A FIRST REPORT. Dolphin, G.W. (National Radiological Protection Board, Harwell (UK)). Dec 1976. 15p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Available from H.M. Stationery Office, price Pound0.50.

Data are given about the cases of cancers of the haematopoietic and lymphatic systems among workers at Windscale Works, BNFL during the period 1950 to 1974. The number of cancers of these types expected to occur in the working population at Windscale has been estimated for the same period. For none of these types is the observed number of cancers significantly different at the 95% confidence level from that expected.

- 732 (PB--263194) COMPARISON OF RADIATION EXPOSURES FROM PANORAMIC DENTAL X-RAY UNITS. FINAL REPORT. Manson-Hing, L.R.; Greer, D.F. (Alabama Univ., Birmingham (USA)). Dec 1976. Contract FDA-74-42. 36p. NTIS, PC A03/MF A01.

The primary objective of this study was to establish exposure distributions for the three most common panoramic units, using the same phantom, dosimetry, operator, and procedures. The interrelationship between exposure distribution and operating characteristics was evaluated for each machine and exposure comparisons were made between the phantom and clinical patients who received panoramic examinations. Also, the stray radiation pattern was determined for each machine.

- 733 (SAAS--204, pp 53-59) RADIATION HYGIENE AT VOCATIONAL WORK WITH NATURALLY RADIOACTIVE ORES. Lyarskii, P.P.; Elovskaya, L.T.; Kapitanov, Yu.T.; Baram, M.G.; Zel'tser, M.P.; Gorbarenko, N.I.; Lobanova, E.A. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Gigieny Truda i Professional'nykh Zabollevaniy). Dec 1976. (In Russian).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

In underground exploitation of non-ferrous and rare metals (as for instance Zr), exposure levels due to radon and thoron daughters may be found of magnitudes similar to those existing in uranium mining. In daylight factories (refining plants etc.) the radiation exposures are caused by the content of Th in the ore, but until now the combined effect of dust and radiation has not yet been taken into consideration in the industrial hygienic norms.

- 734 (SAAS--204, pp 38-42) RADIATION HYGIENIC SITUATION AND GUARANTEE OF SAFE WORKING CONDITIONS TO STAFF IN RADON-SFAS. Danilov, Yu.E.; Gusarov, I.I.; Andreev, S.V. (Tsentral'nyy Nauchno-Issledovatel'skiy Inst. Kurortologii i Fizioterapii, Moscow (USSR)); Jackisch, N. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Dec 1976. (In Russian).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

Measurements were made of radon levels in indoor atmospheres of 19 radon spas situated in the U.S.S.R. (15), G.D.R. (2), and Bulgaria (2). In 5 cases (U.S.S.R.: 1, G.D.R.: 2, Bulgaria: 2) the levels were found to exceed the MPC-values. In the New Radon-Clinic of Pyatigorsk, the radiation exposure to staff could be essentially reduced, as compared to the old one, by means of effective ventilation and other measures.

- 735 (SAAS--204, pp 99-104) LEVEL OF RADIATION EXPOSURE TO STAFF IN X-RAY DIAGNOSIS. Zol'nikova, N.I.; Moiseyev, P.I.; Trunov, B.V. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Gigieny Truda i Professional'nykh Zabollevaniy). Dec 1976. (In Russian).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

In modern radiological service departments the dose rates at working places of medical personnel directly engaged in diagnostic work were found to range from 7 to 100 mR/h during fluoroscopy and up to 1,200 mR/h during roentgenoscopy and ray cinematography, respectively. During fluoroscopic work in the operating theatre the monthly doses to staff ranged from 100 to 380 mR for surgeons and anaesthetists, from 110 to 225 mR for surgical nurses, and from 5 to 30 for nurses. AUTHOR).

- 736 (SAAS--204, pp 43-52) RADIATION EXPOSURE DUE TO RADON AND RADON DAUGHTERS. Ullmann, W. Dec 1976. (In German).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

Underground miners working over long periods of time in mines with a high content of radon and radon daughters belong to that group of occupationally exposed persons who are subject to the greatest somatic risk, with values especially high if the permissible dose limits are exceeded. Following an overview of the permissible limits currently in use for radon and radon daughters as well as the results of examinations performed in nationally-owned underground mining of the G.D.R., considerations are presented on the measuring quantities requisite for statistical, control and safety measurements in this field. Finally,

conclusions are drawn concerning the measuring procedures and instruments to be employed for practical work.

- 737 (SAAS--204, pp 209-213) DIAGNOSTIC VALUATION OF SOME DERMATOLOGICAL PARAMETERS FOR THE EARLY DIAGNOSIS OF RADIATION INJURIES. Lenz, U. Dec 1976. (In German).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

A method for the early diagnosis of macroscopically non-perceptible skin injuries in patients following radiation exposure is described. It is based upon evaluation of the vascular state in the corium by means of different criteria following capillary microscopy, thermographical and histological examinations, as well as intracutaneous histamine tests.

- 738 (SAAS--204, pp 191-196) CONCENTRATION OF DEOXYRIBOSIDES IN HUMAN URINE AND BLOOD OF HEALTHY INDIVIDUALS AS WELL AS PATIENTS BEFORE AND AFTER EXPOSURE TO IONIZING RADIATION. Solle, M. Dec 1976. (In German).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

Results are reported of testing a recently developed method for the direct microbiological determination of the total deoxyriboside concentration in human urine. The amount of total deoxyribosides excreted in the urine of healthy individuals within 24 hours was found to be $55.95 \pm 29.31 \mu\text{g}$ with 45% of the deoxyribosides containing purine bases. The content of deoxycytidine in blood plasma was $0.021 \mu\text{g/ml}$. Tumor patients given therapeutic irradiation as well as individuals who had been accidentally exposed to whole-body irradiation (up to 15 rem) showed, in only a few cases, the appearance of change in deoxyriboside concentrations being more essentially marked in blood plasma than in urine.

- 739 (SAAS--204, pp 153-160) STATISTICAL PROCEDURE IN ELABORATING MATHEMATICAL MODELS FOR THE ESTIMATION OF INTERNAL RADIATION BURDENS. Andronov, S.A.; Bad'in, V.I.; Ermilov, A.P.; Margulis, U.Ya.; Khrushch, V.T. (Institut Biofiziki, Moscow (USSR)). Dec 1976. (In Russian).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on

scientific-technical cooperation in radiation protection in the period 1973-1975.

It is recommended to enlarge the criteria of the Reference Man by the term 'fluctuation of metabolism' which makes allowance for quantifying the statistical fluctuation of the data in estimating internal body burdens following inhalation of radioactive aerosols. In statistical treatment of these parameters the geometrical standard deviation of $\beta_{\text{sub}}(g) = 2$ should be taken as a basis because this value was found for the individual fluctuations of the radionuclide excretion data.

- 740 (SAAS--204, pp 201-208) ASSESSING THE DIAGNOSTIC VALUE OF ALKALINE GRANULOCYTE PHOSPHATASE AND OF THE BEUTLER TEST FOR EARLY DIAGNOSIS OF RADIATION INJURIES IN THE LOW-DOSE RANGE. Jacobsohn, E. Dec 1976. (In German).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

In persons occupationally exposed to 0.01 - 3.3 rem/yr there seems to exist a negative exponential function between the alkaline granulocyte phosphatase and the dose received. By means of the Heinz-body test according to Beutler, no correlation could be found in this dose range.

- 741 (SAAS--204, pp 185-190) DETECTION OF RADIATION EXPOSURES IN MAN. Fedorova, T.A.; Tereshchenko, O.Ya.; Tarakanova, M.P.; Golyshev, E.P. (Institut Biofiziki, Moscow (USSR)). Dec 1976. (In Russian).

From Final conference on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, F.R. Germany (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975, Berlin, Nov. 18-20, 1975.

The method is based on the microbiological determination of the total deoxyriboside levels in urine and blood of humans using *Lactobacillus acidophilus* R-26.

- 742 SALIVARY GLAND TUMORS IN ATOMIC BOMB SURVIVORS, HIROSHIMA, JAPAN. Takeichi, N.; Hirose, F.; Yamamoto, H. (Hiroshima Univ.). Cancer; 38: No. 6, 2462-2468 (Dec 1976).

An epidemiologic investigation was undertaken in Hiroshima to study the relationship of salivary gland tumors to exposure to ionizing radiation. Two hundred and eleven cases examined between 1953 to 1971 were confirmed by a review of histologic specimens. Of these, 66 cases occurred in residents of Hiroshima City who were born before the A-bomb: 30 among A-bomb-exposed, and 36 in non-exposed individuals. The incidence of salivary gland tumors among the exposed individuals was significantly higher, 2.6 times greater than that among the nonexposed individuals for all tumors, and 10 times greater for malignant tumors. The incidence increased with proximity to the hypocenter for the directly exposed. An increased incidence was also found among early

entrants, particularly those entering the city within 3 days of the A-bomb.

743 RADIATION RISKS OF MAMMOGRAPHY.

Sickles, E.A. (Univ. of California, San Francisco). West. J. Med.; 125: No. 6, 493-495(Dec 1976).

In this editorial the author maintains that the radiation risks of mammography are exaggerated. On a benefit risk basis, the author maintains that mammography is a most valuable weapon in the diagnostic armamentarium. (ERB)

744 RADIATION RISKS OF MAMMOGRAPHY: ANOTHER VIEW. Breslow, L. (Univ. California, Los Angeles). West. J. Med.; 125: No. 6, 495-497(Dec 1976).

In this editorial the author maintains that there is significant radiation risk in mammography. His primary concern is with the incidence of radiation-induced breast cancer. (ERB)

745 MAIN POINTS OUT OF THE NEW RADIATION PROTECTION ORDINANCE. Maushart, R. G-I-T (Glas-Instrum.-Tech.) Fachz. Lab.; 20: No. 12, 1287-1289(Dec 1976). (In German).

2 tabs.; 3 refs..

The main changes (30 mrem/a for the general public, 5 rem/a for those occupied whereby the dose for a certain age is dropped, new classification of the controlled and surveyed areas, etc., persons responsible for radiation protection as proprietors of the licence and as the person commissioned with radiation protection, obligation to notify, limiting values for surface concentrations, waste air and waste water measuring techniques and methods) for the operation of isotope laboratories and facilities concerned with nuclear medicine are presented.

746 OER AT LOW-DOSE RATES. Kal, H.B.; Barendsen, G.W. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Instituut TNO). Br. J. Radiol.; 49: No. 588, 1049-1051(Dec 1976).

There is increasing interest in the treatment of human cancers with multifraction beam therapy at low dose-rates, on the assumption that the OER at low dose-rates is smaller than that at high dose-rates. A comparison has therefore been made of various published values of OER as a function of γ dose-rate for *Vicia faba*, HeLa cells, P388 cells, hamster cells and chromosome aberrations. The mean value of the OER at low dose-rate was about 20% lower than the mean OER obtained at high dose-rate, although two OER values at low dose-rates were significantly lower than the other reported values. There are technical difficulties associated with maintaining the test systems under hypoxic conditions for long periods of time and the observed decrease in cloning efficiency of hypoxic control cells indicates that cells can be damaged by this treatment alone. It is therefore possible that the high dose-rate OER values would have been reduced if the cells irradiated at high dose-rates under oxic and anoxic conditions had had a pre-treatment period of storage under anoxic conditions.

747 NUCLEAR ENERGY: HEALTH IMPACT OF CARBON-14. Pohl, R.O. (Cornell Univ., Ithaca, N.Y. (USA). Lab. of Atomic and Solid State Physics). Radiat. Environ. Biophys.; 13: No. 4, 315-327(Dec 1976).

1 fig.; 2 tabs.; 41 refs..

Estimates are presented on the carbon-14 generation rates in several reactor types and in peaceful nuclear explosions. If the carbon-14 generated in light water reactors is released, the population radiation dose rate it causes initially will be comparable to that resulting from the krypton-85 and tritium generated in these reactors. Because of the long half-life, the radiation dose commitment and the dose rate resulting from the environmental build-up of carbon-14 are considerably larger than those of the two other radionuclides.

748 SUPPOSED CANCER RISK FROM MAMMOGRAPHY.

REPLY TO PREVIOUS STATEMENTS. Oeser, H.; Koeppel, P.; Rach, K. (Freie Univ. Berlin (Germany, F.R.). Klinik fuer Radiologie, Nuklearmedizin und Physikalische Therapie). Fortschr. Geb. Roentgenstr. Nuklearmed.; 125: No. 6, 487-490(Dec 1976). (In German).

4 figs.; 2 tabs.; 23 refs..

The view that exposure to diagnostic radiation presents a cancer risk to the female breast should be considered together with the fact that the major factor is ageing of the patient. This risk factor is hidden in experimental and statistical studies on cancer production by exogenous agents; for instance, in studies of radiation effects, it is inherent in the time taken. The assumption that mammography presents a cancer risk is unjustifiable and is denied.

749 PROJECTED NUMBERS OF HEALTH PHYSICISTS, 1975-2000. Kathren, R.L. (Portland General Electric Co., Oreg. (USA)). Health Phys.; 31: No. 6, 489-493(Dec 1976).

Currently (1975), approximately 3000 persons are engaged in the practice of health physics in the U.S. with nearly half working directly for governmental agencies or at large government-sponsored laboratories. By 2000, an estimated 13,450 health physicists will be employed, about half of whom will be in the private sector with only about one-fifth directly or indirectly employed in government. The greatest growth is projected in the power reactor sector, with the least occurring at large federally-funded research laboratories and in government generally. This shift in projected employment for health physicists suggests that education could better be accomplished at the undergraduate level.

750 RADIATION EXPOSURE DURING AIR AND GROUND TRANSPORTATION. Hsu, P.C.; Weng, P.S. (National Tsing Hua Univ., Hsinchu (Taiwan)). Health Phys.; 31: No. 6, 522-524(Dec 1976).

The results of a one year study program of radiation exposure experienced on both domestic and international flights of the China Airline and the Far East Airline in the Pacific, Southeast Asia and Taiwan areas and on trains and buses on Taiwan island are reported. CaSO_4 Dy thermoluminescent dosimeters were used. It has been shown that transit exposures may amount to 10 times that on the ground with an altitude varying from 3,050 to 12,200 m.

751 INVESTIGATION OF OCCUPATIONAL EXPOSURE ON TAIWAN (1973--1975). Weng, P.S.; Wang, C.L. (National Tsing Hua Univ., Hsinchu (Taiwan)). Health Phys.; 31: No. 6, 513-516(Dec 1976).

Analysis of the data obtained from 1973 to 1975 for the yearly occupational exposure to ionizing radiation on Taiwan with reference to the medical, industrial and research services is given. During the 3 yr monitoring period,

the annual dose equivalent did not exceed 500 mrem in 91% of the radiation workers and less than 0.40% exceeded 5 rem. The total average man-rem was about 340 in 1973, 363 in 1974 and 286 in 1975, or less than 363 man-rem annually. The technical assistants were exposed significantly and represented the major occupational personnel. In contrast to other countries' experience, the female radiation workers were less than 10% of the total number of workers being monitored.

- 752 CLINICAL EXPERIENCE WITH A 30 CM IMAGE INTENSIFIER WITH SPECIAL REFERENCE TO A 100 MM FILM TECHNIQUE. Lissner, J.; Remplik, V.; Scherer, U.; Kotschak, O.; Schaeztl, M. (Muenchen Univ. (Germany, F.R.). Klinik und Poliklinik fuer Radiologie). Fortschr. Geb. Roentgenstr. Nuklearmed.; 125: No. 6, 551-555 (Dec 1976). (In German).

8 figs.; with refs..

The report deals with one year's experience of two new 30 cm image intensifiers with special reference to a 100 mm film technique. Attention was paid to its applicability to routine work and the usefulness of this format when demonstrated to a large audience. Comparative dose measurements using the image intensifier and a direct film technique are given. The running costs have been analysed. Suggestions for further improving the technique using this format are given.

- 753 RADIOPROTECTION IN BIOLOGICAL RESEARCH LABORATORIES. Simonnet, G. (Institut National des Sciences et Techniques Nucleaires (INSTN), Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). J. Microsc. Biol. Cell.; 27: No. 2, 103-110 (Dec 1976).

From Meeting on techniques in radioautography; Paris, France (26 Sep - 7 Oct 1975).

The utilizors of radioisotopes are subjected to certain risks since the radiation emitted by these isotopes has deleterious effects on living matter. If the radiation doses are important enough, serious consequences could be born by the person exposed. The radiation can have two types of effects, somatic or genetic. The former involves cell destruction and possible induction of cancer; the latter arises if the damage is at the level of germ cells: ovules or the sperm cell line. During the handling of radioisotopes it is thus necessary to reduce these risks to a minimum by taking a certain number of precautions and by manipulating these products in certain well-defined areas which are suitable for this purpose. This is described.

- 754 RADIATION EFFECTS ON CANCER MORTALITY AMONG A-BOMB SURVIVORS, 1950-72. COMPARISON OF SOME STATISTICAL MODELS AND ANALYSIS BASED ON THE ADDITIVE LOGIT MODEL. Otake, M. (Hiroshima Univ. (Japan). Faculty of Science). J. Radiat. Res.; 17: No. 4, 262-321 (Dec 1976).

Various statistical models designed to determine the effects of radiation dose on mortality of atomic bomb survivors in Hiroshima and Nagasaki from specific cancers were evaluated on the basis of a basic $k(\text{age}) \times c(\text{dose}) \times 2$ contingency table. From the aspects of application and fits of different models, analysis based on the additive logit model was applied to the mortality experience of this population during the 22year period from 1 Oct. 1950 to 31 Dec. 1972. The advantages and disadvantages of the additive logit model were demonstrated. Leukemia mortality showed a sharp rise with an increase in dose. The dose response relationship suggests a possible

curvature or a log linear model, particularly if the dose estimated to be more than 600 rad were set arbitrarily at 600 rad, since the average dose in the 200+ rad group would then change from 434 to 350 rad. In the 22year period from 1950 to 1972, a high mortality risk due to radiation was observed in survivors with doses of 200 rad and over for all cancers except leukemia. On the other hand, during the latest period from 1965 to 1972 a significant risk was noted also for stomach and breast cancers. Survivors who were 9 year old or less at the time of the bomb and who were exposed to high doses of 200+ rad appeared to show a high mortality risk for all cancers except leukemia, although the number of observed deaths is yet small. A number of interesting areas are discussed from the statistical and epidemiological standpoints, i.e., the numerical comparison of risks in various models, the general evaluation of cancer mortality by the additive logit model, the dose response relationship, the relative risk in the high dose group, the time period of radiation induced cancer mortality, the difference of dose response between Hiroshima and Nagasaki and the relative biological effectiveness of neutrons.

- 755 TERATOGENICITY OF RADIATION. Tanimura, T. (Kyoto Univ. (Japan). Faculty of Medicine). Hoshasen Seibutsu Kenkyu; 11: No. 4, 9-24 (Dec 1976). (In Japanese).

Problems on ionizing radiation and congenital anomalies are reviewed with special reference to the comparison between teratogenicity by chemical substances and that by irradiation in fetal period, the disturbances developed after birth which is seriously noticed in recent years and the changes of teratogenicity of radiation by chemical substances. Teratogenicity of radiation is first characterized, and general rules on it are described, such as dose source, factor specificity of nuclides, specificity of irradiation period, specificity of irradiated species, doses, and physiological conditions of mother's body. In developmental disturbances in animal experiments, lethal effects, growth retardation, behavior disturbances, reproductive disturbances, effects on genetics, carcinogenesis, effects on lifespan and so on are studied. Disturbances by therapeutic and diagnostic radiation and atomic bomb are also examined in humans.

- 756 ANALYSIS OF CHROMOSOME ABERRATIONS AS A DOSIMETRIC TECHNIQUE IN RADIATION PROTECTION. Vulpis, N. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari). Com. Naz. Energ. Nucl., Not.; 22: No. 12, 49-54 (Dec 1976). (In Italian).

This study is intended in the first place to supply a set of basic data on existence and practical availability of an important technique in the field of radiation protection. Using this technique it is possible to estimate the dose of radiation absorbed by measuring a typical biologic effects of radiations, i.e. the induction of chromosome aberrations. It is applicable directly to man and therefore is of great importance, especially in the cases of accidental exposure or overexposure, when physical dosimetry is inadequate, uncertain or even lacking.

- 757 ELECTRON MICROSCOPIC STUDIES ON RADIOSENSITIVITY OF UTERINE CERVICAL CANCER. Kotani, T. (Shinshu Univ., Matsumoto, Nagano (Japan). Faculty of Medicine). Shinshu Igaku Zasshi; 24: No. 4, 375-397 (Dec 1976). (In

Japanese).

Forty patients with II or III stage of uterine cervical cancer were given 1000 rads of test irradiation, and radiosensitivity of the tissues was examined electron-microscopically before and 1,3,5 and 7 days after the irradiation. At 24 hours after the irradiation, no changes were observed in the nuclei and the cytoplasm. From 3 days after the irradiation, disturbances of the nuclear membranes (enhancement of sawteeth-like irregularity of the nuclear edge, formation of linear or vacuolar pseudo-enclosures in the nuclei and so on), abnormal distribution of chromatin in the nuclei (agglutination, lightening and so on), enlargement and degeneration of mitochondria, enlargement of endoplasmic reticulum and decrease of ribosomes were observed. These changes were enhanced according to time. In the findings of the cases with good radiosensitivity, marked changes were shown, such as abnormal distribution of chromatin in the nuclei, disturbances of nuclear membranes, decrease of the size of mitochondria, enhancement of electron density of mitochondria, enlargement of endoplasmic reticulum and decrease of ribosomes in the cytoplasm. While in the cases with low radiosensitivity, poor changes were found. Suspected from the findings before the irradiation, small organs in the cells were generally undeveloped, mitochondria were small and few, ribosomes and rude endoplasmic reticulum were poorly found, structure of membrane was weak and intercellular combination was loose in the cases with good radiosensitivity. Contrariwise, the cases, in which these were fully developed, had poor radiosensitivity in general.

- 758 (SAAS--204) FINAL CONFERENCE OF THE MINISTRY OF HEALTH OF THE USSR AND THE NATIONAL BOARD FOR NUCLEAR SAFETY AND RADIATION PROTECTION OF THE GDR ON SCIENTIFIC-TECHNICAL COOPERATION IN RADIATION PROTECTION IN THE PERIOD 1973-1975. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Dec 1976. vp. (In Russian). (CONF-751128--). NTIS (US Sales Only).

From Final conference on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, F.R. Germany (18 Nov 1975).

Separate abstracts were prepared for individual papers. (ERB)

- 759 (SAAS--204, pp 60-67) RADIATION EFFECTS IN THE OFFSPRING OF CHRONICALLY EXPOSED PARENTS. Kudritskii, Yu.K.; Bikkulov, R.I.; Kataev, V.G.; Kuznetsov, A.I.; Rabinovich, Ya. L. (Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR)); Kruzhalov, A.I. (Poliklinik Zheleznovodsk (USSR)). Dec 1976. (In Russian).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

In mice who had been chronically exposed to low levels of ionizing radiation before mating, the effect of these exposures on the offspring was examined with special regard to early post-natal development, radiation resistance as

well as the frequency of cytogenetic variations of bone-marrow cells. Furthermore, studies have been undertaken on the spontaneous incidence of cytogenetic aberrations in peripheral blood lymphocytes of newborns in two cities of the U.S.S.R., but no correlation could be found with the gamma dose rates (5 - 50 μ R/h) ascertained in the parental flats.

- 760 EFFECT OF ^{60}Co γ RADIATION ON THE STEM AND DIFFERENTIATING SPERMATOGONIA OF THE POSTPUBERAL RAT. Erickson, B.H. (Comparative Animal Research Lab., Oak Ridge, TN). Radiat. Res.; 68: No. 3, 433-448 (Dec 1976).

Previous descriptions of the radioresponse of rodent spermatogonia have relied on schemes of spermatogonial proliferation and differentiation that were either incomplete or inaccurate. This study was undertaken, therefore, to interpret the radioresponse of rat spermatogonia after a currently accepted pattern for their renewal and evolution. Rats were irradiated with ^{60}Co γ radiation at doses varying from 12 to 600 rad at 30 rad/min. Tubules were isolated from Zenker-fixed testes and evaluated according to the method of Huckins (Anat. Rec. 169, 533 [1971]). Stem spermatogonial number was little affected by doses up to 200 rad, and the dose-response curve for this criterion yielded a D_0 of 373 ± 37 rad and an extrapolation number (n) of 2.1 ± 0.3 . Stem-cell mitosis, as reflected by counts of type A_1 spermatogonia, was, however, substantially affected by a dose of 12 rad and was characterized by a D_0 of 148 ± 8 rad and an n of 0.5 ± 0.1 . The dose required to produce a measurable effect increased as the spermatogonium attained higher states of differentiation. D_0 and n varied from 139 ± 24 rad and 1.2 ± 0.9 , respectively, for type A_1 , to 215 ± 14 rad and 2 ± 0.4 for type A_{∞} . Due to the extreme lability of its mitosis, the stem spermatogonium appeared to be the weakest link in the chain leading to the spermatozoon.

- 761 EFFECTS OF FRACTIONATED LOCAL IRRADIATION ON THE CANINE RENAL AUTOGRAFTS. Murai, M.; Hasegawa, A.; Nakoneczna, I.; Lee, H.M. (Virginia Commonwealth Univ., Richmond). J. Surg. Res.; 21: No. 6, 395-402 (Dec 1976).

Proteinuria occurring late in renal transplantation has been reported. Even though the common cause of this proteinuria is considered immunologic in nature, the potentially damaging effect of local graft irradiation as a contributing factor in producing proteinuria has not been clearly defined. The present study was carried out to determine whether the fractionated local irradiation, used as immunosuppression in renal transplantation, would contribute to the production of proteinuria and morphological changes.

- 762 (LF--56, pp 3-6) FIELD CHARACTERIZATION OF PLUTONIUM AEROSOLS IN MIXED-OXIDE FUEL FABRICATION. Newton, G.J.; Teague, S.V.; Yeh, H.C. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Nuclear reactor fuel pellets of PuO_2 and UO_2 are fabricated within safety enclosures at Babcock and Wilcox's Parker Township Site near Apollo, Pa. Nineteen sample runs were taken from within glove boxes of aerosols formed during powder comminution and blending. Eight sampling runs were also taken of a centerless grinding operation during routine industrial operations. A small seven-stage cascade

impactor and the Lovelace Aerosol Particle Separator (LAPS) were used to determine aerodynamic size distribution and gross alpha aerosol concentrations. The potential toxicity of inhaled plutonium originating in the nuclear fuel cycle following accidental releases of these aerosols and possible inhalation by industrial workers is considered.

- 763 (LF--56, pp 11-14) CHARGE DISTRIBUTION ON PLUTONIUM-CONTAINING AEROSOLS PRODUCED IN MIXED-OXIDE REACTOR FUEL FABRICATION AND THE LABORATORY. Yeh, H.C.; Newton, G.J.; Teague, S.V. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

The inhalation toxicity of potentially toxic aerosols may be affected by the electrostatic charge on the particles. Charge may influence the deposition site during inhalation and therefore its subsequent clearance and dose patterns. The electrostatic charge distributions on plutonium-containing aerosols were measured with a miniature, parallel plate, aerosol electrical mobility spectrometer. Two aerosols were studied: a laboratory-produced $^{238}\text{PuO}_2$ aerosol (15.8 Ci/g) and a plutonium mixed-oxide aerosol (PU-MOX, natural UO_2 plus PuO_2 , 0.02 Ci/g) formed during industrial centerless grinding of mixed-oxide reactor fuel pellets. Plutonium-238 dioxide particles produced in the laboratory exhibited a small net positive charge within a few minutes after passing through a ^{85}Kr discharger due to alpha particle emission removal of valence electrons. PU-MOX aerosols produced during centerless grinding showed a charge distribution essentially in Boltzmann equilibrium. The gross alpha aerosol concentrations (960-1200 nCi/l) within the glove box were sufficient to provide high ion concentrations capable of discharging the charge induced by mechanical and/or nuclear decay processes.

- 764 (LF--56, pp 15-20) SOLUBILITY OF PLUTONIUM DIOXIDE AEROSOLS, IN VITRO. Newton, G.J.; Kanapilly, G.M. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Solubility of plutonium aerosols is an important parameter in establishing risk estimates for industrial workers who might accidentally inhale these materials and in evaluating environmental health impacts associated with Pu. In vitro solubility of industrial plutonium aerosols in a simulated lung fluid is compared to similar studies with ultrafine aerosols from laser ignition of delta phase plutonium metal and laboratory-produced spherical particles of $^{238}\text{PuO}_2$ and $^{239}\text{PuO}_2$. Although relatively insoluble, industrial plutonium-mixed oxide aerosols were much more soluble than laboratory-produced plutonium dioxide particles. Chain agglomerate aerosols from laser ignition of metallic Pu indicated in vitro dissolution half-times of 10 and 50 days for activity median aerodynamic diameter (AMAD) of 0.7 and 2.3 μm , respectively. Plutonium-containing mixed oxide aerosols indicated dissolution half-times of 40 to 500 days for particles formed by industrial powder comminution and blending. Centerless grinding of fuel pellets yielded plutonium-containing aerosols with dissolution half-times of 1200 to 8000 days. All mixed oxide particles were in the size range 1.0 μm to 2.5 μm AMAD.

- 765 (ORNL/CSD/TM--17) TIMED: A COMPUTER PROGRAM FOR CALCULATING CUMULATED ACTIVITY OF A

RADIONUCLIDE IN THE ORGANS OF THE HUMAN BODY AT A GIVEN TIME, T, AFTER DEPOSITION. Watson, S.B.; Snyder, W.S.; Ford, M.R. (Oak Ridge National Lab., Tenn. (USA)). Dec 1976. Contract W-7405-ENG-26. 154p. Dep. NTIS \$6.75.

TIMED is a computer program designed to calculate cumulated radioactivity in the various source organs at various times after radionuclide deposition. TIMED embodies a system of differential equations which describes activity transfer in the lungs, gastrointestinal tract, and other organs of the body. This system accounts for delay of transfer of activity between compartments of the body and radioactive daughters.

- 766 (LF--56, pp 229-237) TOXICITY OF INHALED $^{238}\text{PuO}_2$ IN BEAGLE DOGS. A. MONODISPERSE 1.5 μm $^{238}\text{PuO}_2$. B. MONODISPERSE 3.0 μm $^{238}\text{PuO}_2$ PARTICLES. III. Lustgarten, C.S.; Mawhinney, J.A.; Hobbs, C.H.; Halliwell, W.H.; Jones, R.K.; Mauderly, J.L.; McClellan, R.O.; Mo, T.; Pickrell, J.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

To obtain essential information on the importance of the homogeneity or non-homogeneity of the radiation dose to lung (the hot particle question), Beagle dogs have been exposed to monodisperse aerosols (sigma/sub g/ < 1.2) of $^{238}\text{PuO}_2$ of either 1.5 μm or 3.0 μm aerodynamic diameter (AD). By using monodisperse particles of these two sizes, the average dose to lung is held constant for a given initial lung burden, but the local alpha dose around the two sizes of particles varies by a factor of about ten. All exposures have been completed with 72 days exposed to each of the two particle sizes of $^{238}\text{PuO}_2$ (total of 144 dogs) resulting in graded initial lung burdens which range from .005 to 2.2 $\mu\text{Ci/kg}$ of body weight. Twenty-four dogs exposed to the diluent aerosol are serving as controls. The animals will be studied over their total life span. Two exposed dogs have died from pulmonary injury: Dog 710C (with an initial lung burden of 2.0 $\mu\text{Ci/kg}$) died at 631 days after inhalation of 3.0 μm AD aerosol. The cause of death was radiation pneumonitis and pulmonary fibrosis. Dog 746B (with an initial lung burden of 1.3 $\mu\text{Ci/kg}$) died at 791 days after inhalation of 1.5 μm AD aerosol. Death was attributed to intrapulmonic hemorrhage resulting from a degenerative vasculitis. One control dog (721A) was euthanized at 820 days after exposure due to a meningitis and encephalomalacia that caused a severe central nervous system disorder that made the dog difficult to handle. A leukopenia in exposed dogs to date has occurred earlier and to a greater degree in dogs exposed to 3.0 μm AD particles than in dogs that received 1.5 μm AD particles. One hundred forty-two exposed and 23 control dogs are surviving at 175 to 1024 days after exposure.

- 767 (LF--56, pp 238-244) TOXICITY OF INHALED POLYDISPERSE OR MONODISPERSE AEROSOLS OF $^{238}\text{PuO}_2$ IN SYRIAN HAMSTERS. IV. Mawhinney, J.A.; Hobbs, C.H.; McClellan, R.O. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Syrian hamsters received inhalation exposure to a polydisperse or to one of three sizes of monodisperse aerosols of $^{238}\text{PuO}_2$ to achieve graded levels of initial lung burden. Some animals were sacrificed serially to determine radiation dose patterns; the remainder were maintained for life span observation to

determine dose-response relationships. Lung retention and tissue distribution data through 500 days after inhalation exposure indicate that no simple relationship exists between aerosol particle size and lung retention or tissue distribution. Mortality data show that life shortening is present only in groups of animals receiving initial lung burdens of greater than 100 nCi. Radiation pneumonitis and pulmonary fibrosis have been the major pathological findings observed in the groups of animals displaying life shortening. No pulmonary neoplasms have been observed to date. Histopathological analyses are continuing.

- 768 (LF--56, pp 245-250) TOXICITY OF INHALED $^{239}\text{PuO}_2$ IN IMMATURE, YOUNG ADULT AND AGED SYRIAN HAMSTERS. IV. Hobbs, C.H.; Mewhinney, J.A.; McClellan, R.O.; Mo, T. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Human populations that might be exposed in the event of a catastrophic nuclear accident would include individuals with widely differing ages. To obtain better information in the possible effects of age on observed dose-response relationships for inhaled $^{239}\text{PuO}_2$, groups of Syrian hamsters were exposed via inhalation at either 28 (immature), 84 (young adults) or 340 (aged) days of age to polydisperse aerosols of $^{239}\text{PuO}_2$. The graded levels of initial lung burden were 240, 60, 15, 3.8, 0.95, 0.25 and 0.029 nCi for the immature and young adult animals and 240, 60, and 3.8 nCi for the aged animals. Additional animals were included in the 60 nCi initial lung burden level for serial sacrifice to determine the radiation dose pattern. All other animals were maintained for life span observation. Lung retention determined for each age group varied in the fraction of the initial burden undergoing rapid initial clearance; 63% cleared with a half-time of 1.2 days for the immature group and 22% cleared with a half-time of 2 days for the young adult group. No separate initial phase of clearance was evident for the aged animals. For all age groups, less than 1% of the sacrifice body burden was found in all tissues other than lung. Mortality data analysis indicated significant life shortening only in animals which received the highest level initial lung burden. These early deaths were related to radiation pneumonitis and pulmonary fibrosis. No pulmonary neoplasms have been observed to date.

- 769 (LF--56, pp 251-258) TOXICITY OF INHALED POLYDISPERSE OR MONODISPERSE AEROSOLS OF $^{241}\text{AmO}_2$ IN SYRIAN HAMSTERS. III. Mewhinney, J.A.; Hobbs, C.H.; Mo, T. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

To obtain a better understanding of dose-response relationships for inhaled ^{241}Am , Syrian hamsters were exposed by inhalation to monodisperse or polydisperse aerosols of $^{241}\text{AmO}_2$. The animals were exposed to achieve graded initial lung burdens of 240, 60, 15, 3.8, 0.95, 0.24 and 0.029 nCi ^{241}Am for the polydisperse aerosol and 240, 60, 15 and 3.8 nCi ^{241}Am for each of the three sizes of monodisperse used (0.8, 1.3 μm AD). In addition to animals exposed for life span observations, other animals were exposed at the same time for serial sacrifice to study patterns of radiation dose. All animals have now died and preliminary data are available on lung, liver, and skeleton retention through 500 days after exposure.

Significant life span shortening was observed in groups of animals receiving initial lung burdens of greater than 110 nCi ^{241}Am for the polydisperse aerosol. Histopathologic examination of tissues taken at necropsy is continuing. No pulmonary neoplasms have been observed to date.

- 770 (LF--56, pp 259-262) TOXICITY OF INHALED POLYDISPERSE AEROSOL OF $^{239}\text{Pu}(\text{NO}_3)_4$ IN SYRIAN HAMSTERS. II. Mewhinney, J.A.; Hobbs, C.H. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Syrian hamsters were exposed via inhalation to polydisperse aerosols of $^{239}\text{Pu}(\text{NO}_3)_4$ to define dose-response relationships. Animals were exposed in groups to achieve graded levels of initial lung burdens of 240, 60, 15, 3.8, 0.95, 0.24 and 0.029 nCi ^{239}Pu . The aerosols had measured activity median aerodynamic diameters of 1.4 μm and a geometric standard deviation of 1.6. Animals were maintained both for serial sacrifice to determine radiation dose pattern and for life span observation to determine radiation dose-response relationships. Lung, liver and skeletal retention of ^{239}Pu has been measured in the groups of animals and radiation dose to these tissues calculated. With only 10 animals remaining alive, excess mortality has been observed only in the highest level of initial lung burden group. Histopathologic observations are continuing on tissue samples obtained at necropsy.

- 771 (LF--56, pp 263-268) OCCURRENCE AND LOBAR DISTRIBUTION OF LUNG CANCER IN SYRIAN HAMSTERS INDUCED BY INTRATRACHEAL ADMINISTRATION OF ^{210}Po (PRELIMINARY REPORT). Halliwell, W.H.; Mewhinney, J.A.; Hobbs, C.H.; Slauson, D.O. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Polonium-210 (^{210}Po) was adsorbed onto hematite carrier particles and administered by 15 weekly intratracheal instillations to Syrian hamsters (SCH : SYR). The animals were divided into four groups: Group 1-Hematite only; Group 2-50 nCi ^{210}Po /instillation (sacrifice study); Groups 3-10 nCi ^{210}Po /instillation (longevity study); Group 4-50 nCi ^{210}Po /instillation (longevity study). In the 50 nCi ^{210}Po /instillation (sacrifice study) consisting of 32 animals, all are dead and three tumors of the lung were recognized at gross examination. All three of these tumors were centrally located in the hilar region of the lung. In the 10 nCi ^{210}Po /instillation (longevity study) consisting of 50 animals, 29 remain alive and 21 are dead. Six of the 21 animals had grossly recognizable tumors of the lung. Twenty-one tumors were recorded in these six animals with the greatest number, 10/21, in the left diaphragmatic region. The majority of these tumors 17/21 were centrally located. In the 50 nCi ^{210}Po /instillation (longevity study) consisting of 53 animals, 14 remain alive and 39 are dead. Seventeen of the 39 animals had grossly recognizable tumors of the lung. Fifty-six tumors were recorded in these animals; the greatest number were in the left diaphragmatic region, 21/56, and there was approximately equal distribution of tumors in the central (27) versus peripheral (29) location. These experiments indicate Syrian hamsters are susceptible to tumor induction by intratracheal instillation of ^{210}Po . The tumors produced were combined epidermoid and adenocarcinomas that originated in the bronchiolar and alveolar

epithelium in the central regions of the lung lobes.

- 772 (LF--56, pp 269-275) BIOLOGICAL EFFECTS OF $^{239}\text{PuO}_2$ INHALATION IN THE RHESUS MONKEY. Brooks, A.L.; LaBauve, R.J.; Redman, H.C.; Mauderly, J.L.; Halliwell, W.H.; McClellan, R.O. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Rhesus monkeys were exposed to polydisperse, high-fired $^{239}\text{PuO}_2$ aerosols and have been studied for 3 yr to determine the biological effects associated with this inhalation exposure. Initial lung burdens in 16 monkeys exposed to aerosols of $^{239}\text{PuO}_2$ ranged from 7 to 1800 nCi. Two monkeys are serving as controls. The inhaled $^{239}\text{PuO}_2$ was retained with a long effective half-life in the lung with some translocation from the lung to the pulmonary lymph nodes. In animals exposed to high levels of $^{239}\text{PuO}_2$, there was a depression in the number of lymphocytes in the peripheral blood. However, blood lymphocytes cultured at time periods up to 30 mo after inhalation showed no increase in chromosome aberration frequency. An animal with an estimated initial lung burden of 1000 nCi showed marked alterations in respiratory function. Only slight respiratory changes were detected in the other animals evaluated. To date, three monkeys have died, two of radiation pneumonitis and the third of gastric torsion. Comparing these data from Rhesus monkeys with those obtained from baboons and Beagle dogs indicate that Rhesus monkeys are similar to dogs in their early radiation response.

- 773 (LF--56, pp 278-282) BIOLOGICAL EFFECTS OF REPEATED INHALATION EXPOSURE OF BEAGLE DOGS TO AEROSOLS OF ^{144}Ce IN FUSED ALUMINOSILICATE PARTICLES. III. Boecker, B.B.; Hahn, F.F.; Lustgarten, C.S.; Mauderly, J.L.; McClellan, R.O. Dec 1976.

Inhalation Toxicology Research Institute. Progress report, October 1, 1975--September 30, 1976.

This experiment is being conducted to study the behavior and long-term biological effects in Beagle dogs of ^{144}Ce inhaled in fused aluminosilicate particles in repeated inhalation exposures for comparison with similar data from dogs that were exposed only once to a similar aerosol. Four groups of nine dogs each were exposed once every 8 wk for 2 yr (13 exposures) to achieve specified exposure goals. These goals were: to increase the lung burden by 2.5 $\mu\text{Ci } ^{144}\text{Ce/kg}$ body weight with each exposure in the first group; to reestablish lung burdens of 9 or 4.5 $\mu\text{Ci } ^{144}\text{Ce/kg}$ body weight in the second and third groups, respectively, and to expose controls (fourth group) to fused aluminosilicate particles containing stable cerium. With these exposure sequences, the ^{144}Ce -exposed dogs received increasing or relatively constant beta radiation dose rates in contrast to the steadily decreasing dose rate seen after a single inhalation exposure. Exposures in the first and second groups were planned to yield a cumulative absorbed dose to lung of approximately equal to 35,000 rads and those in the third group approximately equal to 17,000 rads within 2 yr after the first exposure. Singly exposed dogs that had died with pulmonary tumors when this experiment was initiated had cumulative doses to death of 29,000 to 61,000 rads. All 13 exposures have been completed. One dog in the 4.5 $\mu\text{Ci } ^{144}\text{Ce/kg}$ body weight group died at 771 days after first exposure with emaciation, adrenal cortical

degeneration and bone marrow aplasia. One control dog died accidentally during anesthesia. The remaining 34 dogs appear to be in good physical condition except for a persistent lymphopenia at approximately equal to 3 yr after first exposure. They will be maintained for life span observations.

- 774 (LF--56, pp 283-287) REPEATED INHALATION EXPOSURE OF MICE TO $^{144}\text{CeO}_2$: RETENTION AND DOSIMETRY. IV. Lundgren, D.L.; Hahn, F.F.; McClellan, R.O. Dec 1976.

Inhalation Toxicology Research Institute. Progress report, October 1, 1975--September 30, 1976.

Mice have been exposed repeatedly at approximately 60-day intervals for 1 yr beginning when the mice were 70 days of age to reestablish desired lung burdens of either 0.2, 1.0 or 4.5 $\mu\text{Ci } ^{144}\text{Ce}$. Control mice were exposed once when either 70, 260, or 450 days of age to achieve desired lung burdens of 0.2, 1.0 or 4.5 $\mu\text{Ci } ^{144}\text{Ce}$. The distribution of ^{144}Ce in mouse lung, liver, and carcass as the percentage of the body burden at death was somewhat similar in all groups of mice except in the mice exposed once when 70 days of age. The percentage of the body burden in the liver tended to increase with time in the mice exposed when 70 days of age, in contrast with a tendency for the percentage in the liver to decrease with time after exposure in mice in all other groups. After repeated inhalation exposure to $^{144}\text{CeO}_2$, ^{144}Ce was not cleared as rapidly from the lung, liver and carcass of mice repeatedly exposed to $^{144}\text{CeO}_2$ as it was in mice exposed once at different ages. Repeated inhalation exposure of mice to $^{144}\text{CeO}_2$ resulted in a beta radiation dose rate somewhat similar to that in Beagle dogs exposed to ^{144}Ce in fused aluminosilicate particles when compared on a μCi initial lung burden per kg body weight basis. The dose rate to the lungs varied by a factor of 6 to 3 during the course of the repeated exposures.

- 775 (LF--56, pp 288-291) REPEATED INHALATION EXPOSURE OF MICE TO $^{144}\text{CeO}_2$: LUNG TUMORS. V. Hahn, F.F.; Lundgren, D.L.; McClellan, R.O. Dec 1976.

Inhalation Toxicology Research Institute. Progress report, October 1, 1975--September 30, 1976.

Three groups of C57BL/6J female mice were repeatedly exposed by inhalation to aerosols of $^{144}\text{CeO}_2$ at 60-day intervals to reestablish lung burdens of either 0.2, 1.0 or 4.5 μCi . These repeated exposures simulated the longer effective lung retention of ^{144}Ce which has been observed in Beagle dogs that inhaled ^{144}Ce fused aluminosilicate particles. While the radiation dose rate to the lung in the mice fluctuated because of the repeated exposures, in general it simulated the dose rate to lungs of Beagle dogs exposed once to ^{144}Ce in fused aluminosilicate particles. These repeatedly exposed mice developed malignant pulmonary neoplasms whereas singly-exposed mice had not. These neoplasms were primarily adenocarcinomas but there were two hemangiosarcomas and one fibrosarcoma observed. These data show that tumors can be induced in C57BL/6J mice by inhalation of ^{144}Ce and that they may be dependent on dose rate rather than cumulative dose. The tumor incidence, survival of mice and types of tumors observed are discussed.

- 776 (LF--56, pp 292-296) REPEATED INHALATION EXPOSURE OF SYRIAN HAMSTERS TO $^{144}\text{CeO}_2$. II. Lundgren, D.L.; Hahn, F.F.; McClellan, R.O. Dec 1976.

Inhalation Toxicology Research Institute.
Progress report, October 1, 1975--September 30, 1976.

Syrian hamsters have been repeatedly exposed by inhalation to aerosols of $^{144}\text{CeO}_2$ to reestablish lung burdens of either 0.4, 2.0 or 10 μCi ^{144}Ce at approximately 60-day intervals for one year. Control animals were either repeatedly exposed to stable CeO_2 or exposed once to $^{144}\text{CeO}_2$ to achieve lung burdens of approximately 0.4, 2.0 or 10 μCi when either 84, 290 or 360 days of age. Other control hamsters were exposed once to stable CeO_2 when either 84, 290 or 360 days of age. Reestablishment of the lung burden at approximately 10 μCi significantly decreased the survival rate, whereas reestablishment of the lung burden at 0.4 or 2.0 μCi appears to have had no effect on the survival rate. There is not sufficient survival data available, as yet, to determine the effect of age on the biological effects of inhaled $^{144}\text{CeO}_2$. One pulmonary adenocarcinoma has been observed in a Syrian hamster that died 496 days after the initial inhalation exposure to $^{144}\text{CeO}_2$. This Syrian hamster had lung burdens of 8.9, 9.3, 7.9, 7.3, 7.7 and 6.2 μCi of ^{144}Ce after six repeated exposures and its lungs had absorbed a dose of approximately 48,000 rads to the day of death.

- 777 (LF--56, pp 297-300) BIOLOGICAL EFFECTS OF REPEATED INHALATION EXPOSURE OF SYRIAN HAMSTERS AND MICE TO POLYDISPERSE AEROSOLS OF $^{239}\text{PuO}_2$. II. Lundgren, D.L.; McClellan, R.Q. Dec 1976.

Inhalation Toxicology Research Institute.
Progress report, October 1, 1975--September 30, 1976.

A biological effects study has been initiated in which Syrian hamsters have been repeatedly exposed by inhalation to ^{169}Yb -labeled $^{239}\text{PuO}_2$ to reestablish lung burdens of 2, 10 or 50 nCi of ^{239}Pu at 60-day intervals. Control Syrian hamsters have been either nonexposed, or exposed once or repeatedly exposed to stable Yb_2O_3 or $^{169}\text{Yb}_2\text{O}_3$ to achieve an initial lung burden of 50 nCi ^{169}Yb . Additional Syrian hamsters have been exposed once to ^{169}Yb -labeled $^{239}\text{PuO}_2$ to achieve initial lung burdens of 2, 10 or 50 nCi of ^{239}Pu . All scheduled exposures have been completed. Preliminary observations indicate the cumulative percent survival has been shortened only in the Syrian hamsters repeatedly exposed to reestablish lung burdens at 50 nCi. There has been no evidence of pulmonary tumors in animals that have died through 460 days after initiation of the study. A similar study has been initiated in mice.

- 778 (LF--56, pp 351-355) PULMONARY COLLAGEN METABOLISM IN IRRADIATED HAMSTERS AND THOSE TREATED WITH CORTICOSTEROIDS. Pickrell, J.A.; Straus, F.C.; Halliwell, W.H.; Jones, R.K. Dec 1976.

Inhalation Toxicology Research Institute.
Progress report, October 1, 1975--September 30, 1976.

Syrian hamsters were exposed to ^{90}Y in fused aluminosilicate particles to produce pulmonary fibrosis. Irradiated hamsters and controls were treated with Depomedrol, arresting the developing fibrosis. All hamsters receiving steroid showed a reduced incorporation of ^{14}C -proline into noncollagen protein during the 3-19 wk period after exposure. Collagen synthesis relative to noncollagen protein synthesis was decreased five-fold in these animals at early times after exposure and during high steroid dosage, but had returned to control levels after considerable time at lower steroid

dosage. Collagen synthesis in irradiated animals not receiving steroids was elevated during the same time period and collagen synthesis in irradiated hamsters treated with steroid was intermediate between that in radiation animals and in control or steroid animals. Collagen breakdown was elevated to the same level as in irradiated animals, and collagen content was normal and well below that of irradiated animals. These and previous data indicate that steroid treatment delays development of pulmonary fibrosis in animals irradiated with fibrogenic doses of ^{90}Y in fused aluminosilicate particles. Experiments incubating BAPN or Depomedrol with L-929 or WI-38 fibroblasts in vitro were performed to note any effect of these agents upon fibroblast proliferation, cellular collagen processing or collagen synthesis. Steroids frequently reduced fibroblast proliferation and altered cellular collagen processings to reflect an increased proportion of collagen breakdown products. These changes reflect the importance of fibroblast proliferation in developing pulmonary fibrosis.

- 779 (LF--56, pp 356-359) PULMONARY COLLAGEN METABOLISM IN IRRADIATED HAMSTERS AND THOSE TREATED WITH BETA-AMINOPROPIONITRILE (BAPN) AND OTHERS UNDERGOING REPEATED BRONCHOPULMONARY SALINE LAVAGE. Pickrell, J.A.; Halliwell, W.H.; Bryant, P.L.; Straus, F.C. Dec 1976.

Inhalation Toxicology Research Institute.
Progress report, October 1, 1975--September 30, 1976.

Syrian hamsters were exposed to ^{90}Y in fused aluminosilicate particles which produced pulmonary fibrosis. Two treatments were selected to manipulate this response: continuous treatment with β -aminopropionitrile (BAPN) and bimonthly bronchopulmonary saline lavage. Neither agent affected the development of pulmonary fibrosis observed at necropsy. BAPN did not affect noncollagen protein incorporation of proline but reduced collagen synthesis relative to it. Increased collagen breakdown failed to reduce collagen content because of the long half-life of pulmonary collagen. BAPN changed collagen metabolism minimally in irradiated hamsters. Incorporation of ^{14}C -proline into noncollagenous protein and breakdown of collagen were similar in animals receiving both BAPN and irradiation and in animals receiving only irradiation. Animals exposed to BAPN and radiation had slightly less collagen synthesis than animals exposed to radiation only, however, pulmonary fibrosis as indicated by collagen content was not reduced. Bronchopulmonary lavage was equally ineffective. At 12 wk, collagen content in animals that were irradiated and lavaged was increased relative to either the lavaged or control animals and fibrosis was present.

- 780 (LF--56, pp 385-388) EFFECT OF ALPHA IRRADIATION OF THE LUNGS FROM INHALED $^{239}\text{PuO}_2$ ON THE IMMUNITY OF MICE TO LISTERIA MONOCYTOGENES. Wogenrich, F.J.; Lundgren, D.L. Dec 1976.

Inhalation Toxicology Research Institute.
Progress report, October 1, 1975--September 30, 1976.

The pulmonary clearance of inhaled *Listeria monocytogenes* from the lungs of nonimmunized and immunized mice was observed 3 to 4 or 26 wks after prior exposure to $^{239}\text{PuO}_2$ to achieve initial lung burdens of 2.6, 5.0 and 11.9 nanocuries (nCi). Mice from $^{239}\text{PuO}_2$ and sham-exposed groups were immunized against *L. monocytogenes* and 1 wk later challenged via the respiratory route. Pulmonary clearance was suppressed in mice with an 11.9 nCi initial

- lung burden of ^{239}Pu 26 wk after $^{239}\text{PuO}_2$ inhalation but not in the mice with initial lung burdens of 2.6 and 5.0 nCi at 4 to 5 or 27 wk after $^{239}\text{PuO}_2$ exposure. Mice with a mean initial lung burden of 11.9 nCi of ^{239}Pu , which were immunized against *L. monocytogenes* 26 wk after $^{239}\text{PuO}_2$ inhalation, had a decreased survival after respiratory challenge with *L. monocytogenes* when compared to immunized control animals. Body weight gain and hematological differences did not correlate with suppressed pulmonary clearance or decreased survival. Pulmonary lavage studies indicated that fewer alveolar macrophages were recoverable from mice with a mean initial lung burden of 11.9 nCi of ^{239}Pu 26 wk after $^{239}\text{PuO}_2$ inhalation. It was concluded that an initial lung burden of 11.9 nCi of ^{239}Pu which delivered approximately 700 rads of alpha radiation to the lungs of mice resulted in decreased pulmonary clearance and decreased survival of mice which had been immunized against *L. monocytogenes*.
- 781 (LF--56, pp 399-403) DISTRIBUTION, RETENTION AND CYTOGENETIC EFFECTS OF ^{239}Pu CITRATE IN THE TESTES OF THE CHINESE HAMSTER. Brooks, A.L.; Diel, J.H.; McClellan, R.C. Dec 1976.
Inhalation Toxicology Research Institute. Progress report, October 1, 1975--September 30, 1976.
The distribution and retention of ^{239}Pu citrate was measured in the Chinese hamster and used to determine the average concentration of ^{239}Pu in the testes. Autoradiographs were studied to determine the local concentration and microdistribution of ^{239}Pu in the testes. Morphometric measurements were made in hamsters, mouse and human testes which were combined with retention and autoradiographic data to calculate the local dose to the genetically important spermatogonia for each species. This dose was related to the observed chromosome aberrations in the mitotic cells of the testes. For hamsters and mice, the dose to the spermatogonia was higher than the average dose to the testes. However, because of the large amount of interstitial tissue in humans, no dose enhancement factor for spermatogonia could be demonstrated even when 90% of the activity was uniformly distributed in the interstitial region of the testes. At levels of ^{239}Pu activity which produced marked somatic effects, such as life shortening and high incidences of liver and bone cancer, there was no significant increase in the mitotic chromosome aberration frequency in testes. Extrapolation of potential human genetic hazards using rodent data is impossible without considering the microanatomy of the testes.
- 782 (LF--56, pp 404-407) GAMMA CAMERA IMAGING STUDIES OF REGIONAL RADIATION-INDUCED INJURY. Wolff, R.K.; Mauderly, J.L.; Muggenburg, B.A. Dec 1976.
Inhalation Toxicology Research Institute. Progress report, October 1, 1975--September 30, 1976.
A preliminary study is reported on the use of nuclear medicine techniques to determine regional lung function following radiation-induced injury. Ventilation-perfusion scans were performed on three dogs: one control and two dogs which had received inhalation exposures to ^{144}Ce in fused aluminosilicate particles. Ventilation and perfusion were both altered on a regional basis in the exposed animals. Mismatches in ventilation-perfusion were noted. A tumor scan was performed in one of the exposed dogs which showed a nasal tumor but no lung involvement.
- 783 (LF--56, pp 411-415) DEADSPACE BREATHING AS A SCREENING TEST FOR EARLY LUNG DAMAGE. Mauderly, J.L.; Muggenburg, B.A.; Hahn, F.F. Dec 1976.
Inhalation Toxicology Research Institute. Progress report, October 1, 1975--September 30, 1976.
Breathing through added external deadspace ($V/\text{sub Dext/}$) was found to increase the tidal volume of normal dogs in order to achieve alveolar ventilation adequate for gas exchange. Addition of $V/\text{sub Dext/}$ did not alter alveolar-arterial gas gradients or cardiovascular function. Respiratory patterns during $V/\text{sub Dext/}$ breathing were compared with variables measured during treadmill exercise to investigate deadspace breathing as an indicator of early lung dysfunction caused by radiation pneumonitis in dogs. Dogs were evaluated clinically, radiographically and by pulmonary function tests at rest before and after inhaling ^{144}Ce in fused aluminosilicate particles. By 4 mo after inhalation of 32 to 50 $\mu\text{Ci/kg}$ ^{144}Ce , there were increases in respiratory frequency and minute volume during $V/\text{sub Dext/}$ breathing and in minute volume and the ventilatory equivalent for O_2 while running. No other significant functional, radiographic or clinical changes were noted. The dogs were sacrificed and scattered foci of inflammation were found in their lungs. Dead-space testing detected early, subclinical lung alterations with a sensitivity and at a time identical to treadmill testing and did not require whole-body exercise or training.
- 784 (LF--56, pp 79-83) RADIATION DOSE PATTERNS FROM ^{106}Ru AEROSOLS INHALED BY SYRIAN HAMSTERS. II. RETENTION AND TISSUE DISTRIBUTION. Newton, G.J.; Snipes, M.B.; Boecker, B.B.; Wagner, J.A. Dec 1976.
Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.
The whole-body retention and tissue distribution of inhaled ^{106}Ru were determined in Syrian hamsters. Aerosols of $^{106}\text{Ru--Rh}$ ruthenium oxalate were generated in nitrogen atmospheres and subjected to temperatures of 27, 300, 600, or 1100°C prior to animal inhalation exposures. Aerosols treated at 27°C and 300°C exhibited higher in vivo solubility and lower whole-body retention than aerosols treated at 600°C and 1100°C. However, the long-term retained component, though smaller, was cleared with a longer half-time than for aerosols treated at higher temperatures. No significant concentrations of ruthenium were found in kidney. The highest concentrations of inhaled ^{106}Ru compounds were found in lung, liver, bone, and possibly the nasopharyngeal region; the remaining body burden was diffusely distributed in soft tissue.
- 785 (LF--56, pp 84-87) BILIARY EXCRETION OF ^{144}Ce AFTER INHALATION OF ^{144}Ce CITRATE IN RATS AND SYRIAN HAMSTERS. III. Lustgarten, C.S.; Boecker, B.B.; Cuddihy, R.G.; Kanapilly, G.M. Dec 1976.
Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.
In previous studies the clearance of soluble forms of ^{144}Ce from the liver has been found to be faster in mice, rats and rabbits than in Beagle dogs or Chinese hamsters. Measurements of biliary excretion of ^{144}Ce in the two animal species following aerosol inhalation have helped to identify the reasons for these differences. Fifty-three rats and 27 Syrian

hamsters were exposed by inhalation to aerosols of ^{144}Ce citrate to achieve retained body burdens which ranged between 10-20 μCi . Bile was collected for a period of 36 to 60 hr from an average of seven rats and three hamsters at various times up to 128 days after exposure and was measured for ^{144}Ce activity. After bile collection, animals were sacrificed and their tissues were analyzed to determine ^{144}Ce content. It was found that the clearance of cerium from the livers of rats was primarily due to biliary excretion. In hamsters, the liver avidly retained ^{144}Ce with a very small fraction excreted in the bile.

- 786 (LF--56, pp 88-92) EFFECT OF ACIDITY ON THE RETENTION AND DISTRIBUTION OF INHALED $^{144}\text{CeCl}_3$. Kanapilly, G.M.; Sparling, L.C. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

The effect of acidity of aerosol droplets on the retention of inhaled $^{144}\text{CeCl}_3$ was examined. Syrian hamsters were exposed via inhalation to $^{144}\text{CeCl}_3$ aerosols generated from solutions containing 3.0 mg of Ce/ml and pH at 1.0, 2.9 or 5.0. After the early clearance, the half-times of whole-body retention for the remaining 20% of the ^{144}Ce initial body burdens were 20, 30 and 100 days, respectively, for aerosols generated at pH 1.0, 2.9 or 5.0. However, the tissue distribution data for lung, liver or bone did not indicate significant differences in the in vivo solubilities in metabolism of the three $^{144}\text{CeCl}_3$ aerosols. For each group of hamsters, about 30% of the initial lung burden of ^{144}Ce was transported from lung to liver and bone. Comparisons of in vivo dissolution of $^{144}\text{CeCl}_3$ aerosols in the lung and in vitro dissolution in three different solvents were also made.

- 787 (LF--56, pp 93-95) RADIATION DOSE PATTERN FOLLOWING INHALATION OF MONODISPERSE AND POLYDISPERSE AEROSOLS OF $^{241}\text{AmO}_2$ IN BEAGLE DOGS. I. Mewhinney, J.A.; Hobbs, C.H.; Mo, T.; Muggenburg, B.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Beagle dogs were exposed via inhalation to monodisperse or polydisperse aerosols of $^{241}\text{AmO}_2$ to define the resultant radiation dose pattern and thus establish the relative risk in humans of inhalation of $^{241}\text{AmO}_2$ and $^{239}\text{PuO}_2$ or a combination thereof. Three monodisperse aerosol sizes (3.0 μm , (1.5 μm and 0.75 μm) aerodynamic diameter (AD) and one polydisperse aerosol size 1.5 μm activity median aerodynamic diameter (AMAD) were employed to assess the role of particle size in the in vivo solubility of $^{241}\text{AmO}_2$ in lung and the translocation of solubilized material in other tissues. Animals are scheduled for sacrifice at 8, 32, 64, 128, 256, 365 and 730 days after inhalation exposure with at least three animals held for later sacrifice in each particle size group. Inhalation exposures were conducted to achieve an initial lung burden of approximately equal to 0.07 $\mu\text{Ci/kg}$ body weight. Periodic excretion collections are being made on all animals in the study. Preliminary data are reported on the tissue distribution of ^{241}Am measured in animals sacrificed at 64 days after inhalation exposure. Radiochemical analysis of samples obtained in this study is continuing.

$^{239}\text{PuO}_2$. Mewhinney, J.A.; Hobbs, C.H.; Muggenburg, B.A.; Mo, T. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Radiation dose patterns are being determined in Beagle dogs after inhalation of different sizes of monodisperse or a polydisperse aerosol of $^{239}\text{PuO}_2$. Aerosol sizes employed in the study were 0.7, 1.4, 2.7 μm aerodynamic diameter (AD) monodisperse aerosols and a 1.4 μm activity median aerodynamic diameter (AMAD) polydisperse aerosol. Twenty-six Beagle dogs were exposed to achieve initial lung burdens of approximately equal to 0.07 $\mu\text{Ci/kg}$ for each aerosol form and are being serially sacrificed in groups of two animals at 4 hr, 4, 8, 16, 32, 64, 128, 356, 730 days, 4, 6 and 8 yr after inhalation exposure. Since the study has been in progress only a short time, only limited data are available at this time. The primary purpose of the study is to provide information on the radiation dose distribution to organs and tissues of the Beagle dog as a function of particle size. These data will be of great value in interpreting dose-response relationships following inhalation of different sized aerosols of $^{239}\text{PuO}_2$ observed in other studies at this laboratory.

- 789 (LF--56, pp 99-104) INHALATION TOXICOLOGY OF INDUSTRIAL URANIUM AND PLUTONIUM MIXED OXIDES. I. GENERATION OF AEROSOLS FROM DRY POWDERS AND PRELIMINARY RODENT STUDIES. Eidson, A.F.; Mewhinney, J.A.; Hahn, F.F.; Mo, T. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Two powder samples of industrial mixed U and Pu oxides were obtained from a fuel fabrication facility. Aerosols produced at the industrial facility were analyzed in terms of particle size distribution parameters, density, and total alpha activity concentration. Methods of regeneration of aerosols from these dry powders with properties similar to those observed during onsite sampling were considered. A modified vortex tube was able to generate aerosols similar to those observed on-site. A 64-day, pilot radiation dose pattern study was completed using each material. The desired initial lung burden for each study was 100 nCi. The achieved average initial lung burdens for the 750°C treated and the 1750°C treated aerosols were 110 nCi and 970 nCi, respectively. There were no early deaths among rats exposed to the 750°C treated aerosols, but seven rats exposed to the 1750°C treated aerosols died before the scheduled end of the study. This result is attributed to the overexposure of the animals to the aerosol. Lung retention of the 750°C treated aerosol indicates a retention half-time of 115 days. Analysis of liver and femur indicated that 2.5% of the sacrifice body burden of the 750°C treated material was in each of these tissues. The corresponding value for the 1750°C treated material is 0.3%. These results indicate the greater relative in vivo solubility of the 750°C treated material. Histological examinations were made on tissues obtained at necropsy from all animals that died during the experiment. Lesions were found only in the lungs and the results indicate that early deaths were due to radiation pneumonitis.

- 790 (LF--56, pp 149-153) TOXICITY OF INHALED BETA-EMITTING RADIONUCLIDES: AN EXPERIMENTAL APPROACH. Hahn, F.F.; McClellan, R.O.; Benjamin, S.A. Dec 1976.

Inhalation Toxicology Research Institute

- 788 (LF--56, pp 96-98) RADIATION DOSE PATTERNS IN BEAGLE DOGS FOLLOWING INHALATION OF MONODISPERSE AND POLYDISPERSE AEROSOLS OF

annual report, October 1, 1975--September 30, 1976.

An experimental approach to evaluation of the toxicity of inhaled beta-emitting radionuclides in experimental animals is described. These radionuclides are being studied in both relatively soluble ($^{90}\text{SrCl}_2$, $^{144}\text{CeCl}_3$, $^{91}\text{YCl}_3$, $^{137}\text{CsCl}$) and relatively insoluble aerosol forms (^{90}Y , ^{91}Y , ^{144}Ce and ^{90}Sr in fused aluminosilicate particles). Initial lung or whole-body activity burdens were selected to result in early deaths due to severe lesions at the highest exposure levels, and more subtle changes, such as neoplasia, at the lower levels. The organs affected vary depending on the solubility and chemical characteristics of the isotope. These studies with young adult dogs are complemented with comparable studies in other species (mice, Syrian hamsters) and with animals of different ages (immature, aged). This basic approach, with emphasis on factors that alter the resulting radiation dose pattern, offers the maximum likelihood of meeting the continuing, and not always predictable, needs for information on the toxicity of inhaled beta-emitting radionuclides that may be encountered in nuclear industry operations.

791 (LF--56, pp 154-157) TOXICITY OF INHALED $^{90}\text{SrCl}_2$ IN BEAGLE DOGS. X. Benjamin, S.A.; Muggenburg, B.A.; Boecker, B.B.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Studies on the metabolism, dosimetry, and effects of inhaled $^{90}\text{SrCl}_2$ in the Beagle dog are continuing in an effort to provide a basis for assessing the consequences of inhaling ^{90}Sr such as might be released in certain nuclear accidents. Seventy-two dogs were exposed to aerosols containing ^{90}Sr resulting in initial body burdens ranging from 2.5 to 250 $\mu\text{Ci } ^{90}\text{Sr}/\text{kg}$ body weight. Forty-eight of these dogs are being maintained for lifetime observation. The skeletons of the dogs dying with bone-related neoplasms received initial radiation dose rates of 3.2 to 55 rads/day and cumulative doses to death of 2800 to 22,000 rads. Nine control dogs have died or been euthanized, one during the last year with a mammary adenocarcinoma. Serial observations are continuing on the 18 surviving ^{90}Sr dogs and 13 controls.

792 (LF--56, pp 158-163) TOXICITY OF INHALED $^{144}\text{CeCl}_3$ IN BEAGLE DOGS. X. Benjamin, S.A.; Boecker, B.B.; Lustgarten, C.S.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Studies on the metabolism, dosimetry, and effects of inhaled $^{144}\text{CeCl}_3$ in Beagle dogs are continuing to aid in assessing the biological consequences of inhaling ^{144}Ce such as might be released in certain nuclear accidents. Studies on the organ distribution of inhaled $^{144}\text{CeCl}_3$ have shown that the ^{144}Ce deposited in lung is translocated at a moderately rapid rate to liver and skeleton and that significant radiation doses are accumulated by all three organs. Fifty-five dogs that inhaled $^{144}\text{CeCl}_3$ and 15 control dogs are being observed for their life span. The ^{144}Ce dogs have long-term retained burdens with values ranging from 20 to 2900 μCi . Pathological changes observed at autopsy are reported.

INHALED $^{91}\text{YCl}_3$ IN BEAGLE DOGS. X. Muggenburg, B.A.; Benjamin, S.A.; Boecker, B.B.; McClellan, R.O. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Studies on the metabolism, dosimetry, and effects of inhaled $^{91}\text{YCl}_3$ in Beagle dogs are being continued to provide information that will aid in assessing the biological consequences of nuclear accidents in which ^{91}Y or other radionuclides that produce a similar radiation dose pattern may be released. Forty-two dogs with ^{91}Y initial body burdens from 64 to 1300 $\mu\text{Ci}/\text{kg}$ body weight were placed in four groups with mean lung burdens of 310, 180, 75 and 40 $\mu\text{Ci}/\text{kg}$ body weight. These dogs and 12 control dogs are being maintained for lifetime observation. An additional group of four dogs with a mean initial ^{91}Y body burden of 180 $\mu\text{Ci}/\text{kg}$ body weight were placed in a sacrifice study. Eleven dogs within the highest activity level groups died or were euthanized at 12 to 33 days after inhalation of ^{91}Y with changes related to severe bone marrow damage and associated pancytopenia. Two dogs died approximately 1 yr after ^{91}Y inhalation with convulsive seizures that were presumed to be unrelated to the ^{91}Y exposure. Five ^{91}Y -exposed dogs died or were euthanized due to neoplasms 2000 to 3341 days after exposure. Three dogs had nasal squamous cell carcinomas, one had a bronchioloalveolar carcinoma and another, a mast cell sarcoma. One dog died of renal failure 2660 days after exposure and one control dog died of empyema. Serial observations are continuing on all surviving dogs.

794 (LF--56, pp 167-171) TOXICITY OF INJECTED $^{137}\text{CsCl}$ IN BEAGLE DOGS. IX. Lustgarten, C.S.; Benjamin, S.A.; Hobbs, C.H.; Boecker, B.B.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A.; Redman, H.C. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Studies on the metabolism, dosimetry and effects of intravenously administered $^{137}\text{CsCl}$ in the Beagle dog are being conducted to aid in assessing the biologic consequences of exposure to ^{137}Cs such as occurs in the event of certain nuclear accidents. Effects of the chronic, relatively uniform whole-body exposure produced by ^{137}Cs are being compared with other diverse radiation dose patterns resulting from inhalation of radioactive aerosols. Sixty-six dogs were entered into the study: six with a mean initial ^{137}Cs body burden of 3780 $\mu\text{Ci}/\text{kg}$ and five groups of 12 dogs each with mean initial ^{137}Cs body burdens of 2820, 1940, 1420, 970 and 0 $\mu\text{Ci}/\text{kg}$. Seventeen of the dogs injected with $^{137}\text{CsCl}$ have died: 11 at 19 to 81 days after injection and cumulative whole-body doses of 860 to 1400 rads died with severe bone marrow damage and resultant pancytopenia; two at 2471 and 2707 days after injection and cumulative doses of 690 and 1800 rads with a neurofibrosarcoma of the liver and a mast cell tumor of the skin; four at 693 to 2148 days after injection and cumulative doses of 840 to 2000 rads with shock, aspiration pneumonia, severe arthritis and renal amyloidosis. Two control dogs died; one at 647 days with autoimmune hemolytic anemia and one at 2442 days with renal amyloidosis. Serial observations are continuing on the 37 $^{137}\text{CsCl}$ dogs and 10 control dogs. The $^{137}\text{CsCl}$ dogs now alive have cumulative whole-body doses of 550 to 2200 rads at 2777 to 3031 days after injection.

INHALED ^{90}Y IN FUSED ALUMINOSILICATE PARTICLES IN BEAGLE DOGS. VIII. Lay, J.C.; Hobbs, C.H.; Hahn, F.F.; Jones, R.K.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Studies on the metabolism, dosimetry, and biological effects of inhaled ^{90}Y in fused aluminosilicate particles in the Beagle dog are in progress to assess the consequences of inhalation of an energetic beta emitter that has a short effective half-life in the lung. A radiation dose pattern study in which 12 dogs were sacrificed in pairs at 0, 2, 4, 6, 8 and 12 days after exposure has been completed. A longevity study in which 89 dogs were exposed to initial lung burdens ranging from 80 to 5200 $\mu\text{Ci/kg}$ body weight and 12 control dogs were exposed to stable yttrium in fused aluminosilicate particles is in progress. The short half-life and the relative insolubility of the ^{90}Y in this vector at the doses achieved resulted in a radiation insult to the lung and surrounding structures at a relatively high, but rapidly decreasing dose rate. To date, 39 dogs with cumulative doses to lung from 7200 to 70,000 rads have died from 7.5 to 2250 days after exposure. The predominant findings in these dogs has been radiation pneumonitis, pulmonary fibrosis and right heart dilation and hypertrophy. One dog which died 903 days after exposure with a dose to lung of 11,000 rads also had two small pulmonary adenomas. Only one dog has died during the past year. This dog (333S) died 2250 days after exposure with a dose to lung of 7200 rads and had severe pulmonary edema, extensive pulmonary fibrosis, right heart dilation and hypertrophy and a small bronchioloalveolar carcinoma of the lung. Several dogs in the higher dose levels still containing suggestive of right heart enlargement and/or pulmonary fibrosis. Two exposed dogs are on replacement therapy with a synthetic thyroid hormone for treatment of hypothyroidism. Fifty exposed dogs and 12 control dogs remain alive at 2009 to 2565 days after exposure and will continue to be studied for the remainder of their life span.

796 (LF--56, pp 176-179) TOXICITY OF INHALED ^{91}Y IN FUSED ALUMINOSILICATE PARTICLES IN BEAGLE DOGS. VII. Lay, J.C.; Cuddihy, R.G.; Hahn, F.F.; Hobbs, C.H.; Jones, R.K.; Kanapilly, G.M.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Studies of the radiation hazards due to inhalation of ^{91}Y in fused aluminosilicate particles have been undertaken in Beagle dogs to aid in assessing the biological consequences of inhaling a relatively insoluble, energetic beta emitter with an intermediate effective half-life in the lung. A radiation dose pattern study in which 30 dogs were serially sacrificed from 0 to 320 days after inhalation exposure to ^{91}Y in fused aluminosilicate particles has been completed and results are reported. A longevity study is in progress in which 96 dogs were exposed to achieve initial lung burdens ranging from 11 to 300 μCi ^{91}Y in fused aluminosilicate particles/kg body weight and 12 dogs were exposed to stable yttrium in fused aluminosilicate particles. To date, 47 dogs have died in the longevity study between 113 and 1847 days after exposure. Forty-nine exposed dogs with doses to lung of 2,400 to 23,000 rads and 12 control dogs remain alive from 1833 to 2381 days after inhalation exposure and will continue to be studied throughout the remainder of their life span

with attention directed toward determining the relationship between radiation dose, dose rate and biologic effects.

797 (LF--56, pp 180-185) TOXICITY OF INHALED ^{144}Ce IN FUSED ALUMINOSILICATE PARTICLES IN BEAGLE DOGS. IX. Hahn, F.F.; Boecker, B.B.; Hobbs, C.H.; Jones, R.K.; Lay, J.C.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

The metabolism, dosimetry and effects of ^{144}Ce inhaled in fused aluminosilicate particles are being investigated in the Beagle dog to assess the biological consequences of release of ^{144}Ce in a relatively insoluble form such as might occur in certain types of nuclear accidents. The toxicity of inhaled ^{144}Ce is also of general interest since it is representative of intermediate-lived beta-emitting radionuclides. Two major studies with young adult dogs (12 to 14 mo of age at exposure) are involved: a metabolism and dosimetry study in which 24 dogs were serially sacrificed over an extended period of time; and a longevity study with two series of dogs. Series I contains 15 dogs exposed to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 11 to 210 $\mu\text{Ci/kg}$ body weight and three control dogs exposed to nonradioactive fused aluminosilicate particles. Series II contains 96 dogs exposed to aerosols of ^{144}Ce in fused aluminosilicate particles to yield initial lung burdens of 0.0024 to 66 $\mu\text{Ci/kg}$ body weight and 12 control dogs exposed to nonradioactive fused aluminosilicate particles. To date, 44 dogs have died or were euthanized at 143 to 2682 days after inhalation of ^{144}Ce . The prominent findings were radiation pneumonitis in dogs that died or were euthanized at early time periods and neoplastic disease in dogs that died or were euthanized at 750 days or later.

798 (LF--56, pp 186-189) TOXICITY OF INHALED ^{144}Ce IN FUSED ALUMINOSILICATE PARTICLES IN IMMATURE BEAGLE DOGS. V. Boecker, B.B.; McClellan, R.O.; Hahn, F.F.; Hobbs, C.H.; Lay, J.C.; Mauderly, J.L. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Immature Beagle dogs (approximately 3 months of age at exposure) have been exposed by inhalation to an aerosol of ^{144}Ce in fused aluminosilicate particles to compare the resulting patterns of metabolism, dosimetry and biological effects with those seen in dogs exposed at 12 to 14 mo of age and 8 to 10.5 yr of age. These studies will assess possible age-related differences in the biological behavior and effects of inhaled radionuclides: differences that may be of significance in predicting the response of accidentally-exposed human populations that include individuals of different ages.

799 (LF--56, pp 190-194) TOXICITY OF INHALED ^{144}Ce IN FUSED ALUMINOSILICATE PARTICLES IN AGED BEAGLE DOGS. V. Hahn, F.F.; Boecker, B.B.; Hobbs, C.H.; Lay, J.C.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

The toxicity of ^{144}Ce in fused aluminosilicate particles inhaled by 8- to 10.5-

yr-old dogs is being investigated to provide information on age-related differences in the response of older members of the human population to accidental inhalation of radioactive aerosols. These data on aged dogs will be compared to the results of similar studies of dogs exposed at approximately 3 mo or 12 to 14 mo of age. Six blocks of five female dogs each have been divided into four exposure levels with mean initial lung burdens of 7.2, 14, 28 and 57 $\mu\text{Ci } ^{144}\text{Ce/kg}$ body weight. Six blocks of four male dogs have been divided into three exposure levels with mean initial lung burdens of 7.2, 14 and 28 $\mu\text{Ci } ^{144}\text{Ce/kg}$ body weight. Controls in each block were exposed to fused aluminosilicate particles containing stable cerium. Fifteen dogs with initial lung burdens ranging from 20 to 75 $\mu\text{Ci } ^{144}\text{Ce/kg}$ body weight and cumulative doses to lung of from 22,000 to 74,000 rads have died or were euthanized 197 to 1207 days after exposure with clinicopathologic findings of radiation pneumonitis and pulmonary fibrosis. Pulmonary retention of the inhaled ^{144}Ce was similar to that observed previously in dogs exposed at 18 to 22 mo of age in a radiation dose pattern study. Serial observations are continuing on the 19 surviving ^{144}Ce -exposed and eight control dogs.

800 (LF--56, pp 195-199) TOXICITY OF INHALED ^{90}Sr IN FUSED ALUMINOSILICATE PARTICLES IN BEAGLE DOGS. VII. Snipes, M.B.; Boecker, B.B.; Hahn, F.F.; Hobbs, C.H.; Mauderly, J.L.; McClellan, R.O.; Pickrell, J.A. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Studies on the metabolism, dosimetry, and biological effects of ^{90}Sr inhaled in a relatively insoluble form by Beagle dogs have continued during the past year to define the biological consequences of inhaling this important radionuclide in a form which has a long retention time in the lung. One hundred and six dogs were exposed to a polydisperse aerosol (AMAD 1.4 to 2.8 μm and sigma/sub g/ 1.4 to 2.7) of fused aluminosilicate particles labeled with ^{90}Sr . Initial lung burdens ranged from 0.21 to 94 $\mu\text{Ci } ^{90}\text{Sr}$ per kilogram of body weight ($\mu\text{Ci/kg}$). Eighteen control dogs were exposed to an aerosol of stable strontium in fused aluminosilicate particles. These 124 dogs were assigned to the longevity study. An additional 26 dogs were exposed similarly to achieve lung burdens of approximately 1.5 to 12 $\mu\text{Ci/kg}$ (AMAD 1.9 to 2.5 μm and sigma/sub g/ 1.6 to 2.0) and assigned for sacrifice at intervals after exposure to define metabolism and dosimetry of this aerosol in Beagle dogs. Of the longevity dogs, 32 dogs having initial lung burdens of 29 to 94 $\mu\text{Ci } ^{90}\text{Sr/kg}$ and cumulative doses to lung to death of 40,000 to 96,000 rads have died from radiation pneumonitis and/or pulmonary fibrosis from 159 to 477 days after exposure. Twenty dogs with initial lung burdens of 4.3 to 36 $\mu\text{Ci } ^{90}\text{Sr/kg}$ and cumulative doses to lung to death of 25,000 to 68,000 rads have died from hemangiosarcomas in the lung or heart between 644 and 2156 days after exposure. In addition, one dog developed a bronchioloalveolar carcinoma, another developed epidermoid carcinoma of the lung and a third dog developed a squamous cell carcinoma in the nasal cavity. The remaining exposed dogs and controls of the longevity study are surviving at 657 to 2438 days after exposure.

801 (LF--56, pp 200-204) NASAL CARCINOMAS IN BEAGLE DOGS AFTER INHALATION OF RELATIVELY SOLUBLE FORMS OF BETA-EMITTING RADIONUCLIDES. Benjamin, S.A.; Boecker, B.B.; Snipes, M.B.;

Cuddihy, R.B.; McClellan, R.O. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Beagle dogs were exposed by inhalation to relatively soluble forms of three beta-emitting radionuclides and are being held for life span observation to evaluate hazards associated with nuclear power production. Dogs were exposed to graded activity levels of $^{91}\text{YCl}_3$, $^{144}\text{CeCl}_3$ or $^{90}\text{SrCl}_2$. With $^{91}\text{YCl}_3$ and $^{144}\text{CeCl}_3$, significant radiation dose was delivered to liver, respiratory tract, and skeleton. With $^{90}\text{SrCl}_2$, the dose was essentially to skeleton. Nasal cavity squamous cell carcinomas have been the most frequent neoplasms in the ^{91}Y and one of the most frequent in the ^{144}Ce study while relatively few have been seen after ^{90}Sr exposure. Also one nasal cavity hemangiosarcoma was seen in the ^{144}Ce study. The ^{90}Sr -exposed dogs have survived longer after exposure and have higher skeletal radiation doses than do the dogs exposed to ^{91}Y or ^{144}Ce . The greater incidence of nasal carcinomas can be explained by the finding of high concentrations of the lanthanides, ^{91}Y and ^{144}Ce , associated with the nasal turbinate epithelium.

802 (LF--56, pp 205-207) HEPATIC DEGENERATION IN BEAGLE DOGS AFTER CHRONIC HEPATIC BETA-IRRADIATION. Benjamin, S.A.; Lustgarten, C.S.; Pickrell, J.A.; Wolff, R.K. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

Dogs exposed to the beta-emitting radionuclides $^{144}\text{CeCl}_3$ and $^{91}\text{YCl}_3$ by inhalation have received significant radiation doses to liver. Those that have died at later times after exposure (more than 1500 days) have shown a high incidence of severe hepatic degeneration and nodular hyperplasia. This is in contrast with age-matched controls and dogs exposed to radionuclides such as $^{90}\text{SrCl}_2$ where the dogs receive no radiation dose to liver. The latter dogs have shown relatively little evidence of liver damage. More than half of the surviving dogs exposed to $^{144}\text{CeCl}_3$ show evidence of liver disease on liver function tests. Nuclear medicine scanning techniques have been shown to be effective in evaluating liver disease in vivo. These procedures will be used to derive a better understanding of the dose-response relationships involved.

803 (LF--56, pp 208-212) MORPHOLOGIC CHARACTERISTICS OF LUNG TUMORS IN BEAGLE DOGS AFTER INHALATION OF ^{91}Y IN FUSED ALUMINOSILICATE PARTICLES. Hahn, F.F.; Lay, J.C. Dec 1976.

Inhalation Toxicology Research Institute annual report, October 1, 1975--September 30, 1976.

The lung tumors from six dogs dying after inhalation of ^{91}Y in fused aluminosilicate particles have been examined with light and electron microscopy. The tumors were all epithelial in nature and originated in the peripheral lung. The histologic types were classified as bronchioloalveolar carcinoma, combined squamous cell-bronchioloalveolar carcinoma and bronchogenic adenocarcinoma. Electron microscopy revealed that several cell types were involved in three of the carcinomas. These lung tumors differ in histologic type from those in man associated with inhalation of radon and radon daughters.

804 (LF--56, pp 217-220) TOXICITY OF INHALED ^{144}Ce FUSED ALUMINOSILICATE PARTICLES

IN BALB/C MICE. Hahn, F.F. Dec 1976.
Inhalation Toxicology Research Institute
annual report, October 1, 1975--September 30,
1976.

Three hundred and twelve BALB/C mice have been exposed by inhalation to aerosols of ^{144}Ce fused aluminosilicate particles to achieve lung burdens of 0.03 μCi to 1.6 μCi ^{144}Ce and will be observed for their life span. One hundred and twenty mice have been exposed to ^{144}Ce in fused aluminosilicate particles to achieve lung burdens of $0.36 \pm 0.14 \mu\text{Ci}$ ^{144}Ce and will be sacrificed at intervals to determine the pulmonary retention of ^{144}Ce and to document nonlethal disease in the mice. The survival and lung tumor incidence in these mice will be compared to similar data from BALB/C mice with whole body and thoracic gamma irradiation and C57BL/6J mice exposed to aerosols of $^{144}\text{CeO}_2$.

805 (LF--56, pp 223-228) TOXICITY OF INHALED ALPHA-EMITTING RADIONUCLIDES: AN EXPERIMENTAL APPROACH. Hobbs, C.H.; McClellan, R.O.; Boecker, B.B.; Halliwell, W.H.; Lustgarten, C.S.; Merickel, B.S.; Mewhinney, J.A.; Miglio, J.J.; Mo, T.; Stalnaker, N.D. Dec 1976.

Inhalation Toxicology Research Institute
annual report, October 1, 1975--September 30,
1976.

A series of interrelated dose-response studies in which Beagle dogs and rodents are being exposed to aerosols of transuranic alpha-emitting radionuclides is described. The characteristics of monodisperse aerosols of oxides of ^{239}Pu , ^{238}Pu , ^{241}Am , ^{244}Cm , and ^{242}Cm are discussed for use in studies to determine the relative importance on the resulting biological effects of such factors as the local dose around particles, specific activity of particles, particle size, and number inhaled (the hot particle question). Other factors such as the elemental characteristics and the chemical form of the material and the age of the animal at the time of inhalation which may influence the toxicity of these radionuclides are also being studied. The purpose of the studies is to determine the basic relationships between the radiation dose pattern and resulting biological effects.

806 (SAAS--204, pp 22-30) LATE EFFECTS AFTER INTRATRACHEAL APPLICATION OF ^{147}Pm IN RATS. Burykina, L.N.; Vasil'eva, L.A.; Likhachev, Yu.P.; Ponomareva, V.L.; Shmeleva, E.V. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Gigieny Truda i Professional'nykh Zabolevaniy). Dec 1976. (In Russian).

From Final conference on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, F.R. Germany (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975, Berlin, Nov. 18-20, 1975.

The biological response to low doses of soluble ^{147}Pm was examined in a study with $^{147}\text{PmCl}_3$ in 561 rats after intratracheal application of doses ranging from 5×10^{-3} to $5 \times 10^{-1} \mu\text{Ci/g}$. Although in soluble form, the ^{147}Pm was primarily accumulated in the lungs. The minimum absorbed doses causing pneumosclerosis and lung tumours were found to be 9,000 rads and 900 rads, respectively.

807 (SAAS--204, pp 6-11) METABOLISM AND THE BIOLOGICAL EFFECT OF TRANSURANICS. Moskalev, Yu.I.; Zalikin, G.A. (Institut Biofiziki,

Moscow (USSR)). Dec 1976. (In German).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

The paper deals with the metabolic behaviour and the biological effects of ^{237}Np , ^{241}Am , ^{244}Cm , and ^{252}Cf in rats and dogs with particular emphasis being placed on the tumour and non-tumour late effects.

808 EFFECT OF CONTINUOUS INTAKE OF TRITIATED WATER (HTO) ON THE LIVER CHROMOSOMES OF MICE. Brooks, A.L.; Carsten, A.L.; Mead, D.K.; Retherford, J.C.; Crain, C.R. (Inhalation Toxicology Research Inst., Albuquerque, NM). Radiat. Res.; 68: No. 3, 480-489 (Dec 1976).

Chromosomal damage in the livers of mice exposed to continuous intake of tritiated water (HTO) was evaluated. Hale--Stoner Brookhaven mice were maintained on HTO (3 $\mu\text{Ci/ml}$) for 90, 330, (500, 560), and 700 days. The experimental animals and age-matched controls were partially hepatectomized to stimulate liver cell division and the frequency of chromosome aberrations in metaphase cells of the liver was used as an index of radiation-induced change. When liver cell chromosomes from mice on HTO water were compared with those from age-matched controls, there was a higher level of damage in the animals on HTO. This was true for both hyperdiploid and diploid cells. At the 5% level, however, the increase was not statistically significant. When the data were analyzed without four animals, one with a clone of abnormal cells and three with an unusual distribution of chromosome damage, there was a significant increase in the level of chromosome damage in the livers of mice on HTO for either 330 or (500, 560) days. The level of chromosome damage following HTO ingestion was similar on a per rad basis to that seen in Chinese hamster livers after protracted ^{60}Co gamma exposure or internally deposited ^{144}Ce , an energetic beta emitter. The data support the concept that on a per rad basis the risk for chromosome breakage following tritium exposure as HTO is similar to that from other beta--gamma emitters.

809 CYTOGENETIC EFFECTS OF PROTRACTED EXPOSURES TO ALPHA-PARTICLES FROM PLUTONIUM-239 AND TO GAMMA-RAYS FROM COBALT-60 COMPARED IN MALE MICE. Searle, A.G.; Beechey, C.V.; Green, D.; Humphreys, E.R. (Medical Research Unit, Harwell (UK). Radiobiology Unit). Mutat. Res.; 41: No. 2, 297-310 (Dec 1976).

Adult C3HX 101 hybrid male mice were injected intravenously with 4 μCi of ^{239}Pu citrate per kg body weight and examined for evidence of cytogenetic damage to the testis after exposures of 21, 28 and 34 weeks, with average doses from α -particles estimated as 13, 18 and 18 rad respectively (mean dose rate 0.00006 rad/min). Results were compared with those obtained when equivalent males were exposed continuously and concurrently to 1128 rad ^{60}Co γ -irradiation over 28 weeks (0.004 rad/min). The following estimates of the relative effectiveness of the α - and γ -radiation were made: 24 for reciprocal translocations and for chromosome fragments, 22 for dominant lethal mutations acting after implantation. These values (with mean of 23) are based on average testis doses, with no correction for probable

non-homogeneity of α dose distribution. In the mice exposed to γ -irradiation, there were significant reductions in testis mass and epididymal sperm-count.

- 810 (SAAS--204, pp 161-165) EXHALATION PATTERN OF THORON FOLLOWING INCORPORATION OF ^{22}Ra . Schlueter, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)); Petushkov, A.A.; Zel'tser, M.R. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Gigieny Truda i Professional'nykh Zabollevaniy). Dec 1976. (In Russian).

From Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975; Berlin, German Democratic Republic (18 Nov 1975).

Final conference of the Ministry of Health of the USSR and the National Board for Nuclear Safety and Radiation Protection of the GDR on scientific-technical cooperation in radiation protection in the period 1973-1975.

The emanation factor (w) of thoron was determined by means of thoron exhalation analysis as well as whole-body counting of ^{201}Tl in 4 patients who had been injected intravenously with $^{22}\text{RaCl}_2$ for treatment of Morbus Bechterew. At 5 hours after injection, w was found to be $2.5 \pm 0.3\%$ remaining fairly constant during the period of examination (one week).

- 811 'HALF-LIFE' TERMINOLOGY FOR ^{137}Cs IN HUMANS. Lloyd, R.D. (Utah Univ., Salt Lake City (USA). Radiobiology Div.); Rundo, J. Health Phys.; 31: No. 6, 527-528 (Dec 1976).
Reference is made to a recently published (Lewis et al. Health Phys.; 30:315 (1976)) list of 16 estimates of ^{137}Cs biological half-lives reported in the literature whose values range in magnitude from '0.1 yr to infinity'. It is maintained by the present author that the situation is not as dismal as the table of Lewis et al. may indicate, since the authors have made the error of comparing two distinct kinds of ^{137}Cs 'Half-lives', the biological half-time and the environmental half-time, in humans. The environmental half-time is strongly dependent upon the ^{137}Cs intake while the biological half-time for an individual adult can be considered as a metabolic parameter since it is rather constant under a variety of environmental conditions and appears to change only in response to the development of disease or pregnancy.

- 812 CHEMICAL FORM OF AMERICIUM AND CURIUM IN URINE. Stradling, G.N.; Popplewell, D.S.; Ham, G.J. (National Radiological Protection Board, Harwell (UK)). Health Phys.; 31: No. 6, 517-519 (Dec 1976).
The results of a study carried out to identify the chemical forms of americium and curium in urine, part of a larger investigation of the excretion mechanisms of these elements from the body, are reported. Gel permeation chromatography results are shown. The experimental study shows that both in vivo and in vitro ^{241}Am and ^{242}Cm , like ^{239}Pu , are bound to naturally occurring citrate in urine.

- 813 (LA--6604-PR) LIFE-CYCLE MUTANTS OF CHINESE HAMSTER OVARY CELLS, OCTOBER 1--NOVEMBER 30, 1976. Barnhart, B.J.; Cox, S.H.; Okinaka, R.T. (Los Alamos Scientific Lab., N.Mex. (USA)). Dec 1976. Contract W-7405-

ENG-36;EPA-IAG-D5-E681. 4p. Dep. NTIS \$3.50.

A $t_{\text{sub s/}}$ growth mutant of the cell line DON CCL is being characterized for reversion frequencies following exposure to chemical mutagens and ionizing radiation. The mutagen concentrations and mutation expression times are being defined for optimal reversion frequencies. The Ames Salmonella/mammalian liver microsome test system has been set up and will be used as an ancillary assay for mutagenicity for various polycyclic hydrocarbons prior to assessing these compounds in the tissue culture assay system.

- 814 (TID--27333) IMMUNOLOGICAL AND VIRAL ASPECTS OF RADIATION-INDUCED TUMORS. TWELFTH ANNUAL REPORT, MARCH 1, 1976--FEBRUARY 28, 1977. Reif, A.E. (Mallory Inst. of Pathology Research Foundation, Boston, Mass. (USA)). 30 Nov 1976. Contract EY-76-S-02-2539. 7p. Dep. NTIS \$3.50.

Progress is reported on studies on the incidence of osteosarcomas in mice injected with various doses of ^{90}Sr , or following whole-body exposure to 300 rad γ radiation from a ^{137}Cs source, or exposed to whole-body irradiation one or three days before the injection of ^{90}Sr .

- 815 EXPOSURE OF INDIVIDUALS TO CONCENTRATIONS OF RADIOACTIVE MATERIALS IN AIR IN RESTRICTED AREAS. Fed. Regist. (Wash., D.C.); 41: No. 230, 52300-52302 (29 Nov 1976).

From Energy, 10CFR20, Nuclear Regulatory Commission. Standards for protection against radiation.

Modifications to standards for the control of internal occupational exposures to radioactive materials including provision for use of respiratory protective equipment are announced. The availability of drafts of a related regulatory guide on acceptable programs for respiratory protection and of a related manual of respiratory protection against radioactive materials is also announced in the notice of proposed rulemaking. The new rule includes a reference to that regulatory guide on acceptable concepts, models, equation and assumptions for a bioassay program. The body intake limits for certain mixtures of uranium in soluble form have been changed to conform with recent standards adopted by AEC on July 29, 1974 (39 FR 23990). Conformance and control methods remain essentially the same as before modification of the regulation. (PCS)

- 816 (DOCKET-50272--328) SALEM NUCLEAR GENERATING STATION, UNIT 1. LETTER RE RADIOLOGICAL MONITORING PROGRAM. (Public Service Electric and Gas Co., Newark, N.J. (USA)). 22 Nov 1976. 1p.
Radiological monitoring program re milk samples. SALEM-1 REACTOR;ENVIRONMENTAL EFFECTS; MILK;RADIATION MONITORING;SAMPLING;VENTS; THYROID;INFANTS;RADIATION DOSES

- 817 (DOCKET-50254--933) QUAD-CITIES STATION, UNITS 1 AND 2. RESPONSE TO IE CIRCULAR NO. 76-03. (Florida Power and Light Co., Miami (USA)). 19 Nov 1976. 2p.
(DOCKET-50265--910).
Response to IE circular 76-03 re radiation overexposure. QUAD CITIES-1 REACTOR;PERSONNEL; RADIATION PROTECTION;RADIATION EFFECTS; INSPECTION;EDUCATION

- 818 (DOCKET-STN-50531--57) GENERAL ELECTRIC STANDARDS SAFETY ANALYSIS REPORT, GESSAR-251.

NRC DENIAL OF QUEST FOR PROPRIETARY STATUS RELATED TO PROGRAM FOR REDUCING OPERATIONAL RADIATION EXPOSURES. (General Electric Co., San Jose, Calif. (USA). Nuclear Energy Div.). 19 Nov 1976. 3p.

NRC denial of quest for proprietary status related to program for reducing operational radiation exposures. GE STANDARD REACTOR; RADIATION DOSES; PERSONNEL; REACTOR OPERATION

819 (DOCKET-50255--839) PALISADES NUCLEAR PLANT. RESPONSE TO IE CIRCULAR NO. 76-03. (Consumers Power Co., Jackson, Mich. (USA)). 18 Nov 1976. 1p.

Radiation exposures in reactor cavities. PALISADES-1 REACTOR; PERSONNEL; RADIATION DOSES

820 (DOCKET-50029--724) YANKEE NUCLEAR POWER STATION. LICENSE NO. DPR-3, TECHNICAL SPECIFICATIONS, PROPOSED CHANGE NO. 140, SUPPLEMENT 1. (Yankee Atomic Electric Co., Westboro, Mass. (USA)). 17 Nov 1976. 4p.

Entry into high radiation areas. ROWE YANKEE REACTOR; RADIATION DOSES; SPECIFICATIONS; PERSONNEL; RADIATION PROTECTION

821 (DOCKET-50245--918) MILLSTONE NUCLEAR POWER STATION, UNITS 1 AND 2. IE INSPECTION REPORT NOS. 76-24 AND 76-20 (ROUTINE, UNANNOUNCED). (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 17 Nov 1976. 11p. (DOCKET-50336--620).

Inspection of radiation protection program during Unit 1 refueling and Unit 2 start-up. MILLSTONE-1 REACTOR; MILLSTONE-2 REACTOR; INSPECTION; REACTOR FUELING; REACTOR START-UP; TESTING; RADIATION PROTECTION; DOCUMENTATION; RADIATION MONITORS; RESPIRATORS; TRANSPORT; ACCIDENTS; RADIATION DOSES; PERSONNEL; RADIOACTIVE MATERIALS

822 (DOCKET-50003--611) INDIAN POINT STATION, UNITS 1, 2, AND 3. IE INSPECTION REPORT NOS. 76-10, -23, -25 (SPECIAL UNANNOUNCED). (Consolidated Edison Co. of New York, Inc., New York (USA)). 16 Nov 1976. 23p. (DOCKET-50247--843; DOCKET-50286--554).

Inspection of corrective actions re survey records, radiation work permits, and control of radiation areas. INDIAN POINT-1 REACTOR; INDIAN POINT-2 REACTOR; INDIAN POINT-3 REACTOR; INSPECTION; RADIATION PROTECTION; CONTROL; PERSONNEL; MANAGEMENT; WHOLE-BODY IRRADIATION; RADIATION DOSES

823 SIX YEAR EVOLUTION OF HUMAN EXPERIMENTAL RADIOACTIVE CONTAMINATION. Delpla, M.; Bournay, P.; Schaeffer, R.; Gaulard, R.; Chinardet, J.M.; Letard, H. (Electricité de France, 75 - Paris); Moroni, J.-P. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)); Rocquet, Guy (Centre de Recherches du Service de Santé des Armées, 52 - Clamart (France)). C. R. Hebd. Seances Acad. Sci., Ser. D; 283: No. 12, 1465-1468 (15 Nov 1976). (In French).

A mixture of radioactive substances originating from the core of an electronuclear reactor and able to lead to a corresponding irradiation of the magnitude of the maximum permissible quarterly dose for the lungs was voluntarily inhaled in very well defined conditions. This internal contamination has been monitored for six years.

824 (DOCKET-50317--704) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. REPLY TO IE CIRCULAR NO. 76-03: "RADIATION EXPOSURES

IN REACTOR CAVITIES". (Baltimore Gas and Electric Co., Md. (USA)). 14 Nov 1976. 2p. (DOCKET-50318--369).

Reply to IE circular 76-03: "Radiation Exposures in Reactor Cavities". CALVERT CLIFFS-1 REACTOR; CALVERT CLIFFS-2 REACTOR; PERSONNEL; RADIATION PROTECTION; CONTAINMENT; ANNULAR SPACE; RADIATION DOSES

825 (DOCKET-50309--602) MAINE YANKEE ATOMIC POWER PLANT. LICENSE NO. DPR-36, SUPPLEMENT TO TS PROPOSED CHANGE 49 RE DOSE RATES AND RADIATION WORK PERMITS FOR HIGH RADIATION AREA ENTRIES. (Maine Yankee Atomic Power Co., Westboro, Mass. (USA)). 12 Nov 1976. 4p.

Dose rates and radiation work permits for high radiation area entries. MAINE YANKEE REACTOR; SPECIFICATIONS; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES; RADIATION MONITORS; DOSEMETERS; MAINTENANCE

826 (DOCKET-50325--394) BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2. REPLY TO IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Carolina Power and Light Co., Raleigh, N.C. (USA)). 12 Nov 1976. 3p. (DOCKET-50324--1001).

Radiation exposures in reactor cavities. BRUNSWICK-1 REACTOR; BRUNSWICK-2 REACTOR; CONTAINMENT BUILDINGS; PERSONNEL; RADIATION DOSES; RADIATION HAZARDS

827 (COO--3521-6, pp 33-36) METABOLIC AND IMPROVED ORGAN SCAN STUDIES. IV. DOSIMETRY FOR METABOLIC ISOTOPES IN ANIMALS AND MAN. 12 Nov 1976.

Biological effects of radiation and related biochemical and physical studies. Proposal 3. Metabolic studies in cancer with radioactive isotopes. Progress report, October 1, 1975--September 30, 1976.

Progress is reported on computations of total body and organ absorbed radiation dose necessary to safely progress from basic research studies of radiopharmaceuticals in animal models to clinically useful studies in humans. The radiation dosimetry of ^{204}Bi - and ^{206}Bi -citrate, ^{73}Se -selenite, ^{82}Sr , ^{82}Rb , ^{85}Sr , /sup 87m/Sr, and ^{90}Sr - ^{90}Y , and ^{125}I and ^{131}I has been performed as well as the preliminary dosimetry for $^{150}\text{O}_2$, C^{150}O_2 , and C^{150} . Work has also proceeded on the use of time, dose and fractionation (TDF) factors along with the Normal Standard Dose (NSD) concept for the purpose of comparing treatment regimens of radiation therapy for radionuclides and labeled compounds internally distributed within the body by biological processes.

828 (DOCKET-50244--605) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. REPLY TO IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Rochester Gas and Electric Corp., N.Y. (USA)). 11 Nov 1976. 2p.

Reply to IE circular No. 76-03: radiation exposures in reactor cavities. GINNA-1 REACTOR; CONTAINMENT; RADIATION DOSES; RADIATION MONITORING; PERSONNEL; RADIATION PROTECTION; MANUALS; EDUCATION

829 (DOCKET-50255--849) PALISADES NUCLEAR PLANT. IE INSPECTION REPORT NO. 76-20; REPLY; ACKNOWLEDGEMENT. (Consumers Power Co., Jackson, Mich. (USA)). 11 Nov 1976. 12p.

Inspection of solid radwaste operations, operating procedures, records, semiannual report, and solidification problems. PALISADES-1 REACTOR; INSPECTION; RADIOACTIVE WASTE MANAGEMENT; SOLID WASTES; PACKAGING; DOCUMENTATION;

FORMALDEHYDE;SOLIDIFICATION;UREA;FLOW RATE;
MEASURING INSTRUMENTS;TRANSPORT;LIQUID WASTES;
PERSONNEL;RADIATION DOSES;PH VALUE

RANCHO SECO-1 REACTOR;CONTAINMENT BUILDINGS;
RADIATION PROTECTION;PERSONNEL;RADIATION DOSES

830 (DOCKET-50244--617) ROBERT EMMETT GINNA
NUCLEAR POWER PLANT, UNIT 1. IE INSPECTION
REPORT NO. 76-18 (ROUTINE, UNANNOUNCED); REPLY;
ACKNOWLEDGMENT. (Rochester Gas and Electric
Corp., N.Y. (USA)). 10 Nov 1976. 14p.

Inspection of radioactive waste management
systems. GINNA-1 REACTOR;INSPECTION;RADIATION
PROTECTION;PERSONNEL;EDUCATION;RADIATION DOSES;
ACTIVITY LEVELS;RADIOACTIVE WASTE MANAGEMENT;
DOCUMENTATION;MANAGEMENT;LEAKS;PIPELINES;CRACKS

831 (DOCKET-50263--767) MONTICELLO NUCLEAR
GENERATING PLANT, UNIT 1. REPLY TO IE
CIRCULAR NO. 76-03: RADIATION EXPOSURES IN
REACTOR CAVITIES. (Northern States Power Co.,
Minneapolis, Minn. (USA)). 10 Nov 1976. 2p.

Reply to IE circular 76-03: radiation
exposures in reactor cavities. MONTICELLO
REACTOR;CONTAINMENT;ANNULAR SPACE;PERSONNEL;
RADIATION PROTECTION;RADIATION MONITORS;
RADIATION DOSES;CONTROL;EDUCATION

832 (DOCKET-50271--836) VERMONT YANKEE
NUCLEAR POWER STATION. LICENSE NO. DPR-28,
TECHNICAL SPECIFICATIONS, PROPOSED CHANGE NO.
47, SUPPLEMENT NO. 1. (Vermont Yankee Nuclear
Power Corp., Rutland (USA)). 10 Nov 1976.
5p.

High radiation areas. VERMONT YANKEE REACTOR;
RADIATION DOSES;PERSONNEL;RADIATION PROTECTION;
SPECIFICATIONS

833 (DOCKET-50293--775) PILGRIM NUCLEAR
POWER STATION, UNIT 1. IE INSPECTION REPORT
NO. 76-27 (ROUTINE, UNANNOUNCED); REPLY;
ACKNOWLEDGMENT. (Boston Edison Co., Mass.
(USA)). 10 Nov 1976. 24p.

Inspection of compliance with regulatory
requirements relating to radiation protection
and the health physics program. PILGRIM-1
REACTOR;INSPECTION;AIR;SAMPLING;DECONTAMINATION;
OPERATION;RADIATION MONITORING;TURBOGENERATORS;
BUILDINGS;ROOFS;RADIATION DOSES;RADIATION
PROTECTION;PERSONNEL

834 (DOCKET-50315--625) DONALD C. COOK
NUCLEAR POWER PLANT, UNITS 1 AND 2. REPLY TO
IE CIRCULAR NO. 76-03: "RADIATION EXPOSURES
IN REACTOR CAVITIES". (Indiana and Michigan
Power Co., New York (USA)). 10 Nov 1976.
2p. (DOCKET-50316--271).

Reply to IE circular 76-03: "Radiation
Exposures in Reactor Cavities". COOK-1 REACTOR;
PERSONNEL;RADIATION PROTECTION;CONTAINMENT;
ANNULAR SPACE;RADIATION DOSES

835 (DOCKET-50220--655) NINE MILE POINT
NUCLEAR STATION, UNIT 1. RESPONSE TO IE
CIRCULAR NO. 76-03. (Niagara Mohawk Power
Corp., Syracuse, N.Y. (USA)). 9 Nov 1976.
3p.

Response to IE circular 76-03 re
overexposures in reactor cavities. NINE MILE
POINT-1 REACTOR;PERSONNEL;RADIATION PROTECTION;
CONTAINMENT;ANNULAR SPACE;RADIATION DOSES

836 (DOCKET-50312--456) RANCHO SECO NUCLEAR
GENERATING STATION, UNIT 1. REPLY TO IE
CIRCULAR NO. 76-03: "RADIATION EXPOSURES IN
REACTOR CAVITIES". (Sacramento Municipal
Utility District, Calif. (USA)). 4 Nov 1976.
vp.

Radiation Exposures in Reactor Cavities.

837 (DOCKET-50133--467) HUMBOLDT BAY POWER
PLANT, UNIT 3. IE INSPECTION REPORT NO. 76-15
(ROUTINE, UNANNOUNCED, RADIOLOGICAL).
(Pacific Gas and Electric Co., San Francisco,
Calif. (USA)). 3 Nov 1976. 13p.

Inspection of radiological monitors, survey
instruments, bioassays, emergency drills,
radioactive effluents and coolant water
quality. HUMBOLDT BAY REACTOR;INSPECTION;
RADIATION MONITORS;EMERGENCY PLAN;RADIOACTIVE
EFFLUENTS;WATER QUALITY;COOLANTS;PERSONNEL;
RADIATION DOSES;LIQUID WASTES;GASEOUS WASTES;
SOLID WASTES

838 RADIOACTIVE WASTE TREATMENT COSTS AND
ENVIRONMENTAL IMPACT FOR MILLING OF URANIUM
ORES. Sears, M.B. (Oak Ridge National Lab.,
TN). Trans. Am. Nucl. Soc.; 24: 94-95(Nov
1976).

From Transactions of the American Nuclear
Society 1976 international meeting; Washington,
DC, USA (14 Nov 1976).

URANIUM ORES;MILLING;RADIOACTIVE WASTE
PROCESSING;RADIATION DOSES;COST BENEFIT
ANALYSIS;HUMAN POPULATIONS;ENVIRONMENTAL
EFFECTS

839 WASTE TREATMENT COST/BENEFIT ANALYSIS FOR
FABRICATION OF LIGHT-WATER REACTOR FUEL
CONTAINING PLUTONIUM. Groenier, W.S. (Oak
Ridge National Lab., TN). Trans. Am. Nucl.
Soc.; 24: 95(Nov 1976).

From Transactions of the American Nuclear
Society 1976 international meeting; Washington,
DC, USA (14 Nov 1976).

RADIOACTIVE WASTE PROCESSING;COST BENEFIT
ANALYSIS;NUCLEAR FUELS;FABRICATION;PLUTONIUM
OXIDES;URANIUM OXIDES;FUEL PELLETS;FLOWSHEETS;
RADIATION DOSES;HUMAN POPULATIONS;PWR TYPE
REACTORS;BWR TYPE REACTORS

840 RADIOACTIVE WASTE TREATMENT COSTS AND
ENVIRONMENTAL IMPACT FOR REPROCESSING LIGHT-
WATER REACTOR FUEL. Finney, B.C. (Oak Ridge
National Lab., TN). Trans. Am. Nucl. Soc.; 24:
96(Nov 1976).

From Transactions of the American Nuclear
Society 1976 international meeting; Washington,
DC, USA (14 Nov 1976).

SPENT FUELS;REPROCESSING;RADIOACTIVE WASTE
PROCESSING;COST BENEFIT ANALYSIS;HUMAN
POPULATIONS;RADIATION DOSES;ENVIRONMENTAL
EFFECTS;FLOWSHEETS;PWR TYPE REACTORS;BWR TYPE
REACTORS

841 COSTS AND THE ENVIRONMENTAL IMPACT OF
RADIOACTIVE WASTE TREATMENT IN REPROCESSING
HIGH-TEMPERATURE GAS-COOLED REACTOR FUEL.
Davis, W. Jr. (Oak Ridge National Lab., TN).
Trans. Am. Nucl. Soc.; 24: 96-97(Nov 1976).

From Transactions of the American Nuclear
Society 1976 international meeting; Washington,
DC, USA (14 Nov 1976).

HTGR TYPE REACTORS;RADIOACTIVE WASTE
PROCESSING;COST BENEFIT ANALYSIS;SPENT FUELS;
REPROCESSING;RADIATION DOSES;HUMAN POPULATIONS;
FLOWSHEETS;ENVIRONMENTAL EFFECTS

842 HEALTH EFFECT ESTIMATIONS FOR THE
INACTIVE VITRO URANIUM MILL TAILINGS. Rogers,
V.C. (Ford, Bacon and Davis Utah Inc., Salt
Lake City); Sandquist, G.; Baird, R. Trans.
Am. Nucl. Soc.; 24: 105-106(Nov 1976).

From Transactions of the American Nuclear
Society 1976 international meeting; Washington,

DC, USA (14 Nov 1976).

URANIUM ORES;ORE PROCESSING;RADIOACTIVE WASTES;ENVIRONMENTAL EFFECTS;RADON;DELAYED RADIATION EFFECTS;NEOPLASMS;FORECASTING;HUMAN POPULATIONS;BIOLOGICAL EFFECTS

- 843 (PB--259940) MEASUREMENT OF RADIATION EXPOSURE RECEIVED BY FLIGHT ATTENDANTS FROM SHIPMENTS OF RADIOACTIVE MATERIAL. TECHNICAL REPORT. Tse, A.N. (Nuclear Regulatory Commission, Washington, D.C. (USA). Div. of Engineering Standards). Nov 1976. 46p. (NR/DES--0001). NTIS, PC A03/MF A01.

A study was conducted in late 1974 to measure physically the radiation dose received by selected flight attendants from shipments of radioactive material transported on board commercial airline flights in the United States. This study was sponsored jointly by the two flight attendants' unions and by the U.S. Nuclear Regulatory Commission. Analyses of the data indicates that the radiation dose received by most flight attendants from these shipments is small and is well below the limit recommended for individuals of the general public by international and national organizations on radiation protection.

- 844 ABSORBED RADIATION DOSE BY THE THYROID FROM RADIOIODINE IMPURITIES FOUND IN ^{123}I . Colombetti, L.G.; Johnston, A.S. (Loyola Univ., Maywood, Ill. (USA). Stritch School of Medicine). Int. J. Appl. Radiat. Isot.; 27: No. 11, 656-659 (Nov 1976).

The principal radionuclidic impurities in commercially available ^{123}I have been measured by γ -ray spectroscopy using a Ge(Li) detector and were found to be mainly radioiodines. Calculations showed that the contribution of radioiodine impurities to the total absorbed dose to the thyroid is significant. Depending upon the nuclear reaction used to prepare ^{123}I the absorbed dose by the thyroid per mCi of ^{123}I due to the impurities may increase dramatically with the passing of time. At the end of bombardment (EOB) in ^{123}I produced by the $^{122}\text{Te}(d, n)^{123}\text{I}$ reaction, a method used for commercially available ^{123}I , the total dose to the thyroid is 24 mRads/microCi of ^{123}I ingested by the patient. The observed dose increases almost 20 fold, to 450 mRads/microCi of ^{123}I , as a result of long lived radioiodine impurities, 104 hr (8 half-lives of ^{123}I) after EOB.

- 845 (DOCKET-50309--618) MAINE YANKEE ATOMIC POWER PLANT. AMENDMENT 1 TO OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING SUMMARY OF SURVEY RESULTS: 1 JULY--31 DECEMBER 1974. (Maine Yankee Atomic Power Co., Westboro, Mass. (USA)). Nov 1976. 8p.

Amendment 1 to offsite environmental radiological monitoring summary of survey results: 1 July--31 December 1974. MAINE YANKEE REACTOR;RADIATION MONITORING;ENVIRONMENTAL EFFECTS;IODINE 131;ACTIVITY LEVELS;MILK;INFANTS; THYROID;RADIATION DOSES;COWS

- 846 (KFK--2375, pp 172-176) INVESTIGATION OF THE LONG-TERM RADIOLOGICAL ENVIRONMENTAL IMPACT CAUSED BY AN ACCUMULATION OF NUCLEAR FACILITIES. Bayer, A.; Kalckbrenner, R.; Lorenz, G.; Schueckler, M. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Nov 1976. (In German). First semiannual report 1976.

Some modifications of the program system of the atmospheric transport were introduced and the model of the hydrospheric transport

completed. Some more partial results are obtained. Within an investigation about the release of activation products, particular emphasis was laid upon C-14.

- 847 (STH--9/76) SURVEILLANCE OF RADIONUCLIDES RELEASED FROM NUCLEAR POWER PLANTS. Schwibach, J.; Bretschneider, J.; Gadow, A. von; Haubelt, R.; Huber, O.; Riedel, H.; Winkelmann, I. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Strahlenhygiene). Nov 1976. 102p. Dep. NTIS (US Sales Only), PC A06/MF A01.

The nature and the amount of radionuclides released from nuclear power plants, methods of monitoring the gaseous and liquid effluents as well as in the environment, and the calculation of the potential radiation exposure of the public are discussed. Because of recent studies and new guides for monitoring more data on releases of the individual radionuclides are now available. Radiation exposure of the public may be reported with more credibility if all the individual radionuclides which may contribute significantly are measured in the effluents on a regular basis. In general, emission control will offer more protection to the public than reliance on environmental measurements only.

- 848 POPULATION DOSES AND ALARA: A CASE STUDY. Evans, J.R.; Kolar, M.J. (Gilbert/ Commonwealth, Jackson, MI). Trans. Am. Nucl. Soc.; 24: 92-93 (Nov 1976).

From Transactions of the American Nuclear Society 1976 international meeting; Washington, DC, USA (14 Nov 1976).

NUCLEAR POWER PLANTS;RADIOACTIVE EFFLUENTS; RADIATION DOSES;RELEASE LIMITS;HUMAN POPULATIONS

- 849 GUIDELINES ON THE EVALUATION OF OBJECTIVE RADIATION DOSE AROUND POWER GENERATING LWR PLANTS. Genshiyoku Iinkai Geppo; 21: No. 9, 26-40 (Nov 1976). (In Japanese).

The calculation formulae and the parameters prepared by the subcommittee of reactor safety technology, AEC of Japan, are presented, which are applied to the evaluation of the released quantity of radioactive substances and of the exposure dose owing to them at the time of the normal operation, in the basic design stage of LWR (light water reactor) plants. The contents are broadly concerned with the following matters: calculation of the sources in both gaseous and liquid wastes; and calculation of the exposure doses in both whole body and thyroid gland.

- 850 BASIC CONCEPT CONCERNING THE CALCULATION OF EXPOSURE DOSE TO BE COMPARED WITH THE OBJECTIVE DOSE AROUND POWER GENERATING LWR PLANTS. Genshiyoku Iinkai Geppo; 21: No. 9, 46-48 (Nov 1976). (In Japanese).

The results of study on the basic concept in the calculation of the exposure dose around LWR (light water reactor) plants, submitted by Radiation Council to Director General of the Science and Technology Agency, are presented. Based on the intake routes through foods, the contents are concerned with the following matters: calculation of the whole-body exposure dose due to radioactive substances in both gaseous and liquid wastes; calculation of the thyroid-gland exposure dose due to radioiodine in both gaseous and liquid wastes; and application of the concept to other nuclear power facilities.

- 851 SIMPLE AND INEXPENSIVE CLINICAL WHOLE BODY COUNTER. Rehani, M.M.; Basu, A.K.; Guha, S.K. (All India Inst. of Medical Sciences, New Delhi. Dept. of Nuclear Medicine; All India Inst. of Medical Sciences, New Delhi. Biomedical Engineering Div.); Tandon, B.N. (All India Inst. of Medical Sciences, New Delhi. Dept. of Gastroenterology); Gupta, M.M. (Institute of Nuclear Medicine and Allied Sciences, Delhi (India)). Nucl.-Med. (Stuttgart); 15: No. 5, 248-253(Nov 1976). 5 figs.; 7 tabs.; 14 refs..

The conventional radioisotope scanner has been used as a whole body counter. The background index of the system is 10.9 counts per minute per ml of sodium iodide crystal. The sensitivity and derived sensitivity parameters have been evaluated and found to be suitable for clinical studies. The optimum parameters for a single detector at two positions above the lying subject have been obtained. It has been found that for the case of ^{131}I measurement it is possible to assay a source located at any point in the body with coefficient of variation less than 5%. To add to the versatility, a fixed geometry for in-vitro counting of large samples has been obtained. The retention values obtained by the whole body counter have been found to correlate with those obtained by in-vitro assay of urine and stool after intravenous administration of ^{51}Cr -albumin.

- 852 ASSESSMENT OF LITHIUM BORATE THERMOLUMINESCENT DOSIMETERS FOR THE MEASUREMENT OF DOSES TO PATIENTS IN DIAGNOSTIC RADIOLOGY. Langmead, W.A. (National Radiological Protection Board, Harwell (UK)); Palmer, K.E. Br. J. Radiol.; 49: No. 587, 956-962(Nov 1976).

A pilot survey of doses to patients undergoing four types of radiological procedure - barium enemas, intravenous pyelography, cardiac catheterization and mammography - has been made using lithium borate TL dosimeters. The survey was designed to test the operational suitability of the dosimetry system and to gain experience and gather data for the planning of further larger surveys. The TL dosimeters were calibrated against conventional ionization chambers, and then used on patients for determining gonad doses and maximum doses to the skin. Few difficulties were encountered in using the system. The measured doses to patients have been compared with previous determinations by other authors and reasonable agreement demonstrated.

- 853 USE FACTORS FOR MEDICAL LINEAR ACCELERATORS. Cobb, P.D.; Bjaerngard, B.E. (Harvard Medical School, Boston, Mass. (USA)). Health Phys.; 31: No. 5, 463-465(Nov 1976).

The results of an evaluation of a projected use of a 4 MV linear accelerator, with respect to shielding, are presented. Records of treatments of patients during 1 week in January 1974 on three 4-MV linear accelerators were analyzed to determine the number of patients, treatments and fields; the gantry angles used to deliver the radiation; the field sizes; and the exposures used. A summary of the data is shown in tabular form and the average workload for these units considered in relation to workloads specified in the NCRP Report No. 34 (1970) entitled Medical X-Ray and Gamma-Ray Protection for Energies up to 10 MeV, Structural Shielding Design and Evaluation. Factors which are especially important in shielding calculations are considered. It is concluded that considerable savings in shielding can be made by obtaining accurate estimates of the workload and the average field

size, and by employing a beam direction factor for secondary radiation.

- 854 (NBS-SP--456) MEASUREMENTS FOR THE SAFE USE OF RADIATION. Fivozinsky, S.P. (ed.). (National Bureau of Standards, Boulder, Colo. (USA). Inst. for Basic Standards). Nov 1976. 465p. (CONF-760301--). GPO \$5.15.

From NBS symposium on measurements for the safe use of radiation; Gaithersburg, MD, USA (1 Mar 1976).

These proceedings are the compilation of papers presented at the Symposium, "Measurements for the Safe Use of Radiation," held in Gaithersburg, Maryland, March 1 to 4, 1976. The symposium addressed the present status and future requirements for measurements of ionizing and non-ionizing radiation. Emphasis was placed on the needs for standardization and measurement assurance activities in medical, environmental, and personnel protection applications.

- 855 (NRPB-R--52) HUMAN EXPOSURE TO RADIATION FOLLOWING THE RELEASE OF RADIOACTIVITY FROM A REACTOR ACCIDENT: A QUANTITATIVE ASSESSMENT OF THE BIOLOGICAL CONSEQUENCES. Smith, H.; Stather, J.W. (National Radiological Protection Board, Harwell (UK)). Nov 1976. 43p.p. Dep. NTIS (US Sales Only), PC A03/MF A01.

The objective of this review is to provide a biological basis upon which to assess the consequences of the exposure of a population to radioactivity released after a reactor accident. Depending upon the radiation dose, both early and late somatic damage could occur in the exposed population and hereditary effects may occur in their descendants. The development of dose-effect relationships has been based upon the limited amount of information available on humans, supplemented by data obtained from experiments on animals.

- 856 (SAAS--203) RADIOGENETIC AND RADIOBIOLOGICAL INDICATIONS FOR INTERRUPTION OF PREGNANCY. Neumeister, K. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Nov 1976. 13p. (In German). TIC.

Taking into consideration the recent literature, and based on his own experience, the author deals with the question of interruption following radiation stress in early pregnancy. At fetal doses of above 10 R, induction of abortion is thought to be necessary. In the German Democratic Republic a central consultation service has been established at the National Board of Nuclear Safety and Radiation Protection offering expert opinions on these problems.

- 857 MANTEL--HAENZSEL ANALYSIS OF OXFORD DATA. II. INDEPENDENT EFFECTS OF FETAL IRRADIATION SUBFACTORS. Kneale, G.W.; Stewart, A.M. (Univ. of Birmingham, Eng.). J. Natl. Cancer Inst.; 57: No. 5, 1009-1014(Nov 1976).

A Mantel-Haenszel analysis of fetal irradiation subfactors indicated that most of the extra x-rayed cases in the Oxford Survey of Childhood Cancers were radiation induced. First trimester exposures were rare but probably ten times more dangerous than later exposures. Ratios of observed: expected numbers of cancer deaths were lower for children with abnormal x-rays than for other x-rayed children, and lower for recent than remote exposures. The first of these differences was probably due to several antenatal conditions having positive associations with obstetric radiography and

several causes of early (noncancer) deaths; the second one was probably due to a progressive lowering of film doses between 1940 and the present time. A rare cause of fetal irradiation (hydramnios), whose associations with congenital defects are well documented, led to the discovery that two faults in the International Classification of Diseases and Causes of Death have contributed to mistaken ideas about the etiology of childhood cancers: Neoplasms were not listed among the official causes of stillbirths, and cystic tumors of the kidneys and lungs of infants were not listed as neoplasms.

- 858 REDUCING PATIENT EXPOSURE TO IONIZING RADIATION: IS IT REALLY NECESSARY. Thomas, R.H.; Busick, D.D. (Univ. of California, Berkeley). Am. Ind. Hyg. Assoc. J.; 37: No. 11, 657-664 (Nov 1976).

The thesis that medical radiation exposures to the general population in the United States are excessive and that urgent steps need to be taken to reduce them is examined. At the present time, no evidence is found that deleterious effects result from radiation exposures at the level of a few rads or less. Nevertheless it is prudent that we assume the possibility of harmful effects of radiation exposure. However, because medical radiology is clearly so beneficial, and the harmful effects are problematical, it is doubtful whether the public should be alarmed by the suggestion of any crisis. A balancing of risks and benefits in the medical uses of radiology supports this latter contention.

- 859 (UCRL-Trans--11197) RELATIONS BETWEEN RADIATION RISKS AND RADIATION PROTECTION MEASURING TECHNIQUES. Herrmann, K.; Kraus, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Nov 1976. Translation of SAAS--188. 36p. Dep. NTIS \$4.00.

Relations between radiation risks and radiation protection measuring techniques are considered as components of the radiation risk. The influence of the exposure risk on type and extent of radiation protection measurements is discussed with regard to different measuring tasks. Based upon measuring results concerning the frequency of certain external and internal occupational exposures in the GDR, it has been shown that only a small fraction of the monitored persons are subjected to a high exposure risk. As a consequence the following recommendations are presented: occupationally exposed persons with small exposure risk should be monitored using only a long-term dosimeter (for instance a thermoluminescence dosimeter). In the case of internal exposure, the surface and air contamination levels should be controlled so strictly that routine measurements of internal contamination need not be performed.

- 860 GONAD DOSE PRODUCED BY A ^{60}Co IRRADIATION OF PERIPHERAL, INTERPLEURAL, AND RETROPERITONEAL LYMPH NODE GROUPS. Hassenstein, E.; Nuesslin, F. (Medizinische Hochschule Hannover (Germany, F.R.). Dept. Radiologie; Medizinische Hochschule Hannover (Germany, F.R.). Abt. fuer Strahlentherapie). Strahlentherapie; 152: No. 5, 427-432 (Nov 1976). (In German).

1 fig.; 1 tab.; 9 refs..

A telecobalt therapy of lymph node groups was simulated on the Alderson phantom and the gonad dose caused by each irradiation field was measured with LiF dosimeters. When the supradiaphragmatic and the para-aortal lymph

nodes were irradiated, the ovary dose showed rates up to 20 per thousand of the dose maximum. The irradiation of the same zones brought about a testicle dose of less than 5 per thousand of the dose maximum, and only 1/20 of this rate was achieved when a lead plate of about four cm was used in order to protect the testicles. The results are discussed under the point of view of the genetic risk.

- 861 SOME MEASUREMENTS OF DOSES TO PATIENTS FROM DENTAL X-RAYS. Woehni, T. (Statens Institutt for Straalehygiene, Oslo (Norway)). Nor. Tannlaegeforen. Tid.; 86: No. 10, 451-457 (Nov 1976). (In Norwegian). 11 references.

Some measurements of doses to patients from conventional dental radiography and orthopantomography are presented. Doses to the red bone marrow are calculated. The bone marrow doses from two different exposures, Maxilla incisor and Molar bite-wing, were calculated to be 0.4 and 1.0 mrad respectively. The average dose to red bone marrow from a full-mouth examination (10 exposures) was 0.7 mrad/exposure. An orthopantomographic examination involved 2 mrad to the bone marrow. The greatest doses from an orthopantomographic examination were found around the lateral rotational axis, namely 700 mrad. The dose distributions from the two different cone lengths did not differ as much as expected, mainly due to scattered radiation.

- 862 (ERDA-tr--250, pp 1-62) STUDY AND STANDARDIZATION OF THE RADIOACTIVITY OF BUILDING MATERIALS. Krisyuk, Z.M.; Tarasov, S.I.; Shamov, V.P.; Shalak, N.I.; Lisachenko, E.P.; Gornel'skii, L.G. Nov 1976. Translated from pp 1-48 of Issledovanie i normirovanie radioaktivnosti stroitelnykh materialov.

Translations of Soviet reports on radioactivity in building materials and bone dosimetry. The radiation dose rate to human populations in a building is determined by the concentration of ^{226}Ra , ^{232}Th , and potassium in the building materials, and the radioactivity of the air due to the effective concentration of radium. Numerical values of standards are proposed for each of these quantities. 150 references

- 863 OBSERVATION AND ANALYSIS OF CANCER DEATHS AMONG CLASSIFIED RADIATION WORKERS. Reissland, J.A.; Kay, P.; Dolphin, G.W. (National Radiological Protection Board, Harwell (UK)). Phys. Med. Biol.; 21: No. 6, 903-919 (Nov 1976).

The extent to which occupational radiation exposure contributes to cancer mortality is an influence on future world energy policy. It is also a factor in deciding the level of expenditure to reduce radiation levels experienced by workers. Some of the difficulties in analysing the situation are discussed and the results of some calculations which estimate the expected age-specific radiation mortalities from all inducible cancers and also from leukaemia separately are presented. Using a high value for the average occupational exposure and a conservative estimate of the associated risk, it is shown that a survey of mortality among radiation workers must run over many years before sufficient data would be accumulated to resolve the effects of radiation-induced neoplasms from those arising from other causes. The results show the advisability of determining the cause of death both of persons who remain employed in the industry and all persons who enter and subsequently leave the industry, perhaps being

employed in it for only a short time. The estimates were based on maintenance of an occupationally exposed dose of one rad per person per year during the period of the survey which may extend over several decades. However, scaling the estimates to any other exposure rates is easily performed. Estimates are given of the lowest risk coefficients detectable in a given observation time. Since for a work force of 3000 these lowest detectable values are an order of magnitude larger than those expected, it is clear that only a national or international survey can produce data adequate for even modest objectives.

- 864 (KFK-tr--496) TISSUE-DOSIMETRIC PROPERTIES OF RADIOACTIVE IODINE 131. Moiseev, A.A. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Internationales Buero/Uebersetzergruppe). Nov 1976. Translation of Tkane-dozimetriceskie kharakteriski radioaktivnogo ioda-131. 16p. (In German). NTIS (US Sales Only).

It is the purpose of the present methodical brochure of instruction to assist the course participants in making use of the mathematical apparatus, in describing the behaviour of radionuclides in the environment and in the human organism, in determining the absorbed dose on account of incorporated radionuclides in the so-called 'critical organ', or in estimating the radiation load in an area with massive contamination of the environment as a result of local, tropospheric or global radioactive fallout after nuclear weapons tests or after emission during accidents in nuclear power plants. In the present publication all these questions are dealt with, taking as an example the radionuclide which is potentially one of the most dangerous - the isotope Iodine 131. However, this method can also be applied in the case of environmental contamination due to other radionuclides if the corresponding radioecological, radiobiological and physical-chemical constants of each of these radionuclides are known.

- 865 HEALTH PHYSICS CONSIDERATIONS IN THE USE OF A ROENTGEN DENSITOMETER. Steidley, K.D. (St. Barnabas Medical Center, Livingston, N.J. (USA)). Health Phys.; 31: No. 5, 459-462(Nov 1976).

From 10. annual meeting of the association for the advancement of medical instrumentation; Boston, Mass., USA (1975).

The results are presented of an evaluation of a Roentgen densitometer, developed for the detection of congenital heart defects in infants and children, with respect to the radiation dose delivered to the patients. 59 patients (29 male, 30 female) with a median age of 4.0 yr and mean age of 6.9 yr were considered. The frequency distribution of exposure at the skin surface shows a maximum of 10R and a mean of 4.4R. The mean mAs for all patients was 254. The mean gonadal dose was estimated as 18 mrad with a range of 3 to 51 mrad.

- 866 NUCLEAR SAFETY IN FRANCE. Servant, J. J. Inst. Nucl. Eng.; 17: No. 6, 154-162(Nov 1976).

The establishment in France in 1975 of an Interministerial Committee on Nuclear Safety is described, and the safety aspects with which this Committee will be concerned are reviewed. These include general radiation protection, protection of workers, steps to be taken in case of accidents, discharge of radioactive effluents, nuisance, pollution or inconvenience of a non-nuclear nature, safety of nuclear

facilities, protection of installations against acts of malice, control and physical protection of nuclear materials, transport of radioactive materials, marine nuclear propulsion, waste management, decommissioning of nuclear installations, and export of nuclear equipment and materials. The main ministries and responsible services involved are listed. It is stated that a Higher Nuclear Safety Council is shortly to be established.

- 867 FREE AMINO ACID CONCENTRATIONS IN PLASMA AND ERYTHROCYTE HEMOLYSATES OF URANIUM MINERS. Prochazka, J.; Vich, Z. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)). Radiobiol. Radiother.; 17: No. 5, 571-578(Nov 1976). (In German).

The free amino acid content in plasma and erythrocyte hemolysates of uranium miners and of controls, and the ratio of amino acid concentrations in plasma and erythrocytes were determined. Statistically significant increases of ornithine in hemolysates, of glutamine in plasma, and of the ratio of lysine plasma/erythrocyte were found in uranium miners. The content of glutamic acid, aspartic acid, threonine, ornithine, and especially of glycine in miner hemolysates shows an increasing tendency corresponding to the duration of exposure in uranium mines.

- 868 TWENTY YEARS OF IONIZING RADIATION DOSIMETRY IN THE CZECHOSLOVAK ACADEMY OF SCIENCES. Spurny, Z. Jad. Energ.; 22: No. 10, 361-362(Nov 1976). (In Czech).

The twenty year history of the Laboratory of Radiological Dosimetry of the Czechoslovak Academy of Sciences is discussed. Established as part of the Institute of Nuclear Physics in 1956, the Laboratory is now an independent institute of the Academy. Its research work followed up on the efforts of its predecessor, the State Radiological Institute headed by Academician Frantisek Behounek who was also the first Head of the Laboratory. The scope of activities in ionizing radiation dosimetry is outlined.

- 869 LEUKEMIA IN HIROSHIMA ATOMIC BOMB SURVIVORS FROM 1946 TO 1975. A SUMMARY OF THE FINDINGS AND RECENT TRENDS. Ohkita, T. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Histochemie; 1976: 77-90(Nov 1976). (In Japanese).

Contains 94 refs..

In five recent years, 134 deaths from leukemia among Hiroshima citizen were recorded. Of these, 23 cases (17 acute and 6 chronic types) were atomic bomb survivors exposed within 2,000 m of the hypocenter. Fifteen of them (65%) were over 60 years of age. The frequency of chronic lymphocytic leukemia was still low. Although the risk of leukemia was greatly reduced after 1961, and the frequency of chronic granulocytic leukemia (one of the most characteristic type of Hiroshima atomic bomb-induced leukemia) was also decreased, the death rate from leukemia among survivors exposed within 2,000 m or 1,500 m from the hypocenter was about 3 to 4 times higher than the mean death rate in all Japan. Therefore, careful and long-range follow-up surveillance should be continued. A brief review was also made of relevant studies such as the influence of environmental and host factors in the epidemiology of leukemia, the incidence of leukemia in children exposed in utero, and leukemia in offspring of atomic bomb survivors.

- 870 EXPOSURE DOSE IN CT WITH SPECIAL

REFERENCE TO EXPOSURE IN CT-H 250. Koga, S.; Sawada, T.; Suzuki, S. (Fujita-Gakuen Univ., Toyooka, Aichi (Japan). School of Medicine); Yamamoto, C. Rinsho Hoshasen; 21: No. 12, 1073-1076(Nov 1976). (In Japanese).

Exposure in a computed tomography, Hitachi CT-H 250 type, was discussed. Circumferential dose was measured by using ellipsoidal phantoms (19 x 12, 12 x 11 cm) of Mix Dp. The maximum exposure dose by the large phantom was 2.9 rad and minimum dose was 0.23 rad. The maximum dose measured by the small phantom which was used by supposing the head of infants was 2.2 rad and the minimum dose was the same as that by the large phantom. Exposure dose out of flux (the neck, the abdomen, etc.), volume dose, and distribution of scattered x-ray in a room were also discussed. When an adaptor which restrained infant head was manufactured for trial, decrease of exposure dose was attempted by photographing with low voltage in a tube. Exposure dose was measured by the small phantom with low voltage of 120 kv, 100 kv, and 96 kv. As a result, the maximum dose of exposure decreased from 1740 to 1085 and 850 R which was under 50% of the first measurement value. There was not a significant difference in CT values and photographed pictures.

- 871 CASE OF HIROSHIMA ATOMIC BOMB SURVIVOR WITH CLL AND LUNG CANCER. Ishii, Y.; Yokoyama, Y.; Kaneto, K.; Tanaka, H.; Takata, H. (Hiroshima Memorial Hospital (Japan)). Hiroshima Igaku; 29: No. 1, 1254-1260(Nov 1976). (In Japanese).

This case (an 87 year old woman) was exposed to atomic bomb at the place 1.2 km from the hypocenter when she was 56 years old. This exposure was almost local irradiation and the estimated dose was within 100 rad. She was observed over a long period as a patient with chronic lymphatic leukemia, and died of complicated lung cancer in June of 1975. Clinical and autopsy findings of this case were reported, and at the same time complication of chronic lymphatic leukemia with immunological abnormality or malignant neoplasms, relation between exposure to atomic bomb and leukemia, and that between chronic lymphatic leukemia and lung cancer were considered.

- 872 ANNUAL PLANS ON ENVIRONMENTAL RADIOACTIVITY SAFETY RESEARCH. Genshiryoku Iinkai Geppo; 21: No. 9, 3-26(Nov 1976). (In Japanese).

The annual plans prepared by the subcommittee of environmental radioactivity safety research, AEC of Japan, are presented in two parts: research on the effects of low-dosage radiation, and research on the evaluation of exposure dose. Regarding the former, after explaining the concept and the present status, the research subjects concerning the quantitative evaluation of the effects of low-dose radiation to human beings are given in detail. Regarding the latter, the subjects are concerned with such as the physical characteristics of Japanese people and the radioactivity around nuclear facilities.

- 873 (CEA-N--1911) SEARCH FOR A MODEL OF RADIATION EFFECTS ON THE FOUNDER CELLS OF RAT GONADS, ON THE BASIS OF G. LEMAIRE'S EXPERIMENTAL RESULTS. Delforge, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie). Nov 1976. 31p. (In French). Dep. NTIS (US Sales Only), PC A03/MF A01.

By studying the involution of rat gonads, G. Lemaire has obtained the survival curve for the founder cells of these gonads after gamma and

neutron irradiation. A given population of cells was found to lead to curves presenting, according to the type and spectrum of the radiation, either positive or negative concavities plotted on a semi-logarithmic scale. It is very difficult to account for this phenomenon by the use of conventional radiobiological models. A search for a model capable of explaining the G. Lemaire's experimental results is presented. The context adopted for the purpose is P. Delattre's transformation system theory. From this viewpoint it is possible to arrive at a model which is epistemologically justified since it is based on clearly explained axioms which are difficult to dispute. If this theory is combined with a hypothesis saving principle a minimum single model may be obtained by the procedure used for each set of experimental results.

- 874 (ORNL--5195) BIOLOGY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1976. Storer, J.B.; Carson, S.F. (Oak Ridge National Lab., Tenn. (USA)). Nov 1976. Contract W-7405-ENG-26. 243p. Dep. NTIS \$8.00.

Separate abstracts were prepared for the three sections of the report. (HLW)

- 875 (ORNL--5195, pp 2-91) MUTAGENESIS AND TERATOGENESIS SECTION. Nov 1976.

Biology Division annual progress report for period ending June 30, 1976.

Progress is reported on research with mice in the areas of radioinduced and chemical mutagenesis, cytologic studies, radiation effects on DNA synthesis, radiation effects on germ cells, mutagenicity of coal-conversion products, and others. Research on *Drosophila* was concerned with mutagenesis and genetics of nucleases. Studies were conducted on hamster cells with regard to cytotoxicity and mutagenicity of alkylating agents, modification of the microtubule system, protein kinase activity, and others. Research on bacteria was concerned with effects of x radiation on bacteriophage of *Haemophilus influenzae*, x-ray induced DNA polymerase I-directed repair synthesis in *Escherichia coli*, transformation by DNA polymerase II in *Bacillus subtilis*, and others. Research on *Xenopus laevis* was conducted in the areas of calcium-induced cleavage of oocytes, yolk degradation in explants, and others. (HLW)

- 876 (ORNL--5195, pp 138-210) CANCER AND TOXICOLOGY SECTION. Nov 1976.

Biology Division annual progress report for period ending June 30, 1976.

Progress is reported on research with mice in regard to the following studies: effects of butylated hydroxytoluene, diethylnitrosamine, and x rays during tumorigenesis; late somatic effects of ionizing radiation as a function of dose; resistance of germfree athymic mice to hydrocarbon skin carcinogenesis; metabolism of 7,12-dimethylbenz [a] anthracene in skin homogenates; flow microfluorometric analysis of cells infected with murine leukemia; biological role of ether lipids in growth and neoplasia; changes in mitotic index of megakaryocytes after acute thrombocytopenia; uptake of RNA by cultured embryonic cells, and others. Studies were also conducted on soybean lectins in vivo; development of tolerance in hamsters to lethal doses of an oxidant air pollutant; use of immune guinea pigs for study of cellular immune competence; and isolation of fetal antigens in human leukemia. (HLW)

- 877 INDUCTION OF LYMPHOMA AND ASSOCIATED XENOTROPIC TYPE C VIRUS IN C57L MICE BY WHOLE-BODY IRRADIATION. Arnstein, P. (California State Dept. of Health, Berkeley); Riggs, J.L.; Oshiro, L.S.; Huebner, R.J.; Lennette, E.H. J. Natl. Cancer Inst.; 57: No. 5, 1085-1089 (Nov 1976).

Adult C57L mice received sublethal whole-body x-irradiation. Between 3 and 11 months later, 5 of the 7 exposed mice developed histopathologically confirmed malignant lymphomas (lymphocytic type) that primarily involved the thymus. The lymphomas were readily transplantable to other C57L mice of any age, which developed fatal lymphomatous involvement; the tumor cells could also be propagated in tissue culture. A xenotropic murine type C virus (MuX) was isolated from the cultured lymphoma cells after cocultivation with a permissive dog line. MuX activity was demonstrated by electron microscopy, complement fixation, indirect fluorescent antibody, infectivity, and genome rescue.

- 878 HAPTEN-SPECIFIC IGE ANTIBODY RESPONSES IN MICE. VI. SELECTIVE ENHANCEMENT OF IGE ANTIBODY PRODUCTION BY LOW DOSES OF X IRRADIATION AND BY CYCLOPHOSPHAMIDE. Chiorazzi, N.; Fox, D.A.; Katz, D.H. (Harvard Medical School, Boston). J. Immunol.; 117: No. 5, 1629-1637 (Nov 1976).

Exposure of BALB/c, A/J, and (BALB/c x A/J)_{F1} mice, which are IgE high responder animals, to total body x-irradiation ranging from 50 to 200 R resulted in a dose-dependent enhancement of the hapten-specific IgE antibody level as compared to unirradiated control mice. In contrast, anti-hapten antibody responses of the IgG class in these same animals were rarely enhanced, and when so, were of a lesser degree. This relatively selective augmentation of the IgE vs IgG antibody responses was observed in both unprimed and primed mice. By utilizing adoptive transfer systems, it was demonstrated that the enhancing effects of x-irradiation resulted from its action on the carrier-primed cell population and not upon the responding B cells or upon macrophages. The data presented herein suggest that this enhancement phenomenon is the result of the elimination of T cells (or their products) with suppressive functions and that these cells are neither dependent upon nor specific for the carrier antigen employed in the immunization. This hypothesis is given indirect support by the observations that treatment of the same strains of mice with cyclophosphamide, in doses known to abrogate suppressive T cell functions, resulted in a similar enhancing effect to that observed after low doses of x-irradiation.

- 879 REPRODUCTIVE ABILITY OF FEMALE DOGS (BEAGLES) SURVIVING A SINGLE, MIDDLETHAL, WHOLE-BODY X-RAY EXPOSURE. Andersen, A.C.; Rosenblatt, L.S. (Univ. of California, Davis). Radiat. Res.; 68: No. 2, 361-370 (Nov 1976).

The ability of 82 irradiated and sham-treated female beagles to whelp and wean pups was tested over a major portion of their reproductive life span. The dogs were exposed to 290 or 300 R of x rays (250 kVp) either as young pups, prior to puberty, or at puberty. Although all of the irradiated dogs were fertile and produced approximately the same number of litters as controls, litters of the pup irradiated and prepubertal irradiated dams surviving throughout the study were smaller than those of controls by 17 and 9 percent, respectively. Pup survival was also reduced relative to controls; the number of pups weaned

was 38 percent lower in the pup irradiated group and 18 percent lower in the prepubertal irradiated group, as compared with controls. The overall reproductive ability of dogs irradiated at puberty was similar to that of sham-treated controls.

- 880 EFFECTS OF U.V.-LIGHT, IONIZING RADIATION AND THE CARCINOGEN N-ACETOXY-2-FLUORENYLACETAMIDE ON THE DEVELOPMENT IN VITRO OF ONE- AND TWO-CELL MOUSE EMBRYOS. Ku, K.Y.; Voytek, P. (National Inst. of Environmental Health Sciences, Research Triangle Park, N.C. (USA)). Int. J. Radiat. Biol.; 30: No. 5, 401-408 (Nov 1976).

The development of one- and two-cell mouse embryos to morula-blastula stages was followed in vitro after treatment with low doses of U.V.-light, ionizing radiation or N-acetoxy-2-fluorenylacetamide. Exposure of one-cell embryos to either radiation source 18 and 24 hours after human chorionic gonadotropin injections prevented maturation, most embryos being arrested at the one-cell stage and a few at the two-cell stage. Two-cell embryos, however, were not sensitive to low doses of either U.V. or X-irradiation and developed normally. Treatment of early one-cell embryos with the carcinogen, N-acetoxy-2-fluorenylacetamide (0.7 μ M), also arrested development, whereas exposure of late one-cell embryos did not completely prevent maturation to morula-blastula stages. Exposure of two-cell embryos to the same concentration of carcinogen had no effect on their development to blastulas. Results with all three agents showed that mouse embryos at the one-cell stage are more sensitive than those at the two-cell stage, as judged by their ability to develop in vitro.

- 881 ROLE OF THE SPLEEN IN CARBON-INDUCED RADIOPROTECTION. Mori, K.J.; Kitamura, Y. (Christie Hospital and Holt Radium Inst., Manchester (UK). Paterson Labs.). Int. J. Radiat. Biol.; 30: No. 5, 487-490 (Nov 1976).

Injected particles of substances such as carbon are mainly taken into the liver and the spleen, and the spleen is known to give a favourable environment for the proliferation of haemopoietic stem cells. A study has therefore been made of the role of the spleen in carbon-induced radioprotection, by comparing the patterns of CFU recovery in the spleen up to 15 days after X-irradiation (750 to 850 rad) with that in the femur, in mice intravenously injected with a suspension of carbon particles (Pelikan India ink diluted with physiological saline). The results clearly demonstrated that carbon-induced enhancement of haemopoietic stem cell recovery occurred mainly in the spleen. The number of CFU in the spleen of carbon-treated mice was 40 times as many as that in the controls 4 days after irradiation, whereas there was little difference in the number in the femur between carbon-treated and control mice. Splenectomy of the animals before carbon treatment resulted in a significant reduction in the protective effect. A mechanism involving the microenvironment in the spleen, and stimulated by the injection of carbon particles must play an essential role in the response to acute radiation damage to the haemopoietic system.

- 882 RATE OF LENS LESION DEVELOPMENT AND THE AGE OF MICE AT TIME OF IRRADIATION. Gajewski, A.K. (Institute of Hygiene, Warsaw (Poland)); Majewska, K. (Medical Center of Postgraduate, Warsaw (Poland)); Slowikowska, M.G. (City Hospital at Bielany, Warsaw (Poland)). Radiobiol. Radiother.; 17: No. 5, 639-644 (Nov

1976).

The rate of lens lesion development has been studied in mice irradiated at different age ranging from one day up to one year old mice. The time needed for the first appearance of lens lesion was shortest in groups of mice irradiated at the age of one, two and three days of life, and longest in groups of mice irradiated at the age of 5 days, 1 week and 2 weeks of life. The time needed for the first appearance of lens lesion for mice irradiated between the third week and one year of life was constant. It was longer than for mice irradiated during the first three days of life and shorter than for mice irradiated at 5 up to 14 days of life. In all but one irradiated groups the age at which the first lens lesion occurred differed significantly from the age at which the first senile changes occurred in the lens of control mice. The one exception was the group of mice irradiated at the age of one year.

- 883 REPAIR PROCESSES IN THE DUODENAL MUCOSA OF IRRADIATED MICE AFTER TREATMENT WITH IONOL. Parshkov, E.M.; Nesterenko, V.N. (Akademiya Meditsinskikh Nauk SSSR, Obninsk. Nauchno-Issledovatel'skij Inst. Meditsinskoy Radiologii). Radiobiol. Radiother.; 17: No. 5, 611-626 (Nov 1976). (In German).

The experiments were carried out with mature raceless mice of both sexes. ^{60}Co gamma radiation was applied with a dose of 1,000 R at a dose rate of 30 R/sec. The mice of the first group received within the first minutes and 48 hours after irradiation 10 to 20 mg per kg body weight Ionol, whereas the mice of the second group (control) received the solvent of Ionol (dimethyl sulfoxide). Three days after irradiation clear differences in the histoltrastructural organization of the enterocytes as well as of the stroma elements could be found in treated and untreated animals. Untreated mice died on the 4th to 5th day after irradiation, whereas the majority of treated mice died on the 10th to 12th day. On the 10th day the duodenum of treated animals did not virtually differ from that of healthy mice. By electron microscopic examinations, however, essential differences could be demonstrated especially in the capillaries of the basal membrane of the tunica propria.

- 884 (UCID--17313) DERIVATION OF PLANT-SOIL RELATIONSHIPS FOR DOSE ASSESSMENT ON BIKINI ATOLL. Colsher, C.S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1976. Contract W-7405-ENG-48. 37p. Dep. NTIS \$4.00.

A radiological survey of the terrestrial environment of Bikini and Eneu Islands (Bikini Atoll) was conducted in June 1975 to evaluate the potential radiation dose to the returning Bikini population. This report presents measurements of the radionuclide concentration in soil profiles and in dominant species of edible and nonedible indicator plants and describes the use of these data to derive relationships to predict the plant uptake of radionuclides from soil. Soil-plant concentration factors together with leaf-leaf and fruit-leaf concentration ratios for indicator and edible plant species from the same area are calculated to quantitatively assess and compare the uptake of ^{90}Sr , ^{137}Cs , and $^{239+240}\text{Pu}$. In general, the concentration factors for ^{137}Cs in terrestrial vegetation are greater than those for ^{90}Sr and the concentration factors for both these nuclides exceed those for $^{239+240}\text{Pu}$ by ten to one hundred-fold. Uptake of ^{90}Sr and $^{239+240}\text{Pu}$ by fruit is less than that by mature leaves;

however, the opposite is true for ^{137}Cs . The relative contribution of the individual plant species to the internal dose to man varies with the nuclide. The use of concentration factors and concentration ratios to predict nuclide concentrations in fruit from those in soil or leaves is prescribed.

- 885 (ERDA-tr--250) TRANSLATIONS OF SOVIET REPORTS ON RADIOACTIVITY IN BUILDING MATERIALS AND BONE DOSIMETRY. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Nov 1976. Translation of USSR reports. 88p. Dep. NTIS \$5.00.

Separate abstracts were prepared for translations of two Russian language reports on radioactivity in building materials and radiation dose commitments following the uptake of ^{90}Sr , ^{45}Ca , ^{140}Ba , and ^{133}Ba .

- 886 (ERDA-tr--250, pp 63-86) METHODOLOGICAL APPROACH TO ESTIMATION OF DOSE LOADS OF OSTEOTROPIC ISOTOPES WITH DUE CONSIDERATION OF CHANGES IN METABOLIC PARAMETERS IN THE COURSE OF GROWTH OF THE ORGANISM. Borisova, V.V.; Zapol'skaya, N.A.; Shamov, V.P. Nov 1976. Translated from pp 3-28 of Metodicheskiy podkhod k otsenke dosovykh nagruzok ot osteotropnykh izotopov s uchedom izmeneniya parametrov obmena v protsess rosta organizma.

Translations of Soviet reports on radioactivity in building materials and bone dosimetry. A quantitative estimate was made of changes in biological parameters of metabolism of strontium, calcium and barium isotopes in the course of growth of the organism, and the effect of these parameters on formation of dose loads in bone tissue of the growing organism. These studies were conducted on mongrel male rats that were kept on a standard diet for the duration of the experiment. For balance experiments, the animals were kept in special metabolic cages that made it possible to collect excreta separately. We used 565 animals in these studies. The following isotopes were used: strontium-90, calcium-45, barium-140, and barium-133. Isotopes were given either once or chronically. Single injections were given intraperitoneally, or the material was given by mouth. For chronic administration, the isotope was introduced through a probe into the stomach daily, before mealtime. Mathematical and metabolic models were used to calculate radiation dose commitments to the skeleton as a function of age.

- 887 PLUTONIUM TOXICITY. AN EVALUATION INDICATES IT IS RELATIVELY HARMLESS. Cohen, B.L. (Pittsburgh Univ., Pa. (USA)). Nucl. Eng. Int.; 21: No. 250, 35-38 (Nov 1976).

Widespread apprehension about Pu toxicity and a general feeling that it represents a formidable problem in the development of nuclear power had made it necessary to quantify some of the problems and put them into perspective. The calculation of cancer risk of Pu intake based on generally accepted procedures is outlined and estimates are made based on data from radiation effects on humans and some animal studies of lung cancer. Certain criticisms of these standard treatments, which give enhanced effects, such as the hot particle theory, the Gofman theory, and proposals for higher RBE values for Pu in bone are evaluated and rejected. Other issues discussed are Pu dispersal in a populated area and ^{239}Pu contamination as a long term hazard. Comparison with other poisonous inhalants Pu is shown to be less of a hazard than poisonous gases.

- 888 COMBINATIONS OF HYPERTHERMIA (40°, 45°C) WITH RADIATION. Henle, K.J.; Leeper, D.B. (Thomas Jefferson Univ., Philadelphia). Radiology; 121: No. 2, 451-454(Nov 1976).
Incubation of Chinese hamster cells at an elevated but sublethal temperature between fractions of radiation and/or pulses of hyperthermia at 45°C strongly modified the effectiveness of cell killing. Increasing the incubation temperature from 37 to 40°C between fractions of hyperthermia at 45°C followed by radiation substantially enhanced cell killing; while the opposite sequence (radiation + incubation at 40°C + hyperthermia at 45°C) resulted in less effective cell killing than would have been expected from the independent interaction of hyperthermia and radiation alone. This suggests the use of short pulses of localized hyperthermia in the presence of physiologically tolerable fever followed by irradiation as one approach to the utilization of hyperthermia in cancer therapy.
- 889 INHALATION CARCINOGENESIS OF HIGH-FIRED $^{239}\text{PuO}_2$ IN RATS. Sanders, C.L.; Dagle, G.E.; Cannon, W.C.; Craig, D.K.; Powers, G.J.; Meier, D.M. (Battelle Pacific Northwest Labs., Richland, WA). Radiat. Res.; 68: No. 2, 349-360(Nov 1976).
Wistar rats were given a single, nose-only exposure to freshly prepared, submicronsize, high-fired $^{239}\text{PuO}_2$ particles and the rats were examined over their life spans. A total of 343 rats were examined: 295 exposed to $^{239}\text{PuO}_2$, and 48 serving as unexposed controls. The activity median aerodynamic diameter of PuO_2 was $2.5 \pm 0.7 \mu\text{m}$. About 50 percent of initial alveolar deposition of ^{239}Pu was cleared during the first 30 days after exposure; thereafter, the alveolar retention half-time for ^{239}Pu was about 250 days. A significantly increased incidence of malignant tumors was found only in the lung. Most of the lung tumors were adenocarcinomas followed in decreasing order of abundance by squamous cell carcinomas, hemangiosarcomas, and one fibrosarcoma. The incidences of lung tumors were 0 percent in unexposed controls, 0 percent at an initial alveolar deposition of 0.18 nCi ^{239}Pu , 10.0 percent at 5.0 nCi, 37 percent at 45 nCi, and 53 percent at 180 nCi. An analysis of radiation dose to lung indicated that a significantly increased incidence of lung tumors occurred at lung doses of greater than 78 rad.
- 890 RADIOGRAPHIC FEATURES OF BONE IN SEVERAL STRAINS OF LABORATORY MICE AND OF THEIR TUMOURS INDUCED BY BONE-SEEKING RADIONUCLIDES. Loutit, J.F.; Corp, M.J. (Medical Research Council, Harwell (UK). Radiobiological Research Unit); Ardran, G.M. J. Anat.; 122: No. 2, 357-375(Nov 1976).
The natural radiographic appearance of the various bones of the skeleton are described for several strains of laboratory mice. Skeletal tumours induced in these mice by the administration of bone-seeking radionuclides ^{90}Sr , ^{226}Ra and Pu (predominantly ^{239}Pu) fall into three categories: (a) osteosarcomata, which are commonly radio-opaque to a variable degree owing to calcified tumour bone, but which may be osteolytic, (b) primitive mesenchymal (angio-) sarcomata which are non-osteogenic and osteolytic, (c) fibrosarcomata - which also are osteolytic - and to local or general lymphomata from irradiation of parental cells in bone marrow, but no special radiological features have been found associated with these last-named tumours.
- 891 (CEA-R--4792) STRONTIUM 90 LEVELS IN HUMAN BONES COLLECTED IN 1975. Jeanmaire, L.; Patti, F.; Gros, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Nov 1976. 13p. (In French). NTIS (US Sales Only).
 ^{90}Sr levels as well as some values for stable strontium in human bones collected in the Paris area during 1975 are presented. There is a general trend towards a stabilization of radioactive contamination as compared with last year.
- 892 CESIUM-137 BODY BURDEN IN JAPANESE FROM 1967 TO 1975. Anzai, I.; Ueda, K.; Togo, M. (Tokyo Univ. (Japan). Faculty of Medicine). Health Phys.; 31: No. 5, 441-444(Nov 1976).
Cesium-137 concentrations in Japanese male adults were measured monthly during 1967 to 1975 by whole body counting. The ^{137}Cs content decreased rapidly until 1968, then the reduction rate was considerably decelerated, being probably affected by the French and Chinese nuclear testing. A small rise was observed at the end of 1970, and its causes have been multilaterally studied from the radioecological viewpoints, which has not resulted in a clearcut conclusion. Daily intake estimated from body burden varies in a wide range but, on the average, agrees well with the reported values based on the radiochemical analyses of foods. The integrated absorbed dose from January 1967 to April 1975 is calculated to be 2.5 mrad. The authors re-emphasize the importance of the periodic measurement of human population.
- 893 PREVENTION BY COPPER OF CADMIUM SEQUESTRATION BY METALLOTHIONEIN IN LIVER. Irons, R.D.; Smith, J.C. (Univ. of Rochester, NY). Chem.-Biol. Interact.; 15: No. 3, 289-294(Nov 1976).
Following chronic CdCl_2 administration to rats, more than 98% of the metal in liver supernatant is bound to the low molecular weight binding protein, metallothionein. Simultaneous administration of high doses of Cd and copper salts result in an increase in toxicity which is accompanied by a failure of Cd sequestration by metallothionein in vivo. This may be due to an aggregation of metallothionein which has been observed in the presence of copper in vitro.
- 894 TWO QUARTERS FOR ONE. Brown, G.J.; Martin, J.G. (Univ. of Lowell, MA). Trans. Am. Nucl. Soc.; 24: 416-417(Nov 1976).
From Transactions of the American Nuclear Society 1976 international meeting; Washington, DC, USA (14 Nov 1976).
Radiation protection of personnel in nuclear industry. NUCLEAR INDUSTRY; PERSONNEL; RADIATION PROTECTION; RADIATION DOSES
- 895 NRC REVIEW FOR ASSURING THAT OCCUPATIONAL RADIATION EXPOSURES WILL BE AS LOW AS REASONABLY ACHIEVABLE (ALARA). Kreger, W.E. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc.; 24: 485(Nov 1976).
From Transactions of the American Nuclear Society 1976 international meeting; Washington, DC, USA (14 Nov 1976).
NUCLEAR POWER PLANTS; RADIATION DOSES; RADIATION HAZARDS; PERSONNEL; RADIATION PROTECTION; SAFETY STANDARDS; REGULATIONS; IMPLEMENTATION

- 896 OCCUPATIONAL ALARA AT DUKE POWER COMPANY. Lewis, L. (Duke Power Co., Charlotte, NC). Trans. Am. Nucl. Soc.; 24: 485-486 (Nov 1976). From Transactions of the American Nuclear Society 1976 international meeting; Washington, DC, USA (14 Nov 1976). SAFETY STANDARDS;NUCLEAR POWER PLANTS; REGULATIONS;IMPLEMENTATION;RADIATION DOSES; RADIATION PROTECTION;SAFETY STANDARDS;PERSONNEL
- 897 UNITED NUCLEAR INDUSTRIES, INC. PRACTICAL APPLICATION OF ALARA (ALAP) PHILOSOPHY. Hall, T.M. (United Nuclear Industries, Inc., Richland, WA). Trans. Am. Nucl. Soc.; 24: 486 (Nov 1976). From Transactions of the American Nuclear Society 1976 international meeting; Washington, DC, USA (14 Nov 1976). HANFORD PRODUCTION REACTORS;SAFETY STANDARDS; RADIATION PROTECTION;PERSONNEL;REGULATIONS; IMPLEMENTATION;RADIATION DOSES
- 898 (UCRL--13766) ANALYSIS OF NUCLEAR WASTE MANAGEMENT. Center, J.L.; Crawford, B.S.; Ross, B.; Sutherland, A.A. Jr. (Analytic Sciences Corp., Reading, Mass. (USA)). 31 Oct 1976. Contract W-7405-ENG-48. 104p. Dep. NTIS, PC A06/MF A01. An event tree is developed, outlining ways which radioactivity can be accidentally released from high level solidified wastes. Probabilities are assigned to appropriate events in the tree and the major contributors to dose to the general population are identified. All doses are computed on a per megawatt electric-year basis. Sensitivity relations between the expected dose and key characteristics of the solidified waste are developed.
- 899 X-RAY INDUCED MUTATIONS, DNA AND TARGET THEORY. Kohn, H.I. (Harvard Medical School, Boston, Mass. (USA)). Nature (London); 263: No. 5580, 766-767 (28 Oct 1976). It is stated that X-ray induced, specific locus, germ-line mutation rates vary significantly in eukaryotes. A consideration of the radiobiology of the individual gene by the author leads to three major conclusions. (1) Mutation rates tend to be much lower than radiation theory predicts. (2) Selection and/or repair are major factors that determine the rates. (3) The mouse 7-locus test, which provides a principal data base for the standards of human radiation hygiene, may not provide adequate overall representation of the mutability of the mammalian genome, so more research is needed.
- 900 (UCRL--52164) POTENTIAL FOR TUMOR THERAPY WITH TRITIATED TETRACYCLINE. SUMMARY EVALUATION. Davis, R.C.; Wood, P.; Wood, L.L.; Mendelsohn, M.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Oct 1976. Contract W-7405-ENG-48. 34p. Dep. NTIS \$4.00. Reports of tetracycline accumulation in human and animal tumors have led a number of investigators to postulate that this drug, if radio-labeled, might have potential as a therapeutic or diagnostic agent. This paper describes attempts to investigate this potential for tritiated tetracycline. The therapeutic studies demonstrated that while a significant reduction in the growth rates of transplanted tumors could be obtained by the administration of heavy doses of TTC relative to uninjected controls, similar reductions were observed in the growth rates of tumors in animals receiving unlabeled TC. In the localization studies in rodents, the concentrations of TTC in normal tissues and tumors were compared and were correlated with the corresponding concentrations of ^{14}C -thymidine, a measure of proliferative activity.
- 901 HETEROTOPIC OSSIFICATION IN POSTGASTRECTOMY SCARS. Nishitani, H. (Atomic Bomb Casualty Commission, Hiroshima). Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 10, 880-887 (25 Oct 1976). Heterotopic ossification in laparotomy scars, though known for years, has been considered rare. Its clinical significance lies in its diagnostic differentiation from recurrent gastric and other neoplasms since it may mimic the latter on palpation. Few cases have been reported in America and only 12 so far in Japan, all in surgical publications. Only Katz and LeVine's report exists in the American radiological literature. Its frequency has rarely been documented. Retrospective review of all roentgenograms of 135 postgastrectomy cases yielded 5 with this abnormality. The results and a review of the literature are presented here.
- 902 (DOCKET-50344--371) TROJAN NUCLEAR PLANT. IE INSPECTION REPORT NO. 76-10 (ROUTINE, UNANNOUNCED). (Portland General Electric Co., Oreg. (USA)). 22 Oct 1976. 10p. Inspection of personnel contamination program, start-up procedures, design changes and modifications, and records. TROJAN REACTOR; INSPECTION;PERSONNEL;RADIATION DOSES;REACTOR START-UP;DESIGN;MODIFICATIONS;TESTING;DIAGRAMS; HEAT EXCHANGERS;REACTOR PROTECTION SYSTEMS; ALARM SYSTEMS;TANKS;RADIOACTIVE WASTES;GASEOUS WASTES;DOORS;CONTAINMENT;SAFETY INJECTION;BORON; STORAGE;RELAYS;FEEDWATER;PUMPS;DIESEL ENGINES; DIAGRAMS;DOCUMENTATION
- 903 (DOCKET-50289--734) THREE MILE ISLAND NUCLEAR STATION, UNITS 1 AND 2. IE INSPECTION REPORT NOS. 76-20 AND -11 (ROUTINE, UNANNOUNCED, EMERGENCY PLANNING); REPLY; ACKNOWLEDGMENT. (Metropolitan Edison Co., Reading, Pa. (USA)). 21 Oct 1976. 22p. (DOCKET-50320--281). Inspection of emergency plan, radiological problems, radiation exposures, radioactive effluent releases, strikes, fires, and publicity. THREE MILE ISLAND-1 REACTOR;THREE MILE ISLAND-2 REACTOR;EMERGENCY PLAN;INSPECTION; RADIATION DOSES;RADIATION ACCIDENTS;PERSONNEL; RADIOACTIVE EFFLUENTS;ACTIVITY LEVELS;RELEASE LIMITS;FIRE PREVENTION;COMMUNICATIONS;RADIATION MONITORS;CALIBRATION;DOCUMENTATION;EQUIPMENT; DECONTAMINATION;TRANSPORT;PERSONNEL
- 904 (DOCKET-50289--733) THREE MILE ISLAND NUCLEAR STATION, UNIT 2. U.S. EPA'S COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT. (Metropolitan Edison Co., Reading, Pa. (USA)). 18 Oct 1976. 15p. (DOCKET-50320--280). EPA's comments on draft environmental statement. THREE MILE ISLAND-2 REACTOR; ENVIRONMENTAL EFFECTS;RADIATION DOSES;PERSONNEL; GASEOUS WASTES;LIQUID WASTES;RADIOACTIVE EFFLUENTS;RELEASE LIMITS;ACTIVITY LEVELS; THERMAL EFFLUENTS;STANDARDS;ENVIRONMENTAL PROTECTION AGENCY;REACTOR ACCIDENTS;RADIOACTIVE WASTE MANAGEMENT;TRANSPORT;WATER QUALITY; RADIOACTIVE MATERIALS;POWER TRANSMISSION LINES; METEOROLOGY
- 905 TOXICITY OF ^{90}Sr , ^{226}Ra AND ^{239}Pu . Thorne, M.C.; Vennart, J. (Medical Research

Council, Harwell (UK). Radiobiological Research Unit). Nature (London); 263: No. 5578, 555-558(14 Oct 1976).

It is stated that data now available on the risks of radiation-induced fatal cancer and hereditary disease and radionuclide metabolism suggest that limits on the rates of intake of ^{90}Sr , ^{226}Ra and ^{239}Pu at work, presently recommended by the International Commission on Radiological Protection, might be in need of considerable revision one with another and with the limit for uniform exposure of the whole body.

- 906 (DOCKET-50259--940) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. IE INSPECTION REPORT NOS. 76-18 AND 76-16 (ROUTINE, UNANNOUNCED); REPLY. (Tennessee Valley Authority, Chattanooga (USA)). 13 Oct 1976. 31p. (DOCKET-50260--711; DOCKET-50296--404).

Inspection of completion status of the requirements in SER supplement 2. BROWNS FERRY-1 REACTOR; BROWNS FERRY-2 REACTOR; BROWNS FERRY-3 REACTOR; INSPECTION; FIRE PREVENTION; FIRE EXTINGUISHERS; RADIATION EFFECTS; VENTILATION; DIESEL ENGINES; HPCI; EQUIPMENT; ELECTRIC CABLES; OFF-GAS SYSTEMS; CLEANING; COMBUSTION; FIRES; MANUALS; RESPIRATORS; PERSONNEL; EDUCATION; INSPECTION; CONTROL ROD DRIVES; TESTING; REACTOR START-UP; CRITICALITY; CONTAINMENT; LEAK TESTING

- 907 (DOCKET-50376--129) NORTH COAST NUCLEAR PLANT, UNIT 1. U.S. DEPT. OF HEALTH, EDUCATION, AND WELFARE COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT. (Puerto Rico Water Resources Authority, San Juan). 13 Oct 1976. 2p.

HEW comments on draft environmental statement. NORTH COAST-1 REACTOR; ENVIRONMENTAL EFFECTS; SOCIO-ECONOMIC FACTORS; CONSTRUCTION; HOUSES; SCHOOL BUILDINGS; PERSONNEL; ROADS; RADIATION EFFECTS; RADIOACTIVE MATERIALS; TRANSPORT; POWER TRANSMISSION LINES; POWER TRANSMISSION TOWERS; RADIATION MONITORING; MILK; FOOD

- 908 (AD-A--031276) SPECTRAL IRRADIANCE OF SEVERAL ULTRAVIOLET SOURCES, JULY--SEPTEMBER 1976. NONIONIZING RADIATION PROTECTION SPECIAL STUDY. Franks, J.K. (Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md. (USA)). 13 Oct 1976. 12p. (USAHA--42-C305-77). NTIS \$3.50.

A special study of the optical hazards associated with the operation of five different types of laboratory ultraviolet sources in the Toxicology Division of the US Army Environmental Hygiene Agency was performed. (Author) (GRA)

- 909 RADIATION GUARD APPARATUS. Collica, C.; Epifano, L.; Farella, R. (to Medi-Ray, Inc.). US Patent 3,884,695. 5 Oct 1976. Filed date 6 Jan 1975. 2p.

Radiation shielding apparatus for use in conjunction with a pad on a table. The apparatus comprises a set of units, each unit comprising a pair of joined substantially flat orthogonal flaps. The flaps are formed of a radiation shielding material and are adapted for removable placement under the pad whereby one flap contacts the table and the other flap extends vertically from an edge thereof. In a preferred embodiment of the invention the set consists of five units that provide protection around three sides of a rectangular table. In this embodiment, two of the units are identical and have asymmetrical trapezoidal flaps, and two others of the units are also identical, but

have trapezoidal flaps which are of reversed orientation with respect to the first-mentioned two units. 6 claims, 4 drawing figures.

- 910 RADIATION GUARD FOR X-RAY TABLE. Collica, C.; Epifano, L.; Farella, R. (to Medi-Ray, Inc.). US Patent 3, 984,696. 5 Oct 1976. Filed date 11 Dec 1974. 4p.

A radiation guard suitable for use in conjunction with a diagnostic table and penetrable by the hands of an operator to facilitate moving or examining a patient positioned on a table. In accordance with the invention there is provided a supportive frame mountable at about an edge of the table so as to extend vertically from about the edge, the frame comprising at least a pair of spaced bars. A plurality of strips of flexible radiation shielding material are mounted across the bars in closely spaced relationship, the strips being mounted sufficiently close together to prevent substantial radiation leakage through the frame. The hands of an operator can be inserted between the adjacent strips to manually reposition or examine a patient while protecting most of the operator's body from substantial radiation. 9 claims, 4 drawing figures.

- 911 (HASL--308) HEALTH AND SAFETY LABORATORY ENVIRONMENTAL QUARTERLY, JUNE 1, 1976--SEPTEMBER 1, 1976. Hardy, E.P. Jr. (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). 1 Oct 1976. vp. Dep. NTIS \$8.50.

This report presents current data from the HASL environmental programs. The initial section consists of interpretive reports and notes on Sr-90 concentrations in human bone through 1975, global deposition of Sr-90 through 1975, Pu-238 in canal and river sediment from the Mound Laboratory area, and trace metals in atmospheric deposition. Subsequent sections include tabulations of radionuclide levels in stratospheric air; lead and radionuclides in surface air; Sr-90 in deposition, milk, diet and tap water. A bibliography of recent selected publications related to environmental studies is also included. (auth)

- 912 (CEA-R--4787) OPTIMIZATION OF RADIATION PROTECTION IN A FRENCH URANIUM MINE. Fagnani, F.; Maitre, P.; Meslin, T.; Pages, P.; Wormser, F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Oct 1976. 119p. (In French). Dep. NTIS (US Sales Only), PC A06/MF A01.

The optimization of radiation protection in uranium mines has been considered in the light of ICRP publication 22, viz, to keep risks as low as is readily achievable, economic and social considerations being taken into account. The aims are: to verify the relevance of present protection procedures as a function of α energy and Rn concentrations; to compare several protection programs without carrying them out into effect at the level of the mine. A simulation model of the physical reality of the mine, particularly radon transport and decay was therefore developed. Radon concentrations, α -energy levels in each gallery, dose distributions in a control population were thus estimated; predictable effects were assessed as a function of a given dose-effect relationship, for each case of ventilation considered. The development and use of the model made it possible to think over the problem of optimization at various levels. It showed out how cautious the present provisions

are and the usefulness of procedures of job planning. The use of cost-effectiveness curves makes it possible to assess the relevance of various possible investments, and their usefulness as decision-making instrument is shown.

- 913 (CONF-761020-- , pp 105-116) HAZARDS AVAILABLE FROM TOXIC SUBSTANCES. Bruns, L.E. (Atlantic Richfield Hanford Co., Richland, WA). Oct 1976.

From Symposium on waste management; Tucson, AZ, USA (3 Oct 1976).

Waste management 76.

The perceived hazard to human beings from ingestion and inhalation of any particular toxic substance can range from a minor nuisance to serious harm, depending on which risk-benefit analysis one favors. To avoid such uncertainty in defining toxicity a firm basis for determining how much of a toxic substance actually reaches man through various pathways needs to be established. This presentation addresses this problem.

- 914 (NRPB-R--48) ASSESSMENT OF THE RADIOLOGICAL PROTECTION ASPECTS OF DISPOSAL OF HIGH LEVEL WASTE ON THE OCEAN FLOOR. Grimwood, P.D.; Webb, G.A.M. (National Radiological Protection Board, Harwell (UK)). Oct 1976. 117p. Dep. NTIS (US Sales Only), PC A06/MF A01.

This study is a preliminary assessment of the potential radiological consequences of disposal of solidified high-level radioactive waste on the floor of the deep ocean. As an input to the modelling used in the assessment, an arbitrary choice is made to consider the total high-level waste which would be generated by a postulated world nuclear power programme to the year 2000. It is assumed that all this waste, in solidified form, is disposed of on to the floor of the North Atlantic. The body of this report is the modelling of the subsequent release of activity into the water, its dispersion in the ocean and eventual uptake in marine organisms and sediments. The consequent radiation exposure of man is assessed in terms of both individual and collective doses. It is intended that only broad conclusions should be drawn from this study. The objective of the assessment is to highlight those subject areas where more study of information is required before a decision can be reached regarding this method of disposal. No overriding reason connected with the radiological protection considerations has been identified which would preclude the disposal of suitably conditioned high-level waste on the ocean floor. Further evaluation of this disposal option is therefore justified.

- 915 RADIOACTIVE WASTE DISCHARGE BY NUCLEAR POWER PLANTS AND FUEL REPROCESSING PLANTS. Ruf, M.; Huebel, K.; Herrmann, H.; Luensmann, W. Wasserwirtschaft; 66: No. 10, 287-293 (Oct 1976). (In German).

10 tabs.; 11 refs..

Nuclear power plants and fuel reprocessing plants are depended to release some fission and activation product activities with the radioactive waste waters into the environment. Data are given about the activity inventory in the fuel elements of various types of nuclear power plants, the appearance of fission and activation products in the primary cooling circuits as well as about the emission of radioactive substances together with the waste waters of nuclear power plants and of fuel processing plants. Besides this the ecological effects of the removal of radioactive waste

waters into surface waters and the additional radiation burden for people are discussed and compared with the radiation protection orders which are available for the Federal Republic of Germany.

- 916 (HASL--314) HASL MEASUREMENTS OF FALLOUT FOLLOWING THE SEPTEMBER 26, 1976 CHINESE NUCLEAR TEST. (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). Oct 1976. 18p. Dep. NTIS \$3.50.

Results are reported from measurements of radioactivity in the fallout from the nuclear test conducted by the Peoples Republic of China on September 26th, 1976. These measurements were carried on through Monday, October 18th. Results of these measurements made in New York and New Jersey, including external radiation exposure, air concentrations, deposition and the concentration of radioiodine in milk, are reported. An estimate of the thyroid dose from milk consumption is also included.(CH)

- 917 (HASL--310) TRANSFER OF ^{137}Cs THROUGH THE FOOD CHAIN TO MAN. Evans, C.; Bennett, B.G. (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). Oct 1976. 100p. Dep. NTIS \$5.00.

Deposition, concentrations in diet, and body burdens of ^{137}Cs have been measured since 1954 at various sites throughout the world. This report is a compilation and updating of various fallout ^{137}Cs measurements and an interpretation of transfer properties of ^{137}Cs from deposition to diet and from diet to man. An empirical model is used to correlate deposition and diet data. Direct foliar contamination, stored food supplies, and uptake from soil contribute to the dietary levels of ^{137}Cs . The accumulation of ^{137}Cs by man is described by a single exponential model. The inferred biological half-times, 200 to 400 days, are somewhat greater than the half-time of about 100 days obtained from shorter term studies. Differences in body burdens due to sex, age, and weight are discussed. During the period 1954 to 1974, the internal dose from fallout ^{137}Cs , based on average body burdens, is estimated to be 4 to 5 percent of the 21 year radiation dose from ^{40}K .

- 918 RADIATION-INDUCED MURINE LEUKEMIA ERLD IN CELL CULTURE. Albrecht, A.M.; Biedert, J.L.; Hutchison, D.J.; Spengler, B.A.; Stockert, E. (Memorial Sloan-Kettering Cancer Center, New York). Cancer Res.; 36: 3784-3788 (Oct 1976).

The lymphoblastic leukemia ERLD, induced by radiation in a C57BL/6 mouse, was established in culture. Three cell lines, ERLD/Y3, ERLD/T, and ERLDTwo, have been in culture for nearly three years. Their isolation and growth depended upon the presence of 2-mercaptoethanol, glutamine, and asparagine in the medium. The cell lines, except ERLD/T, possess the TL antigen, a characteristic of ERLD and of other murine leukemia cells in vivo and of normal thymus cells of certain mouse strains, but not of C57BL/6. A distinctive submetacentric marker chromosome is also common to ERLD and the derived cell lines. The successful establishment of ERLD in culture provides a malignant thymocyte-related cell system for studies in nutrition and immunobiology.

- 919 MAMMALIAN CELL MUTAGENESIS: COMPARISON OF THE SENSITIVITY IN ASSAY SYSTEMS OF MUTATIONS INDUCED BY RADIATIONS AND CHEMICALS.

Horikawa, M. (Kanazawa Univ., Japan); Suzuki, F.; Ban, S. *Mutat. Res.*; 38: No. 5, 337 (Oct 1976).

Establishment of sensitive assay systems for mutations of mammalian cells in vitro is urgent for detection of various potential mutagens present in the human environment as well as for elucidation of the mechanisms of somatic mutation and phenotypic expression in cultured mammalian cells. We have isolated several kinds of mutant (azg-resistant cells, azg-sensitive cells, prototrophic cells (Ala⁺, Asn⁺, Pro⁺, Asp⁺, Hyp⁺, Glu⁺) and auxotrophic cells (TdR-)) from a single cultured Chinese hamster cell line and compared the induced forward- and reverse-mutation frequencies by radiations (x-rays and uv) and typical chemical mutagens (ethyl methanesulfonate, 4-nitroquinoline-N-oxide and N-methyl-N'-nitro-N-nitrosoguanidine) using these mutants. The forward mutation system using prototrophic cells was most sensitive for assay of mutations induced by radiations and chemicals. The reverse mutation system using azg-resistant cells and auxotrophic cells was also useful. The forward system using azg-sensitive cells was not sensitive as an assay system, when compared with other systems reported by many workers to date. These results point out the complexity of studies on mutagenesis with cultured mammalian cells, especially since the induced mutation frequency in cultured cells is affected by mutation expression time, size of cell inoculum, concentration of selective agent, etc. Additionally, we found that AF-2 (or furylfuramide), a nitrofurant antimicrobial food additive, had a powerful mutagenic activity in our forward mutation system using prototrophic cells.

- 920 (BNWL-SA--5966) RADIOLOGICAL PHYSICS AND DOSIMETRY RESEARCH WITH A SMALL POSITIVE ION ACCELERATOR. Wilson, W.E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1976. Contract E(45-1)-1830. 20p. (CONF-761059--18). Dep. NTIS \$3.50.

From 4. annual conference on the use of small accelerators; Denton, TX, USA (25 Oct 1976).

The distribution of energy along and around the path of charged particles is the fundamental determinant of the chemical and biological effects of ionizing radiation. This energy is deposited initially in a relatively small number of excited molecules lying generally close to the path of the secondary charged particles. This discreet initial structure of the track is of special importance to radiological research. The task confronting the radiation physicist is to develop a comprehensive description, on a microscopic scale, of the primary energy depositions prevailing when a radiation field interacts on biological matter. In view of the inhomogeneity and complexity of this system, this is a monumental task. This paper reviews the current status for measuring directly the energy deposition in simulated biological matter. Inasmuch as current radiobiological information indicates that the sensitive volume is very small, diameter of order 1 μ m or smaller, deposition in volumes of this dimension are of primary interest. Limitations of experimental techniques make the direct measurement of energy deposition in such small volumes difficult and hence very uncertain. A Monte Carlo method for calculating this discreet initial track structure is discussed. The input data for calculations of microscopic energy depositions are double differential cross sections for electron ejection by energetic ions. The current status of the experimental measurement of these cross sections is

reviewed.

- 921 (CEGB-RD/B/N--3862) RELATIONSHIP BETWEEN DOSES TO HUMAN BODY ORGANS AND EXPOSURE IN A CLOUD OF GAMMA EMITTING NUCLIDES. Clarke, R.H. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Oct 1976. 21p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Monte Carlo computer techniques were recently developed in USA to derive the photon spectrum in a semi-infinite cloud of monoenergetic photon source of uniform concentration and the dose to human body organs was estimated computationally using further Monte Carlo techniques. These results are used here to derive the exposure to be expected from a cloud emitting monoenergetic photons at discrete energies between 0.01 and 4 MeV. The exposure contributions from scattered and unscattered photon fluxes are identified at each energy and the total exposure is related to doses in a range of human body organs. It is intended to use these values of rads per Roentgen to convert the exposures calculated by the reactor safety analysis code WEERIE and those derived from environmental measurements of known airborne discharges (e.g. ⁴¹Ar, ⁸⁵Kr, ¹³³Xe) into doses to human body organs.

- 922 (FDA--77-8002, pp 9-13) DEVELOPMENT OF UV EXPOSURE RECOMMENDATIONS. Andersen, F.A. (Food and Drug Administration, Rockville, MD). Oct 1976.

From Symposium on biological effects and measurement of light sources; Rockville, MD, USA (25 Mar 1976).

Symposium on biological effects and measurement of light sources.

The Bureau of Radiological Health is concerned with ultraviolet radiation emitted from common light sources and from sources used in medicine and dentistry. In order to ensure a common basis for hazard evaluation, the Bureau is proposing that a national recommendation for ultraviolet radiation exposure be developed. With expressed support from medical practitioners, university researchers, and industry representatives, the Bureau is proceeding with the establishment of an advisory committee of sufficient expertise to address the several research areas and with the development of the administrative support needed.

- 923 (FDA--77-8003) FIRST IMAGE RECEPTOR CONFERENCE: FILM/SCREEN COMBINATIONS. PROCEEDINGS OF CONFERENCE HELD IN ARLINGTON, VIRGINIA, NOVEMBER 13--15, 1975. (Bureau of Radiological Health, Rockville, Md. (USA)). Oct 1976. 176p. (CONF-7511116--). GPO \$2.50.

From 1. image receptor conference: film/screen combinations; Arlington, VA, USA (13 Nov 1975).

These are the proceedings of a conference of recognized experts from industry, government, and the private sector held by the American College of Radiology, under contract with BRH, to discuss problems with and solutions to the proper selection of x-ray film screen combinations. Conclusions include the necessity for public education in proper film/screen selection, the desirability of a single index for evaluating film-screen performance, and the recognition that proper film/screen selection is only one part of a broader quality assurance program required to include the entire radiographic process. A list of suggested combinations for several common exams is included.

- 924 (HRP--0015136) GUIDELINES FOR RADIATION THERAPY. (Southeastern Wisconsin Health Systems Agency, Inc., Milwaukee (USA)). Oct 1976. 31p. NTIS PC A03/MF A01.

Guidelines for radiation therapy services are presented in order to further community understanding of radiation therapy services and their delivery in southeastern Wisconsin; to meet planning needs for the organization, distribution, and coordination of such services; to encourage improvements in the provision of service while discouraging their inappropriate proliferation; and to support efficiency in their operation without infringing upon sound medical practice. The guidelines were developed in 1973 by a committee of 16 radiation oncologists and radiologists practicing therapy in southeastern Wisconsin. In 1976, a committee of 12 representatives of each of the principle hospitals in the radiation therapy network reviewed and revised the guidelines. The areas affected by the guidelines include: consultation and the referring physician; radiotherapy facility types and their overall evolution; facility size; the number and distribution of facilities; personnel requirements; radiation sources such as cobalt and linear accelerators; supporting facilities such as data storage and retrieval; inpatient facilities; training programs; research programs; and organizational considerations such as a cancer registry. Policies for areawide planning and the application of the guidelines are also proposed. Tabular data pertaining to the hospitals in the region are appended.

- 925 (NRPB-R--47) DATA SUBMITTED BY THE UNITED KINGDOM TO THE UNITED NATIONS SCIENTIFIC COMMITTEE ON THE EFFECTS OF ATOMIC RADIATION FOR THE 1977 REPORT TO THE GENERAL ASSEMBLY. Taylor, F.E.; Webb, G.A.M.; Simmonds, J.R. (National Radiological Protection Board, Harwell (UK)). Oct 1976. 112p. Dep. NTIS (US Sales Only), PC A06/MF A01.

Available from H.M. Stationery Office, price Pound0.50.

The subject is dealt with under the following headings: environmental radiation (natural sources; power production by nuclear fission for civil programmes and the nuclear fuel cycle; nuclear explosions; exposures due to nuclear research, the use of radioisotopes and other uses of atomic energy); medical radiation exposure (diagnostic radiology equipment; doses from specific x-ray procedures); occupational exposure (nuclear fuel cycle; research, industrial, medical and defence establishments); miscellaneous sources of radiation.

- 926 (ORNL--5171, pp 68) ABSORBED DOSE TO MAMMARY GLANDS. Warner, G.G.; Poston, J.W. Oct 1976.

Health Physics Division. Annual progress report for period ending June 30, 1976.

The radiation dose absorbed in the female breast(s) as a result of various x-ray exposures was calculated. To the 70-kg computerized phantom used in BRHGAM (a dose estimation program) have been added the mathematical descriptions of two female breasts. For these initial studies, the composition of the breasts was tissue-equivalent. Investigations are under way to determine if there should be a more realistic composition in BRHGAM. Five cases have thus far been simulated on the computer.

- 927 (ORNL--5171, pp 81-82) IN-PHANTOM SPECTROMETRY OF MEDICAL X RAYS. Stansbury, P.S.; Poston, J.W. Oct 1976.

Health Physics Division. Annual progress report for period ending June 30, 1976.

The performance of a NaI(Tl) scintillation detector used to measure the spectral fluence at various locations inside the MR. ADAM phantom exposed to x-ray fields simulating medical diagnostic radiological examinations was tested. Both in-beam and out-of-beam measurements will be performed, and the distortions in the measured spectra due to Gaussian broadening will be removed. The detector will be positioned so as to minimize the distortions due to x rays entering the detector parallel or nearly parallel to the axis of the light pipe. Under the geometrical conditions required by this project, it is believed that the performance of the spherical NaI(Tl) spectrometer will be superior to the performance of a more conventional spectrometer.

- 928 (ORNL--5171, pp 83) EVALUATION OF THE DISTRIBUTION OF ABSORBED DOSE IN PEDIATRIC PHANTOMS EXPOSED TO DIAGNOSTIC MEDICAL X RAYS. Chen, W.L.; Poston, J.W. Oct 1976.

Health Physics Division. Annual progress report for period ending June 30, 1976.

The distribution of absorbed radiation dose in pediatric phantoms exposed to diagnostic medical x rays was studied. Phantoms representing a one-year-old and a five-year-old child were used.

- 929 (ORNL--5171, pp 361-362) ANALYTIC DOSIMETRY. Turner, J.E.; Loebl, A.S.; Holoway, C.F.; Houser, B.L. Oct 1976.

Health Physics Division. Annual progress report for period ending June 30, 1976.

The analytic dosimetry program was established to serve as a focal point where technical questions could be directed to assist researchers in the Health Physics Division as well as individuals and organizations outside the Division. Ready access to the entire Division staff enables the group to respond to a wide variety of needs within the broad interdisciplinary areas associated with health physics. The group also functions in a core operation of gathering information, compiling bibliographies, and adding critical judgment on various subjects to assist the Division's research programs. This activity, which parallels responding to specific questions, also provides researchers the opportunity to review specific problems in some depth and to synthesize and evaluate what is known about them. Files developed from both these activities are abstracted. The abstracts are made machine-readable and put into the computerized Health Physics Information System (HPIS), which is one of the data bases managed through the Information Division. Like the other computerized data bases at Oak Ridge National Laboratory, HPIS files are available and accessible to searches by any user with access to the local Information Center Complex.

- 930 (ORP/CSD--76-2) ESTIMATES OF THE CANCER RISK DUE TO NUCLEAR-ELECTRIC POWER GENERATION. Ellett, W.H.M.; Richardson, A.C.B. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). Oct 1976. 39p. (CONF-760937--2). Environmental Protection Agency, Washington, DC.

From Conference on cell proliferation; Cold Spring Harbor, NY, USA (7 Sep 1976).

The cancer risk from the uranium fuel cycle

for nuclear power plants is estimated and some of the issues concerning the degree of uncertainty in such risk estimates are discussed. The estimated risk of fatal cancer for the various portions of the uranium fuel cycle was calculated. If the risk per gigawatt from accidents and waste disposal are as low as seems likely now, about one cancer death could be committed for each gigawatt-year of electrical energy produced.

- 931 (PB--262109) RADIATION SAFETY HANDBOOK FOR IONIZING AND NONIONIZING RADIATION. Kincaid, C.B. (Bureau of Radiological Health, Rockville, Md. (USA)). Oct 1976. Contract FDA-77-8007. 70p. (BDA/BRH--77/15). NTIS, PC A04/MF A01.

The Handbook is directed primarily to users of radiation sources throughout the Food and Drug Administration. Specific precautions regarding the possession and use of radiation sources in meeting the Agency's objectives are an inherent responsibility of all employees. In addition, the increased emphasis on occupational safety and health and the responsibilities placed on the Department by Public Law and Executive Order make it mandatory that all organizational levels and activities conform to the intent of this Handbook. The policies and procedures described in this document apply to all Agency operators and activities and are intended to protect employees and the general public.

- 932 (PB--262453) THE BIOLOGICAL EFFECTS OF IONIZING RADIATION: AN OVERVIEW. FINAL REPORT. Barnett, M.H. (Bureau of Radiological Health, Rockville, Md. (USA)). Oct 1976. 26p. (DHEW/PUBL/FDA--77/8004; FDA/BRH--77/16). NTIS, PC A03/MF A01.

The manual on the biological effects of ionizing radiation is an overview of the biological effects of ionizing radiation, including: basic mechanisms of radiation injury; determinants in radiation damage; short-term effects; and long-term somatic and genetic effects, including a summary of human epidemiological studies.

- 933 (SAAS--202) SI UNITS IN RADIATION PROTECTION. Herrmann, D. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Oct 1976. 38p. (In German). NTIS (US Sales Only).

In the field of radiation protection all hitherto used units for activity, activity concentrations, exposure, absorbed dose, and dose rates have to be replaced by SI units during the next years. For this purpose graphs and conversion tables are given as well as recommendations on unit combinations preferentially to be used. As to the dose equivalent, it is suggested to introduce a new special unit being 100 times greater than the rem, instead of maintaining the rem or using the gray for both absorbed dose and dose equivalent. Measures and time schedule relating to the gradual transition to SI units in measuring techniques, training, and publishing et cetera are explained.

- 934 OVER-EXPOSURE OF A SERVICE ENGINEER IN A HOSPITAL. Butler, M.J. (National Radiological Protection Board, Harwell (UK)); Orchard, P.G. Radiol. Prot. Bull.; No. 17, 36-38 (Oct 1976).

A description is given of accidental over-exposures resulting from the procedure used in a hospital by two service engineers for the routine changing of a 5.1 kCi cobalt-60 source in the treatment head of teletherapy equipment.

Since this transfer is normally required every 3.5 years to maintain radiation output, an estimated 30 such operations are carried out annually in hospitals in England and Wales. In this case, the over-exposures were ascribed to the source drawer having been pushed too far beyond the shielded storage position when some difficulty was experienced in re-coupling the source drawer, although the engineers, who did not appear to know the manufacturer's recommended safety procedure, denied that their procedure could have accounted for the doses received. The hospital Radiological Protection Adviser recognised his responsibilities, but the engineers had failed to ensure his presence during the actual transfer. The design of equipment containing kilocurie sources should incorporate engineering safeguards and a physicist in authority should monitor the whole transfer operation with a dose-rate meter. An audible low range (0 to 5R) alarm monitor could be worn by the engineers to give immediate warning, in addition to a 0 to 50R QFE to record any over-exposure. Although the Medical and Dental Code of Practice does not at present contain any requirements for these source transfer procedures, some general protocol is obviously required.

- 935 COLLECTIVE DOSE EQUIVALENT. Dunster, H.J.; Rae, S. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 17, 34-36 (Oct 1976).

The quantity 'collective dose equivalent' is defined and its applications discussed. Radiological protection policy for the exposure to ionizing radiations of individuals or populations requires an assessment of the resulting detriment, and the magnitude of this detriment depends in general on the number of people exposed, the level of exposure and the distribution of dose equivalent in the exposed group. For many practical situations, the quantity 'collective dose equivalent' measured in units of man rems is a useful measure of the total exposure of the exposed population. Its significance is discussed in terms of possible consequences for linear and non-threshold dose-effect relationships and also for two special cases of non-linear dose-effect relationships. The practical uses of collective dose equivalent, social policy for the inclusion of only those individual dose equivalents above some level corresponding to the trivial level of individual detriment and the establishment of limits on collective dose equivalents are all considered, and it is concluded that collective dose equivalent is a useful quantity in procedures involved in implementing an effective radiological protection policy for activities where numbers of people are involved.

- 936 HANFORD'S MINOR EXPLOSION MAKES IMPACT WORLD-WIDE. King, L. Nucl. Eng. Int.; 21: No. 249, 37-38 (Oct 1976).

An investigation is in progress of an incident at the Hanford site in August 1976 when, following a chemical explosion, the front of a glove box shattered injuring a worker who received multiple cuts and first and second degree burns from nitric acid used in the box's ion-exchange column for extracting americium. A brief account is given of the incident and the radiation exposure. It is suggested that the incident may focus new attention on safety procedures at Government facilities.

- 937 RADIATION AND THE PUBLIC. Dunster, H.J. (Health and Safety Executive (UK)). Energy Dig. (London); 5: No. 5, 5-7 (Oct 1976).

Extracts from a paper given at a conference organised by the Financial Times* Nuclear power and the public interest.

A summary is given of the current approach to radiological protection, based on the cautious assumption that there is no threshold dose below which radiation is totally harmless. The principles of justification, optimisation and dose limits are stated: together they make up the ICRP system of recommendations for dose limitation. Problems of applying these principles, and public reaction, are discussed.

- 938 USE OF CENSUS DATA IN PREDICTING SPATIAL DISTRIBUTIONS OF COLLECTIVE DOSE. Clarke, R.H.; Henning, M.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); Fitzpatrick, J.; Goddard, A.J.H. (Imperial Coll. of Science and Technology, London (UK). Dept. of Mechanical Engineering). J. Br. Nucl. Energy Soc.; 15: No. 4, 297-303 (Oct 1976).

Methods have been developed for the economical computer storage of census data and its direct use, with a reactor environmental analysis program, in collective dose calculations. Graphical methods for the display of population and collective dose distributions provide an effective aid in understanding the relationship between radioactive releases and the exposed population.

- 939 POPULATION DOSE FROM NATURAL RADIONUCLIDES IN PHOSPHATE FERTILIZERS. Pfister, H.; Philipp, G.; Pauly, H. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Radiologie). Radiat. Environ. Biophys.; 13: No. 3, 247-261 (Oct 1976). 1 fig.; 7 tabs.; 35 refs..

The natural radionuclide content of mineral phosphate fertilizers used in the Federal Republic of Germany has been determined gammaspectrometrically. The mean values, weighted by the percentual agricultural consumption of the main phosphate fertilizer groups in 1973/74 and related to the phosphate content, amounted to 58, 40, 2 and 584 nCi/kg P_2O_5 for Usub(nat), ^{226}Ra , Thsub(nat), and ^{40}K . This resulted in an annual distribution due to phosphate fertilizing of about 3.9 μCi Usub(nat), 2.7 μCi ^{226}Ra , 0.1 μCi Thsub(nat), and 39.9 μCi ^{40}K per ha of arable or pasture land in 1973/74 on the average. From these values the air dose rates over agricultural areas have been estimated to be 0.02 mrd/a on the average and 0.4 mrd/a in the region of highest phosphate fertilizing intensity. If it is assumed that radium contained in phosphate fertilizers were completely accumulated in the soils during the last 80 years, this value would be raised to 0.3 mrd/a on the average. The occupational external radiation exposure due to natural radionuclides contained in phosphate fertilizers was estimated to be 0.1 mrd/a on the average and 2.3 mrd/a at maximum for persons working in agriculture. These estimates show that natural radionuclides in phosphate fertilizers contribute but very little to the mean terrestrial radiation exposure of the population which is 50 to 55 mrd/a in Germany. Only for the small group of persons working in fertilizer production plants or storehouses a significant increase of the external radiation exposure has to be expected which could reach a doubling of the mean natural exposure value.

- 940 PROTECTION AGAINST NEUTRONS: RESEARCH ASSOCIATED WITH THE BOARD'S ACCELERATOR. Dennis, J.A. (National Radiological Protection

Board, Harwell (UK)). Radiol. Prot. Bull.; No. 17, 30-33 (Oct 1976).

Some problems associated with radiological protection against neutrons are outlined, together with relevant current research projects of the National Radiological Protection Board (NRPB). Neither the data nor the methods are yet available for good neutron depth dose calculations to be combined with certainty with the relevant quality factor, Q, or RBE values of secondary particles produced in tissue. The limitations of available personal dosimeters for neutrons are considered. The design of shields and collimators for higher energy neutrons requires further knowledge of non-elastic and inelastic neutron scattering reactions. The NRPB neutron generator has been designed to produce mono-energetic neutrons of high intensity both for shielding studies and for a wide range of biological experiments. Benchmark experiments are in progress with iron as part of an international series of measurements. Instruments have been developed for the spectrometry and dosimetry of neutrons and the NRPB's neutron facilities should prove suitable for the calibration of radiological protection instruments. The continuing series of investigations of the dependence of chromosome aberration yields in cultured human lymphocytes on neutron and secondary particle spectra as well as absorbed dose, using 14 MeV, 3 MeV and possible fission neutrons generated by the accelerator is of importance in the accurate dosimetry of accidental over-exposure to neutron radiation.

- 941 IRRADIATION DAMAGE TO THE GONADS CAUSED BY RADIOTHERAPY OF BENIGN DISEASES. PT. 2. INFLAMMATORY DISEASES AND CHELOIDS. Hassenstein, E.; Nuesslin, F. (Medizinische Hochschule Hannover (Germany, F.R.). Abt. fuer Strahlentherapie und Spezielle Onkologie). Strahlentherapie; 152: No. 4, 358-362 (Oct 1976). (In German).

1 fig.; 2 tabs.; 22 refs..

The irradiation damage to the gonads caused by the radiotherapy of parotiditis and mastitis and of cheloids was determined partially under different irradiation methods. The measurements were carried out with LiF dosimeters in the Alderson phantom with a tube tension of 250 kV for the inflammatory diseases and 55 kV for the cheloids. The gonad dose measured at the surface was within the range of hundredths of permille for the parotiditis, for the mastitis it was between tenths of permille and 20/100 depending on the therapy method. The gonad dose of the cheloid irradiations showed a clear relation to the distance between radiation source and gonads. The importance of radiation protection is emphasized.

- 942 DOSIMETRIC STUDY DURING CARDIAC ANGIOGRAPHY IN YOUNG CHILDREN. Amiel, M.; Clermont, A.; Jocteur-Monrozier, D. (Hopital Cardio-Vasculaire et Pneumologique de Lyon, 69 (France)); Moroni, J.P.; Brun, P. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Ann. Radiol.; 19: No. 6, 623-628 (Oct 1976). (In French).

A dosimetric study was carried out in collaboration with the SCPRI in 30 infants during cardiac catheterization for a congenital cardiopathy. As far as the doctor is concerned, the results show that the dose received by the right hand of the operator is the only one that is relatively high and notably higher than in the adult; the other results are in agreement with those published in the literature. For the manipulator the doses received are practically

negligible. This finding does not agree with those of certain publications in the literature and it emphasizes the importance of the working conditions for these personnel. For infants, the gonadal dose is much higher than in the adult and the magnitude of the dose relative to the dose at the place of entry of the incident beam, taking into account the weight of the infant, certainly represents a long-term risk, in particular, in patients who must undergo repeated examinations.

- 943 Strahlenschutzpruefungen in medizinischen Roentgenbetrieben. Regeln fuer die Pruefung des Strahlenschutzes nach Errichtung medizinischer Roentgenanlagen bis 300kV. Entwurf. (RADIATION PROTECTION TESTS. RULES FOR TESTING THE RADIATION PROTECTION AFTER INSTALLATION OF MEDICAL X-RAY PLANTS UP TO 300 KV. DRAFT). Berlin; Beuth (Oct 1976). 8p. (In German).

1 tab..

Rules for testing the technical radiation protection devices, measurement and permissible values of local dose and local dose rate for diagnostic and therapeutic installations.

- 944 ACUTE RADIATION INJURY CAUSED BY FAULTY X-RAY FLUOROSCOPY DURING CARDIAC PROCEDURES. Iyer, P.S. (Bhabha Atomic Research Centre, Bombay (India). Div. of Radiation Protection). Health Phys.; 31: No. 4, 385-387 (Oct 1976).

Skin doses received by two patients, caused by faulty x-ray fluoroscopic procedures during pacemaker insertion and cardiac catheterisation, have been estimated to be 5,800 and 2,200 rads respectively. Records indicate that the medical personnel involved also received very high doses. The unsatisfactory work practices which lead to the excessive doses are discussed and it is concluded that these could have been avoided by the proper use of the diaphragm, filter and image intensifier and adequate dark adaption.

- 945 ⁶⁰CO HOT CELL ACCIDENT. Steidley, K.D. (St. Barnabas Medical Center, Livingston, N.J. (USA). Radiotherapy Dept.). Health Phys.; 31: No. 4, 382-385 (Oct 1976).

Events following the accidental irradiation of a male hot cell operator by a 120,000 Ci ⁶⁰Co source are discussed with especial reference to administrative aspects. Theoretical calculations to estimate the absorbed dose received by the victim are examined. The total stay of the man in the cell has been variously estimated to be between 3 and 10 sec. Calculation and estimate of the received dose by various means are discussed and vary between 165 and 400 rads while the best value obtainable from the subject's spoiled film badge is 1500 ± 700 R.

- 946 SURVEY OF RADIATION DOSES RECEIVED BY ATOMIC-BOMB SURVIVORS RESIDING IN THE U.S. Kerr, G.D. (Oak Ridge National Lab., Tenn. (USA)); Yamada, H.; Marks, S. Health Phys.; 31: No. 4, 305-313 (Oct 1976).

A survey has been completed of 300 of an estimated 500 to 750 survivors of the atomic bombings in Hiroshima and Nagasaki who reside in the U.S. Distributions with respect to age, sex, citizenship status, distance from the hypocenter at the time of bombing, and dose from immediate weapon radiation have been tabulated from the results and are presented for this group of 300 survivors. Also presented are survey results concerning exposures to residual radiation from fallout and neutral-induced radioactivity in the areas adjacent to

the hypocenter.

- 947 ACCURACY OF DIAGNOSIS OF CANCER AMONG AUTOPSY CASES: JNII-ABCC POPULATION FOR HIROSHIMA AND NAGASAKI. Steer, A. (Radiation Effects Research Foundation, Hiroshima); Land, C.E.; Moriyama, I.M.; Yamamoto, T.; Asano, M.; Sanefuji, H. Gann; 67: No. 5, 625-632 (Oct 1976).

The accuracy of death certificate diagnoses of cancer in the fixed population of about 100,000 samples in Hiroshima and Nagasaki was determined for the period 1961 to approximately 1970 by comparison with autopsy findings. In general, when the death certificate listed cancer as a cause of death it was found at autopsy in a high proportion of cases. However, cancer was not always reported on death certificates, indicating that cancer occurs more frequently than recorded by official mortality statistics. Older persons, persons who die at home, and persons with certain cancers are more likely not to have cancer named on their death certificates. It is estimated that in the 10,749 deaths occurring at home or in hospital, there were 32 percent more deaths due to cancer than certified on death certificates (3,095 vs. 2,345) and for persons aged 70 or more dying at home it is estimated there were 55 percent more stomach cancer (269 estimated vs. 174 listed) and 244 percent more lung cancer (141 estimated vs. 41 listed) than were certified on death certificates. The death certificate is not a good source of information for cancer of the cervix because many cases of this disease are reported on death certificates as cancer of the uterus. This practice needs to be taken into account in the use of mortality data for cervical cancer in Japan.

- 948 OBSERVATION AND ANALYSIS OF CANCER DEATHS AMONG CLASSIFIED RADIATION WORKERS. Reissland, J.A. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 17, 23-27 (Oct 1976).

Arguments are presented in favour of the establishment of a nationally-based long-term survey of the influence of radiation on the health of all radiation workers in the U.K. Since effects may occur some time after exposure, a follow-up until death is necessary, and the resulting large volume of data should be accumulated economically, efficiently, accurately and as completely as possible to avoid bias. The objectives of such a survey are clarified, and the chances of achieving these objectives within a reasonable time of study estimated from the results of a trial statistical analysis based on a working population of 50,000 occupationally exposed to radiation, a 30 year leukaemia and a 50 year all-cancer risk latent period. The establishment of a central collection of dose records, which are already kept as a legal requirement by employers of radiation workers, and the arrangement for adding the cause of death, is not an expensive or massive project. Sufficient data will provide information on the overall effect on the total number of cancer deaths, and make selective analyses possible. Data for workers in particular industries may indicate correlations between type of exposure and particular forms of cancer. A national survey could identify any rare cancer associated with exposure to radiation. An exposure-specific analysis, in which accumulated dose is correlated with cause of death, may provide evidence in support of, or in conflict with, ICRP recommended levels.

- 949 ULTRAVIOLET EXPOSURE PATTERNS. Scotto, J.; Fears, T.R.; Gori, G.B. (National Cancer Inst., Bethesda, MD). Environ. Res.; 12: No. 2, 228-237(Oct 1976).

Using new measurements of ultraviolet radiation, exposure by time of day and month of year are examined at nine urban locations in the continental United States. About 60% of the total annual ultraviolet radiation count is received between the 4 hour period, 10:00 am to 2:00 pm. Most people can substantially reduce their annual exposure levels by sheltering themselves during the noon-time hours of 11:00 am through 1:00 pm. Individuals who need to limit their sunlight exposure time, i.e., those of light skin pigmentation, should benefit most from the results of this study.

- 950 ANALYSIS OF THE TIME RELATIONSHIP FOR THE INTERACTION OF X-RAY-INDUCED PRIMARY BREAKS IN THE FORMATION OF DICENTRIC CHROMOSOMES. Schmid, E.; Bauchinger, M.; Mergenthaler, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.)). Inst. fuer Biologie). Int. J. Radiat. Biol.; 30: No. 4, 339-346(Oct 1976).

In split-dose experiments, the time relationship for the interaction of primary breaks in the formation of dicentric chromosomes was analysed. Human peripheral lymphocytes were irradiated with a dose of 340 R of 220 kV x rays split into two equal fractions separated by intervals up to 360 min. Assuming an exponential decline of the time-dependent quadratic component of the dose relation of dicentric a theoretical formula was deduced. Fitting this formula to the empirical data a mean time of 110 min could be calculated in which primary breaks induced by both dose-fractions can interact to form dicentric chromosomes.

- 951 DOSIMETRY IN RADIOISOTOPE PLACENTOGRAPHY. Sastry, K.G.K.; Reddy, A.R.; Nagaratnam, A. (Institute of Nuclear Medicine and Allied Sciences, Delhi (India)). Indian J. Med. Res.; 64: No. 10, 1527-1536(Oct 1976).

21 refs..

Radionuclide investigation of the placenta is being widely used in recent years for the diagnosis and management of vaginal bleeding in the third trimester of pregnancy. One is, therefore, concerned about the radiation exposure to the foetus during such procedures. In the present communication a precise method of estimation of radiation doses is presented. A concept termed 'effective absorbed dose constant' is utilized to enable the absorbed fractions and equilibrium absorbed dose constants to be more easily employed in radiation dose estimations. Tables of the effective absorbed dose constants for radionuclides like ^{131}I , ^{123}I , $\text{sup}(^{113}\text{m})\text{Tc}$, $\text{sup}(^{99\text{m}})\text{Tc}$, ^{67}Ga , and ^{51}Cr , are given for different masses and shapes. Masses of different organs of both mother and foetus at different periods of pregnancy and the biological turnover data for different radiopharmaceuticals are reviewed and typical values are presented. Radiation doses to different organs of both mother and foetus at the 30th week of pregnancy are finally estimated for ^{131}I -HSA, ^{123}I -SHA, $\text{sup}(^{99\text{m}})\text{Tc}$ -HSA and $\text{sup}(^{113}\text{m})\text{In}$ -chloride. The advantage of the effective absorbed dose constants in radiation dosimetry in general is discussed. The relative merits of different radiopharmaceuticals for placental investigations are brought out in comparison with antenatal pelvimetric and abdominal X-ray investigations, from the point of view of

radiation doses.

- 952 DARK-ADAPTATION IN IRRADIATED EYE. Oda, I.; Tabuchi, S. (Japanese Foundation for Cancer Research, Tokyo. Cancer Inst.). Gan No Rinsho; 70: No. 10, 1042-1050(Oct 1976). (In Japanese).

Dark-adaptation test was carried out to 33 cases of irradiated eye in radiotherapy. The following results were obtained. Dark-adaptation is disturbed by irradiation. The degree is variable: in some cases the dark-adaptation is not influenced at all, but in other cases the dark-adaptation was greatly decreased. It is difficult to find any obvious proportional relationship with dose. Some of the cases showed a marked decrease of dark-adaptation even by a small dose of irradiation. The individual variation is remarkable. Even if the dark-adaptation is disturbed at the early time of irradiation and the state succeeds or becomes worse, the state may be improved reversibly in some cases. Radiation retinopathy occurred in 5 of 12 cases with (+) of decreased dark-adaptation, 2 of 12 cases with the (+) and 1 of 9 cases with the (-). There was a relationship between decreased dark-adaptation and the occurrence of radiation retinopathy. ERG test was carried out to 21 cases. There was a slight relationship between decreased dark-adaptation and decreased ERG.

- 953 INSTRUCTION FOR DOSE RATE MEASUREMENTS AROUND STATIONARY MEDICAL X-RAY MACHINES. Menzel, B.; Taschner, P.; Koenig, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Radiol. Diagn.; 17: No. 5, 729-736(Oct 1976). (In German).

On the basis of radiation protection regulations of the GDR dose rate measurements in X-ray medical departments have to be registered in records according to the specimens given in the annex. By evaluating the records from all X-ray departments it will become possible to compare and - if necessary - to improve the situation with regard to radiation protection of the personnel.

- 954 CONTROLLED AREA FOR MOBILE MEDICAL X-RAY EQUIPMENT. Menzel, B.; Taschner, P.; Koenig, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)); Fuehr, K.P.; Kucharz, R. (Rostock Univ. (German Democratic Republic). Radiologische Klinik). Radiol. Diagn.; 17: No. 5, 737-745(Oct 1976). (In German).

On the basis of dose rate measurements the radiation protection situation during operation of mobile X-ray machines is described. According to these results, the controlled area has been definitely fixed by the National Board of Nuclear Safety and Radiation Protection with respect to the following fields of application: stomatology, mobile radiography of patients confined to bed as well as performing radiological examinations in the operating theatre.

- 955 ORDINANCE ON THE PROTECTION AGAINST HAZARDS FROM IONIZING RADIATION. RADIATION PROTECTION ORDINANCE - STRLSCHV. Bundesgesetzblatt, Teil 1; No. 125, 2905-2995(Oct 1976). (In German).

The most important innovations of the radiation protection ordinance are the reduction of radiation exposure of the population living near to nuclear facilities to 30 mrem/a. via exhaust air and waste waters and limits for people exposed to radiation for

professional reasons of 5 rem/a. for body, bone marrow, gonads and uterus.

used in combination with fast neutrons and possibly other high-LET radiation thus offers no added advantage to local tumor control.

- 956 AEC ORGANIZES YEAR TO YEAR LONG-TERM PLAN FOR SAFETY STUDY OF ENVIRONMENTAL RADIATION. At. Jpn.; 20: No. 10, 27-48(Oct 1976).

The AEC's program of studies on environmental radiation is presented in the following two parts: biological effects of low-level radiation, and estimation of doses from environmental radiation. Covering the ten years and beyond from 1973, the first concerns quantitative estimates of late injuries, genetic damage and risk from internal emitters, and basic studies. Then, covering the 4 years and beyond from 1979, the second concerns evaluation methods of popular exposure around nuclear facilities, evaluation methods of doses of the Japanese people, and environmental monitoring systems.

- 957 APPROACH TO GENERAL ONCOLOGY: PRINCIPLES AND PROCEDURES. Golomb, H.M.; Ultmann, J.E. (Univ. of Chicago Cancer Research Center). J. Reprod. Med.; 17: No. 4, 191-197(Oct 1976).

The obstetrician-gynecologist is frequently the only physician to attend women during their reproductive years. Malignant disease outside the pelvic organs is a fairly frequent occurrence in this age group. Certain findings in the patient's history and physical examination can suggest malignant disease. The routine laboratory examination can also provide indications of the presence of a neoplastic process. Once this process is suspected, histologic proof of malignancy must be obtained before further staging and therapy are considered. The extent of the disease is important for the planning of therapy, i.e., whether it is to be surgery, radiotherapy, chemotherapy or some combination of the three. Adjuvant chemotherapy is recognized as a form of treatment designed to eradicate micrometastases, prevent the occurrence of subsequent clinical metastatic disease and, as a result, improve survival.

- 958 INTERACTION OF HYPERTHERMIA WITH FAST NEUTRONS OR X RAYS ON LOCAL TUMOR RESPONSE. Hahn, E.W.; Canada, T.R.; Alfieri, A.A.; McDonald, J.C. (Sloan-Kettering Cancer Center, New York). Radiat. Res.; 68: No. 1, 39-56(Oct 1976).

Studies were carried out to examine the interactions of local tumor hyperthermia (LTH) with single and multiple doses of fast neutrons as compared to x rays and to gain further information on the possible mechanisms involved in the radiosensitization of tumor tissues. Ridgway osteogenic sarcomas, (1.0 $\pm$ 0.1 cm average diameter) grown in both AKR/Jax and AKD₂F₁/Jax male mice were exposed to single and multiple doses of x irradiation or cyclotron-produced neutrons (En approximately 3.5 MeV) alone or in combination with LTH (42.5 $\pm$ 0.5°C for 15 min). Hyperthermia alone produced a transitory retardation in tumor growth. The RBE of single doses of neutrons alone ranged from 2.6 to 30 depending on the endpoint observed. LTH did not appreciably increase the effectiveness of single or multiple doses of neutrons. The effect of a single dose of x rays was enhanced by a value ranging from 1.4 to 1.6 and with multiple doses of x rays the radiation enhancement factor (REF) for LTH ranged from 2.2 to 2.4. The increased killing effect on tumor cells, as a result of x rays combined with heat, probably represents heat-induced inhibition of tumor cell repair and increased radiosensitivity of the hypoxic cell compartment. On this basis hyperthermia when

- 959 RESPONSE OF A TRANSPLANTABLE TUMOR TO FRACTIONATED IRRADIATION. II. FAST NEUTRONS. Denekamp, J. (Mount Vernon Hospital, Northwood, Eng.); Harris, S.R.; Morris, C.; Field, S.B. Radiat. Res.; 68: No. 1, 93-103(Oct 1976).

A transplantable murine carcinoma has been used to compare the relative effect of single doses, 2 and 5 fractions of x rays, and of cyclotron-produced fast neutrons. In addition the hypoxic cell radiosensitizer Ro-07-0582 has been tested in combination with single doses of fast neutrons. The relative biological efficiency of the fast neutrons was high for all the fractionation schedules, but the therapeutic gain factor (i.e., tumor RBE/skin RBE) decreased for the fractionated treatments. The relative therapeutic efficiencies for the x-ray and neutron treatments were compared by estimating the tumor delay that was caused by the dose necessary to produce a constant level of skin damage. An advantage of fractionated x rays relative to single doses was previously demonstrated. All the neutron schedules caused more tumor delay than the corresponding x-ray schedules. A single dose of neutrons plus the radiosensitizer Ro-07-0582 was the most effective treatment of all. The effectiveness of fast neutrons was compared with our recently published work using x rays plus the radiosensitizer Ro-07-0582. When a high dose of this drug was used with x rays, the resulting schedules were similar in efficiency to the fast neutron schedules (without drug), for single doses, and for 2 and 5 fractions at 2-day intervals.

- 960 RELATIVE CONTRIBUTION OF TARGET CELL DISTURBANCES AND IMMUNOSUPPRESSION IN RADIATION LEUKEMOGENESIS: MODEL STUDIES WITH EXOGENOUS VIRUS. Yuhas, J.M.; Pazmino, N.H. (Univ. of New Mexico, Albuquerque). Radiat. Res.; 68: No. 1, 104-114(Oct 1976).

The effects of preirradiation on the sensitivity of adult BALB/c mice to the leukemogenic and sarcomagenic effects of MSV/MLV have been studied. Chronic radiation (392 rad at 28 rad/day) induces a transient enhanced sensitivity to the leukemogenic effects of MLV, which disappears between 2 and 6 months after exposure. Acute irradiation (392 rad at 41 rad/min) decreases sensitivity to the leukemogenic effects of MSV/MLV below that of unirradiated mice and this decrease persists through 6 months' postexposure. Conversely, acute irradiation enhances sensitivity to the sarcomagenic effects of MSV/MLV. Both of these effects of acute irradiation can be reversed by addition of immunostimulants such as poly(Am). It is proposed that enhanced sensitivity to leukemogenesis is a reflection of lymphoid hyperplasia while decreased sensitivity reflects lymphoid depletion. In contrast, enhanced sensitivity to sarcomagenesis is a reflection of lymphoid depletion, while increased resistance reflects lymphoid hyperplasia.

- 961 INFLUENCE OF DOSE AND DOSE RATE ON THE INCIDENCE OF NEOPLASTIC DISEASE IN RFM MICE AFTER NEUTRON IRRADIATION. Ullrich, R.L.; Jernigan, M.C.; Cosgrove, G.W.; Satterfield, L.C.; Bowles, N.D.; Storer, J.B. (Oak Ridge National Lab., TN). Radiat. Res.; 68: No. 1, 115-131(Oct 1976).

The influence of dose and dose rate on tumorigenicity after neutron irradiation was

investigated in female RFM mice exposed to various doses of neutrons at dose rates of 5 and 25 rad/min or 1 rad/day. Comparison of neutron irradiation with acute gamma irradiation showed that tumors were induced more effectively with neutrons than with gamma rays, particularly at low doses. Linear relationships were obtained at both dose rates for thymic lymphoma induction after neutron irradiation, while a dose-squared relationship was obtained for gamma rays. At low doses little dose-rate dependence was seen with neutrons, while at the highest doses the low dose rate was more effective. An increased incidence of lung adenomas was seen after neutron irradiation with doses as low as 20 rad, while the incidence after gamma-ray irradiation decreased with increased dose except at approximately 300 rad. In spite of the apparent sensitivity, the neutron dose-response curve for lung tumors was not linear. Neutron irradiation at low dose rates appeared to induce thymic lymphomas and possibly lung adenomas more efficiently than irradiation at high dose rates, but was less effective than high dose rates in inducing ovarian and pituitary tumors. Both the importance of a more complete understanding of dose and dose-rate relationships (particularly in the low dose range) and the need for examination of the basis of such relationships are discussed.

- 962 HEMODYNAMIC CHANGES IN RATS AFTER RADIOPROTECTIVE COMBINATION OF CYSTAMINE ADMINISTERED SUBCUTANEOUSLY AND 5-METHOXYTRYPTAMINE INJECTED INTRAMUSCULARLY. Kuna, P. *Strahlentherapie*; 152: No. 4, 377-384 (Oct 1976).

8 figs.; 1 tab.; 34 refs..

Administration of cystamine (20 mg base/kg s.c.) and 5-methoxytryptamine (10 mg base/kg i.m.) with 12 minutes delay to anesthetized rats induced the depression of whole cardiovascular system, hemoconcentration and great blood flow decrease in the radiosensitive tissues. Distribution of lowered cardiac output preferred the fractions to brain, heart, liver and lungs. Hemodynamic responses to protective combination may participate in its radioprotective action.

- 963 POTENTIATION OF RADIATION MYELITIS IN RATS BY HYPERTHERMIA. Miller, R.C.; Leith, J.T.; Veomett, R.C.; Gerner, E.W. (Arizona Univ., Tucson (USA)). *Br. J. Radiol.*; 49: No. 586, 895-896 (Oct 1976).

An investigation has been carried out into the potentiation of the biological effects of single doses of radiation (4 MeV photons) on the spinal cord of rats by whole-body hyperthermic treatment of anaesthetized animals (42°C for 30 min). The animals received doses ranging from 1000 to 2900 rad, and hyperthermia was produced by placing the animals in chambers heated with warm moist air. Spinal canal temperature was monitored in other animals by surgical placement of a thermistor into the spinal canal, and these temperatures were shown to correspond to within 0.2°C of the rectal temperatures. Production of overt myelopathy at seven months post irradiation was demonstrated in over 50% of the animals receiving 2000 rad plus hyperthermia, whereas only one in ten rats receiving 2000 rad radiation alone showed paralysis at 10 months post irradiation. No myelopathy had developed at 9 months post irradiation in rats receiving 1000 or 1500 rad plus hyperthermia. Heat treatment plus 2600 rad caused paralysis in ten of ten animals. This decrease in the radiation tolerance of the spinal cord by hyperthermia has important implications for any clinical trials of

combined hyperthermia and radiation in diseases where the spinal cord may be in the radiation field.

- 964 EFFECT OF LOW-DOSE PRE-OPERATIVE X-IRRADIATION OF IMPLANTED MOUSE MAMMARY CARCINOMAS ON LOCAL RECURRENCE AND METASTASIS. Sheldon, P.W.; Fowler, J.F. (Mount Vernon Hospital, Northwood (UK)). *Br. J. Cancer*; 34: No. 4, 401-407 (Oct 1976).

Pre-operative x irradiation of s.c. implanted first-generation mammary tumours in C3H mice, using either 500 rad or two fractions of 350 rad, produced no improvement in the success of surgery in causing local control or in reduction of distant metastases. The metastasis rate was just significantly higher after the two-fraction treatment of the implanted tumour than after surgical removal alone. The results are in agreement with previously published results on carcinomas and a sarcoma but contrast with those for murine lymphomas.

- 965 EFFECTS OF X-RAYS ON VASCULAR FUNCTION IN TRANSPLANTED TUMOURS AND NORMAL TISSUES IN THE MOUSE. Zanelli, G.D.; Lucas, P.B. (Mount Vernon Hospital, Northwood (UK)). *Br. J. Cancer*; 34: No. 4, 408-417 (Oct 1976).

The effects of X-radiation on the Nembutal-induced redistribution of the cardiac output in two types of transplanted mouse tumours and some normal mouse tissues have been investigated, using rubidium-86 and ¹²⁵I-human serum albumin. Irradiation caused an increase in ⁸⁶Rb uptake (relative blood perfusion) by the tumours of anaesthetized mice, but had little or no effect in non-anaesthetized mice. The increase was dose- and time-dependent. Tumour plasma space was not significantly affected by radiation and Nembutal. Muscle blood perfusion was severely decreased in anaesthetized mice and was not affected by radiation, at least within the time limits of the experiments. This means that radiation-induced functional vascular changes in normal and neoplastic tissues followed different time courses. On the basis of the present results, and of the results of other authors, it is argued that irradiation damaged the vasculature of tumours in such a way that it became more sensitive to changes in systemic blood pressure.

- 966 (ORNL--5171, pp 1-11) MAXIMUM PERMISSIBLE CONCENTRATION (MPC) VALUES FOR SPONTANEOUSLY FISSIONING RADIONUCLIDES. Ford, M.R.; Snyder, W.S.; Dillman, L.T.; Watson, S.B. Oct 1976.

Health Physics Division. Annual progress report for period ending June 30, 1976.

The radiation hazards involved in handling certain of the transuranic nuclides that exhibit spontaneous fission as a mode of decay were reassessed using recent advances in dosimetry and metabolic modeling. Maximum permissible concentration (MPC) values in air and water for occupational exposure (168 hr/week) were calculated for ²⁴⁴Pu, ²⁴⁶Cm, ²⁴⁸Cm, ²⁵⁰Cf, ²⁵²Cf, ²⁵⁴Cf, /sup ²⁵⁴mEs, ²⁵⁵Es, ²⁵⁶Fm, and ²⁵⁷Fm. The half-lives, branching ratios, and principal modes of decay of the parent-daughter members down to a member that makes a negligible contribution to the dose are given, and all daughters that make a significant contribution to the dose to body organs following inhalation or ingestion are included in the calculations. Dose commitments for body organs are also given. (CH)

- 967 (ORNL--5171, pp 12-16) SPECIFIC ABSORBED FRACTIONS FOR PHOTONS EMITTED IN THE WALLS OF THE GI TRACT. Deus, S.F.; Provenzano, V.; Snyder, W.S. Oct 1976. Health Physics Division. Annual progress report for period ending June 30, 1976. The specific absorbed radiation dose fractions in target organs were calculated for photon sources in the stomach and upper and lower large intestine using an improved human phantom in which the radioactivity in the contents and walls of the gastrointestinal tract are separated. Computer calculations based on the Monte Carlo method and energy loss to each organ of the phantom during decay of the radionuclide were used. (CH)
- 968 (ORNL--5171, pp 17-19) DOSE TO THE STOMACH WALL FROM INJECTED /SUP 99M/Tc PERTECHNETATE. Ford, M.R.; Deus, S.F.; Snyder, W.S. Oct 1976. Health Physics Division. Annual progress report for period ending June 30, 1976. Methods used for computer calculations of the radiation dose to the stomach wall from injected /sup 99m/Tc pertechnetate are described. (CH)
- 969 (ORNL--5171, pp 23-26) DOSE COMMITMENT ESTIMATES BASED ON URINARY AND FECAL EXCRETION DATA FOR THE CASE OF HUMAN EXPOSURE TO $^{238}\text{PuO}_2$. Bernard, S.R. Oct 1976. Health Physics Division. Annual progress report for period ending June 30, 1976. The metabolic model reported by Stuart and his colleagues was used for the case of inhalation of $^{238}\text{PuO}_2$ by beagles to interpret an unusual set of urinary excretion data for the inhalation of $^{238}\text{PuO}_2$ by a human. These data were plotted on a semilogarithmic graph. The ordinate plots the dis/min 24 hr^{-1} urine, and the abscissa is the approximate time in days after the intake. There are three distinct peaks in excretion between 400 and 600 days, at which time diethylenetriaminopentaacetic acid (DTPA) was administered. In order to estimate organ burdens, the effect of DTPA was ignored, and a single exponential was used to approximate the excretion data. Preliminary 50-year dose estimates for liver, kidneys, and lungs were made. It is pointed out that metabolic models based on $^{238}\text{PuO}_2$ inhalation in dogs may not be accurate for $^{238}\text{PuO}_2$ in man.
- 970 (ORNL--5171, pp 27-40) ESTIMATES OF PHOTON DOSE TO THE GONADS PER MICROCURIE-DAY AS A FUNCTION OF THE SOURCE ORGAN AND THE AGE OF THE INDIVIDUAL. Snyder, W.S.; Ford, M.R.; Poston, J.W.; Warner, G.G. Oct 1976. Health Physics Division. Annual progress report for period ending June 30, 1976. When a photon emitter is present in the body, essentially all the body is irradiated. Thus the gonads will receive some irradiation, but the amount will reflect the geometrical locations of the source and the target organs as well as the energy of the photons. To estimate the average genetic dose to the population, one needs to know the photon dose as a function of body size or age. Using an average body size for each age, one finds that the dose per microcurie-day increases rather regularly as age or body size decreases. This is the first complete presentation of doses per microcurie-day for the gonads. Doses (rads per microcurie-day) are given for a monoenergetic source of photons of yield 1 photon per nuclear transformation.
- 971 (ORNL--5171, pp 41-44) ESTIMATES OF

RADIATION DOSE TO THE EMBRYO FROM NUCLEAR MEDICINE PROCEDURES. Smith, E.M.; Warner, G.G. Oct 1976.

Health Physics Division. Annual progress report for period ending June 30, 1976.

The estimate of the radiation absorbed dose to the embryo is important when a radiopharmaceutical has been intentionally or unknowingly administered to a female who is at the beginning of her pregnancy. Currently, there are no direct methods of calculating the dose to the embryo. The dose to the uterus can be calculated and assumed to be equal to the dose to the embryo. Methods for the computation are described.

- 972 (ORNL--5171, pp 45-49) PRACTICAL METHODS OF DOSE REDUCTION TO THE BLADDER WALL. Smith, E.M.; Warner, G.G. Oct 1976. Health Physics Division. Annual progress report for period ending June 30, 1976.

The design objective for contemporary radiopharmaceuticals used in nuclear medicine is rapid and specific localization in the tissues to be imaged, followed by rapid elimination of the radionuclide via the kidney and bladder. Thus the bladder should be one of the primary organs considered when dose estimates are made for current and future radiopharmaceuticals. The accumulated dose to the bladder wall can be quite significant, since it is subject to irradiation from most nuclear medicine procedures at relatively high levels compared with other tissues of the body. The activity in the contents of the bladder irradiates not only the bladder wall but also tissues in close proximity to the bladder. A substantial dose reduction to both the bladder wall and, possibly, nearby organs could be achieved if the urine volume and the time during which the excreted activity remained in the bladder were optimized in a manner compatible with most patients and the clinical environment. The purpose of this study was to determine what parameters affect the mean dose to the bladder wall and to suggest methods of optimizing these parameters to minimize the mean dose.

- 973 (ORNL--5171, pp 50) ESTIMATION OF DOSE COMMITMENT FROM AN ACCIDENTAL INTAKE OF ^{241}Am . Bernard, S.R.; Poston, J.W. Oct 1976. Health Physics Division. Annual progress report for period ending June 30, 1976.

Four employees at the Oak Ridge National Laboratory inhaled ^{241}Am as a result of an accidental release of this radionuclide. Urine and fecal samples were analyzed and Bioassay Laboratory chest counts were made with a whole body counter. Ca-DTPA mists were inhaled within hours after the intake. These data, together with data on the inhalation of ^{241}Am in the dog, were used to obtain a 50-year dose commitment to lungs, skeleton, and liver. The 50-year dose commitment to skeleton for two of the employees was estimated to be about 170 rems. The estimation methods used for dose commitment, together with the values for other organs, are presented and discussed.

- 974 (ORNL--5171, pp 51) FIFTY-YEAR DOSE COMMITMENT TO VARIOUS ORGANS AND TISSUES FROM INHALATION OF ^{133}Xe . Bernard, S.R.; Snyder, W.S. Oct 1976. Health Physics Division. Annual progress report for period ending June 30, 1976.

Metabolic models for a single inhalation of ^{133}Xe , together with computer calculations, were employed for estimating dose commitments to various organs and tissues in the adult human body. The code uses the Monte Carlo data

for photons and assumes complete absorption of the energy from the emitted electrons in organs and tissues. For bone, the dose to red and yellow marrow and to endosteal cells of both trabecular and cortical bone was estimated. For a single inhalation of 1 mCi of ^{133}Xe , the 50-year dose to gonads was about 0.4 millirad. The dose to lungs from ^{133}Xe dissolved in tissues was about the same; however, the dose to the lungs from ^{133}Xe in air spaces was about 1 millirad.

- 975 (ORNL--5171, pp 53-54) DOSE-CONVERSION FACTORS FOR SOME FISSION PRODUCTS. Poston, J.W.; Bernard, S.R.; Ford, M.R.; Watson, S.B.; Snyder, W.S. Oct 1976.

Health Physics Division. Annual progress report for period ending June 30, 1976.

Dose-conversion factors are presented that provide estimates of dose per microcurie inhaled for 54 fission product radionuclides. The data are given in a table which lists the isotope with the clearance class indicated and the value of f_1 . The units are changed to rems per curie inhaled as being somewhat more familiar.

- 976 (ORNL/NUREG/TM--6) CORRELATION OF RADIOACTIVE WASTE TREATMENT COSTS AND THE ENVIRONMENTAL IMPACT OF WASTE EFFLUENTS IN THE NUCLEAR FUEL CYCLE: REPROCESSING LIGHT-WATER REACTOR FUEL. Finney, B.C.; Blanco, R.E.; Dahlman, R.C.; Hill, G.S.; Kitts, F.G.; Moore, R.E.; Witherspoon, J.P. (Oak Ridge National Lab., Tenn. (USA)). Oct 1976. Contract W-7405-ENG-26; NRC-INA-40-10-01-01-0. 164p. Dep. NTIS \$6.75.

A cost/benefit study was made to determine the cost and effectiveness of radioactive waste (radwaste) treatment systems for decreasing the release of radioactive materials from a model nuclear fuel reprocessing plant which processes light-water reactor (LWR) fuels, and to determine the radiological impact (dose commitment) of the released materials on the environment. The study is designed to assist in defining the term as low as reasonably achievable in relation to limiting the release of radioactive materials from nuclear facilities. The base case model plant is representative of current plant technology and has an annual capacity of 1500 metric tons of LWR fuel. Additional radwaste treatment systems are added to the base case plant in a series of case studies to decrease the amounts of radioactive materials released and to reduce the radiological dose commitment to the population in the surrounding area. The cost for the added waste treatment operations and the corresponding dose commitments are calculated for each case. In the final analysis, radiological dose is plotted vs the annual cost for treatment of the radwastes. The status of the radwaste treatment methods used in the case studies is discussed. Much of the technology used in the advanced cases is in an early stage of development and is not suitable for immediate use. The methodology used in estimating the costs, and the radiological doses, detailed calculations, and tabulations are presented in Appendix A and ORNL-4992. This report is a revision of the original study (ORNL/TM-4901).

- 977 (ORP/EAD--76-4) COMPUTER CODE (RVRDOS) TO CALCULATE POPULATION DOSES FROM RADIOACTIVE LIQUID EFFLUENTS AND AN APPLICATION TO NUCLEAR POWER REACTORS ON THE MISSISSIPPI RIVER BASIN. Martin, J.A. Jr.; Robbins, C.; Nelson, C.B.; Cousins, R.D. Jr.; Culliton, M.A. (Environmental Protection Agency, Washington,

D.C. (USA). Office of Radiation Programs). Oct 1976. 82p. Environmental Protection Agency, Washington, DC.

A computer program RVRDOS has been developed to calculate population doses due to releases of radionuclides into flowing streams. Concentrations of the radionuclides downstream take into account dilution, decay, and the ingrowth of a daughter product. Population doses to four organs are calculated for drinking water and fish ingestion pathways. Individual doses due to swimming may also be estimated. A program manual for RVRDOS is included in this report. RVRDOS has been used to calculate population doses due to releases from nuclear power reactors on the Mississippi River Basin during 1973. The data base for these calculations and a summary of the calculations are discussed.

- 978 INFLUENCE OF STEROID HORMONES ON THE CARCINOGENICITY OF ^{90}Sr . Nilsson, A.; Broome-Karlsson, A. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Acta Radiol., Ther., Phys., Biol.; 15: No. 5, 417-426 (Oct 1976).

Groups of female CBA-mice were given ^{90}Sr (14.8 kBq/g-0.4 $\mu\text{Ci/g}$ -bodyweight) alone or in combination with polyestradiolphosphate, methylprednisolone or nortestosterone, respectively. When ^{90}Sr was given in the first combination, the frequency of osteosarcomas was significantly increased whereas the tumour latency time was decreased compared to mice given ^{90}Sr alone. In combination with nortestosterone such effects were not found, whereas the combination ^{90}Sr +methylprednisolone resulted in a strong reduction of the osteosarcoma incidence and a prolonged tumour latency time. The latter experiment was repeated in a larger experiment whereby the results were confirmed.

- 979 IN VIVO THYROID MONITORING FOR IODINE-131 IN THE ENVIRONMENT. Plato, P.; Jacobson, A.P. (Michigan Univ., Ann Arbor (USA). Dept. of Environmental Health); Homann, S. Int. J. Appl. Radiat. Isot.; 27: No. 10, 539-545 (Oct 1976).

An effort to monitor ^{131}I directly in the thyroids of individuals living near nuclear facilities that release ^{131}I into the environment is described. A NaI(Tl)-detector system was assembled in the back of a truck for rapid and convenient measurements of members of the general public. The monitoring system has a minimum detectable activity for thyroid-bound ^{131}I of approximately 35 pCi which is sensitive enough to satisfy all legal requirements for environmental monitoring in the U.S.A. except for the child who receives ^{131}I continuously from a nuclear-power plant. Thyroid doses are calculated with more certainty from in vivo measurements than from measurements made on environmental and effluent samples.

- 980 INGESTION OF RADIUM 226 AND ITS EVALUATION IN A SELECTED POPULATION GROUP. Ivan, J.; Slovak, M.; Abel, E.; Patzeltova, N. (Vyskumny Ustav Hygieny, Bratislava (Czechoslovakia)). Cesk. Hyg.; 21: No. 8, 382-386 (Oct 1976). (In Slovak).

The activity of ^{226}Ra was followed in the drinking water of the West Slovakia region and in the all-day food intake. The volume activities of ^{226}Ra in drinking water were in the range 0 to 63 mBq.l $^{-1}$ (0.0 to 1.7 pCi.l $^{-1}$) with the mean value 9.3 mBq.l $^{-1}$ (0.25 pCi.l $^{-1}$). The average activity of ^{226}Ra in the food, as expressed per person and day, was 47.7 mBq (1.29 pCi). A general intake of ^{226}Ra by ingestion in the observed group, also

calculated per person and day, was 57 mBq (1.54 pCi) on the average. The value found was used for the evaluation of the group exposure of a homogeneous group of boarders of a university canteen. The values obtained indicate an average exposure to ^{226}Ra . The calculated value of the annual dose equivalent of ^{226}Ra to the skeleton in adults was 2.48 mrem, with the corresponding dose equivalent being 0.119 rem; these values are small in view of the above mentioned annual ^{226}Ra intake, but are not negligible with regard to the ICRP recommendations.

- 981 (NUREG--0119) EIGHTH ANNUAL OCCUPATIONAL RADIATION EXPOSURE REPORT, 1975. Brooks, B.G. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Management Information and Program Control). Oct 1976. 29p. Dep. NTIS \$4.00.

This is a report by the U.S. Nuclear Regulatory Commission on the operation of the Commission's centralized repository of personnel occupational radiation exposure information. Annual reports were received from 387 covered licensees indicating that some 78,713 individuals, having an average exposure of 0.36 rems, were monitored for exposure to radiation during 1975 and that 21,601 individuals terminated their employment or work assignment with covered licensees in 1975. The number of personnel overexposures reported in 1975 decreased from previous years. The most significant overexposures which occurred in 1975 are summarized.

- 982 (ORNL--5171, pp 299-359) EMERGENCY TECHNOLOGY PROGRAM. Chester, C.V. Oct 1976. Health Physics Division. Annual progress report for period ending June 30, 1976.

Emergency technology programs to protect human populations against the consequences of nuclear war and severe radiation accidents are reviewed. Civil defense programs in the USSR and the USA are compared and the protection afforded by various types of shelters, the relocation of populations, and the consequences of nuclear attack on the nuclear power industry are considered. Severe nuclear accidents are postulated and radiation dose estimates from radioactive effluents released are presented.

- 983 (DOCKET-50244--588) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION RE PROTECTION MEASURES FOR DIVERS. (Rochester Gas and Electric Corp., N.Y. (USA)). 29 Sep 1976. 5p.

Protection measures for divers; responses to NRC requests for additional information. GINNA-1 REACTOR; FUEL POOLS; MODIFICATIONS; PERSONNEL; DIVING OPERATIONS; SAFETY; RADIATION DOSES; TIME DEPENDENCE; RADIATION PROTECTION

- 984 (PB--260840) SPECIAL LISTING OF CURRENT CANCER RESEARCH ON PRECLINICAL ASPECTS OF CANCER RADIOTHERAPY AND RELATED RADIOBIOLOGY. (Smithsonian Science Information Exchange, Inc., Washington, D.C. (USA). Current Cancer Research Project Analysis Center). 28 Sep 1976. 34p. NTIS, PC A03/MF A01.

The listing includes studies of biological effects of particle irradiation, radiopharmaceuticals, and radio-nuclides, including aspects of neutron radiation in experimental systems and irradiation with heavy ions, pions, protons, and other beams; radiosensitizers, including the effect of tumor oxygen level on radiation effects; combination of radiotherapy with chemotherapy,

immunotherapy, or hyperthermia; radioprotection by chemical agents and bone marrow transplantation; radiation dose rate and dose fractionation studies; effects of radiation on DNA, on cell cycle, and other in vitro studies; effects of radiation on metastases and tumor vasculature; radiation in in vivo model systems; effects of radiotherapy on non-target tissues and on host immunity; and broad radiation biology projects and programs. The listed projects are indexed by research area and by investigator.

- 985 (DOCKET-50390--126) WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2. LICENSE APPLICATION, FINAL SAFETY ANALYSIS REPORT, VOLUME 12: CHAPTERS 12 AND 13. (Tennessee Valley Authority, Chattanooga (USA)). 27 Sep 1976. 392p. (DOCKET-50391--126).

FSAR Volume 12; radiation protection, conduct of operations, and initial test program. WATTS BAR-1 REACTOR; WATTS BAR-2 REACTOR; RADIATION PROTECTION; REACTOR OPERATION; REACTOR START-UP; TESTING; RADIATION DOSES; RELEASE LIMITS; RADIATION SOURCES; EDUCATION; PERSONNEL; EMERGENCY PLAN; SECURITY

- 986 (UCRL--52176) PLUTONIUM CONCENTRATIONS IN DIETARY AND INHALATION PATHWAYS AT BIKINI AND NEW YORK. Robison, W.L.; Noshkin, V.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Sep 1976. Contract W-7405-ENG-48. 21p. Dep. NTIS \$3.50.

This report assesses the plutonium intake via inhalation and ingestion for residents of New York and residents of Bikini Atoll. Based on inhalation and ingestion intake, the plutonium transferred to urine would be roughly seven times greater at Bikini than at New York. This ratio compares with data reported to the authors showing urine samples from Bikini residents had about ten times the Pu of urine samples from New York residents. The comparison of these ratios indicates that differences in the levels of intake in the New York and Bikini populations can account for the relative difference between the Pu concentrations observed in urine samples from the two locations.

- 987 (COO--1826-35) URANIUM MINER LUNG CANCER STUDY. PROGRESS REPORT, JULY 1, 1975--JULY 1, 1976. Saccomanno, G. (Saint Mary's Hospital, Grand Junction, Colo. (USA). Dept. of Pathology). 15 Sep 1976. Contract E(11-1)-1826. 8p. Dep. NTIS \$3.50.

This study on the rate of lung cancer development in uranium miners was initiated in 1957 by the U. S. Public Health and many facets of this project are reaching final objectives. Many new studies have developed in the course of this study and will continue. The projects supported by The Energy Research and Development Administration are of utmost importance and consist of: collection of material from uranium miners known to have cancer of the lung into a tumor registry; manual on pulmonary cytology; regression study of sputum cytological findings in uranium miners who showed marked atypical squamous cell metaplasia and have quit smoking cigarettes, mining, or both; continuation of sputum collection and collection of lungs from deceased miners, and the development of instruments such as uv fiber-optic bronchoscopes for localization of carcinoma in situ of the lung. Approximately 75,000 sputum samples were examined over the last 19 years in cases that showed normal cytology at the inception of study and subsequently developed carcinoma of the lung and resulted in an

- accumulation of material that is worthy of study.
- 988 (DOCKET-50244--580) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. IE INSPECTION REPORT NO. 76-11, ACTIONS AND CORRESPONDENCE. (Rochester Gas and Electric Corp., N.Y. (USA)). 15 Sep 1976. 28p.
Inspection of radiation protection and health physics program. GINNA-1 REACTOR; INSPECTION; RADIATION PROTECTION; CONTAMINATION; CONTROL; RADIATION MONITORING; RADIOACTIVE MATERIALS; RADIATION DOSES; PERSONNEL; CALIBRATION; VENTILATION; RADIOACTIVE EFFLUENTS; ACTIVITY LEVELS
- 989 (DOCKET-50289--763) THREE MILE ISLAND NUCLEAR STATION, UNIT 1. IE INSPECTION REPORT NO. 76-17 (ROUTINE, UNANNOUNCED); REPLY; ACKNOWLEDGMENT. (Metropolitan Edison Co., Reading, Pa. (USA)). 15 Sep 1976. 38p.
Inspection of radiological protection and operations. THREE MILE ISLAND-1 REACTOR; INSPECTION; RADIATION PROTECTION; DOCUMENTATION; REACTOR OPERATION; PERSONNEL; RADIATION DOSES; SAMPLING; RADIATION MONITORING; RADIATION DETECTORS; CALIBRATION; WASTE DISPOSAL; VENTS; CONTAINMENT BUILDINGS
- 990 (DOCKET-50003--562) INDIAN POINT STATION, UNIT 1. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Consolidated Edison Co. of New York, Inc., New York (USA)). 13 Sep 1976. 3p.
IE circular 76-03: radiation exposures in reactor cavities. INDIAN POINT-1 REACTOR; CONTAINMENT; ANNULAR SPACE; RADIATION EFFECTS; PERSONNEL; RADIATION PROTECTION
- 991 (DOCKET-50029--699) YANKEE NUCLEAR POWER STATION. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Yankee Atomic Electric Co., Westboro, Mass. (USA)). 13 Sep 1976. 3p.
Radiation exposures in reactor cavities. ROWE YANKEE REACTOR; PERSONNEL; RADIATION DOSES
- 992 (DOCKET-50244--577) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Rochester Gas and Electric Corp., N.Y. (USA)). 13 Sep 1976. 3p.
IE circular 76-03: radiation exposures in reactor cavities. GINNA-1 REACTOR; CONTAINMENT; ANNULAR SPACE; PERSONNEL; RADIATION PROTECTION; RADIATION DOSES
- 993 (DOCKET-50259--936) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES; REPLY. (Tennessee Valley Authority, Chattanooga (USA)). 13 Sep 1976. 2p. (DOCKET-50260--707; DOCKET-50296--400).
IE circular 76-03: radiation exposures in reactor cavities; reply. BROWNS FERRY-1 REACTOR; BROWNS FERRY-2 REACTOR; BROWNS FERRY-3 REACTOR; PERSONNEL; RADIATION PROTECTION; CONTAINMENT; ANNULAR SPACE; RADIATION DOSES
- 994 (DOCKET-50285--593) FORT CALHOUN STATION, UNIT 1. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Consolidated Edison Co. of New York, Inc., New York (USA)). 13 Sep 1976. 3p.
IE circular 76-03 radiation exposures in reactor cavities. CALHOUN-1 REACTOR; PRESSURE VESSELS; ANNULAR SPACE; PERSONNEL; RADIATION DOSES;
- CONTAINMENT
- 995 (DOCKET-50289--711) THREE MILE ISLAND NUCLEAR STATION, UNIT 1. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Metropolitan Edison Co., Reading, Pa. (USA)). 13 Sep 1976. 3p.
Radiation exposures in reactor cavities. THREE MILE ISLAND-1 REACTOR; PERSONNEL; RADIATION DOSES
- 996 (DOCKET-50293--729) PILGRIM NUCLEAR POWER STATION, UNIT 1. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Boston Edison Co., Mass. (USA)). 13 Sep 1976. 3p.
Radiation exposures in reactor cavities. PILGRIM-1 REACTOR; PERSONNEL; RADIATION DOSES; CONTAINMENT
- 997 (DOCKET-50298--659) COOPER NUCLEAR STATION. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Nebraska Public Power District, Columbus (USA)). 13 Sep 1976. 3p.
IE circular 76-03: radiation exposures in reactor cavities. COOPER REACTOR; CONTAINMENT; ANNULAR SPACE; PERSONNEL; RADIATION PROTECTION; RADIATION DOSES; RADIATION MONITORS
- 998 (DOCKET-50322--157) SHOREHAM NUCLEAR POWER STATION, UNIT 1. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Long Island Lighting Co., Hicksville, N.Y. (USA)). 13 Sep 1976. 5p.
Radiation exposures in reactor cavities. SHOREHAM REACTOR; PERSONNEL; RADIATION DOSES
- 999 (DOCKET-50327--271) SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Tennessee Valley Authority, Chattanooga (USA)). 13 Sep 1976. 3p. (DOCKET-50328--252).
Radiation exposures in reactor cavities. SEQUOYAH-1 REACTOR; SEQUOYAH-2 REACTOR; PERSONNEL; RADIATION DOSES
- 1000 (DOCKET-50338--441) NORTH ANNA POWER STATION, UNITS 1, 2, 3, AND 4. SURRY POWER STATION, UNITS 3 AND 4. IE CIRCULAR NO. 76-03. (Virginia Electric and Power Co., Richmond (USA)). 13 Sep 1976. 3p. (DOCKET-50339--429; DOCKET-50404--189; DOCKET-50405--199; DOCKET-50434--152; DOCKET-50435--150).
IE circular No. 76-03: radiation protection procedures for maintenance personnel. NORTH ANNA-1 REACTOR; NORTH ANNA-2 REACTOR; NORTH ANNA-3 REACTOR; NORTH ANNA-4 REACTOR; SURRY-3 REACTOR; SURRY-4 REACTOR; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES
- 1001 (DOCKET-50344--346) TROJAN NUCLEAR PLANT. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Portland General Electric Co., Oreg. (USA)). 13 Sep 1976. 3p.
Radiation exposures in reactor cavities. TROJAN REACTOR; CONTAINMENT BUILDINGS; RADIATION HAZARDS; PERSONNEL; RADIATION DOSES
- 1002 (DOCKET-50387--164) SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Pennsylvania Power and Light Co., Pittsburgh (USA)). 13 Sep 1976. 3p.

(DOCKET-50388--158).

Radiation exposures in reactor cavities.
SUSQUEHANNA-1 REACTOR;SUSQUEHANNA-2 REACTOR;
PERSONNEL;RADIATION DOSES

1003 (DOCKET-50416--158) GRAND GULF NUCLEAR STATION, UNITS 1 AND 2. IE CIRCULAR NO. 76-03. (Mississippi Power and Light Co., Jackson (USA)). 13 Sep 1976. 3p. (DOCKET-50417--157).

IE circular 76-03 concerning radiation exposure in reactor cavities. GRAND GULF-1 REACTOR;GRAND GULF-2 REACTOR;CONTAINMENT; PERSONNEL;RADIATION DOSES;ACTIVITY LEVELS; RADIATION PROTECTION

1004 (DOCKET-50443--234) SEABROOK NUCLEAR STATION, UNITS 1 AND 2. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Public Service Co. of New Hampshire, Manchester (USA)). 13 Sep 1976. 3p. (DOCKET-50444--234).

Radiation exposures in reactor cavities. SEABROOK-1 REACTOR;SEABROOK-2 REACTOR; CONTAINMENT BUILDINGS;RADIATION HAZARDS; PERSONNEL;RADIATION DOSES

1005 (DOCKET-50463--96) FULTON GENERATING STATION, UNITS 1 AND 2. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Philadelphia Electric Co., Pa. (USA)). 13 Sep 1976. 3p. (DOCKET-50464--95).

Radiation exposures in reactor cavities. FULTON-1 REACTOR;FULTON-2 REACTOR;CONTAINMENT BUILDINGS;RADIATION HAZARDS;PERSONNEL;RADIATION DOSES

1006 (DOCKET-50471--150) PILGRIM NUCLEAR POWER STATION, UNIT 2. IE CIRCULAR NO. 76-03: RADIATION EXPOSURES IN REACTOR CAVITIES. (Boston Edison Co., Mass. (USA)). 13 Sep 1976. 3p.

Radiation exposures in reactor cavities. PILGRIM-2 REACTOR;CONTAINMENT;RADIATION DOSES; PERSONNEL;RADIATION HAZARDS

1007 (DOCKET-50220--618) NINE MILE POINT NUCLEAR STATION, UNIT 1. IE INSPECTION REPORT 76-09. (Niagara Mohawk Power Corp., Syracuse, N.Y. (USA)). 10 Sep 1976. 26p.

Inspection of radiological protection program. NINE MILE POINT-1 REACTOR;INSPECTION; PERSONNEL;RADIATION EFFECTS;RADIATION DOSES; RADIATION PROTECTION;DOSEMETERS;DOCUMENTATION; MANAGEMENT;CONTROL;INTAKE STRUCTURES;FISHES; IMPINGEMENT;TESTING;CALIBRATION;RADIATION MONITORS;RADIOACTIVE MATERIALS;TRANSPORT

1008 PREMATURE CHROMOSOME CONDENSATION IN IRRADIATED MAN. Witkowski, R.; Anger, H. (Humboldt-Universitaet, Berlin). Hum. Genet.; 34: No. 1, 65-68(10 Sep 1976).

Micronuclei and premature chromosome condensation previously described in mammalian cells exposed to different types of irradiation and chemicals in vitro or in vivo could be demonstrated in cultured lymphocytes derived from chronically low-dose irradiated persons. The usefulness of these findings for biological recording of irradiation effects is suggested.

1009 HOW TOXIC IS PLUTONIUM. Wethe, P.I. (Institut for Atomenergi, Kjeller (Norway)). Tek. Ukebl.; 123: No. 37, 29-30,33(9 Sep 1976). (In Norwegian).

The toxicity of plutonium is discussed in fairly general terms, also related to its

metabolism. It is pointed out that, due to the precautions taken in handling plutonium from its discovery, no serious injuries in humans which can be ascribed to plutonium have been found, despite very thorough investigations. The 'hot particle' problem is especially discussed, and the environmental effects of plutonium are also fairly briefly treated. It is concluded that, so long as the usual precautions are taken, the handling of plutonium, on a small or on an industrial scale, does not pose unacceptable hazards.

1010 (DOCKET-50313--645) ARKANSAS NUCLEAR ONE, UNIT 1. IE INSPECTION REPORT NO. 76-10 (ROUTINE, UNANNOUNCED RE RADIATION PROTECTION); REPLY; ACKNOWLEDGMENT. (Arkansas Power and Light Co., Little Rock (USA)). 8 Sep 1976. 23p.

Inspection of radiation protection program. ARKANSAS-1 REACTOR;INSPECTION;RADIATION PROTECTION;DEMINERALIZERS;CONTROL;VALVES; ACTIVITY LEVELS;WHOLE-BODY COUNTING;RADIATION MONITORS;PERSONNEL;EDUCATION;QUALITY CONTROL; RADIOCHEMISTRY;STACKS;CONTAINMENT;FLOW RATE; CALIBRATION;RADIATION DOSES;EQUIPMENT; DOCUMENTATION;CONTAMINATION;AIR SAMPLERS

1011 (DOCKET-STN-50556--86) BLACK FOX STATION, UNITS 1 AND 2. PUBLIC SERVICE COMPANY OF OKLAHOMA COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT. (Public Service Co. of Oklahoma, Tulsa (USA)). 7 Sep 1976. 31p. (DOCKET-STN-50557--83).

Public Service Company of Oklahoma comments on draft environmental statement. BLACK FOX-1 REACTOR;BLACK FOX-2 REACTOR;ENVIRONMENTAL EFFECTS;LAND USE;POWER TRANSMISSION LINES; HURRICANES;REACTOR SITES;FILTERS;RADIOACTIVE WASTE MANAGEMENT;OFF-GAS SYSTEMS;WASTE WATER; CONSTRUCTION;PONDS;ARCHAEOLOGY;RAILWAYS; HOSPITALS;PERSONNEL;NATURAL GAS;OILS;RADIATION DOSES;MONITORING

1012 HODGKIN'S DISEASE FOLLOWING THORIUM DIOXIDE ANGIOGRAPHY. Gotlieb, A.I.; Kirk, M.E. (McGill Univ., Montreal, Quebec (Canada)). Dept. of Pathology; Hutchison, J.L. (Montreal General Hospital, Quebec (Canada)). Can. Med. Assoc. J.; 115: No. 5, 433-434(4 Sep 1976). 17 refs..

Hodgkin's disease occurred in a 53-year-old man who, 25 years previously, had undergone cerebral angiography, for which thorium dioxide suspension (Thorotrast) was used. Deposits of thorium dioxide were noted in reticuloendothelial cells in various locations. An association between thorium dioxide administration and the subsequent development of malignant tumours and neoplastic hematologic disorders has previously been reported.

1013 (DOCKET-50267--575) FORT ST. VRAIN NUCLEAR GENERATING STATION. SEMI-ANNUAL OPERATIONS REPORT NO. 5, JANUARY--JUNE 1976. (Public Service Co. of Colorado, Denver (USA)). 3 Sep 1976. 96p.

The plant was shut down during the entire period. Information concerning fuel and equipment performance; changes in facility design, procedures, and personnel are summarized. Surveillance testing, maintenance, primary and secondary chemistry, occupational personnel radiation exposures, and radioactive effluents are described. (FS)

1014 (DOCKET-50413--131) CATAWBA NUCLEAR STATION, UNITS 1 AND 2. IE CIRCULAR NO. 76-03 AND CORRESPONDENCE. (Dairyland Power

Cooperative, La Crosse, Wis. (USA)). 2 Sep 1976. 4p. (DOCKET-50414--128).

IE circular 76-03 re radiation exposures in reactor cavities. CATAWBA-1 REACTOR; CATAWBA-2 REACTOR; PRESSURE VESSELS; ANNULAR SPACE; PERSONNEL; RADIATION DOSES; RADIATION PROTECTION; REACTOR FUELING

- 1015 (UCRL--51444-76) PROGRAM REPORT: FY 1976, ATMOSPHERIC AND GEOPHYSICAL SCIENCES DIVISION, PHYSICS DEPARTMENT. Knox, J.B.; Orphan, R.C. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Sep 1976. Contract W-7405-ENG-48. 46p. Dep. NTIS \$4.00.

The Atmospheric Release Advisory Capability (ARAC), with its central facility located at LLL, is meeting the long-term need for rapid and accurate regional dose-to-man estimates of nuclear material released as a result of accidents, operations, or terrorism acts. During the past two years, ARAC has been used in four potential WARMSPOUT events and for one accidental release. Continuing research, in terms of new modeling techniques, simulation of regional tracer experiments, and other verification activities, support this capability. Emergency response is currently being upgraded to evaluate the consequences of atmospheric releases at selected nuclear facilities and for potential acts of nuclear terrorism anywhere in the Northern Hemisphere. Regional modeling was also applied in monitoring SO₂-sulfate concentrations in the northeastern USA.

- 1016 (HEDL-TME--76-75) RADIATION EXPOSURE CONTROL TECHNOLOGY SEMIANNUAL PROGRESS REPORT, JUNE--DECEMBER 1975. Smith, R.C.; Strobe, J.N.; Brackenbush, L.W.; Faust, L.G. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Sep 1976. Contract E(45-1)-2170. 22p. AT.

This is the third semiannual program report on the program being conducted to measure and control radiation levels during Pu fuel fabrication. Measurements of the neutron attenuation for several high-efficiency neutron shielding materials under slightly differing neutron scattering conditions are given. Results of a three-month radiation exposure measurement program conducted at the Nuclear Materials Division of Babcock and Wilcox during production of fuel for FFTF are also included. (DLC)

- 1017 (GEAP--14144) INHALATION DOSE CONVERSION FACTORS FOR VARIOUS RADIONUCLIDES ASSOCIATED WITH LIQUID METAL FAST BREEDER REACTORS. Teresi, J.D.; Boudreau, F.C. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Sep 1976. Contract EY-76-C-03-0893-015. 70p. AT.

The report presents: (1) values of the parameters needed in the estimation of internal radiation doses from inhalation of radioactive aerosols resulting from hypothetical liquid metal fast breeder reactor accidents, (2) the values of the time integrated organ deposited radioactivity per unit of radioactivity inhaled ($\mu\text{Ci-days/Ci inhaled}$) based on a metabolic model that incorporates the respiratory tract model adopted by the International Commission on Radiological Protection Task Group on Lung Dynamics, and (3) the values of the dose conversion factors (F-factors) in Rem per curie inhaled for various important LMFBR radionuclides.

- 1018 (GEAP--14034-8) RADIOLOGICAL

ASSESSMENT MODELS EIGHTH QUARTERLY REPORT, JUNE--AUGUST 1976. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Sep 1976. Contract E(04-3)-0893-TAS-15. 32p. AT.

This report, documenting progress during June, July, and August 1976, is the eighth in a series of quarterly reports published under the Radiological Assessments Program. The objectives of the program are to develop models for analyzing and evaluating postulated radiological sources, aerosol dynamics, sodium fires, and radiological dosages arising from hypothetical core disruptive accidents in liquid metal fast breeder reactors.

- 1019 (Juel-Conf--21, pp 172-184) MANAGEMENT OF RADIATION EXPOSURES IN NUCLEAR POWER PLANTS IN INDIA. Parameswaran, S.; Venkatesan, S.; Sah, B.M.L.; Subbaratnam, T. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). Sep 1976.

From 4. Indo-German seminar on operation of nuclear power plants; Julich, F.R. Germany (29 Jun 1976).

Proceedings of the fourth Indo-German seminar on operation of nuclear power plants. Session 3.

The distribution of radiation exposure among various work groups in the power station is presented. 50% of the total exposure is received by the maintenance personnel. Within this working group it has been observed that most of the burden is shared between the mechanical maintenance group and the group which is engaged in jobs such as decontamination of equipment and area and collection and movement of radioactive solid waste. Operational personnel consume about 30% of the total exposure. It may be important to mention that the significant tritium exposure is taken into consideration while computing the whole body exposure.

- 1020 (Juel-Conf--21, pp 193-210) RADIATION EXPOSURE IN THE AVR EXPERIMENTAL NUCLEAR POWER STATION. Ziermann, E. (Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Juelich (Germany, F.R.)). Sep 1976.

From 4. Indo-German seminar on operation of nuclear power plants; Julich, F.R. Germany (29 Jun 1976).

Proceedings of the fourth Indo-German seminar on operation of nuclear power plants. Session 3.

The mean collective annual dose of AVR-personnel exposed to radiation on the job during the first eight years of operation, including out-of-house personnel, was relatively low at a level of $D_{\text{sub}}(k) = 74$ rem. This dose is attributable primarily to movement within the containment during power operation. The collective annual dose could be reduced to about half the level experienced during the first three years by means of improvement in this area. It could be still considerably lower with a better configuration of the biological shielding. As a result of the integrated configuration there is a transport of activated corrosion products and their deposits at a few isolated points within the power house, resulting in appreciable radiation fields. However, since only a few personnel work in these areas - and even these only rarely - the percentage of the dose caused by this effect is so small that it can be disregarded.

- 1021 (EPA--520/5-76-015) AIR PATHWAY EXPOSURE MODEL VALIDATION STUDY AT THE MONTICELLO NUCLEAR GENERATING PLANT. Partridge, J.E.; Broadway, J.A.; Phillips, C.R.;

Windham, S.T.; Nelson, C.B. (Environmental Protection Agency, Washington, D.C. (USA)). Sep 1976. 27p. Environmental Protection Agency, Washington, DC.

The results of a study designed to improve the methodology for estimating the population exposures resulting from nuclear power plant gaseous effluents are given. The primary objective of this study was to validate a mathematical model (AIREM) for estimating radiation exposures due to atmospheric radioactive releases. This validation was accomplished by comparing the model predictions with actual field measurements made using pressurized ionization chambers and thermoluminescent dosimeters. Use of this model for predicting external exposures was shown to be quite acceptable for most applications. The usefulness of pressurized ionization chambers for making low-level exposure measurements was also demonstrated by this study.

- 1022 ESTIMATION OF THE VOLATILIZATION RATE OF RADIOIODINE INTO THE ATMOSPHERE. Maekoshi, H.; Orito, T.; Nishizawa, K.; Ohara, K. (Nagoya Univ. (Japan). Faculty of Medicine); Koga, S. Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 9, 803-807(Sep 1976). (In Japanese).

Radioiodine excreted in the saliva and sweat from patients who have been administered large doses of radionuclides for treatment has been found to be the cause of air contamination in the patient's room. Ten samples of filter-paper (Toyo Roshi No. 2) immersed in a solution 2 μ Ci of Na¹³¹I were set in a draught chamber in a laboratory. These samples were periodically measured by a NaI scintillation counter (TEN-PS-200) for 400 hr, and a decay curve accompanied by radioiodine volatilization was obtained. A mean room temperature of 23 $\pm$ 2.5°C, mean relative humidity of 59 $\pm$ 7.7%, and mean air flow rate of 437 m³/hr were maintained during these experiments. Effective half-life of the samples deduced from the decay curve was 6 to 7.3 days, and the rate of volatilization was calculated as 1.2 x 10⁻³ to 3.6 x 10⁻⁴/hr.

- 1023 (AECL--5527) RAMM: A SYSTEM OF COMPUTER PROGRAMS FOR RADIONUCLIDE PATHWAY ANALYSIS CALCULATIONS. Lyon, R.B. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Sep 1976. 38p. NTIS (US Sales Only). 3 refs..

A generalized system of computer programs, designated RAMM (Radioactive Materials Management) system, has been developed to assist in the analysis of the movement of radionuclides through the environment to man. RAMM incorporates the GASP IV continuous/discrete simulation system. A nodal approach is used whereby the system to be analyzed is split up into parts small enough that the distribution of nuclides within the node may be taken to be homogeneous. Pathways are defined between nodes, and appropriate transfer coefficients are input or generated. Output includes the time dependent contents of the nodes and dose rates, integrated doses and dose commitments of selected nodes.

- 1024 RBE VALUES OF HIGH-ENERGY ELECTRON BEAMS AT VARIOUS DEPTHS IN CULTURED MAMMALIAN CELLS. Khalili, K.G.; Takeshita, K. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). J. Radiat. Res.; 17: No. 3, 135-141(Sep 1976).

Mouse leukemic cells (L5178Y) were used to determine the RBE values of high energy electron beams at various depth doses in a water phantom at 37°C. The RBE values of 10, 20

and 30 MeV electrons relative to 180 Kv x-rays were 0.77, 0.83 and 0.86 at 100% depth dose, respectively. The RBE values of 30 MeV electrons were 0.85 at 95%, near the surface, and 0.89 at 68% depth doses. At 18% depth dose, a 0.78 RBE value was detected.

- 1025 (AERE-M--2839) NUCLEAR ACCIDENT DOSIMETRY. REVISION OF EMERGENCY DATA SHEETS. Delafield, H.J. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Sep 1976. 23p. NTIS (US Sales Only).

The Emergency Data Sheets on Nuclear Accident Dosimetry have been revealed following the publication of a three part manual on this subject (Delafield, Dennis and Gibson, AERE-R 7485/6/7, 1973). This memo provides an explanation of the action levels adopted for the initial segregation of irradiated persons following a criticality accident, by monitoring the activity of indium foils contained in personnel dosimeters and the induced body sodium activity. The data sheets are given as an Appendix. They provide basic information on: the segregation of irradiated persons, the estimation of radiation exposure, and the assessment of personnel γ -ray and neutron doses.

- 1026 (BNWL--1915) DOSE-TO-THE-POPULATION EXPOSURE ESTIMATES FOR USE OF PLUTONIUM-238-POWERED ARTIFICIAL HEARTS. McKee, R.W.; Clark, L.L.; Cole, B.M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1976. Contract E(45-1)-1830. vp. Dep. NTIS \$9.00.

Estimates of dose to the population from ²³⁸Pu-powered artificial hearts were developed using a calculational model called REPRIEVE. This model develops the projected user population by incorporating assumptions regarding future heart disease death rates, the fraction dying who would be eligible candidates for artificial hearts, population projections, beginning implant rates, death rates after implant due to natural causes, and deaths caused by device failure. The user population was characterized by age, sex, household description, employment status and occupation. Census data on household descriptions and special surveys in selected cities provided the information necessary to describe persons exposed during both household and public activities. These surveys further defined distance and time of contact factors for these persons. Calculations using a dosimetry computer code defined the relationships between distance and dose. The validity of these calculations has been substantiated by experimental measurements.

- 1027 (BNWL--2022) BIOLOGICAL EFFECTS OF TRITIUM RELEASES FROM FUSION POWER PLANTS. Strand, J.A.; Thompson, R.C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1976. Contract EY-76-C-06-1830. 27p. Dep. NTIS \$4.00.

Tritium released as tritium oxide is a much more significant potential hazard to the environment than is elemental tritium. Although most biochemical reactions discriminate against the incorporation of tritium in favor of hydrogen, the possibility of some concentration should not be overlooked. A fraction of tritium accumulated as tritiated water becomes organically bound, that is, exchanges with hydrogen bound in organic molecules. The rate and extent of incorporation are dependent upon metabolic activity of the organism. On this basis, the highest concentration of organically-bound tritium would be expected in tissues and

population segments which are in formative or growth stages at the time of exposure. Furthermore, as exposure duration increases from acute to chronic situations, tritium concentrations are shown to approach equilibrium levels with a single tritium-to-hydrogen ratio common to all parts of the hydrogen pool. Organic binding would not be expected to result in significant bioaccumulation of tritium from tritiated water. Tritium loss, both from tissue-free water and the tissue-bound fraction, depends upon metabolic activity. Processes that allow accumulation and incorporation of tritium also assist its elimination. Tritium which is organically bound demonstrates a longer half-time, but it would appear to constitute a small fraction of the total tritium label. The radiation exposure of all living organisms by environmentally dispersed tritium, in whatever form, is essentially a whole body exposure. Uncertainties in the individual parameters, involved in converting measured intake to estimated dose equivalent are probably no larger than a factor of three or four. If fusion reactors hold tritium releases with ICRP standards, no significant adverse impact to the environment from those releases are expected.

- 1028 (BNWL-SA--5992) EVALUATING THE EFFECTS OF LOW-LEVEL CHRONIC EXPOSURES. Gilbert, E.S. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1976. Contract E(45-1)-1830. 18p. (CONF-761023--4). Dep. NTIS \$3.50.

From 2. ERDA statistical symposium; Oak Ridge, TN, USA (25 Oct 1976).

Problems involved in assessing health effects of chronic low-level exposures to environmental contaminants are reviewed. This problem is illustrated by a study of health effects of occupational exposure to ionizing radiation at Hanford. Hanford was established in the early forties as an installation for plutonium production. Since this time, over 33,000 workers have been employed, many in jobs involving some exposure to radiation. Yearly records of this exposure, as well as occupational data, are maintained for all such employees. The yearly exposures are measured in rems of ionizing radiation able to reach critical organs of the body. Even for those who routinely work in radiation zones, yearly readings seldom exceed one or two rems. Methods for assessing directly the health effects of continuing relatively small doses of radiation over a number of years are discussed that should be applicable to evaluating exposures to other industrial and environmental contaminants.

- 1029 (CEA-R--4781) ASSESSMENT OF POPULATION DOSES RESULTING FROM RADIOACTIVE RELEASES INTO THE ATMOSPHERE-METHODOLOGY. Garnier, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Sep 1976. 59p. (In French). NTIS (US Sales Only) \$4.50.

The assessment of the collective dose resulting from radioactive releases, required for the assessment of nuclear plant impact on man, is difficult on account of the complexity of the pathways. A method is presented as an example to assess in an average French region the collective doses resulting from continuous release of noble gases and iodine 131. An attempt is made to evaluate the variability of collective and individual doses, which are compared with the doses to the individuals of the more exposed group. Atmospheric concentrations are calculated from average diffusion conditions for French sites. Iodine-

131 concentrations in milk used for the calculation of doses resulting from the ingestion of contaminated milk are assessed, taking account of the use of agricultural lands and marketing of the products. The doses from annual releases of ICI, differ by several orders of magnitude according to the various radionuclides. They should be weighted according to the isotopic compositions of releases from the various types of plants whose impact of the population is to be assessed.

- 1030 (INS-R--196) RADIATION IN RELATION TO MUTATION RATE, MUTATIONAL DAMAGE AND HUMAN ILL-HEALTH. Roberts, P.B. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Sep 1976. 10p. Dep. NTIS (US Sales Only), PC A02/MF A01.

The effect of radiation in increasing the frequency of gene mutations is now reasonably understood. We discuss first how an increase in the mutation rate is reflected in the mutational damage expressed in populations. It is shown that the mutational damage, assessed by the loss of fitness in a population or the number of eventual gene extinctions, is equal to the number of new mutations arising per generation or the mutation rate. In a population of stable size, a dose of 1 rem given to 10^6 people leads to roughly 600 gene extinctions when summed over all ensuing generations if the dose is applied to only one generation; this number of extinctions will occur in each succeeding generation if the dose is given to every generation. However, the concept of genetic extinction, although quantifiable, is of limited value in assessing radiation risks since its impact on human ill-health is very speculative. In particular, no estimate can be made of the total cost of effects which are minor in each individual in which they arise, but which, because they are so minor, persist in the population for many generations. The best current estimate is for 14 to 140 obvious defects in the first few generations following exposure of 10^6 people to a dose of 1 rem.

- 1031 (NRPB-R--43, pp v) GENERAL MEMORANDUM OF EVIDENCE TO THE ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION. Sep 1976.

Evidence given by the National Radiological Protection Board to the Royal Commission on Environmental Pollution: 1974-76.

In the course of an enquiry by the Royal Commission on Environmental Pollution into the organisation for radiological safety in the United Kingdom, evidence was given by the National Radiological Protection Board. The 'general memorandum of evidence' covers the following matters: constitution, functions and responsibilities of the Board; a short statement of the various sources of radiation to which the people of the United Kingdom are exposed; methods by which the basic recommendations of the International Commission on Radiological Protection are translated into values that can be applied to particular forms of practice; radioactive wastes; radiological problems in the protection of persons exposed to plutonium; transport of radioactive materials.

- 1032 (NRPB-R--43, pp v) BOARD'S VIEW ON THE DESIRABILITY OF ITS BEING STATUTORILY CONSULTED BY GOVERNMENT DEPARTMENTS IN RELATION TO NUCLEAR AND ASSOCIATED ENVIRONMENTAL MATTERS. Sep 1976.

Evidence given by the National Radiological Protection Board to the Royal Commission on

Environmental Pollution: 1974-76.

A list is given of the United Kingdom government departments concerned in one way or another with the problems of radiological protection, a summary of the scope of involvement and the present consultative position. The opinion of the National Radiological Protection Board on the future of consultation is stated.

- 1033 (NRPB-R--43, pp v) COMMENTARY ON RECENTLY PUBLISHED CRITICISMS OF THE ICRP PROTECTION LIMITS FOR PLUTONIUM. Dolphin, G.W. Sep 1976.

Evidence given by the National Radiological Protection Board to the Royal Commission on Environmental Pollution: 1974-76.

During the last two years several papers have been published claiming that the exposure limits recommended by the International Commission on Radiological Protection (ICRP) for plutonium are too high. The essential points of these papers and some criticisms of them are given.

- 1034 (NRPB-R--43, pp v) USE OF NUMERICAL GUIDELINES IN THE REQUIREMENT THAT DISCHARGES OF RADIOACTIVITY FROM NUCLEAR INSTALLATIONS SHOULD BE 'AS LOW AS PRACTICABLE'. Richings, L.D.G. Sep 1976.

Evidence given by the National Radiological Protection Board to the Royal Commission on Environmental Pollution: 1974-76.

Reasons are given for the conclusion reached by the National Radiological Protection Board that the formulation of general and arbitrary guidelines could lead to unreasonable operational restrictions and undue expenditure without significant reductions in exposure; and that the main emphasis for the future should be on the process of 'optimisation' as described by ICRP.

- 1035 (NRPB-R--43) EVIDENCE GIVEN BY THE NATIONAL RADIOLOGICAL PROTECTION BOARD TO THE ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION: 1974-1976. (National Radiological Protection Board, Harwell (UK)). Sep 1976. vp. TIC.

Separate abstracts were prepared for individual papers. (ERB)

- 1036 (NRPB-R--46) RADIOLOGICAL PROTECTION STANDARDS IN THE UNITED KINGDOM. Pochin, E.; McLean, A.S.; Richings, L.D.G. (National Radiological Protection Board, Harwell (UK)). Sep 1976. 7p.p. NTIS (US Sales Only).

Available from H.M. Stationary Office, price Pound 0.50.

In view of the interest now being expressed in the means by which radiological protection standards are derived and applied, this report briefly outlines the roles of the international organisations involved, summarises the UK arrangements, and indicates the principal sources of relevant biological information.

- 1037 (ORNL--5191) CHORD SIMULATION FOR INSULT ASSESSMENT TO THE RED BONE MARROW. Jones, T.D. (Oak Ridge National Lab., Tenn. (USA)). Sep 1976. Contract W-7405-ENG-26. 37p. Dep. NTIS \$4.00.

Critical Human Organ Radiation Dosimetry (CHORD) probability density functions for A-P, P-A, bilateral, rotational, and isotropic incidence, plus simple depth-dose data, permit the rapid estimation of the radiation insult to the active red bone marrow system of the ICRP Reference Man. The CHORD concept follows the variations in the microscopic processes of

absorption, attenuation, and scattering on a macroscopic level so that it is not necessary to attempt detailed calculations for each and every case of interest. Similar techniques have been applied to reactor criticality calculations and the general logic of the CHORD process can be applied to any cause-response type situation which can be described in terms of variation with distance in the medium of interest. Doses to active bone marrow from exposures to photons and neutrons are presented and excellent agreement is shown with the few available experimental results.

- 1038 (ORNL/TM--5453) MATHEMATICAL DESCRIPTION OF A NEWBORN HUMAN FOR USE IN DOSIMETRY CALCULATIONS. Hwang, J.M.L.; Shoup, R.L.; Poston, J.W. (Oak Ridge National Lab., Tenn. (USA)). Sep 1976. Contract W-7405-ENG-26. 50p. Dep. NTIS \$4.00.

Estimating absorbed doses to children from external and internal radiation sources has become important to the nuclear industry and pediatric nuclear medicine. The design of mathematical representations of children of ages newborn, 1-year, and 5-years old, referred to as pediatric phantoms, establish a meaningful model for use in estimating radiation dose to children. The newborn (neonate) phantom is described. (CH)

- 1039 (ORNL/TM--5454) MODIFICATIONS AND ADDITIONS TO THE PEDIATRIC AND ADULT MATHEMATICAL PHANTOMS. Hwang, J.M.L.; Shoup, R.L.; Poston, J.W. (Oak Ridge National Lab., Tenn. (USA)). Sep 1976. Contract W-7405-ENG-26. 26p. Dep. NTIS \$4.00.

Mathematical representations of humans one year, five years, and twenty years (adult) of age have been modified and are discussed in detail in the following sections. These modifications include the addition of a mandible and salivary glands in the head section and the inclusion of the gall bladder to the trunk region. These mathematical phantoms are undergoing continuous refinement in response to their increasing usefulness in absorbed radiation dose calculations for both external and internal emitters and diagnostic x-ray procedures.

- 1040 (PB--258653) TASK DESCRIPTIONS IN DIAGNOSTIC RADIOLOGY. RESEARCH REPORT NO. 7. VOLUME 3. MACHINE-RELATED, PATIENT CARE AND ADMINISTRATIVE TASKS. Gilpatrick, E. (Health Services Mobility Study, New York (USA)). Sep 1976. Contract DL-82-34-69-34. 420p. NTIS, PC A18/MF A01.

The volume covers tasks done by radiologists, technologists, nurses and physicists in the areas of administration, teaching, quality assurance, radiation protection, machine maintenance, patient care, processing and housekeeping. The document describes how the material was collected, the coverage, the definition of task, and how to read the task descriptions. It includes a guide to the tasks arranged by system, function, and main type of recipient, respondent or co-worker involved. These task descriptions are offered for use as instructional materials, to help define the appropriate levels and job titles that are emerging in the area of radiation health protection and quality assurance, and for team training. (GRA)

- 1041 (PB--258654) TASK DESCRIPTIONS IN DIAGNOSTIC RADIOLOGY. RESEARCH REPORT NO. 7. VOLUME 4. INDEX OF TASKS BY CODE NUMBER AND EXTENDED NAME. Gilpatrick, E. (Health

Services Mobility Study, New York (USA)). Sep 1976. Contract DL-82-34-69-34. 148p.

Sponsored in part by Hunter Coll., New York, and City Univ. of New York. Research Foundation. See also Volume 3 dated Sep 76, PB-258 653..

The report presents the core data of the first application of the Health Services Mobility Study (HSMS) task analysis method to an entire functional area, i.e., Diagnostic Radiology. This work is reported as follows: Medical tasks: what the radiologist does; Radiologic technologist tasks dealing with patient procedures; Machine-related, patient care and administrative tasks: what radiologists, technologists, nurses, and physicists do to run things and look after patients and equipment; Index of tasks by code number and extended name; Job ladders in diagnostic radiology: assigning tasks to jobs; Safe practice and radiation health protection aspects of tasks; Curriculum objectives for radiologic technology. (GRA)

- 1042 (SAAS--201, pp 3-24) HISTORICAL DEVELOPMENT OF RADIATION PROTECTION LIMITS. Schuettmann, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Sep 1976. (In German).

Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

The present internationally largely corresponding radiation protection limits are based on recommendations given by the ICRP in 1965. In order to better understand the underlying concepts, a historical sketch of the development is presented including actual discussions of trends to be expected. Although exposure of healthy individuals by man-made sources up to these maximum levels is legally permissible, it should be emphasized again and again that any unavoidable exposure must be justified by the need for its associated cause.

- 1043 (SAAS--201, pp 53-64) DOSE RATE MEASUREMENTS AROUND ROENTGEN IMAGE INTENSIFIER UNITS AND INTERPRETATION OF THE DATA. Taschner, P.; Menzel, B.; Koenig, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Sep 1976. (In German).

Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

A study was made of the radiation exposure to operation room staff due to fluoroscopy during surgical work. When using roentgen image intensifiers in the operation theatre, the controlled area is postulated as a circular area around the operating table, the radius being 3 meters.

- 1044 (SAAS--201, pp 65-81) INSTRUCTION FOR DOSE RATE MEASUREMENTS AROUND X-RAY MEDICAL EQUIPMENT. Menzel, B.; Taschner, P.; Koenig, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Sep 1976. (In German).

Report of the National Board of Nuclear Safety and Radiation Protection of the GDR.

Dose rate measurements in X-rays medical departments have to be registered in records according to the specimens given in the annex. These records are to enable more exact intercomparisons of the radiation exposure to medical staff.

- 1045 ELECTIVE WHOLE LUNG IRRADIATION. Caldwell, W.L. (Univ. of Wisconsin, Madison). Radiology; 120: No. 3, 659-666(Sep 1976).

Whole lung irradiation has been effective in 10 of 17 patients irradiated solely electively (no demonstrable metastatic nodules) who are alive and well 2 to 5 years. Of an additional 17 patients with only one or two demonstrable pulmonary metastases (treated with resection or boost therapy plus whole lung irradiation), 6 are alive and well 5 to 8 years. Only one patient developed clinically significant postirradiation pneumonitis and this case proved to be fatal. Elective whole lung irradiation, especially in conjunction with modern adjuvant chemotherapy, shows promise in improving the survival of patients with tumors having a high propensity for metastasizing to the lungs.

- 1046 EFFECTS OF IRRADIATION ON THE EYE. Chan, R.C.; Shukovsky, L.J. (Univ. of Texas, Houston). Radiology; 120: No. 3, 673-675(Sep 1976).

From 61. scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL, USA (30 Nov 1976).

From 1954 through 1971, 47 patients with malignant tumors of the nasal cavity and paranasal sinuses were treated with an entire eye included in the tumor dose volume. All patients were treated with megavoltage radiation and received approximately 6,000 rads in 30 fractions in six weeks. Two thirds of the patients treated by irradiation alone had no problems with vision or difficulties related to treatment of the eye. When 5-fluorouracil (5-FU) was used in conjunction with high-dose radiotherapy, loss of vision was much more frequent and all patients had either visual loss or major clinical difficulties.

- 1047 ESTIMATION OF FETAL DOSE TO PATIENTS UNDERGOING DIAGNOSTIC X-RAY PROCEDURES. Jacobson, A.; Conley, J.G. (Univ. of Louisville, KY). Radiology; 120: No. 3, 683-685(Sep 1976).

The estimation of fetal dose incurred by patients undergoing various radiologic procedures can be very perplexing. The problem is especially critical for women who do not know that they are pregnant at the time of x-ray exposure. A description is offered of efforts to quantitate the fetal dose by after-the-fact calculations. Such conservatively employed calculations may be essential for a clinical decision regarding therapeutic abortion.

- 1048 WORKSHOP ON LATE EFFECTS OF IRRADIATION TO THE HEAD AND NECK IN INFANCY AND CHILDHOOD. Beahrs, O.H. (National Cancer Inst., Bethesda, MD). Radiology; 120: No. 3, 733-734(Sep 1976).

A summary statement from the Workshop on Late Effects of irradiation to the Head and Neck in Infancy and Childhood is presented. The Workshop, conducted by the National Cancer Institute with the cooperation of several other organizations, was convened to determine the present status of knowledge about thyroid disease related to irradiation of the head and neck and to develop guidelines with respect to detection, diagnosis, treatment, and followup. It was decided that surgical exploration should be considered for all palpable thyroid nodules, particularly those that are firm and clearly demarcated and appear as a "cold" area on the scan. Persons at risk because of prior irradiation to the head or neck should have regular reexaminations every one to two years.

- 1049 RADIATION-INDUCED SALIVARY GLAND TUMORS.

REPORT OF A CASE. Smith, S.A. (Univ. of Louisville, KY). Arch. Otolaryngol.; 102: No. 9, 561-562(Sep 1976).

Radiation-induced salivary gland tumors are discussed with special emphasis on those tumors thought to be secondary to childhood head and neck irradiation for benign diseases. I report such a case and review the literature. Statistically, 77.6 percent of irradiation-induced tumors occur in the parotid gland and 22.4 percent in the submaxillary and minor salivary glands. A greater proportion of malignant tumors are noted in the submaxillary and minor salivary glands. At present, there is no demonstrable relationship between tumor occurrence and the amount of radiation received. Young children are more susceptible to irradiation-induced salivary tumors than older individuals.

- 1050 PARAMETRIAL CALCIFICATION IN CERVICAL CARCINOMA PATIENTS TREATED WITH RADIOACTIVE GOLD. Deeths, T.M.; Stanley, R.J. (Washington Univ., St. Louis). Am. J. Roentgenol.; 127: No. 3, 511-513(Sep 1976).

A unique appearance of soft tissue calcification in the pelvis which may be specific for patients treated with parametrial injection of ^{198}Au colloid is described. The calcification appears in the area of maximum radiation dose and can appear within 5 years of treatment. It is significant because it occurred in approximately one-half of the cases radiographically reviewed and may be confused with calcification from other etiologies.

- 1051 MATHEMATICAL MODEL OF THE HUMAN BODY FOR CALCULATION OF LETHAL OUTCOME PROBABILITY OF UNEVEN IRRADIATION. Obaturov, G.M. (Scientific-Research Inst. of Medical Radiology, Obninsk, USSR). Med. Radiol.; 21: No. 9, 70-76(Sep 1976). (In Russian).

The human body is regarded as a complex of individual independent systems (bone marrow, gastro-intestinal tract, etc); irradiation of each system in lethal doses causes death. It is established that the probability of the lethal outcome depends both on the dose and the part of the irradiated mass of the organism, this probability corresponding to the integral function of normal distribution. For the bone marrow the migration of the stem cells from the nonirradiated (or weakly irradiated) part of the brain to the irradiated one is taken into consideration. A formula for calculation of the probability of the lethal outcome is proposed.

- 1052 ABUSE OF NUCLEAR POWER. Hill, J. (UKAEA). Atom (London); No. 239, 236-241(Sep 1976).

From Nuclear power and the public interest - the implication for business; London, UK (8 Jul 1976).

This paper reproduces an address by Sir John Hill, Chairman of the United Kingdom Atomic Energy Authority, at a conference in London organised by the Financial Times in July 1976. Actions that, in the author's view, could be regarded as constituting abuse of nuclear power are first summarised, and the various aspects of the use and abuse of nuclear power are discussed. The author considers that achieving the maximum degree of acceptance of the Non-Proliferation Treaty is the most important political objective in nuclear power, but considers that nuclear terrorism would be abortive and that, so far as the UK is concerned, the present precautions are adequate and will remain so. It is considered that much abuse of nuclear power arises from the prevalence of its critics, particularly with

reference to Pu hazards, the health of nuclear employees, and possible damage to the health of the public. The Pu problem is considered to be far more emotive than rational. The possibility of lung cancer and leukaemia is discussed. It is concluded that atomic energy is one of the best of industries in which to work, both from the health and interest points of view.

- 1053 VALUE OF LEAD SHIELDS IN REDUCING RADIATION DOSAGE TO THE EYE DURING NEURORADIOLOGICAL PROCEDURES. Dowding, D.V. (Southampton General Hospital (UK). Wessex Neurological Centre); Whall, M. Radiography; 42: No. 501, 181-184(Sep 1976).

The dose of radiation delivered to the crystalline lens of the eye during diagnostic X-ray examinations is significant, particularly in conventional neuroradiological procedures such as angiography and pneumoencephalography which involves large numbers of exposures. Experiments have therefore been devised to record the radiation level present in the vicinity of the eyeball during plain and contrast radiography of the skull. A description is given of the construction and performance of protective lead eyeshields designed for use during certain types of skull radiography. Measurements made during the examination of patients and with a phantom skull indicated that a ten-fold reduction in radiation dose to the eye could be achieved through their use during certain diagnostic procedures.

- 1054 RADIOTOXIC HAZARD DURING THE IODINATION OF PROTEINS. Restall, S.W.F. (Microbiological Research Establishment, Porton (UK)). Lab. Pract.; 25: No. 9, 581-582(Sep 1976).

The potential radiological hazards involved in the technique of radioimmunoassay, including the possibility of laboratory contamination leading to thyroid contamination of personnel during the radioiodination of proteins with ^{125}I is discussed. A safety cabinet suitable for carrying out such work is described. Air sampling and thyroid monitoring are recommended as routine safety precautions in order to check that handling techniques are satisfactory.

- 1055 RADIATION EXPOSURE FROM EMI SCANNER - MULTIPLE SCANS. Horsley, R.J.; Peters, V.G. (Ontario Cancer Treatment and Research Foundation, Hamilton (Canada)). Br. J. Radiol.; 49: No. 585, 810-811(Sep 1976).

Estimates have been made of the effect of the multiple adjacent scans of an EMI scanner on the radiation exposure to the skull, since the total field size for a full series of scans is such that considerable backscatter is to be expected. Measurements were made using capsules of LiF powder distributed around the circumference of a Rando phantom skull in the plane of the scan. Normal operating conditions of 120 kV, 32 mA were employed. No measurements were made inside the skull, and exponential attenuation was assumed in order to obtain the isodose lines. The results for multiple scans, subsequently verified by measurements on patients, confirmed that scatter doses from adjacent scans are not negligible. The dose to the cranium of patients undergoing routine skull examinations on the EMI scanner is therefore higher than previous estimates. Although doses measured for a single scan were consistent with published data, contributions from scattered radiation from adjacent scans were significant for multiple adjacent scans. A series of three transverse axial skull scans using the EMI scanner gave peak dose of 4.0 to 5.0 R depending upon the size of the skull. It

is recommended that patient exposures from different models of computerized transverse axial brain or body scanners should be thoroughly evaluated, particularly with regard to sensitive body structures.

- 1056 RADIATION-INDUCED CHROMOSOMAL ABERRATIONS IN HUMAN LYMPHOCYTES. 1. DEPENDENCE ON THE DOSE OF GAMMA-RAYS AND AN ANOMALY AT LOW DOSES. Luchnik, N.V.; Sevankaev, A.V. (Akademiya Meditsinskikh Nauk SSSR, Obninsk. Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii). *Mutat. Res.*; 36: No. 3, 363-378 (Sep 1976).

Cultures of human lymphocytes obtained from the blood of healthy adult donors were irradiated with different doses of ^{60}Co γ -rays and the irradiated cells were analysed in metaphase 50 h after irradiation. The effect (total yield of aberrations of chromosome type, or total yield of exchange type aberrations) produced by the lowest dose (5 rad) appears to be statistically significant in a sample of 1500 cells. In the usual dose range (25-400 rad), both parabolic and linear-quadratic equations give a satisfactory fit of experimental data (dicentric, fragments, or all aberrations of chromosome type). Low doses of γ -rays, however, produced more aberrations than expected, if one extrapolates dose-effect curves from higher doses. Both relations should be considered, therefore, merely as empirical equations. Dicentric show at low doses (10-30 rad) a plateau which appears to be statistically significant. Some indications are obtained that the total number of chromosome-type aberrations is a more reliable criterion of cytogenetic damage than the usually accepted yield of dicentric and rings.

- 1057 USE AND EFFECT OF X-RAY PROTECTIVE CLOTHING. Rothe, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). *Dtsch. Gesundheitswes.*; 31: No. 38, 1794-1796 (Sep 1976). (In German).

The use of X-ray protective clothing in direct handling the patient was studied in 76 X-ray departments. Mainly two types of lead rubber aprons are used, older ones with a lead equivalent of 0.2 mm and aprons according to TGL 200-1606 with a lead equivalent of 0.25 mm. Aprons are not yet worn in all surgical departments. Their replacement by protective skirts is to be refused. If at all, lead rubber gloves are only used in standardized fluoroscopic examinations, especially in examining the gastrointestinal tract. It is emphasized that only the protected fore-part is to be directed to the main radiation source, especially in seating or leaning forward positions.

- 1058 RADIATION AND MAN. THE 1973 SIEVERT LECTURE. Lindell, B. (National Institute of Radiation Protection, Fack, Stockholm (Sweden)). *Health Phys.*; 31: No. 3, 265-272 (Sep 1976).

This lecture appeared in *Proc. 3rd international congress of IRPA, Sep 1973*.

The radiation doses received by man from natural sources are considered with especial reference to those which arise from normal building materials. Considering dose/effect relationships, the concept of a dose threshold for such risks is examined. It is concluded that it is not meaningful to give dose limits for natural radiation but that there is no reason to exempt natural radiation from cost-benefit assessments as far as countermeasures are concerned. In addition any practice that

results in radiation exposures should be subject to a risk-benefit assessment. Other exposures to which man is commonly exposed, especially x-rays for diagnosis, are considered in the light of such risk-benefit analysis. Finally risk-benefit assessments and their replacement by agreed dose limits for the protection of workers in certain areas such as radiology and uranium mining are considered. It is shown that radiation sources differ widely with regard to dose commitment and harm commitments.

- 1059 ROLF M. SIEVERT: THE PIONEER IN THE FIELD OF RADIATION PROTECTION. Morgan, K.Z. (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering). *Health Phys.*; 31: No. 3, 263-264 (Sep 1976).

The enormous contribution of Rolf M. Sievert to the science of radiation protection in over 40 years is outlined. His main contributions to clinical physics were from 1920 to 1940 and in 1941 he was primarily responsible for developing the first Swedish radiation protection laws. His institute, under his leadership, was in charge of radiation protection problems in Sweden until he retired in 1965. Sievert was not only the leader in radiation protection in his own country, but he was a giant in the world community. His personal character is praised.

- 1060 REQUIREMENTS FOR APPLICATION FOR CERTIFICATION BY THE AMERICAN BOARD OF HEALTH PHYSICS. *Health Phys.*; 31: No. 3, 257-262 (Sep 1976).

The requirements for candidates for certification by the American Board of Health Physics including the necessary academic qualifications, length of experience, professional status, the ability to submit radiation protection evaluations and the passing of two written examinations, are stated.

- 1061 ADRIAMYCIN AND ENHANCED RADIATION REACTION IN NORMAL ESOPHAGUS AND SKIN. Greco, F.A.; Brereton, H.D.; Kent, H.; Zimble, H.; Merrill, J.; Johnson, R.E. (National Cancer Inst., Bethesda, MD). *Ann. Intern. Med.*; 83: No. 3, 294-298 (Sep 1976).

Clinical evaluation of 10 patients with small cell carcinoma of the lung treated with radiotherapy and periodic cycles of combination chemotherapy with cyclophosphamide, vincristine, and adriamycin showed frequent and occasionally severe esophageal and skin reactions. Eight of the 10 patients had esophagitis, four required supportive intravenous fluids, and two subsequently developed esophageal narrowing and stricture formation. Recurrent esophagitis with augmentation of injury in the recently irradiated esophagus was observed 11 times in eight of the 10 patients after cycles of chemotherapy, and contributed to the sustained toxicity seen in two patients. Dermatitis in the form of moist desquamation was observed in five of the patients at very low doses of supervoltage radiation therapy. Acute pulmonary reactions were notably absent. This combination of chemotherapy, particularly adriamycin, potentiates the effect of radiotherapy on the normal esophagus and skin, and further implicates the radiosensitizing property of adriamycin.

- 1062 INFECTIOUS DISEASES IN ATOMIC BOMB SURVIVORS. STATISTICAL STUDY ON AUTOPSY CASES, 1965-1975. Hamada, T.; Ishida, S.

(Hiroshima Atomic Bomb Hospital (Japan)); Matsushita, H. Nagasaki Igakkai Zasshi; 51: No. 3, 237-245 (Sep 1976). (In Japanese).

Incidences of various infectious diseases in 986 autopsy cases at Hiroshima Atomic Bomb Hospital and Hiroshima Red Cross Hospital from 1965 to 1975 were compared according to the distance from the explosion place, and the following results were obtained. There was not a significant difference at incidences of most infectious diseases between each exposed group and not-exposed group. Incidence of old tuberculosis focus was a little higher in exposed groups, but incidences of main lesions such as tuberculosis, active tuberculosis, and miliary tuberculosis were lower in exposed groups and effect of exposure was negative. Out of urinary tract infections, the nearer the distance to the explosion place was, the higher incidence of cystitis in female was. Incidence of cystitis of female was higher than that of male in the group exposed near to the explosion place. With respect to stomach cancer, leukemia, malignant lymphoma, and cerebrovascular disorder, the nearer the distance to the explosion place was, the higher incidences of various infectious diseases were.

- 1063 SISTER CHROMATID EXCHANGE RATE IN PERIPHERAL HUMAN LYMPHOCYTES EXPOSED TO RADIATION AND CHEMICAL AGENTS. Pant, G.S.; Kamada, N.; Tanaka, R. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Nagasaki Igakkai Zasshi; 51: No. 3, 165-170 (Sep 1976).

Sister chromatid exchanges (SCEs) in lymphocyte chromosomes of atomic bomb survivors and normal individuals were detected by the F. P. G. technique. No difference was observed in the incidence of SCEs in these two groups. In order to confirm the results of an in vivo study, lymphocytes from normal individuals were irradiated with different doses of gamma rays. A slight but not statistically significant increase in the incidence of SCEs between 0 and 100 rads was observed, whereas chromosome aberrations were increased significantly with the dose of radiation. Irradiated serum and medium increased the incidence of chromosome aberrations but not SCEs. One of the in vitro experiments, with DNA damaging chemicals, showed a high incidence of SCEs. In spite of induction of chromosome aberration by chemical agents and radiation, SCEs are induced by only chemical agents, which suggests that the nature of DNA damage by these agents and the mode of its repair may be different.

- 1064 STATISTICAL OBSERVATION ON AUTOPSY CASES OF MALIGNANCY AT THE JAPANESE RED CROSS, NAGASAKI ATOMIC BOMB HOSPITAL. Takahara, O.; Toyoda, S.; Tsuno, S.; Mukai, H.; Uemura, S. (Nagasaki Atomic Bomb Hospital (Japan)). Nagasaki Igakkai Zasshi; 51: No. 3, 206-212 (Sep 1976). (In Japanese).

Statistical observation was made as to autopsy cases of atomic-bomb survivors in Nagasaki. The total of autopsy cases at the Japanese Red Cross, Nagasaki Atomic Bomb Hospital from the opening of the hospital, 1968, to December in 1975 was 1,486 cases (autopsy rate, 65.1%) in which 880 cases of atomic bomb survivors (autopsy rate, 68.0%) were contained. Cases of malignancy totaled 829 and 528 cases of those were atomic bomb survivors. Cases of malignancy were divided into three groups, that is, group exposed to atomic bomb at place within 2 km from the explosion place, group exposed at place from more than 2 km or entering after explosion into the city, and not-exposed group. Relationship

between main malignancies and exposure was discussed, and the following results were obtained. 1) Obvious relationship was found to exist between exposure and acute and chronic medullary leukemia. 2) Malignant lymphoma was scarcely correlated with exposure, but its occurrence rate was higher than the mean rate in Japan in reflection the region where this disease occurs much geographically. 3) Relationship between exposure and stomach cancer, lung cancer, cancer of the large intestine, and double cancer was not found obviously, but occurrence rate of hepatic cancer was higher than the mean rate in Japan in three groups. The reason was supposed to be geographical factor. 4) Cases of thyroid gland cancer were a small number in female of the group exposed within 2 km, and cases of prostate cancer were a small number in the group within 2 km, but their occurrence rate was high specifically.

- 1065 CYTOGENETIC STUDY OF THE OFFSPRING OF ATOMIC-BOMB SURVIVORS. Awa, A. (Radiation Effects Research Foundation (Japan)). Nagasaki Igakkai Zasshi; 51: No. 3, 273-276 (Sep 1976). (In Japanese).

Cytogenetic changes by exposure was discussed based on the data in United Nations Scientific Committee on Effects of Atomic Radiation (UNSCEAR, 1972) with mice and author's investigation on children of the atomic-bomb survivors. According to the experiment with mice reported in the UNSCEAR, the incidence of translocation in the spermatogonium increased in accordance with increased doses of neutron, x-ray and γ -ray irradiation, and decreased after a certain amount of doses, the peaks being 100 rad in neutron irradiation, 700 rad in x-ray and γ -ray irradiation. Such decreased of spermatogonium possessing translocation in itself indicated the fact that these cells might be naturally selected under the irradiation with high amount of dose. As the result, manifested abnormality in the first spermatocyte decreased. The investigation on the children of atomic-bomb survivors was done in two groups; a group of children whose parents were non-exposed or exposed below 1 rad of exposure and a group of children whose parent or both parents were exposed above 1 rad of exposure. The results were compared to the data on the newborn groups. The incidence of aberration in the number of the chromosomes was slightly higher in the exposed group than in the non-exposed group, however, there were no significant differences between them. It might be because unbalanced type abnormality was naturally selected by abortion and balanced type abnormality wasn't manifested. Further abnormality would be selected naturally either.

- 1066 GENETIC EFFECTS OF ATOMIC BOMB RADIATION ON GROWTH OF STATURE OF F_1 GENERATION. Furusho, T. (Kagoshima Univ. (Japan). Faculty of Medicine). Nagasaki Igakkai Zasshi; 51: No. 3, 259-270 (Sep 1976). (In Japanese).

On the basis of the data on stature of high school students aged from 15 to 17 in Hiroshima Prefecture, exposed group was divided into two groups. One was both-parents exposed group and the other was one-parent only exposed group. Each group was subdivided into 1 rad > exposed group and 1 rad $\leq$ exposed group to compare the difference of mean stature and variance between the exposed group and the non-exposed group. In both-parents exposed group, the difference of variance, third central moment and covariance was revealed to be frequently plus, except for the difference of mean in 16-year-old female group exposed 1 rad >. However, the difference

of fourth central moment and correlation showed no definite tendency. Difference of mean was minus in many children of the father exposed and mother non-exposed group, but was plus in the contrary group. In other groups, no definite tendency was found. Regression analysis of exposure dose of parents from mean value of children showed no particular results, including non-exposed group or not. However, minus regression coefficient was more frequently seen on statistically significant level. Estimated value of induced mutation rate of polygene by A-bomb radiation, which effected on stature per generation, site of polygene in co-ordinate and 1 rad, was very low. As it was, however, the estimated value per 1 rad, it seemed to be not necessarily low. Concerning on the induced mutation rate, similar results were obtained in both-parents exposed group and one-parent only exposed group.

- 1067 CLINICAL PICTURE OF CHRONIC GRANULOCYTIC LEUKEMIA IN THE EARLY STAGE. A RETROSPECTIVE ANALYSIS FROM ATOMIC BOMB SURVIVORS. Kamada, N.; Oguma, N.; Tanaka, R.; Ohkita, T.; Takahashi, H. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Nagasaki Igakkai Zasshi; 51: No. 3, 175-179 (Sep 1976). (In Japanese).

Subjects were selected from Atomic-bomb survivors who exposed at the time of bombing, or exposed when the subject visited the City several days after bombing and received health examinations regularly through before and after the manifestation of chronic granulocytic leukemia (CGL), and whose records were held satisfactorily. Subjects consisted of 5 males and 11 females. Two subjects were exposed in the area 1 km. from the hypocenter, 13 were exposed in the area from 1 to 3 km. and one subject was exposed after the bombing. The mean age of subjects were 47 years old. Examined items were as follows; blood picture urinary findings, blood pressure, WBC count, neutrophilic AP value, and iron in the serum up to manifestation of CGL, and vitamin B₁₂ value in some cases. The data was recorded in the table with passage of time, and the changes in blood picture before and after the manifestation of CGL were studied. CGL development didn't appear suddenly but appeared through a series of steps involving appearance of Philadelphia chromosomes, increase of basocytes, increased white blood cells 10,000 to 20,000, decrease in neutrophilic AP value, increase of Vitamin B₁₂, and palpable spleen, and the course prior to manifestation of the symptoms was about 2 years. The patients with early detected, and early treated CGL survived for 38.1 months while the patients with delayed treatment survived 23.3 months on the average. Such findings was very useful for the early selection of CGL and for prolongation of life in atomic-bomb survivors suffering from CGL.

- 1068 LEUKEMIA AMONG HIROSHIMA A-BOMB SURVIVORS FROM 1971 TO 1975. Ohkita, T.; Takahashi, H.; Kawakami, M.; Shigeta, C. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology); Shimizu, H. Nagasaki Igakkai Zasshi; 51: No. 3, 171-174 (Sep 1976). (In Japanese).

The number of death from leukemia between 1971 - 1975 was 134. 91 cases of them were born before A-bomb explosion. Out of 91 cases, 34 cases were exposed within 5 km from the hypocenter, 23 cases were exposed within 2 km, and 18 cases were exposed within 1.5 km. There were 10 cases of early entrants after A-bomb explosion (till August 16). The mortality from leukemia was the highest in 1975. With respect to the type of leukemia in 23 cases exposed

within 2 km from the hypocenter, acute leukemia was seen in 17 cases and chronic leukemia, in 16 cases. Age of 15 cases was over 60 years old, 10 cases were males and 13 cases were females. According to the calculation from 1971 - 1974, the mortality from leukemia among the proximally exposed was higher in both female and male than that of the mean in Japan. The relative risk in the exposed within 1.5 km was about 3 times of the mean in Japan and about 1.8 times in the exposed within 2 km. With respect to the estimated exposure dose in 23 cases exposed within 2 km, 7 of 8 cases in the range from 10 to 99 rad were exposed to over 40 rad. 4 cases received 0 rad, and further 3 cases were not subject for dose estimation. The number of leukemia found out in the physical examination of A-bomb survivors was 8 of acute leukemia and 10 of chronic leukemia. The incidence rate of leukemia was 3.4 (per 100,000 population per year) which was not over the estimated number of about 4 calculated from the mortality from leukemia in Japan.

- 1069 COMMENTS ON THE EXPOSURE DISTANCE AS A FACTOR OF SEVERITY OF A-BOMB CATARACTS. Sugimoto, S. (Sugimoto Ophthalmological Clinic, Hiroshima (Japan)). Hiroshima Igaku; 29: No. 9, 1042-1046 (Sep 1976). (In Japanese).

In the study of A-bomb disorders, it is important in decision of exposure dose to consider not only exposure distance from the hypocenter but also shelter factors, and 8 cases were reported as examples. Group 1 (4 cases) was exposed to A-bomb in the train 750 m east of the hypocenter, and group 2 (4 cases) was exposed in the concrete steel building 620 m east of the hypocenter. Age, exposure distance, exposure place, shelter condition, wounds, acute symptoms due to A-bomb exposure, radiation dose, condition of turbidity of the crystalline lens, effect of A-bomb on visual acuity of eight cases were listed in table. Group 1 was exposed to A-bomb at the place 130 m from the place where group 2 was exposed, but the exposed dose of group 1 was equivalent to twice that of group 2. Acute symptoms due to A-bomb exposure, turbidity of the crystalline lens, and effect of A-bomb on visual acuity were by far stronger in group 1 than in group 2. It was stressed that physical history and treatment course of the patients with A-bomb cataract were enough to be important materials on the study of A-bomb disorders.

- 1070 TWO CASES OF PRIMARY ACQUIRED SIDEROBLASTIC ANEMIA AND ATYPICAL LEUKEMIA WITH CHROMOSOMAL ABNORMALITY IN ATOMIC BOMB SURVIVORS. Tagawa, M.; Sadamori, N.; Matsunaga, M.; Tomonaga, Y.; Nonaka, M. (Nagasaki Univ. (Japan). School of Medicine). Nagasaki Igakkai Zasshi; 51: No. 3, 180-184 (Sep 1976). (In Japanese).

Case 1 was a 81 year old male who was exposed to A-bomb at the place 1.9 km from the hypocenter (the estimated exposure dose of 13 rad) when he was 52 years old. He was pointed out Hb 5.0 g/dl in the health examination of 1975, and he was diagnosed as primary acquired sideroblastic anemia from a result of examination. In analysis of chromosomes, nucleus of abnormal type was recognized, but structural abnormality was not found out. Case 2 was a 80 year old male with symptoms of diarrhea, epilation, and blood-spot, who was exposed at the place 1.4 km far from the hypocenter when he was 51 years old. In January of 1976, fever, cough and sputum appeared, and neutropenia was pointed out as a result of routine examination. Furthermore, from a result of detailed examination, he was diagnosed as a typical leukemia with neutropenia and

monocytosis. Abnormal type 7sub(q)- was recognized in chromosome. Case 1 was leukemia induced by exposure within a range of low dose, so that it was impossible to estimate the effect of exposure to A-bomb. It seemed likely that case 2 was delayed disorder induced by exposure, because it showed acute symptoms by exposure.

- 1071 HISTOLOGICAL CHANGES OF SALIVARY GLANDS IN AUTOPSY CASES AMONG ATOMIC BOMB SURVIVORS. I. YOUNG AGED AND PROXIMALLY EXPOSED CASES. Takeichi, N.; Hirose, F.; Fukazawa, K. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology); Yamamoto, T. Nagasaki Igakkai Zasshi; 51: No. 3, 201-205(Sep 1976). (In Japanese).

Subjects were twenty males and 9 females who were exposed by atomic bomb in Hiroshima within 1,500 m. from the hypocenter, and died during 1958 to 1967. Controls were the non-exposed whose ages were within the same range to the exposed, and who died during the same period. Among exposed subjects, 6 of 12 males (50 per cent) showed total of 8 masses of adenoma or ductal hyperplasia in the salivary glands, and 2 of 9 females showed 2 lesions of ductal hyperplasia (22.2 per cent), and no masses of adenoma. Among controls, 3 of 13 males (23.1 per cent) revealed neoplastic changes, such as adenoma and ductal hyperplasia, and 1 of 15 females revealed neoplastic changes of adenoma. The incidence of neoplastic changes in the exposed male, 50 per cent, was 2.2 times that in the controls, 23.1 per cent, and the incidence of all the exposed, 8 of 21 subjects (38.1 per cent) was about 2.7 times that in the controls, 4 of 28 subjects (14.3 per cent). The results demonstrated the higher incidence of neoplasia in the salivary glands in the exposed subjects in Hiroshima.

- 1072 LATE AND LATENT EFFECTS OF ATOMIC BOMB ON CHROMOSOMES IN THE EXPOSED POPULATION. Tanaka, R.; Kamada, N. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Nagasaki Igakkai Zasshi; 51: No. 3, 277-281(Sep 1976). (In Japanese).

Cytogenetic changes of exposed individuals, and the diseases and cytogenetic changes of the F_1 were discussed. The subjects exposed within 0.5 km. from the hypocenter revealed chromosomal aberration of the bone marrow in 83 per cent and those within 0.5 to 1.0 km. from the hypocenter revealed it in 47 per cent. The aberration was mostly the stable type, and was frequent in deletion, balanced-type translocation, unbalanced-type translocation, and inversion, in the order named. The number of abnormal clone varied with year. The chromosomes of the lymphocytes in the peripheral blood also showed high rate of stable type aberration, and the chromosomes were also aberrant in the fibroblasts of the keloid lesion. However, there were no abnormalities in the spermatogonium. Thirty seven subjects of F_1 group included 13 subjects whose father had been exposed, 19 subjects whose mother had been exposed, and 5 subjects whose both parents had been exposed. The diseases seen in the F_1 subjects were hematonosis in 28 subjects, autoimmune diseases in 5 subjects, and hypertension and lymphadenitis in 4 cases. Acute myelogenic leukemia (AML) showed normal chromosomes in all the 3 cases, the acute lymphatic leukemia (ALL), showed abnormal clones in 2 of 3 cases. Chronic myelogenic leukemia (CML) revealed abnormal chromosomes in all the 3 cases. The cytogenetic changes of abnormal clone in the F_1 of non-exposed were 60 per cent in AML, 57 per cent, in ALL and 100 per cent in CML.

- 1073 CHROMOSOME ABNORMALITIES IN ATOMIC BOMB SURVIVORS. Tomonaga, Y. (Nagasaki Univ. (Japan). School of Medicine). Nagasaki Igakkai Zasshi; 51: No. 3, 282-286(Sep 1976). (In Japanese).

Chromosome abnormalities in bone marrow cells were recognized in 6 cases which consisted of one case of chronic myelogenous leukemia, two cases of acute myelogenous leukemia, one case of sideroblastic anemia, and two cases of myelodysplasia. Frequency of stable type chromosome abnormalities in bone marrow cells was investigated in 45 atomic bomb survivors without hematologic disorders and 15 controls. It was 1.4% (15 cases) in the group exposed to atomic bomb within 1 km from the hypocenter, which was significantly higher as compared with 0.1% (15 cases) in the group exposed to atomic bomb over 2.5 km from the hypocenter and 0.2% in normal controls. Examination of chromosome was also made on 2 of 3 cases which were the seconds born of female with high chromosome abnormality, who was exposed to within 1 km from the hypocenter, and healthy male exposed 3 km from the hypocenter. These two cases showed chromosome of normal male type, and balanced translocation was not recognized. There was not a significant difference in chromosome abnormalities between the seconds of atomic bomb survivors and controls.

- 1074 SYNTHETIC MEDICAL STUDIES ON A-BOMB SURVIVORS EXPOSED IN NEAR DISTANCES FROM THE HYPOCENTER, 5. RESULT OF PHYSICAL MEASUREMENTS. Yamamoto, H.; Ohya, M.; Okamoto, M.; Kamada, N.; Kuramoto, A. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Nagasaki Igakkai Zasshi; 51: No. 3, 226-230(Sep 1976). (In Japanese).

The examinations of physique and physical strength of aging were performed in A-bomb survivors exposed in near distance from the hypocenter consisting of 8 male (from 47 to 78 years old) and 6 female (from 39 to 54 years old), and the intermediate results were reported in this paper. All the subjects were suffering from some diseases at the time of measurement. The subjects had no common property of physiques. The respiration rate per second in the male subjects was higher than that in the group of subjects with low dose exposure, and that in the female subjects was lower than that in the group of low dose exposure. The grasping power in the male was almost the same with that in the group of low dose exposure, and that in the female was lower than that in the group of low exposure. The problems found in examining the physique and physical strength of such A-bomb survivors were represented.

- 1075 SOME EXAMINATION ON THE A-BOMB EXPOSED POPULATION AND THE NUMBER DECEASED THROUGH THE POPULATION CHANGES IN CENSUS. 2. AN OUTLINE OF THE ESTIMATED RESULTS, NAGASAKI. Yuzaki, M.; Ueoka, H. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Nagasaki Igakkai Zasshi; 51: No. 3, 135-139(Sep 1976). (In Japanese).

The population of Nagasaki City was estimated from the source materials such as the national census and the census of the population taken from 1920 to 1950, and values obtained were discussed. During the period from 1944 to 1945, the population of Nagasaki prefecture showed remarkable changes, such as abnormal decrease of 130 thousands (47.6 per cent) in Nagasaki City, and increase of 83

thousands (10.3 per cent) in the suburban districts. The fact indicated that the changes of population were owing to the decrease by atomic bomb exposure, and the considerable number of population drained from Nagasaki City to the suburban districts. The population in 1945 was estimated to 286 thousands based on the changes of the population in the past when the actual population was 142 thousands being the defect 144 thousands. As this defect also included the survivors who had settled out from Nagasaki City, the estimation of the defective population revealed to be 90 thousands, by the examination on the increased population and increasing rates in the preceding year in the neighbouring 4 rural districts, and on the above-mentioned estimation of the population in 1945. In addition, draftees who had been working in Nagasaki Prefecture might resettle out to other prefectures because of the derequisition in the latest period of the War being the conjecture 20 thousands people. The real defective population was conjectured to be 6 to 7 thousands.

- 1076 INVESTIGATION OF STOMACH DISEASES IN ATOMIC BOMB SURVIVORS. Itoh, C.; Naitoh, Y.; Kumasawa, T. (Hiroshima A-Bomb Survivors Health Control Clinic (Japan)). Nagasaki Igakkai Zasshi; 51: No. 3, 231-237 (Sep 1976). (In Japanese).

Fluororontogenography of stomach was carried out on the cases of which stool-test was positive at the time of general physical examinations from October, 1971 to September, 1975. Necessity rate of detailed examination was high in male, but there was no difference by exposure condition between female and male. Rate of detailed examination carried out tended to be high in female, but there was no difference by exposure condition. Rate showing abnormal findings was high in male, and was high in the aged of both female and male. Rate showing abnormal findings according to exposure condition was higher in the group exposed directly to atomic bomb over 2.1 km from the hypocenter, in the group who entered city after explosion, and in other groups than in the group exposed within 2 km from the hypocenter. In findings of the detailed examinations, incidence of gastric ulcer was high in young fellows and male, and incidence of gastric polyp was high in the aged of female. Incidence rate of stomach cancer was high in male, and it increased with increase of age in both female and male. Estimated incidence rate of stomach cancer by exposure condition seemed to be high in the group exposed directly within 1 km from the hypocenter. However, a statistically significant difference was not recognized because of small samples. Incidence rate of stomach cancer by sex was higher in females exposed proximally.

- 1077 ESTIMATION OF BIOLOGICAL AGE ON ATOMIC BOMB SURVIVORS BY MULTIVARIATE ANALYSIS. Matsushita, H. (Hiroshima Red Cross Hospital (Japan)); Hamada, T.; Kawagoe, K.; Nakamaru, S.; Shigenobu, T. Nagasaki Igakkai Zasshi; 51: No. 3, 143-149 (Sep 1976). (In Japanese).

The subject was 415 persons picked up from about 3000 persons admitted to human dock of Hiroshima Red Cross Hospital, according to the selective standards of blood pressure, the number of erythrocyte, value of blood sugar and PSP value. The subjects were classified into the nonexposed group, the group exposed within 2 km from the hypocenter and the group exposed over 2 km + the group of entrants by sex. Age ranged from 30 to eighties. The examination items were 14 items effective for estimation of biological age of the aged. Calculation of the

mean value and standard deviation by each group, simple correlation analysis, multivariate analysis and multiregression analysis were made by using computer, and then estimated age and degree of aging were calculated. The exposed within 2 km showed accelerated aging of 2 to 3 years in male and 4 to 6 years in female as compared with nonexposed, and 1 to 3 years in male and 1 to 6 years in female as compared with the exposed over 2 km + the entrants. The accelerated aging by A-bomb effect was not recognized in the exposed over 2 km + the entrants.

- 1078 CYTOGENETIC STUDY ON PERIPHERAL LEUKOCYTES OF A-BOMB SURVIVORS WITH CANCER. Nerishi, S. (Radiation Effects Research Foundation, Nagasaki (Japan)). Nagasaki Igakkai Zasshi; 51: No. 3, 163-164 (Sep 1976). (In Japanese).

The subject was 32 A-bomb survivors (18 cases in Hiroshima and 14 cases in Nagasaki, 5 males and 27 females of ages 28 to 77, and 48.5 year old of the mean age) who were diagnosed as malignant neoplasms from results of adult health study. 32 cases of A-bomb survivors with benign neoplasms were used as control. Discussion was made on the subjects, excluding 3 cases, of which cell cultivation was impossible. In 18 cases which did not received medical exposure, incidence rate of leukocytes with chromosome abnormality was 0.4% at 0 rad of the estimated dose, 4.5% at 1 to 299 rad, and 7.3% at over 300 rad, respectively, and it increased with increase of dose. 24 cases of controls, which did not received medical exposure, also showed the same tendency. In 11 cases which received medical exposure, incidence of leukocytes with chromosome abnormality was high in the exposed group (15.6%) and the nonexposed group (61.7%), and there was not a difference between them. From the above-mentioned results, it can be concluded that chromosome abnormalities in peripheral leukocytes of A-bomb survivors with malignant neoplasms are caused by exposures both of A-bomb exposure and medical exposure, and they increase significantly with the increase of dose.

- 1079 COMPARATIVE STUDY ON ATOMIC BOMB SURVIVORS WHO WERE EXPOSED PROXIMALLY, 4. CLINICAL AND LABORATORY FINDINGS. Ohya, M.; Okamoto, N.; Kamada, N.; Kuramoto, A.; Kurihara, M. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Nagasaki Igakkai Zasshi; 51: No. 3, 222-225 (Sep 1976). (In Japanese).

Discussion was made as to clinical findings in 24 A-bomb survivors exposed proximally within 500 m (ages of 39 - 81, the mean 56) by Research Institute for Nuclear Medicine and Biology. As a result, 24 survivors had many diseases (the mean was 6 diseases), and this was thought to be caused by unbalance of investigation subjects. As diseased organs, digestive system, circulatory system and respiratory system were mentioned and changes in these organs by aging were recognized in many cases. Therefore, it was thought that introduction of indicator of aging and analysis of relation between diseases and aging would be necessary in future.

- 1080 INVESTIGATION OF LUNG CANCER IN ATOMIC BOMB SURVIVORS. Sasaki, H. (National Hospital of Kure, Hiroshima (Japan)); Itoh, C.; Mitsuyama, T.; Katsuta, S. Nagasaki Igakkai Zasshi; 51: No. 3, 212-215 (Sep 1976). (In Japanese).

Forty two cases of lung cancer in A-bomb

survivors experienced between 1971 and 1975 were compared to non-exposure cases with lung cancer, and discussed. The mean age of A-bomb survivors with lung cancer was 68.7 year old, and that of control cases was 60 year old. The incidence ratio of male to female in the group was 4 : 1, and that of control group was 5 : 1. Occupation was one of the predisposing causes, but patients who had engaged in the occupation which was considered to predispose lung cancer were three. Among 39 patients with lung cancer whose smoking histories were clarified, 20.5 per cent was nonsmoker, and 69.3 per cent was heavy smoker. Among 39 patients whose cancer histories were clarified, 28.2 per cent of the patients had family history of cancer. Subjective symptoms of this disease were cough, sputum, bloody sputum and chest pain, and some had no symptoms. Seventeen cases (40.5 per cent) were detected in the physical examination for the A-bomb survivors. For the early detection of lung cancer in A-bomb survivors, patients with high risk should be selected to have received clearly established diagnosis. Histologically, squamous cell carcinoma was seen in many cases, following adenoma, and undifferentiated large cell carcinoma and small cell carcinoma. Disturbances in pulmonary functions were obstructive ventilation, high rate of residual air, lowered diffusions ability. Therapy was operation in stage I, chemotherapy and radiation therapy in stage II and stage III.

- 1081 CLINICAL SURVEY OF BLOOD DYSCRASIAS AMONG HIROSHIMA A-BOMB SURVIVORS BY THE PERIODICAL HEALTH EXAMINATION, 2. Taketomi, Y.; Kamada, N.; Takahashi, H.; Ohkita, T. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology); Ito, C. Nagasaki Igakkai Zasshi; 51: No. 3, 185-188(Sep 1976). (In Japanese).

An actual condition of anemia in A-bomb survivors was discussed from the periodical health examination of the fiscal years 1972 and 1973. Under 11.5 g/dl of hemoglobin was determined as anemia. An actual number of cases with anemia in both fiscal years was nearly the same, but ratio of anemia to the total number of recipient of periodical health examination increased 1.5% in the fiscal year 1973. 35.3% of the subjects with anemia in both fiscal years was the same persons. In the following examination of 478 subjects with under 10.0 g/dl of hemoglobin, in the fiscal year 1972, 96 subjects (20.1%) still showed under 10.0 g/dl of hemoglobin in the fiscal year 1975. Characteristics of anemia were that hypochromic anemia was comparatively frequent in the young, and normochromic anemia was frequent in the aged. In the former, marked decrease of value of iron in serum was recognized, and in the latter, fall of hematopoiesis by old age and secondary anemia were recognized. Marked relationship between exposure distance and anemia in each group was not recognized. 17.9% of cases with moderate anemia showed positive in stool guaiac test and 8.9% and past history of duodenal or peptic ulcer.

- 1082 DELAYED ERYTHROPOIESIS IN IRRADIATED RATS GRAFTED WITH SYNGENEIC MARROW: EFFECTS OF CYTOTOXIC DRUGS AND IRON-DEFICIENCY ANEMIA. Rodday, P.; Bennett, M.; Vitale, J.J. (Boston Univ.). Blood; 48: No. 3, 435-447(Sep 1976).

Erythropoiesis in spleens of lethally irradiated Lewis rats grafted with $4-35 \times 10^6$ syngeneic marrow cells was inhibited or delayed during the test period of 5 days; this was in marked contrast to observations in irradiated mice. The mechanism of this inhibition was the

subject of this study. Pretreatment of recipients 9 days prior to irradiation with the cytotoxic drugs cyclophosphamide (CY), busulfan (BUS), or dimethylmyleran (DMM), or the induction of iron deficiency with anemia in recipients reversed this delayed erythropoiesis. However, neither iron-deficiency anemia nor pretreatment with BUS or DMM affected the ability of irradiated recipients to reject 20 to 50×10^6 allogeneic marrow cells. The administration of commercial preparations of erythropoietin to hosts stimulated erythropoiesis moderately. However, proliferation of syngeneic marrow cells was not enhanced when infused into lethally irradiated spontaneous hypertensive (SH) inbred-strain rats which have high levels of endogenous erythropoietin. Finally, plasma from irradiated rats treated with phenylhydrazine to produce severe anemia was rich in erythropoietin but failed to stimulate erythropoiesis in the cell transfer system. Two hypotheses are considered.

- 1083 COMPARISON OF MATHEMATICAL MODELS FOR RADIATION FRACTIONATION. Hethcote, H.W.; McLarty, J.W.; Thames, H.D. Jr. (Univ. of Texas System Cancer Center, Houston). Radiat. Res.; 67: No. 3, 387-407(Sep 1976).

Radiation fractionation data can be plotted in four planes: long N-log D, dose-reciprocal total dose, dose-response, and dose-recovery dose. Properties of curves in these planes corresponding to five models are developed. One model assumes that total dose is a power function of the number of fractions; the other four models assume that the dose-log surviving fraction curve is described by a multitarget, a two component (product of single-hit and multitarget factors), a quadratic, and a cubic function, respectively. Several nonlinear regression criteria are defined and corresponding computer programs have been developed. Best fits for the five models are found for three specific data sets involving normal tissues in mice. One regression criterion and three models are shown to be unsuitable.

- 1084 MODIFICATION OF SURVIVAL OF GAMMA IRRADIATED MICE BY ADENOSINE NUCLEOTIDES. Grant, G.A.; Barlow, J.A.; Leach, K.E. (Defence Research Establishment, Ottawa, Ontario (Canada)). Strahlentherapie; 152: No. 3, 285-291(Sep 1976).

1 fig.; 4 tabs.; 15 refs..

The administration prior to irradiation of adenosine triphosphate (ATP) or other adenosine nucleotides, singly or in combination, increased the radioresistance of mice. Post-irradiation treatment with the adenosine nucleotides had no effect on the survival of the irradiated mice. Dose reduction factors of 2.32 could be obtained by pretreatment of mice with the following combination of protective agents: S-2(4-aminobutylamino)ethyl phosphorothioic acid (WR 2822), cysteamine (MEA) and ATP. Since cyclic AMP levels were unchanged in the spleen or gut by administration of cysteamine and other protectors it is unlikely that the increase in protection was due to changes in cyclic AMP levels. The calcium salt of ATP provided a higher level of protection than the ATP alone, indicating that the protective mechanism of ATP is probably not related to anoxia.

- 1085 REGENERATION AND DOSE-RESPONSE CHARACTERISTICS OF IRRADIATED MOUSE DORSAL EPIDERMAL CELLS. Al-Barwari, S.; Potten, C.S. (Christie Hospital and Holt Radium Inst., Manchester (UK). Paterson Labs.). Int. J.

Radiat. Biol.; 30: No. 3, 201-216(Sep 1976).

A microcolony technique is described for measuring epidermal cell survival 3 days after whole-body X-irradiation. This assay provided a cell D_0 value of 233 ± 11 rad and a zero-dose extrapolate of 1.23×10^4 cells/cm² for mice irradiated in oxygen 20 hours after hair plucking. The microcolony cellularity had an apparent doubling-time of 25 hours which may be an upper limit at least for some clones. The clones appeared to fragment continually and form new daughter clones, suggesting that few would form macroscopic nodules. Many of the clones were also apparently associated with hair follicles.

- 1086 RADIOSENSITIVITIES OF LYMPHOCYTES FROM PIG, SHEEP, GOAT, AND COW. Leonard, A. (C.E.N./S.C.K., Mol, Belgium); Gerber, G.B.; Papworth, D.G.; Decat, G.; Leonard, E.D.; Deknuddt, G. Mutat. Res.; 36: No. 3, 319-332(Sep 1976).

Dose-effect curves for X-irradiation in vitro were determined on cultured blood lymphocytes of four mammalian species, cow, goat, sheep and pig, having approximately the same number of chromosome arms, the same nuclear volume and the same DNA content. The data from cow, but not those from the other species, exhibited significant inhomogeneity between the experiments. On inspection the numerical yields appear not to differ greatly in the lower dose range. Evaluation of the parameters according to the quadratic law and the power law, however, demonstrate significant differences. Pig differs from the other species regardless of which presentation is chosen. For the power law a significant difference is also found between goat and sheep.

- 1087 (BNWL--2020) METHODOLOGY FOR ESTIMATING RADIATION DOSES DUE TO TRITIUM AND RADIOCARBON RELEASES. Baker, D.A.; Soldat, J.K. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1976. Contract EY-76-C-06-1830. 26p. Dep. NTIS, PC A03/MF A01.

Although the exact release rates of tritium (³H) and ¹⁴C to the environment from a fusion power plant are not known, unit dose rates from postulated releases to air or to surface water can be calculated for a hypothetical individual and for population groups. Assuming a tritium release of 1 curie per year (Ci/yr) as HTO to the atmosphere, a hypothetical maximum individual residing near a fusion power plant might receive a dose rate of 2×10^{-3} millirem per year (mrem/yr). Assuming a 1 Ci/yr release to surface waters, this individual might receive a dose rate of 1.5×10^{-5} mrem/yr. The dose rate to the population of the world including the United States and the regional population was estimated to be 1×10^{-2} man-rem/yr from the release to the atmosphere and 6×10^{-2} man-rem/yr from the release to surface waters. Dose rates from releases of 1 Ci/yr ¹⁴C to the atmosphere were estimated to be 0.4 mrem/yr to the bone of the hypothetical maximum individual and 2 man-rem/yr to the total body of the world population. Because of the persistence of ¹⁴C in the environment and the fact that carbon is a major constituent of any living thing, efforts should be made to eliminate those releases with available technology such as double containment of the reactors to prevent air leakage.

- 1088 (PB--259624) URANIUM IN DENTAL PORCELAIN. TECHNICAL REPORT. Thompson, D.L. (Bureau of Radiological Health, Rockville, Md. (USA)). Sep 1976. 41p. (DHEW/PUBL/FDA--76/

8061). NTIS, PC A03/MF A01.

The radiological health aspects of the use of uranium in dental porcelain are presented. The concentration of uranium is reported for 18 sets of porcelain teeth and 23 samples of porcelain powder. Particle emission rates were obtained for uranium and for the potassium-40 also present in the teeth. These data are used to calculate the annual doses to the individuals who wear porcelain prostheses and to persons who are occupationally exposed to the teeth and powders. Dose modifying factors are discussed for both alpha and beta particle exposures. Recommendations are presented regarding substitution of nonradioactive agents and interim guidelines on the maximum permissible concentration of uranium in dental porcelain.

- 1089 GONADAL RADIATION DOSE AND ITS GENETIC SIGNIFICANCE IN RADIOIODINE THERAPY OF HYPERTHYROIDISM. Robertson, J.S.; Gorman, C.A. (Mayo Clinic, Rochester, MN). J. Nucl. Med.; 17: No. 9, 826-835(Sep 1976).

Published estimates of radiation dose to the gonads from ¹³¹I therapy of Graves' disease vary widely, largely because of differences in assumptions regarding the details of iodine kinetics. The calculations described in this paper show that hyperthyroid patients treated with 10 mCi of ¹³¹I will usually receive a total radiation dose to the ovaries or testes of less than 3 rad. Several common roentgenographic diagnostic procedures may involve a greater radiation dose and a greater genetic hazard than does the usual ¹³¹I treatment for hyperthyroidism. It is important to minimize total exposure to radiation, but it seems unreasonable to deny ¹³¹I treatment for hyperthyroidism to young men and nonpregnant young women on the grounds of genetic hazard alone.

- 1090 ESTIMATES OF RADIATION DOSE TO THE EMBRYO FROM NUCLEAR MEDICINE PROCEDURES. Smith, E.M.; Warner, G.G. (Oak Ridge National Lab., TN). J. Nucl. Med.; 17: No. 9, 836-839(Sep 1976).

These phantom studies and computer calculations provide a direct means of estimating the radiation dose to the embryo resulting from the administration of a radiopharmaceutical to the mother during organogenesis. The specific absorbed fractions to the embryo from 19 source organs were computed for 12 monoenergetic photon energies. Tables of absorbed dose per unit cumulated activity, S, for the embryo as a target organ have been assembled for ^{99m}Tc, ¹¹¹In, ¹²⁵I, ¹³¹I, and ¹³³Xe. In addition, the dose to the embryo was calculated for several of the radiopharmaceuticals for which the MIRD Committee has published dose estimate reports.

- 1091 RADIOACTIVE POLLUTION. Pohl, R.O. (Cornell Univ., Ithaca, NY). ASHRAE J.; 18: No. 9, 47-51(Sep 1976).

The widely published claims that the public health effects resulting from routine emissions are between 0.01 and 0.1 serious health effects per gigawatt-year, and hence are at least a thousand times smaller than those resulting from air pollution by the burning of coal, cannot be true, for two reasons. The authors of these claims have ignored at least two of the more important isotopes, radon-222 and carbon-14, which are presently released to the environment, and thus contribute greatly to the health impact of nuclear energy. The health effects calculated in the earlier work cover

only those which occur during the year in which the energy is generated. This means, figuratively speaking, that the authors have confused an annual installment payment with the full cost. This is unacceptable. The contribution to the health impact of nuclear energy arising from the single isotopic species radon-222 emanating from the mill tailings is estimated to 400 lung cancer deaths/GW(e)y, larger even than the most pessimistic estimates of the health impact of energy from coal through atmospheric pollution. We have no assurance that other long-lived isotopes do not contribute comparable amounts to the health impact of nuclear energy. The discussion of the health impact of radon-222 raises the fundamental moral question--how far into the future our responsibility extends. If such a long-term responsibility is rejected, then we must at least try to predict the environmental buildup of radioactive pollutants, in order to avoid unacceptable and irreversible levels of radiation dose rate. The potential health consequences from long-lived radioisotopes seem to have been largely ignored so far, and should be explored in detail.

- 1092 RE-EVALUATION OF ^{131}I THYROIDAL UPTAKES IN NORTHERN TASMANIA. Richards, P.A.C. (Launceston General Hospital (Australia). Dept. of Nuclear Medicine). Radiographer; 23: No. 3, 79-81(Sep 1976).

The effect on ^{131}I thyroidal uptakes by the introduction of iodine in euthyroid subjects were evaluated during the period 1960-July 1975.

- 1093 REPLY TO J.C. THOMPSON, JR.'S COMMENTS ON THE PAPER 'RADIATION DOSES FROM IODINE-129 IN THE ENVIRONMENT'. Soldat, J.K. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Health Phys.; 31: No. 3, 288-290(Sep 1976).

Reference is made to comments by Thompson (Health Phys.; 31: 287 (1976)) on the present author's paper on 'Radiation Doses from ^{129}I in the Environment' (Health Phys; Jan 1976) concerning the human and bovine consumption data that were used to arrive at thyroid dose estimates. Clarification is given of the diet and consumption data used in the original work and the sources of such data cited. Should modified diet data be accepted the thyroid dose estimates from unit concentrations of ^{129}I in air originally tabulated could easily be altered in proportion to the diet assumed.

- 1094 COMMENTS ON THE PAPER 'RADIATION DOSES FROM IODINE-129 IN THE ENVIRONMENT' BY J.K. SOLDAT. Thompson, J.C. Jr. (Cornell Univ., Ithaca, N.Y. (USA)). Health Phys.; 31: No. 3, 287-288(Sep 1976).

Reference is made to a recent article by Soldat entitled 'Radiation Doses from ^{129}I in the Environment' (Health Phys. Jan 1976) in which it is claimed that human and bovine consumption estimates were used in arriving at ^{129}I thyroid doses which do not conform to observed consumption data. It is claimed that the disparity between the consumption data for milk, leafy vegetable and beef and the feed intake estimates for beef cattle is sufficient to produce ^{129}I thyroid dose estimates that are considerably elevated. Using consumption data here advocated a modified table of thyroid dose estimates from unit concentrations of ^{129}I in air is presented.

- 1095 DOSIMETRY IN SINGLE LUNG CELLS BY MEANS OF MICROAUTORADIOGRAPHIC ACTIVITY MEASUREMENTS.

Kraus, W. (Board for Nuclear Safety and Radiation Protection, Berlin (German Democratic Republic)). Phys. Med. Biol.; 21: No. 5, 81-822(Sep 1976).

After inhalation of compounds containing promethium-147 in the lungs of mice most of the activity was deposited in the form of local concentrations (hotspots). By means of a special quantitative microautoradiographic method using stripping film ORWO K 105, measurements of the activity of single hotspots of about 10^{-14} Ci were possible. A microphotometer with a variable measuring diaphragm was used for the determination of the density profile of the autoradiographic image in order to get hotspot depth within the biological specimen. To determine hotspot activity it was necessary to calibrate the film with a Pm-147 plane source. The systematic and random errors of the method are discussed in detail, giving a total error of $\pm 21\%$ (SD) for one hotspot activity measurement. A few examples of biological results obtained by the method are given. Simple models were used to calculate doses absorbed in macrophage and alveolar cell nuclei from the measured activities.

- 1096 INCIDENCE OF HYPOTHYROIDISM FOLLOWING SMALL DOSES OF ^{131}I IN THE TREATMENT OF GRAVES' DISEASE. McCullagh, F.P.; Jelden, G.L.; Rodriguez-Antunez, A. (Cleveland Clinic, OH). Ohio State Med. J.; 72: No. 9, 538-540(Sep 1976).

In a group of 147 patients treated with ^{131}I in doses of 3.0 millicuries or less for Graves' disease, the incidence of hypothyroidism was calculated 10 to 17 years after treatment. This paper emphasizes the frequency of hypothyroidism after treatment with ^{131}I in small doses, if sufficient time lapse is considered.

- 1097 FREQUENCY OF PRENATAL X-RAY EXAMINATION AND RADIATION RISKS IN JAPAN. Kitabatake, T.; Sato, T.; Takeuchi, S. (Niigata Univ. (Japan). School of Medicine). J. Radiat. Res.; 17: No. 3, 204-210(Sep 1976).

Frequency of prenatal x-ray examination in 1,701 parturient women was surveyed in 19 Japanese hospitals in 1974. Of 1,701 women, 470 or 27.6% have received maternal x-ray examination during the pregnant period. There is no significant difference in frequency of prenatal x-rays between in the primipara and multipara. Chest examination was frequent in the 3rd to 6th month of gestation, while a pelvimetric study was performed mainly after the 10th month. About 82% of the fetal dose was contributed from a prenatal pelvimetric study. The fetus receives averagedly 202 mrad of radiation from the prenatal x-ray examinations. It is calculated that about 6.5 leukemias may be induced yearly by maternal x-ray. This corresponds to about 1% of leukemias in the same generation.

- 1098 CASE OF RECURRENT PARALYSIS CAUSED BY EXTRAVASATED THOROTRAST. Ohbuchi, M.; Sato, T.; Yoshii, H. (Kumamoto Univ. (Japan). School of Medicine). Jibi Inkoka Rinsho; 69: No. 9, 1115-1119(Sep 1976). (In Japanese).

Report was made as to the clinical course and the laboratory findings of a 59 year old man suffering from tracheophony (recurrent paralysis) caused by thorotrastoma of the neck which occurred after 36 years of the injection of thorotrast. Local radiation was 294 C / 5 min in the right neck, 192 C / 5 min in the left neck, and 118 C / 5 min in the air. (C means count). Recurrent paralysis of this case

was caused by thorotrast-granuloma of the neck formed with a great amount of thorotrast which leaked on the occasion of angiography. Marked changes were not recognized in the liver and the spleen, but a long-term observation on them including thorotrastoma of the neck would be necessary.

- 1099 EFFECTS OF POLYMERIC PLUTONIUM ON ERYTHROCYTE SURVIVAL IN MICE, (1). Joshima, H.; Kashima, M.; Matsuoka, O. (National Inst. of Radiological Sciences, Chiba (Japan)). J. Radiat. Res.; 17: No. 3, 192-203 (Sep 1976).

The changes in erythrocyte counts, hematocrit, hemoglobin, reticulocyte counts and erythrocyte survival following an intravenous injection of polymeric ^{239}Pu at the dose level of 15 $\mu\text{Ci/kg}$, 10 $\mu\text{Ci/kg}$ and 5 $\mu\text{Ci/kg}$ were studied in CF no. 1 male mice in order to investigate the possible pathogenesis of anemia produced by irradiation of polymeric plutonium. The administration of 15 $\mu\text{Ci/kg}$ and 10 $\mu\text{Ci/kg}$ of polymeric plutonium produced anemia but 5 $\mu\text{Ci/kg}$ had no significant effect. Studies with ^{51}Cr labelled erythrocyte showed a moderate reduction in survival of erythrocyte following a single intravenous injection of polymeric plutonium. Not only the intracorporeal effect but also extracorporeal effect of polymeric plutonium was considered to lead to a reduction in erythrocyte survival, but no clear dose relationship could be observed between the reduction of survival and either intracorporeal effect or extracorporeal effect. Although the most important pathogenesis of anemia produced by polymeric plutonium is supposed to be a decreased erythropoiesis, it was believed that both qualitatively impaired erythropoiesis and abnormal erythrocyte destruction might also play some role in the occurrence of anemia.

- 1100 (BNWL--2088) PROCEEDINGS OF THE WORKSHOP ON MEASUREMENT OF HEAVY ELEMENTS IN VIVO. Swinth, K.L. (ed.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1976. Contract E(45-1)-1830. 247p. (CONF-760697--). Dep. NTIS \$9.00.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Separate abstracts were prepared for 22 papers that discuss methods for the external measurement of transuranium elements deposited in personnel.

- 1101 (BNWL--2088, pp 1-10) PLUTONIUM PROBLEM IN BIOLOGICAL PERSPECTIVE. Marks, S. (Battelle-Pacific Northwest Labs., Richland, WA). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

A brief summary is presented of some relevant results of animal studies on the biology of Pu that are concerned mostly with the location and migration of various forms of Pu in the body. The status of human studies, including measurements of the concentration of Pu in tissues of the body after death and the incidents and mortality rates for various diseases in Pu personnel, is discussed. The function of the Transuranium Registry for collecting information about the concentration and distribution of Pu in various organs and tissues and verification of estimates of body-burdens of personnel based on postmortem measurements of tissues obtained at autopsy is summarized.

- 1102 (BNWL--2088, pp 11-17) ROLE OF CHEST COUNTING IN PERSONNEL DOSIMETRY. Heid, K.R. (Battelle-Pacific Northwest Labs., Richland, WA). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

The use of plutonium in the production of energy is becoming increasingly important. Specifically ^{239}Pu is being used to enrich fuel for power reactors, is being used in heat sources, and as a source of power for prosthetic heart pacers and mechanical heat pumps. As the use of Pu increases, the number of Pu workers or persons potentially exposed to plutonium increases. Each facility handling Pu in significant quantities must have a radiation protection program that includes plans and/or programs to minimize or prevent internal exposure of personnel to Pu. The program, at a minimum, must include methods to estimate Pu deposited in the body or to establish a basis for judgement that significant depositions have not occurred. The effectiveness of external counting for measurements of ^{238}Pu or ^{239}Pu deposited in the respiratory tract is discussed.

- 1103 (BNWL--2088, pp 19-37) CALIBRATION TECHNIQUES AND ERROR ANALYSIS FOR PHOSWICH COUNTING OF ACTINIDE NUCLIDES AT OAK RIDGE NATIONAL LABORATORY. Goans, R.E.; Good, W.M. (Oak Ridge National Lab., TN). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

One of the most difficult and demanding areas of low-level counting is the detection of actinides in vivo. In the case of inhalation of these nuclides, it is common practice at many installations to determine the resulting lung burden by external counting of low-intensity L X-rays from the daughter nucleus with either a phoswich detector or a proportional counter. Calibration techniques using these detectors are examined and possible uncertainties in the determination of lung burden by using standard techniques are discussed. The use of phoswich detectors is discussed in detail.

- 1104 (BNWL--2088, pp 53-62) USE OF ^{103}Pd AS A CALIBRATION SOURCE FOR THE DETERMINATION OF ^{239}Pu IN VIVO. Toohey, R.E. (Argonne National Lab., IL). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Questions that arise concerning the use of ^{103}Pd as a calibration source for in vivo ^{239}Pu are discussed. Although the energies of the rhodium K/sub α / and uranium L/sub γ / x rays are identical at 20.2 keV, the effect of the rhodium K/sub β / line at 22.8 keV must be considered. The effects of backscattering and calibration factors for ^{239}Pu from data obtained from ^{103}Pd in vivo are discussed.

- 1105 (BNWL--2088, pp 63-80) ERROR ANALYSIS AND PROPAGATION OF UNCERTAINTIES FOR THE MEASUREMENT OF INHALED TRANSURANIUM ELEMENTS. Falk, R.B. (Atomics International Div., Golden, CO). Sep 1976.

From Workshop on measurement of heavy

elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Measurement of inhaled transuranium elements is accomplished by counting photons emitted from inhaled radioactive materials using detectors placed against the chest, sides, or back of the subject. The uncertainty in the measured amount of the inhaled material depends upon the uncertainties resulting from an intangible source geometry and from attenuation in the subject's body, as well as upon the statistics of obtaining a net positive count. A method of error analysis is presented to deal with the uncertainties from the various sources of error to yield the propagated uncertainty in the measured values of the amount of the inhaled activity.

- 1106 (BNWL--2088, pp 81-84) DETERMINATION OF HEAVY ELEMENTS IN HUMANS. Olson, D.G. (Energy Research and Development Administration, Idaho Falls, ID). Sep 1976. From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

The uncertainties associated with the determined measurement of lung burdens of transuranium elements become important when positive results are obtained. A lung burden of 16 nCi of ^{239}Pu with no uncertainty was reported for one individual on each of three different counts. Because the uncertainty was not reported it was impossible to evaluate the exposure with any degree of confidence. The result could mean that one lung burden of activity has been determined or it could mean that the detection limit for the method has not been exceeded and so the person has no measurable activity. An alternate method of measuring ^{239}Pu in the body is to separate and count the ^{239}Pu excreted in the feces or the urine. An assumption must be made about how the eliminations from the body represent the material deposited inside the body. Although uncertainties do exist in this assumption the advantage over chest counting is that the detection limit is only 0.002 of a maximum permissible lung burden instead of being a one permissible burden.

- 1107 (BNWL--2088, pp 85-87) SUMMARY OF DISCUSSION CALIBRATION TECHNIQUES AND ERRORS I. Tomlinson, F.K. Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Some of the problems that are yet to be solved in the measurement of heavy elements in vivo are reviewed. A current area of general concern is in the agreement of lung deposition assessments between various lung counter facilities. The solution of this problem, which has decreased in magnitude over the past 6 years, relates directly to the calibration of each lung counter.

- 1108 (BNWL--2088, pp 89-100) CALIBRATION FOR PLUTONIUM-238 LUNG COUNTING AT MOUND LABORATORY. Tomlinson, F.K. (Mound Lab., Miamisburg, OH). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

The calibration technique for lung counting of ^{238}Pu at Mound Laboratory is somewhat similar to those used at some other contractor of the Energy Research and Development Administration. However, some portions of Mound Laboratory's technique are unique. The primary purpose of this paper is to present the details of how we calibrate the lung counter facility. Calibration is not complete without an analysis of the errors involved and the calculation of the minimum detectable activity. Following the calibration technique used at Mound Laboratory is an explanation of the errors included, those not included, the method of determining minimum detectable activity, and finally a typical example of how the calibration curve and errors are used in making an uptake assessment.

- 1109 (BNWL--2088, pp 101-106) CALIBRATION TECHNIQUES FOR THE IN VIVO MEASUREMENT OF ALPHA-EMITTING ACTINIDES. Fleming, R.R. (Savannah River Plant, Aiken, SC). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Reliable interpretation of in vivo measurements for alpha-emitting actinides deposited in the lungs is largely dependent on three factors: correction of observed count rates for background contributions; correction for photon absorption in the body; and accurate calibration of the counting system. Terrestrial and cosmic radiation contributions can be minimized by extensive shielding and good pulse-shape discrimination. Techniques are available to minimize errors inherent in the calibration of an in vivo counting system. Minimum amounts of alpha-emitting actinides detectable in the lungs are primarily affected by the accuracy of two factors: predicted body background due to ^{137}Cs and ^{40}K , and estimated photon absorption in chest-wall tissue. A matched pair of 12.5-cm-dia phoswich detectors, purchased from the Harshaw Chemical Company, are used to measure low-energy photons emitted by the radioactive actinides.

- 1110 (BNWL--2088, pp 107-123) MEASUREMENT OF TRANSURANIC ELEMENTS IN VIVO AT CRNL. Johnson, J.R. (Chalk River Nuclear Labs., Ont.). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

The isotopes of interest as potential inhalation hazards to persons working in the mixed oxide fuel fabrication plant are mainly ^{238}Pu , ^{239}Pu , and ^{240}Pu , and with time, ^{241}Am , as it grows in from the decay of ^{241}Pu . The plutonium isotopes do not emit any radiation during decay capable of penetrating to the outside of the chest from the lungs in measurable quantities other than the L X-rays of uranium. These X-rays are of low relative abundance and are highly attenuated as they pass through the chest wall. A measurement of a subject's chest for lung burdens of these isotopes at or below the maximum permissible lung burden of 16 μCi essentially consists of measuring the subject's background in the L X-ray energy region and comparing the measured value to a predicted value. A calibration factor that depends on the isotopic ratios of the deposited radioactive material, the pattern of the deposition, and the attenuation of the L X-rays in the tissue between the deposited material and the detectors is then applied to the difference between the measured and

predicted background to obtain an estimate of the lung burden for this subject. The performance of the phoswich detectors and statistical parameters that can be used to describe the background for uncontaminated subjects, which can then be used as aids in predicting the background of suspected contaminated subjects, were evaluated.

- 1111 (BNWL--2088, pp 125-131) IN VIVO PLUTONIUM MEASUREMENT AT THE BATTELLE-NORTHWEST WHOLE BODY CENTER. Palmer, H.E.; Rieksts, G.A.; Houston, J.R. (Battelle-Pacific Northwest Labs., Richland, WA). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Lung counting is a major part of the in vivo counting for internal contamination in the Hanford project employees. Approximately 1,100 of the 4,000 counts made at the Battelle-Northwest whole body counting facilities in 1975 were lung counts in which plutonium is the main radionuclide of interest. For a 250-working-day-year, the average number of lung counts per day is between four and five but as many as ten lung counts are often done in a single eight-hour day. This use rate requires that the detectors and instrumentation be reliable and stable during the course of the day since there is not time to check the calibration and response of the system between each count. Although phoswich detectors have been in use at the counter facilities for several years, the pulse-shape analysis instrumentation has not had sufficient stability and reliability for use in the routine lung counting program. The phoswich detectors are used in special cases of positive lung contamination to help identify and quantify the deposited material. The method for determining plutonium in the lungs depends on the use of large NaI(Tl) detectors for measurement of the 60 keV gamma ray from ^{241}Am , which is associated with almost all ^{239}Pu on the Hanford project. The ratio of ^{239}Pu to ^{241}Am in the inhaled material is determined by alpha energy analysis of air filter, nasal smear, and, if necessary, fecal samples. For ^{239}Pu or pure ^{239}Pu , which does not contain ^{241}Am from the decay of ^{241}Pu , the 17 keV uranium L X-rays are measured with the phoswich detector system.

- 1112 (BNWL--2088, pp 133-149) LLL PLUTONIUM LUNG COUNTER CALIBRATION AND DISCUSSION OF ERRORS. Anderson, A.L.; Campbell, G.W. (Lawrence Livermore Lab., CA). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

The Whole Body Counter at Lawrence Livermore Laboratory is located in a shielded room 6.1 metres underground, and is equipped with a filtered air supply to remove approximately 99 percent of the radioactivity present from radon-thoron daughters in the air. Two Harshaw Phoswich detectors 120 mm in diameter are presently used for lung counting. These are placed high on the chest tangent to the sternum and clavicle. The front face of the detector consists of a 1.6-mm-thick NaI(Tl) scintillation crystal with a 0.25-mm beryllium window, and is used as the X-ray detector. This is backed by a thicker 38.1-mm CsI(Na) crystal coupled to the same photomultiplier tube. This crystal is used for Compton background suppression, and also to provide spectral

information over the energy range from 100 keV to 2.5 MeV. The detector outputs, using risetime discrimination electronics, can be summed or accumulated separately in a pulse height analyzer. An Alderson Remab phantom is used for calibration. This is a take-apart phantom which has a human skeleton and fillable compartments to simulate the body organs. The lung cavities, which are shown in the figure, can be filled with lung-equivalent material containing radioactive standards for calibration. Several uniformly loaded sets of these lungs have been made incorporating various isotopically pure radionuclides including ^{238}Pu , ^{239}Pu , and ^{241}Am .

- 1113 (BNWL--2088, pp 151-156) PRESENT STATUS OF AND FUTURE PLANS FOR ITRI'S HUMAN AND DOG CHEST COUNTING FACILITIES. Stanley, J.A.; Mewhinney, J.A. (Lovelace Foundation for Medical Education and Research, Albuquerque, NM). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Chest counting of actinide lung burdens on humans and dogs at ITRI began with the installation of a dual detector phoswich system in 1970. The system made use of pulse-shape discrimination circuitry and employing the leading edge-to-crossover timing principle.

- 1114 (BNWL--2088, pp 161-178) ESTIMATION OF LUNG AND SKELETAL BURDENS OF BONE-SEEKING RADIONUCLIDES IN MAN FROM IN VIVO SCINTILLATION MEASUREMENTS OF THE THORAX AND THE HEAD. Cohen, N.; Spitz, H.B.; Laurer, G.R.; Wrenn, M.E. (New York Univ. Medical Center, NY). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Although measurements of the concentration of actinides in excreta of personnel may indicate whether an exposure has occurred and, if the time of exposure is known, may permit an estimate of the approximate magnitude of the intake, bioassay measurements usually cannot be used to reliably establish absolute values of a systemic burden, specific deposition sites, or the presence of nontransportable material in the lung. For these reasons, in vivo measurement techniques in conjunction with excreta bioassay have been used more extensively and with increasing sophistication. Utilization of in vivo head counting techniques holds considerable promise for estimating the total skeletal burden of various bone-seeking nuclides more easily and with greater precision than has been possible in the past. Once the skeletal content of activity has been determined, it will be possible to estimate the amount of rib, sternum, and vertebrae activity that contributes to in vivo thorax measurements. This, in turn, will provide extremely useful data for estimating the partition of activity between the lung and these bone structures. It should be assumed that any estimate of bone-seeking radionuclide activity in the lung that has been made from in vivo scintillation counting will be derived from measurements made over the head as well as over the thorax.

- 1115 (BNWL--2088, pp 179-196) METHODS FOR THE ASSAY OF PLUTONIUM IN VIVO: WHAT ARE THE ALTERNATIVES. Rundo, J.; Strauss, M.G.;

Sherman, I.S.; Brenner, R. (Argonne National Lab., IL). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

The problem of estimating the amount of plutonium in the human body in vivo is of considerable importance in view of the major role Pu may play in the future nuclear power program. It is a particularly difficult one because the ^{238}Pu and ^{239}Pu present in reactor-grade material emit virtually no penetrating radiation, so that conventional methods of body radioactivity measurement are useless. The existing methods of estimating Pu body burdens are reviewed and alternatives are suggested. Emphasis is placed on Pu in lung, the major problem, but reference is also made to systemically deposited Pu. Both indirect and direct methods are discussed.

- 1116 (BNWL--2088, pp 197-198) DEVELOPMENT OF AN IMPROVED COUNTER FOR IN VIVO PLUTONIUM MEASUREMENT. Palmer, H.E. (Battelle-Pacific Northwest Labs., Richland, WA). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

A relatively new counter was developed for measurement of Pu in vivo which has the potential of providing a large detecting area and significantly improved resolution which should result in a more sensitive instrument for measuring Pu both in vivo and in the environment. This gas scintillation proportional counter contains pure xenon gas and has a scintillation light output which is 100 times that of NaI(Tl) per unit of absorbed photon energy. With a collimated beam of low energy gamma or X-rays (from 0.1 to 100 keV) the resolution is about ten times better than that obtained from thin crystal NaI(Tl) detectors and two times better than ordinary proportional counters.

- 1117 (BNWL--2088, pp 199-205) EFFECTS OF PLUTONIUM REDISTRIBUTION ON LUNG COUNTING. Swinth, K.L. (Battelle-Pacific Northwest Labs., Richland, WA). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Early counts of Pu deposition in lungs will tend to overestimate lung contents since calibrations are performed with a uniform distribution and since a more favorable geometry exists in contaminated subjects because the activity is closer to the periphery of the lungs. Although the concentration into the outer regions of the lungs continues as evidenced by the autopsy studies, the counts performed by L X-rays will probably underestimate the lung content; because, simplistically, the geometry several years after exposure consists of a spherical shell with a point of activity in the center. This point of activity represents concentration in the lymph nodes from which the 60 keV gamma of ^{241}Am will be counted, but from which few of the L X-rays will be counted (this is an example of interorgan distribution). When a correction is made to the L X-ray intensity, the lymph node contribution will tend to increase the amount subtracted while correcting for ^{241}Am X-rays. It is doubtful that the relative increase in X-ray intensity by

concentration in the pleural and sub-pleural regions will compensate for this effect. This will make the plutonium burden disappear while the ^{241}Am can still be detected. This effect has been observed in a case where counts with an intraesophageal probe indicated a substantial lymph node burden. In order to improve the accuracy of in vivo plutonium measurements, an improved understanding of pulmonary distribution and of distribution effects on in vivo counting are required.

- 1118 (BNWL--2088, pp 207-218) DETECTION SYSTEM FOR THE LOCALIZATION AND MEASUREMENT IN VIVO OF SMALL AMOUNTS OF PHOTON EMITTERS. Laurer, G.R.; Eisenbud, M.; Cohen, N. (New York Univ. Medical Center, NY). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

The purpose of this paper is to describe the design of a photon detection system for whole body in vivo detection and quantitative assessment of body burdens of ^{238}Pu , ^{239}Pu , or ^{241}Am which will simultaneously yield information proportional to both the magnitude and the site(s) of deposition of photon emitters accidentally inhaled, ingested, or otherwise deposited in the body. The operating principle of the detector system, active collimation, results from the use of pulse-shape discrimination and allows spatial resolution (X, Y and Z axes) without the use of separate collimating devices and, hence, with the possibility of increased geometric detection efficiency compared to other collimated systems used to define source position.

- 1119 (BNWL--2088, pp 219-227) ULTRASONIC MEASUREMENT TECHNIQUES USED AT LLL FOR DETERMINING CHEST WALL THICKNESS AND ORGAN SHAPES. Campbell, G.W.; Anderson, A.L. (Lawrence Livermore Lab., CA). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

Methods used for determination of the amount of transuranic elements deposited in the lungs of personnel are described. A method of ultrasonography has been used which allows better definition of the sub-surface structures within the body, and is potentially a more accurate means of determining tissue thickness. Continuous transverse and longitudinal scans are traced over the area which the detectors cover on each side of the chest. The scans are recorded on a storage scope and a hard copy is made. The data from each scan are also recorded on magnetic tape. The magnetic tape is then read into a computer system which displays each scan in 64 colors, where each color is related to an assigned echo intensity.

- 1120 (BNWL--2088, pp 229-230) PRELIMINARY EVALUATIONS OF A HIGH-PURITY GERMANIUM DETECTOR SYSTEM FOR IN VIVO MEASUREMENT OF INHALED TRANSURANIUM ELEMENTS. Falk, R.B. (Atomic International Div., Golden, CO). Sep 1976.

From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).

Proceedings of the workshop on measurement of heavy elements in vivo.

A body counter system is described that uses two arrays of high-purity (intrinsic) germanium detectors. The capabilities of the system for

- the measurement of inhaled Pu and Am in personnel are discussed. The system consists of two arrays of four planar, intrinsic Ge detectors each, mounted in downward-looking cryostats. Each of the eight individual detectors is 10 mm deep and 36 mm in diameter and has a useful surface area of approximately 10 cm² with a resolution at full-width-half-maximum of better than 650 keV at 60 keV. Data from each detector are collected, separated and processed with a Data General 1220 computer and dual disc system.
- 1121 (BNWL--2088, pp 235-241) DEVELOPMENT OF AN ANTHROPOMORPHIC PHANTOM FOR THE CALIBRATION OF EXTERNAL DETECTORS FOR THE IN VIVO MEASUREMENT OF PLUTONIUM. Sep 1976.
From Workshop on measurement of heavy elements in vivo; Seattle, WA, USA (24 Jun 1976).
Proceedings of the workshop on measurement of heavy elements in vivo.
There are many methods of calibrating external detectors for in vivo measurements of Pu in personnel. The most frequently used involve point sources, phantoms, and direct use of exposed humans. It was concluded that the phantoms currently used in calibrating detectors are mostly inadequate since they were not designed for X-ray emitters in the lung. The design and construction of a more realistic phantom is discussed. This phantom will permit a detailed study of the effect on counting efficiency of the distribution of radioactive material in the lung. After the phantom has been carefully studied, it will be circulated among the interested laboratories and hopefully will become a primary standard for the intercalibration program.
- 1122 (KFK--2354, pp 8) NEW APPROACH FOR AN IMPROVED SHORT-TIME PROCEDURE FOR LOCATING AND MEASURING LOW-ACTIVITY, LOW-ENERGY TRANSURANIUM DEPOSITS IN WOUNDS. Fromheim, G.; Ohlenschlaeger, L.; Rapp, W. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (Germany, F.R.)). Sep 1976.
3 figs.; 7 refs. Available from the IAEA. Reprint from 'Diagnosis and treatment of incorporated radionuclides', IAEA Vienna, 1976.
New approach for an improved short-time procedure for locating and measuring low-activity, low-energy transuranium deposits in wounds. Removal of a four-month-old ²³⁹Pu deposit in a puncture wound at the tip of the left middle finger.
The paper describes a system in use at the Medical Department of the 'Gesellschaft fuer Kernforschung', Karlsruhe for locating and measuring the activity of transuranium deposits inside wounds and at the surface of wounds. The measuring system consists of a set of two NaI(Tl) scintillation detectors particularly designed to detect and locate low-energy X-rays, and a third NaI(Tl) detector for the energy range up to 1 MeV. All three detectors have nearly the same sensitivity of 1 nCi for a ²³⁹Pu point source and a measuring time of 100 s, but their geometrical resolution is different being especially optimized in the wound probe for locating a radiating point deposit within 2 to 3 mm. The detectors are held by a flexible mechanical support which allows the surgeon to manipulate the detector in the wound until the maximum response of the pulses produced is found by audio inspection. The nuclide is identified as far as possible, and the source activity is quantitatively estimated, with the help of the displayed spectrum of a multichannel pulse-height analyser.
- 1123 (KFK--2354, pp 6) REMOVAL OF A FOUR-MONTH-OLD ²³⁹Pu DEPOSIT IN A PUNCTURE WOUND AT THE TIP OF THE LEFT MIDDLE FINGER. Ohlenschlaeger, L. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (Germany, F.R.)). Sep 1976.
5 figs.; 3 refs. Available from the IAEA. Reprint from 'Diagnosis and treatment of incorporated radionuclides', IAEA Vienna, 1976.
New approach for an improved short-time procedure for locating and measuring low-activity, low-energy transuranium deposits in wounds. Removal of a four-month-old ²³⁹Pu deposit in a puncture wound at the tip of the left middle finger.
The necessary diagnostic and therapeutic measures taken in a case of a 4-month-old plutonium-239 wound deposit are discussed. The development of a wound probe detector allows deposition of transuranium elements in wounds to be measured and, consequently, gives a better location of the wound activity, thus providing the possibility of selective and careful removal of the wound deposit. The detection limit of the wound probe is about 2 nCi. The results of the measurements with the wound probe are discussed for the case of a 4-month-old plutonium-239 deposit in a puncture wound on a finger tip.
- 1124 (NRPB-R--43, pp v) CAUSES OF DEATH OF RADIATION WORKERS WITH SPECIAL REFERENCE TO PLUTONIUM. Sep 1976.
Evidence given by the National Radiological Protection Board to the Royal Commission on Environmental Pollution: 1974-76.
The Board considered the Commission's view that a survey of all relevant data on workers who have been occupationally exposed to plutonium should be undertaken and that this survey should include all past employees. The Board had reservations about the value of such a survey but accepted that an extended study should be carried out. This would be in association with the Board's Register of Radiation Workers.
- 1125 (NRPB-R--43) EVIDENCE GIVEN BY THE NATIONAL RADIOLOGICAL PROTECTION BOARD TO THE ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION: 1974--1976. (National Radiological Protection Board, Harwell (UK)). Sep 1976. vp. TIC.
Separate abstracts were prepared for individual papers. (ERB)
- 1126 SHOULD ZN-DTPA REPLACE CA-DTPA FOR DECORPORATION OF RADIONUCLIDES IN MAN. Volf, V. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Strahlenbiologie). Health Phys.; 31: No. 3, 290-291(Sep 1976).
Reference is made to two recent notes on Ca-DTPA fetal toxicity by Fisher et al (Health Phys.; 29: 780 (1975)) and Mays et al (Health Phys.; 30: 247 (1976)). The present author agrees with these workers with the administration of the less toxic Zn-DTPA instead of Ca-DTPA in pregnant women and also that Zn-DTPA is indicated for protracted administration, however it is not considered that there is any reason to replace Ca-DTPA by Zn-DTPA under prompt treatment conditions, because a markedly lower decorporation effect of Zn-DTPA is to be expected.
- 1127 RETENTION AND EXCRETION OF RADIUM-226 AND STRONTIUM-90 IN TWO DOUBLY CONTAMINATED PERSONS. Wenger, P. (Service Cantonal de Controle des Irradiations, Geneva (Switzerland)); Cosandey, M. Health Phys.; 31:

No. 3, 225-229(Sep 1976).

The ^{90}Sr and ^{226}Ra excretion rates and body burdens have been measured for about 10 yr in two doubly contaminated persons. Experimental data have been compared with predictions from ICRP model. The agreement between theory and experiment is satisfactory.

- 1128 FATE OF IODINE-131 IN MAN. Fu, Y.K. (Inst. of Nuclear Energy Research, Lung-Tan, Taiwan); Hsia, D.Y.; Liu, K.Y.; Hou, C.C. Nucl. Sci. J. (Taiwan); 13: No. 3, 118-136(Sep 1976).

The fate of ^{131}I in man was studied using both three-compartment and four-compartment models to account for the metabolism of this isotope. The differential equations were solved with Runge-Kutta (Gill) method by the HP 9820A calculator and plotted with a HP 9862A calculator plotter. Some of these theoretical results of both models have been compared with the experiments on: iodine uptake rate of thyroid, daily intake of stable iodine, biological and effective half-life of ^{131}I , and body retention and excretion function of ^{131}I . The three-compartment model for iodine metabolism seems more reasonable to apply on the internal radiation protection problem in Taiwan, Republic of China.

- 1129 ASSESSMENT OF PLUTONIUM IN LUNG. Shirotani, T.; Akaishi, J.; Fujita, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Nippon Genshiryoku Gakkaishi; 18: No. 9, 572-581(Sep 1976). (In Japanese).

For the measurement of plutonium deposited in lungs, the bioassay method has been employed in the past. However, the external measurement with lung monitors has been improved recently, and is practically used in a few nuclear facilities in Japan. The external measurement is not in the well developed stage yet, because there are many difficulties in the development and calibration of its detectors. As the detectors, large-area proportional counters and scintillation detectors are used. The Phoswich type detectors belonging to the scintillators show the maximum performance at present. The calibration procedures include the several important items, namely the thickness determination of chest effective soft tissue, the distribution of plutonium dust in lungs, and its movement to other organs through metabolism. There are many difficulties in the estimation of plutonium deposition in lungs by the bioassay method. In addition, it is an indirect method, and includes the troublesome collection and analysis of the samples. Therefore, the external measurement with the lung monitors seems to be the central method. For the evaluation of the measured results of plutonium from the viewpoint of radiation protection, the knowledges on cleaning inhaled plutonium from lungs and its movement to other organs are first required. With the present techniques, the detection and determination of permissible burden would be the possible best result.

- 1130 (AD-A--037829) INVESTIGATION OF OCULAR EFFECTS OF CHRONIC EXPOSURES OF PRIMATES TO MICROWAVE RADIATION AT 2.45 GHZ. PHASE I. FINAL TECHNICAL REPORT, 29 SEPTEMBER 1974--30 JUN 1975. Heynick, L.N.; Polson, P.; Karp, A. (Stanford Research Inst., Menlo Park, Calif. (USA)). Sep 1976. Contract DAMD17-74-C-4135. 60p. NTIS, PC A04/MF A01.

The development is described of a prototype module for irradiating nonhuman primates of sizes up to and including stump-tail macaques at

2.45 GHz for long time periods without constraining the animals (except for cage confinement). This developmental work represents the first phase of an investigation to determine whether eye damage can be caused by chronic, low-level exposure to microwaves. Containers having various quantities of saline were used as first approximations to the RF losses of monkeys in a number of calorimetric measurements of 'whole-body' absorption dose rates as related to: values of net (forward minus reflected) power into the cavity and its contents, container placement within the cavity, and saline water mass. The results indicate that absorption dose rate at any given input power is insensitive to container location (indicative of isotropy) and is inversely related to the water mass.

- 1131 (Juel-Conf--21, pp 185-192) PHILOSOPHY OF GERMAN RADIATION PROTECTION LEGISLATION AND SUPERVISION. Jacobs, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Sep 1976. From 4. Indo-German seminar on operation of nuclear power plants; Juelich, F.R. Germany (29 Jun 1976).

Proceedings of the fourth Indo-German seminar on operation of nuclear power plants. Session 3.

It is the objective of the German Radiation Protection Ordinance to protect life, health and property from the harmful effects of ionizing radiations and to ensure compensation for damage caused by ionizing radiations. This scope is already fixed in section 1 of the Atomic Law of the FRG and in accord with the comparable regulation or decrees of other countries all over the world. To reach this objective, by the Radiation Protection Ordinance: 1) the handling of radioactive material is subjected to an extensive control by the state or his organisations (part of this control are the licensing procedures for handling, carriage, import and export, and transactions of radioactive materials as well as the direct supervision by the concerned authorities), 2) dose limits and limits of activity and concentrations are defined, 3) safety provisions are fixed which are legally binding the holder of a license and other persons appointed by him, responsible for radiation protection, 4) statutory offences are listed so that any person who wilfully or negligently contravenes the prescriptions shall be punished.

- 1132 (DOCKET-50267--569) FORT ST. VRAIN NUCLEAR GENERATING STATION. MONTHLY OPERATIONS REPORT FOR JULY 1976. (Public Service Co. of Colorado, Denver (USA)). 31 Aug 1976. 30p.

Monthly operations report for July 1976. VRAIN REACTOR; REACTOR OPERATION; RADIATION PROTECTION; MAINTENANCE; REACTOR MAINTENANCE; INSPECTION; TESTING; PERSONNEL; REACTOR START-UP; POWER; POWER GENERATION; RADIATION DOSES; RADIOACTIVE EFFLUENTS; SOLID WASTES; METEOROLOGY

- 1133 (DOCKET-50171--211) PEACH BOTTOM ATOMIC POWER STATION, UNIT 1. SEMIANNUAL DECOMMISSION REPORT, 1 JANUARY--30 JUNE 1976, REPORT NO. 2. (Consumers Power Co., Jackson, Mich. (USA)). 30 Aug 1976. 10p.

Semiannual decommission report, 1 January--30 June 1976, report No. 2. PEACH BOTTOM-1 REACTOR; REACTOR DECOMMISSIONING; SPENT FUEL ELEMENTS; TRANSPORT; FISSION PRODUCT RELEASE; RADIOACTIVE EFFLUENTS; ACTIVITY LEVELS; PERSONNEL; RADIATION DOSES

- 1134 (DOCKET-50331--784) DUANE ARNOLD ENERGY CENTER, UNIT 1. GALE INPUT TO COST-BENEFICIAL CASE FOR INFORMATION REQUIRED BY SECTION V.B OF APPENDIX I TO 10 CFR PART 50. (Iowa Electric Light and Power Co., Cedar Rapids (USA)). 30 Aug 1976. 13p.
GALE input to cost-beneficial case for appendix I 10 CFR part 50. DUANE ARNOLD-1 REACTOR; RADIOACTIVE EFFLUENTS; ACTIVITY LEVELS; RELEASE LIMITS; COST BENEFIT ANALYSIS; AIR FILTERS; GASEOUS WASTES; CONDENSATION CHAMBERS; MILK; RADIATION DOSES; G CODES; INFANTS
- 1135 (DOCKET-50271--780) VERMONT YANKEE NUCLEAR POWER STATION. LICENSE NO. DPR-28, TECHNICAL SPECIFICATIONS, PROPOSED CHANGE RE ENTRIES INTO HIGH RADIATION AREAS. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 26 Aug 1976. 4p.
Entries into high radiation areas. VERMONT YANKEE REACTOR; SPECIFICATIONS; RADIATION PROTECTION; ANNULAR SPACE; PERSONNEL; RADIATION MONITORS; RADIATION DOSES; DOSEMETERS
- 1136 (DOCKET-STN-50484--137) TYRONE ENERGY PARK, UNIT 1. LEAGUE AGAINST NUCLEAR DANGERS COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT. (Northern States Power Co., Minneapolis, Minn. (USA)). 14 Aug 1976. 63p.
League Against Nuclear Dangers comments on draft environmental statement. TYRONE-1 REACTOR; ENVIRONMENTAL EFFECTS; REACTOR OPERATION; RADIATION MONITORING; RADIATION DOSES; THYROID; WHOLE-BODY IRRADIATION; PERSONNEL; BACKGROUND RADIATION; TRITIUM
- 1137 (DOCKET-50277--790) PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3. CONTAINMENT LEAKAGE TESTING PROGRAM. (Philadelphia Electric Co., Pa. (USA)). 13 Aug 1976. 7p. (DOCKET-50278--672).
Containment leakage testing program. PEACH BOTTOM-2 REACTOR; PEACH BOTTOM-3 REACTOR; LEAK TESTING; PERSONNEL; RADIATION DOSES; OPENINGS; STEAM LINES; VALVES; UNDERWATER; CONTAINMENT
- 1138 (DOCKET-50247--735) INDIAN POINT STATION, UNIT 2. IE INSPECTION REPORT NO. 76-14. (Consolidated Edison Co. of New York, Inc., New York (USA)). 12 Aug 1976. 16p.
Inspection of health program during refueling. INDIAN POINT-2 REACTOR; INSPECTION; RADIATION PROTECTION; AIR FILTERS; PERSONNEL; RADIATION DOSES; BETA PARTICLES; WHOLE-BODY IRRADIATION; IN CORE INSTRUMENTS; REMOVAL
- 1139 (DOCKET-50309--549) MAINE YANKEE ATOMIC POWER PLANT. LICENSE NO. DPR-36, TECHNICAL SPECIFICATIONS, PROPOSED CHANGE RE ENTRIES INTO HIGH RADIATION AREAS. (Maine Yankee Atomic Power Co., Westboro, Mass. (USA)). 12 Aug 1976. 4p.
Change re entries into high radiation areas. MAINE YANKEE REACTOR; SPECIFICATIONS; RADIATION PROTECTION; RADIATION MONITORS; RADIATION DOSES; PERSONNEL
- 1140 (DOCKET-50254--853) QUAD-CITIES STATION, UNITS 1 AND 2. RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION, EXPOSURE, JANUARY--JUNE, 1976. (Commonwealth Edison Co., Chicago, Ill. (USA)). 11 Aug 1976. 83p. (DOCKET-50265--823).
Radioactive waste, environmental monitoring and occupational personnel radiation, exposure, January--June, 1976. QUAD CITIES-1 REACTOR; QUAD CITIES-2 REACTOR; PERSONNEL; RADIATION DOSES; ENVIRONMENT; MONITORING; RADIATION MONITORING; RADIOACTIVE EFFLUENTS; GASEOUS WASTES; SOLID WASTES; LIQUID WASTES; METEOROLOGY; IODINE 131; AQUATIC ECOSYSTEMS; MILK; GRASS; PLANTS; ATMOSPHERIC PRECIPITATIONS; RAIN; SOILS; VEGETABLES; GROUND WATER; ENVIRONMENTAL EFFECTS
- 1141 (DOCKET-50295--741) ZION NUCLEAR PLANT, UNITS 1 AND 2. IE INSPECTION REPORT NO. 76-19 AND 76-16. (Commonwealth Edison Co., Chicago, Ill. (USA)). 11 Aug 1976. 9p. (DOCKET-50304--620).
Inspection of radiation monitoring equipment and personnel radiation exposure incident. ZION-1 REACTOR; ZION-2 REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES; RADIATION MONITORS; RADIATION MONITORING
- 1142 (DOCKET-50016--249) ENRICO FERMI ATOMIC POWER PLANT, UNIT 1. ANNUAL DECOMMISSIONED REPORT EF-122, 1 JULY 1975--30 JUNE 1976. (Power Reactor Development Co., Detroit, Mich. (USA)). 6 Aug 1976. 14p.
Annual decommissioned report 1 July 1975--30 June 1976. ENRICO FERMI-1 REACTOR; REACTOR DECOMMISSIONING; NOZZLES; SODIUM; STORAGE; INSPECTION; PERSONNEL; RADIATION DOSES; TESTING; TRANSPORT; STORAGE; PRIMARY COOLANT CIRCUITS; EQUIPMENT; CONTAMINATION; RADIATION MONITORS; CALIBRATION; DRINKING WATER; RADIATION MONITORING
- 1143 (DOCKET-50010--584) DRESDEN NUCLEAR POWER STATION, UNITS 1, 2, AND 3. SEMI-ANNUAL REPORT, SECOND PORTION: RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION EXPOSURE, JANUARY--JUNE 1976. (Commonwealth Edison Co., Chicago, Ill. (USA)). 5 Aug 1976. 93p. (DOCKET-50237--1070; DOCKET-50249--859).
Semi-annual report, second portion: radioactive waste, environmental monitoring and occupational personnel radiation exposure, January--June 1976. DRESDEN-1 REACTOR; DRESDEN-2 REACTOR; DRESDEN-3 REACTOR; ENVIRONMENT; MONITORING; RADIOACTIVE EFFLUENTS; RADIATION MONITORING; SOLID WASTES; PERSONNEL; RADIATION DOSES; IODINE 131; AQUATIC ECOSYSTEMS; MILK; GRASS; RAIN; VEGETABLES; GROUND WATER; METEOROLOGY
- 1144 (UCID--17000) AERIN: A COMPUTATIONAL VERSION OF THE ICRP LUNG MODEL. Powell, T.J.; Myers, D.S.; Parlagreco, J.R.; Haggin, G.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Aug 1976. Contract W-7405-ENG-48. 82p. Dep. NTIS, PC A05/MF A01.
The computer program AERIN is a computational version of the model for the behavior of inhaled radionuclides developed by the International Commission on Radiological Protection (ICRP) Task Group on Lung Dynamics. To this end, the program will compute and plot the burden of radioactivity versus time in various portions of the lung and lymph nodes that result from chronic or acute inhalation of a radionuclide. In addition to describing the basic ICRP lung model, the program has been extended to compute the burden of inhaled plutonium deposited in the liver and bones that has been transported there via the lungs or lymph nodes and the rate of plutonium excretion via the urine and feces. Finally, the program will compute the average radiation dose delivered to each organ by the inhaled radionuclide.
- 1145 (EPRI-EA--43-SY) PLUTONIUM: FACTS AND INFERENCES. OVERVIEW, SUMMARY REPORT. Comar, C.L. (ed.). (Electric Power Research Inst., Palo Alto, Calif. (USA)). Aug 1976.

19p. Dep. NTIS, PC A02/MF A01.

This overview summarizes the knowledge available about Pu and the reasonable inferences that can be drawn from that knowledge. Every attempt is made to avoid misleading statements and to convey an evenhanded view. Chemistry, industrial/military experiences, nuclear power experiences, waste management, behavior in biosphere, behavior in human beings, and toxicity and hazard all are considered. Quantitative estimates are summarized, and the possible diversion of Pu for malevolent purposes is considered. It is concluded that Pu does not critically limit nuclear power safety and is not more difficult to control than many other substances commonly handled in industry. (DLC)

- 1146 (IRS--290) STUDIES FOR A COMPARISON OF THE MAXIMUM POSSIBLE CONSEQUENCES OF ACCIDENTS IN A REPROCESSING PLANT AND A NUCLEAR POWER STATION. Bachner, D.; Holm, D.; Meltzer, A.; Morlock, G.; Neusser, P.; Urbahn, H. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (Germany, F.R.)). Aug 1976. 42p. (In German). Dep. NTIS (US Sales Only), PC A03/MF A01.

The article aims at comparing the danger potential of a commercial reprocessing plant with that of a large NPP. For doing this, the radiological effects of a so-called 'Super-MCA' were tested with no safety measures: melting of the fuel element receiving area and of the concentrate containers of a reprocessing plant and core meltdown. The tables contain the doses calculated for the critical organs for the distances 1, 10 and 100 km. The investigations demonstrate that there are no principal differences in the safety of a reprocessing plant and a NPP under those hypothetical pessimistic assumptions.

- 1147 (KFK--2255, pp v) EXPERIENCE GAINED IN THE OPERATION OF REPROCESSING OF LWR-FUELS IN THE WAK. Huppert, K.L. (Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen m.b.H., Eggenstein-Leopoldshafen (Germany, F.R.)). Aug 1976. (In German).

Compilation of papers for the 1st status report of the project 'reprocessing and waste treatment', November 17, 1975.

A report is given on technical improvements in the reprocessing plant Karlsruhe (WAK) and on their effect on the operational behaviour.

- 1148 (AED-Conf--76-280-000, pp 250-263) DEVELOPMENT OF STORAGE TECHNIQUES FOR RADIOACTIVE WASTES AND OF THE RADIATION EXPOSURE OF THE PERSONNEL IN THE EXPERIMENTAL PLANT ASSE. Breest, H.C. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Abt. Reaktorsicherheit und Strahlenschutz); Albrecht, E. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Wolfenbuettel (Germany, F.R.)). Inst. fuer Tiefelagerung). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities. Experience and consequences from a technical point of view.

The FRG is to deposit its radioactive wastes in salt at great depths. With this in mind, experiments with suitable methods are made in the trial facility of Asse. Experience gained is taken into account in further developments. Low-level radioactive wastes are stored already in routine operation. Final storage of medium-activity wastes is still in the experimental

stage; the next step of development in this context will be the application of the cavern technique. The final storage of high-activity wastes developing decay heat is in the early stages. Two important steps in this direction are the trial deposits of unprocessed carbide AVR fuel elements (radiation, but no heat problems of any significance yet) and extensive temperature fields (temperature influence, but no radiation effects). The radiation exposure of the personnel, despite increasing amounts and increased specific activities of the wastes, has been continuously lowered, and at present it lies on average below the detection limit of 40 mrem/month.

- 1149 (BNWL--2075) METHODOLOGY FOR CALCULATION OF RADIATION DOSES IN THE ENVIRONS FROM NUCLEAR FUEL CYCLE FACILITIES. Soldat, J.K. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1976. Contract E(45-1)-1830. vp. Dep. NTIS \$6.00.

Comparison of the impacts of various nuclear fuel cycle alternatives includes the evaluation of the radiological impacts. To evaluate the radiological impacts of fuel cycle alternatives, exposure to man must first be identified. The pathways of consequence by which man can be exposed to radiation from a nuclear facility are listed and are grouped into those associated with gaseous effluents, those associated with liquid effluents, and those involving exposure to direct radiation from the facility or from transportation of radioactive materials to or from the facility. Calculations for each pathway were made for those selected organs which could potentially receive the highest radiation dose. Some of the programs developed for calculating radiation doses from radionuclides in the environment are described. (CH)

- 1150 (AED-Conf--76-280-000, pp 189-196) RADIATION PROTECTION ASPECTS IN CONNECTION WITH THE PRODUCTION OF FUEL ELEMENTS CONTAINING PLUTONIUM. Hagenberg, W. (Alpha Chemie und Metallurgie G.m.b.H. (ALKEM), Hanau (Germany, F.R.)). Abt. Sicherheit). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

When designing and operating a factory for fuel elements containing plutonium, not only those guidelines and regulations which are also valid for conventional factories and which serve to prevent accidents have to be observed, but additional regulations and conditions which take into account the very special radiological danger potential have to be paid attention to. A brief description of the fabrication of mixed oxide fuel elements is followed by an outline of those main measures which are indispensable in safe plutonium handling, in particular in avoiding Pu contaminations and incorporation, and in keeping the external radiation exposure of exposed personnel as low as possible.

- 1151 (AED-Conf--76-280-000, pp 210-220) RADIATION PROTECTION IN THE REPROCESSING PLANT KARLSRUHE. Herrmann, G. (Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen m.b.H., Eggenstein-Leopoldshafen (Germany, F.R.)). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

The reprocessing plant Karlsruhe has gained experience in the field of radiation protection

since 1971. The measures to supervise not only external irradiation but also personnel contaminations resulted in the fact that the radiation exposure of the personnel remained considerably below the permissible values. The average personnel dose per annum on account of external irradiation was not more than 24% of the permissible annual dose of 5 rem, the highest dose was 80%. Activity incorporations were within the percentage of permissible values.

- 1152 (PB--260584) PLUTONIUM: FACTS AND INFERENCES. Comar, C.L.; Seefeldt, W.B.; Mecham, W.J.; Steindler, M.J.; Cohen, B.L. (Electric Power Research Inst., Palo Alto, Calif. (USA)). Aug 1976. 163p. (EPRI/EA--43-SR). NTIS, PC A08/MF A01.

This report reviews the knowledge that we have about plutonium from the point of view of the inferences that can be drawn from such knowledge relative to the implications for society of the creation of this element in a nuclear power industry. It represents a detailed source of information that should be helpful in promoting an understanding of the issues. An idea of the content can be gained from the chapter titles: (1) Properties of Plutonium; (2) Release of Plutonium into the Environment from the Nuclear Power Industry; (3) Plutonium in the Biosphere; (4) Plutonium and Human Beings; (5) Diversion of Plutonium for Malevolent Purposes. In the report itself there was an attempt to avoid stating conclusions. However, the contributing authors did express a general view based on their collective experiences. (GRA)

- 1153 (AED-Conf--76-280-000, pp 197-204) RADIATION PROTECTION IN THE KERNKRAFTWERK BIBLIS. Schroeder, H. J. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Biblis (Germany, F.R.). Hauptabteilung Ueberwachung). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

The organisation of the Health Physics Group is described. Some data of radiation exposure of the personnel during 1975 and the refuelling period 1976 are given.

- 1154 'INCIDENT' AT THE KERNKRAFTWERK NECKAR. Energiewirtschaft. Tagesfragen; 26: No. 8, 467 (Aug 1976). (In German).

When an engine fitter entered the facility to go to work the alarm at the entrance went off. This alarm system reacts to radioactive substances and then closes all doors. It happened that the fitter had undergone an examination of the brain at a hospital some hours earlier, and for this purpose the doctor had given him an injection of technetium 99. Dose rate measurements in the nuclear power plant read a surface radiation of the man's head and body of 4 mrem/h. The facility reports: 'The man was sent home straight away in order to try and keep the power plant free of contamination'.

- 1155 (AED-Conf--76-280-000, pp 48-58) RADIATION PROTECTION EXPERIENCE WITH THE LARGE-SCALE ACCELERATOR OF CERN. Goebel, K. (European Organization for Nuclear Research, Geneva (Switzerland). Health and Safety Div.). Aug 1976. (In German).

From 1. workshop on facilities and experimental devices; Orsay, France (9 Jun 1976).

radiation protection in nuclear facilities.

The radiation protection problems connected with the 300 GeV accelerator are discussed and the radiation protection system of the 300 GeV, which is based on the experience from the smaller CERN accelerators, is described.

- 1156 (AED-Conf--76-280-000, pp 66-72) FIRST OPERATING EXPERIENCE AT SIN. Janett, A. (Schweizerisches Inst. fuer Nuklearforschung, Villigen). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

The induced radioactivity of the extraction elements of a high-intensity accelerator, coupled with the quite high rate of maintenance, is presenting the most important radiation safety problem for personnel and can only be reduced by providing a practical training in the use of radioactive materials and by using remote handling techniques. The short and long time behavior of the γ -dose rates along the whole beam line is presented and compared with theoretical ones.

- 1157 (ERDA--76-104(Vol.1)) ENVIRONMENTAL MONITORING AT MAJOR U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION CONTRACTOR SITES: CALENDAR YEAR 1975. VOLUME 1. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Safety, Standards and Compliance). Aug 1976. 744p. Dep. NTIS \$18.75.

The purpose of the compilation is to present, in a central reference document, all of the individual annual reports summarizing the results of the environmental monitoring programs conducted at each of the Energy Research and Development Administration (ERDA) sites having a potential for environmental impact or which release a significant quantity of radioactivity or nonradioactive pollutants. The individual reports comprising the compilation were prepared and previously published by ERDA contractors in accordance with ERDA Manual Chapter 0513, Effluent and Environmental Monitoring and Reporting. These reports contain data on the levels of radioactivity and nonradioactive pollutants in effluents and the environs at each site, and an interpretation of effluent and environmental measurements and sampling results in relation to the appropriate standards for environmental protection, including estimates of potential radiation exposures offsite. The annual reports have been routinely distributed to Federal, state, and local public health and pollution control agencies and to the public. Copies of the individual reports for each site are available upon request from the local ERDA Operations Office or the National Technical Information Center, U. S. Department of Commerce, Springfield, Virginia 22151.

- 1158 (ERDA--76-104(Vol.2)) ENVIRONMENTAL MONITORING AT MAJOR U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION CONTRACTOR SITES: CALENDAR YEAR 1975. VOLUME 2. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Safety, Standards and Compliance). Aug 1976. 756p. Dep. NTIS \$18.75.

This report describes environmental monitoring conducted during 1975 in the vicinity of the Beaver Valley Power Station and the Shippingport Atomic Power Station. The environmental monitoring program consists of onsite sampling of water, gaseous, and air effluents, as well as offsite monitoring of

water, air, soil, and radiation levels in the vicinity of the site. The report discusses releases of small quantities of radioactivity to the Ohio River from the Shippingport Atomic Power Station during 1975. The Beaver Valley Power Station was under construction during the report year, and therefore, made no radioactive releases. Additional analyses of the effluent from the reactor portion of Shippingport were performed to ensure that the water quality standards specified by Energy Research and Development Administration Manual Chapter 0510 and the Commonwealth of Pennsylvania have been met. The results of environmental monitoring described by this report show that Shippingport operations and the pre-operational phase of the Beaver Valley Power Station have not adversely affected the surrounding environment.

the right tibia was the only abnormality noted in the scan. An open biopsy revealed Paget's disease, and no radiographic evidence of Paget's disease was found in any other bone. These cases again illustrate that localized accumulation of a bone-scanning agent, in patients with known primary tumors, does not necessarily denote malignancy in bone.

- 1159 (ORNL--5169) APPLIED HEALTH PHYSICS AND SAFETY ANNUAL REPORT FOR 1975. (Oak Ridge National Lab., Tenn. (USA)). Aug 1976. Contract W-7405-ENG-26. 77p. Dep. NTIS \$5.00.

This report describes and summarizes the activities of the applied sections and/or groups of the Health Physics Division. Projects and activities covered include personnel monitoring, environmental monitoring, radiation and safety surveys, and industrial safety. (CH)

- 1160 AIR EXCHANGE AND ^{222}Rn CONCENTRATIONS IN THE CARLSBAD CAVERNS. Wilkening, M.H.; Watkins, D.E. (New Mexico Inst. of Mining and Technology, Socorro (USA)). Health Phys.; 31: No. 2, 139-145(Aug 1976).

Radon ^{222}Rn concentrations in the air in Carlsbad Caverns have been measured at different times of year in order to define certain features of the natural circulation of the cave atmosphere and to estimate the internal radiation exposure to visitors and Park Service personnel. Concentrations average 48 pCi/l. in the summer when the temperature lapse rate provides a stable cave atmosphere. In the winter months air from outside having a ^{222}Rn concentration of only about 0.2 pCi/l. mixes with the cave air reducing radon levels to about 15 pCi/l. A simple model obtained by equating the input of ^{222}Rn atoms from the rocks and soils of the cave's interior surfaces to the sum of terms for radioactive decay and dilution of the cave atmosphere by outdoor air enables one to predict, for steady-state conditions, the approximate levels of activity to be expected for all months of the year. If it is assumed that the short-lived daughter products of ^{222}Rn are present in equilibrium amounts, Park Service personnel spending most of their time underground approach the 4 WM/yr (working level months per year) exposure limit established for the uranium industry. A visitor on a 3-hr trip through the Caverns would receive only a few per cent of the exposure guides for the general population.

- 1161 TWO UNUSUAL CAUSES OF PERIPATELLAR NONMETASTATIC POSITIVE BONE SCANS IN PATIENTS WITH MALIGNANCIES: CASE REPORTS. Turner, J.W.; Syed, I.B.; Spencer, R.P. (Wesson Memorial Hospital, Springfield, MA). J. Nucl. Med.; 17: No. 8, 693-695(Aug 1976).

Bone scans performed with ^{99m}Tc -polyphosphate in two patients with epidermoid carcinoma of the lung each showed activity in one knee area. In the first case, radiographs of the area revealed Pellegrini-Stieda calcification over the internal femoral condyle. Uptake corresponded to this process, rather than to a lesion deep in the bone. In the second case, the activity accumulation in

- 1162 INFLUENCE OF DOSE RATE ON CARCINOGENESIS RESULTING FROM X-RAY, ^{137}Cs , AND ^{198}Au IRRADIATION. Witcowski, R.L.; Pizzarello, D.J. (Bowman Gray School of Medicine, Winston-Salem, NC). J. Nucl. Med.; 17: No. 8, 715-718(Aug 1976).

The potential hazards from internally administered radionuclides used in nuclear medicine are usually compared with one another and with diagnostic x-rays on the basis of the absorbed dose in rads, with no regard to the dose rate of the radiation. This study compared the carcinogenic potential of a dose of 250 rads delivered at different dose rates to rat livers by x-ray, ^{137}Cs , and ^{198}Au . The chemical carcinogen N-2-fluorenyldiacetamide was administered after irradiation to reduce the latent period and increase the number of radiogenic liver tumors. No significant difference in tumor incidence was observed among groups of animals treated with either ^{198}Au , ^{137}Cs , or x-irradiation.

- 1163 ANALYSIS OF THE DEVELOPMENTAL STAGE OF SPECIFIC AND NONSPECIFIC CYTOTOXICITY. I. SEPARATION OF THE DEVELOPMENTAL STEPS OF SPECIFIC CYTOTOXICITY BY SUSCEPTIBILITY TO IRRADIATION. Taniguchi, K.; Nomoto, K.; Sato, M.; Yano, Y.; Takeya, K. (Kyushu Univ., Fukuoka). Cell. Immunol.; 25: No. 2, 228-236(Aug 1976).

Susceptibility of T-cell-mediated cytotoxicity to x irradiation was examined in the stages of induction and expression. C3H/He mice and a methylcholanthrene-induced sarcoma of C57BL/6 origin were used for experiments. Established cytotoxicity was radioresistant. Irradiation of hosts before tumor inoculation suppressed induction of cytotoxicity. Irradiation at 3 hr after tumor inoculation or later did not affect induction of cytotoxicity. Cytotoxicity became detectable on day 7 but not on day 3, when mice were irradiated 3 hr after tumor inoculation. Tumor resection abolished cytotoxicity when carried out 24 hr after tumor inoculation but not when carried out on day 3 or later. Sonicated antigen of tumor cells proved to be effective in raising the radioresistant state in the hosts, since cytotoxicity was detectable in those given irradiation 3 hr and viable tumor cells 6 hr after the priming. The radioresistant nature of cytotoxicity may be acquired within a very short period after immunization. However, development of killer cells from such a radioresistant state requires further antigen stimulation with viable tumor cells for a limited period, and maturation of such cells requires some latent period thereafter.

- 1164 MUTAGENICITY STUDIES ON IRRADIATED POTATOES AND CHLOROGENIC ACID; MICRONUCLEUS TEST IN RATS. Hossain, M.M. (Atomic Energy Centre, Dacca, Bangladesh); Huismans, J.W.; Diehl, J.F. Toxicology; 6: No. 2, 243-251(Aug 1976).

The micronucleus test was used to study possible mutagenic effects of (1) irradiated potatoes extracted (a) immediately and (b) after 24-h storage following irradiation; (2) irradiated and unirradiated chlorogenic acid; and (3) trenimon. It was observed that

irradiated potatoes (groups 1 a, b) and chlorogenic acid (group 2) did not cause mutagenic effects in the bone-marrow cells of rats. The Trenimon group (group 3), which was used as the positive control group, did show significant mutagenic effects.

- 1165 (AED-Conf--76-280-000, pp 107-112) RADIATION EXPOSURE OF PERSONNEL IN NUCLEAR MEDICINE. Oberhausen, E. (Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.). Abt. fuer Nuklearmedizin und Medizinische Physik). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities. Experience and consequences from a technical point of view.

Generally speaking, it is not possible to detect radiation exposure of personnel in nuclear medicine with the film badges of ordinary personnel dosimetry. The main exposures are those of the hands, and in particular of the fingers, on account of administering sup(99m)Tc medicaments, and those of the thyroid as a result of ^{131}I incorporations. As sup(99m)Tc is used very often, it is necessary to pay special attention to exposures of this kind.

- 1166 (AED-Conf--76-280-000, pp 1-4) OPENING ADDRESS OF THE PRESIDENT OF THE CONGRESS. Rausch, L. Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Short communication only. Available from ZAED. Will be published in Strahlenschutz in Forschung und Praxis (1977) v. 17. Thieme.

Radiation protection in nuclear facilities. Experience and consequences from a technical point of view.

PUBLIC RELATIONS; RADIATION PROTECTION; NUCLEAR FACILITIES

- 1167 (AED-Conf--76-280-000, pp 231-240) EXPERIENCE IN RADIATION PROTECTION MONITORING GAINED BY THE DECONTAMINATION DEPARTMENT OF THE KERNFORSCHUNGSZENTRUM KARLSRUHE. Koenig, L.A.; Neumann, W. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

The decontamination department disposes of the liquefied and solid radioactive wastes of the Kernforschungszentrum Karlsruhe (KFZK) and the Reprocessing Plant Karlsruhe and makes end products ready for storage, by means of contraction and fixation. The department also takes the radioactive wastes of the depot of the Land Baden-Wuerttemberg for further processing. The facilities of the decontamination department are being made more efficient just now in order to adapt them to increased requirements. The facility's present condition and the activities to increase efficiency during normal operation make special radiation protection measures necessary. These measures are reported on.

- 1168 (AED-Conf--76-280-000, pp 267-272) TRAINING AND EXPERT KNOWLEDGE. Lenkeit, S. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Schule fuer Kerntechnik). Aug 1976. (In German).

From 10. annual meeting of the Fachverband

fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

The training of the radiation protection specialist can be seen at 3 levels: technician, laboratory assistant or operator, and engineer and scientist. There is no such thing as technician or laboratory assistant education in radiation protection. Personnel employed in nuclear power plants or nuclear research centres under this description of occupation are usually technicians or laboratory assistants trained in other fields, but with radiation protection know-how acquired during their work. With regard to the engineer's training, things are not a lot different. For those with an academic degree, too, there is no special radiation protection education. At very few universities only, special lectures are given on radiation protection. There are only two exceptions. These are the 'Strahlenschutzassistentinnen und -assistenten' (laboratory technicians), trained in the department for radiation protection and safety, and training facilities as offered by the Fachhochschule Giessen. Expert knowledge is a precondition for radiation protection responsibility according to the first and also the new Radiation Protection Ordinance and the X-Ray Ordinance. For the time being, this expert knowledge is only defined in more detail in the X-Ray Ordinance for the non-medical sector.

- 1169 (AED-Conf--76-280-000, pp 98-106) RADIOACTIVELY LABELLED SUBSTANCES FOR IN VIVO AND IN VITRO TESTS FROM THE TIME OF THEIR PRODUCTION UP TO THEIR USE IN NUCLEAR MEDICINE. Riccato, M.T. (Byk-Mallinckrodt Chemische Produkte G.m.b.H., Dietzenbach (Germany, F.R.). Abt. Strahlenschutz). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

Most important production steps and control tests applied to radionuclides and radioactive labelled compounds used in nuclear medicine are described. Radiopharmaceutical products are subdivided in products for therapy and for in vivo and in vitro diagnostics tests.

- 1170 (AED-Conf--76-280-000, pp 205-209) RADIATION PROTECTION EXPERIENCE IN THE KERNKRAFTWERK STADE. Ruebenberg, P. (Kernkraftwerk Stade G.m.b.H. (KKS) (Germany, F.R.)). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

The organization of radiation protection in the Kernkraftwerk Stade having been described, the extent of work during the period of revision is portrayed. The personnel dose rates, for own as well as foreign staff members, show a static tendency with annual doses between 300 and 400 rem per man. The lecture concludes with radiation protection measures during diving activities in 1973 when the core grid was exchanged in the flooded reactor pressure vessel.

- 1171 (AED-Conf--76-280-000, pp 278) CONDUCT IN CONTROLLED AREAS. Samuel, T. (Kernkraftwerk Beznau, Doettingen (Switzerland)). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

- Radiation protection in nuclear facilities.
EDUCATION; INSPECTION; NUCLEAR FACILITIES;
PERSONNEL; RADIATION PROTECTION; REPAIR;
SWITZERLAND
- 1172 (AED-Conf--76-280-000, pp 7-17)
IRRADIATION PLANTS CONTAINING RADIOACTIVE
SUBSTANCES. Ehret, R. (Bundesministerium des
Innern, Bonn (Germany, F.R.)). Aug 1976.
(In German).
From 10. annual meeting of the Fachverband
fuer Strahlenschutz e.V.; Giessen, F.R. Germany
(9 Jun 1976).
Radiation protection in nuclear facilities.
Within the framework of a security
inspection by the Federal Minister of the
Interior, the safety level of non-medical gamma
irradiation plants in the FRG was covered. The
consequences derived from the experience gained
from inspections and questionnaires are to be
seen from the statistical evaluations of the
results.
- 1173 (AED-Conf--76-280-000, pp 42-47)
EXPERIENCE GAINED BY CHECKING MEDICAL
ACCELERATORS IN THE LAND OF NORTH RHINE-
WESTPHALIA WITHIN THE FRAMEWORK OF THE
ACCELERATOR GUIDELINES. Ewen, K.
(Gewerbeaufsicht des Landes Nordrhein-
Westfalen, Duesseldorf (Germany, F.R.)).
Zentralstelle fuer Sicherheitstechnik,
Strahlenschutz und Kerntechnik). Aug 1976.
(In German).
From 10. annual meeting of the Fachverband
fuer Strahlenschutz e.V.; Giessen, F.R. Germany
(9 Jun 1976).
Radiation protection in nuclear facilities.
Ever since the guidelines for the operation
of accelerators in the field of medicine came
into force in 1973, the plants operated in the
Land of North-Rhine-Westphalia are inspected
every year by the supervisory authorities,
i.e. a check is made whether the requirements
in the guidelines have been adhered to or not.
This contribution presents a survey of the
results obtained during these examinations. The
lecture is also critically concerned with the
question whether the various requirements set
up in the guidelines have been adopted sensibly
to accelerator operation in medical practice.
- 1174 (AED-Conf--76-280-000, pp 29-41)
PROBLEMS IN THE STANDARDIZATION OF TECHNICAL
RADIATION PROTECTION PROVISIONS FOR MEDICAL
ELECTRON ACCELERATORS. Kossel, F.
(Bundesgesundheitsamt, Neuherberg/Muenchen
(Germany, F.R.)). Inst. fuer Strahlenhygiene).
Aug 1976. (In German).
From 10. annual meeting of the Fachverband
fuer Strahlenschutz e.V.; Giessen, F.R. Germany
(9 Jun 1976).
Radiation protection in nuclear facilities.
Recently published drafts of the standards
for medical electron accelerators provide for a
maximum of automatic safety control. Due to the
necessary complex devices, there might be more
interruptions, which, however, will not
directly affect the patient, but interfere in
the regular irradiation treatment procedure.
Safety philosophy should in this case
comprehend the entire irradiation operation in
which the technical safety is adequately
integrated.
- 1175 (AED-Conf--76-280-000, pp 90-97)
RADIATION PROTECTION PROBLEMS WITH REGARD TO
THE PRODUCTION AND PROCESSING OF SHORT-LIVED
RADIONUCLIDES. Sauermann, P.F.; Friedrich, W.
(Kernforschungsanlage Juelich G.m.b.H.
(Germany, F.R.)). Inst. fuer Chemie). Aug
1976. (In German).
From 10. annual meeting of the Fachverband
fuer Strahlenschutz e.V.; Giessen, F.R. Germany
(9 Jun 1976).
Radiation protection in nuclear facilities.
In production and separation of short-lived
radionuclides high activities are involved.
Consequently, high doses to workers are to be
expected, mainly to the hands and the forearms.
In this paper some of the health physics
problems associated with the operation of a
compact cyclotron and the handling of short-
lived radionuclides are discussed, particularly
activation of air and target material,
shielding of fast neutrons and external doses
to workers.
- 1176 (AED-Conf--76-280-000, pp 273-277)
RADIATION PROTECTION TRAINING AND IMPARTING
KNOWLEDGE IN THE KERNFORSCHUNGSANLAGE JUELICH.
Tzschaschel, R.; Heinzelmann, M.
(Kernforschungsanlage Juelich G.m.b.H.
(Germany, F.R.)). Zentralabteilung
Strahlenschutz). Aug 1976. (In German).
From 10. annual meeting of the Fachverband
fuer Strahlenschutz e.V.; Giessen, F.R. Germany
(9 Jun 1976).
Radiation protection in nuclear facilities.
The Zentralabteilung Strahlenschutz (ZST) is
considerably engaged in various activities of
health physics training. There are lectures at
the Fachhochschule of Aachen, Juelich division,
courses held within the KFA, instructions and
informations as are prescribed by the law, and
exercises in cooperation with services of the
Technisches Hilfswerk, (ABC-troops).
- 1177 (AED-Conf--76-280-000, pp 154-163)
DOSE RATES AND PERSONNEL DOSES WITH REGARD TO
THE CARRIAGE OF RADIOACTIVE SUBSTANCES WITH THE
FEDERAL RAILWAY. Werner, K. (Bundesbahn-
Zentralamt, Minden (Germany, F.R.)). Aug
1976. (In German).
From 10. annual meeting of the Fachverband
fuer Strahlenschutz e.V.; Giessen, F.R. Germany
(9 Jun 1976).
Radiation protection in nuclear facilities.
In connection with the present tendency to
lower the intake as well as the legally
permissible radiation doses, it is of interest
to know which radiation loads occur nowadays in
connection with the carriage of radioactive
substances. In this context, estimates are made
on the basis of statistical data on 13,187
packages sent by express during the course of 2
months, and on the basis of personnel dose
measurements. These estimates demonstrate that
the radiation exposure of the persons engaged
in the transport was considerably below 500/
mrem/a, a few of the people covered being
excepted.
- 1178 (AED-Conf--76-280-000, pp 147-153)
RADIATION PROTECTION IN THE TRANSPORT OF SPENT
FUEL ELEMENTS. Christ, R. (Transnuklear
G.m.b.H., Grossauheim (Germany, F.R.)). Aug
1976. (In German).
From 10. annual meeting of the Fachverband
fuer Strahlenschutz e.V.; Giessen, F.R. Germany
(9 Jun 1976).
Radiation protection in nuclear facilities.
The shipment of spent fuel elements is the
most complicated transport operation of the
nuclear fuel cycle. Safety-related features of
container design are reported. Also experience
from shipments and future aspects are
discussed.
- 1179 (AED-Conf--76-280-800, pp 80-89)
RADIOACTIVITY IN CONSUMER GOODS. Wachsmann,

F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Auswertungsstelle fuer Strahlendosimeter). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

A report is given on the results of a study executed in the nine countries of the European Community on the amount of radionuclides used in consumer goods. Medium and long term risk evaluation for the users and the public for the different radionuclides has been done. Presuming the correct use of the radioactive consumer goods, there does not appear to be significant danger at present and up to the end of this century for either individuals or the public in general, since the expected average of gonadal and whole-body dose remains under 1 mrem/year. Suggestions are given to keep these doses small.

- 1180 (AERE-M--2811) CODE OF PRACTICE FOR USE IN BIOMEDICAL RESEARCH INVOLVING THE IRRADIATION OF EMPLOYEES OF THE UKAEA. Morgan, A.; Foord, N. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Aug 1976. 10p. NTIS (US Sales Only).

Volunteers have been used in biomedical studies at AERE Harwell since 1964. The procedures to be followed by investigators and the responsibilities of the Head of Environmental and Medical Sciences Division of the Chief of Medical Services were described in the minutes of the inaugural meeting of the Inhalation Studies and Approval Committee. Recently, these procedures have been reviewed and to make them readily available are summarised in this Code of Practice.

- 1181 (CONF-751158--), pp 117-121) CYTOGENETIC STUDY OF A-BOMB SURVIVORS AND THEIR CHILDREN IN HIROSHIMA AND NAGASAKI. Awa, A.A.; Sofuni, T.; Honda, T. (Radiation Effects Research Foundation, Hiroshima). Aug 1976.

From Workshop on automated cytogenetics; Pacific Grove, CA, USA (30 Nov 1975).

Automation of cytogenetics.

Chromosome studies were performed on the somatic cells of A-bomb survivors and their children in Hiroshima and Nagasaki to evaluate both somatic and genetic effects of A-bomb irradiation. Radiation-induced chromosome exchanges, particularly symmetric types, have persisted in the somatic cells of survivors, and a dose-aberration relationship is present more than two decades after A-bomb exposure. Among the children of the exposed, the frequencies of cases with sex chromosome aneuploidy or structural rearrangements appeared to be slightly higher in the children of the exposed parents than in the controls, though the differences between the two groups of children are not statistically significant.

- 1182 (FDA--76-8054) SPECIFIC AREA GONAD SHIELDING. RECOMMENDATION FOR USE ON PATIENTS DURING MEDICAL DIAGNOSTIC X-RAY PROCEDURES. (Department of Health, Education, and Welfare, Rockville, Md. (USA)). Aug 1976. 19p. BRH Technical Information, Rockville, MD.

Recommendations for shielding the gonads of patients during diagnostic x-ray procedures are presented. Two general types of gonad shields are described and directions for their use are included. (CH)

- 1183 (INS-R--195) CRITIQUE OF THE USE OF THE LINEAR NO-THRESHOLD HYPOTHESIS IN THE

ESTIMATION OF RADIATION RISKS TO LARGE POPULATIONS. Roberts, P.B. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Aug 1976. 26p. Dep. NTIS (US Sales Only), PC A03/MF A01.

The estimation of radiation risks to large populations is heavily dependent at present upon the hypothesis that there is a linear relationship between dose and biological effects at all doses. This report outlines why this is so and discusses the likely validity of the hypothesis. It is concluded that the hypothesis may be reasonable for high LET radiation and for genetic risks, especially if low dose rate data are used for the latter. For radiation carcinogenesis, particularly with low LET radiation, the linear hypothesis may substantially overestimate the risk to the majority of the public.

- 1184 (KFK--2348) CALCULATED RADIOLOGICAL IMPACT ON THE ENVIRONMENT OF THE KARLSRUHE NUCLEAR RESEARCH CENTER DUE TO RADIOACTIVE EMISSIONS TO THE ATMOSPHERE IN THE YEARS 1975 AND 1976. Huebschmann, W.; Nagel, D.; Papadopoulos, D. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). Aug 1976. 28p. (In German). NTIS (US Sales Only).

5 figs.; 6 tabs.; 18 refs..

The radiological impact by radioactive offgas and exhaust air on the environment of the Karlsruhe Nuclear Research Center (KNRC) is calculated every year and compared with the permissible equivalent doses. This report includes both the forecasted maximum doses from maximum releases scheduled for the year 1976 and the actual doses of 1975 based on the measured releases in 1975. According to the various irradiation mechanisms of the nuclides emitted, the following doses are indicated, each calculated for an adult person: whole body dose by γ -irradiation and tritium inhalation, skin dose by external β -irradiation, lung dose by aerosol inhalation, bone dose by plutonium inhalation, and effective integral dose. The maximum infant thyroid dose due to iodine ingestion via the pasture-cow-milk-pathway is also calculated. The respective maximum doses indicate that the dose limits of 30 mrem/a whole body dose (adult) and 90 mrem/a thyroid dose (Infant) which are to be observed by the KNRC since the year 1975 are not exceeded at any point, provided the emissions remain below the scheduled maximum level. The doses in 1975 were markedly below the dose limits mentioned above. This is even true when partial body and organ doses are integrated in an 'effective dose'.

- 1185 (KFK-tr--484) PROBLEM OF THE POPULATION DOSE. Belyaev, V.A. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Internationales Buero/ Uebersetzergruppe). Aug 1976. 16p. (In German). NTIS (US Sales Only).

From 20. anniversary of nuclear power engineering; Obninsk, USSR (25 Jun 1974).

1 fig.; 2 tabs.; 5 refs. Translated from Russian: K voprosu o populyatsionnoi doze. Also published in the proceedings: 20 let atomnoi energetike. Opyt ekspluatatsii AES i puti dal'neishego razvitiya atomnoi energetiki, 1974, v. 2, p. 355-366.

This report investigates methods of calculating the population dose due to emissions from nuclear reactors. The exposure of the local population is considered as well as the exposure of the population of the remote area where food produced near the reactor site is consumed. Units of measurement for the

population dose are discussed. A concrete example is given for calculating the contribution of isotopes of radioactive noble gases, ^{131}I and ^{137}Cs .

- 1186 (NTIS/PS--76/0612) RADIATION EFFECTS ON CELLS AND CHROMOSOMES (A BIBLIOGRAPHY WITH ABSTRACTS). REPORT FOR 1964--AUG 1976.

Crockett, P.W. (National Technical Information Service, Springfield, Va. (USA)). Aug 1976. 131p. NTIS (US Sales Only).

Supersedes NTIS/PS--75/551.

Reports on the effects of radiation on cell physiology, chemistry, and genetics are cited. Mechanisms of radiotherapy on cancerous cells are discussed. (This updated bibliography contains 126 abstracts, 24 of which are new entries to the previous edition.) (GRA)

- 1187 (PB--258039) SPECIFIC AREA GONAD SHIELDING. RECOMMENDATION FOR USE ON PATIENTS DURING MEDICAL DIAGNOSTIC X-RAY PROCEDURES. TECHNICAL REPORT, 23 JUL 1976. (Bureau of Radiological Health, Rockville, Md. (USA)). Aug 1976. 21p. (FDA/BRH--76/101). NTIS \$3.50.

The objective of this document is to encourage the use of gonad shielding during x-ray procedures so that unnecessary radiation exposure of the reproductive organs of patients can be avoided. This in turn can lessen the likelihood of adverse genetic consequences in future generations as a result of today's medical radiologic practices. (GRA)

- 1188 (RPD--76) RADIATION PROTECTION IN DENTAL RADIOGRAPHY. Jozani, F.; Parnianpour, H. (Atomic Energy Organization of Iran, Teheran. Radiation Protection Dept.). Aug 1976. 24p. Dep. NTIS (US Sales Only), PC A02/MF A01.

44 refs..

In considering the special provisions required in dental radiography, investigations were conducted in Iran. Radiation dose levels in dental radiography were found to be high. Patient exposure from intraoral radiographic examination was calculated, using 50kV X-ray. Thermoluminescent dosimeters were fastened to the nasion, eyes, lip, philtrum, thyroid, gonads and to the right and left of the supra-orbital, infra-orbital temporomandibular joints of live patients. The highest exposure value was for the lower lip. Recommendations concerning educational training and protection of staff and patients were included.

- 1189 (SRL--76004) SAFETY ANALYSIS OF DOUBLY ENCAPSULATED ^{252}Cf MEDICAL SOURCES, MODEL TALC-PC. Boulogne, A.R. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Aug 1976. Contract E(07-2)-1. 13p. Dep. NTIS \$3.50.

This document describes the doubly encapsulated ^{252}Cf neutron sources prepared for use in remote afterloading cancer brachytherapy. These neutron sources are classed as special form radioactive material and as such must meet certain Regulations prescribed by the U.S. Department of Transportation. This document describes the tests that have been performed and shows that this group of medical sources does meet the applicable DOT Regulations. The doubly encapsulated neutron sources are fabricated by the Savannah River Laboratory and are loaned by the U.S. Energy Research and Development Administration under contract agreement to medical organizations for evaluation of ^{252}Cf in the treatment of cancer.

- 1190 APLASTIC ANEMIA IN JAPANESE RADIOLOGICAL TECHNICIANS. Kitabatake, T.; Watanabe, T.; Saito, A.; Nakamura, M. (Niigata Univ. (Japan). Dept. of Radiology; Shiohama Hospital, Mie (Japan). Dept. of Radiology). Strahlentherapie; 152: No. 2, 187-190(Aug 1976).

4 tabs.; 11 refs..

Among the Japanese radiological technicians, four deaths from aplastic anemia have been reported after 1930. On the other hand, during the period from 1930 to 1960, the population of radiological technicians is estimated to be 74,400 man-years, in which 0.5 aplastic anemias are expected. However, actually three died from aplastic anemia. This difference is statistically significant at the 1% level. While, in the period from 1961 to 1973, the observed value is 1 against 0.7 expected. It is concluded that aplastic anemia had been induced frequently among the Japanese radiological technicians in the era when there was much exposure to occupational radiation.

- 1191 NEW TECHNOLOGICAL DEVELOPMENT IN COMPETITION WITH X-RAY DIAGNOSTICS FOR THE CIVILIZING RADIATION DOSES OF MAN. Stieve, F.E. (Bundesgesundheitsamt, Neuherberg/Muenchen (F.R. Germany). Inst. fuer Strahlenhygiene). Fortschr. Geb. Roentgenstr. Nuklearmed.; 125: No. 2, 97-111(Aug 1976). (In German).

14 figs.; 16 tabs.; with refs..

Radiation exposure of the population is expressed nowadays in terms of genetically significant dose and its individual components are compared. The calculations necessary for the present considerations have been carried out. As a basis for evaluating radiation protection, the natural sources of radiation and their variations are used. The dose of 110 mrem/a for the population of the Federal Republic is subject to considerable variations. Artificially produced radiation contributes a total of 60 mrem/a to the exposure. Of this, most is contributed by medical sources with 50 mrem/a, second is exposure due to atom bomb research. Other sources of radiation, such as occupational exposure, its use in research and technology, and use of nuclear technology contribute little to total exposure, each producing about 1 mrem/a. The data provided is supported by numerical evidence.

- 1192 OER REDUCTION WITH HIGH-ENERGY NEUTRONS. Harrison, G.H. (Univ. of Maryland, Baltimore); Kubiczek, E.B.; Robinson, J.E. Br. J. Radiol.; 49: No. 584, 733(Aug 1976).

Further to work recently reported (Harrison et al Brit. J. Radiol.; 48:409 (1975)) that neutrons produced by 80 MeV deuterons bombarding a thick beryllium target have an OER = 1.3 ± 0.2 measured with Vicia seedlings, data are here presented of additional measurements with other high-energy neutron sources. Primary beams of 35 MeV deuterons, 66 MeV protons, 80 MeV deuterons and 101 MeV protons produced neutrons of 15, 22, 32 and 50 mean energy respectively. The neutron OER values, with standard errors, are shown as a function of mean neutron energy. The data suggest a significant reduction in OER as the mean energy is increased above 25 MeV. The implications of these results for cancer therapy are clear since the original rationale for clinical trials with neutrons was centred almost exclusively on reduced OER.

- 1193 RADIOACTIVE CONTAMINATION HAZARD FROM PATIENTS. reece, B.L. (Queen Elizabeth

Hospital, Birmingham, Eng.); Roberts, P.J. Br. J. Radiol.; 49: No. 584, 736(Aug 1976).

It is stated that the hazard of contamination and cross contamination associated with in-patients who have been injected with radioactive material for diagnostic purposes (such as imaging) is sometimes not fully appreciated. The quantity of activity appearing in the 24-hour urine from a patient initially injected with 10 mCi of ^{99}Tc sup(m), for example, may be 0.5 mCi so that spillage or incontinence can easily produce a contamination hazard. It is urged that patients who have received such levels of radioactivity should be easily identifiable to enable nursing staff to appreciate that a hazard exists in the event of incontinence and that instructions should be available to the Nursing Officer in charge of wards summarizing the precautions to be taken in such circumstances, and indicating the length of time for which these special provisions should apply.

- 1194 PROBLEMS INVOLVED IN DETECTING INCREASED MALIGNANCY RATES IN AREAS OF HIGH NATURAL RADIATION BACKGROUND. Pochin, E.E. (National Radiological Protection Board, Harwell (UK)). Health Phys.; 31: No. 2, 148-151(Aug 1976).

Difficulties in obtaining information on the frequency with which various forms of malignant disease are induced following human exposure to low dose rate are discussed. In particular difficulties arise in ensuring that malignant rates are fully ascertained in the areas concerned and in establishing an adequate control population, differing only by being exposed to lower background radiation levels. In addition it is emphasised that very long periods of observation would be required to detect any such induction of excess malignant disease. The problem is considered mathematically.

- 1195 RADIATION INCIDENTS WITH A COBALT-60 TELETHERAPY UNIT. Lane, R.G.; Tolbert, D.D.; Pailwal, B.R.; Radtke, R.R. (Wisconsin Univ., Madison (USA)). Dept. of Radiology. Health Phys.; 31: No. 2, 163-165(Aug 1976).

Three radiation incidents associated with source drive failures on one particular ^{60}Co teletherapy unit, which took place during a single year's operation, are discussed. In each case the extra treatment time of the patient, the exposure to the technician, the cause of the breakdown and the subsequent action taken are detailed. Recommendations for users of ^{60}Co teletherapy units to minimise the results of the malfunctioning of such a system are given.

- 1196 COMMENT. Fry, R.M.; Cook, J.M. (Australian Atomic Energy Commission, Coogee). Search; 7: No. 8, 351-353(Aug 1976).

It is argued that the level of risk resulting from radon emission from uranium tailing piles is insignificant, and that attempts to seal the tailings for the purpose of protecting geographically remote future generations would be an irrational expenditure.

- 1197 RESPONSE TO COMMENTS BY FRY AND COOK. Pohl, R.O. (Cornell Univ., Ithaca, N.Y. (USA)). Dept. of Physics. Search; 7: No. 8, 353-354(Aug 1976).

The health impact of radon-222 is compared with that of tritium and krypton-85. A discussion is given of the environment buildup of thorium-230 from uranium tailings piles. It is argued that radon-222 can be disposed of at a reasonable cost.

- 1198 Strahlenschutzregeln fuer die technische Anwendung umschlossener radioaktiver Stoffe. T. 5. Errichtung von Anlagen fuer die Gammarradiographie. Entwurf. (RADIATION PROTECTION RULES FOR THE TECHNICAL APPLICATION OF SEALED RADIOACTIVE SOURCES. PT. 5. INSTALLATION OF GAMMARADIOGRAPHY PLANTS. DRAFT). Berlin, Germany, F.R.; Beuth (Aug 1976). 6p. (In German).

3 figs.; 3 tabs..

The draft applies to the erection of non-stationary gammarradiography equipment. It contains maximum permissible body doses, proportioning and determination of protective layers, limitations for time spent in the exclusion area, the danger zone, and the monitored area, warning system, marking and radiation protection documents.

- 1199 HEALTH EFFECTS OF RADON-222 FROM URANIUM MINING. Pohl, R.O. (Cornell Univ., Ithaca, N.Y. (USA)). Dept. of Physics. Search; 7: No. 8, 345-353(Aug 1976).

A discussion is given of the health effects of radon-222 and its short-lived daughters which arise from tailings in milling operations. It is shown that the radioactive decay product of thorium-230, radon-222, together with short-lived species polonium-218 and -214, lead-214 and bismuth-214 are expected to lead to approximately 400 lung cancer deaths per gigawatt-year at electrical energy produced in light water reactors.

- 1200 DECAY PRODUCTS OF ^{222}Rn IN THE LIVING ENVIRONMENT. Parthasarathy, K.S. (Bhabha Atomic Research Centre, Bombay (India)). Div. of Radiation Protection. Health Phys.; 31: No. 2, 187-188(Aug 1976).

Consideration is given to the problem of high concentrations of decay products of ^{222}Rn in public buildings and private homes especially where poor ventilation exists. Available guides and recommendations for working levels are discussed and the findings of various workers in the field considered with respect to the dose received by lungs.

- 1201 ALAP. Rummerfield, P.S. (Applied Radiation Protection Services, San Diego, Calif. (USA)). Health Phys.; 31: No. 2, 188(Aug 1976).

Reference is made to the NCRP Report No. 34 'Medical X-Ray and Gamma-Ray Protection for Energies up to 10 MeV' and also to the NCRP's philosophy of 'as low as practicable' which appear to the author to be at variance. The cost incurred in shielding the operators booth of a typical hospital x-ray installation is considered from both stand points. The futility of making rigorous definitions and applying objective logic and manipulations to terms, which by their very nature, are subjectively viewed and differently interpreted by different persons is considered.

- 1202 RADIATION PROTECTION SHIELD FOR THE OPERATING ROOM. Roloff, W.; Broemme, H. (Zwickau County Hospital (German Democratic Republic)). Dtsch. Gesundheitswes.; 31: No. 35, 1658-1659(Aug 1976). (In German).

Short communication only.

MEDICAL PERSONNEL; RADIATION PROTECTION; SHIELDS; SPECIFICATIONS; SURGERY

- 1203 STATUS AND TRENDS IN PERSONNEL MONITORING - A WORLDWIDE SURVEY. Becker, K. (DIN Deutsches Inst. fuer Normung e.V., Berlin

(Germany, F.R.). Fachnormenausschuss Kerntechnik). Kerntechnik; 18: No. 8;9, 345-351(Aug 1976).

4 tabs.; 6 refs..

About 70 detailed questions have been answered in mid-1975 by 89 personnel monitoring services in 33 countries, representing almost half a million or about one-third of the world's total radiation workers as well as by 11 customers of U.S. commercial services. Extensive data are given on many questions regarding the current system in use, future plans, and experiences, for example on the type (s) of TLD, film and readout instrumentation; monitoring period; applications for extremity and environmental monitoring; advantages and disadvantages of various systems; research and development projects; experience with beta and neutron dosimetry; intentional 'fake' exposures; lower and upper dose limits; recordkeeping; and reporting of the results. Some of the more important results are: - The larger services in the advanced countries lead in the transition from film to TLD. More than half of the radiation workers already wear TLD's, or will do so within about one year. - Important unsolved problems are fast neutron monitoring and the low information content and high initial cost of TLD. - The trend is towards large, centralized, automatic services and recordkeeping, with extensive computer use for evaluation and data handling. - There is a need for better performance standards and testing, and more information exchange and cooperation between services.

1204 RESPIRATORY EXPOSURE IN BUILDINGS DUE TO RADON PROGENY. Auxier, J.A. (Oak Ridge National Lab., Tenn. (USA)). Health Phys.; 31: No. 2, 119-125(Aug 1976).

The α radiation dose to the lungs of people who live in buildings constructed of some granites, low density concretes, and gypsum boards is higher than for residents of most other types of dwellings due to the air-borne progeny of radon. There is evidence that sealing the interior surfaces with epoxy paint, for example, can reduce the α dose to the lung significantly without a compensating increase in whole-body exposure to the γ -rays from radon progeny. Based on the incidence rates for lung cancer in uranium miners, a concentration of radon of the order of 1 to 5 pCi/l. appears to be a reasonable limit for 'lifetime' exposure indoors for 'typical' home ventilation conditions.

1205 LOG-NORMAL DISTRIBUTIONS OF OCCUPATIONAL EXPOSURE TO MEDICAL PERSONNEL. Specht, R.P.; Brodsky, A. (Mercy Hospital, Pittsburgh, Pa. (USA)). Health Phys.; 31: No. 2, 160-163(Aug 1976).

In an attempt to examine trends in occupational radiation exposure at Mercy Hospital USA during the years 1965 to 1974, recorded data from the commercial film badge vendor were plotted as cumulative percentages of population with exposures less than or equal to each of a set of chosen exposure levels. These cumulative exposure distributions for the years 1965 to 1974 are shown together with 95% confidence intervals estimated from respective binomial sampling errors. The ten plots each show an occupational radiation exposure distribution consistent with the log-normal distribution function. The exposure distributions and trends, for the hospital personnel, indicated by this study are discussed. The usefulness of the log-normal plot presentation of occupational exposure is pressed.

1206 PROTECTION OF HEALTHY PERSONS ON WHICH CLINICAL TESTS WITH MEDICAMENTS LABELLED BY RADIOACTIVE SUBSTANCES ARE PERFORMED. Gemeinsames Ministerialbl., A; 27: No. 24, 366-369(Aug 1976). (In German).

It has been examined together with the Minister for Youth, Family and Health if and how already before applying the provision of the sections 41(9) and 83, contained within the new Radiation Protection Ordinance, clinical tests of medicaments labelled with radioactive substances can be permitted on the basis of the regulations of the atomic and radiation protection law with the aim of optimal protection of the test person. There are no reserves against licensing these tests according to section 3 of the First Radiation Protection Ordinance if the following requirements and protective measures are fulfilled: 1) Application for a licence, 2) competence and necessary knowledge of the relevant personnel, 3) required installations and protective measures, 4) provisions for liability and indemnification, 5) public interests, 6) stipulations and limitations.

1207 UV KERATOCONJUNCTIVITIS VS. ESTABLISHED DOSE EFFECT RELATIONSHIPS. Gulvady, N.U. (Bhabha Atomic Research Centre, Bombay). J. Occup. Med.; 18: No. 8, 573(Aug 1976).

A patient who received a uv dose to his eyes 11 times greater than the photokeratitic threshold of Pitts and $4\frac{1}{2}$ times the photokeratitic threshold as found by Leach. The patient had severe keratoconjunctivitis for 3 days and did not develop any keratitis.

1208 (AECL--5524) PROJECT ZEUS: A FIELD IRRADIATOR FOR SMALL-MAMMAL POPULATION STUDIES. Turner, B.N.; Iverson, S.L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Aug 1976. 22p. NTIS (US Sales Only).

62 refs., 2 figs..

The ZEUS (Zoological Environment Under Stress) Project will assess the effects of long-term low-level radiation on meadow vole populations in a northern temperate area through a series of replicated experimental irradiations. These rodent populations will live in grassland areas surrounded by forest, and will be exposed to a dose designed to be a maximum 6 R/day.

1209 (COO--1602-60) EFFECTS OF X-IRRADIATION ON STEROID BIOTRANSFORMATIONS BY TESTICULAR TISSUE. FINAL REPORT, MAY 1, 1966--JULY 31, 1976. Ellis, L.C. (Utah State Univ., Logan (USA). Dept. of Biology). Aug 1976. Contract EY-76-S-02-1602. 67p. Dep. NTIS \$4.50.

A number of parameters of testicular and body function were investigated after various dosages of x-irradiation to ascertain: what relationship they have to the radiation syndrome and testicular repression and regeneration of the rat; and how sensitive these parameters are to radiation. Changes in androgen synthesis were not well correlated with either body or gonad weights, hematocrit values or testicular histology. Lipid peroxidation, catalase activity, metabolism of testosterone, prostaglandins, cyclic nucleotides and serotonin metabolism were all related to the direct effects of radiation on the male gonad. Indirect effects on the testis appear to be mediated by serotonin and the pineal gland. The pineal gland appeared to be responsible for variations in androgen synthesis and radiosensitivity of the testis

through its secretory products-melatonin and arginine vasopressin. These compounds have the capacity of inducing endocrine rhythms by affecting: the hypothalamus-pituitary axis; the liver; and/or the gonad directly.

- 1210 (COO--3426-13) EXPERIMENTAL ECOLOGY OF SELECTED VERTEBRATE SPECIES. FINAL REPORT. Hartman, R.T.; Graybill, D.L. (Pittsburgh Univ., Pa. (USA)). Aug 1976. Contract E(11-1)-3426. 24p. Dep. NTIS \$3.50.

This report summarizes the results of a long term (1960 to 1973) study designed to determine the suitability of various vertebrate species for experimental radioecology, to determine their individual and population characteristics under natural conditions, and to utilize these characteristics to gauge the effects of sub-lethal doses of gamma radiation. The study focused on free ranging populations of *Tamias striatus* in northwestern Pennsylvania and *Thomomys talpoides* in northwestern Wyoming. Results of the study were collated with those of a concurrent and cooperative study of populations of *Tamias striatus* in southern Vermont. Major achievements of the study included: the discovery that single insults of 200 R and 400 R of gamma radiation decreased the rate of disappearance of individuals from populations of *Tamias striatus* and *Thomomys talpoides* so treated, and resulted in a reduction in home range size in a population of *Tamias striatus* in which the average range of males was quite large; the construction and analysis of life tables which were based on more than 80,000 captures of *Tamias striatus* and *Thomomys talpoides*; and the construction and analysis of correlation coefficients relating annual mast production and *Tamias striatus* population parameters for 26 annual cycle/population combinations.

- 1211 (MBL--1976-11) IN VITRO EVALUATION OF SOME LATENT RADIOPROTECTIVE COMPOUNDS. Vos, O.; Grant, G.A.; Budke, L. (Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands)). Medisch Biologisch Lab. TNO). Aug 1976. 26p. Dep. NTIS (US Sales Only), PC A03/MF A01.

30 refs., 13 figs., 6 tables.

Protection against X-irradiation by a number of cysteamine derivatives was studied in tissue culture and the results were compared with data obtained in mice. Compounds with a covered SH group like WR 638, cysteamine phosphate, WR 2721 and AE 48527, showed practically no protection when dissolved in tissue culture medium, but developed a protective activity when dissolved in rat blood. Thiol measurements demonstrated that in rat blood the compounds were partly hydrolysed to thiols. C511 was also hydrolysed in culture medium and was slightly less effective than cysteamine in culture medium. Cysteamine phosphate was hydrolysed more easily than cysteamine sulphate and concordantly the protective activity in rat blood was better. WR 2721 was also partly hydrolysed in rat blood. The in vitro protection of this compound was disappointing when compared with results in vivo. Its SH form (WR 1065) also showed less protection than expected from in vivo experiments. Thus the little protection by WR 2721 in vitro in rat blood is not only due to its incomplete conversion into its thiol. Longer incubation times and the use of rat blood as a solvent brought the protective activity of WR 1065 up to almost the level of cysteamine. This may indicate that WR 1065 is poorly penetrating into the cells. WR 1065 was the only compound studied whose protective activity in vitro was improved appreciably by dissolving it in rat

plasma.

- 1212 RADIATION-INDUCED MUTATIONS AT MOUSE HEMOGLOBIN LOCI. Russell, L.B.; Russell, W.L.; Popp, R.A.; Vaughan, C.; Jacobson, K.B. (Oak Ridge National Lab., TN). Proc. Natl. Acad. Sci. U.S.A.; 73: No. 8, 2843-2846 (Aug 1976).

In experiments designed to detect new mutations affecting hemoglobin, we irradiated the male or female parent in reciprocal crosses of two mouse strains that differ in alleles at the hemoglobin (Hba, Hbb) loci as well as at five other specific loci. Offspring were analyzed for hemoglobin properties (electrophoretic pattern, solubility, crystal pattern), serum albumin differences, erythrocyte lysis, reticulocyte count, and external appearance. Five hemoglobin variants were found among the mutants. In three, the genetic contribution from the irradiated father was not expressed with regard to the α -chain; one carried a tandem duplication (the first known case in the mouse) involving Hbb; and one probably resulted from double nondisjunction of chromosome 7. The finding that major chromosome aberrations can mimic hemoglobin mutations indicates the need, in similar experiments, to follow F_1 screening with thorough cytogenetic analysis. The variants in which there is nonexpression of the α chain may be the result of small deficiencies or of faults in transcription or translation. Mutation rates based on these three variants are not out of line with earlier specific-locus results, although confidence limits are still wide.

- 1213 RADIOPROTECTION OF MICE BY PHENYLHYDRAZINE-DAMAGED ERYTHROCYTES. Smith, L.H.; McKinley, T.W. Jr. (Oak Ridge National Lab., TN). Radiat. Res.; 67: No. 2, 286-298 (Aug 1976).

Erythrocytes (RBC) from mice given phenylhydrazine are protective when injected into syngenic mice before x irradiation. The LD/sub 50/30/ was increased about 90 R when these RBC (PhRBC) were given iv 1 day before exposure. PhRBC were not protective when given 4 hr after irradiation. Radioprotection by PhRBC did not appear to result from either an increase in the radioresistance (D_0) of hemopoietic stem cells or an increase in number of stem cells at risk at the time of irradiation. Using blood clearance and liver accumulation of labeled sheep RBC as a measure of reticuloendothelial activity, we found no evidence that a stimulated reticuloendothelial system was responsible for radioprotection by PhRBC. Some evidence suggested that repair of hemopoietic stem cells was enhanced in mice injected with PhRBC before x irradiation.

- 1214 LIVER DYSFUNCTION FOLLOWING WHOLE-BODY CO-60 IRRADIATION IN GERBIL (*MERIONES HURRIANAE* JERDON) AND HOUSE RAT (*RATTUS RATTUS* RUFESCENS). Dixit, V.P. (Rajasthan Univ., Jaipur, India); Agrawal, M.; Gupta, C. Strahlentherapie; 152: No. 2, 183-186 (Aug 1976).

Liver dysfunction following whole-body Co-60 irradiation has been studied in domestic and desert rat species. A significant elevation in the serum transaminases activity was noticed both in gerbil and house rat. Alkaline phosphatase and plasma cholesterol levels were also increased indicating an early radiation impairment of the liver tissue, which was later confirmed by histological studies. A steady fall in liver glycogen in irradiated gerbils was strikingly in contrast to an increase in irradiated house rat. Drastic depletion in liver glycogen, changes in the serum enzyme

levels and the severity of the hepatic necrosis in gerbils point out that desert mammalian species are much more sensitive to radiation hazard as compared with domestic ones.

in everyday practice. With reference to 1 μCi activity, the maximum reduction to be achieved for the organ dose is of the 3rd, the one actually realized of the 2nd order.

- 1215 TOLERANCE OF RODENT TAILS TO NECROSIS AFTER 'DAILY' FRACTIONATED X-RAYS OR D-T NEUTRONS. Hendry, J.H. (Christie Hospital, Manchester, Eng.); Rosenberg, I.; Greene, D.; Stewart, J.G. Br. J. Radiol.; 49: No. 584, 690-699(Aug 1976).

The rat tail has been used as a model system to study the necrosis of an organized tissue following fractionated doses of collimated D - T neutrons or 290 kV x-rays. RBE values for tail tolerance - 10 per cent of tails necrosing after the early skin reactions - rise from about 1.7 (single doses) to about 3.1 (16 fractions in 22 days). Neutron tolerance doses are almost independent of fractionation from 2 to 16 fractions. The tissues at risk are shown to be rather hypoxic. Early skin reaction levels can be used to predict the fraction of tails that will necrose. Early peak reactions for a given fraction of necrotic tails were slightly higher for neutrons than for x-rays, and this difference was consistent for all the dose fractionation schedules employed.

- 1216 RADIOTOXICITY OF IODINE-125 IN MAMMALIAN CELLS. II. A COMPARATIVE STUDY ON CELL SURVIVAL AND CYTOGENETIC RESPONSES TO ^{125}I UDR, ^{131}I UDR, AND $^3\text{HTDR}$. Chan, P.C.; Lisco, E.; Lisco, H.; Adelstein, S.J. (Harvard Medical School, Boston). Radiat. Res.; 67: No. 2, 332-343(Aug 1976).

Hydrogen-3, iodine-125, or iodine-131 was incorporated into cellular DNA in the form of thymidine or its analog 5-iodo-2-deoxyuridine. The effects of these radionuclides on cell survival and chromosomes were examined in the V79 Chinese hamster cell line. It was found that in terms of cell killing, iodine-125 was considerably more effective than iodine-131 and hydrogen-3. The mean radioactivity contents at 37 percent survival were 0.10, 1.16, and 1.64 pCi per cell for iodine-125, iodine-131, and hydrogen-3, respectively. Similarly, iodine-125 was much more effective in inducing chromosome aberrations than iodine-131 or hydrogen-3. For example, 0.1 pCi per cell of iodine-125 gave rise to three chromosome breaks per cell; it took 1.0 pCi per cell of iodine-131 or 1.7 pCi per cell of hydrogen-3 to produce the same effect. The cytogenetic consequences of irradiation by these radionuclides, which decay by disparate processes, were directly related to their lethal effects and strengthens the theory that radiation-induced cell death results from damage in chromatin structures.

- 1217 (AED-Conf--76-280-001, pp 113-121) RADIATION EXPOSURE OF PATIENTS IN CONNECTION WITH THE USE OF SHORT-LIVED RADIONUCLIDES. Kaul, A.; Roedler, H.D. (Freie Univ. Berlin (Germany, F.R.). Sektion Physik und Strahlenschutz (Biophysik); Freie Univ. Berlin (Germany, F.R.). Klinik fuer Radiologie, Nuklearmedizin und Physikalische Therapie). Aug 1976. (In German).

From 10. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Giessen, F.R. Germany (9 Jun 1976).

Radiation protection in nuclear facilities.

In nuclear medicine diagnostics, more and more use is made of short-lived radionuclides. The values for possible dose reduction resulting thereof are discussed on the basis of the radionuclides' physical properties and of the biokinetic data of radiodiagnostics, and these values are compared with those achieved

- 1218 EXPOSURE TO PLUTONIUM: RADIATION PROTECTION STANDARDS. Dolphin, G.W. (National Radiological Protection Board, Harwell (UK)). Atom (London); No. 238, 220-221(Aug 1976).

The author discusses the way in which ICRP standards for radiation protection against Pu are set, and criticises the views expressed by an American scientist in a recent television programme, in that protection standards are set too low.

- 1219 DOSES TO THE CAUDA EQUINA DUE TO THOROTRAST MYELOGRAPHY. Molla, M.A.R.; Harrison, J.E.; McNeill, K.G. (Toronto Univ., Ontario (Canada). Dept. of Physics). Health Phys.; 31: No. 2, 109-114(Aug 1976).

Estimates have been made of the long term dose received by the cauda equina of subjects who had thorotrast myelograms around 1940. These estimates are based on previously published data from beagles concerning the spatial and temporal distribution of thorium and its daughters following intraspinal injection, on published data on human body burden, and on new data on concentrations of radioactivity in human cauda equina. The results show that in those subjects whose long term body burdens were about 0.5 g Th, or 0.05 microCi, the cauda equina tissue typically received 10 k rad in the years between myelography and onset of myelopathy.

- 1220 OCCURRENCE OF TUMOURS AND KARYOLOGICAL FINDINGS IN PERSONS WITH LONG-TERM ^{226}Ra AND ^{90}Sr BONE DEPOT. Kleiner, V.; Tuscany, R.; Svoboda, V. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zarení). Vnitř. Lek.; 22: No. 8, 767-772(Aug 1976). (In Czech).

In the years 1971 to 1973 an investigation was carried out of the health condition of persons with long-term bone depot of ^{226}Ra and ^{90}Sr resulting from work with radioactive phosphors before 1958. The data collected using a questionnaire and interviews showed a higher incidence of cancer in this group as compared with national statistics of the whole population. The karyological examination of bone marrow and lymphocytes revealed a higher yield of asymmetric exchanges and their marked decrease in the course of time. As to radiation as a factor contributing to the observed effects, external irradiation was probably more significant in this respect than radiation from the incorporated osteotropic radionuclides.

- 1221 SOME EFFECTS OF CHRONIC TRITIUM EXPOSURE DURING SELECTED AGES IN THE RAT. Laskey, J.W.; Bursian, S.J. (Environmental Protection Agency, Research Triangle Park, NC). Radiat. Res.; 67: No. 2, 314-323(Aug 1976).

To assess the implication of age at the time of exposure to chronic irradiation, rats were exposed to constant tritium (HTO) activities of 10 $\mu\text{Ci}/\text{ml}$ of body water for 42 days beginning either on the first day of pregnancy or at birth, or at 42 days or 74 days of age. This activity level provided a calculated whole-body dose rate of 3 rad/day. The indicators of radiobiologic damage employed were reproductive, endocrine, and neurochemical parameters and were assessed at 49, 120, or 300 days of age. A significant reduction in the testes weight and sperm content in rats exposed either from the first day of pregnancy or birth

was evident upon examination at 49 days of age. Females exposed from the first day of pregnancy had a significant reduction in their F_2 litter size and an increase in the number of resorbed embryos. Analysis for norepinephrine (NE) and dopamine (DA) concentration in the brain and follicle-stimulating hormone (FSH) concentration in the pituitary was performed at 49 and 300 days. Rats exposed from conception had increases in NE and DA and a decreased FSH concentration when examined at 49 days of age. When examined at 300 days of age all groups had decreased NE and DA concentrations. At the same time, all treatment groups showed increased FSH concentration with the groups exposed later in life showing the greatest increase. From the parameters examined all age groups showed some effects due to the HTO exposure, but the group most sensitive to the effects of chronic irradiation was the group exposed from the first day of pregnancy.

1222 PULMONARY COLLAGEN METABOLISM AFTER LUNG INJURY FROM INHALED ^{90}Y IN FUSED CLAY PARTICLES. Pickrell, J.A.; Harris, D.V.; Benjamin, S.A.; Cuddihy, R.G.; Pfeleger, R.C.; Mauderly, J.L. (Inhalation Toxicology Research Inst., Albuquerque, NM). Exp. Mol. Pathol.; 25: No. 1, 70-81(Aug 1976).

Pulmonary fibrosis was studied in Syrian hamsters exposed by inhalation to an aerosol of ^{90}Y in fused montmorillonite clay particles. Control hamsters were exposed to an aerosol of fused clay containing stable zirconium. Animals with cumulative radiation doses to lung of 2000 to 14,000 rad were sacrificed between 14 and 169 days after exposure. Controls were sacrificed at similar times. One day before sacrifice, the animals were injected with [^{14}C]-proline to label pulmonary collagen. When compared with controls, fractional incorporation of [^{14}C]-proline into native collagen increased as early as 14 days after ^{90}Y exposure. This collagen synthesis continued to increase until about 126 days after exposure when fractional incorporation in irradiated animals was 175 percent of the mean control values. It remained at this level through 169 days. Collagen degradation, measured by ultrafilterable hydroxyproline peptides, increased similarly by 14 days after exposure, but later returned to values similar to those for control animals. By 55 days after exposure, when fibrosis was observed histologically, pulmonary native collagen was increased in irradiated animals as compared to control animals. Static lung compliance in irradiated hamsters, a measure of expansibility of the lung, was decreased 14 through 55 days after exposure. Later, compliance became indistinguishable from that of control animals when this parameter increased in both groups. This study demonstrated that pulmonary injury from beta irradiation delivered within a 2-week period stimulated both synthesis and degradation of collagen which led to collagen accumulation and scarring by 2 months after exposure. Continued radiation was not necessary to sustain this particular response of the lung to injury.

1223 FACTORS AFFECTING THE UPTAKE OF /SUP 99M/ TC-SULFUR COLLOID BY THE LUNG AND KIDNEY. Klingensmith, W.C. III, Tsan, M.F.; Wagner, H.N. Jr. (Johns Hopkins Medical Institutions, Baltimore). J. Nucl. Med.; 17: No. 8, 681-684(Aug 1976).

Occasionally patients injected with /sup 99m/ Tc-sulfur colloid (TSC) for liver-spleen imaging show increased uptake by the lungs or kidneys. In animals, increased lung uptake of TSC can be produced by injecting endotoxin

intraperitoneally. Using an intraperitoneal endotoxin model, we studied the effect of heparin on dose-response curves for TSC uptake by the lungs and kidneys. Over a dose range of 1 μg to 10 mg of endotoxin, TSC uptake by the lungs increased progressively; heparin had no effect. In the kidneys, endotoxin in doses from 1 μg to 1 mg resulted in an increased TSC uptake which was less marked than that in the lungs and which was also unaffected by heparin. However, at a dose of 10 mg of endotoxin, a marked increase occurred in TSC uptake by the kidneys, and this could be prevented by heparin. Although the increased TSC uptake by the kidneys at lower doses of endotoxin and by the lungs at all doses is probably not related to intravascular coagulation, the marked increase in TSC uptake by the kidneys at 10 mg of intraperitoneal endotoxin probably is related to intravascular coagulation, possibly by entrapment in fibrin deposits in the renal capillaries.

1224 SALIVARY GLAND UPTAKE OF ^{67}Ga -CITRATE FOLLOWING RADIATION THERAPY. Bekerman, C.; Hoffer, P.B. (Univ. of Chicago). J. Nucl. Med.; 17: No. 8, 685-687(Aug 1976).

Radiogallium uptake in the salivary glands is strongly correlated with prior therapeutic radiation which includes the cervical region. Fifteen of 17 patients with increased salivary gland uptake had such a history. An easily identified characteristic pattern of symmetric localization of ^{67}Ga occurs in the parotid and submandibular regions in these patients. This pattern must not be mistaken for recurrent tumor in the cervical region.

1225 QUANTITATIVE ANALYSIS OF THE FATE IN MAN OF ^{37}Ar PRODUCED IN BODY CALCIUM BY FAST NEUTRON EXPOSURE. Bigler, R.E.; Laughlin, J.S. (Memorial Sloan-Kettering Cancer Center, New York). Radiat. Res.; 67: No. 2, 266-276(Aug 1976).

Methods have been developed to investigate the quantitative production and the ultimate fate of ^{37}Ar produced in bone calcium in the living human body. A healthy male subject's whole body was irradiated using cyclotron-produced neutrons provided by the $^9\text{Be}(^3\text{He},n)$ reaction. The dose of fast neutrons was limited to 1.6 mrad. Six breath samples were collected and assayed for ^{37}Ar content over a 12.5 hr period after irradiation. Low background (0.5 to 5 counts/day) gas proportional counting techniques were used to assay samples containing as little activity as 0.01 dis/min corrected to end of irradiation. Analysis of the exhalation data by a two-component exponential relation indicated 82 percent of the activity left the body by way of the lungs with a half-time of 40 min. The remaining 18 percent was exhaled with a 200 min half-time. Exhalation was demonstrated to account for approximately 70 percent of the ^{37}Ar activity produced in the body. Evidence from studies of isolated bone indicated that essentially permanent trapping in bone crystals accounted for the remaining activity.

1226 STRONTIUM-90 IN HUMAN BONE IN NORWAY 1974. Christensen, G.C.; Loevby, L.; Pappas, A.C. (Oslo Univ. (Norway). Institutt for Kjemi). Health Phys.; 31: No. 2, 147-148(Aug 1976).

As a continuation of the program reported earlier, measurements of ^{90}Sr in human vertebrae from subjects who died in Norway in 1974 are presented. The results from 140 samples are classified according to five age groups and geographical distribution. The

results show a minor decrease in the ^{90}Sr levels compared to 1973 for the age groups 15 days to 1 yr, > 1 to 5 yr and > 20 yr. The mean values are 2.8, 3.2, and 2.4 pCi/g Ca, respectively. The mean value of the age group 0 to 14 days (including still-born) is 1.7 pCi/g Ca, and of the age group > 5 to 20 yr 2.9 pCi/g Ca. These two groups show a minor increase in the ^{90}Sr levels compared to 1973. The general trend during the last 5 yr shows a slow decrease in the levels of all age groups of about 0.2 pCi/g Ca annually. The ratio of the $^{90}\text{Sr}/\text{Ca}$ ratio in bone to that in milk (bone/milk ratio) is computed for the age group > 1/2 to 2 yr and the results show a mean bone/milk ratio of 0.45 (10 samples) in 1973 and 0.56 (6 samples) in 1974. The mean age of these 16 children was 14 months.

- 1227 UPTAKE AND RETENTION OF ^{133}Ba AND ^{140}Ba - ^{140}La IN MOUSE TISSUES. Dencker, L.; Nilsson, A.; Roennbaeck, C.; Walinder, G. (Uppsala Univ. (Sweden); Foersvarets Forskningsanstalt, Stockholm (Sweden)). Acta Radiol., Ther., Phys., Biol.; 15: No. 4, 273-287 (Aug 1976).

The distribution of barium in the mouse has been determined qualitatively by whole-body autoradiography after i.v. administration of $^{133}\text{BaCl}_2$ solution. The quantitative distribution of ^{140}Ba and ^{140}La has been analyzed after i.p. injections of the two nuclides in equilibrium by measuring the activity in excised organs in a two-channel scintillation counter. Approximate doses to the eyes and different parts of the skeleton have been calculated.

- 1228 (DOCKET-50261--682) H. B. ROBINSON PLANT, UNIT 2. IE INSPECTION REPORT NO. 76-07; REPLY (6 JUL 1976). (Carolina Power and Light Co., Raleigh, N.C. (USA)). 26 Jul 1976. 10p.

Inspection of radiation protection program. ROBINSON-2 REACTOR; INSPECTION; RADIATION PROTECTION; RESPIRATORS; PERSONNEL; RADIATION DOSES; RADIATION MONITORS; CALIBRATION; FLOWMETERS; DOCUMENTATION

- 1229 (DOCKET-50293--697) PILGRIM NUCLEAR POWER STATION, UNIT 1. IE INSPECTION REPORT NO. 76-12 AND RESPONSES. (Boston Edison Co., Mass. (USA)). 23 Jul 1976. 50p.

Inspection of radiation protection program. PILGRIM-1 REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES; CONTROL; DEMINERALIZERS; DOORS; CONDENSATION CHAMBERS; DOCUMENTATION; PUMPS; COOLANT CLEANUP SYSTEMS

- 1230 SPECIFIC AREA GONAD SHIELDING. Fed. Regist. (Wash., D.C.); 41: No. 143, 30327-30329 (23 Jul 1976). (21CFR1000).

From Food and Drugs, 21CFR1000, Food and Drug Administration, Department of Health, Education, and Welfare--General. Radiation protection recommendations.

The Food and Drug Administration (FDA) is promulgating in final form voluntary recommendations to provide guidance for the use of specific area gonad shielding for patients undergoing x-ray examination. This amendment of Part 1000 is effective July 23, 1976.

- 1231 (DOCKET-50155--555) BIG ROCK POINT NUCLEAR PLANT. IE INSPECTION REPORT NO. 76-15. (Consumers Power Co., Jackson, Mich. (USA)). 21 Jul 1976. 9p.

Inspection of radiation protection including personnel monitoring procedures and records, air sampling, and in vivo counts. BIG ROCK

POINT REACTOR; INSPECTION; RADIATION PROTECTION; STACKS; SAMPLING; PIPELINES; FREEZING; OFF-GAS SYSTEMS; RADIATION DOSES; PERSONNEL

- 1232 (JPRS--67629) PERSONAL PROTECTION IN THE EVENT OF RADIATION ACCIDENTS. Gorodinskii, S.M.; Rokhlin, M.I.; Shcherbakov, V.L. 20 Jul 1976. Translation of Individualnaya Zashchita pri Radiatsionnykh Avariyakh, Moscow, n.d., p. 363-370. 11p. NTIS \$3.50.

The report contains a description of a procedure for evaluating the protective efficiency of various types of personal protection equipment with respect to radioactive substances using a specially designed chamber. Descriptions are given of suits for use in radiation accidents. (GRA)

- 1233 (UCRL--78409) LLL PLUTONIUM LUNG COUNTER CALIBRATION AND DISCUSSION OF ERRORS. Anderson, A.L.; Campbell, G.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Jul 1976. Contract W-7405-ENG-48. 19p. (CONF-760634--4). Dep. NTIS \$3.50. From Pacific regional symposium; Seattle, WA, USA (24 Jun 1976).

The Whole Body Counter at Lawrence Livermore Laboratory is located in a shielded room 6.1 metres underground, and is equipped with a filtered air supply to remove approximately 99 percent of the radioactivity present from radon-thoron daughters in the air. Two Harshaw Phoswich detectors 120 mm in diameter are presently used for lung counting. An Alderson Remab phantom is used for calibration. This is a take-apart phantom which has a human skeleton and fillable compartments to simulate the body organs. The lung cavities can be filled with lung-equivalent material containing radioactive standards for calibration. Several uniformly loaded sets of these lungs have been made incorporating various isotopically pure radionuclides including ^{238}Pu , ^{239}Pu , and ^{241}Am .

- 1234 PLUTONIUM CONTROVERSY. Gofman, J.W. (Univ. of California, Berkeley). J. Am. Med. Assoc.; 236: No. 3, 284-286 (19 Jul 1976).

If the world chooses to seek a solution to the energy dilemma through nuclear energy, the element plutonium will become an article of commerce to be handled in quantities of thousands of tonnes annually. Plutonium is a uniquely potent inhalation carcinogen, the potential induction of lung cancer dwarfing other possible toxic effects. For reasons to be presented here, it is the author's opinion that plutonium's carcinogenicity has been very seriously underestimated. If one couples the corrected carcinogenicity with the probable degree of industrial containment of the plutonium, it appears that the commercialization of a plutonium-based energy economy is not an acceptable option for society. Sagan's statement that "the experience of 30 years supports the contention that plutonium can be used safely" is manifestly indefensible. No meaningful epidemiological study of plutonium-exposed workers for that 30-year period has ever been done. Since thousands of those possibly exposed have left the industry and are not even available to follow-up, it is doubtful that any meaningful study of "the experience of 30 years" will ever be accomplished.

- 1235 (DOCKET-50315--545) DONALD C. COOK NUCLEAR POWER PLANT, UNIT 1. IE INSPECTION REPORT NO. 76-07, REPLY. (Indiana and

Michigan Power Co., New York (USA)). 15 Jul 1976. 24p.

Inspection of radiation protection. COOK-1 REACTOR; INSPECTION; TANKS; FISSION PRODUCT RELEASE; RESPIRATORS; WHOLE-BODY IRRADIATION; WHOLE-BODY COUNTING; RADIATION DOSES; DOCUMENTATION; RADIOCHEMISTRY; PERSONNEL; EDUCATION; RADIATION PROTECTION; CONTROL; RADIATION MONITORS; CALIBRATION

1236 (DOCKET-50220--579) NINE MILE POINT NUCLEAR STATION, UNIT 1. REPLY TO IE INSPECTION REPORT NO. 76-09. (Niagara Mohawk Power Corp., Syracuse, N.Y. (USA)). 14 Jul 1976. 2p.

Inspection of radiation exposure data. NINE MILE POINT-1 REACTOR; RADIATION DOSES; PERSONNEL

1237 (DOCKET-50220--590) NINE MILE POINT NUCLEAR STATION, UNIT 1. REPORT OF APPARENT EXPOSURES TO RADIATION IN EXCESS OF APPLICABLE LIMITS; NRC REPLY (19 MAY 1976). (Niagara Mohawk Power Corp., Syracuse, N.Y. (USA)). 14 Jul 1976. 5p.

Apparent exposures to radiation in excess of applicable limits. NINE MILE POINT-1 REACTOR; PERSONNEL; RADIATION DOSES

1238 (DOCKET-50293--614) PILGRIM NUCLEAR POWER STATION, UNIT 1. IE INSPECTION REPORT NO. 76-14. (Boston Edison Co., Mass. (USA)). 9 Jul 1976. 11p.

Inspection of radiation monitoring and health physics procedures. PILGRIM-1 REACTOR; INSPECTION; RADIATION MONITORING; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES

1239 OSMOTIC RESISTANCE OF VENOUS ERYTHROCYTES IN UNDERGROUND URANIUM MINERS. CHANGES CAUSED BY URANYL AND LEAD IONS. Nosek, J.; Bartonova, H. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia). Laboratorni Oddeleni). Cas. Lek. Cesk.; 115: No. 27, 827-829 (9 Jul 1976). (In Czech).

The osmotic resistance was determined of venous blood erythrocytes in a group of 97 miners from underground uranium mines as well as in a group of 83 controls. The miners were found to have decreased minimal erythrocyte resistance in response to osmotic hemolysis. In all other, more hypotonic solutions of sodium chloride the miners' group was found to have on the average more erythrocytes hemolyzed than in the control group. The change in osmotic resistance of erythrocytes in the miners should, in the authors' view, be seen in relation to the uranyl ion influence on erythrocytes. This influence was proved experimentally in vitro on models using an erythrocyte suspension. The erythrocytes of miners working in underground uranium mines were found to contain a significantly higher amount of uranium than that found in the controls.

1240 (DOCKET-50305--446) KEWAUNEE NUCLEAR POWER PLANT, UNIT 1. IE INSPECTION REPORT NO. 76-08. (Wisconsin Public Service Corp., Green Bay (USA)). 8 Jul 1976. 14p.

Inspection of radwaste management, airborne overexposures, monitor calibration, and records. KEWAUNEE REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES; RADIATION MONITORS; CALIBRATION; RELEASE LIMITS; DOCUMENTATION

1241 DOWN'S SYNDROME AND RELATED ABNORMALITIES IN AN AREA OF HIGH BACKGROUND

RADIATION IN COASTAL KERALA. Kochupillai, N.; Verma, I.C.; Grewal, M.S.; Ramalingaswami, V. (All India Inst. of Medical Sciences, New Delhi). Nature (London); 262: No. 5563, 60-61 (1 Jul 1976).

It is stated that in a coastal area of Kerala, Southern India, the background radiation is between 1500 and 3000 mR/yr, this being due to the presence of Th-containing monazite mineral in the soil. During an epidemiological study of modular lesions of the thyroid in this area an apparently high prevalence of Down's syndrome and other forms of severe mental retardation was observed. A house-to-house survey of relevant abnormalities in this area was made, and also in a comparable control area without high background radiation. The frequency of chromosome aberrations in a sample of the population in the study and control areas was also investigated. The observations support the view that radiation induces genetic anomalies occur with above average frequency in the population living in the area with high background radiation. Only gross abnormalities evident in clinical examination were recorded. The study and control populations were similar in age and sex structure and general sociologic conditions. Severe mental retardation was the commonest abnormality encountered, and 85% of the abnormalities detected in the study population were genetic in origin, compared with 56% in the control population. Prevalence of Down's syndrome was 0.93 per 1000 in the study population.

1242 (EUR--5428) GUNDREMMINGEN (KRB) NUCLEAR POWER PLANT. ANNUAL REPORT 1974. (Kernkraftwerk RWE-Bayernwerk G.m.b.H., Gundremmingen/Guenzburg (Germany, F.R.); Commission of the European Communities, Brussels (Belgium)). Jul 1976. 68p. (In German). NTIS (US Sales Only).

The 1974 operating year was characterized by even almost trouble-free operation at full load, which was interrupted only by a 6-week period for refuelling and overhaul in May-June. The availability time of the power station exceeded 88% in 1974 and 1920 GWh of electric power were produced. The deposits observed in the core area in the previous year did not occur again. The short-term load reductions distributed over the year, served for variation of the control rod withdrawal sequence and for carrying out routine tests on the turbine control system and other important units. The three unscheduled outages mentioned lasted a total of only 48 hours. During the scheduled outage time from 4 May to 15 June 1974, the following important operations among others, were carried out: - Refuelling: as a result of the leak detection tests carried out on all fuel elements. 24 elements were suspected of cladding defects. Of these, 12 elements had reached their target burn up. A total of 72 new elements were loaded, together with 24 repaired elements, which were partially burnt up. 16 of the 72 new elements were plutonium elements. - By means of pressure tests in the secondary system, 18 leaking pipes were discovered in the no.1 and no.2 secondary steam generators; they were sealed by means of explosive plugging. - The entire core was unloaded and pressure tests was carried out simultaneously with a sound emission test. The results of the analysis performed during the period of high pressure without loss of time confirmed, on the one hand, the integrity of the primary system and, on the other, the suitability of the sound emission process for detecting and locating defects in such complex systems. In 1974, in addition to 118 members of Gundremmingen Power station staff, 316 outside staff members were

employed and monitored. The radiation burden of the Gundremmingen staff amounted to 342 rem, that of the outside staff to 322 rem.

- 1243 (STH--8/76) STUDIES ON THE SUITABILITY OF TLDs FOR THE MEASUREMENT OF RADIATION DOSES IN X-RAY DIAGNOSTICS. Kragh, P. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Strahlenhygiene). Jul 1976. 56p. (In German). Dep. NTIS (US Sales Only), PC A04/MF A01.

In TLD dose measurements, errors may arise from the following causes: 1) lack of reproducibility, 2) direction dependence, 3) radiation quality dependence. The two latter types of error are of a systematic nature; they cannot be reduced even by a large number of measurements. The first type of error is a statistical error, albeit a small one. It follows that a large number of measurements with the aim of reducing errors of measurement is too time-consuming and therefore uneconomical.

- 1244 (ORNL/EIS--91) ENVIRONMENTAL ASPECTS OF THE TRANSURANICS: A SELECTED, ANNOTATED BIBLIOGRAPHY. Fore, C.S.; Martin, F.M.; Faust, R.A. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Jul 1976. Contract W-7405-ENG-26. 204p. (NVO/AEIC--76/1). Dep. NTIS \$7.75.

This bibliography of 500 references is compiled from the Data Base on the Environmental Aspects of the Transuranics built to provide information support to the Nevada Applied Ecology Group (NAEG) of ERDA's Nevada Operations Office. The general scope is environmental aspects of uranium and the transuranic elements, with emphasis on plutonium. Laboratory and field studies dealing with the effects of plutonium-239 on animals are highlighted in this bibliography. Supporting information on ecology of the Nevada Test Site and reviews on the effects of other radionuclides upon man and his environment has been included at the request of the NAEG. The references are arranged by subject category with first authors appearing alphabetically in each category. Indexes are given for author, geographic location, keywords, taxons, permuted title and publication description.

- 1245 (EPA--520/5-76-005) RADIONUCLIDE ACCUMULATION IN A REACTOR COOLING LAKE. Shearin, R.L.; Lyon, R.J. (Eastern Environmental Radiation Facility, Montgomery, Ala. (USA)). Jul 1976. 76p. Environmental Protection Agency, Washington, DC.

In the utilization of a cooling lake for a commercial power reactor, low-level quantities of liquid waste are released to the lake water. Due to the retention and recycling of water for condenser cooling purposes, concentrations of radionuclides can increase to levels which are directly measurable in the water. Such a site design is represented by the H. B. Robinson Unit 2 operated by the Carolina Power and Light Company at Hartsville, SC. For a 4-year period lake water and other lake components such as fish, aquatic vegetation, and benthic sediments were sampled and analyzed to determine if any long-term buildup occurred. Results indicated that the lake water concentrations followed general mixing equations and that turnover rates in the individual components of the lake were too short to quantitate with this study design. This indicates that concentrations of radionuclides in the lake would be primarily a function of parameters such as radioactivity released and lake flow for the previous year and essentially independent of earlier

parameters. An estimate of annual external doses to an individual utilizing the lake for recreation (i.e., swimming, boating, and fishing) would be about 5 microrem.

- 1246 EFFECTS OF NEGATIVE PI MESONS ON MOUSE BONE MARROW CELLS. Carlson, D.E.; Thornton, J. (Univ. of Texas Health Science Center, Dallas). Radiology; 120: No. 1, 213-215 (Jul 1976).

Mouse bone marrow cells exposed in vitro to graded doses of negative pi mesons at 3.5--6.0 rads/min. gave D_0 values of 160 rads in the plateau (0.6 and 12.0 cm), and 130 rads in the peak (16.5 and 18.4 cm). Survival curve shoulders were narrow, with $D/\text{sub } q/$ values of 25 and 15 rads for plateau and peak positions. Gamma rays from ^{60}Co at 4.5 rads/min. produced a curve with wider shoulder but steeper slope such that the RBE was essentially 1 for single doses between 100--400 rads.

- 1247 ENHANCEMENT OF POSTREPLICATION REPAIR IN CHINESE HAMSTER CELLS. D'Ambrosio, S.M.; Setlow, R.B. (Brookhaven National Lab., Upton, NY). Proc. Natl. Acad. Sci. U.S.A.; 73: No. 7, 2396-2400 (Jul 1976).

Alkaline sedimentation profiles of pulse-labeled DNA from Chinese hamster cells showed that DNA from cells treated with N-acetoxy-acetylaminofluorene or ultraviolet radiation was made in segments smaller than those from untreated cells. Cells treated with a small dose (2.5 μM) of N-acetoxy-acetylaminofluorene or (2.5 $\text{J} \cdot \text{m}^{-2}$) 254-nm radiation, several hours before a larger dose (7 to 10 μM) of N-acetoxy-acetylaminofluorene or 5.0 $\text{J} \cdot \text{m}^{-2}$ of 254-nm radiation, also synthesized small DNA after the second dose. However, the rate at which this small DNA was joined together into parental size was appreciably greater than in absence of the small dose. This enhancement of postreplication repair (as a result of the initial small dose) was not observed when cells were incubated with cycloheximide between the two treatments. The results suggest that N-acetoxy-acetylaminofluorene and ultraviolet-damaged DNA from Chinese hamster cells are repaired by similar postreplicative mechanisms that require de novo protein synthesis for enhancement.

- 1248 IN VITRO MORPHOLOGIC TRANSFORMATION OF SYRIAN HAMSTER CELLS BY U.V.-IRRADIATION IS ENHANCED BY X-IRRADIATION AND UNAFFECTED BY CHEMICAL CARCINOGENS. DiPaolo, J.A.; Donovan, P.J. (National Cancer Inst., Bethesda, Md. (USA)). Int. J. Radiat. Biol.; 30: No. 1, 41-53 (Jul 1976).

U.V.-exposure of foetal hamster cells (secondary or tertiary sub-cultures) seeded for colony formation resulted in the induction of transformation. The U.V.-effect on colony-forming ability resulted in a D_{37} of 58 ergs/ mm^2 . The observed transformation frequency induced by U.V.-increased approximately in proportion to increased doses in the range of 7.5 to 60.8 ergs/ mm^2 examined. When cells seeded for colony formation were treated with U.V. and later with either benzo(a)pyrene or N-acetoxy-fluorenyl-acetamide, commencing 6 min after exposure to U.V., there was neither an additive nor a synergistic enhancement of the transformation frequency ordinarily observed with either chemical agent alone. In mass cultures that were X-irradiated with 250 R, seeded for colony formation and treated with either 15 or 30 ergs/ mm^2 of U.V. 48 hours later, the enhancement of transformation was approximately 12- and 6-fold on a colony basis and 6- and 3-fold on a dish basis,

respectively. No transformation occurred after X-irradiation only. The enhancement obtained by the pre-treatment with X-ray is similar to that reported for the combination of X-ray and chemical carcinogens.

- 1249 EFFECT OF LOW DOSE RATE IRRADIATION ON THE DIVISION POTENTIAL OF CELLS IN VITRO. II. MOUSE LUNG FIBROBLASTS. Macieira-Coelho, A.; Diatloff, C.; Malaise, E. (INSERM, Villejuif, France). Exp. Cell Res.; 100: No. 2, 228-232(Jul 1976).

Previous results have shown that low dose rate ionizing radiation shortens the life span of fibroblasts with a limited growth potential (chicken fibroblasts). In the present work the same type of irradiation was done on mouse fibroblasts which invariably acquire an unlimited growth potential in vitro. It was found that contrary to the results obtained with chicken cells, irradiation accelerated the establishment of mouse fibroblasts. The results suggest that low dose rate ionizing radiation accelerates a natural phenomenon in each cell type tested and is additional proof that the life span in vitro of fibroblast populations is a property that depends on the cell rather than on the environment.

- 1250 (NRPB-R--42) RADIOLOGICAL PROTECTION TESTS FOR PRODUCTS WHICH CAN LEAD TO EXPOSURE OF THE PUBLIC TO IONIZING RADIATION. Hill, M.D.; Wrixon, A.D.; Wilkins, B.T. (National Radiological Protection Board, Harwell (UK)). Jul 1976. 16p. NTIS (US Sales Only).

Available from H.M. Stationery Office, price Pound0.50.

Testing plays an important role in deciding whether products which irradiate the general public are acceptable from a radiological protection point of view. This report discusses the role which testing should play in decision-making and develops a systematic approach to the testing of products. As an example of this approach, a proposed test programme for ionisation chamber smoke detectors is described. The use of test results as a basis for design specifications and performance requirements in the development of radiological protection standards for products is discussed. A description of the relevant standards is included.

- 1251 (PB--259947) REPORT OF STATE AND LOCAL RADIOLOGICAL HEALTH PROGRAMS. ANNUAL REPORT, 1973--1975. Miller, L. (Bureau of Radiological Health, Rockville, Md. (USA)). Jul 1976. 73p. (FDA/BRH--77/6; DHEW/PUBL/FDA--77/8005). NTIS, PC A04/MF A01. Supersedes PB--246845.

The report is the fifteenth of a series based on data collected during fiscal year reviews of 53 state and local radiological health programs. The resources and activities of state and local radiological health programs are presented and summarized from data collected as of June 30, 1975. Summary data are included for fiscal years 1973 through 1975. Resources include data on personnel, funds, and equipment. The program activity areas are basic planning and administration, x-ray survey and control, environmental surveillance, radioactive materials, electronic products, and other radiological health activities. (GRA)

- 1252 CHROMOSOMAL ABERRATIONS IN LYMPHOCYTES OF NORMAL ADULTS LONG AFTER THYMUS IRRADIATION. Goh, K.O.; Reddy, M.M.; Hempelmann, L.H. (Univ. of Rochester, NY). Radiat. Res.; 67: No. 1, 82-85(Jul 1976).

Cytogenetic studies from the cultured peripheral blood lymphocytes were carried out on 12 normal adults, who were treated with x radiation for thymus enlargement during early childhood, and five normal controls. The frequencies of the abnormal cells and chromosomal breakages were higher in the thymus-irradiated subjects than in the controls.

- 1253 RADIATION SENSITIVITY OF THE MALIGNANT MELANOMA. von Lieven, H.; Skopal, D. (Muenchen Univ. (F.R. Germany). Klinik und Poliklinik fuer Radiologie. Strahlentherapie; 152: No. 1, 1-4(Jul 1976). (In German). 1 fig.; 1 tab.; 28 refs..

Based on case histories of 67 patients with malignant melanomas (14 primary tumors and 53 metastases to the lymph nodes) who underwent sole irradiation, the correlation between the total dose needed for a local healing and the period of treatment has been investigated. It appeared that excessively high doses are not necessary for healing. A dose of about 5,500 rd in 35 days is regarded as sufficient. In long-term treatment, however, the total dose has to be increased more than, for example, with squamous cell carcinoma.

- 1254 RADIOLOGIY NOW. MALIGNANCIES FOLLOWING LOW RADIATION EXPOSURES IN MAN. Pochin, E.E. (National Radiological Protection Board, Harwell (UK)). Br. J. Radiol.; 49: No. 583, 577-579(Jul 1976).

Published statistical evidence for the induction of malignancies in man by absorbed doses of less than 10 rad is reviewed. The evidence includes the increased mortality ratios for leukaemia in the populations of Hiroshima and Nagasaki exposed at 0 to 9 rad, the increase in thyroid cancers following scalp irradiation in childhood, and the increased incidence of malignancies following fetal irradiation. Consideration is then given to the implications of these findings in the field of radiation protection.

- 1255 ACCIDENTAL OVER-EXPOSURE FROM DENTAL X-RAY EQUIPMENT. Phillips, B.G. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 16, 21-22(Jul 1976).

A description is given of an unusual dental X-ray procedure which resulted in accidental over-exposure both to the dentist and to several of his patients when a short-circuit was present in newly-installed equipment. The short-circuit by-passed the exposure control and energized the tube for certain orientations of the X-ray tube. The dentist left the patients, who wore protective aprons, to initiate the exposure themselves, using the control button. Although the warning lights were on, the dentist was not present in the room during the exposure, and the over-exposures were only detected when the developed X-ray films were found to be completely blackened. A reconstruction of the procedure enabled estimates to be made of the dose equivalents to the dentist's body and to the skin of the head, the eyes and the gonads of the patients. The dentist had overlooked several of basic principles recommended in the Code of Practice for the Protection of Persons against Ionizing Radiations from Medical and Dental Use (1972). It is pointed out that incidents involving failure of dental equipment (usually the timer mechanism) are not infrequent.

- 1256 RADIOLOGICAL PROTECTION AND CHROMOSOME ABERRATIONS. Dolphin, G.W. (National

Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 16, 12-14(Jul 1976).

If a logical system for radiological protection is to be developed, then dose-risk relationships are required before dose limits for particular types of exposure can be set at levels which correspond to acceptable risks. Most of the dose-risk relationships for humans are extrapolated from dose levels well above the present annual limits or the actual lifetime doses accumulated, and the existing ICRP exposure levels were not based on dose-risk relationships. The yields of dicentric chromosome aberrations in human peripheral blood lymphocytes following in vitro irradiation with high and low dose rate ^{60}Co γ -rays and fission neutrons at doses in the range 5 to 1000 rads are related to dose by three different equations according to the radiation. These results are used to illustrate the types of problem likely to be encountered in attempts at valid extrapolation and assessment of RBES as more information becomes available on dose-risk relationships.

1257 ULTRAVIOLET: INITIATOR OF CANCER.

Illingworth, J.E. Am. Lab.; 8: No. 7, 56-60(Jul 1976).

A review of relevant literature leads the author to conclude that the basic cause of cancer may be ultraviolet radiation. It has been determined that radiomimetic chemicals emit radiation in specific wavelengths causing cancer. This may also be true of radiomimetic foods. Additional support for the theory and for the ubiquitous nature of ultraviolet radiation includes the phenomena of bioluminescence, chemiluminescence, sensitization, photoallergy, phototoxicity, and synergism. (RFC)

1258 RADIATION DOSES TO STAFF ON A DEPARTMENT OF NUCLEAR MEDICINE. Harbottle, E.A.; Parker, R.P.; Davis, R. (Royal Marsden Hospital, Sutton (UK)). Br. J. Radiol.; 49: No. 583, 612-617(Jul 1976).

A survey of data concerning radiation protection of staff working in the Nuclear Medicine Department and associated sections of the Physics Department at the Royal Marsden Hospital (Surrey Branch) is given for the period 1972 to 1975 inclusive. Results of routine film monitoring and whole-body counting are presented. Additional film monitors were used to check working areas, finger doses and any discrepancies between doses to the upper and lower trunk of personnel. In general, exposure to staff in the Nuclear Medicine Department is below 220 mrad per person per year, and below 1,000 mrad per person per year in the Radioisotope Dispensary. The dose received by radiographers is primarily due to spending time close to patients. Since about 5,000 intravenous injections of radionuclides are given each year in this department, the resulting finger doses to the staff involved may give rise to concern unless the task is shared.

1259 Erste Hilfe bei erhoehter Einwirkung ionisierender Strahlen. Merkblatt. (FIRST AID IN THE CASE OF INCREASED EXPOSURE TO IONIZING RADIATION. PAMPHLET). Cologne; Heymann (Jul 1976). 15p. (In German).

1 ref..

Describes first aid measures for persons who have been exposed to increased radiation, especially certain steps to be taken in the case of external exposure of the whole and/or the partial body, in the case of contamination and incorporation. The pamphlet not only

includes definition of terms but also a list of regional radiation protection centres.

1260 Neutronendosimetrie.

Berechnungsgrundlagen. Entwurf. (NEUTRON DOSIMETRY. TABLES AND FORMULAE FOR CALCULATIONS. DRAFT). Berlin, Germany, F.R.; Bauth (Jul 1976). 4p. (In German). (DIN--6802(Pt.2)).

2 figs.; 4 tabs..

The standard contains tables and formulae for the calculation of the size of the Kerma, the absorbed dose, and the dose equivalent, values which are important when handling neutrons, in particular in radiation protection. The share which photons, present in a mixed radiation field or produced by neutrons as secondary radiation, have in a dose is not contained in this standard.

1261 SCOPE AND LIMITATIONS OF

XERORADIOGRAPHY. Herbst, J.; Rosenkranz, G. (Medizinische Akademie, Dresden (German Democratic Republic). Radiologische Klinik). Dtsch. Gesundheitswes.; 31: No. 27, 1249-1257(Jul 1976). (In German).

Advantages and disadvantages of the application of xeroradiographic techniques in biomedical radiography are discussed. Among others the doses to patients are considered. In comparison with conventional techniques integral doses can be kept much lower. However, first measurements show that gonad doses are higher than with conventional methods.

1262 MEDICAL IRRADIATION. Ouvrard, R.

Rayonnem. Ionis. Tech. Mes. Prot.; No. 3, 105-111(Jul 1976). (In French).

Medical irradiation, and mostly the radiodiagnosis, is, at present time, the most important artificial source of irradiation. Reasons of this importance are reviewed and different solutions (technical and others) to decrease it, are considered.

1263 ACCIDENT IN AN INDUSTRIAL IRRADIATION

PLANT. Steidley, K.D. Rayonnem. Ionis. Tech. Mes. Prot.; No. 3, 125-132(Jul 1976). (In French).

An accident in an industrial irradiation plant is reported. Dosimetric results are presented and discussed.

1264 PREVENTION OF IONIZING RADIATION

INJURIES. HISTORY AND VIEW OF OCCUPATIONAL DISORDERS. Suzuki, M. (National Inst. of Radiological Sciences, Chiba (Japan)). Rodo Eisei; 17: No. 7, 5-13, 18(Jul 1976). (In Japanese).

In the first age (1895 - 1940), radiation injuries of skin (75% of death caused by RI injury) and chronic radiation injury of hematopoietic organs (almost remains) appeared in radiologist and people engaged in RI treatment for medical use, and Ra poisoning appeared in workers who treated aluminous paint. As prevention of radiation injuries in this age, measurement of radiation dose, shelter effect and finding of injuries were studied, and internal radiation allowed level was determined. From 1942 to 1960, acute RI injuries due to exposure of large amount of RI by an accident and secondary leukemia appeared to workers of atomic-bomb industries and researcher of atomic energy. U and Pu poisoning accompanied with development of nuclear fuel industry appeared. This expanded industrial hygiene of this age together with epidemiological data of atomic-bomb exposed

people. From 1960 onward, it is an age of industry for peaceful use of atomic energy, and manifestation of various kinds of delayed injuries, especially malignant tumor due to RI exposure, is recognized. Labourer has many opportunity to encounter dangerously with pollution and injuries by RI, and regional examination of RI enterprise and countermeasure to decrease exposure dose were mentioned as future theme from a viewpoint of exposure dose of nation.

1265 ICRP'S RECOMMENDATIONS. Genshiryoku Iinkai Geppo; 21: No. 5, 6-16(Jul 1976). (In Japanese).

The recommendation by the ICRP (International Commission on Radiological Protection) has been studied in Radiation Council in connection with the application to the prevention of radiation injuries in Japan. The results intended for the reference to take governmental measures in radiation protection are summarized. After explaining the ICRP's Recommendation introduced into Japanese legislation, the technological aspects are expounded: classification of concerned people, dose equivalent, internal exposure, uneven skin exposure, maximum permissible occupational exposure dose, radiation protection for workers occupational exposure of those below 18 years old, exposure limit for public constituents, group exposure, as-low-as principle, medical exposure, action level, and environmental monitoring.

1266 GOVERNMENTAL MEASURES TAKEN IN THE LAW CONCERNING PREVENTION FROM RADIATION HAZARDS DUE TO RADIOISOTOPES, ETC. Genshiryoku Iinkai Geppo; 21: No. 5, 18-33(Jul 1976). (In Japanese).

Having been enforced for about 18 years, the Law assumes increasing importance in recent years with the rise in the utilization of radioisotopes, etc. in Japan. With the intention of contributing to future administration in the field, the situation of governmental measures taken presently is described, after presenting the history of RI utilization in Japan. Guidance to the prevention of radiation injuries, collaboration among concerned governmental offices, promotion of own safety measures in enterprises and industries, the enterprises related to nondestructive tests, safety management in hospitals and educational institutions, RI theft prevention, public relation activities, and restudy of the Law.

1267 ROENTGENOGRAPHY OF HIP-JOINT USING TUBUS IN INFANTS. Sakuyama, K.; Imamura, K.; Uji, T.; Fujikawa, M.; Ishikawa, T. (St. Mariana Univ., Kawaseki, Kanagawa (Japan). School of Medicine). Shoni Geka Naika; 8: No. 7, 932-933(Jul 1976). (In Japanese).

Roentgenography of hip-joint using tubus was discussed. This technique has been made at St. Marianna University, School of Medicine, in order to reduce the exposure dose in x-ray examination of congenital dislocation of hip-joint. The tubus is designed to butterfly-shaped. Only the site which is necessary for roentgenography of hip-joint is exposed, and the sexual gland is outside exposure. The exposure dose of the sexual gland using tubus is 1/10 in female infants and 1/30 in male infants of those without tubus (6.7 mR in male infants, 2.0 mR in female infants). There are some advantages in the tubus: it is clinically used for both sexes as well as reducing exposure doses, and it can be used widely from neonates to infants.

1268 REDUCTION METHOD OF THE RADIATION DOSE FOR THE UROGRAPHY IN CHILDREN. Uhtake, K.; Chiba, N.; Terashima, K. (Kanagawa Children's Medical Center, Yokohama (Japan)). Shoni Geka Naika; 8: No. 7, 930-931(Jul 1976). (In Japanese).

An Al-Filter corresponding to the half value layer of exposure voltage was used at the lower abdomen to protect the sexual gland, when the urography was done. In I.V.P., the picture was taken by covering the site lower than the iliac region with an Al-Filter. Supposing that an ovary is located at the one-half of the thickness of the abdomen, exposure dose to the sexual gland was determined using the Mix D P phantom. The dose exposed at 56 kv, 2mAs was 5.2 mRad in the skin. On the other hand, it was decreased to one-half dose (2.6 mRad) in the skin by exposed with filter. The exposure dose to the sexual gland was decreased to about 20% of non-filter exposure. It was decreased to 45% at 72 kv, 8 mA. Therefore, the Al-Filter can reasonably reduce exposure dose to the sexual gland.

1269 ESTIMATION OF POPULATION DOSES FROM DIAGNOSTIC MEDICAL EXAMINATIONS IN JAPAN, 1974. IV. DOSE ESTIMATION OF FETUS EXPOSED IN UTERO TO DIAGNOSTIC X RAYS. Hashizume, T.; Maruyama, T.; Kumamoto, Y. (National Inst. of Radiological Sciences, Chiba (Japan)). Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 7, 645-651(Jul 1976). (In Japanese).

In fetus exposed in utero to diagnostic x rays for the medical examinations of the mother, the absorbed dose has been estimated on the basis of a 1974 nation wide radiological survey. The results of the survey showed that the number of radiographs per year connected with pregnant women was 0.32 million for chest examination excluding mass surveys. 0.25 million for obstetrical examinations including pelvimetry, and 0.21 million for abdominal and pelvic examinations with a total of 0.82 million. The dose absorbed in the fetus was measured with an ionization chamber placed at the hypothetical center of the fetus in an "average woman" Rando phantom in which a maternal body was simulated by adding MixDp materials. "The collective dose" to the fetus in the pregnant women receiving a given type of examination was calculated from the number of radiographs per year connected with the pregnant women and the fetal doses. The percapita mean marrow dose (CMD), the leukemia significant dose (LSD) and the genetically significant dose (GSD) for the fetus were determined from the collective dose, taking into account the birth expectancy, the child expectancy, life expectancy and significant factor for the fetus. The collective dose to the fetus was estimated to be 9.3×10^4 man rad per year. The resultant values of CMD, LSD and GSD were 0.81 mrad per year, 0.79 mrad per person per year and 1.44 mrad per person per year, respectively.

1270 (PB--257937) CSU-FDA COLLABORATIVE RADIOLOGICAL HEALTH LABORATORY ANNUAL REPORT, 1975. Shore, M.L. (Colorado State Univ., Fort Collins (USA). Coll. of Veterinary Medicine and Biomedical Sciences). Jul 1976. Contracts FDA-72-302; FDA-223-76-6002. 156p. NTIS \$6.75.

See also annual report dated 1974, PB--246722.

The Collaborative Radiological Health Laboratory was conceived in 1962 as a joint operation between the Division of Biological Effects and the Department of Radiology and

Radiation Biology, Colorado State University, to conduct a study of the long-term effects in the beagle from low-level, wholebody gamma irradiation. The first section summarizes current investigations in the developing animal. The second section describes pathologic and hemodynamic findings in the prepubertal adult and aging animal, including development of ultrasound devices for measurement of organ function, providing the foundation for major experimental work. The third section analyzes some colony statistics, study design, and dosimetry. (GRA)

- 1271 IMMUNOLOGIC PARAMETERS OF ULTRAVIOLET CARCINOGENESIS. Kripke, M.L. (Frederick Cancer Research Center, MD); Fisher, M.S. J. Natl. Cancer Inst.; 57: No. 1, 211-215 (Jul 1976).

Skin tumors induced in mice by uv light are usually immunologically rejected by normal syngeneic recipients. We evaluated, the immune status of primary hosts against these highly antigenic tumors immediately after surgical removal of the primary tumor. All primary hosts were susceptible to challenge with their autochthonous tumors, though most of these were rejected by untreated control mice. Primary hosts were also susceptible to challenge with isografts of antigenically dissimilar uv-induced neoplasms. The susceptibility of the primary hosts to tumor challenge was probably induced by chronic exposure to uv light, since uv-irradiated non-tumor-bearing mice were also susceptible to challenge with these tumors. Although uv-treated mice were unable to reject these syngeneic tumors, they could reject skin and tumor allografts. Further, uv irradiation did not interfere with the second-set rejection of syngeneic uv-induced tumors in mice that were specifically immunized before uv treatment.

- 1272 RESPONSE OF STEM CELLS IN THE MOUSE TESTIS TO FISSION NEUTRONS OF 1 MEV MEAN ENERGY AND 300 KV X RAYS. METHODOLOGY, DOSE-RESPONSE STUDIES, RELATIVE BIOLOGICAL EFFECTIVENESS. de Ruiter-Bootsma, A.L. (State Univ., Utrecht); Kramer, M.F.; de Rooij, D.G.; Davids, J.A.G. Radiat. Res.; 67: No. 1, 56-68 (Jul 1976).

The response of spermatogonial stem cells in the CBA mouse to 1 MeV fission neutrons was investigated. Spermatogenic clones arising from surviving stem cells were counted indirectly by determining the fraction of repopulated tubules in testicular sections at four time intervals (3, 5, 8, and 11 weeks) after irradiation with graded doses (50 to 410 rad) of fast neutrons. This fraction, the repopulation index (RI), is proved to be a linear parameter of the number of surviving stem cells when determined between 5 and 11 weeks after irradiation. The mean D_0 value of the stem cell survival curves in this period amounts to 81 ± 2 rad, pointing to the existence in the mouse testis of a highly radioresistant population of stem cells. Evidence was obtained that age of the animal does not influence stem cell sensitivity once the animal is adult, though clones grow at a slower rate in older animals. Our findings permit an estimate of the number of stem cells present in the normal unirradiated testis. This number amounts to about 1800. The existence of a population of more radiosensitive stem cells cannot be excluded. Stem cell survival after irradiation with 300 kV x rays was also investigated. The x-ray curve is exponential from 400 rad onward; the value of D_0 is 242 ± 7 rad, and the quasi-threshold dose $D_{sub q}$ amounts to 165 rad. By comparison with the

neutron curve for the same time interval the RBE of 1 MeV fission neutrons was calculated. The RBE decreases from 5.5, at a surviving fraction of stem cells of 0.30, to 4.1 at a fraction of 0.01.

- 1273 SCANNING ELECTRON MICROSCOPY OF MOUSE INTESTINAL MUCOSA AFTER COBALT 60 AND D-T NEUTRON IRRADIATION. Hamlet, R. (Belvidere Hospital, Glasgow (UK). Institute of Radiotherapeutics and Oncology); Carr, K.R.; Toner, P.G.; Nias, A.H.W. Br. J. Radiol.; 49: No. 583, 624-629 (Jul 1976).

The stem-cell population of the intestinal crypt is an important model system in experimental radiobiology. Standardized techniques have been developed to allow quantitation of the response of crypt cells to radiation injury following doses of 0 to 2 krad of D-T neutrons or ^{60}Co γ rays. These techniques rely on the identification of regenerating crypt cells three-and-a-half days after irradiation. The results were expressed as the number of regenerating crypts per circumference of small intestine, as determined by conventional histological examination; the more profound the injury, the smaller the crypt count. The practical relevance of crypt-counting techniques to clinical radiotherapy is limited by their relative insensitivity; the dose levels commonly used in fractionated radiotherapy produced no detectable response. Scanning electron microscopy of the mucosal surface provided a more sensitive measure of radiation injury. The earliest detectable changes occurred at the level of 300 rad of γ radiation, well below the threshold of the crypt-counting technique. At around 1,000 rad, where the first drop in crypt counts occurred, there were well-marked morphological changes which became more severe with increasing dose levels. Some differences have been observed between the morphological effects of γ and neutron irradiation at points of radiobiological equivalence in terms of crypt counts (using RBE value of about 2). The changes observed may reflect more than the disruption of epithelial cell kinetics. Mucosal morphology is the total expression of many different biological parameters of which the regenerative ability of the crypt cells is only one. The surface microanatomy of the gut may be the most sensitive indicator of radiation injury which is conveniently available for study.

- 1274 EFFECT OF LOW DOSE X IRRADIATION ON THE SUCCINATE DEHYDROGENASE ACTIVITY OF GUINEA PIG, RAT AND MOUSE TISSUES. Shah, V.C.; Bhatawdekar, J.M.; Aravinda Babu, K. (Gujarat Univ., Ahmedabad (India). Dept. of Zoology). Strahlentherapie; 152: No. 1, 83-91 (Jul 1976). 8 figs.; 2 tabs.; 17 refs..

The histochemical changes in succinate dehydrogenase (SDH) were investigated in pectoralis major muscle of guinea pig, rat and mouse after level X-irradiation (72 R and 240 R) and compared with control animals. Biochemical studies were carried out on liver, kidney, muscle (pectoralis major), adrenal and spleen of these animals after low dose local X-irradiation and compared with control animals. Changes in SDH activity were studied up to 72-h post-irradiation, which shows that low dose local X-irradiation leads to increased enzymic activity. The increase in enzymic activity was remarkable in mouse tissues as compared with guinea pig and rat. Adrenals of all the three animals showed significant activation after all the doses of radiation studied. The significance of these results, with special reference to oxidative metabolism, has been

discussed.

sex in Kuwait in 1973, the annual GSD (microrad) due to application of radiopharmaceuticals in Kuwait in 1973 and a comparison of annual GSDs in various countries, are shown in tabular form. The results are discussed and in particular the high GSD in Kuwait, 52%, is attributed in part to therapy doses of ^{131}I used for treatment of thyrotoxicosis which is relatively frequent in the country.

275 PERMEABILITY OF THE SMALL INTESTINE AFTER INTRA-ARTERIAL INJECTION OF HISTAMINE-TYPE MEDIATORS AND IRRADIATION. Kingham, J.G.C.; Loehry, C.A. (Royal Victoria Hospital, Bournemouth (UK)). Gut; 17: No. 7, 517-526(Jul 1976).

Permeability and selectivity of rabbit small intestine were estimated by a perfusion technique after intra-arterial injection of histamine-type mediators and an intestinal dose of 1.5 MR gamma irradiation. It was shown that the histamine-type mediators caused an increase in capillary permeability which produced an overall moderate increase in transmucosal permeability with a moderate loss of selectivity. Local intestinal irradiation caused a very marked increase in permeability and a profound loss of selectivity. It was felt that this was produced partly by an increase in capillary permeability but largely by damage to the epithelial basement membrane. It is concluded that the intestinal capillary endothelium is both rate-limiting and selective, though not to a major degree in either case. The epithelial basement membrane, however, appears to be both rate-limiting and markedly selective.

1276 CHANGES OF HEMOPOIESIS IN LONG-TERM IRRADIATED MICE. Praslicka, M.; Kalina, I. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie). Vnitr. Lek.; 22: No. 7, 680-684(Jul 1976). (In Slovak).

Changes were studied in the number of stem cells, in cellularity of the bone marrow and in the number of leukocytes, erythrocytes and blood platelets in the peripheral blood of mice continuously irradiated at dose rates of 25, 50 and 80 R/day. With dose rates of 25 and 50 R/day, a steady state was reached of the parameters studied at a level which depended on the dose rate and was lowest in CFU and highest in granulocytes and erythrocytes of the peripheral blood. With the dose rate of 80 R/day no such steady state was attained and the number of elements of hemopoiesis fell continuously until death of the experimental animals.

1277 FOURTEEN-YEAR REMISSION OF ACUTE LEUKEMIA IN A PATIENT EXPOSED TO THOROTRAST. Mabry, J.; Gralnick, H.; Carbone, P.P. (National Cancer Inst., Bethesda, MD). Cancer; 38: No. 1, 306-309(Jul 1976).

A case report of a patient who developed acute myelogenous leukemia 15 years after injection of Thorotrast and who has been in a sustained long term remission for 14 years is presented with a review of the problems associated with Thorotrast, subsequently shown to be radioactive with long term sequelae.

1278 GENETICALLY SIGNIFICANT DOSE FROM USE OF RADIOPHARMACEUTICALS IN KUWAIT. Novotny, J.; Al Mudaires, J. (Radiotherapy and Radioisotope Centre, Al Sabah Hospital, Kuwait). Health Phys.; 31: No. 1, 59-62(Jul 1976).

Since Kuwait, with 0.85 million inhabitants in 1973, has had a single nuclear medical service situated in one clinic for the past 10 yr it is possible to carry out a statistical evaluation of the radiation dose received by a defined population. The data collected from patients for the genetically significant dose (GSD) calculations are listed and the equation used in the calculations is given. The annual number of radionuclide procedures by age and

1279 BIOLOGICAL BASIS OF PLUTONIUM SAFETY STANDARDS. Mole, R.H. (Medical Research Council, Harwell, Eng.). J. Br. Nucl. Energy Soc.; 15: No. 3, 203-213(Jul 1976).

From British Nuclear Energy Society Meeting; London, UK (22 Apr 1976).

Since no radiation injury or cancer in man can, as yet, be directly attributed to Pu, all safety standards for Pu must be determined by reference to other safety standards, development of which is discussed. A system of safety standards must be based on links with real damage, such as the requirement for ^{226}Ra in bone. The type of biological information required for making standards realistic is considered in relation to Pu and Ra in bone. Also considered are the possible effects of Pu in soft tissue such as bone marrow. Not only dose, but also the number of cells exposed to the dose are important biologically and cellular aspects are examined. Since there is no positive evidence of Pu toxicity relevant information on other α emitters must be examined. The observed effectiveness of Ra, daughters of ^{222}Ra and ^{232}Th in causing mutations and cancer, is surveyed. Reference is made to the necessity of improving the ICRP system, currently based on the critical organ concept, by recognising the need for summation of risks in other organs where exposure to Pu is concerned. Improved biological understanding particularly that of hereditary damage, in recent years leads to less pessimistic thinking on the effects of ionizing radiations. The immediate need appears to be for consistency in safety standards.

1280 ROLE OF RATS AGE AND THE AMOUNT OF PLUTONIUM ADMINISTERED IN THE OSTEOSARCOMOGENESIS IN RATS. Sinyakov, E.G. Radiobiologiya; 16: No. 4, 631-634(Jul 1976). (In Russian).

One six- and twelve month-old rats have been used for the experiment. It is shown that the most osteosarcomogenous plutonium amount is 2.5 $\mu\text{curie/kg}$ for both young and adult animals, although the ionizing doses absorbed have been lower in the organisms of the former. It has been revealed that the life span of animals, the frequency of osteosarcoma occurrence and the duration of its latent period are inversely proportional to radiation dose absorbed.

1281 LONG-TERM RETENTION OF AMERICIUM-241 FOLLOWING ACCIDENTAL INHALATION. Fry, F.A. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Health Phys.; 31: No. 1, 13-20(Jul 1976).

The distribution and retention of ^{241}Am have been studied in two men for a period of almost 4 yr following accidental inhalation of americium oxide. At the time of the first measurement several months after intake, approximately half the total body content was located in the thorax and elimination from this region has been slow, with a half-life of at least 900 days. The presence of activity in liver and bone of both subjects has been confirmed and investigation of the relative distribution between these sites suggests that

the liver may be the most critical organ for systemic ^{241}Am .

- 1282 (BNWL--2056) BIOLOGY OF THE TRANSURANIUM ELEMENTS: AN INDEXED BIBLIOGRAPHY. Thompson, R.C. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1976. Contract E(45-1)-1830. 238p. Dep. NTIS \$8.00.

This bibliography on the biology of the transuranium elements is a revision of one issued in 1973 (BNWL-1782). It includes essentially all of the citations from the earlier document, a few corrections and additions from the older literature, plus the new literature to mid-1975. It also includes a subject-matter index not present in the original document.

- 1283 TOPOGRAPHIC ANALYSIS OF THE MICRODISTRIBUTION OF ^{241}Am IN THE RAT FEMUR AS INFLUENCED BY DTPA TREATMENT. Polig, E. (Kernforschungszentrum, Karlsruhe, Ger.). Radiat. Res.; 67: No. 1, 128-141 (Jul 1976).

The influence of growth and $\text{Na}_2\text{Ca-DTPA}$ treatment on the microscopic distribution of Am(III) in the distal femora of 8-week-old female rats were examined by means of solid-state nuclear-track detectors and an electronic scanning technique. The iv dose of [^{241}Am]citrate was 30 $\mu\text{Ci/kg}$; Ca-DTPA was administered ip once weekly in a dose of 30 $\mu\text{mole/kg}$, and the first dose was injected 1.5 hr after the ^{241}Am . The animals were sacrificed 7, 14, 28, and 56 days after the ^{241}Am injection. The distribution of ^{241}Am was presented as computer-generated scan plots giving quantitative information about radiation dose rates. The redeposition of ^{241}Am in newly formed bone tissue between the zone of heavy initial uptake and the epiphyseal cartilage plate was absent in the case of DTPA treatment. There was a diminution of activity by DTPA in the metaphyseal band to 40 percent of the control values on the 7th day and to 26 percent on the 56th day. While DTPA does not significantly affect removal of the epiphyseal deposit of ^{241}Am , there is a continuing effectiveness in the metaphysis and diaphysis, yielding a reduction to 70 percent of the control radioactivity at the 7th day, and 28 percent at the 56th day. Bone remodeling tended to increase the nonuniformity of the dose-rate distribution, which, for example, led to an enhancement of the maximum dose rates in the metaphyseal band. This increase of the nonuniformity of the dose-rate distribution is even enhanced by DTPA treatment. The information contained in the dose-rate scans was reduced to probability density curves and compared for the effects of aging and DTPA.

- 1284 SELECTIVE ELIMINATION OF MARROW PRECURSORS WITH THE BONE-SEEKING ISOTOPE ^{89}Sr : IMPLICATIONS FOR HEMOPOIESIS, LYMPHOPOIESIS, VIRAL LEUKEMOGENESIS, AND INFECTION. Bennett, M.; Baker, E.E.; Eastcott, J.W.; Kumar, V.; Yonkosky, D. (Boston Univ. School of Medicine, MA). J. Res. U.S. Geol. Surv.; 20: No. 1, 71-87 (Jul 1976).

Radioactive strontium (^{89}Sr) is a bone-seeking isotope that becomes incorporated into bone and emits alpha particles, thus destroying hemopoietic cells within marrow cavities. Other hemopoietic tissues are spared and the spleen takes over all stem cell functions of the mouse. This procedure is effectively equivalent to a bone marrow-ectomy and the question can be asked: Do any particular cell types depend upon residence within the marrow for critical stages in their differentiation. Mice treated with

^{89}Sr were able to generate Ab-forming cells and to reject skin allografts. These data indicated that stem cells from the spleen were able to differentiate into B cells in the bursa equivalent central lymphoid organ (which was obviously not the bone marrow), into T cells in the thymus, into monocyte/macrophage cells which function as accessory cells in humoral immunity and into effector cells in tissue allograft immunity. The effects of ^{89}Sr administration on various T cell, B cell, and macrophage functions in mice were investigated. Most of the functions tested were normal and results of these investigations are presented in detail.

- 1285 (LA-NUREG--6427-PR) RESPIRATOR STUDIES FOR THE NUCLEAR REGULATORY COMMISSION. PROGRESS REPORT, JULY 1, 1974--JUNE 30, 1975. Hack, A.L.; Moore, T.O.; Revior, W.H. (Los Alamos Scientific Lab., N.Mex. (USA)). Jul 1976. Contract W-7405-ENG-36. 6p. Dep. NTIS \$3.50.

Major accomplishments during FY75 were training NRC personnel in the principles of respiratory protection, preparing video tapes explaining respiratory protection aspects of NRC Guides, publishing a newsletter of current happenings in respiratory protection, organizing a respiratory symposium, producing and NRC manual of respiratory protection, and initiating a study to define protection factors of air-supplied hoods.

- 1286 TRANSPORT CALCULATIONS OF γ -RAY FLUX DENSITY AND DOSE RATE ABOUT IMPLANTABLE CALIFORNIUM-252 SOURCES. Shapiro, A.; Lin, B.I. (Cincinnati Univ., Ohio (USA). Dept. of Chemical and Nuclear Engineering); Windham, J.P.; Kereiakes, J.G. Phys. Med. Biol.; 21: No. 4, 509-523 (Jul 1976).

γ flux density and dose rate distributions have been calculated about implantable californium-252 sources for an infinite tissue medium. Point source flux densities as a function of energy and position were obtained from a discrete-ordinates calculation, and the flux densities were multiplied by their corresponding kerma factors and added to obtain point source dose rates. The point dose rates were integrated over the line source to obtain line dose rates. Container attenuation was accounted for by evaluating the point dose rate as a function of platinum thickness. Both primary and secondary flux densities and dose rates are presented. The agreement with an independent Monte Carlo calculation was excellent. The data presented should be useful for the design of new source configurations.

- 1287 (DOCKET-50269--583) OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3. ADDITIONAL INFORMATION RE PERMANENT WASTE MANAGEMENT FACILITY. (Duke Power Co., Charlotte, N.C. (USA)). 30 Jun 1976. 4p. (DOCKET-50270--549; DOCKET-50287--468).

Permanent waste management facility; responses to NRC questions. OCONEE-1 REACTOR; OCONEE-2 REACTOR; OCONEE-3 REACTOR; RADIOACTIVE WASTE MANAGEMENT; RADIOACTIVE WASTE FACILITIES; RADIOACTIVE EFFLUENTS; IODINE 131; RADIATION MONITORING; EVAPORATORS; FILTERS; SOLID WASTES; PACKAGING; PERSONNEL; RADIATION DOSES; HYDROGEN METERS

- 1288 (PB--258552) EFFECT OF RADIATION-INDUCED XEROSTOMIA ON THE HUMAN ORAL MICROFLORA. REPORT NO. 12 (FINAL), 1 JUL 1971-30 JUN 1976. Dreizen, S.; Brown, L.R. (Texas Univ., Houston (USA). Dental Science

Inst.). 30 Jun 1976. Contract PHS-71-2377. 21p. NTIS, PC A02/MF A01.

The caries-conductive impact of xerostomia was studied in 42 irradiated cancer patients. The radiation-induced xerostomia was paralleled by changes in the physical, microbial, biochemical, immunologic and dietary parameters of cariogenicity that collectively comprised an overwhelming caries challenge. Microbiologically, significant xerostomia-related increases in *Strep. mutans*, lactobacilli, staphylococci, yeasts and catalase-positive diphtheroids were accompanied by decreases in *Strep. sanguis*, bacteroides and fusobacteria in each of the 5 microenvironments tested. The scanty xerostomic saliva contained greater amounts of Na(+), Cl(-), Ca(++), Mg(++), Prot(-), lysozyme, IgA and IgG and considerably less HCO₃(-). The increased concentrations of caries protective electrolytes and immunoproteins were negated by huge reductions in total daily saliva output. The xerostomia created caries challenge was almost completely neutralized by a preventive program of daily topical NaF applications and strict oral hygiene. (GRA)

1289 (TID--27160) STUDY OF THE PHYSIOLOGICAL FUNCTION AND HISTOLOGICAL CHANGES OF THYROIDS IRRADIATED WITH RADIOACTIVE IODINE. PROGRESS REPORT, OCTOBER 1, 1975--SEPTEMBER 30, 1976. Dobyns, B.M. (Case Western Reserve Univ., Cleveland, Ohio (USA)). 30 Jun 1976. Contract E(11-1)-1784. 11p.

Progress is reported on the following research projects: radiation effects of therapeutic doses of ¹³¹I in the thyroid in clinical subjects with hyperthyroidism; dosimetry of ¹³¹I for treatment of Graves' disease; development of thyroid neoplasms in animals and man; development of thyroid neoplasms in the Marshallese; role of TSH in neoplasm formation following ¹³¹I radiation, radioimmunoassay for TSH; neoplasms of the thyroid following x irradiation in clinical subjects; and the kinetics of various treatment doses of ¹³¹I. (HLW)

1290 (DOCKET-50133--400) HUMBOLDT BAY POWER PLANT, UNIT 3. IE INSPECTION REPORT NO. 76-07. (Pacific Gas and Electric Co., San Francisco, Calif. (USA)). 23 Jun 1976. 11p. Inspection of radiological program. HUMBOLDT BAY REACTOR; INSPECTION; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES; SAFETY; RADIOACTIVE EFFLUENTS; RADIATION MONITORING; RADIATION MONITORS; CALIBRATION

1291 (DOCKET-50003--536) INDIAN POINT STATION, UNITS 1 AND 2. IE INSPECTION REPORT NOS. 76-05 AND 76-08, NOTICE OF VIOLATION AND NOTICE OF PROPOSED IMPOSITION OF CIVIL PENALTIES. (Consolidated Edison Co. of New York, Inc., New York (USA)). 21 Jun 1976. 10p. (DOCKET-50247--666).

Inspection of personnel radiation doses. INDIAN POINT-1 REACTOR; INDIAN POINT-2 REACTOR; PERSONNEL; RADIATION DOSES; INSPECTION; RADIATION PROTECTION

1292 (DOCKET-50010--550) DRESDEN NUCLEAR POWER STATION, UNITS 1, 2, AND 3. IE INSPECTION REPORTS NOS. 76-05 AND 76-04 REPLIES. (Commonwealth Edison Co., Chicago, Ill. (USA)). 17 Jun 1976. 23p. (DOCKET-50237--1021; DOCKET-50249--820).

Inspection of radiological protection procedures. DRESDEN-1 REACTOR; DRESDEN-2 REACTOR; DRESDEN-3 REACTOR; INSPECTION; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES

1293 DOUBLING POTENTIAL OF FIBROBLASTS FROM DIFFERENT SPECIES AFTER IONISING RADIATION. Macleira-Coelho, A.; Diatloff, C. (Institut National de la Sante et de la Recherche Medicale (INSERM), 94 - Villejuif (France). Inst. de Cancerologie et d'Immunogenetique); Malaise, E. Nature (London); 261: No. 5561, 586-588(17 Jun 1976).

It is stated that whereas chicken fibroblasts invariably die after a certain number of doublings in vitro, and this fact is never altered by chemical or physical agents, mouse fibroblasts invariably acquire spontaneously an infinite growth potential. In the human species fibroblasts never acquire spontaneously the capacity to divide for ever, although they can become permanent cell lines after treatment with certain viruses. This behaviour of fibroblasts in vitro has been attributed to different nutritional requirements. Experiments are described with human and mouse fibroblasts in which it was found that the response to ionising radiation matches the relative tendencies of the fibroblasts to yield permanent cell lines. Irradiation was commenced during the phase of active proliferation. Human fibroblast cultures irradiated with 100 R stopped dividing earlier than the controls, whereas cultures irradiated with 200, 300 and 500 R had the same lifespan as the control cultures. Cultures irradiated with 400 R showed the longest survival. With mouse fibroblasts the growth curves of the irradiated cells were of the same type as in the controls, but recovery occurred earlier. The results indicated that ionising radiation accelerates a natural phenomenon; in cells with a limited growth potential (chicken) it shortens the lifespan, whereas in cells that can acquire an unlimited growth potential (mouse) it accelerates acquisition of this potential; human fibroblasts showed an intermediate response, since ionising radiation neither established the cultures as with mouse cells nor reduced the number of cells produced as with chicken fibroblasts. Possible explanations for the different behaviour of the species are offered.

1294 (PB--255459) CURRENT CANCER RESEARCH ON RADIATION CARCINOGENESIS. (Smithsonian Science Information Exchange, Inc., Washington, D.C. (USA). Current Cancer Research Project Analysis Center). 15 Jun 1976. 26p. NTIS \$4.00.

The listing is one of a planned series produced by the Current Cancer Research Project Analysis Center (CCRESPAC) for the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute. The purpose of the series is to inform cancer investigators of ongoing projects related to their current research in laboratories all over the world. Each listing focuses on a specific cancer research area. Information on the listed projects was derived from descriptions supplied to CCRESPAC by cancer investigators and research organizations. This listing (Special Listing of Current Cancer Research on Radiation Carcinogenesis) covers projects related to occupational radiation carcinogenesis, cancer risk in populations exposed to therapeutic or diagnostic radiation or to radioactive fallout, radiation carcinogenesis in animal model systems, mechanisms of radiation carcinogenesis, and cancer induction by radiation in combination with carcinogenic agents (chemicals or hormones). (GRA)

1295 (DOCKET-50293--611) PILGRIM NUCLEAR

- POWER STATION, UNIT 1. LETTER RE RADIATION EXPOSURE; NRC ACKNOWLEDGMENT (8 JUNE 1976). (Boston Edison Co., Mass. (USA)). 14 Jun 1976. 3p.
Radiation exposure. PILGRIM-1 REACTOR; PERSONNEL; RADIATION DOSES; RADIATION PROTECTION; EDUCATION
- 1296 (DOCKET-50295--711) ZION NUCLEAR PLANT, UNIT 1. IE INSPECTION REPORT NO. 76-12 AND SPECIAL WORK PERMIT. (Commonwealth Edison Co., Chicago, Ill. (USA)). 11 Jun 1976. 19p.
Inspection of employee's radiation exposure. ZION-1 REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES; RADIATION MONITORING; RADIATION PROTECTION; LEAKS; REACTOR COOLING SYSTEMS
- 1297 RADIOACTIVE POLLUTION. Lafuma, J.; Masse, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Rev. Prat.: 26: No. 33, 2337-2342 (11 Jun 1976). (In French).
The basic data available to-day on radioactive pollution levels of various origins are compared to those of natural origin. In the year 2000, radioactive pollution from nuclear electricity will represent only one additional day of, natural irradiation per year. Human data now available on action of chronic irradiation are given, together with the results of very many experiments on animals. Finally, the risk evaluation which can be derived are analyzed, as well as the safety limits they imply.
- 1298 (DOCKET-50409--370) LACROSSE BOILING WATER REACTOR. IE INSPECTION REPORT NO. 76-02 AND REPLY. (Dairyland Power Cooperative, La Crosse, Wis. (USA)). 9 Jun 1976. 23p.
Inspection of personnel radiation exposures. LACBWR REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES
- 1299 (DOCKET-50295--708) ZION NUCLEAR PLANT, UNITS 1 AND 2. IE INSPECTION REPORT NOS. 76-13 AND 76-11 AND REPLY. (Commonwealth Edison Co., Chicago, Ill. (USA)). 8 Jun 1976. 25p. (DOCKET-50304--593).
Inspection of radiation protection activities, audits, training, procedures, records, surveys, dosimetry, material inventory, and respiratory protection. ZION-1 REACTOR; ZION-2 REACTOR; INSPECTION; AIR; SAMPLING; RADIATION DOSES; TANKS; RADIATION PROTECTION; DOCUMENTATION; EDUCATION; PERSONNEL; WHOLE-BODY IRRADIATION; RADIOCHEMISTRY; RADIOACTIVE MATERIALS; RADIATION MONITORS; CALIBRATION
- 1300 (UCRL--52081) AGE-DEPENDENT RADIOSENSITIVITY OF MOUSE OOCYTES. Koehler, C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Jun 1976. Contract W-7405-ENG-48. 24p. Dep. NTIS \$3.50.
Thesis.
It has been shown that there are three distinct phases of radiosensitivity in oocytes of prepubertal mice: a period of rapidly increasing sensitivity between 0 and 4 days of age; a period of consistent, high sensitivity between 5 and 18 days of age; and a period of decreasing sensitivity from 19 to at least 21 days of age. Two distinct phases have been demonstrated for the rate of population decline of the oocytes of primary follicles: an initial period of rapid loss from 0 to 4 days of age; and a period of much slower loss from 5 through 23 days of age. Correlations have been drawn between the first two phases of radiosensitivity and morphological changes in the oocyte, and between the third phase of radiosensitivity and endocrinological changes in the maturing animal. The reaction of oocytes to radiation has been separated into two categories: immediate death (within 24 hours); and delayed death (over the entire lifespan of the animal). (auth)
- 1301 (DOCKET-50133--391) HUMBOLDT BAY POWER PLANT, UNIT 3. LICENSE NO. DPR-7, INFORMATION RE OVER EXPOSURE OF TWO INDIVIDUALS TO RADIATION. (Pacific Gas and Electric Co., San Francisco, Calif. (USA)). 7 Jun 1976. 3p.
Over exposure of two individuals to radiation. HUMBOLDT BAY REACTOR; PERSONNEL; RADIATION DOSES; WHOLE-BODY IRRADIATION; CONDENSATION CHAMBERS; COOLANT CLEANUP SYSTEMS; REPAIR; PHOTOGRAPHIC FILM DOSEMETERS
- 1302 (DOCKET-50295--682) ZION NUCLEAR PLANT, UNIT 1. LICENSE NO. DPR-39, INFORMATION RE OVEREXPOSURE OF TWO INDIVIDUALS TO RADIATION. (Commonwealth Edison Co., Chicago, Ill. (USA)). 7 Jun 1976. 7p.
Overexposure of two individuals to radiation. ZION-1 REACTOR; PERSONNEL; RADIATION DOSES; REACTOR OPERATION
- 1303 (DOCKET-50320--227) THREE MILE ISLAND NUCLEAR STATION, UNIT 2. EVALUATION TO DEMONSTRATE COMPLIANCE WITH 10 CFR 50, APPENDIX I. (Metropolitan Edison Co., Reading, Pa. (USA)). 4 Jun 1976. 162p.
Evaluation to demonstrate compliance with 10 CFR 50, appendix I concerning activity levels of radioactive wastes. THREE MILE ISLAND-2 REACTOR; RADIOACTIVE EFFLUENTS; ACTIVITY LEVELS; ENVIRONMENTAL EFFECTS; COST BENEFIT ANALYSIS; FISSION PRODUCT RELEASE; PERSONNEL; RADIATION DOSES; LIQUID WASTES; GASEOUS WASTES
- 1304 (DOCKET-50245--746) MILLSTONE NUCLEAR POWER STATION, UNITS 1 AND 2. IE INSPECTION REPORT NO. 76-08 AND 76-11. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 2 Jun 1976. 10p. (DOCKET-50336--475).
Inspection of organization, radiation surveys, use of instruments, personnel exposure control, and effluent releases. MILLSTONE-1 REACTOR; MILLSTONE-2 REACTOR; INSPECTION; RADIOACTIVE EFFLUENTS; PERSONNEL; RADIATION DOSES
- 1305 (DOCKET-50269--550) OCONEE NUCLEAR STATION, UNIT 1. TRIP REPORT ON MAY 18, 1976 TO REVIEW THE NEW WASTE MANAGEMENT FACILITY. (Duke Power Co., Charlotte, N.C. (USA)). 1 Jun 1976. 4p.
Trip report on May 18, 1976 by NRC to review the new waste management facility. OCONEE-1 REACTOR; RADIOACTIVE WASTE MANAGEMENT; RADIOACTIVE WASTE FACILITIES; EVAPORATORS; SOLID WASTES; REMOTE HANDLING; RADIATION DOSES; PERSONNEL; RADIOACTIVE EFFLUENTS; RADIATION MONITORING; VENTILATION; TRITIUM; OFF-GAS SYSTEMS; MEETINGS; INSPECTION
- 1306 (BNWL-SA--5672) MICRODOSIMETRY OF INTERNAL SOURCES. Roesch, W.C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1 Jun 1976. Contract E(45-1)-1830. 35p. (CONF-760652--5). Dep. NTIS \$3.50.
From Health Physics Society meeting; San Francisco, CA, USA (27 Jun 1976).
Microdosimetry has been limited to irradiations characterized by uniform probabilities of charged-particle production.

New methods are here presented for dealing with particles emitted by radionuclides embedded in the irradiated medium; these particles seldom emerge uniformly, because the radionuclides are not dispersed uniformly. In particular, emission from radionuclides that are agglomerated into particulates is extremely nonuniform. Microdosimetric distributions for these internal emitters can be calculated by: (1) determining the probability density in specific energy due to single energy deposition events by charged particles from a point source, (2) combining these densities by Fourier-transform methods, and (3) using existing numerical methods to evaluate the Fourier result. Examples are given calculated for ^{239}Pu alpha particles from point sources (particulates) and from particulates uniformly distributed through all space, a half space, and a sphere.

- 1307 (ORNL/TM--5538) POTENTIAL GENERATION AND RADIOLOGICAL IMPACTS OF GASEOUS ^{14}C RELEASED DURING REPROCESSING OF ADVANCED LMFBR FUELS. Tennery, V.J.; Bomar, E.S.; Bond, W.D.; Kaye, S.V.; Morse, L.E.; Till, J.E. (Oak Ridge National Lab., Tenn. (USA)). Jun 1976. Contract W-7405-ENG-26. 28p. AT.

Use of advanced carbide or nitride fuels in place of the reference oxide fuel in LMFBRs may be required in the future to optimize the utilization of this reactor system. Differences in the environmental impact associated with such fuel substitutions are of critical importance in determining the real future viability of various advanced fuels. Calculations indicate that the concentration of ^{14}C can be significantly different in the various fuels following their residence in the reactor. Most of the ^{14}C present in the spent fuels is converted to $^{14}\text{CO}_2$ during fuel reprocessing, and ^{14}C released to the environment will be in this form. Best estimates indicate a release to the environment of no more than 1 percent of the ^{14}C contained in the spent fuels. Radiation dose commitments due to $^{14}\text{CO}_2$ release from advanced-fuel reprocessing plants were calculated. They range between 1.5×10^{-5} mrem from nitride fuel containing no ^{14}N to a maximum of 50 mrem from nitride fuel synthesized with natural nitrogen. Population doses within an 80-km (50-mile) radius of the reprocessing plant were calculated to be 13 man-rems for carbide fuel containing 1000 ppm ^{14}N and 760 man-rems for nitride fuels synthesized from natural nitrogen.

- 1308 PREDICTION OF INCREASED GAMMA FIELDS AFTER APPLICATION OF A RADON BARRIER ON CONCRETE SURFACES. Culot, M.V.J. (Instituto Nacional de Energia Nuclear, Mexico City); Schiager, K.J.; Olson, H.G. Health Phys.; 30: No. 6, 471-478 (Jun 1976).

A sizable reduction of the indoor radon progeny exposure level is anticipated in structures from the application of a radon barrier to the indoor surfaces of concrete foundations, behind or in which uranium mill tailings exist. The predicted accumulation of radon and gamma emitting radon progeny behind the barrier was studied. Radon accumulations were modeled by application of linear diffusion theory to a multilayered system of porous media. A comparison of the gamma exposures associated with concentration profiles prior to and after application of a radon barrier resulted in the prediction of sufficiently low fractional increases to justify field testing of the barrier.

- 1309 (EUR--5476-d) STRUCTURE, EQUIPMENT AND ORGANISATION OF THE PERSONNEL EMPLOYED FOR INSPECTION, MAINTENANCE AND REPAIR IN THE CONTROL AREA OF NUCLEAR POWER PLANTS. (Commission of the European Communities, Brussels (Belgium)). Jun 1976. 46p. (In German). NTIS (US Sales Only).

A survey of personnel problems which have arisen during inspection, maintenance and repair work in the control area of nuclear power plants in the European Community is presented. The following aspects have been investigated: determination of the number of personnel employed for the different activities during certain time periods (years); allocation of the personnel employed according to its provenance (own personnel of the nuclear power plant, supplier's personnel, personnel hired by the nuclear power plant from other firms); qualification of the personnel employed; preparation of the personnel for specialized work (e.g. special training by means of models). On the basis of these data, which represent the experience gained so far, the future demand of personnel for inspection, maintenance, and repair has been estimated, considering also the growing portion of nuclear power production in total power production. Furthermore this study results in a number of recommendations, which refer to the employment of personnel in the control area.

- 1310 (PB--257054) OCCUPATIONAL RADIATION EXPOSURE AT LIGHT WATER COOLED POWER REACTORS, 1969--1975. Murphy, T.D.; Dayem, N.J.; Bland, J.S.; Pasciak, W.J. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Reactor Regulation). Jun 1976. 25p. (NUREG--0109). NTIS \$3.50.

The report presents an updated compilation of occupational radiation exposures at commercial light water cooled power reactors for the years 1969 through 1975. The information is derived from reports submitted to the United States Nuclear Regulatory Commission in accordance with requirements of individual plant Technical Specifications and Part 20.407 of Title 10, Chapter 1, Code of Federal Regulations (10 CFR Part 20.407). The MAN-REM/UNIT for all LWR's in 1975 is greater than the 1974 value. The cumulative average since 1969 continues to increase. No significant trend was indicated over the period of 1969-1975 in the mean value of MAN-REM/MEGAWATT-YEAR. (GRA)

- 1311 ISSUE OF PLUTONIUM TOXICITY. Cohen, B.L. (Univ. of Pittsburgh). Trans. Am. Nucl. Soc.; 23: 442 (Jun 1976).

From Transactions of the American Nuclear Society 1976 annual meeting; Toronto, Canada (13 Jun 1976).

NUCLEAR POWER PLANTS; RADIOACTIVE EFFLUENTS; HEALTH HAZARDS; COMPARATIVE EVALUATIONS; PLUTONIUM 239; TOXICITY

- 1312 DEVELOPMENT OF NUCLEAR POWER AND THE RADIATION BURDEN ON THE POPULATION. Paulicka, I. (Atomova Elektraren, Jaslovske Bohunice, Czechoslovakia); Trnovec, T. Jad. Energ.; 22: No. 6, 201-204 (Jun 1976). (In Slovak).

Czechoslovakia's territorial radiation burden is derived from the assumption that in 2000, the installed nuclear reactor power in the country will be 35000 MW. Liquid wastes are not considered to be significant. For the so-called closed system gaseous emissions are estimated to attain a value of 0.36 Ci/km^2 for ^3H and 30.6 Ci/km^2 for ^{85}Kr . The average dose exposure due to ^3H in the closed system will be 546.eta man.rem/MW by inhalation and 252.eta

man.rem/MW by ingestion, where ϵ is the coefficient of penetration efficiency. Based on the concentration of emissions in the atmosphere and certain assumptions, dose exposures from ^3H and ^{85}Kr are predicted to be 4.19×10^{-1} and 24.2 man.rem/MW respectively. The estimation of the average radiation dose made possible the prognosis of the effect of the development of nuclear power on the magnitude of biological risks (genetic defects, leukemogenic and carcinogenic effects) and the evaluation of the contribution of spent fuel processing plants to these risks. It is concluded that for normal operation, the average risk of the biological damage of the population in Czechoslovakia in the year 2000 may be expressed by a factor less than 5×10^{-6} .

- 1313 (GEAP--14034-7) RADIOLOGICAL ASSESSMENT MODELS. SEVENTH QUARTERLY REPORT, MARCH 1976--MAY 1976. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Jun 1976. Contract E(04-3)0893-TAS-15. 71p. AT.

The objectives of the program reported are to develop models for analyzing and evaluating postulated radiological sources, aerosol dynamics, sodium fires, and radiological dosages arising from hypothetical core disruptive accidents in liquid metal fast breeder reactors.

- 1314 (HEDL-TME--76-42) RADIATION EXPOSURE CONTROL TECHNOLOGY SEMI-ANNUAL PROGRESS REPORT, JANUARY--JUNE 1975. Smith, R.C.; Strode, J.N.; Brackenbush, L.W.; Faust, L.G. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1976. Contract E(45-1)-2170. 32p. AT.

Data on occupational exposure and measurements of the radiations from fast-reactor mixed ($\text{UO}_2\text{-PuO}_2$) fuels are presented. Dose rate measurement data include: a) measurements of wrist to shoulder dose accumulation by men fabricating FBR fuel with high exposure plutonium; b) gamma exposure rates from strip layers of fuel pins containing high exposure plutonium; c) neutron dose rates through four inch Opti/Gel viewing windows; and d) gamma energy spectra from plutonium enriched fuel through several common shielding materials for gloveboxes.

- 1315 DESIGN PROGRAM FOR OCCUPATIONAL DOSE REDUCTION. Vivian, G.A. (Ontario Hydro, Toronto). Trans. Am. Nucl. Soc.; 23: 64(Jun 1976).

From Transactions of the American Nuclear Society 1976 annual meeting; Toronto, Canada (13 Jun 1976).

CANDU power reactors. CANDU TYPE REACTORS; PERSONNEL; RADIATION DOSES; RADIATION PROTECTION; MANAGEMENT

- 1316 DESIGN CONSIDERATIONS AND EVALUATION OF THE TAMVEC NEUTRON THERAPY SHIELD. Smathers, J.B. (Texas A and M Univ., College Station); Wilson, W.B.; Otte, V.A.; Almond, P.R.; Grant, W. Trans. Am. Nucl. Soc.; 23: 634-635(Jun 1976).

From Transactions of the American Nuclear Society 1976 annual meeting; Toronto, Canada (13 Jun 1976).

RADIOTHERAPY; TEXAS A AND M CYCLOTRON; SHIELDING; DESIGN; NEUTRON BEAMS; RADIATION DOSES; PHANTOMS; GAMMA RADIATION

- 1317 (EPA--600/4-76-027) RADIOIODINE PREDICTION MODEL FOR NUCLEAR TESTS. Black,

S.C.; Barth, D.S. (Environmental Protection Agency, Las Vegas, Nev. (USA). Environmental Monitoring and Support Lab.). Jun 1976. 44p. NTIS.

Over a 5-year period, 14 major experiments were conducted to investigate the air-forage-cow-milk system for transfer of radioiodine. The experiments included controlled releases using prepared aerosols, planned releases during Plowshare cratering tests, and releases due to accidental venting of underground nuclear tests. Two or more groups of dairy cows, three to six cows per group, were used in each experiment to study the effect on radioiodine transfer of such factors as: the mode of exposure, the type and state of forage fed, the type of aerosol, and variations in feeding practices. In each experiment, measurements were made of the total radioiodine intake and output in milk of the cows, the concentrations in forage and milk, the gaseous and particulate air concentrations, the open-field gamma exposure rate, and the deposition per unit area. The mean values of the experimental data are assembled in this report and are used to develop the parameters for a standard milk excretion pattern for dairy cows and to develop predictive equations for radioiodine. The resultant equations, for predicting the infinite dose to a 2-gram human thyroid caused by ingestion of ^{131}I , are presented.

- 1318 (KFK-EXT--20/76-1) INVESTIGATION OF THE TRITIUM LEVEL IN THE ENVIRONMENT OF THE KARLSRUHE NUCLEAR RESEARCH CENTER. Koenig, L.A.; Winter, M.; Schueler, H.; Tachlinski, W. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). Jun 1976. 24p. NTIS (US Sales Only).

8 figs.; 6 tabs.; 5 refs..

Under an IAEA sponsored measurement program the tritium level is investigated in the immediate and more distant environment of the Karlsruhe Nuclear Research Center. The tritium concentration in precipitations, surface, ground and drinking water is measured within a long-term program. In addition, relationships existing between the tritium concentration of plants and the concentrations of ground water, precipitation, soil and air humidities are investigated at three points in special series of measurement. A summary report is presented on recent measured results. According to these results, the annual mean values for precipitations and surface water tend to rise. In 1975 the annual mean values amounted to 0.89 nCi/l of tritium concentration in precipitations in the more distant environment of the Nuclear Research Center and to 0.68 nCi/l in the Rhine river. In plants tritium concentrations were observed which correspond to that measured in the humidity of the air. The radiation exposure of people living in large towns is calculated to be about 50 $\mu\text{rem/a}$ in the region monitored, due to the presence of tritium in the drinking water. A little group of the population takes up as much as 110 $\mu\text{rem/a}$.

- 1319 ATMOSPHERIC RADIOACTIVITY DATA AND THE WEIBULL DISTRIBUTION FUNCTION. Apt, K.E. (Los Alamos Scientific Lab., NM). Trans. Am. Nucl. Soc.; 23: 87(Jun 1976).

From Transactions of the American Nuclear Society 1976 annual meeting; Toronto, Canada (13 Jun 1976).

RADIATION MONITORING; NUCLEAR FACILITIES; SURFACE AIR; LASL; ENVIRONMENT; HUMAN POPULATIONS; RADIATION DOSES; TRITIUM COMPOUNDS; PLUTONIUM 239; RADIOACTIVITY; AIR SAMPLERS; SAMPLING; MATHEMATICAL MODELS; STATISTICS; SPATIAL DOSE

DISTRIBUTIONS; TEMPORAL DOSE DISTRIBUTIONS;
DIFFUSION

- 1320 EFFECT OF RADIATION IN VITRO ON ERYTHROPOIETIN ACTION. Barcos, M.; Goldwasser, E. (Univ. of Chicago). Radiat. Res.; 66: No. 3, 541-551 (Jun 1976).

The effect of ionizing radiation on the response to erythropoietin of cultured rat marrow cells, at constant erythropoietin dose and constant cell density, differed according to the end point analyzed. Erythropoietin-induced RNA synthesis (an early response) and induced glucosamine incorporation into stroma (a late response) were relatively radioresistant. Induced hemoglobin synthesis was characterized by marked radiosensitivity. Inactivation parameters were $\text{anti } n = 1.04$ and $D_0 = 63 \text{ R (59 rad)} \pm 15 \text{ R (95 percent confidence interval)}$. The radiosensitivity was not the result of inactivation of secondary enzymic processes. The inactivation curves for stimulated hemoglobin synthesis at different doses of erythropoietin near the physiological range were found to be linear, with $\text{anti } n$ values in the range of 0.92 to 1.14. The corresponding log-log erythropoietin dose--response plots at different radiation doses were linear and parallel, a result inconsistent with an all-or-none action of radiation on erythropoietin-sensitive cells. At high cell density, the effect of 60 R on induced hemoglobin disappeared, whereas the effect on induced iron uptake persisted.

- 1321 FACTORS EFFECTING THE EFFICIENCY OF PURINE ANALOGUES AS SELECTIVE AGENTS FOR MUTANTS OF MAMMALIAN CELLS INDUCED BY IONISING RADIATION. Thacker, J.; Stephens, M.A.; Stretch, A. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). Mutat. Res.; 35: No. 3, 465-478 (Jun 1976).

In the Chinese hamster cell line V79-4, the frequencies of cells selected for their resistance to purine analogues do not always reflect the true frequencies of resistant mutants. The frequency of cells resistant to 8-azaguanine varied widely, especially when different sources of serum were used in the selective medium. Even with the more efficient analogue, 6-thioguanine, small colonies arose in the selective medium at a frequency which was strongly dependent upon analogue concentration and viable cell seeding density. These colonies were shown to have a phenotype which was indistinguishable from wild type. Hence with irradiated cells, where the viability of the cell population is reduced to an extent varying with the dose and the interval allowed for mutant expression, the counting of all colonies arising in selective medium can lead to spuriously variable, and sometimes very high, 'mutation frequencies'. Although the frequency of wild type colonies selected in thioguanine was diminished by the use of high concentrations of the analogue, a loss of induced mutants also occurred at these concentrations. Further, the V79-4 line contained two distinct types of mutant with different levels of hypoxanthine-guanine phosphoribosyl transferase (HGPRT) activity, and only one of these types (HGPRT-negative mutants) increased in frequency with radiation dose. These results can account for many of the anomalies encountered in previous studies with purine analogues as selective agents, and show that some care has to be taken to characterize the mutants selected by resistance to purine analogues before meaningful dose-response relationships can be established.

- 1322 GENETIC EFFECTS OF FEEDING IRRADIATED WHEAT TO MICE. Vijayalaxmi (National Inst. of Nutrition, Hyderabad (India)). Can. J. Genet. Cytol.; 18: No. 2, 231-238 (Jun 1976).

12 refs..

The effects of feeding irradiated wheat in mice on bone marrow and testis chromosomes, germ cell numbers and dominant lethal mutations were investigated. Feeding of freshly irradiated wheat resulted in significantly increased incidence of polyploid cells in bone marrow, aneuploid cells in testis, reduction in number of spermatogonia of types A, B and resting primary spermatocytes as well as a higher mutagenic index. Such a response was not observed when mice were fed stored irradiated wheat. Also there was no difference between the mice fed un-irradiated wheat and stored irradiated wheat.

- 1323 (EPA--520/7-76-004) RADIATION PROTECTION, 1975. ANNUAL EPA REVIEW OF RADIATION PROTECTION ACTIVITIES. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). Jun 1976. 184p. NTIS.

The EPA, under its Federal Guidance authorities, is responsible for advising the President on all matters pertaining to radiation and, through this mechanism, to provide guidance to other Federal agencies on radiation protection matters. Highlights are presented of significant radiation protection activities of all Federal agencies which were completed in 1975, or in which noteworthy progress was made during that period, and those events affecting members of the public. State or local activities are also presented where the effects of those events may be more far-reaching. At the Federal level significant strides have been made in reducing unnecessary radiation exposure through the efforts of the responsible agencies. These efforts have resulted in the promulgation of certain standards, criteria and guides. Improved control technologies in many areas make it feasible to reduce emissions at a reasonable cost to levels below current standards and guides. This report provides information on the significant activities leading to the establishment of the necessary controls for protection of public health and the environment. Radiation protection activities have been undertaken in other areas such as medical, occupational and consumer product radiation. In the context of radiation protection, ancillary activities are included in this report in order to present a comprehensive overview of the events that took place in 1975 that could have an effect on public health, either directly or indirectly. Reports of routine or continuing radiation protection operations may be found in publications of the sponsoring Federal agencies, as can more detailed information about activities reported in this document. A list of some of these reports is included.

- 1324 (FDA--76-8043) PHOTOGRAPHIC QUALITY ASSURANCE IN DIAGNOSTIC RADIOLOGY, NUCLEAR MEDICINE, AND RADIATION THERAPY. VOLUME I. THE BASIC PRINCIPLES OF DAILY PHOTOGRAPHIC QUALITY ASSURANCE. Gray, J.E. (Toronto Univ., Ontario (Canada). Radiological Research Labs.). Jun 1976. 98p. HEW.

The objective of this two-part manual is to provide the information necessary to establish and maintain an effective photographic quality assurance program in diagnostic radiology, nuclear medicine, and radiation therapy. Volume I provides the x-ray technologist with basic, practical information necessary for the

establishment and maintenance of a photographic quality assurance program involving a minimum investment in his time for training and daily quality assurance procedures and a minimum investment in equipment and materials. This volume also provides sufficient information for the technologist to compare the contrast, speed, and resolution of various screen-film combinations.

- 1325 (IA--1321, pp 256) RISK AND SAFETY IN THE NUCLEAR INDUSTRY AND CONVENTIONAL NORMS OF SOCIETY. Tadmor, J. Jun 1976.
In abstract form only.
Research laboratories annual report, 1975.
COMPARATIVE EVALUATIONS; COST; FISSION PRODUCT RELEASE; HAZARDS; ISRAEL; NUCLEAR INDUSTRY; SAFETY

- 1326 (IA--1321, pp 225-227) IMPROVED METHOD FOR EVALUATION OF X-RAY DOSES. Israeli, M.; Malhi, S. Jun 1976.
In abstract form only.
Research laboratories annual report, 1975.
KEV RANGE 10-100; KEV RANGE 100-1000; PERSONNEL DOSIMETRY; PHOTOGRAPHIC FILM DOSEMETERS; PROGRAMMING; RADIATION DOSES; SENSITIVITY; SPECTRA; X RADIATION

- 1327 (INIS-mf--3344, pp 37-41) INFLUENCE OF RADIATIONS ON ORGANISMS, CH. 7. Jun 1976. (In Dutch).
2. ed..
Nuclear energy.
An introduction is given on the possible effects of ionizing radiations on organisms. Somatic and genetic hazards are outlined and the conclusion is drawn that it is harmful to further pollute the environment with an increase of background radiation.

- 1328 (INIS-mf--3344, pp 90-138) RADIATION EFFECTS ON THE HUMAN ORGANS, APP. A. Jun 1976. (In Dutch).
60 refs., 9 figs., 11 tables.
Nuclear energy.
The appendix is subdivided into eleven chapters dealing with radiation effects on organisms and comprising the following subjects: biological effects of ionizing radiations (dose, LET, RBE, formation of radicals, age and sex, cell types, biological repair), recommendations and protective measures for somatic risks, genetic risks, experimental models and dose-effect relationships, and internal radiation. The groups conclusions are given.

- 1329 (KFK--2262, pp 413-450) THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE ATMOSPHERIC DIFFUSION OF RADIOACTIVE GASES AND AEROSOLS AND OF THE PROBABILISTIC RADIATION DOSES AROUND NUCLEAR PLANTS DUE TO ACCIDENTAL ACTIVITY RELEASES. Dilger, H.; Hiller, J.; Huebschmann, W.; Nester, K.; Schuettelkopf, H.; Thomas, P.; Vogt, S. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit); Schultz, H.; Voelz, E.; Wuenecke, C.D. (Technische Univ. Hannover (Germany, F.R.). Arbeitsgruppe fuer Technischen Strahlenschutz). Jun 1976. (In German).
10 figs.; 1 tab.; 29 refs..
Semiannual report, 1975/2.
The evaluation of the experiments supports the result gained in previous experiments and puts them on a broader statistical base. The evaluation method has been applied also to a French meso-scale diffusion experiment in the Rhone valley. The investigation of the dynamic behaviour of the atmospheric diffusion has

resulted in the Karlsruhe Prognostic Model: depending on daytime, diffusion category and estimated release duration, the area is defined, in which the maximum activity concentrations may be expected. The analysis of the 'Reactor Safety Study' has been concluded by a checking calculation. As a result, the contributions from the three radiation damage pathways, i.e. inhalation, irradiation by deposition and irradiation from the passing cloud, to the total dose has been analysed. Further details of the model used in the 'Rasmussen Study' have been clarified. The investigation of wind- and vector vane data was continued. The result is a proposal to modify the sigma sub(y)-values for stable diffusion categories (E and F).

- 1330 (PB--255629) RADIOIODINE PREDICTION MODEL FOR NUCLEAR TESTS. FINAL REPORT. Black, S.C.; Barth, D.S. (Environmental Protection Agency, Las Vegas, Nev. (USA). Environmental Monitoring and Support Lab.). Jun 1976. 44p. (EPA--600/4-76-027). NTIS \$4.00.

Results of 14 experiments on the air-forage-cow-milk transfer of iodine-131 are summarized and used to develop prediction models for dose to the thyroids of infants. The models are based on data from various types of nuclear tests together with data from controlled experiments using contaminating aerosols. This provides a realistic foundation for the predictions and for adjusting the predictions to correct for some types of forage. Equations developed from these studies can be used to predict within a factor of 2 the infinite dose to a 2-gram thyroid from a single contaminating event where cows continue to ingest contaminated forage and the subject drinks 0.7 liters of milk per day. This dose, in rads, is equal to 0.37 times the peak exposure rate measured 1 meter above ground, or 0.07 times the integrated air concentration. For wet deposition, it is suggested that the predicted doses be increased by a factor of 10. An equation for pre-test prediction is also developed. Short-lived radioiodines and inhalation during effluent passage have a definite effect on the predicted doses. (GRA)

- 1331 (PB--259655) RADIATION PROTECTION - 1975, ANNUAL EPA REVIEW OF RADIATION PROTECTION ACTIVITIES. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). Jun 1976. 185p. (EPA--520/7-76/004). NTIS, PC A09/MF A01.
Contents: Executive summary; Legislation and standards activities; Nuclear energy; Medical, occupational and consumer product radiation; Naturally-occurring radioactivity; Other nuclear energy activities; Nonionizing radiation; International activities of interest to the U.S. (GRA)

- 1332 RADIATION-INDUCED INTRACRANIAL MALIGNANT FIBROUS HISTIOCYTOMA. Gonzalez-Vitale, J.C.; Slavin, R.E.; McQueen, J.D. (Baltimore City Hospitals). Cancer; 37: No. 6, 2960-2963 (Jun 1976).

An autopsy case of radiation-induced intracranial malignant fibrous histiocytoma (fibroxanthosarcoma) is reported. The tumor developed in the region of the sella turcica 11 years after high dose radiotherapy of a chromophobe adenoma of the pituitary. The tumor had infiltrated the base of the brain as well as the base of the skull. Metastases were not found. The tumor was composed of an admixture of bizarre fibroblasts, histiocytes and giant cells, xanthoma cells and siderophages, with a

storiform fibrous stroma. This appears to be the first documented instance of a malignant fibrous histiocytoma occurring intracranially after local x irradiation.

- 1333 VISUAL SENSATIONS INDUCED BY RELATIVISTIC PIONS. McNulty, P.J.; Pease, V.P.; Bond, V.P. (Clarkson Coll. of Tech., Potsdam, NY). Radiat. Res.; 66: No. 3, 519-530 (Jun 1976).

Visual sensations were experienced when bursts of high-energy pions passed through the dark-adapted right eyes of three human subjects. The threshold for a visual sensation was typically 1 to 3 μ rad at the retina. Data are presented to show that the mechanism is Cerenkov radiation generated within the vitreous humor. Threshold measurements agree with published optical data. A comparison is made between our observations and the light flashes observed in deep space by Apollo astronauts.

- 1334 U.S. ENVIRONMENTAL PROTECTION AGENCY'S VIEWS ON TRANSPORTATION OF RADIOACTIVE MATERIALS. Roe, W.D. (Environmental Protection Agency, Washington, DC). Trans. Am. Nucl. Soc.; 23: 85 (Jun 1976).

From Transactions of the American Nuclear Society 1976 annual meeting; Toronto, Canada (13 Jun 1976).

RADIATION PROTECTION; HUMAN POPULATIONS; ENVIRONMENTAL PROTECTION AGENCY; SAFETY STANDARDS; RADIOACTIVE MATERIALS; ENVIRONMENT; TRANSPORT; MOTOR VEHICLE ACCIDENTS; ACCIDENTS; MATERIALS HANDLING; US NRC; REGULATIONS; RADIOACTIVITY; DIFFUSION; FAULT TREE ANALYSIS; RADIATION DOSES

- 1335 RADIATION EXPOSURE OF THE BREAST IN FILM- AND XERO-MAMMOGRAPHY. Saebel, M.; Weishaar, J.; Willgeroth, F. (Erlangen-Nuernberg Univ., Erlangen (F.R. Germany). Inst. fuer Gynaekologische Radiologie). Strahlentherapie; 151: No. 6, 504-510 (Jun 1976).

11 figs.; 19 refs..

In addition to other advantages, xeroradiography, compared with film-mammography, seems to result in a lower radiation dosage to the breast. In order to get some valid information concerning this point, depth dose measurements, were carried out in a plexiglas phantom for the different radiographic factors used in film- and xero-mammography. It could be shown that the exposure of the skin and the mean exposure of the breast are generally lower in xero-mammography than in film-mammography, and that this difference increased with increasing thickness of the breast. Therefore it can be concluded that xero-mammography should be preferred on account of its lower radiation exposure, whenever it is possible from the diagnostic point of view.

- 1336 ORDINANCE ON THE PROTECTION AGAINST DAMAGE FROM IONIZING RADIATION. RADIATION PROTECTION ORDINANCE - STRLSCHV. Bundesrat - Drucksache; No. 375/76, 1-83 (Jun 1976). (In German).

With figs., tabs. and apps..

The text in full, including reasons, tables, and 14 appendices, of the bill amending the Radiation Protection Ordinance - StrLSchV - (personal remark by the abstractor: different drafts having been much discussed, and the outcome still not a 100%) to be passed on the Bundesrat.

- 1337 EVALUATION AND RE-EVALUATION OF GENETIC RADIATION HAZARDS IN MAN. INTERSPECIFIC COMPARISON OF ESTIMATES OF MUTATION RATES. I. Schalet, A.P.; Sankaranarayanan, K. (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese; Cohen (J.A.) Instituut voor Radiopathologie en Stralenscherming, Leiden (Netherlands)). Mutat. Res.; 35: No. 3, 341-369 (Jun 1976). 18 refs..

A detailed presentation is made of the experimental data from the various systems used by Abrahamson to conclude that the per locus per rad (low LET) radiation-induced forward mutation rates in organisms whose DNA content varies by a factor of about 1000, is proportional to genome size. Additional information pertinent in this context is also reviewed. It is emphasized that the mutation rates cited by Abrahamson, although considered as pertaining to mutations at specific loci, actually derive from a broad variety of genetic end-points. It is argued that an initial (if not sufficient) condition for sound interspecific mutation rate comparisons, covering a wide range of organisms and detecting systems of various sensitivities, requires a reasonably consistent biological definition of a specific locus mutation, namely, a transmissible intralocus change. Granting the differences between systems in their resolving power to detect intergenic change, the data cited in this paper do not support the existence of a simple proportionality between radiation-induced intralocus mutation rate and genome size for the different species reviewed here.

- 1338 EFFECT OF CHANGES IN DOSE RATE ON THE YIELD OF CHROMOSOME ABERRATIONS IN HUMAN LYMPHOCYTES EXPOSED TO GAMMA RADIATION. Purrott, R.J.; Reeder, E. (National Radiological Protection Board, Harwell (UK). Research and Development Div.). Mutat. Res.; 35: No. 3, 437-444 (Jun 1976).

The yield of chromosome aberrations was studied in G_0 human peripheral blood lymphocytes following in vitro exposure to 100, 250 and 500 rad of caesium-137 gamma radiation. The doses were given at various rates up to 400 rad per h with the longest exposures lasting for approx. 50 h. At 500 and 250 rad the dicentric yields fell by 66 and 64% when the dose rate was reduced from 400 to 10 rad per h whereas at 100 rad the reduction was only 29%. Reductions were also noted in the frequency of acentric aberrations. At the higher dose rates (>150 R/h) the aberration yield was constant and agreed with data published elsewhere for 3000 R/h. The dose rate at which the decline in aberration yield became apparent was dose dependent and, for dicentrics, occurred at about 150, 100 and 25 rad/h respectively for the 500-, 250- and 100-rad doses. The data are interpreted in terms of the quadratic model of aberration induction in which the dose-squared term represents dose rate dependent two-track aberrations which constitute an increasingly important component of yield as dose increases. The implications of this work for cytogenetic dosimetry are discussed.

- 1339 PROTOCOL OF THE 2ND OBERAUDORF TALKS ON OCTOBER 12TH - 14TH, 1975, ON PROPHYLAXIS AND THERAPY OF LATE RADIATION EFFECTS IN CARCINOMAS OF WOMEN. Strahlentherapie; 151: No. 6, 489-494 (Jun 1976). (In German).

The chapter 'prophylaxis and therapy of radiation effects' summarizes the papers on this topic read during the Oberaudorf talks. It is found that a clear definition must be made first of all. Depending on the disease and its

stage, certain side-effects must be put up with. Modern methods have helped to avoid some radiation injuries but not fibroses in the broadest sense. Apart from the technique and dosage used radiation effects also depend on a local and/or general accompanying treatment. In radiotherapy of cancer of the breast, some early changes such as erythemas are unavoidable while others can be avoided. In the treatment of relapses, severe radiation injuries are sometimes unavoidable. Special regard must be paid to changes in the neighbouring organs. The earlier assumption that previous irradiations are a contraindication to surgical treatment at a later stage is no longer generally valid.

- 1340 EVALUATION AND RE-EVALUATION OF GENETIC RADIATION HAZARDS IN MAN. OTHER RELEVANT DATA AND RISK ASSESSMENT. III. Sankaranarayanan, K. (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese; Cohen (J.A.) Instituut voor Radiopathologie en Stralenbescherming, Leiden (Netherlands)). *Mutat. Res.*; 35: No. 3, 387-413 (Jun 1976).

Some of the advances in mammalian radiation genetics, human genetics and cytogenetics that were made during the last 2-3 years and that have either a direct bearing on or that may be potentially useful in the evaluation of genetic radiation hazards in man have been examined. Among these are (1) the new data on the incidence of genetic diseases in man; (2) the latest results of the study of mortality rates among children born to survivors of the atomic bombings of Hiroshima and Nagasaki; (3) new data on the radiation induction of reciprocal translocations in human spermatogonia; (4) new results from radiation studies with mice on skeletal mutations, autosomal recessive lethals, sex-chromosome losses, translocation induction and recovery etc., and (5) a re-analysis of the earlier data on dose-rate effects for the induction of specific locus mutations in mouse spermatogonia. Using the pertinent new information as a basis, quantitative estimates are presented employing both a direct method of expressing risks in terms of effects per unit dose of irradiation and the indirect doubling-dose method of expressing these as increments over the load of genetic disorders occurring spontaneously in man.

- 1341 RADIATION EXPOSURE RATES ON SYRINGE SURFACES FROM ^{99m}Tc . Henson, P.W. (Royal Perth Hospital (Australia). Dept. of Medical Physics); Husak, V.; Trousil, J. *Br. J. Radiol.*; 49: No. 582, 569-570 (Jun 1976).

Thermoluminescent dosimeter measurements have been made of surface exposure rate over the mid-point of the syringe active volume for unshielded plastic syringes (2 to 20 ml) containing ^{99}Tc sup(m). These results were compared with those obtained by two different methods of calculation, in an attempt to explain the range of values reported in the literature (Henson, P.W.; 1973, *Br. J. Radiol.*, vol. 46, 972; Husak, V., 1971, *J. Nucl. Med.*, vol. 12, 574). Satisfactory agreement has now been achieved. Earlier discrepancies have been ascribed to the use of different values of the exposure rate constant, the incorporation of a build-up function for scattered radiation only in Henson's original calculation, the rounding of results by Henson only, and the use of glass not plastic syringes in Husak's original work.

- 1342 RADIATION DOSE MEASUREMENTS TO THE EYES DURING CEREBRAL ANGIOGRAPHY. Smith, C.C.; Williams, H.S.; Du Boulay, G. (National

Hospital, London (UK)). *Br. J. Radiol.*; 49: No. 582, 570-571 (Jun 1976).

Measurements made with thermoluminescent dosimeters placed over the eyes of eight patients undergoing cerebral angiography have indicated that the dose to the eye is chiefly dependent on the numbers of Towne's and antero-posterior views, and that in magnification angiography the region of interest strongly affects the radiation dose to the eyes; coning down to the area of interest may minimise this on one side at least. There are clearly strong grounds for using lead eye shields of suitable design wherever possible. Fortunately one may always be worn for the antero-posterior position in carotid angiography.

- 1343 QUESTIONS OF RADIATION PROTECTION CONCERNING THE OPERATION OF NUCLEAR POWER PLANTS. Burnazian, A.I. *Arch. Energiewirtsch.*; 30: No. 6, 536-544 (Jun 1976). (In German).

Translated from Russian: *Radiacionnaja bezopasnost' pri ekspluatatsii atomnykh elektrostancij*. Published in: *Atomnaja energija*, v. 39(3) p. 167-172, Sep 1975.

Methods for monitoring persons and environment in and around nuclear power plants used in the USSR are described, but without bibliographic reference being made to guidelines or ordinances.

- 1344 OVARIAN FAILURE FOLLOWING ABDOMINAL IRRADIATION IN CHILDHOOD. Shalet, S.M.; Beardwell, C.G.; Jones, P.H.M.; Pearson, D. (Christie Hospital and Holt Radium Inst., Manchester (UK)); Orrell, D.H. *Br. J. Cancer*; 33: No. 6, 655-658 (Jun 1976).

Ovarian function was studied in 18 female patients treated for abdominal tumours during childhood. All received abdominal radiotherapy as part of their treatment and were studied between 1 and 26 years after irradiation. The serum gonadotrophins and oestradiol levels were consistent with ovarian failure in each case and there was a disproportionate elevation in serum follicle stimulating hormone (FSH) when compared to serum luteinizing hormone (LH) in 16. In 2 patients, the radiotherapeutic field extended downwards only as far as the sacral promontory. However, these 2 girls show similar evidence of ovarian failure to that in the other 16.

- 1345 WHEN ARE FUME-CUPBOARDS NECESSARY IN HOSPITAL RADIOISOTOPE LABORATORIES. Birks, J.L. (Singleton Hospital, Swansea (UK)). *Br. J. Radiol.*; 49: No. 582, 568-569 (Jun 1976).

Suggestions are made for procedures likely to require the provision of efficient fume-cupboards in hospital radioisotope laboratories. All such departments undertaking *in vivo* radioisotope procedures will require a supply of sterile materials, but only some of these will also require a fume-cupboard, since the use of a relatively inexpensive aseptic cabinet, without air flow and exhaust system, may suffice for such procedures as the labelling of blood cells or plasma. Efficient fume-cupboards may be required in hospital laboratories that are routinely concerned with the elution of generators of isotopes such as ^{99}Tc sup(m) and ^{113}In sup(m), the sterilization of radiopharmaceuticals (e.g. technetium-sulphur colloid) requiring the use of a pressure cooker, and the storage and handling of therapeutic quantities of ^{131}I . Copious general ventilation of isotope rooms may be preferable to the too frequent incorporation of unnecessary fume-cupboards.

- 1346 LUNG CANCER IN URANIUM MINERS AND LONG-TERM EXPOSURE TO RADON DAUGHTER PRODUCTS. Sevc, J. (Institut Hygieny a Epidemiologie, Prague); Kunz, E.; Placek, V. Health Phys.; 30: No. 6, 433-437 (Jun 1976).

Epidemiological study of lung cancer in Czechoslovak miners discloses an increasing cumulative exposure above 1000 WLM. The course of exposure-to-effect relationship was different in the age subgroups, but was not at variance with linearity in the total followed up population of miners. A comparison of the findings of Czechoslovak and American studies up to 1973 is also presented.

- 1347 RADIATION ABUSE AND ITS EFFECTS. Halm, A. (Prince of Wales Hospital, Randwick, Australia). Radiographer; 23: No. 2, 51-55 (Jun 1976).

This paper delves into overuse practiced in diagnostic radiography. The conventional attitudes to low-dose irradiation are critically examined, as is the MPD related to individual radiosensitivity. Concern is expressed that a sizeable proportion of radiologists ignore important aspects of the Code of Practice and this attitude is readily emulated in the hospital setting. The author advocates education within the medical profession and the community on the risks involved in radiation abuse and the benefits derived from justified exposures to x rays.

- 1348 RADIATION-INDUCED CHROMOSOME ABERRATIONS IN RADIOLOGICAL PROTECTION. DOSE-RESPONSE CURVES AT LOW DOSE-LEVELS. Vulpis, N. (Comitato Nazionale per l'Energia Nucleare, Casaccia, Italy); Panetti, G.; Tognacci, L. Int. J. Radiat. Biol.; 29: No. 6, 595-600 (Jun 1976).

Chromosome aberrations have been suggested and used as biological dosimeters. A calibration curve for X-rays has been obtained in the close-range 50 to 700 rad but a reliable extrapolation to doses lower than 50 rad could not be done. To overcome this difficulty blood samples were irradiated over the range 5 to 60 rad and dicentric and centre rings measured. Both these yields plotted against dose could be fitted with a straight line but agreement is significant only for the dicentrics. The data was combined with previous values to give a dose-response relationship over the range 5 to 500 rad.

- 1349 RADIATION DOSE TO THE HEAD, AND PARTICULARLY TO THE LENS OF THE EYE, DURING AXIAL TOMOGRAPHY WITH THE EMI SCANNER. Nemec, H.W.; Roth, J. (Kantonsspital Basel (Switzerland). Universitaetsinstitut fuer Medizinische Radiologie). Fortschr. Geb. Roentgenstr. Nuklearmed.; 124: No. 6, 526-530 (Jun 1976). (In German).

5 figs.; 8 refs..

Radiation dose to the lens of the eye was estimated using thermoluminescence and film dosimetry on patients undergoing computerised axial skull tomography with the EMI scanner, and also on various phantoms. The dose decreases from the lateral margin of the right eye to the lateral margin of the left eye. During conventional three-layer tomography, maximal exposure of the eye is about 0.6 R (1.55×10^{-4} C x kg⁻¹), produced entirely by scatter. Direct irradiation of the plane of the orbits produces a maximal exposure rate of 3 R (7.7×10^{-4} C x kg⁻¹). Maximal dose to the head depends on skull size and is about 4 R (approximately 10^{-3} C x kg⁻¹). The local dose dependence of the eyes was confirmed

theoretically by drawing up a computer programme, and was related to the method used by the EMI scanner.

- 1350 FALL IN BLOOD PRESSURE DURING RADIATION THERAPY. Larsson, L.E.; Lindahl, J.; Unsgaard, B. (Karolinska Sjukhuset, Stockholm (Sweden); Statens Straalskyddsinstitut, Stockholm (Sweden)). Acta Radiol., Ther., Phys., Biol.; 15: No. 3, 241-251 (Jun 1976).

Blood pressure and heart rate at rest in the supine and standing positions were followed before, during and after irradiation for malignant tumours in 114 patients. A statistically significant gradual reduction in blood pressure during the treatment period was established. This was more marked in older patients and in patients with higher initial blood pressure but was not related to the region irradiated or the type of tumour treated. Particularly if the patient experiences vertigo and nausea on change of position, it seems advisable to check the blood pressure during treatment.

- 1351 NOTE ON THE EFFECTIVENESS OF INDOOR SHELTER AS A COUNTERMEASURE TO ACHIEVE REDUCED RADIONUCLIDE INHALATION IN THE EVENT OF A NUCLEAR ACCIDENT. Cederwall, R.T.; Meyers, R.E.; Polk, J.D. (Brookhaven National Lab., Upton, N.Y. (USA)). Water, Air, Soil Pollut.; 5: No. 4, 501-505 (Jun 1976).

A simple mathematical model is used to demonstrate the effectiveness of early warning to seek low ventilation shelter for reducing internal radiation dose from inhaled radionuclides in the case of a nuclear accident.

- 1352 SAFER X-RAYS. Subrahmanian, G. (Bhabha Atomic Research Centre, Bombay (India). Div. of Radiation Protection). Sci. Today (Bombay); 10: No. 12, 29-35 (Jun 1976).

The article traces the history of X-rays and radioactivity. The significant role of X-rays in medical diagnosis and therapy has been discussed. Harmful effects of X-rays and other radiations and precautions to be taken are reported. Maximum permissible doses and dose limits set by the International commission on Radiological Protection are summarised.

- 1353 DOSES RECEIVED IN FINGER-TIPS BY PERSONS WORKING IN A NUCLEAR MEDICINE CENTER. Sachdev, M.R.; Raghavendran, K.V.; Wadhvani, C.N.; Jeevanram, R.K. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). Australas. Radiol.; 20: No. 2, 176-178 (Jun 1976).

It is concluded that LiF (TLD-100) dosimeters may be used successfully to monitor the doses to extremities such as finger-tips of the persons carrying out radioactive work. Such a study may be helpful in assessing the adequacy and effectiveness of health physics precautions taken during various operations in a radioisotope laboratory, and in evaluating the need for and the feasibility of reducing the radiation exposures of personnel.

- 1354 EXAMINATION OF RADIATION INJURIES OF THE SKIN USING LIQUID CRYSTAL THERMOGRAPHY. Lenz, U.; Schmidt, P. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Radiobiol. Radiother.; 17: No. 3, 329-331 (Jun 1976). (In German).

In examining radiation injuries of the skin liquid crystal thermography is used for surface

temperature measurements. Besides the presentation of the optical properties of the cholesteric liquid crystals the thermographic procedure is discussed. First conclusions have been drawn with regard to radiation-induced disturbances of temperature regulation dynamics of the capillary blood flow.

- 1355 INCORPORATION SURVEILLANCE OF THE OPERATING PERSONNEL OF THE RHEINSBERG NUCLEAR POWER PLANT IN THE PERIOD FROM 1967 TO 1973 - WHOLE-BODY-COUNTER MEASUREMENTS. Poulheim, K.F.; Klucke, H. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). *Kernenergie*; 19: No. 6, 189-194 (Jun 1976). (In German).

Analysis of the measured data showed that the crude nuclide ^{60}Co was incorporated most frequently and with the highest activity. In total, 605 persons were measured in the whole-body counter during the period from 1967 to 1973. Internal contamination was found in 86 % of examinations. 13 radionuclides were identified. After long-term operation of the plant gamma spectrometric measurements showed that $^{54}\text{Mn}/^{58}\text{Co}$ were second-frequent as internal contaminants. Furthermore, the gamma peaks of the fission products ^{85}Sr , ^{131}I , ^{134}Cs , ^{137}Cs , ^{95}Nb , ^{65}Zn , ^{124}Sb , ^{140}La , and of the crude nuclide ^{51}Cr were detected. Calculation of internal dose equivalents caused by ^{60}Co and $^{54}\text{Mn}/^{58}\text{Co}$ yielded mean values of 175 mrem for the lungs and 5 mrem for the whole body per year per person examined.

- 1356 GUIDE FOR EXTERNAL EXPOSURE DOSE CONTROL USING FILM BADGES (FOR RADIOISOTOPE HANDLING FACILITIES). Genshiryoku Iinkai Geppo; 21: No. 4, 35-44 (Jun 1976). (In Japanese).

When the work using radiation is started, it is required for the facilities to know the laws and regulations to be applied concerning radiation. And it is necessary to fulfil the regulatory items faithfully. Main laws and regulations concerning radiation, the classification of persons entering controlled areas and the permissible exposure dose are described. There are four types of film badges to measure personal exposure. Notices for attaching, measuring, and storing the film badges are described. For recording exposure dose, prior to the first entry into controlled area, the exposure history so far must be recorded, making reference to the format No.1, and examining the reference book of the person engaged in radiation work if it is carried. Next, the exposure dose during the pre-determined period must be recorded making reference to the format No.2. Notices for recording are given. When the result of exposure measurement is below the detecting limit, no specific measure is necessary. However, if it is above the detecting limit and the change is significant, the follow-up examination and the proper measures must be taken. Further, the result must be informed to the person in question.

- 1357 INTRAUTERINE X-RAY EXPOSURE DOSES DUE TO ROENTGENOGRAPHIC FETAL EXAMINATION OR PELVIMETRY AT TERM. Yabuki, Y.; Kato, T. (Kanazawa Medical Univ. (Japan)). *Nippon Sanka Fujinka Gakkai Zasshi*; 28: No. 6, 616-624 (Jun 1976). (In Japanese).

Intrauterine x-ray exposure doses due to roentgenographic fetal examination or pelvimetry at term were measured in phantom and pregnant women before and after the expected date of confinement according to the KYOKKO-TLD system. The exposure doses measured at intervals of about 5 cm from the external os of

the uterus in the middle line of the uterus on the side of the x-ray tube were as follows; from the external os of the uterus to the upper parts 0.35 - 0.14 - 0.08 - 0.09 - 0.08 - 0.06 rads by the prone abdominal plain roentgenogram, 0.22 - 0.30 - 0.28 - 0.35 - 0.30 - 0.29 rads by the supine abdominal plain roentgenogram, 0.05 - 0.13 - 0.39 - 0.80 - 1.74 - 2.70 rads by the Martius method, 0.30 - 0.25 - 0.33 - 0.78 - 0.75 - 0.88 rads by the Guthmann method, and $(0.39 \pm 0.08) - (0.59 \pm 0.13) - (1.30 \pm 0.23) - (1.85 \pm 0.34) - (2.76 \pm 0.44) - (3.65 \pm 0.33)$ rads by the Martius method + Guthmann method + the prone abdominal plain roentgenogram. The following results were obtained; (1) intrauterine x-ray exposure doses markedly depended on the sites measured, (2) because x-ray exposure doses by the Martius were large in the mother and the fetus, this method is unsuitable for the measurement during pregnancy, (3) when the Guthmann method was used, the x-ray doses were from one fifth to one sixth of the doses of the skin of the mother. Therefore, the exposure doses to the fetus was comparatively small, and (4) when x-rays were exposed to the fetus under the prone position, the exposure doses can be reduced to doses lower than those used in the supine position.

- 1358 RADIATION AND THYROID NEOPLASIA. McConahey, W.M.; Hayles, A.B. (Mayo Clinic, Rochester, MN). *Ann. Intern. Med.*; 84: No. 6, 749-750 (Jun 1976).

It is now generally accepted that an association exists between external radiation administered to the head, neck, and upper thorax of infants, children, and adolescents and the subsequent development of neoplastic changes in the thyroid gland. Until recent years, external radiation was frequently administered to shrink an enlarged thymus or for the treatment of tonsillitis, adenoiditis, hearing loss, hemangioma, acne, tinea capitis, and other conditions. During the course of these treatments, the thyroid gland was exposed to scatter radiation. The use of external radiation therapy was then accepted practice, and its value was attested by many. Concern about the adverse effects was not initially appreciated, primarily because of the long periods of time between the radiation and the recognition of changes in the thyroid. The availability and effectiveness of other therapeutic measures and the growing concern about the delayed effects of radiation therapy when administered to the young for relatively benign conditions has, in recent years, largely eliminated use of this form of therapy, except in a few unusual conditions.

- 1359 INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION; BASES FOR ITS RECOMMENDATIONS. Stewart, C.G. (International Commission on Radiological Protection, Sutton (UK)). *Proc. Jpn. Conf. Radioisot.*; No. 12, 5-29 (Jun 1976).

From 12. Japan conference on radioisotopes; Tokyo, Japan (26 Nov 1975).

The historical background of radiological protection is first treated, then tolerable and permissible doses and also the threshold nature in radiation effect are explained. The problem is variously described with risk-dose relationship, cell sterilization, dose response function etc. In this way, the considerations in preparation of a set of general recommendations for radiation protection are expounded. The risks acceptable as occupational hazard, radiation risk-dose relation, and the effect of protracted dose imply that the present system of dose limits is not seriously in error.

- 1360 RADIATION PERICARDITIS AND MYOCARDIAL FIBROSIS. Westerhof, P.W.; van der Putte, S.C.J. (Univ., Utrecht). Eur. J. Cardiol.; 4: No. 2, 213-218 (Jun 1976).

The case of a 45-yr-old man with constrictive pericarditis due to radiation for Hodgkin's disease is described. After pericardiectomy the clinical condition did not improve. At necropsy an extensive fibrosis of the myocardium especially located in the anterior part of the heart was found. The clinical consequences of this finding with respect to surgical treatment are briefly discussed.

- 1361 EVALUATION AND RE-EVALUATION OF GENETIC RADIATION HAZARDS IN MAN. THE ARM NUMBER HYPOTHESIS AND THE INDUCTION OF RECIPROCAL TRANSLOCATIONS IN MAN. II.

Sankaranarayanan, K. (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese; Cohen (J.A.) Instituut voor Radiopathologie en Stralenbescherming, Leiden (Netherlands)). Mutat. Res.; 35: No. 3, 371-386 (Jun 1976).

The arm number hypothesis proposed by Brewen and colleagues in 1973 has been examined in the light of information thus far available from mammalian studies. In experiments with peripheral blood lymphocytes (radiation in vitro), a linear relationship between dicentric yield and the effective chromosome arm number of the species was obtained in the mouse, Chinese hamster, goat, sheep, pig, wallaby and man. However, the data are not consistent with such a relationship in several primate species (marmoset, rhesus monkey, cynomolgus monkey, squirrel monkey and the slow loris), the cat and the dog. In the rabbit, the data are conflicting. In the mouse and the Chinese hamster the frequencies of reciprocal translocations recorded in spermatocytes descended from irradiated spermatogonia are in line with the expectation based on the arm number hypothesis, whereas in the golden hamster, rabbit and the rhesus they are not. In man and the marmoset, the limited data are not inconsistent with a 2-fold higher sensitivity of these species relative to the mouse although they do not rule out a difference as high as 4-fold. In the guinea-pig, the situation is unclear. New data on the transmission of reciprocal translocations in mice suggest that the frequency in the F_1 progeny may be close to one-quarter of that recorded in the spermatocytes of the irradiated fathers (spermatogonial irradiation) at an exposure level of 150 R, whereas at higher exposures, the reduction factor is about one-eighth, the latter being in line with the earlier finding. All these results taken together suggest that inter-specific extrapolation from the radiosensitivity of somatic cells (to dicentric induction) to that of germ cells (to translocation induction) is fraught with uncertainty at present. Certain aspects that need to be studied in more detail in the context of induced chromosome aberrations are discussed.

- 1362 BASIC CELL BIOLOGY OF THE LIFE OF ORGANISMS IN A RADIATION FIELD. Fliedner, T.M.; Steinbach, K.H.; Raffler, H. (Ulm Univ. (F.R. Germany). Abt. Klinische Physiologie). Atomwirtsch., Atomtech.; 21: No. 6, 292-297 (Jun 1976). (In German).

From Reactor meeting; Duesseldorf, F.R. Germany (30 Mar 1976).

5 figs..

The article tries to point out the many ways

in which the organism of mammals - and thus also of humans - is able to adapt to changes in its environment. The biosphere of man with its chemical, physical and biological factors is shortly described, and the mechanisms of heat regulation are gone into. This is followed by a discussion of the radiation field in the environment of man and, in this connexion, of an acute or chronic radiation exposure and their effects. The author then proceeds to describe the structure and function of the cell regeneration system and talks about his attempts to develop a simulation model of the reaction of cell systems to radiation, using granulocytes as an example. He finds that a radiobiological understanding of cell systems yields new approaches to the detection of loads on a system and of impending failure and demands more extensive studies of the biological effects of ionizing radiation during chronic exposure to small doses to be made.

- 1363 RESPONSE OF THE SERTOLI CELL AND STEM GERM CELL TO ^{60}Co γ -RADIATION (DOSE AND DOSE RATE) IN TESTES OF IMMATURE RATS. Erickson, B.H.; Blend, M.J. (Comparative Animal Research Lab., Oak Ridge, TN). Biol. Reprod.; 14: No. 5, 641-650 (Jun 1976).

Gamma-radiation effects (dose and dose rate) on the Sertoli cells and stem cells of the germinal line in immature rat testes were examined. Prior to Day 4 of postnatal development, the gonocyte or primitive germ cell was the most radiosensitive cell in the testis. From Day 4 to approximately Day 15 the Sertoli cell was the most critical element, and thereafter the stem cell was of first importance. A dose of 100 rads irreversibly reduced the number of Sertoli cells to 63 percent of control. Of the ages tested beyond Day 2, the 9-day testis was most severely affected. It was estimated that a dose of 400 rads would reduce sperm output of the 9-day testis to 21 percent of control. After Day 4 and prior to Day 20, 300 rads produced a permanent decrement in the stem-cell population. Six hundred rads are required to produce this effect in the adult. Dose rate was an important mediator of the radioresponse of both Sertoli and germ cells.

- 1364 ONCOGENIC TRANSFORMATION IN VITRO AFTER SPLIT-DOSE X IRRADIATION. Terzaghi, M. (Harvard School of Public Health, Boston); Little, J.B. Int. J. Radiat. Biol.; 29: No. 6, 583-587 (Jun 1976).

The influence of split-dose radiation and the possible role of the repair of sub-lethal damage on malignant transformation in vivo was studied. Mice embryo fibroblasts were irradiated with 100 keV x-rays and their survival rates measured. No enhancement in the transformation frequency was demonstrated after irradiation in the range 150-800 rad. Transformation was significantly reduced following total doses of 300 and 800 rad when the dose was split in two fractions 5 hours apart.

- 1365 EFFECTS OF IONIZING RADIATION AND CYSTEAMINE (MEA) ON ACTIVITY OF MOUSE SPLEEN ADENYL CYCLASE. Soltysiak-Pawluczuk, D. (Inst. of Hygiene and Epidemiology, Warsaw); Bitney-Szlachto, S. Int. J. Radiat. Biol.; 29: No. 6, 549-553 (Jun 1976).

In mice x-irradiated with doses of 200 R and 400 R, there was a substantial increase in spleen adenylyl cyclase activity; there was similar activation by MEA. In mice given MEA before irradiation, an additive effect of radiation and the radioprotective drug was

observed. On the other hand, a dose of 800 R given either alone or after pre-treatment with MEA failed to elicit any change in cyclase activity. The results indicate the importance of the adenylyl cyclase system in the response of cells to irradiation and action of MEA.

- 1366 EFFECTS OF IONIZING RADIATION ON THE ACTIVITY OF THE CILIATED EPITHELIUM OF THE TRACHEA. Baldetorp, L.; Huberman, D.; Haakansson, C.H.; Toremalm, N.G. (Konung Gustaf V:s Jubileumsklinik, Lund (Sweden); Malmö Allmänna Sjukhus (Sweden). Dept. of Otolaryngology). Acta Radiol., Ther., Phys., Biol.; 15: No. 3, 225-232 (Jun 1976).

The immediate effect of ionizing radiation on the activity of the ciliated epithelium of the trachea has been investigated using a light reflection method. This method enables continuous registration of the mucociliary activity both during and after irradiation. A notable increase of the mucociliary occurred within 5 seconds after beginning of irradiation and this activity reached its maximum 10 seconds after initial exposure with a dose rate of 0.34 Gy/s (34 rad/s). The mechanism causing the phenomena observed is not clear but theoretically it might be due to ATP, the source of energy of the cilia being freed by the irradiation, possibly through disturbances of the permeability in the mitochondrion membranes.

- 1367 OVARIAN TUMORIGENESIS AFTER WHOLE BODY X-RAY IRRADIATION IN DDY/F AND C3H/TW MICE. Komuro, M. (Tokyo Univ. (Japan). Faculty of Science). J. Radiat. Res.; 17: No. 2, 99-105 (Jun 1976).

The process of ovarian tumorigenesis in ddY/F and C3H/Tw mice was studied at various times until 18 months after whole body irradiation with a single dose of 130 R or 260 R of x-rays. The first ovarian tumors were observed at 9 months after irradiation in ddY/F mice. In a total of 28 of 71 ddY/F mice, 33 ovarian tumors were developed, which were subdivided to 25 luteomas, 4 granulosa-cell tumors, one mixed cell tumor and 3 tubular adenomas. On the other hand, 21 of 29 C3H/Tw mice had altogether 32 tubular adenomas and one mixed cell tumor. At older ages, small interstitial cells with eosinophilic cytoplasm were observed in irradiated ovaries. The cells resembled luteoma cells. Luteoma may be derived from the small interstitial cells.

- 1368 RESTORATION OF RADIATION INJURY BY INTRAPERITONEAL INJECTION OF GINSENG EXTRACT IN MICE. Yonezawa, M. (Radiation Center of Osaka Prefecture, Sakai (Japan)). J. Radiat. Res.; 17: No. 2, 111-113 (Jun 1976).

Published in summary form only.

BIOLOGICAL REPAIR;HEMATOPOIETIC SYSTEM; INTRAPERITONEAL INJECTION;MEDICINAL PLANTS;MICE; RADIATION INJURIES;RADIATION PROTECTION; RADIOPROTECTIVE SUBSTANCES;SURVIVAL TIME;WHOLE-BODY IRRADIATION;X RADIATION;RADIOSENSITIVITY EFFECTS

- 1369 EFFECT OF SINGLE AND FRACTIONATED X IRRADIATION ON MAZE LEARNING ABILITY OF MICE. Aoyama, T.; Norimura, T.; Nakamura, T.; Yoshikawa, I. (Nagasaki Univ. (Japan). School of Medicine). J. Radiat. Res.; 17: No. 2, 82-91 (Jun 1976).

Fifty-six-day-old male ddk mice at the starting of the investigation were used as subjects through the experiment for 64 weeks. After 15 days' preliminary training, and 16 times of weekly trial training using complete

maze, 15 mice received a single 224 rads of x-rays (S group); another 15 mice received two 112 rads spaced two weeks apart (F group) and another 15 mice were sham-irradiated (Control group). Then those mice were tested on the multiple T-maze with nine-choice points and change of performance was observed in terms of errorchoices by giving one test trial a week. We introduced the concept of "confusional trials" as an index for surmising to what extent mice failed to exhibit good maze learning habits. In the results, the F group showed significantly worse performance than the two other groups at early stages, opposite to it the S group exhibited the same, but at late stages after irradiation. The worse performance of F group should be considered to be due to the psychological after-effect to fractionated irradiation and that for S group could be assumed to be due to the acceleration of aging by the irradiation.

- 1370 (BNWL-B--454) REVIEW OF CALCULATIONAL MODELS AND COMPUTER CODES FOR ENVIRONMENTAL DOSE ASSESSMENT OF RADIOACTIVE RELEASES. Strenge, D.L.; Watson, E.C.; Droppo, J.G. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1976. Contract E(45-1)-1830. 65p. Dep. NTIS \$4.50.

The development of technological bases for siting nuclear fuel cycle facilities requires calculational models and computer codes for the evaluation of risks and the assessment of environmental impact of radioactive effluents. A literature search and review of available computer programs revealed that no one program was capable of performing all of the great variety of calculations (i.e., external dose, internal dose, population dose, chronic release, accidental release, etc.). Available literature on existing computer programs has been reviewed and a description of each program reviewed is given.

- 1371 (ORNL/TM--5278) DEVELOPMENT AND USE OF A FIFTEEN YEAR-OLD EQUIVALENT MATHEMATICAL PHANTOM FOR INTERNAL DOSE CALCULATIONS. Jones, R.M.; Poston, J.W.; Hwang, J.L.; Jones, T.D.; Warner, G.G. (Oak Ridge National Lab., Tenn. (USA)). Jun 1976. Contract W-7405-ENG-26. 84p. Dep. NTIS \$5.00.

The existence of a phantom based on anatomical data for the average fifteen-year-old provides for a proficient means of obtaining estimates of absorbed dose for children of that age. Dimensions representative of an average fifteen-year-old human, obtained from various biological and medical research, were transformed into a mathematical construct of idealized shapes of the exterior, skeletal system, and internal organs of a human. The idealization for an average adult presently in use by the International Commission on Radiological Protection was used as a basis for design. The mathematical equations describing the phantom were developed to be readily adaptable to present-day methods of dose estimation. Typical exposure situations in nuclear medicine have previously been modeled for existing phantoms. With no further development of the exposure model necessary, adaptation to the fifteen-year-old phantom demonstrated the utility of the design. Estimates of absorbed dose were obtained for the administration of two radiopharmaceuticals /sup 99m/Tc-sulfur colloid and /sup 99m/Tc-DMSA. (auth)

- 1372 SUBSEQUENT FERTILITY AND BIRTH HISTORIES OF CHILDREN AND ADOLESCENTS TREATED WITH ¹³¹I FOR THYROID CANCER. Sarkar, S.D.;

Beierwaltes, W.H.; Gill, S.P.; Cowley, B.J. (Univ. of Michigan Medical Center, Ann Arbor, MI). J. Nucl. Med.; 17: No. 6, 460-464 (Jun 1976).

Forty patients aged 20 years or less who had been treated with ^{131}I after surgery for papillary-follicular thyroid carcinoma were contacted for followup study. Five had died and two were unmarried; the remaining 33 were studied with respect to their subsequent reproductive histories and the health of the offspring. The mean age at the time of the first ^{131}I therapeutic dose was 14.6 years (range 6 to 20), and the average followup interval, from that first dose until followup, was 18.7 years (range 14 to 25). The mean total dose of ^{131}I was 196 mCi (range 80 to 691). The incidences of infertility (12 percent), miscarriage (1.4 percent), prematurity (8 percent), and major congenital anomaly (1.4 percent) found in this series are not significantly different from those in the general population. Thus, our study offers no overt evidence of genetic damage in children and adolescents treated with high doses of ^{131}I for thyroid carcinoma. (auth)

1373 YEAR 2000 ESTIMATED POPULATION DOSE FOR THE TENNESSEE VALLEY REGION. Fletcher, J.F. (Hanford Engineering Development Lab., Richland, WA); Strauch, S.; Siegel, G.R.; Witherspoon, J.P. Trans. Am. Nucl. Soc.; 23: 85-86 (Jun 1976).

From Transactions of the American Nuclear Society 1976 annual meeting; Toronto, Canada (13 Jun 1976).

TENNESSEE VALLEY AUTHORITY; REGIONAL ANALYSIS; TENNESSEE RIVER; CUMBERLAND RIVER; HUMAN POPULATIONS; RADIATION DOSES; RADIOACTIVE EFFLUENTS; NUCLEAR FACILITIES; EXTERNAL IRRADIATION; INTERNAL IRRADIATION; RADIONUCLIDE KINETICS; FORECASTING; TIME DEPENDENCE; TENNESSEE; DIFFUSION; ENVIRONMENT

1374 ESTIMATE OF NATURAL INTERNAL RADIATION DOSE TO MAN. Manocha, K.K. (Medical Coll., Rohtak, India); Mohindra, R.K. Health Phys.; 30: No. 6, 485-487 (Jun 1976).

An analytical approach has been developed to evaluate the internal radiation dose to a standard man due to natural and very long lived radioisotopes of elements whose existence in the human metabolism is well established. The relative abundance of various radioisotopes inside the body is taken from the existing established data for a standard man. The small contributions like K-capture and internal conversion with the following x-rays, and the external and internal β -bremsstrahlung were considered. Also, contribution due to atomic recoils after alpha emission is taken into account. The data on each contributing radioisotope and respective alpha, beta, gamma calculated doses are listed. The total evaluated dose of about 19 mrem/yr with about 20% variation is in fair agreement with earlier investigations.

1375 ABSORBED RADIATION DOSE FROM RADIONUCLIDIC IMPURITIES IN SEVERAL ^{123}I -LABELED RADIOPHARMACEUTICALS. Colombetti, L.G. (Loyola Univ., Maywood, Ill. (USA). Stritch School of Medicine; Michael Reese Hospital and Medical Center, Chicago, Ill. (USA)); Barnes, W.E. (Veterans Administration Hospital, Hines, Ill. (USA). Nuclear Medicine Service). Nucl.-Med. (Stuttgart); 15: No. 3, 152-155 (Jun 1976).

4 tabs.; 25 refs..

The radiation dose to patients from RISA, sodium iodohippurate, and rose bengal labeled

with commercially available ^{123}I and its accompanying radioimpurities has been studied. The extra radiation dose to target organs was found to range from 29% to 97% that due to ^{123}I alone when the radiopharmaceutical is administered at calibration time. Additional delay in the time of administration increases the relative impurity dose.

1376 THOROTRASTOMA THAT CAUSED DYSPHAGIA AND DYSPNEA. Kamijo, A.; Okabe, K.; Hirabayashi, G.; Hirose, T. (Shinshu Univ., Matsumoto, Nagano (Japan). Faculty of Medicine). Jibi Inko-ka; 48: No. 6, 417-423 (Jun 1976). (In Japanese).

A case of cervical tumor caused by instillation of thorotrast in a man aged 46 is reported. The agent was instilled into the cervical aorta for cerebral angiography 30 years ago. The greater portion of the agent remained in the neck forming a granulomatous mass and causing dyspnea and dysphagia. An attempt to remove of the tumor was made with only partial success. The patient died of a profuse hemorrhage caused by an aortic fistula which was the result of constant pressure of the tumor on the aorta. Necropsy showed microscopic deposits of thorotrast in the liver but none in the spleen or the lymphatic glands.

1377 DOMINANT LETHAL MUTATIONS IN MICE RESULTING FROM CHRONIC TRITIATED WATER (HTO) INGESTION. Carsten, A.L.; Commerford, S.L. (Brookhaven National Lab., Upton, NY). Radiat. Res.; 66: No. 3, 609-614 (Jun 1976).

The possible genetic consequences of continued ingestion of tritiated water (HTO) have been investigated in Hale--Stoner--Brookhaven strain mice maintained on HTO (3 $\mu\text{Ci}/\text{ml}$). Second-generation females on HTO were sacrificed in late pregnancy and the corpora lutea, viable, nonviable embryos (early death and late death) and preimplantation loss determined to calculate the mutation rate. The breeding efficiency (pregnancy rate and litter size) was also measured. Analysis of results by both parametric and nonparametric tests has indicated a significant reduction in the number of viable embryos resulting from matings between animals maintained on the tritium regimen, with no effect on breeding efficiency. The integrated radiation dose to the testes and ovary, based on average tissue tritium content from fetal origin through breeding of the 8-week-old animals, was calculated.

1378 RBE OF TRITIUM RADIATION MEASURED IN MOUSE OOCYTES: INCREASE AT LOW EXPOSURE LEVELS. Dobson, R.L.; Chinnie Kwan, T. (Univ. of California, Livermore). Radiat. Res.; 66: No. 3, 615-625 (Jun 1976).

Developing mice were exposed to tritium in body water continuously from conception to 14 days after birth. Concentrations close to 1, 3, 6, and 9 $\mu\text{Ci}/\text{ml}$ were maintained by giving mothers ^3HOH in their drinking water throughout pregnancy and the first 2 weeks of lactation. When the offspring were 14 days old, primary oocytes in their ovaries were counted microscopically and compared with controls. Confirming earlier findings, survival of these cells decreased exponentially with exposure; there was no threshold; the LD_{50} level was 2 $\mu\text{Ci}/\text{ml}$, delivering 0.44 rad/day. For comparison, oocytes were similarly enumerated in mice continuously exposed for the same period to ^{60}Co gamma rays at 1, 2.1, and 3.2 rad/day. Cell killing in this case was not as great. Nor was it exponential; lower doses showed decreasing effectiveness. The data were in general accord with the linear--quadratic

dose relation of the theory of dual radiation action. The effective LD₅₀ level for gamma rays was about 1.1 rad/day. Owing to these differences in dose-response, the RBE (relative biological effectiveness) of tritium compared to gamma radiation, as measured here in the intact animal, varied inversely with dose. At effective gamma-ray doses of some 40 rad, it was about 1.6. However, at lower exposure levels, giving effective doses of only a few rads, the RBE of tritium rises to approximately 3. This is of special interest from the standpoint of health and environmental protection.

- 1379 (AD-A--033411) A METHOD OF MEASURING THYROID BURDEN OF I125. TECHNICAL NOTE. Webber, W.R.; Donovan, R.L. (Armed Forces Radiobiology Research Inst., Bethesda, Md. (USA)). Jun 1976. 12p. (AFRRI-TN--76-5). NTIS, PC A02/MF A01.

Laboratory workers producing I125 labeled compounds may ingest or inhale small quantities of radioactive iodine which is deposited preferentially in the thyroid. Measurement of the thyroid burden is required to quantify the radiation dose to the individual and to provide early warning of possible health hazards. A rapid, accurate method of measuring thyroid burden using an Anger camera and pulse height analysis techniques was developed. The procedure requires 2 to 3 minutes, equipment commonly available in a nuclear medicine department, and causes no discomfort for the subject. The minimum detectable amount of I125 has been found to be approx. 1.0 nCi with a counting time of 100 seconds. The linearity of the method has been measured using an ORINS thyroid phantom and sources traceable to the NBS. The method is in regular use at the AFRRI and some results obtained from this use are presented. (Author)

- 1380 ⁹⁰Sr IN SLOVAK POPULATION IN 1971 TO 1972: SKELETON DISTRIBUTION AND TRANSPORT FROM MILK TO BONE TISSUES. Cechvala, L.; Carach, J.; Viktory, D. (Krajska Hygienicka Stanica, Bratislava (Czechoslovakia)). Cesk. Hyg.; 21: No. 5, 221-227 (Jun 1976). (In Czech).

Observations of the ⁹⁰Sr content in the bone tissue of the Slovak population were made during the 1971 to 1972 period. Maximum levels of ⁹⁰Sr were found in the population group of children aged from 2 months to 4 years in the northern, mountainous regions (1.77 pCi/g Ca). With the children growing up, the proportion of radiostrontium tends to drop down to no more than 0.3 to 0.4 pCi/g Ca. The distribution of ⁹⁰Sr is assessed by means of the V/D ratio which is also age-dependent and seen rising from the value of 1 up to that of 2.12 for the over-50 age group. Statistical proof is presented of a significantly higher contamination of the bone tissue in the northern region population in comparison with the southern plains. The milk to bone tissue transfer of ⁹⁰Sr is assessed by the ratio of 0.30 for the population group of up to 20 years of age.

- 1381 FACTORS USED FOR THE ESTIMATION OF RADIOACTIVE NUCLIDE INTAKE THROUGH FOODSTUFFS BY INHABITANTS IN COASTAL AREA OF IBARAKI PREFECTURE. V. CONSUMPTION OF MARINE FOODS IN NAKAMINATO CITY. Sumiya, M.; Ohmomo, Y. (National Inst. of Radiological Sciences, Nakaminato, Ibaraki (Japan). Marine Radioecological Research Station). Hoken Butsuri; 11: No. 2, 115-122 (Jun 1976).

The consumption of eight categories of marine foods was surveyed on fisherman's and

non-fisherman's families in Nakaminato city. The average daily intake of whole marine foods through a year was 193 g/d/p for fisherman's and 143 g/d/p for non-fisherman's families, respectively. Fisherman's families showed higher consumption of all categories of marine foods than non-fisherman's and about one-half of the total marine foods consumption was occupied by fishes. It was observed that the fish in season was eaten much by both groups. Less consumption of benthic fish, crustacea and shell-fish was recognized.

- 1382 ANIMAL EXPERIMENTS ON THE DECORPORATION OF IODINE 131. Vogler, H.; Pink, V.; Correns, H.J.; Hollenbach, K.; Keller, C. (Ernst-Moritz-Arndt-Univ., Greifswald (German Democratic Republic)). Radiobiol. Radiother.; 17: No. 3, 383-388 (Jun 1976). (In German).

Experiments have been performed on the decorporation of iodine 131 from rats. The effects of potassium iodide, sodium perchlorate and methimazol - each combined with TSH - were studied. The combination of methimazol and TSH was most efficient and decreased the thyroid exposure by 51.8 per cent - beginning 6 hours after incorporation - and 42.3 per cent - beginning 12 hours after incorporation. A further improvement of the decorporation effect could be achieved on the first day adding perchlorate.

- 1383 (PB--259866) RECOMMENDATIONS ON GUIDANCE FOR TECHNIC TO REDUCE UNNECESSARY EXPOSURE FROM X-RAY STUDIES IN FEDERAL HEALTH CARE FACILITIES. BACKGROUND REPORT. (Environmental Protection Agency, Washington, D.C. (USA)). Jun 1976. 43p. (EPA--520/4-76-012). NTIS, PC A03/MF A01.

The Administrator of the Environmental Protection Agency formed an Interagency Working Group on July 5, 1974, to develop guidance to reduce unnecessary radiation exposures from the use of x rays in the health arts in Federal health care facilities. The consensus of this group was that it is desirable and possible to reduce exposure from diagnostic uses of x rays by: (1) eliminating clinically unproductive examinations, (2) assuring the use of optimal technic when examinations are performed, and (3) requiring appropriate equipment to be used. As a result of this consensus a Subcommittee was formed to examine the use of equipment and technic to perform medical and dental x-ray examinations and to make recommendations for guidance to assure that diagnostic quality radiographs are produced with minimal patient exposure. The recommendations made herein are believed to be basic to assuring that these considerations are met in Federal health care facilities. (GRA)

- 1384 EARLY INDICES OF CANCER RISK AMONG URANIUM MINERS WITH REFERENCE TO MODIFYING FACTORS. Saccomanno, G. (St. Mary's and Veterans Administration Hospitals, Grand Junctions, CO); Archer, V.E.; Saunders, R.P.; Auerbach, O.; Klein, M.G. Contract AT(11-1)-1826. Ann. N.Y. Acad. Sci.; 271: 377-383 (28 May 1976).

Cancer of the lung develops from normal epithelial changes that progress from regular squamous cell metaplasia to progressively more and more atypical stages to eventually develop into squamous-cell carcinoma in situ. The in situ stage sheds large numbers of cells that can often be identified as malignant cells in sputum. This allows early diagnosis, localization, and resection, increasing, it is hoped, survival from bronchogenic carcinoma.

1385 (AD-A--25970) ATLAS OF NUCLEAR EMULSION MICROGRAPHS FROM PERSONNEL DOSIMETERS OF MANNED SPACE MISSIONS. Schaefer, H.J.; Sullivan, J.J. (Naval Aerospace Medical Inst., Pensacola, Fla. (USA)). 27 May 1976. Contract NASA ORDER-T-3057-C. 53p. (NAMRL-Monograph--22). NTIS \$4.50.

A collection of micrographs is presented taken from nuclear emulsions of personnel dosimeter packs carried by the astronauts on near-Earth orbital and lunar missions. It is intended as a pictorial record and illustration of the radiation environment in space and as a supplement to earlier reports and publications of the laboratory in which the emulsion findings have been presented in detail for individual missions. A complete list of those earlier accounts precedes the picture sections. (Author) (GRA)

1386 (DOCKET-50254--782) QUAD-CITIES STATION, UNITS 1 AND 2. IE INSPECTION REPORT NOS. 76-10 AND 76-08, REPLY. (Commonwealth Edison Co., Chicago, Ill. (USA)). 26 May 1976. 24p. (DOCKET-50265--771).

Inspection of personnel radiation exposure. QUAD CITIES-1 REACTOR; QUAD CITIES-2 REACTOR; PERSONNEL; RADIATION DOSES; INSPECTION

1387 (DOCKET-50247--671) INDIAN POINT STATION, UNIT 2. INFORMATION RE THE EXPOSURE OF AN INDIVIDUAL TO RADIATION. (Consolidated Edison Co. of New York, Inc., New York (USA)). 25 May 1976. 4p.

Exposure of an individual to radiation. INDIAN POINT-2 REACTOR; PERSONNEL; RADIATION DOSES

1388 (CONF-760542--1) ENVIRONMENTAL CONSIDERATIONS AND REGULATIONS. Blanco, R.E. (Oak Ridge National Lab., Tenn. (USA)). 25 May 1976. 44p. Dep. NTIS \$4.00.

From UCC-ND engineering division radiochemical technology training program; Oak Ridge, TN, USA (25 May 1976).

Methods used to control the radiological impact of the nuclear fuel cycle are described. This control is exercised through the application of a series of federal laws and regulations that are used as the basis for licensing nuclear facilities. The control is exercised more directly by the use of radwaste treatment equipment at the nuclear facilities to limit the release of radioactive materials. Federal laws and regulations are summarized and their applications in licensing actions are discussed. Radiological doses from materials released from licensed facilities are compared with doses from natural background. A series of cost/benefit engineering surveys are being made to determine the cost and effectiveness of radwaste systems for decreasing the release of radioactive materials from model fuel cycle facilities and to determine the benefits in terms of reduction in dose commitment to individuals and populations in surrounding areas.

1389 RADIATION EXPOSURE DURING CARDIAC CATHETERISATION. Stott, A.N.B. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Lancet; 1: No. 7969, 1131 (22 May 1976).

Dr. Lloyd and his colleagues (1976, Lancet, i, 854) report the chromosome aberration yields in cultured lymphocytes and babies X-rayed during cardiac catheterisation. Their yields seem high in comparison with those derived from experimentally produced adult calibration

curves, and an explanation is offered for this in addition to those suggested in their letter. In children at the ages included in their study the field for fluoroscopy during cardiac catheterisation will certainly include the thymus itself, lying as it does in the anterior and superior mediastina of the thorax. As the primary central organ of the lymphoid system it would be surprising if it did not contain a substantial reservoir of the non-circulating T lymphocytes. These would consequently have sustained a comparatively greater radiation dose, regardless of their degree of radiosensitivity.

1390 (DOCKET-50254--811) QUAD-CITIES STATION, UNITS 1 AND 2. INFORMATION ON OVEREXPOSURE OF INDIVIDUALS TO RADIATION. (Commonwealth Edison Co., Chicago, Ill. (USA)). 20 May 1976. 5p.

Information on overexposure of individuals to radiation. QUAD CITIES-1 REACTOR; QUAD CITIES-2 REACTOR; PERSONNEL; RADIATION DOSES

1391 (DOCKET-50295--664) ZION NUCLEAR PLANT, UNIT 1. NOTICE OF VIOLATION AND PROPOSED IMPOSITION OF CIVIL PENALTIES. (Commonwealth Edison Co., Chicago, Ill. (USA)). 20 May 1976. 8p.

Notice of violation and proposed imposition of civil penalties of \$13,000. ZION-1 REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES; RADIATION PROTECTION; CIVIL LIABILITY

1392 (DOCKET-50305--449) KEWAUNEE NUCLEAR POWER PLANT, UNIT 1. ADDITIONAL INFORMATION RE EXPOSURE OF AN INDIVIDUAL TO RADIOACTIVE MATERIAL. (Wisconsin Public Service Corp., Green Bay (USA)). 17 May 1976. 1p.

Exposure of an individual to radioactive material. KEWAUNEE REACTOR; PERSONNEL; RADIATION DOSES; WHOLE-BODY IRRADIATION

1393 (DOCKET-50213--523) HADDAM NECK PLANT. IE INSPECTION REPORT NO. 75-13, NOTICE OF VIOLATION AND REPLY. (Connecticut Yankee Atomic Power Co., Hartford (USA)). 12 May 1976. 24p.

Inspection of radiological protection activities. CONNECTICUT YANKEE REACTOR; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES; DOCUMENTATION; MANUALS

1394 ANTENATAL RADIOGRAPHY AND THE TEN-DAY RULE. Kneale, G.W.; Stewart, A.M. (Birmingham Univ. (UK)). Lancet; 1: No. 7967, 1021 (8 May 1976).

The assumption that the human fetus is not much more sensitive to the carcinogenic effects of low-level irradiation during early stages of development than during later stages was made by Dr. Mole (Lancet, 1976, i, 738). He calculated, on the basis of Oxford data, the cost in terms of childhood cancer induction of not taking any steps to avoid irradiation of pregnant women. An examination of the separate effects of four fetal irradiation subfactors (exposure age, number of exposures, reasons for the examinations and X-ray findings) has demonstrated that exposure age does exert an independent effect on the cancer induction risk, and for this effect first-trimester exposures are probably 16 times as dangerous as third-trimester exposures. It is emphasised that as a result of 10% of viable fetuses being involved in these examinations, there was between 1953 and 1970, a 5% addition to the number of children who died from malignant diseases.

1395 (DOCKET-50255--710) PALISADES NUCLEAR PLANT. IE INSPECTION REPORT NO. 76-03 AND REPLY. (Consumers Power Co., Jackson, Mich. (USA)). 7 May 1976. 21p.

Inspection of maintenance activities, nonroutine events reports, observation of operations and follow-up. PALISADES-1 REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES; REACTOR FUELING; MAINTENANCE; THERMAL EFFLUENTS; ALARM SYSTEMS; CONDENSATES; SEISMIC EFFECTS; VALVES; FAILURES; COOLING TOWERS

1396 (DOCKET-50295--647) ZION NUCLEAR PLANT, UNIT 1. REPORT ON INVESTIGATION OF OVEREXPOSURE OF AN INDIVIDUAL TO RADIATION. (Commonwealth Edison Co., Chicago, Ill. (USA)). 6 May 1976. 8p.

Investigation of overexposure of an individual to radiation. ZION-1 REACTOR; PERSONNEL; RADIATION DOSES; MANAGEMENT; REACTOR FUELING; LEAKS; PUMPS; RADIATION PROTECTION; SPECIFICATIONS

1397 (DOCKET-50295--702) ZION NUCLEAR PLANT, UNIT 1. REPORT ON INVESTIGATION OF THE OVEREXPOSURE OF AN INDIVIDUAL TO RADIATION. (Commonwealth Edison Co., Chicago, Ill. (USA)). 6 May 1976. 8p.

Report on investigation of the overexposure of an individual to radiation. ZION-1 REACTOR; PERSONNEL; RADIATION DOSES

1398 (DOCKET-50549--71) GREENE COUNTY NUCLEAR POWER PLANT. PRIVATE CITIZEN'S COMMENTS ON THE DRAFT ENVIRONMENTAL STATEMENT. (Power Authority of the State of New York (USA)). 2 May 1976. 1p.

Citizen's comments on the draft environmental statement. GREENE COUNTY REACTOR; ENVIRONMENTAL EFFECTS; WATER POLLUTION; RADIATION EFFECTS; RADIATION DOSES; PERSONNEL; FISSION PRODUCT RELEASE; RADIOACTIVE MATERIALS; TRANSPORT

1399 (Y/UB--4) ENVIRONMENTAL MONITORING REPORT: UNITED STATES ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, OAK RIDGE FACILITIES, CALENDAR YEAR 1975. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1 May 1976. Contract W-7405-ENG-26. 57p. Dep. NTIS \$4.50.

Surveillance of radioactivity in the Oak Ridge environs for calendar year 1975 indicates that atmospheric concentrations of radioactivity were not significantly different from other areas in East Tennessee. Concentrations of radioactivity in the Clinch River and in fish collected from the river were less than 2 percent of the permissible concentration and intake guides for individuals in the offsite environment. While some radioactivity was released to the environment from plant operations, the concentrations in all of the media sampled were well below established standards. The total body dose to a hypothetical maximum exposed individual at the site boundary was calculated to be 8.4 mrem/yr which is 1.7 percent of the ERDA Manual Chapter 0524 standard. The maximum dose to the critical organ of an individual from the aquatic food chain was calculated to be 3.4 millirem to the bone which is 0.7 percent of the allowable standard. The maximum dose to individuals living nearest the site boundary from airborne releases, assuming continuous residence, was 0.4 mrem/yr to the total body and 6.9 millirem to the lung. These doses are 0.08 percent and 0.5 percent, respectively, of the standards. The average dose to an Oak Ridge resident (the

critical population group) was calculated to be 0.06 mrem/yr to the total body and 0.3 millirem to the lung as compared to approximately 100 mrem/yr from natural background radiation. The cumulative total body dose to the population within a 50-mile radius of the Oak Ridge facilities resulting from 1975 effluents was calculated to be 7.4 man-rem. This dose may be compared to an estimated 74,000 man-rem to the same population resulting from natural background radiation.

1400 OPERATING EXPERIENCE WITH NUCLEAR POWER STATIONS IN THE FEDERAL REPUBLIC OF GERMANY. Birkhofer, A.; Hawickhorst, W.; Koeberlein, K. (Technische Univ. Muenchen, Garching (F.R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Atomwirtsch., Atomtech.; 21: No. 5, 250-253 (May 1976). (In German). 5 figs..

The operating experience so far accumulated by nuclear power stations in the Federal Republic of Germany has been satisfactory. A comparison of the availabilities in terms of time broken down by power categories shows that the larger plants so far have provided the best results. Although this statement should be taken with a grain of salt, because of the relatively small number of plants, an increase in the mean availability in terms of time from approximately 62% with the experimental facilities to 80% with the large plants seems to indicate that good use has been made of the experience. With boiling water reactors turbines turned out to be the plant components decisive for downtimes and the number of outages. Most of the outages of pressurized water reactors were due to steam generator defects and failures of the main coolant pumps. A survey of the releases of radioactive effluents to the environment shows that BWR-type nuclear power stations so far have had slightly higher release rates than PWR-type plants, with both types remaining below 10% of the licensed release rates. In order to reduce the dose rates to the plant crews, efforts must be concentrated upon designs of nuclear power stations which facilitate plant maintenance work.

1401 SELF-CHARGING OF ^{198}Au -LABELED MONODISPERSE GOLD AEROSOLS STUDIED WITH A MINIATURE ELECTRICAL MOBILITY SPECTROMETER. Yeh, H.C.; Newton, G.J.; Raabe, O.G.; Boor, D.R. (Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. (USA)). J. Aerosol Sci.; 7: No. 3, 245-253 (May 1976).

Knowledge of the electrostatic character of an aerosol may be essential in assessing its potential inhalation hazard. In inhalation studies with radioactive aerosols, the aerosol charge state may change in the course of transport due to the emission of α , β or γ radiations. This paper describes an experimental study of the self-charging of ^{198}Au -labeled aerosols of monodisperse gold spheres by β emission. A miniature aerosol electrical mobility spectrometer, suitable for use in inhalation studies with radioactive aerosols, was developed and used in this study. This device is relatively inexpensive, easy to manufacture and its contamination by radioactive material has been minimized. Using polystyrene latex spheres, ranging in diameter from 0.176 to 1.18 μm , the spectrometer was calibrated with flow rates ranging from 400 to 4800 ml/min. Experiments with two sizes of ^{198}Au -labeled monodisperse gold aerosols were performed. Results indicate that the radioactivity of an aerosol can cause self-charging and affect the charge distribution.

240Pu per kg of wet weight.

- 1402 (BNL--21541) HIGH EFFICIENCY MIXED SPECIES RADIOIODINE AIR SAMPLING, READOUT, AND DOSE ASSESSMENT SYSTEM. Distenfeld, C.; Klemish, J. (Brookhaven National Lab., Upton, N.Y. (USA)). May 1976. Contract E(30-1)-16. 65p. Dep. NTIS \$4.50.

Reactor accidents require monitoring to assess the impact to persons in the environment. This implies methods and apparatus to accurately and economically sample and evaluate possible released activity. The development of a prototype iodine air sampling system that can differentiate against noble gas activity and be evaluated by standard Civil Defense instrumentation is reported. The apparatus can efficiently (95 percent) collect organic or inorganic, particulate or gaseous radioiodine in concentrations below stable atmospheric iodine, and under severe ambient conditions. Response to noble fission gases was reduced to less than 4×10^{-4} of an equal iodine airborne activity by heating the collector to approximately 100°C. Reliable sample size, ± 5 percent, was achieved by using a simple air flow regulator. Thyroid dose commitment was mathematically and graphically related to the iodine isotope distribution expected in the environment and to the response of the Civil Defense CDV-700 instrument used to evaluate the sample. Sensitivity of the method allows dose assessment of 1 to 2 rads to a child's thyroid. (CH)

- 1403 (LA--6337-PR) CONTAMINATION LIMITS FOR REAL AND PERSONAL PROPERTY. PROGRESS REPORT, JULY--DECEMBER 1975. Healy, J.W.; Wenzel, W.J. (Los Alamos Scientific Lab., N.Mex. (USA)). May 1976. Contract W-7405-ENG-36. 8p. Dep. NTIS \$3.50.

Studies of surface contamination continued with an attempt to apply previous concepts. Revision of the proposed limit for plutonium in soils was started with major efforts on wind resuspension and the use of data on environmental lead to estimate intake by children.

- 1404 (COO--3011-6) RADIOACTIVE FOODCHAINS IN THE SUBARCTIC ENVIRONMENT. PROGRESS REPORT, AUGUST 15, 1975--AUGUST 14, 1976. Miettinen, J.K. (Helsinki Univ. (Finland). Dept. of Radiochemistry). May 1976. Contract E(11-1)-3011. 20p. Dep. NTIS \$3.50.

Cesium-137 is accumulated in the foodchain lichen-reindeer-man causing high body burdens in Lapps who have reindeer meat as staple food. A group of Finnish Lapps has been whole body counted for ^{137}Cs annually since 1961. Results of the measurements made in April 1976 show 18 percent decrease in ^{137}Cs body burdens from the previous year. A dietary study confirmed that there was no mentionable change in the total amount of reindeer meat consumed although winter consumption has slightly decreased and summer consumption increased in recent years. Plutonium analyses of stockpiled lichen and reindeer samples from 1960 to 1973 were begun in 1973; since then the sampling has continued. Lichen had 200 pCi per kg dry weight in 1963 to 1964, 100 pCi/kg in 1966 to 1970, 20 pCi/kg in 1973 to 1975. Biological half-time of plutonium in lichen is 2 years. Reindeer liver contained about 20 pCi per kg fresh weight in 1963, 2 pCi in 1973. The ratio of plutonium in liver to its lifelong total intake gave a lower limit to absorption in reindeer. Of bones, plutonium concentration is highest in teeth, medium high in sternum, vertebra and humerus, and lowest in solid long bones. Human autopsy samples gave for lungs 0.19 liver 0.02 and bone 0.09 pCi 239

- 1405 (PB--255097) CONCENTRATION FACTORS AND TRANSPORT MODELS FOR RADIONUCLIDES IN AQUATIC ENVIRONMENTS. A LITERATURE REPORT. FINAL REPORT. Patzer, R.G. (Environmental Protection Agency, Las Vegas, Nev. (USA). Environmental Monitoring and Support Lab.). May 1976. 64p. (EPA--600/3-76/054). NTIS \$4.50.

The relative risks to man from radionuclides released to the environment depend heavily on their accumulation or concentration by aquatic organisms. The organisms which accumulate those radionuclides present in the environment may be useful as indicators for environmental monitoring purposes. In addition, these organisms may be directly in food chain pathways to humans. Literature is reviewed and summarized in regard to biological concentration of radionuclides in freshwater and marine environments. Concentration factors for elements found in organisms are tabulated for plants, invertebrates, and fish in marine and freshwater environs. Literature is also reviewed on models developed to calculate the possible radiation dose delivered to humans from radionuclides released into aquatic environments. (GRA)

- 1406 (UCRL--52000-76-5, pp 31-38) FLOW KARYOTYPING: A PROMISING NEW CYTOGENETIC TOOL. May 1976.

Energy and technology review.

A new method of chromosome analysis (flow karyotyping) was developed that uses flow systems and is much faster than conventional techniques. A companion method, flow sorting, provides chromosome populations purified to a degree not possible before. These two methods are providing new information about chromosomes and are potentially useful for detecting human chromosomal abnormalities, including those resulting from energy-related pollutants.

- 1407 LIVER UPTAKE OF /SUP 99M/TC--DIPHOSPHONATE. Chaudhuri, T.K. (Eastern Virginia Medical School, Hampton). Radiology; 119: No. 2, 485-486(May 1976).

From 62. scientific assembly and annual meeting; Chicago, IL, USA (14 Nov 1976).

A report of intense liver uptake of a bone-imaging agent (/sup 99m/Tc-EHDP) is presented. Millimicron colloid particles may be responsible for such uptake. Previous reports of this finding have not come to the author's attention. (auth)

- 1408 INTRODUCTION OF SI UNITS INTO THE RADIOLOGICAL SCIENCES. Nicholson, J.P. (Westminster Hospital, London (UK)). Br. J. Radiol.; 49: No. 581, 477(May 1976).

Although the concept of a unified International System of Units is to be applauded, the rigidity of its application is less welcome. The new unit of activity, the becquerel, lacks convenience since it is at least a million times too small. A modest tracer dose will already be in the mega range; a therapeutic dose of radioiodine will be expressed in gigabq. and a large cobalt unit will have a source whose activity is in hundreds of terabq. The introduction of SI units into the radiological sciences is not therefore likely to be greeted with any great enthusiasm.

- 1409 KINETICS OF SYRIAN HAMSTER CELLS DURING X-IRRADIATION ENHANCEMENT OF TRANSFORMATION IN

VITRO BY CHEMICAL CARCINOGEN. DiPaolo, J.A.; Donovan, P.J.; Popescu, N.C. (National Cancer Inst., Bethesda, MD). Radiat. Res.; 66: No. 2, 310-325 (May 1976).

The x-irradiation of cultured Syrian hamster cells followed by exposure to a chemical carcinogen after seeding for colony formation results in an enhancement of transformation ordinarily associated with the chemical. Maximum enhancement occurred when 48 hr separated the two treatments and when 250 R was used. With different concentrations of benzo(a)pyrene (0.1-5 µg/ml medium) a similar factor of enhancement was obtained with 250 R, which averaged 8.35, implying that the irradiation pretreatment caused a constant multiplying factor. These results are consistent with the interpretation that transformation occurs through interactions in keeping with a one-hit hypothesis. The transitory effect of irradiation and the lack of transformation with irradiation alone argues against the selection of a special radiation-sensitive cell. At the time of maximum enhancement (48 hr), the cell cycles of irradiated and nonirradiated cells do not differ. The addition of benzo(a)pyrene to irradiated cells does not alter the number of cells capable of synthesizing DNA or the flow of cells from G₁ to S. The number of cells accumulated in mitosis also does not appear to differ between irradiated and nonirradiated cultures treated with 2.5 µg benzo(a)pyrene. Chromosome aberrations or alterations in ploidy cannot account for the significant increase in enhancement observed at 48 hr postirradiation; however, twice as many cells with chromosome or chromatid gaps were found at 48 hr as compared to either 24 or 72 hr postirradiation.

- 1410 (AD-A--028733) ROLE OF NUCLEAR STARS IN THE LIGHT FLASHES OBSERVED ON SKYLAB 4. SCIENTIFIC REPORT NO. 3, 1 MAY 1975--30 APR 1976. McNulty, P.J.; Filz, R.C.; Rothwell, P.L. (Emmanuel Coll., Boston, Mass. (USA)). May 1976. Contract F19628-73-C-0190. 17p. NTIS \$3.50.

The astronauts on Skylab 4 observed bursts of intense visual light-flash activity when their spacecraft passed through the portion of the earth's inner trapped radiation belt known as the South Atlantic Anomaly (SAA). Two experimental sessions were carried out on board Skylab which compare the flash rates with the measured flux of Z greater than or equal to 1 particles that would pass through the astronaut's eyes. It was concluded that the flash rates, which became as great as 20/minute, were anomalously high. The authors explored a number of alternative explanations for the anomalous flash rates that would be consistent with the accepted SAA flux values and the laboratory data on particle induced visual sensations and found that, when one includes the effect of nuclear interactions in and near the retina which result in star formation (the emission of slow protons, neutrons, and alphas from the nucleus in an evaporation-like process), the apparent anomaly is removed. (GRA)

- 1411 (EPA--520/1-76-010) RADIOLOGICAL QUALITY OF THE ENVIRONMENT. Feldmann, K.L. (ed.). (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). May 1976. 258p. Environmental Protection Agency, Washington, DC.

This report is part of the dose assessment program of the Office of Radiation Programs of the U. S. Environmental Protection Agency for evaluating the radiological quality of the environment. As a prototype effort, this first

report is intended only to summarize information available in the open literature. Special emphasis was placed on acquiring recent dose data. For some source categories, dose information was available for calendar year 1975; for others the most recent data goes back to the early 1970's. It is not intended in this initial effort to calculate or extrapolate from existing data to supply missing dose information. Instead, the concern was for the availability of data and what the existing data provides for individual and population dose information. However, gaps in data coverage and areas of inadequate data coverage are identified when found.

- 1412 (FDA--76-8030) ORGAN DOSES IN DIAGNOSTIC RADIOLOGY. Rosenstein, M. (Bureau of Radiological Health, Rockville, Md. (USA)). May 1976. 126p. GPO \$1.95.

A computational method generally applicable for the estimation of organ doses from diagnostic radiology procedures is presented. The underlying methodology utilizes a Monte Carlo radiation transport technique and an anthropomorphic and heterogeneous phantom containing mathematically described organs, including lung and skeletal regions. Using the technique, tissue-air ratios have been generated for the testes, ovaries, active bone marrow, thyroid, and embryo/uterus of a reference adult patient for various photon energies and views (AP, PA, LAT). From the tissue-air ratios, a compilation of organ doses per unit entrance exposure free-in-air (mrad/R) has been developed as a function of beam quality (HVL, mm Al) for projections common in diagnostic radiology. Detailed material is presented on the methods, application procedures and comparisons to literature data.

- 1413 (FDA--76-8031) HANDBOOK OF SELECTED ORGAN DOSES FOR PROJECTIONS COMMON IN DIAGNOSTIC RADIOLOGY. Rosenstein, M. (Bureau of Radiological Health, Rockville, Md. (USA)). May 1976. 43p. GPO.

This handbook contains data from which dose (mrad) to selected organs can be estimated for common projections in diagnostic radiology. The organ doses are for a reference adult. The intent of the handbook is to permit the user to evaluate the effect on organ dose of changes in technical parameters used in or among facilities.

- 1414 (GSF-S--400) ANNUAL REPORT 1975. Godt, K.J. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Strahlenschutz). May 1976. 116p. (In German). TIC. 31 figs..

The 7th annual report of the Institut fuer Strahlenschutz of the Gesellschaft fuer Strahlen- und Umweltforschung mbH gives information on targets and results in the year 1975. The tasks in the fields of radiation protection research and radiation protection services have increased considerably during this year. Aside from problems of radiation protection in connection with the increasing use of nuclear energy, attempts have been made to improve radiation protection in medicine, in particular in the field of X-ray diagnostics. The elaboration of concepts, recommendations and comments on basic problems as well as the practical implementation of the X-ray ordinances and advice to the authorities still make up a major part of the program of activities.

1415 (KFK--2266) ANNUAL REPORT, 1975.

Kiefer, H.; Koelzer, W.
(Kernforschungszentrum Karlsruhe (Germany,
F.R.). Abt. Strahlenschutz und Sicherheit).
May 1976. 160p. (In German). INIS.

With figs., tabs. and refs..

The Safety Officer of the GfK is responsible for radiation protection and technical safety, both conventional and nuclear, within the company. To fulfill his functions he relies on the assistance of the Radiation Protection and Safety Department. His duties cover tasks relative to radiation protection and safety on behalf of the institutes and departments of the GfK and environmental monitoring for the whole Nuclear Research Center, on the one hand, and own research and development work, most of which carried out under the Nuclear Safety Project, on the other hand. These activities concentrate on radiation protection methods of measurement and personnel dosimetry, theoretical and experimental studies of the diffusion behaviour of gases and aerosols in the atmosphere, the amount and consequences of radioactive and thermal emissions from large nuclear plants. This report gives details of the different duties, indicates the results of 1975 routine measurements, and reports about results of investigations and developments of the working groups of the department.

initiating, and operating a successful dental exposure reduction program. The manual can serve as a guide and reference for conducting all phases of the program. It details the assistance offered by the Bureau of Radiological Health, as well as the responsibilities and functions of participating radiation control agencies. (GRA)

1419 (PB--258159) PROGRAM STATEMENT.
(Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs).
May 1976. 52p. (EPA--520/7-76/007). NTIS \$4.50.

The Environmental Protection Agency (EPA) has the responsibility to protect the health and welfare of man and the environment from adverse effects due to radiation exposure. This responsibility is implemented through the Agency's authorities which established EPA in a role to provide continuing Federal overview of radiation protection philosophies, policies and controls. This mandate is achieved by developing policies and controls based on the soundest available scientific and technical information, that satisfy the requirement and intent of the law, that are legally enforceable, and that reflect responsible public policy. (GRA)

1416 (ORNL/TM--5336) MATHEMATICAL MODEL OF A PHANTOM DEVELOPED FOR USE IN CALCULATIONS OF RADIATION DOSE TO THE BODY AND MAJOR INTERNAL ORGANS OF A JAPANESE ADULT. Kerr, G.D.; Hwang, J.M.; Jones, R.M. (Oak Ridge National Lab., Tenn. (USA)). May 1976. Contract W-7405-ENG-26. 33p. Dep. NTIS \$4.00.

A mathematical model of a phantom simulating the body and major internal organs of a Japanese adult has been developed for use in computer calculations of radiation dose. The total body height of the mathematical phantom is 162 cm, and the total body mass is 55 kg based on densities of 0.3, 1.4, and 1.0 g/cm³ for the lung, skeleton, and bulk tissues of the body, respectively.

1420 EXPOSURE OF RADIOLOGISTS TO SCATTERED RADIATION DURING RADIODIAGNOSTIC EXAMINATIONS. Kan, K. (St. Elizabeth Hospital, Tilburg, Netherlands); Santen, B.C.; Velthuyse, H.J.M.; Jullius, H.W. Radiology; 119: No. 2, 455-457 (May 1976).

From 62. scientific assembly and annual meeting; Chicago, IL, USA (14 Nov 1976).

The exposure to scattered radiation was measured on both hands, the forehead and gonads of six radiologists by means of thermoluminescent dosimeters in two fluoroscopy rooms. Exposure of the forehead was found not to exceed approximately 1% of the maximum permissible exposure (MPD) (3% pursuant to NCRP recommendations). During examinations of the colon, the exposure of the right hand proved to be significantly higher compared to the left. There was only slight exposure to the gonads as measured behind the apron. (auth)

1417 (PB--255363) ORGAN DOSES IN DIAGNOSTIC RADIOLOGY. Rosenstein, M. (Bureau of Radiological Health, Rockville, Md. (USA)). May 1976. Contract W-7405-ENG-26. 132p. (FDA/BRH--76/88; DHEW/PUBL/FDA--76/8030). Dep. NTIS \$6.00.

There is considerable interest in the medical, radiological health, and public sectors for data that can be used easily to make estimates of organ doses that result from diagnostic radiology procedures within and among medical facilities. At these facilities the choices of technical parameters for the conduct of x-ray examinations impact significantly on patient dose. This report describes a system for obtaining such dose estimates. The techniques and data in the report were designed for general applicability and are the most complete and versatile treatment of the topic to date. While the organ doses tabulated apply to a limited number of routine procedures performed on a reference adult patient, the dose estimation methodology is completely general.

1421 MANTEL--HAENZSEL ANALYSIS OF OXFORD DATA. I. INDEPENDENT EFFECTS OF SEVERAL BIRTH FACTORS INCLUDING FETAL IRRADIATION. Kneale, G.W.; Stewart, A.M. (Univ., Birmingham, Eng.). J. Natl. Cancer Inst.; 56: No. 5, 879-883 (May 1976).

Data from the Oxford Survey of Childhood Cancers were subjected to the Mantel--Haenszel procedures to recognize independent effects of associated factors in retrospective data. Our results showed that several birth factors, including fetal irradiation, social class, maternal age, and sibship position, exerted separate effects on childhood cancers in general, and reticuloendothelial system neoplasms in particular.

1422 IN VITRO RUBIDIUM UPTAKE BY ERYTHROCYTES FOLLOWING LOW LEVEL X-RAY EXPOSURE. Mattler, F.A. Jr. (Massachusetts General Hospital, Boston (USA). Radiology Dept.); Drolette, M. Health Phys.; 30: No. 5, 401-404 (May 1976).

Scott et al (Archs. Envir. Health; 26:64 (1973)) reported increased in vitro uptake (39.2 vs 34.1%) of rubidium in erythrocytes from populations exposed to low levels of x-ray. The present authors, however, report that in their experiments no increased uptake of rubidium by erythrocytes attributable to

1418 (PB--256678) DENTAL EXPOSURE NORMALIZATION TECHNIQUE 'DENT' INSTRUCTION MANUAL. Crabtree, C.L.; Jameson, W.R. (Bureau of Radiological Health, Rockville, Md. (USA)). May 1976. 61p. (DHEW/PUBL/FDA--76/8042; FDA/BRH--76/92). NTIS \$4.50.

The DENT Instruction Manual is designed for use by radiation control agencies in planning,

radiation could be detected in persons occupationally exposed to x-ray. No difference was detectable either between controls and matched exposed groups or among matched groups with varying exposure. It is suggested that the difference reported by Scott et al may result from the choice of control population.

- 1423 NEW SPECIAL NAMES OF SI UNITS IN THE FIELD OF IONIZING RADIATIONS. Wyckoff, H.O.; Allisy, A.; Liden, K. (Lund Univ. (Sweden). Radiofysiska Institutionen). Br. J. Radiol.; 49: No. 581, 476-477(May 1976).

The authors write on behalf of the International Commission on Radiation Units and Measurements (ICRU). Details are given of two resolutions adopted by the Fifteenth General Conference of Weights and Measures at its meeting in May-June 1975, following proposals put by ICRU to the International Committee of Weights and Measures. The SI unit the joule per kilogram when used for ionizing radiation (absorbed dose, kerma, specific energy imparted, etc.) has been given the name gray with the symbol Gy. $1 \text{ Gy} = 100 \text{ rad} = 1 \text{ J/kg}$. The SI unit the reciprocal second (one per second) for activity has been given the name becquerel, symbol Bq. $1 \text{ Bq} = 1 \text{ s}^{-1}$ approximately $2.703 \times 10^{-11} \text{ Ci}$. Although ICRU did not then recommend giving a special name to the SI unit of exposure to replace the currently used roentgen, it is now recommended that the special units the rad, the roentgen and the curie be gradually abandoned over a period of not less than about 10 years. The formulation (for selection) of a suitable unit for dose equivalent, which has the same physical dimension as absorbed dose, is a special problem which will be thoroughly discussed by ICRU, since the availability of a proper set of quantities and units is of paramount importance in the field of radiation protection.

- 1424 NEW SPECIAL NAMES OF SI UNITS IN THE FIELD OF IONIZING RADIATIONS. Wyckoff, H.O.; Allisy, A.; Liden, K. (Lund Univ. (Sweden). Radiofysiska Institutionen). Health Phys.; 30: No. 5, 417-418(May 1976).

A letter from the International Commission on Radiation Units and Measurements (ICRU) announce two resolutions adopted by the 15th General Conference of Weights and Measures at its meeting in May-June 1975 concerning the adoption of special names for the SI unit the joule per kilogram, J/kg, when applied to absorbed dose and related quantities, and for the SI unit the reciprocal second, s^{-1} , when applied to the quantity activity as a measure of the rate of spontaneous nuclear transformation of radioactive nuclides. It was decided that the SI unit for activity should be the becquerel, symbol Bq, equal to the second to the power minus one and that the SI unit for ionizing radiations be the gray, symbol Gy, equal to the joule per kilogram. The ICRU now recommends that the special units the rad, the roentgen and the curie be gradually abandoned over a period not less than about 10 yr and replaced by the SI units the gray (Gy), the coulomb per kilogram (C/kg) and the becquerel (Bq), respectively.

- 1425 RADIATION RISK FROM OPERATION OF Sc^{3+}H ELECTRON-CAPTURE DETECTORS. Baum, J.J. (Analog Technology Corp., Pasadena, Calif. (USA)). Health Phys.; 30: No. 5, 419-420(May 1976).

Reference is made to a previous communication by Carlton et al (Health Phys.; 29: 411 (1975)) in which reference was made to

tritium contamination of their laboratory, apparently caused by operation of a Sc^{3+}H electron-capture detector and to the apparent casual attitude of manufacturers towards this potential hazard. The present author, on behalf of one such manufacturer, strongly refutes both these points. The terms of the license under which they are permitted to manufacture and distribute electron-capture detectors are outlined. The question of venting the detector exhaust with reference to the contamination problem is discussed.

- 1426 DEPTH ABSORBED DOSE DISTRIBUTIONS FOR ELECTRONS. Atherton, L. (M.E.L. Equipment Co. Ltd., Crawley (UK). Particle Accelerator Div.). Phys. Med. Biol.; 21: No. 3, 453-454(May 1976).

The author is replying to criticisms (Brahme, A., and Svensson, H., 1976, Phys. Med. Biol., Vol. 21, 304) of central axis depth absorbed dose distributions for linear accelerator electron beams (Atherton, L., and Coleman, F.G., 1976, Phys. Med. Biol., Vol. 20, 658). Comparison of data relating to SL75-20 and microtron beams under comparable conditions showed that the fall-off characteristics as judged by the 85, 50 and 35% values are virtually identical for the two beams, and the small differences in the build-up region are not clinically significant. There is therefore no justification in their claim that the narrow energy spectrum, clean geometry and small amount of scattering in the microtron produced beams which are significantly different from those obtained from linear accelerators.

- 1427 MUTAGENIC EFFECT OF X-RAYS. III. RADIATION GENETIC RISKS. Stephan, G. (Bundesgesundheitsamt, Neuherberg/Muenchen (F.R. Germany). Inst. fuer Strahlenhygiene). Roentgen Bl.; 29: No. 5, 253-257(May 1976). (In German).

4 tabs.; with refs..

In the estimation of radiation genetic risks, the results must be derived from animal experiments. According to recently performed investigations, humans have almost the same mutation sensibility like mice. In risk estimations, it is necessary to take into account the factors which influence the mutation rate induced per unit dose. Risk estimations are carried out by comparing the effect per unit dose with the risk of the same effect, which is caused by unknown natural influences. The reader is referred to data derived from humans.

- 1428 RADIATION PROTECTION POLICIES OF EURATOM. Recht, P.; Eriskat, H. (Commission of the European Communities, Luxembourg. Directorate for Health Protection). Arbeitsmed., Sozialmed., Praeventivmed.; 11: No. 5, 126-129(May 1976). (In German).

8 refs..

Presented is roll and authority of EURATOM in promoting and achieving in the first place preventive european radiation protection policies on the basis of the EURATOM basic norms (article 2, letter 6, and article 30). To its sphere of responsibility belong also: Regulations concerning safety for the disposal of radioactive waste and supervising the radioactivity in the environment.

- 1429 DRAFT AMENDMENT TO THE RADIATION PROTECTION ORDINANCE. REMARKS BY AN INVOLVED PERSON. Wegner, L.A.; Maurischat, A. Atomwirtsch., Atomtech.; 21: No. 5, 243-246(May 1976). (In German).

1 tab.; 20 refs..

In the Federal Republic of Germany radiation protection procedures are covered by the 'First Ordinance on the Protection against Damage from Radiation Emitted by Radioactive Materials'. Even this first ordinance, which dates from 1960 and is presently applied in the version as amended on October 15, 1965, is hardly a model of lucidity. Yet this ordinance, which is still valid, has been quite useful in practical applicability. The draft published in late 1974 and the other versions of the amendment of the First Radiation Protection Ordinance were intended to do away with the shortcomings of the present version and make the ordinance a clearer instrument easier to understand. However, it now appears in practice that the new wording is even more difficult to comprehend, lacking in clarity and, in some places, so contradictory as to be actually false. These comments were written in the light of practical experience; they list and criticize in detail the mistakes, ill advised alterations, ambiguous wording and problematic rules as well as those passages which should be revised. In the opinion of those concerned, the large number of complaints arising from practical application of the ordinance have so far not found their way into the present revisions.

would add, respectively, approximately 30% and 15% to their capital cost. This high standard of current U.K. radiographic practice can only be maintained if the present levels of training and supervision are retained.

- 1430 T.D.F. (TIME DOSE FRACTIONATED IRRADIATION) AND TOLERANCE TO LOW DOSE RATE AND LOW FRACTIONATED IRRADIATION. Swynghedauw, J. J. Radiol., Electrol., Med. Nucl.; 57: No. 5, 373-377(May 1976). (In French).

The factor (T.D.F.) defined by Orton and Ellis for regularly distributed discontinuous irradiation may be dissociated from Ellis' equation. The essential fact is that, in principle, the T.D.F. is given as 100 for all techniques which are associated with full tolerance or, if desired exact saturation of the normal supporting tissue. Dissociation of the T.D.F. factors from Ellis' equation makes it possible to generalize its principle and to extend it to all normal tissue (kidney, lung, intestine, marrow). Their T.D.F. represents a state in which radiolesions are maximally compatible with reversibility, in the immediate or in the shortest possible time. It would be theoretically possible, using a suitable experimental technique, to develop, for each of these particularly sensitive organs, tables analogous to those provided by Orton and Ellis.

- 1431 SPOILT FILMS IN X-RAY DEPARTMENTS AND RADIATION EXPOSURE TO THE PUBLIC FROM MEDICAL RADIOLOGY. Berry, R.J.; Oliver, R. (British Inst. of Radiology, London. Radiation Protection Committee). Br. J. Radiol.; 49: No. 581, 475-476(May 1976).

A survey has been carried out of the numbers and causes of spoilt X-ray films in four X-ray departments located in typical examples of the four major types of hospitals in the U.K. All films taken over a period of either one or two months in each department were reviewed, and the major causes of spoilt films recorded. The results of the survey, which covered over 10000 examinations averaging 3.0 films per examination, showed that approximately one patient in six who underwent X-ray examination had at least one film spoilt and retaken. Overall, however, retakes of these spoilt films result in only about 5 to 6 per cent increase in the population exposure to radiation which occurs as a result of medical radiography. Providing automatic controls of exposure and field size on all new X-ray machines, which could thus only reduce population exposure by less than 5% of that due to medical radiography

- 1432 DOSIMETRY OF HIGH ENERGY ELECTRON BEAMS FROM A LINEAR ACCELERATOR. Briot, E.; Dutreix, A. J. Radiol., Electrol., Med. Nucl.; 57: No. 5, 447-454(May 1976). (In French).

The dosimetric characteristics of the electron beams from the Sagittaire (C.G.R. MeV) linear accelerator are presented. The variation in dose output with the distance from the source are indicated for the usual treatment distances. equivalent square field corresponding to the same deep yield as a 1x1 rectangular square law for distances. The graphs for the variation in dose output in terms of the opening of the collimator are given for square and rectangular openings. The measurements demonstrate the preponderant influence of the short side l of the rectangular field on the relative variation in dose output. The variations in the graphs of the deep yield in terms of beam energy, distance from the source and field dimension were studied. For the different energies, the influence of the distance from the collimator and the dimension of the field on the dose at entry and on the depth of the maximum was shown. Measurements of the deep yields were carried out in the case of rectangular fields. In each case, the side of the equivalent square field corresponding to the same deep yield as a 1x1 rectangular field was determined; a comparison was carried out with the equivalent square field defined for cobalt radiation.

- 1433 SEARCH FOR THE LOWEST IRRADIATION DOSE FROM LITERATURES ON RADIATION-INDUCED CANCER IN GASTROINTESTINAL TRACT. Yoshizawa, Y.; Kusama, T. (Tokyo Univ. (Japan). Faculty of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 5, 433-439(May 1976). (In Japanese).

A survey of past case reports about radiation-induced cancer in the gastrointestinal tract was carried out with the main object of finding the lowest irradiation dose. Search of the literature published since 1923 revealed 80 cases of radiation-induced large intestine cancer and one case of stomach cancer. The cases of radiation-induced cancer in the large intestine had received radiation for the treatment of non-malignant conditions, fibroma, ovarian cyste, myoma, endometritis and duodenal ulcer. The lowest irradiation dose was estimated at 460 rads. Adenocarcinoma was the histopathological finding in all cases of radiation-induced cancer in the caecum, colon and rectum, and squamous cell carcinoma in the cases of anal cancer. The latent period ranged from 1 to 31 years, with the average of 13.6 years. There were some reports of statistical studies of radiation-induced stomach cancer. Three groups were the subjects of these studies. The first group was composed of atomic bomb survivors, the second of patients who had undergone radiation treatment for ankylosing spondylitis, and the third of duodenal ulcer patients subjected to radiation treatment for the purpose of suppressing gastric acid secretion. These statistical studies showed no significant increase of the incidence of stomach cancer in the irradiated groups.

- 1434 TREATMENT OF DISORDERS CAUSED BY RADIATION INJURY IN THE HAND AND FINGERS. Watanabe, Y. (Yamagata Univ. (Japan)). Saigai Igaku; 19: No. 5, 327-334(May 1976). (In

Japanese).

In this paper, a report was made on 8 cases of disorders caused by radiation injury in the hand and fingers and on those treatment. In 5 cases of them, keratosis of the skin (an average of 10 years after the initial fluoroscopy) and ulceration (an average of 17 years after the initial one) due to x-ray fluoroscopy were noted. Cancer was found in 2 cases of them and precancer in the other 2 cases of them. The lesions continued to develop after radiation was stopped. In 2 cases which had received x-ray irradiation for the treatment, one case developed erosion one year after the institution of the therapy and the other had the similar change two years after that. In both of the cases, precancerous state was noticed. In the last case, erosion appeared 6 years after the patient had dealt with radium in giving treatment. Ulceration appeared 16 years after the patient had dealt with radium in giving treatment. In 4 cases in which lesions had been restricted in the corium layer, the treatment was the resection of the skin and dermatoplasty, and thus the function of the fingers recovered. In the other 4 cases in which the pathological changes had spreaded over the deeper layers, the fingers were severed.

- 1435 SYSTEMIC PROTECTION AGAINST RADIATION. II. EFFECT OF PROTEIN AND LIPID CONSTITUENTS OF DIET. Pageau, R.; Bounous, G. (Centre Hospitalier Univ., Sherbrooke, Quebec). Radiat. Res.; 66: No. 2, 267-273(May 1976).

Ratios of nonhydrolyzed versus hydrolyzed nitrogenous constituents (NHP:HP) and medium-chain versus long-chain triglycerides (MCT:LCT) were modified in five formula-defined diets fed to male rats. We measured the effects of these dietary modifications on the incorporation of ^3H -TdR in the thymus, the spleen, the lymph nodes, and the bone marrow of nonirradiated animals as well as on the survival of animals given total-body irradiation of 700 rad. It was found that both ^3H -TdR incorporation in hematopoietic tissues (especially the bone marrow) and the ability to withstand the effects of 700 rad were inversely proportional to the NHP content of the diets. In the case of the lipidic constituents, a ratio of 1 MCT:4 LCT (providing that nitrogenous materials were present in a hydrolyzed form) gave the best results both in terms of a higher uptake of ^3H -TdR by hematopoietic tissues and a greater resistance to radiation.

- 1436 RELATIONSHIP OF STRAIN, SEX, AND BODY WEIGHT TO SURVIVAL FOLLOWING SUBLETHAL WHOLE-BODY X-IRRADIATION. Holland, J.M.; Mitchell, T.J. (Oak Ridge National Lab., TN). Radiat. Res.; 66: No. 2, 363-372(May 1976).

Life-shortening effects of whole-body x-irradiation of C3H, BALB/c, RFM, C57BL/6, C3CF₁, B6RFMF₁, and a four-way cross were compared. Male and female mice exposed to 300 R at 5-6 weeks of age showed significant life shortening in all strains and crosses. Females were, in general, 1.5 times more sensitive than males of the same strain, suggesting a constant effect of sex. There were substantial differences in sensitivity within the same sex among strains and it was found that this strain-specific difference was highly correlated with body weight at 6 weeks of age. On this basis a hypothesis has been advanced which views some of the strain-specific differences in radiation sensitivity as due to differences in maturational rate or to processes which are highly correlated with maturational rate.

- 1437 EFFECT OF MULTIPLE SMALL DOSES OF X RAYS ON SKIN REACTIONS IN THE MOUSE AND A BASIC INTERPRETATION. Douglas, B.G.; Fowler, J.F. (Mount Vernon Hospital, Northwood, Eng.). Radiat. Res.; 66: No. 2, 401-426(May 1976).

Multiple-fraction experiments have been carried out to determine the response to repeated small doses of 240 kV x rays down to 45 rad per fraction, using the mouse skin reaction system. A method of irradiating without anesthetic was developed so that up to 64 fractions could be given within 8 days; over this time, proliferation was negligible. It was found that the total dose required to produce a given reaction continued to rise with the number of fractions above 30 fractions, in contradiction to the recent conclusions of Dutreix and colleagues. The plot of reciprocal total dose against size of each fraction was shown to be linear. This finding led to an analysis in terms of a function $F/\text{sub } e/$, which is proportional to the slope of the chord of the appropriate cell survival curve from the origin to the dose per fraction used. The cell survival curve derived here was well fitted by an equation of the form $s = e/\text{sup } -(\alpha D + \beta D^2)/$. The initial slope was 1/690 rad and the slope at 2340 rad was 1/126 rad. Thus, 1 rad at a dose approaching 0 rad has 18 percent of the effect of 1 rad at a single dose of 2340 rad for mouse skin reactions. A cell survival theory based on Neary's theory of chromosome aberrations is presented and the current results are consistent with the postulate that cell death results for the formation of chromosome aberrations.

- 1438 PROLIFERATION OF MYELOGRANULOCYTES IN THE PROCESS OF PROLONGED DAILY IRRADIATION. Muksinova, K.N.; Murzina, L.D. Med. Radiol.; 21: No. 5, 62-67(May 1976). (In Russian).

The authors studied the duration of mitotic cycle and its separate periods and also proliferative pool of granulocytes of the bone marrow of mice in the process of prolonged irradiation in a dose of 48.5 rad a day. It was shown that reinforcement of granulocytopoietic cells during irradiation occurs at the expense of shortening the cycle. A proliferative pool of these cells is not changed in the process of irradiation and is 100 percent. Certain variations were revealed in the change of temporary parameters of the mitotic cycle of granulocytes of different degree of maturity. Contribution of the observed shifts of proliferation to the cell production was defined. It was shown that in the bone marrow of the irradiated animals granulocyte production in the course of the whole experiment was maintained on the control level or even exceeded it.

- 1439 OBSERVATIONS ON LATE EFFECTS IN MICE EXPOSED TO 400 MEV NEUTRONS. Covelli, V.; Di Paola, M.; Bassani, B.; Metalli, P. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari); Baarli, J.; Bianchi, M. Int. J. Radiat. Biol.; 29: No. 5, 439-453(May 1976).

Life-long observations on mortality and pathology at death were carried out on groups of mice irradiated with 250 kV X-rays or exposed to a 400 MeV neutron beam, both directly and after attenuation corresponding to the maximum dose build-up region, at comparable dose-rates. Doses up to 84 rad of 400 MeV neutrons and up to 200 rad of X-rays showed no effect on the longevity of the animals, which suggests an upper limit to the RBE for life-shortening of approximately 2.5. Similar conclusions were drawn from the data on all types of leukemias. For all other neoplasms,

the age-specific death-rate showed a similar shortening of the latency times for groups of mice irradiated with 0 to 84 rad of 400 MeV direct neutrons and 0 to 400 rad of X-rays, also suggesting an upper limit to the r.b.e. slightly higher than that previously indicated for life-shortening. No definite effect was observed after exposure to the attenuated neutron beam at the doses used in these experiments.

- 1440 CONTROL OF IGE AND IGGL ANTIBODY PRODUCTION IN MICE. De Macedo, M.S.; Braga, F.; Mota, I. (Instituto Butantan, Sao Paulo, Brazil). *Cell. Immunol.*; 23: No. 2, 342-355(May 1976).

The production of IgE and IgG1 was studied in untreated, thymectomized, splenectomized, anti-thymocyte serum-treated, or sublethally X-irradiated mice. Dinitrophenyl, Ascaris, and ovalbumin were used as antigens, and aluminum hydroxide was used as adjuvant. A suppression of IgE production was observed in adult thymectomized mice, although the kinetic pattern of the antibody response was the same as in control animals. IgG1 antibody production was not affected by thymectomy. Splenectomy did not change either IgE or IgG1 production. A single dose of rabbit antithymocyte serum (ATS) given 8 days after immunization inhibited IgE antibody production. The effect of ATS was dose dependent and also varied with the amount of antigen used, the immune response to high doses being more susceptible to the effect of ATS. No alteration in IgG1 production was caused by ATS even when IgE antibody formation was completely inhibited. When preceding immunization, sublethal irradiation enhanced IgE antibody formation and partially suppressed IgG1 production; applied after immunization, irradiation caused an enhancement of IgE production which was inversely proportional to the interval elapsed between the two procedures. On the other hand, the IgG1 antibody production was fairly resistant to the same treatment. The results suggest a clearcut separation between the mechanisms regulating IgE and IgG1 production in mice.

- 1441 RADIATION-INDUCED MUTATION FREQUENCY IN MARKED CHROMOSOME OF MACACA MULATTA. Dzhemilev, Z.A.; Machavariani, M.G. (Akademiya Meditsinskikh Nauk SSSR, Sukhumi. Inst. Eksperimental'noj Patologii i Terapii). *Tsitologiya*; 18: No. 5, 605-610(May 1976). (In Russian).

The symmetric and asymmetric exchange frequencies of marked (nucleolus forming) chromosomes were studied in the lymphocytes and epithelial kidney cells irradiated by X-rays at G_0 , both in vivo and in vitro. Symmetric and asymmetric exchange frequencies were found to be equal. In both the types of Macaca mulatta cells, the exchange frequency in the long arm appeared to be higher than theoretically expected. The increased exchange in the long arm is thought to be due to a greater quantity of late replicating heterochromatin in it. The short arm of marked chromosome of epithelial kidney cells enters the exchange in accordance to its length in mitosis, but exchange number in the short arm chromosome in lymphocytes is lower than in epithelial cells. This difference is caused likely by different functioning of the nucleolus forming heterochromatin.

- 1442 ACTIVITY OF DNA DEPOLYMERASES IN THE RAT SPLEEN AFTER THE COSMOS-605 FLIGHT. Makeeva, V.F.; Komolova, G.S.; Serova, L.V.; Belikova, E.V.; Egorov, I.A. *Kosm. Biol. Aviakosmicheskaya Med.*; 10: No. 3, 14-17(May

1976). (In Russian).

Biological effects of space flight factors (weightlessness, cosmic radiation) were studied. The activity of DNA catabolism enzymes (acidic and alkaline DN-ases) was determined in the spleen of rats after 22-day flight on "Kosmos-605" space-ship. Alkaline DN-ase activity remained unchanged while the activity of acidic DN-ase grew more than twice. 26 days after the flight acidic DN-ase activity returned to normal. Measurements of DNA intrinsic viscosity showed that activation of the enzyme was not accompanied by DNA fragmentation.

- 1443 RADIATION HAZARDS FROM ^{241}Am SOURCES USED IN THYROID STUDIES. Venkatraman, G.; Jayaraman, S. (Bhabha Atomic Research Center, Bombay). *J. Nucl. Med.*; 17: No. 5, 408-410(May 1976).

The neutron and gamma photon doses corresponding to the neck and eye level from an $^{241}\text{AmO}_2$ source used in thyroid studies have been theoretically estimated. The radiation hazard to the patient is found to be not significant.

- 1444 EFFECT OF INHALED YTTRIUM-90 IN FUSED CLAY PARTICLES ON THE PULMONARY CLEARANCE OF INHALED STAPHYLOCOCCUS AUREUS IN MICE. Lundgren, D.L.; Hahn, F.F.; Sanchez, A.; McClellan, R.O. (Inhalation Toxicology Research Inst., Albuquerque, NM). *Radiat. Res.*; 66: No. 2, 231-246(May 1976).

The effect of ^{90}Y inhaled in fused clay particles on the pulmonary clearance of inhaled *Staphylococcus aureus* in mice was investigated to provide an improved understanding of the influence of localized irradiation from inhaled radionuclides on infectious processes. Pulmonary clearance of inhaled *S. aureus* was suppressed in mice with initial lung burdens of 20 $\mu\text{Ci } ^{90}\text{Y}$ or greater at 2, 3, and 4 weeks after inhalation exposure to ^{90}Y . Suppressed clearance rates were accompanied by radiation-induced lifespan shortening, retarded increases in average body weight, suppression of blood lymphocyte count, and pulmonary lesions. Only equivocal suppression of bacterial clearance was observed in mice with initial lung burdens of less than 20 $\mu\text{Ci } ^{90}\text{Y}$ that were tested from 1 through 52 weeks after inhalation exposure. An initial lung burden of 1 $\mu\text{Ci } ^{90}\text{Y}$ was estimated to result in 400 rad to the lung delivered within 24 days after exposure.

- 1445 CHANGES IN THE ACID RESISTENCE OF ERYTHROCYTES DURING GENERAL BETA AND GAMMA IRRADIATION. Beresnev, V.L.; Zhiltsov, I.V. *Med. Radiol.*; 21: No. 5, 84-86(May 1976). (In Russian).

White male rats were subjected to single and repeated doses from xenon-133 with the beta dose being varied from 560 to 2730 rads, and the gamma dose being varied from 43 to 212 R. On using 0.004 N HCl solution as a hemolytic agent it was found that the irradiation led to a significant and prolonged decrease in the acid resistance of erythrocytes. A shift in the erythrogram and its maximum to the left was noted. The decrease in cell stability after the single or double irradiations is probably connected with the action of hemolytic agents formed as a result of the irradiation. The decrease in resistance of erythrocytes after the third irradiation may be caused by the suppression of erythropoiesis.

- 1446 DOSE RATES, DOSE AND TIME EFFECTS OF $^{90}\text{Sr} + ^{90}\text{Y}$ AND ^{22}Ra ON BEAGLE SKELETON.

Momeni, M.H.; Williams, J.R.; Jow, N.; Rosenblatt, L.S. (California Univ., Davis (USA). Radiobiology Lab.). Health Phys.; 30: No. 5, 381-390 (May 1976).

Radiation-induced skeletal changes were studied in beagles fed from mid-gestation to 1.5 yr of age diets containing $^{90}\text{SrCl}_2$ in equilibrium with ^{90}Y , or administered $^{226}\text{RaCl}_2$ in 8 semimonthly i.v. injections starting at 2, 4 or 14 months of age. Skeletal changes were evaluated with a radiographic X-ray scoring system in 20 skeletal regions. The effects of dose, dose rate, age and time on the changes induced in the beagle skeleton with body burdens of $^{90}\text{Sr} + ^{90}\text{Y}$ or ^{226}Ra are examined. The relative effects of $^{90}\text{Sr} + ^{90}\text{Y}$ and ^{226}Ra in beagles are compared. Implications of the extrapolation of experimental animal data to man are discussed.

- 1447 RELATIONSHIP BETWEEN CHANGES IN THE HYDROXYPROLINE AND LIPID CONTENT OF RAT LUNGS AND THE AMOUNT OF PLUTONIUM ADMINISTERED. Surina, A.G. Radiobiologiya; 16: No. 3, 344-347 (May 1976). (In Russian).

Inhalation of a polymer plutonium (0.11, 0.37 and 0.64 curie) increased the content of hydroxyproline, total lipids and phospholipids in lungs. The extent of the increase and the time of its manifestation were determined by the amount of α -radiator administered. An increase in the lipid level detected after seven days preceded the increase of the hydroxyproline content in the lungs which was maximum for one or two months after the administration of the isotope.

- 1448 TRITIUM CONCENTRATION IN URINE AND BLOOD OF AUSTRIAN RESIDENTS. Irlweck, K.; Teherani, D.K. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Health Phys.; 30: No. 5, 407-409 (May 1976).

The results of an investigation which has been carried out into tritium concentrations in urine and blood samples of occupationally non-exposed persons in Austria, are reported. Results are shown tabulated. Values for concentrations of tritiated water in urine samples varied from 0 to almost 10 pCi HTO/ml. An arithmetic mean of measurements on 20 persons was found to be 3.7 ± 2.6 pCi HTO/ml urine. Concentrations of total tritium in blood samples seem to be somewhat higher. An arithmetic mean of investigations on 15 persons was 10.7 ± 5.8 pCi T/ml blood. These results are discussed.

- 1449 TRAINING OF SKIN DECONTAMINATION AND ITS RESULTS. Yasunaka, H. (Japan Atomic Energy Research Inst., Qarai, Ibaraki. Qarai Research Establishment); Wadachi, Yoshiki. Nippon Genshiryoku Gakkaishi; 18: No. 5, 286-291 (May 1976). (In Japanese).

In the nuclear power and radioisotope handling facilities, one of the most important problems is a radioactive contamination on skin. Hand skin contamination occurs very often in the operation area and such surface contamination must be removed as soon as possible to prevent an internal contamination. From 1967 to 1975, training courses for skin decontamination had been held with total 536 of trainee based on the radiation protection manual at the Qarai Research Establishment of JAERI. In the training courses, fresh pig skin samples used instead of human skin were contaminated with ^{137}Cs , ^{131}I , ^{85}Sr , ^{60}Co , ^{144}Ce , ^{88}Y , ^{239}Pu , fission products and activated metal corrosion particles, respectively. These samples were washed

practically by each trainee with the skin decontamination method recommended in the manual. Results obtained in the training show that such training itself is a significant work and this skin decontamination method is an excellent first aid.

- 1450 BIOLOGY AND TOXIC ACTION OF PLUTONIUM AND TRANSPUTONIUMS. Nenot, J.C.; Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Rev. Gen. Nucl.; No. 3, 229-232 (May-Jun 1976). (In French).

From One-day meeting on the ecology and toxicology of plutonium and transplutonium elements; Paris, France (11 Mar 1976).

The metabolism of plutonium and transplutoniums both in inhalation cases and in the case of a contaminated injury is analyzed. Having evoked the different therapeutic methods, the toxic action of plutonium is studied and more particularly the specific problems of the 'hot point' and the mechanism of slight doses.

- 1451 RETENTION AND SKELETAL DOSIMETRY OF INJECTED ^{226}Ra , ^{228}Ra , AND ^{90}Sr IN BEAGLES. Lloyd, R.D.; Mays, C.W.; Atherton, D.R.; Taylor, G.N.; Van Dilla, M.A. (Univ. of Utah, Salt Lake City). Radiat. Res.; 66: No. 2, 274-287 (May 1976).

Total-body retention has been determined by in vivo counting in beagles injected with ^{226}Ra (125 dogs), or ^{228}Ra (78 dogs), or ^{90}Sr (96 dogs). The radionuclides were administered intravenously in a citrate buffer solution when the animals were about 1.4 years of age. Retention measurements now extend to more than 14 years after injection; therefore, future revision of these retention equations appears unlikely since the median lifespan in our control beagles is about 12.7 years. Dogs injected with about 10 μCi $^{226}\text{Ra}/\text{kg}$ had a higher long-term retention than those receiving 0.04 to about 4 μCi $^{226}\text{Ra}/\text{kg}$. The ^{228}Ra retention data were not analyzed numerically, but visual inspection of the curves prepared for individual dogs indicated that ^{228}Ra retention could be described adequately by the retention equation derived for dogs given 0.04 to 4 μCi $^{226}\text{Ra}/\text{kg}$. The average skeletal radiation dose rate and cumulative radiation dose were calculated for each beagle injected with ^{226}Ra , ^{228}Ra , or ^{90}Sr using the appropriate retention equation, normalized to each dog's individual retention measurements. Allowance was made in the ^{226}Ra calculations for the changing skeletal retention of ^{222}Rn and its radioactive daughters; in the ^{228}Ra calculations for the diminution of ^{228}Ra activity by radioactive decay as well as for the ingrowth and skeletal retention of ^{228}Th and its radioactive daughters; and in the ^{90}Sr calculations for the diminution of ^{90}Sr concentration by radioactive decay and the escape of β -energy from bone. The half-time (4621 days) of the longest-lived component in the ^{90}Sr retention equation was similar to that for the lower-level Ra dogs. This may reflect the net remodeling rate of cortical bone in the beagle skeleton.

- 1452 (UCRL--52000-76-5, pp 26-31) ENERGY TECHNOLOGY AND THE GENOME. May 1976.

Energy and technology review.

In pursuing our goal of understanding the effects of energy-related effluents on man and the environment, we are studying mutagenesis: injury to the genome. Our work in mutagenesis has involved basic research into the organization of the genome--the cell's genetic

material--and its major constituent DNA. For several years, we have studied intensively the remarkable DNA of the kangaroo rat. These studies have provided a rich source of insight into how DNA is organized, giving us a better understanding of how mutagens act in man and other organisms.

- 1453 (DOCKET-50293--644) PILGRIM NUCLEAR POWER STATION, UNIT 1. LICENSE APPLICATION, FSAR, AMENDMENT 38. (Boston Edison Co., Mass. (USA)). 30 Apr 1976. 77p.

FSAR Amendment 38; emergency plan. PILGRIM-1 REACTOR; EMERGENCY PLAN; OPERATION; HOSPITALS; RADIATION DOSES; PERSONNEL; SECURITY; RADIATION ACCIDENTS; REACTOR ACCIDENTS

- 1454 (ORO--2401-94) RADIOISOTOPE STUDIES UTILIZING A LOW LEVEL WHOLE BODY COUNTER AND CLINICAL APPLICATIONS OF ACTIVATION ANALYSIS. PROGRESS REPORT. Brill, A.B. (Vanderbilt Univ., Nashville, Tenn. (USA). Medical Center). 30 Apr 1976. 70p. Dep. NTIS \$4.50.

Design modifications in radioisotope scanners are discussed. Studies on the radiation dose distribution in patients from / sup 90mTc-albumin microspheres in the lungs, ⁵⁹Fe-citrate, ¹³¹I-hippuran in kidney transplants, and /sup 99mTc-pyrophosphates are reported. Data on the levels of fallout ¹³⁷Co in normal individuals during 1975, as measured by whole-body counting, are reported. Results of studies on iodine metabolism in patients with hyperthyroidism and with T₃-thyrotoxicosis during ¹³¹I therapy with activities up to 17 mCi showed that the apparent volumes of distribution for different iodine compounds do not change appreciably during therapy in this dose range. Methods are described for measuring the content of Ca alone and Ca and P in bone tissues by transmission scanning using a ²⁵²Cf neutron source for activation of Ca and P. (CH)

- 1455 (DOCKET-50245--769) MILLSTONE NUCLEAR POWER STATION, UNIT 1. IE INSPECTION REPORT NO. 76-04 AND CORRESPONDENCE. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 28 Apr 1976. 16p.

Inspection of radiation protection program, records, and equipment. MILLSTONE-1 REACTOR; INSPECTION; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES; RADIATION MONITORS; DOCUMENTATION; EQUIPMENT

- 1456 (COO--2783-1) PHYSIOPATHOLOGY OF BLOOD PLATELETS AND DEVELOPMENT OF PLATELET SUBSTITUTES. PROGRESS REPORT, AUGUST 1, 1975--JULY 31, 1976. Baldini, M.G. (Brown Univ., Providence, R.I. (USA)). 28 Apr 1976. Contract E(11-1)-2783. 27p. Dep. NTIS \$4.00.

Progress is reported on studies on the physiology of blood platelets in thrombocytopenic patients and rabbits. Methods for the detection of platelet antibodies and the preservation of platelets in vitro were investigated. Studies on the effect of low doses of x irradiation (up to 1000 R) on platelet function indicate that platelets exposed to ionizing radiation have increased functional activity. A list is included of publications that report the results of the studies in detail.

- 1457 (DOCKET-50305--407) KEWAUNEE NUCLEAR POWER PLANT, UNIT 1. ADDITIONAL INFORMATION RE EXPOSURE OF INDIVIDUALS TO AIRBORNE RADIOACTIVE MATERIAL. (Wisconsin Public Service Corp., Green Bay (USA)). 23 Apr 1976.

6p.

Additional information re exposure of individuals to airborne radioactive material. KEWAUNEE REACTOR; PERSONNEL; RADIATION DOSES

- 1458 (DOCKET-50305--450) KEWAUNEE NUCLEAR POWER PLANT, UNIT 1. INFORMATION RE THE EXPOSURE OF AN INDIVIDUAL TO RADIOACTIVE MATERIAL. (Wisconsin Public Service Corp., Green Bay (USA)). 23 Apr 1976. 5p.

Exposure of an individual to radioactive material. KEWAUNEE REACTOR; PERSONNEL; FASTENERS; DECONTAMINATION; RADIATION DOSES; COBALT 58; MANAGEMENT; CONTROL; RESPIRATORS; PRESSURE VESSELS; CLEANING

- 1459 INDUCTION OF STABLE PROTEIN-DEOXYRIBONUCLEIC ACID ADDUCTS IN CHINESE HAMSTER CELL CHROMATIN BY ULTRAVIOLET LIGHT. Strniste, G.F.; Rall, S.C. (Los Alamos Scientific Lab., NM). Biochemistry; 15: No. 8, 1712-1719 (20 Apr 1976).

Ultraviolet (uv)-light-mediated formation of protein-DNA adducts in Chinese hamster cell chromatin was investigated in an attempt to compare chromatin alterations induced in vitro with those observed in vivo. Three independent methods of analysis indicated stable protein-DNA associations: a membrane filter assay which retained DNA on the filter in the presence of high salt-detergent; a Sepharose 4B column assay in which protein eluted coincident with DNA; and a CsCl density gradient equilibrium assay which showed both protein and DNA banding at densities other than their respective native densities. Treatment of the irradiated chromatin with DNase provided further evidence that protein-DNA and not protein-protein adducts were being observed in the column assay. There is a fluence-dependent response of protein-DNA adduct formation when the chromatin is irradiated at low ionic strength and is linear for protein over the range studied. When the chromatin is exposed to differing conditions of pH, ionic strength, or divalent metal ion concentration, the quantity of adduct formed upon uv irradiation varies. Susceptibility to adduct formation can be partially explained in terms of the condensation state of the chromatin and other factors such as rearrangement, denaturation, and dissociation of the chromatin components. Besides providing information on the biological significance of these types of uv-induced lesions, this technique may be useful as a probe of chromatin structure.

- 1460 RADIATION EXPOSURE DURING CARDIAC CATHETERISATION. Lloyd, D.C.; Cooper, S.J.; Wall, B.F. (National Radiological Protection Board, Harwell (UK)). Lancet; 1: No. 7964, 854-855 (17 Apr 1976).

Letter to the editor.

BIOLOGICAL INDICATORS; BIOMEDICAL RADIOGRAPHY; CHROMOSOMAL ABERRATIONS; DICENTRIC CHROMOSOMES; DOSE-RESPONSE RELATIONSHIPS; IN VIVO; INFANTS; LYMPHOCYTES; RADIATION INJURIES; RADIOSENSITIVITY; X RADIATION; RADIOINDUCTION

- 1461 (DOCKET-50255--725) PALISADES NUCLEAR PLANT. IE INSPECTION REPORT NO. 76-09. (Consumers Power Co., Jackson, Mich. (USA)). 15 Apr 1976. 15p.

Inspection of radiation protection program. PALISADES-1 REACTOR; INSPECTION; RADIATION PROTECTION; RESPIRATORS; EDUCATION; PERSONNEL; RADIATION DOSES; CONTAMINATION; COBALT 60; COBALT 58; CESIUM 137; CESIUM 134; IODINE 131; ZINC 65; WHOLE-BODY COUNTING

- 1462 STUDY OF HAEMOPOIETIC MICROENVIRONMENT IN VITRO. van Zant, G.E.; Goldwasser, E.; Baron, J.M. Nature (London); 260: No. 5552, 609-611(15 Apr 1976).

The data presented here permit several conclusions with respect to an understanding of the haemopoietic inductive microenvironment. The role of the spleen in promoting erythropoiesis of mouse bone marrow cells can be studied in vitro. Two different mechanisms seem to augment haemoglobin synthesis by splenic tissue. One concerns the existing level of haemoglobin formation by normal marrow cells; the second concerns the increase in response to added erythropoietin. The action of normal spleen cells on baseline haemoglobin synthesis can be duplicated partially by cells which have been frozen rapidly and thawed, making it likely to be an effect of a cell constituent rather than of viable cells. Mouse spleen cells can affect the baseline haemoglobin synthesis of rat marrow cells. The action of either normal spleen cells or cells from the spleens of irradiated mice potentiates the action of erythropoietin or haemoglobin synthesis, but this effect is restricted to intact cells.

- 1463 (BNWL-SA--5644) PERSONNEL PROTECTION ASPECTS OF X-RAY DIFFRACTION APPARATUS. Waite, D.A.; McClelland, T.W.; Bramson, P.E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Apr 1976. Contract E(45-1)-1830. 13p. (CONF-760525--2). Dep. NTIS \$3.50.

From American industrial hygiene conference; Atlanta, GA, USA (16 May 1976).

The objective of radiation safety is to keep radiation exposure of man to an acceptable level without imposing undue restriction upon the use of radiation concerned. Meeting this objective may involve many considerations. This discussion will attempt to outline, from a health physics viewpoint, considerations in radiation safety in using x-ray diffraction equipment. Important considerations in keeping exposures to a practicable minimum may be categorized into several general groups including: equipment and facility configurations; equipment operational characteristics; radiological evaluation; and operator training.

- 1464 (DOCKET-50315--481) DONALD C. COOK NUCLEAR POWER PLANT, UNIT 1. IE INSPECTION REPORT NO. 75-22 AND REPLY. (Indiana and Michigan Power Co., New York (USA)). 9 Apr 1976. 13p.

Inspection of plant, personnel radiation overexposure, and failure of steam generator feedwater line hydraulic snubber. COOK-1 REACTOR; INSPECTION; CONTAINMENT; PERSONNEL; RADIATION DOSES; CLEANING; RADIATION PROTECTION; STEAM GENERATORS; FEEDWATER; PIPELINES; RESTRAINTS; SHOCK ABSORBERS; FAILURES

- 1465 (PB--253790) SPECIAL LISTING OF CURRENT CANCER RESEARCH ON OCCUPATIONAL CARCINOGENESIS AND RELATED STUDIES. (Smithsonian Science Information Exchange, Inc., Washington, D.C. (USA). Current Cancer Research Project Analysis Center). 9 Apr 1976. 22p. NTIS \$3.50.

Included are projects on cancer related to minerals and inorganic materials, industrial organic chemicals, occupational radiation hazards, and other specific occupational hazards as well as broad surveys and epidemiological studies of occupational carcinogenesis. The listed projects are indexed by research area and by investigator. (GRA)

- 1466 (DOCKET-50293--642) PILGRIM NUCLEAR POWER STATION, UNIT 1. IE INSPECTION REPORT NO. 76-03 AND NOTICE OF VIOLATION. (Boston Edison Co., Mass. (USA)). 5 Apr 1976. 14p.

Inspection of radiological protection during refueling outage. PILGRIM-1 REACTOR; INSPECTION; PERSONNEL; RADIATION DOSES; REACTOR FUELING; RADIATION PROTECTION; VENTILATION; FLOW RATE; RADIATION MONITORS; PERSONNEL; PROTECTIVE CLOTHING; RESPIRATORS; AIR SAMPLERS; SOLID WASTES; TRANSPORT; RADIOACTIVE EFFLUENTS; STACKS

- 1467 (DOCKET-50213--499) HADDAM NECK PLANT. ANNUAL REPORT, 1975, ERRATA. (Connecticut Yankee Atomic Power Co., Hartford (USA)). 1 Apr 1976. 3p.

Annual report, 1975, errata; radiation exposure summary. CONNECTICUT YANKEE REACTOR; PERSONNEL; RADIATION DOSES; REACTOR OPERATION

- 1468 (DOCKET-50341--164) ENRICO FERMI ATOMIC POWER PLANT, UNIT 2. SUMMARY OF A MEETING HELD ON FEBRUARY 18, 1976 RE EMERGENCY AND INDUSTRIAL SECURITY PLANNING. (Detroit Edison Co., Mich. (USA)). 1 Apr 1976. 3p.

Summary of a meeting held on February 18, 1976 re emergency and industrial security planning. ENRICO FERMI-2 REACTOR; MEETINGS; EMERGENCY PLAN; SECURITY; ACCIDENTS; RADIATION ACCIDENTS; RADIATION MONITORS; ALARM SYSTEMS; RADIATION DOSES; METEOROLOGY; BUILDINGS; PERSONNEL

- 1469 (PB--253670) ADMINISTRATION OF THE RADIATION CONTROL FOR HEALTH AND SAFETY ACT OF 1968. PUBLIC LAW 90-602, APRIL 1, 1976. ANNUAL REPORT 1 JAN-31 DEC 75. (Bureau of Radiological Health, Rockville, Md. (USA)). 1 Apr 1976. 102p. (FDA/BRH--76/85). NTIS \$5.50.

See also PB-244 781..

Contents: Report by subject area. Appraisal of incidence of biological injury and effects; List of radiation control standards; Evaluation of observance of applicable standards; Summary of outstanding problems; Analysis and evaluation of research activities and technological progress; Completed or pending judicial actions; Dissemination of technical and consumer-oriented information; Cooperation between government and industry and other interested parties; Recommendations for legislation. (GRA)

- 1470 IS CHROMATID-TYPE DAMAGE IN ATAXIA TELANGIECTASIA AFTER IRRADIATION AT G₀ A CONSEQUENCE OF DEFECTIVE REPAIR. Taylor, A.M.R.; Metcalfe, J.A.; Oxford, J.M.; Harnden, D.G. (Birmingham Univ. (UK)). Nature (London); 260: No. 5550, 441-443(1 Apr 1976).

Letter to the editor.

BIOLOGICAL RADIATION EFFECTS; BIOLOGICAL REPAIR; CELL CYCLE; CHROMATIDS; CHROMOSOMAL ABERRATIONS; DNA; FIBROBLASTS; LYMPHOCYTES; PATIENTS; RADIOSENSITIVITY; SKIN; TELANGIECTASIS; X RADIATION; RADIOINDUCTION

- 1471 (PB--252670) RADIATION SURVEY IN BEATTY, NEVADA, AND SURROUNDING AREA (MARCH 1976). FINAL TECHNICAL NOTE. Hendricks, D.W.; Fort, C.W. Jr. (Environmental Protection Agency, Las Vegas, Nev. (USA). Office of Radiation Programs). Apr 1976. 53p. (ORP/LV--76-1). NTIS \$4.50.

At the request of the State of Nevada, a radiation survey was initiated in the Beatty, Nevada, area on March 10, 1976, to identify and locate radioactive materials which might have

been removed from the Nuclear Engineering Company low-level radioactive waste burial site located near Beatty. Approximately 280 locations including dwellings, storehouses, schools, saloons, hotels, motels, businesses, ranches, and mines were inspected. Seventeen residences in Beatty and the surrounding area were identified where the sole radioactive items found were radium-dial clocks, compasses, and instrument gauges which had been distributed from the burial site. An additional 25 locations were identified where other radioactive items originating from the Beatty site were found. Radiation exposures to persons possessing the various radioactive materials appear to have been generally and fortuitously minimal. (GRA)

- 1472 RADIOPROTECTION OF X RAYS GENERATORS AT C.E.N. SACLAY. Vialettes, H.; Petit, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Protection contre les Rayonnements). Rayonnem. Ionis. Tech. Mes. Prot.; No. 2, 55-58 (Apr 1976). (In French).

From Meeting on radioprotection; Tunis, Tunisia (25 Mar 1976).

The use of x-ray generators involves radiation hazards which are not negligible, because beam dose rates are very high. The use of suitable protection, the improvement of working conditions, and the education of workers reduce these hazards to an acceptable level.

- 1473 RADIOLOGICAL SIGNIFICANCE OF SOME LONG-LIVED NUCLIDES DISCHARGED TO THE ENVIRONMENT FROM THE NUCLEAR POWER INDUSTRY. Kelly, G.N.; Morley, F. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 15, 8-10 (Apr 1976).

A summary is given of the main features and conclusions of a report on predicted radiation exposure resulting from nuclear power plant effluents published recently by the Health Protection Directorate of the Commission of the European Communities. The sources of production, radiation exposures of populations, and the collective dose commitments from these isotopes are considered both in terms of European Community production and global circulation of activity. Environmental inventories of carbon-14 and tritium also depend on cosmic ray interactions and nuclear weapons testing. The dose from carbon-14 could even be reduced from its present level if the burning of more fossil fuels increases the inventory of carbon-12. Although effort is already being directed towards reducing discharges from the nuclear power industry, these estimates show that radiation exposures resulting from discharges of all four nuclides are trivial in relation to both natural background radiation and ICRP dose limits.

- 1474 RADIATION PROTECTION IN NUCLEAR POWER PLANTS. Beau, P. (Electricite de France, 75 - Paris). Mediterr. Med.; No. 98, 105-106, 108-110, 112-113 (Apr 1976). (In French).

The organization of workers' protection in a nuclear power plant is stated. Considering the nature and magnitude of potential risks and protection procedures, an inventory of occupational safety is made, taking account of accident statistics. It shows the credit to nuclear energy can be granted to occupational safety.

- 1475 (LA--6313-PR, pp 15-24) INDUSTRIAL HYGIENE GROUP. Apr 1976.

Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January--December 1975.

Inhalation is the most likely and potentially hazardous route for exposure to environmental pollutants, and developmental studies of filter efficiency, particle production characterization, and resuspension are being conducted to define proper containment conditions in the work place. To date, these studies have emphasized containment and characterization of radionuclides but provide the basis for investigating a broader spectrum of industrial pollutants. To determine the extent of plutonium exposure in man, several coordinated studies also are being conducted to measure lung burden distribution in occupationally exposed populations, the amount of plutonium in tissues from the general population, the health of LASL plutonium workers, and assessment of the health impact of plutonium in the environment.

- 1476 (BNWL--1979) ENVIRONMENTAL SURVEILLANCE AT HANFORD FOR CY-1975. Speer, D.R.; Fix, J.J.; Blumer, P.J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1976. Contract E(45-1)-1830. vp. Dep. NTIS \$6.00.

Environmental data collected during 1975 showed continued compliance of Hanford operations with all state and federal regulations. Levels of radioactivity in the atmosphere at all offsite sampling locations were indistinguishable from levels due to natural causes and worldwide fallout. Radiological, chemical, biological, and physical analyses of Columbia River water of the Hanford Reservation did not show any identifiable effect due to Hanford operations with the exception of temperature. The majority of radioactivity measured in foods was the result of naturally occurring ^{40}K and the fallout radionuclides ^{90}Sr and ^{137}Cs . External radiation levels in the Hanford environs were measured by thermoluminescent dosimeters deployed at 17 different locations, TLDs immersed in the Columbia River at four locations, and several portable instrument surveys. The total background dose was estimated to be approximately 100 m rem/yr. Radioactivity in wildlife, oysters, sediment in the Columbia River, and on the islands from past once-through cooling production reactor operations was also evaluated. The total body dose to the population received during 1975 and the 50-yr dose commitment received from effluents released during 1975 were estimated to be 0.93 and 1.5 man-rem, respectively. (HLW)

- 1477 (EMSL-LV--539-4) ENVIRONMENTAL MONITORING REPORT FOR THE NEVADA TEST SITE AND OTHER TEST AREAS USED FOR UNDERGROUND NUCLEAR DETONATIONS, JANUARY--DECEMBER 1975. (Environmental Protection Agency, Las Vegas, Nev. (USA). Environmental Monitoring and Support Lab.). Apr 1976. 104p. Dep. NTIS \$5.50.

During 1975, the monitoring of gamma radiation levels in the environs of the NTS was continued through the use of an off-site network of radiation dosimeters and gamma-rate recorders. Concentrations of radionuclides in pertinent environmental media were also continuously or periodically monitored by established air, milk, and water sampling networks. Before each underground nuclear detonation, mobile radiation monitors, equipped with radiation monitoring instruments and sampling equipment, were on standby in off-NTS locations to respond to any accidental release of airborne radioactivity. An airplane was

airborne near the test area at detonation time to undertake tracking and sampling of any release which might occur. A total of about 22 curies (Ci) of radioactivity, primarily radioxenon, was reported by ERDA/NV as being released intermittently throughout the year. The only off-NTS indications of this radioactivity from test operations were low concentrations of xenon-133, krypton-85, and tritium (hydrogen-3) in various combinations, measured in air samples collected at Beatty, Diablo, Hiko, Indian Springs, and Las Vegas, Nevada. The concentrations at these locations when averaged over the year were less than 0.01 percent of the Concentration Guide of 1×10^{-7} microcuries per millilitre ($\mu\text{Ci}/\text{ml}$) as listed in the ERDA Manual, Chapter 0524, for exposure to a suitable sample of the population. Based upon time-integrated concentrations of the nuclides at these locations, dose calculations, and population information, the whole-body gamma dose commitment to persons within 80 km of the NTS Control Point for test operations during this year was estimated to be 0.00065 man-rem. The highest dose commitment, *0.062 man-rem occurred beyond 80 km of NTS at Las Vegas, Nevada, a location with a much higher population density than any within 80 km of NTS.

- 1478 (LA--6321-MS) ENVIRONMENTAL SURVEILLANCE AT LOS ALAMOS DURING 1975. Apt, K.E.; Lee, V.J. (comps.). (Los Alamos Scientific Lab., N.Mex. (USA)). Apr 1976. Contract W-7405-ENG-36. 57p. Dep. NTIS \$4.50.

This report documents the CY 1975 environmental monitoring program of the Los Alamos Scientific Laboratory (LASL). Data are presented for concentrations of radioactivity measured in air, ground and surface waters, sediments, soils, and foodstuffs, and are compared with relevant U.S. Energy Research and Development Administration guides and/or data from other reporting periods. Levels of external penetrating radiation measured in the LASL environs are given. The average whole-body radiation dose to residents of Los Alamos County resulting from LASL operations is calculated. Chemical qualities of surface and ground waters in the LASL environs have been determined and compared to applicable standards. Results of related environmental studies are summarized.

- 1479 (LBL--4678) ENVIRONMENTAL SURVEILLANCE PROGRAM OF THE LAWRENCE BERKELEY LABORATORY AND ANNUAL ENVIRONMENTAL MONITORING REPORT OF THE LAWRENCE LIVERMORE LABORATORY FOR THE CALENDER YEAR 1975. Thomas, R.H. (ed.). (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1976. Contract W-7405-ENG-48. 142p. Dep. NTIS \$6.00.

The major radiological environmental impact of the Lawrence Berkeley Laboratory is due to the operation of four particle accelerators in the pursuit of fundamental research in various disciplines including biology, chemistry, medicine, and physics. Potential sources of population exposure at the Laboratory are discussed. The major source of population exposure due to accelerator operation arises from the prompt radiation field which consists principally of neutrons and photons. Release of small quantities of radionuclides is also a potential source of population exposure but is usually an order of magnitude less significant. Accelerator produced radiation levels at the Laboratory boundary are comparable with the magnitudes of the fluctuations found in the natural background radiation. Considerable effort has, therefore, been expended in

understanding the magnitude of the components of natural background at the Lawrence Berkeley Laboratory, so that the magnitude of Laboratory produced radiation may be accurately determined. Environmental monitoring of accelerator-produced radiation and of radionuclides is carried on throughout the Laboratory, at the Laboratory perimeter, and in the regions surrounding the Laboratory. The techniques and models used to calculate population exposure are described and discussed. (auth)

- 1480 EMERGENCY REFERENCE LEVELS FOR REACTOR ACCIDENTS. A RE-EXAMINATION OF THE WINDSCALE REACTOR ACCIDENT. Baverstock, K.F.; Vennart, J. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). Health Phys.; 30: No. 4, 339-344(Apr 1976).

Application of the data in the Medical Research Council (1975) report on 'Criteria for Controlling Radiation Doses to the Public after Accidental Release of Radioactive Material' to the circumstances of the Windscale reactor accident, confirms the views held at the time of the accident that ^{131}I was the most important radionuclide concerned, especially with respect to its ingestion in milk by infants, and that control of milk distribution would significantly reduce its effects. Estimates of dose in thyroids using data in the report and activities of ^{131}I in air, on pasture and in milk measured at the time of the accident agree well with those made from direct measurements of the activities of ^{131}I in human thyroids. It is shown that the dose resulting from ingestion of ^{89}Sr , ^{90}Sr , ^{131}I and ^{137}Cs in milk can be many times greater than from inhalation of these radionuclides after their accidental release to the environment. This has an important bearing on the siting of nuclear reactors in relation to milk producing areas.

- 1481 GENERAL POPULATION EXPOSURE OF STABLE LEAD AND ^{210}Pb TO RESIDENTS OF NEW YORK CITY. Bogen, D.C.; Welford, G.A.; Morse, R.S. (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). Health Phys.; 30: No. 4, 359-362(Apr 1976).

Brief note.

AIR; BIOLOGICAL MATERIALS; CHRONIC INTAKE; DIET; EXCRETION; INHALATION; LEAD; LEAD 210; NEW YORK CITY; RADIATION DOSES; RADIONUCLIDE KINETICS; URBAN POPULATIONS; WATER; RADIATION MONITORING; MAN; RADIOACTIVITY

- 1482 (SAND--76-0209) ENVIRONMENTAL MONITORING REPORT, SANDIA LABORATORIES 1975. Holley, W.L.; Simmons, T.N. (Sandia Labs., Albuquerque, N.Mex. (USA)). Apr 1976. Contract AT(29-1)-789. 22p. Dep. NTIS \$3.50.

Water and vegetation are monitored to determine Sandia Laboratories impact on the surrounding environment. Nonradioactive pollutants released are reported. Radioactive effluents are also reported and their person-rem contribution to the population is calculated.

- 1483 HEMATOMA INDUCED BY THORIUM DIOXIDE. Mann, N.S.; Chaudhry, A.; Thaler, S.; Sachdev, A. (Veterans Administration Hospital, Louisville, KY). South. Med. J.; 69: No. 4, 510-512(Apr 1976).

A 74-year-old man complained of anorexia and weight loss. Twenty-six years earlier he had received an injection of Thorotrast. A needle biopsy of the liver showed thorium dioxide granules and periportal fibrosis. On

laparotomy, a hepatoma of the left lobe of the liver was discovered. Hepatic malignancy should be suspected in any patient with abnormal results of liver function tests, particularly an elevated level of alkaline phosphatase, who previously has had an injection of Thorotrast.

- 1484 RADIONUCLIDE ANGIOGRAPHY. Muroff, L.R.; Freedman, G.S. (Univ. Community Hospital, Tampa, FL). Semin. Nucl. Med.; 6: No. 2, 217-230(Apr 1976).

Radionuclide angiography is an established, widely used diagnostic tool. It is safe, easy to perform, and the low patient radiation dose makes frequent follow-up studies feasible. High-quality scintiscans have contributed to the widespread clinical acceptance of the procedure. The areas of application include virtually every organ of the body. In the brain, abnormalities in cerebral perfusion may be detected with this technique. Hepatic and renal tumors can be differentiated from cysts with radionuclide angiography. Its application to cardiology is achieving rapid growth and acceptance in both congenital and acquired heart disease.

- 1485 THE EFFECT OF COMBINED TREATMENT WITH A PLATINUM COMPLEX AND IONIZING RADIATION ON CHINESE HAMSTER OVARY CELLS IN VITRO. Szmiel, I.; Nias, A.H.W. (Belvidere Hospital, Glasgow (UK)). Br. J. Cancer; 33: No. 4, 450-458(Apr 1976).

Cis-dichlorobis(cyclopentylamine)platinum II (DBCP) belongs to the group of platinum complexes which have recently been reported to have anti-tumour activity. Its cytotoxic activity in CHO cells was not cell-age-dependent, but enhancement of the effect of ionizing radiation was both dose- and cell cycle phase-dependent. In asynchronous cell populations DBCP acted as a dose-modifying factor for ionizing radiation. Doses of DBCP reducing survival of CHO cells to 26% and 4% applied 1 h before irradiation reduced the D_0 value of radiation dose-survival curves by factors of 1.34 and 1.59 respectively. In synchronized CHO populations enhancement by DBCP of the effect of radiation was most pronounced in G_1 and in late S while it was reduced in mid-S. Possible mechanisms of DBCP-radiation interaction are discussed.

- 1486 LINEAR DOSE-RESPONSE RELATIONSHIPS AFTER PROLONGED EXPRESSION TIMES IN V-79 CHINESE HAMSTER CELLS. Zeeland, A.A. van; Simons, J.W.I.M. (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese). Mutat. Res.; 35: No. 1, 129-137(Apr 1976).

The expression time for induced mutants resistant to 6-thioguanine, in V-79 Chinese hamster cells, was determined by rescreening the cells in the selective medium at various times after treatment. The length of the expression time for mutants induced by X-rays, ethyl methane sulphonate and ultraviolet irradiation was dose dependent. For the highest dose used this was 7 to 8 days, beyond which there was no further change in mutant frequency. The dose-response relationship of these agents does not appear to deviate from linearity; this permits the calculation of mutation rate per unit dose. For X-rays, this value was 1.35×10^{-7} per rad per locus, for ethyl methane sulphonate, 2.2×10^{-2} per mole per locus and for ultraviolet irradiation, 6.3×10^{-6} per erg per mm^2 per locus. The effectiveness of the 3 different mutagens for the induction of mutations was compared by calculating the increase in mutant frequency

per unit of decrease in survival (D_0). These increments in frequency were: 5.6×10^{-5} for X-rays, 69.5×10^{-5} for ethyl methane sulphonate and 16.6×10^{-5} for ultraviolet irradiation.

- 1487 (AD-A--025756) ADJOINT MONTE CARLO GENERATED RADIATION RESPONSE FUNCTIONS FOR THE B-1 AIRCRAFT. FINAL REPORT. Alexander, A.J. (Air Force Weapons Lab., Kirtland AFB, N.Mex. (USA)). Apr 1976. 53p. (AFWL-TR--76-6). NTIS \$4.50.

The adjoint Monte Carlo radiation transport technique is used to calculate radiation response functions for the B-1 aircraft. These radiation response functions are given for the neutron dose and also for the neutron plus the secondary gamma dose. The response functions are given for the head and stomach positions of the left front crew member. They can be folded with any angle and energy dependent neutron and/or gamma ray free field exposure to give the radiation dose. The MORSE multigroup, coupled neutron-gamma ray, Monte Carlo code is used for the adjoint transport in the B-1 aircraft which is modeled with combinatorial geometry. The theory and equations needed to evaluate the coupling integral in terms of the statistical weight of the adjunction on the coupling surface are developed. (GRA)

- 1488 (FDA--76-8034) GONAD DOSES AND GENETICALLY SIGNIFICANT DOSE FROM DIAGNOSTIC RADIOLOGY: U.S., 1964 AND 1970. (Bureau of Radiological Health, Rockville, Md. (USA)). Apr 1976. 62p. GPO \$1.30.

In 1970, the United States Public Health Service conducted a nationwide study of population exposure to medical and dental x-ray examinations. In order to assess the change in radiologic practice, the results of this study were compared to the results of a similar study conducted in 1964. Data from these studies have been used to calculate mean gonad dose per examination and the Genetically Significant Dose (GSD) from medical radiographic examinations by age, sex, and type of examination for 1964 and 1970. The GSD was 17 mrad for 1964 and 20 mrad for 1970. The largest statistically significant increase in mean gonad dose per examination from 1964 to 1970 occurred for barium enema examinations of females (578 mrad to 903 mrad), and the largest statistically significant decrease for the same period occurred for intravenous or retrograde pyelogram examinations of males (537 mrad to 207 mrad). Eight other statistically significant changes in mean gonad dose per examination were observed. The difference between the estimated Genetically Significant Dose of 17 mrad in 1964 and 20 mrad in 1970 is not statistically significant.

- 1489 (FS--75-12-T, pp 70-83) RELATIONS BETWEEN PERSONNEL DOSE AND BODY OR ORGAN DOSES. Drexler, G.; Kramer, R. Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

9 figs.; 2 tabs.; 19 refs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

Correlations personnel dose-body dose are possible. The influence of all irradiation parameters can be investigated with the aid of computer simulation. In order that these investigations may be of practical assistance to those responsible for radiation protection, two preconditions have to be fulfilled: 1) Agreement on a standardized phantom with corresponding calculation methods for organ

doses. The differences in mathematical and physical phantoms present difficulties when comparing results. In the ORNL a physical phantom ('MR.ADAM') has been elaborated which is completely identical with the structures of the mathematical 'SnyPh'. The first comparisons between calculation and measurement with this phantom pair have been satisfactory. This is another reason why it is sensible to refer to these phantoms in the future, 2) the determination of body and organ doses with the standard phantom by employing representative irradiation parameters and taking into account the actual body dimensions of the persons irradiated. - Concerning the radiation parameters, it seems wise to choose the surface dose as the dose to be measured, because the measured amount and the place of measurement can be clearly defined and determined. It is conceivable that for certain place-of-work conditions personnel dosimeters are useful which directly signal an organ dose as a result of a built-in sensitivity function, e.g. angular or energy dependence.

- 1490 (FS--75-12-T, pp 400-404) LEGAL BASES FOR INCORPORATION MONITORING IN EUROPEAN COUNTRIES. Jacobs, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

Monitoring personnel exposure. Targets, methods, results and evaluation.

In almost all European countries there are legal stipulations in the respective Atomic Energy Acts or in the ordinances (= Radiation Protection Ordinance) connected with these concerning the measurement of the external exposure of personnel. There is no direct obligation of this kind for the citizen affected concerning the measurement of the radiation load on account of incorporated radioactive substances. As a rule, an obligation to incorporation monitoring can only be derived indirectly from orders by the ministry responsible or the national authorities, from provisions in licences, or from special directions of the supervisory authorities. Such orders, provisions, or directions, however, never turn to the exposed persons, but to those holding the licence. As a result of this situation, one finds in Europe a very unhomogeneous system of practical incorporation monitoring, as was demonstrated by a survey in 16 countries. The selection criteria for laying down the group of persons to be monitored, the way to measure, the frequency of the measurements, the interpretation and documentation of the results of the measurements not only vary from Land to Land but often within one Land from one institution to another.

- 1491 (FS--75-12-T, pp 252-264) WORK PLACE MONITORING AT KARLSRUHE NUCLEAR RESEARCH CENTRE. PROGRAMMES AND FINDINGS. Koenig, L.A. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

1 fig.; 6 tabs.; 8 refs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

A summarizing view is given about the programmes in Karlsruhe nuclear research centre for working-place monitoring (monitoring of personnel doses, dosage, contamination of surfaces and breathing air) and the expenses

necessary for this. The results are statistically evaluated and analyzed. Relationships between results of various measuring methods (e.g. personnel dosimetry and air contamination, surface contamination and incorporation) are explained in detail. Expenditure for working-place monitoring for environmental protection by means of controlling exports is reported on.

- 1492 (FS--75-12-T, pp 54-69) FURTHER DEVELOPMENTS IN PERSONNEL MONITORING WITHIN THE FRAMEWORK OF RADIATION PROTECTION IN NUCLEAR FACILITIES. Kossel, F. (Bundesgesundheitsamt, Neuherberg/Muenchen (Germany, F.R.)). Inst. fuer Strahlenhygiene). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

4 figs.; 7 refs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

It is to be welcomed that the new Radiation Protection Ordinance, in contrast to the regulation valid so far, provides for the possibility to refrain from personnel dose measurements if it can be proved that the activity during the handling of radioactive substances is too low to cause external exposure which exceeds the maximum permissible dose. In these cases, it is often more sensible to make routine examinations of the body or excreta activity in order to make sure that no incorporations were incurred. Results presented demonstrate quite plainly the trend that any financial expense is justified which enables a careful analysis of the cause for a dose which exceeds the limit, something which very seldom occurs. This way, the further development of personnel dose monitoring within the framework of radiation protection in establishments has been rendered an important service.

- 1493 (FS--75-12-T, pp 245-251) SURVEY OF RADIATION DOSES INCURRED BY PERSONS OCCUPATIONALLY EXPOSED TO RADIATION IN SWITZERLAND. Moos, W.S.; Hunzinger, W. (Eidgenoessisches Gesundheitsamt, Bern (Switzerland)). Sektion fuer Strahlenschutz). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

7 tabs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

Survey in tabular form of accumulated average annual doses in the field of medicine, and of dose commitment of various facilities in 1974.

- 1494 (FS--75-12-T, pp 227-244) SCPRI EXPERIENCE IN THE FIELD OF PERSONNEL DOSIMETRY. Moroni, J.P.; Pellerin, P. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

Monitoring personnel exposure. Targets, methods, results and evaluation.

Some aspects, data, and experience on the evaluation of more than 3 million personnel dosimeters in the French Central Radiation Protection Service (SCPRI) are reported. The radiation exposure of monitored employees is determined as 270 mrad, thus the population dose being 0.17 mrad.

1495 (FS--75-12-T, pp 384-393) PRECONDITIONS FOR A CENTRALIZED PERSONNEL DOSE REGISTER. REPORT FROM A TASK GROUP. Nitschke, J.; Platzsch, W. (Bundesgesundheitsamt, Neuherberg/Muenchen (Germany, F.R.)); David, J.; Wachsmann, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.)); Trier, J.O. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). Apr 1976. (In German).
From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

Monitoring personnel exposure. Targets, methods, results and evaluation.

The current organisation of the official determination of the personnel dose leads to difficulties, e.g. in controlling the personnel doses of persons exposed to radiation for professional reasons whose place of employment is frequently changed and in recording the dose cumulated during professional activity. Considering the continuously increasing number of persons monitored, the foundation of a personnel dose register is discussed. The register is to cover the results determined by the official measuring services for all persons monitored by personnel dosimetry. The central recording can help to get rid of the imperfections mentioned in the whole FRG. A centralised registration also facilitates the recording of the radiation load of the population due to professional radiation exposure and the setting up of professional age doses for the various sorts of radiation application as are being required by the scientific committee of the United Nations on the effects of rays. (UNSCEAR).

1496 (FS--75-12-T, pp 276-284) PERSONNEL DOSIMETRY IN THE MEDICAL FIELD. ORGANIZATION AND EXPERIENCE. Pohle, G. (Staedtisches Krankenhaus Moabit, Berlin (Germany, F.R.)). Abt. fuer Strahlungsphysik). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

Monitoring personnel exposure. Targets, methods, results and evaluation.

The organisation and the experiences in the radiation protection surveillance of the personnel in a hospital with more than 1.000 beds is reported. A problem nowadays very interesting for the persons responsible for radiation protection is dealt with several times. Exact personnel monitoring in the controlled area (even for cleaning personnel) with regard to eventual claims for liability.

1497 (FS--75-12-T, pp 491-495) RESULTS OF THE ACTIVITIES OF THE WORKING GROUP 'INCORPORATION MONITORING' WITHIN THE 'FACHVERBAND FUEER STRAHLENSCHUTZ'. Schieferdecker, H. (Kernforschungszentrum Karlsruhe (Germany, F.R.)). Toxikologisches Labor). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

13 refs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

Within the working group 'Incorporation monitoring', persons who are active in this field have exchanged experience and discussed problems. Questions concerning selection criteria, frequency of monitoring measurements, suitable measurement and analysis methods, and interpretation of measured results were discussed, and some results were put down in

writing. Cooperation between the various measuring centres is promoted by regularly carrying out analytical quality control. On the basis of the results achieved so far, the possible future activities of the working group are demonstrated.

1498 (FS--75-12-T, pp 38-44) LEGAL BASIS FOR PERSONNEL DOSIMETRY IN SWITZERLAND. Hunzinger, W.; Moos, W. (Eidgenoessisches Gesundheitsamt, Bern (Switzerland)). Sektion fuer Strahlenschutz). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

5 figs.; 1 ref..

Monitoring personnel exposure. Targets, methods, results and evaluation.

On the basis of a dispute on dosimetry duty for persons occupationally exposed to radiation, the Swiss legal basis for compulsory dosimetry is demonstrated to be obviously insufficient. The views of legal experts on this matter are discussed briefly. The contribution concludes by presenting an improved version of the Radiation Protection Ordinance article in question.

1499 (FS--75-12-T, pp 45-53) SUPERVISION BY THE AUTHORITIES AND ON ACCOUNT OF SOLE RESPONSIBILITY. Kiefer, H. (Kernforschungszentrum Karlsruhe (Germany, F.R.)). Abt. Strahlenschutz und Sicherheit). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

1 fig..

Monitoring personnel exposure. Targets, methods, results and evaluation.

If radiation protection is not to miss its purpose, it has to be preventive. This results in the fact that supervision by the authorities and sole responsibility in preventive radiation protection can only be seen as a common effort, i.e. taking the FRG as an example, on three levels: 1) It is the duty of the Bund to adapt all legal regulations to the existing state of science and technology and to maintain this standard, in order that the statements made therein are clear and that they can be expressed in figures which have to be adapted to the risks and which have to be comparable with other permissible risks, 2) it is the task of the Laender authorities to see that the legal regulations are adhered to in individual cases, i.e. to examine the conformity of applications with existing legal provisions, and above all, to supervise that those responsible for radiation protection have their special qualifications, and that the personnel at their disposal has its equipment, 3) it is the duty of those responsible for radiation protection and their personnel to practice radiation protection in sole responsibility at their place of work and for the environment. Supervision is a success only in the case of each level being first of all its own supervisor, and if there is a constant mutual exchange of experience, as without this exchange each sector lives its own life. The supervision of measurement techniques by the authorities only fulfils its purpose if measurements supplement each other and if work is not done twice. Taking personnel dosimetry, possibilities are presented. However, where measurements are taken it is inevitable that equipment and methods are compared.

1500 (FS--75-12-T, pp 7-37) TARGETS AND

VERIFICATION OF RADIATION PROTECTION MONITORING OF PERSONNEL FROM AN INTERNATIONAL AND NATIONAL POINT OF VIEW. Mehl, J.G. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

20 refs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

The contribution is limited to that part of radiation protection monitoring which covers the recording of radiation exposure to workers by means of radiation measurements. A survey is presented of international recommendations and national regulations. The survey is linked with an analysis of those problems which arise when these recommendations and regulations are carried out. From the analysis, it can be concluded that certain targets should be pondered over again, and the proposal is made to intensify certain R + D activities, which, in the authors's opinion, could lead to improvements in the radiation protection monitoring of workers.

1501 (FS--75-12-T, pp 326-343) CHROMOSOME ABERRATIONS AS A BIOLOGICAL DOSEMETER.

Kemmer, W. (Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.). Inst. fuer Biophysik). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

12 figs.; 11 refs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

Results obtained from experiments carried out in vivo and in vitro (dose effect relations for X-rays, ^{60}Co , neutrons; thorotrast- and ^{131}I -patients, ^{60}Co -body irradiations) are used in discussing the practicability of the method. The method can be improved by a standardized culture- and preparation method, by evaluation of a larger number of metaphase plates, and automatical evaluation of biocytocultures.

1502 (FS--75-12-T, pp 1-6) ICRP-

RECOMMENDATIONS ON DOSE LIMITS FOR WORKERS. Beninson, D.J. (United Nations Scientific Committee on the Effects of Atomic Radiation). Apr 1976.

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

4 figs.; 1 tab..

Monitoring personnel exposure. Targets, methods, results and evaluation.

Dose limits proposed by the ICRP have been incorporated in most national and international standards and their respect has caused a distribution of doses with a average not exceeding 1/10 of the maximum permissible dose. This distribution corresponds to a risk which is well within the risks in 'safe industries'. There are at present some inconsistencies in the current system of recommended limits, for example having the same limit of 5 rem for the whole-body and also for some organs. Hopefully, this inconsistency will be removed in the next recommendation of the ICRP. But the whole-body limit of 5 rem in a year has been safe and there is little ground to reduce this limit on the basis of comparisons with 'safe industries'.

1503 (FS--75-12-T, pp 415-422) EIR CONCEPT

FOR THE COMBINATION OF ORGAN EXPOSURE. Wernli, C. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)).

Abt. Strahlenueberwachung). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

2 figs.; 2 refs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

There are no bases for assessment formulated by the legislator as far as simultaneous internal and external irradiation is concerned, something which often occurs in the case of persons occupationally exposed to radiation. This is the reason why a concept was developed which allows the overall radiation to be determined in practice. A linear dose-risk relation is taken as a basis. The measure for the overall radiation is a value without dimension (radiation index B_i). The value $B_i = 1$ is identical with the maximum permissible annual exposure, $B_i = 0,5$ with the quartely one.

1504 (INS-TS--12) RECORDS OF RADIATION EXPOSURE CONTROL, 4. Nakamura, T.; Kawabata, H. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Apr 1976. 100p. (In Japanese). Dep. NTIS (US Sales Only), PC A05/MF A01.

The Radiation Control Center controls the radiation levels in and around the Institute to protect mankind and instrument from the radiation hazard. The center is also performing health physics and shielding research cooperating with other health physics and shielding groups. In this report, the records of environmental and personal monitoring of radiation exposure at the Institute for Nuclear Study are accumulated for the period during March 1975 - March 1976. This report includes the technical details of monitoring program and several research activities, skyshine, residual radioactivity, thick target neutron and photon spectra etc., in the Radiation Control Center.

1505 (PB--254095) A METHOD FOR COMPUTING THE GAMMA-DOSE INTEGRALS I1 AND I2 FOR THE FINITE-CLOUD SECTOR-AVERAGE MODEL. FINAL REPORT. Hamawi, J.N. (Yankee Atomic Electric Co., Westborough, Mass. (USA). Nuclear Services Div.). Apr 1976. 33p. (YAEC--1105). NTIS \$4.00.

A method and a FORTRAN subroutine are presented for computing the integrals (I sub 1) and (I sub 2) in Meteorology and Atomic Energy - 1968 in connection with the evaluation of long-term external gamma doses from routine atmospheric releases of radioactive materials. Equations for determining the limits of integration are presented along with a procedure to circumvent the singularity of the exponential integral ($E_{\text{sub } 1}$) (μh) at the origin. The method relies on polynomial and rational approximations for the exponential integral and uses the 9-point Newton-Cotes formula for numerical integration. The overall accuracy of the method is in excess of what is normally required for most applications; even with as few as 17 integration intervals the errors in (I sub 1) and (I sub 2) are less than 0.3 percent over the entire range of conditions. (GRA)

1506 (PB--254173) GONAD DOSES AND GENETICALLY SIGNIFICANT DOSE FROM DIAGNOSTIC RADIOLOGY, U.S., 1964 AND 1970. (Bureau of Radiological Health, Rockville, Md. (USA)). Apr 1976. 68p. (FDA/BRH--76/50). NTIS \$4.50.

The U.S. Public Health Service conducted a nationwide X-Ray Exposure Study in 1964 and

- again in 1970. Previous reports of these studies have provided such estimates as examination rates, films per examination and exposure at skin surface. Subsequently, a dose model was developed to translate exposure free-in-air at tabletop to gonad dose. This report lists estimated mean gonad doses for 18 examination categories, tabulated by examination and sex. These values have also been combined with information on examination rates and the expected Genetically Significant Dose (GSD), which is reported here. Contributions to the GSD are listed by examination, sex, and age. (GRA)
- 1507 (SAAS--197, pp 9-14) CONTRIBUTION TO THE PROBLEM OF BIOLOGICAL DOSE ASSESSMENT IN OCCUPATIONALLY EXPOSED PERSONNEL. Anger, H.; Jacobsohn, E. Apr 1976. (In German).
Report of the Board of Nuclear Safety and Radiation Protection of the GDR.
Chromosome studies were made on lymphocytes taken from the peripheral blood of occupationally exposed personnel (four groups, exposure < 5 rems). In all exposed individuals the rate of aberration was found to be higher compared to the controls, with maximum values observed in those who had been additionally exposed to acute partial body irradiation. In order to get statistically significant differences over the controls, it is necessary, however, to calculate the frequency of the various aberrations in terms of a 'point system' rather than in per cent.
- 1508 RADIATION DOSIMETRY OF ^{204}Bi - AND ^{204}Bi -CITRATES. Bigler, R.E.; Russ, G.A.; Laughlin, J.S. (Sloan-Kettering Cancer Center, New York). J. Nucl. Med.; 17: No. 4, 301-304(Apr 1976).
The absorbed-radiation doses from ^{204}Bi - and ^{204}Bi -citrate to humans are calculated from available nuclear and biologic data in order to evaluate the relative radiation risk of these radionuclides. The calculations reveal that the radiation dose to the kidneys is reduced by a factor of 8 if ^{204}Bi replaces ^{204}Bi . This reduction suggests that ^{204}Bi should be investigated further as a possible soft-tissue scanning agent. (auth)
- 1509 NORMAL TISSUE TOLERANCE AND DAMAGE. Cancer, Suppl.; 37: No. 4, 2046-2055(Apr 1976).
Acute effects of radiotherapy are discussed with regard to cell killing, quantitation of postradiation changes in critical organs, cell survival in vivo, and physiological and cell kinetic phenomena. Late effects are discussed with regard to interaction of radiation injury and repair in renewal systems and time-dose relationships in vivo. Other topics discussed are modification of injury, oncogenesis, and goals for future research. (HLW)
- 1510 (LF-tr--123) COMBINED INJURY CAUSED BY NUCLEAR EXPLOSIONS. Messerschmidt, O. (Technische Univ. Muenchen (Germany, F.R.)). Apr 1976. Translation of "Kombinationsschade als Folge nuklearer Explosionen," Sonderdruck aus Chirurgie der Gegenwart: Volume 4, Unfallchirurgie, Urban and Schwarzenberg, Munich, Berlin, Vienna. 94p. Dep. NTIS \$5.00.
Some topics discussed are: effects of nuclear weapons and combined injuries; effects of the pressure shock wave; effects of thermal radiation; burns caused by whole-body irradiation; whole-body irradiation and open skin-muscle wounds; radioactive contamination of wounds and burns; whole-body irradiation and fractures; and abdominal injuries and operations combined with whole-body irradiation. (HLW)
- 1511 CONCLUSIONS OF THE BEIR AND UNSCEAR REPORTS ON RADIATION EFFECTS PER MAN-REM. Cohen, B.L. (Pittsburgh Univ., Pa. (USA)). Health Phys.; 30: No. 4, 351-352(Apr 1976).
Brief note.
BIOLOGICAL RADIATION EFFECTS;DOSE LIMITS; GENETICALLY SIGNIFICANT DOSE;MAN;NEOPLASMS; RADIATION HAZARDS;RADIATION PROTECTION; RECOMMENDATIONS;UNSCEAR
- 1512 REMOTE AFTER-EFFECT OF OCCUPATIONAL RADIATION ACTION. Gus'kova, A.K.; Soldatova, V.A.; Denisova, E.A.; Gorbarenko, N.I.; Gribova, I.A.; Kirsanova, G.I.; L'vovskaya, E.N. (Inst. of Hygiene and Occupational Disease, Moscow). Med. Radiol.; 21: No. 4, 34-40(Apr 1976). (In Russian).
Examination of medical roentgenologists and operators of accelerators and gamma-defectosopes exposed for a long time to ionizing radiation and irradiated in total doses of 30 to 400 rad showed that the condition of their health was quite satisfactory. Cases of occupational diseases (chronic radiation sickness and local radiation affections) were single with the maximum total dose. There is a tendency to the increase of the number of cases of the vegetative-vascular dystony of a hypertensive type and in the group with a large dose of irradiation--a tendency to acceleration of involutional processes in the lens and in the cardiovascular system. No substantial shifts in the indices of the peripheral blood in all the occupational groups were revealed.
- 1513 GRADUATION OF METERS FOR γ -RADIATION ABSORBED DOSE. Bregadze, Yu.I.; Muratov, N.I.; Tultae, A.V. Med. Radiol.; 21: No. 4, 48-52(Apr 1976). (In Russian).
The state standard of the unit of the absorbed dose power of photon ionizing radiation makes it possible to make graduation of meters for absorbed dose of γ -radiation in the muscle tissue-equivalent substance. For this purpose by using a thin-walled thimble ionization chamber graduated by a graphite calorimeter the power of the absorbed dose of γ -radiation in the point of the tissue-equivalent phantom is determined. The measured value of the absorbed dose is attributed to the reading of the graduated device the detector of which is placed in this point of the phantom.
- 1514 IRRADIATION OF VOLUNTEERS IN MEDICAL RESEARCH. Rae, S. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 15, 4-7(Apr 1976).
Attempts to produce guidelines for use in medical research involving the irradiation of volunteers are surveyed. The recommendations of the British Institute of Radiology (Irradiation of Human Subjects for Medical Research, Bull. Brit. Radiology, 1975, vol.1, no.2, 4) are summarized. These recommendations, based on a preliminary working document produced by the World Health Organization, are considered in three parts, the selection of subjects, the categorisation and the approval of research projects. The importance of freely given and informed consent is emphasized. The suggested four categories of project are classified by the amount of total body radiation to be received by the subject in each project, and the necessary assessment and prior approval

procedures are related to this classification. The imposition of a lifetime exposure limit is compared with occupational exposures which are assessed on an annual basis, and the ICRP's 'planned special exposures'. Repeated irradiation of the same subject, although permissible within the recommended limits, may create difficulties. The total lifetime accumulated dose may not always be immediately available if the subject has worked in a number of different establishments. The possibility of compiling an approved list of procedures to reduce some of the anticipated delays in processing applications is discussed.

- 1515 RADIOLOGICAL PROTECTION IN THE MINING INDUSTRY. O'Riordan, M.C. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 15, 11-13 (Apr 1976).

The information contained in the National Radiological Protection Board's report (Strong, J.C., Laidlaw, A.J. and O'Riordan, M.C., Radon and its daughters in various British mines, NRPB-R39 (1975), HMSO) is updated with data collected between October 1975 and January 1976, and certain aspects of the work highlighted. The latest results in the continuing survey, which now covers more than 60 non-coal mines employing nearly 2000 men underground, reflect the corrective actions taken in a number of mines by improvements in ventilation management. The survey is now carried out by means of radon flasks supplied by post and returned to the NRPB for measurement. An empirical relationship is used to relate the radon gas and daughter concentrations at different ventilation rates. The results show that there has been a marked decrease (from 42% to 24%) in the number of men exposed above 4 working level months (WLM) in a year, the category requiring supervision (1 to 4 WLM in a year) has increased from 15% to 28%, and the lowest exposure category has increased from 43% to 48%. Although excessive exposures are still a problem, particularly in some tin mines in Cornwall, general compliance with the exposure limit seems possible in the near future.

- 1516 RESPONSE OF HUMAN LYMPHOCYTES TO MITOGENIC STIMULI AFTER IRRADIATION IN VITRO. Baral, E.; Blomgren, H. (Karolinska Sjukhuset, Stockholm (Sweden)). Acta Radiol., Ther., Phys., Biol.; 15: No. 2, 149-161 (Apr 1976).

Human lymphocytes were exposed to varying doses of roentgen irradiation in vitro and thereafter tested for reactivity to different polyclonal mitogens and antigens using DNA synthesis as a marker for viability. The dose response profiles obtained indicate that there are two subpopulations of lymphocytes which are responsive to phytohaemagglutinin, pokeweed mitogen, concanavalin A, and allogeneic cells. One is relatively sensitive to radiation and the other is relatively resistant. However, no 'resistant' PPD-tuberculin responsive cell population could be detected. Irradiated lymphocyte populations enriched for T-cells exhibited both a sensitive and a resistant PHA-responsive population, whereas cell populations enriched for B-cells only exhibited a radiation sensitive one.

- 1517 RADIATION SENSITIVITY OF LYMPHOCYTES FROM HUMAN BLOOD AND FROM THE THORACIC DUCT. Edgren, J.; Weber, T.H. (Helsinki Univ. Central Hospital (Finland); Minerva Institute for Medical Research, Helsinki (Finland)). Acta Radiol., Ther., Phys., Biol.; 15: No. 2, 177-182 (Apr 1976).

Peripheral blood and thoracic duct

lymphocytes are sensitive to irradiation. However, a distinct population of resistant lymphocytes exists, which is characterized by reactivity to very low doses of lymphocyte-stimulating lectins in vitro. Blood lymphocytes are rapidly eliminated from the circulation after radiation damage. An analysis of the function of blood lymphocytes is thus of little or no use in assessing the therapeutic effect of extracorporeal irradiation. Lymphocyte activation must accordingly also be unsuitable for use as a biologic dosimeter after accidental total body irradiation.

- 1518 INTEREST AND LIMITS OF RADIOPROTECTION IN RADIOLOGICAL PEDIATRY. Beraud, C. Rayonnem. Ionis. Tech. Mes. Prot.; No. 2, 59-64 (Apr 1976). (In French).

From Meeting on radioprotection; Tunis, Tunisia (25 Mar 1976).

The radiologic pediatry, because of its specificity, exposes the personnel to hazards which are difficult to avoid.

- 1519 TASKS OF THE INSTITUTE FOR RADIATION HYGIENE OF THE FEDERAL HEALTH OFFICE. Stieve, F.E. (Bundesgesundheitsamt, Berlin (F.R. Germany)). Abt. fuer Strahlenhygiene. Bundesgesundheitsblatt; 19: No. 7, 123-127 (Apr 1976). (In German).

Following a brief historical review, the tasks of the institute are outlined: 1) the determination of the radiation effect related to man, i.e. the collection, reviewing and evaluation of physical measurements and their judgment with a view to possible statements, 2) the evaluation of the data obtained by physical means according to biological-medical criteria, i.e. the relation of the actual measured data to man, where appropriate with comparison to reactions on other forms of life. This diversion via the judgment of ecological-biological links is particularly necessary for the determination and evaluation of changes in the genetic material, 3) the working out of protection and precautionary measures against radiation, i.e. the field of actual radiation protection. It includes technical, organisational and medical-biological tasks.

- 1520 IRRADIATION IN RADIODIAGNOSIS: RECENT POSSIBILITIES OF DECREASING THE DOSES. Weill, F.; Tuetey, J.B.; Courvoisier, P. (Centre Hospitalier Universitaire, 25 - Besancon (France)). J. Radiol., Electrol., Med. Nucl.; 57: No. 4, 347-350 (Apr 1976). (In French).

Depending on the film used, the new superfast re-enforcing screens enable a four to six fold reduction in diagnosis cutaneous irradiation. This diagnosis irradiation which remains rather considerable under classical techniques, is frequently unfairly neglected: the distribution of this new type of material seems desirable. On the contrary, the use of xeroradiography leads to an irradiation which is three times greater than in these new techniques: xeroradiography must therefore be reserved for very specific problems.

- 1521 LEGISLATION AND RADIOPROTECTION. Ouvrard, R. Rayonnem. Ionis. Tech. Mes. Prot.; No. 2, 73-77 (Apr 1976). (In French).

From Meeting on radioprotection; Tunis, Tunisia (25 Mar 1976).

The general aspects of the legislation in radioprotection are reviewed: use of ionizing radiation, protection of workers and population.

- 1522 LOWER RADIATION EXPOSURE DURING METABOLIC INVESTIGATION. Muench. Med. Wochenschr.; 118: No. 14, 10(Apr 1976). (In German).
Short communication only.
DIAGNOSTIC TECHNIQUES; EXCRETION; FECES; GAMMA SPECTROSCOPY; METABOLISM; PATIENTS; RADIATION DOSES; URINE
- 1523 APPLICATION OF THE RULES OF RADIOLOGICAL SECURITY IN HOSPITALS. Durgeat, J. Rayonnem. Ionis. Tech. Mes. Prot.; No. 2, 65-71(Apr 1976). (In French).
From Meeting on radioprotection; Tunis, Tunisia (25 Mar 1976).
The application of radioprotection in medicine (radiodiagnostic and therapy, radioisotopes) is reviewed. An experience in the field of industrial medicine is presented.
- 1524 HUMAN HAZARDS. Delpla, M.; Vignes, S.; Wolber, G. (Electricite de France, 75 - Paris). Mediterr. Med.; No. 98, 29-30, 33, 35-36, 39, 43, 45-46(Apr 1976). (In French).
Among health hazards from ionizing radiations, a distinction is made of observed, likely and theoretical risks. Theoretical risks, derived from extrapolation of observations on sublethal exposures to low doses may frighten. However, they have nothing in common with reality as shown for instance, by the study of carcinogenesis risks at Nagasaki. By extrapolation to low doses, theoretical mutation risks are derived by geneticists from the observation of some characters especially deleterious in the progeny of parents exposed to sublethal doses. One cannot agree when by calculation they express a population exposure by a shift of its genetic balance with an increase of the proportion of disabled individuals. As a matter of fact, experimental exposure of successive generations of laboratory animals shows no accumulation of deleterious genes, sublethal doses excepted. Large nuclear plants should not be overwhelmed by horrible charges on sanitary grounds, whereas small sources have but too often shown they may originate mortal risks.
- 1525 SI UNITS FOR IONIZING RADIATIONS. THE USE OF THE 'GRAY'. Dunworth, J.V. (National Physical Lab., Teddington (UK)). Radiography; 42: No. 496, 84(Apr 1976).
ICRU has recently given publicity to the adoption, by the 15th General Conference for Weights and Measures, of the gray as the special name of the SI unit for ionizing radiations, equal to the joule per kilogram. Some further interim guidance is given on the use of the gray. There are at present six physical quantities in the field of ionizing radiations which can be expressed in joules per kilogram, and ICRU anticipates that the gray will gradually come into general use as the unit for four of these, namely specific energy imparted, absorbed dose, kerma and absorbed dose index. The Consultative Committee for Units (CCU) of the International Committee for Weights and Measures (CIPM) is considering, in consultation with other professional bodies, whether the gray should be used for the other two quantities. These two quantities, dose equivalent and dose equivalent index, relate to the subject of radiation protection and entail a biological factor. The CIPM will, if necessary, present a further resolution to the next General Conference for Weights and Measures.
- 1526 GENERAL PRINCIPLES OF RADIATION PROTECTION. Jammet, H.; Mechali, D.; Dousset, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Mediterr. Med.; No. 98, 7, 9-10, 12(Apr 1976). (In French).
The pathological effects of ionizing radiations are reviewed; the purpose and means of radiation protection are specified.
- 1527 CRITERIA FOR SAFE WORKING WITH IODINE-125. Linsley, G.S. Radiography; 42: No. 496, 89-91(Apr 1976).
Radio-immunoassay and other saturation assay tests involving the use of the iodine-125 are finding wide application for the determination of hormone concentrations in biological fluids. In such tests, iodinations involving concentrations of a millicurie per microlitre are common. Iodine-125 presents a problem from the monitoring standpoint because of its low energy photon emission (27 and 35 keV). Iodine is preferentially taken up by the thyroid gland and work involving moderate amounts of radio-iodine may give rise to a significant hazard in an accident situation. The general precautions which should be taken in work with unsealed radioactive substances are briefly summarized, working limits for iodine-125 are identified, and methods of personal monitoring and protection in an emergency situation described.
- 1528 CONCLUSION: THE DEVELOPMENT OF NUCLEAR ENERGY IS GOVERNED BY RADIATION PROTECTION. Pellerin, P. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Mediterr. Med.; No. 98, 135-140, 142, 145-146(Apr 1976). (In French).
The biological effects of radiations on man are reviewed as well as the way the ICRP has developed the fundamentals and recommendations that are the basis of national regulations. The French regulations and their application by the Central Service of Protection against Ionizing Radiation (SCPRI) are stated.
- 1529 MEDICAL SURVEILLANCE OF WORKERS IN THE NUCLEAR INDUSTRY. Mazaury, E.; Rosay, J. (CEA, 75 - Paris (France)). Mediterr. Med.; No. 98, 117-118, 121, 122, 125-126, 128, 130, 132(Apr 1976). (In French).
Medical and biological surveillance of nuclear industry workers is organized as a function of the various hazards. The task of the occupational health service is twofold: medical surveillance itself and evaluation of job specifications and occupational hazards.
- 1530 EFFECTS OF PANTOTHINE ON CHANGES IN IRRADIATED SKIN. Tanaka, T.; Kayama, F. (Center for Adult Diseases of Kanagawa (Japan)). Kiso To Rinsho; 10: No. 4, 1038-1041(Apr 1976). (In Japanese).
Forty eight patients with cancer of skin and other cancers received 400 mg of Pantothen per day because of dermatitis due to radiotherapy. The following irradiations were used as radiotherapies; 250 rads of 6-15 MeV electrons on alternate days, 200 rads of Lineac x-rays every day, telecobalt etc. The patients with administration of Pantothen were divided into three; the group administered during irradiation, the group administered 6 months to 1 year after irradiation, and the group administered several years after irradiation. The irradiated patients without administration of Pantothen were regarded as controls. There are some effective cases in the group administered during irradiation. However, almost no effect was seen in the group with late radiation damage.

- 1531 HEALTH AND SAFETY RECORD OF THE NUCLEAR INDUSTRY. Carter, M.W.; Carruthers, E.; Button, J.C.E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Environment and Public Health Div.). At. Energy Aust.; 19: No. 2, 9-18(Apr 1976).

This paper examines the claim of the nuclear industry to have an excellent safety record, in terms of health and accident records of workers in the industry. It does not consider accidents which have not resulted in harm to the workers' health. Data are presented on the radiation exposure of nuclear workers in Europe, America, India and Australia, in relation to the internationally recommended limits, and there is some discussion of the risks involved in these limits. The death rate in parts of the nuclear industry in America, the United Kingdom, and Australia is presented and compared with the death rate for other industries in those countries, and a listing is made of deaths caused by radiation in the period 1945-1958. Injury rate for the United States and Australian nuclear industries are also compared with the injury rates for other industries in these countries. Consideration is given to the safety record of individual components of the nuclear industry (using the wide definition of this industry given above), special attention being given to health records of uranium miners, plutonium workers and radiologists.

- 1532 FREQUENCY OF PRENATAL X-RAY EXAMINATION AND RADIATION RISKS IN JAPAN. Kitabatake, T.; Sato, T.; Kurokawa, S.; Takeuchi, S.; Otake, S. (Niigata Univ. (Japan). School of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 4, 351-356(Apr 1976). (In Japanese).

The frequency of prenatal x-ray examination in 1,701 parturient women just after the childbirth was surveyed in 19 Japanese hospitals in 1974. Of 1,701 women, 470 or 27.6% had received some kind of x-ray examination during pregnancy. There was no significant difference in the frequency of prenatal x-rays between the primipara and multipara. Chest examination was frequent in the 3rd to 6th month of gestation, while pelvimetric study was performed mainly after the 10th month. About 82% of the fetal dose was contributed from a pelvimetric study. On the average, the fetus receives 202 mrad of ionizing radiation during the entire period of gestation from prenatal maternal x-ray examinations in Japan. Based on these data, it is calculated that about 6.5 pediatric leukemia may be induced yearly by maternal x-ray before the childbirth. This corresponds to about 1% leukemias seen in the same generation in Japan.

- 1533 EXAMINER'S EXPOSURE DURING NUCLEAR MEDICAL EXAMINATION WITH SUP(99m)TC. THE NEED FOR A REMOTE-CONTROL GAMMA IMAGING TABLE. Yamamoto, C. (Nagoya Univ. (Japan). Faculty of Medicine); Kaneko, M. Kaku Igaku; 13: No. 2, 157-160(Apr 1976). (In Japanese).

The exposure of the examiner using a remote-controlled gamma imaging table which was manufactured to reduce exposure dose was examined, by measuring the surface dose of an sup(99m)Tc-injected phantom placed on the imaging table and the dose distribution in the room space. When the remote-controlled gamma imaging table was used the exposure dose in the examiner was 1/4 that in the examiner using hand operation. The exposure dose in hand operation was 1.1 times the maximum permissible exposure dose and that in use of this table 0.07 times. Therefore, this remote-controlled

gamma imaging table is necessary. Exposure of the hands of the examiner was only 0.3 times the maximum permissible dose even in hand operation. The remote-controlled gamma imaging table is also necessary for positioning the patient safely and accurately.

- 1534 (N--76-23145) RADIATION SAFETY OF SPACE FLIGHTS. RADIOBIOLOGICAL ASPECTS. Grigoryev, Y.G. Apr 1976. Translation of Radiatsionnaya Bezopastnost-Kosmicheskikh Poletov. Radiobiologicheskii Aspekty. (NASA-TT-F--16853). 359p. NTIS \$10.50.

Dose characteristics of the possible radiation on man in space are given as well as criteria for evaluating the radiation danger of space flights. Data on the biological effect of protons and heavy ions and the results of radiobiological experiments in space are presented, and the modifying action of physical factors of the environment on the radiobiological effect is discussed. (Author) (GRA)

- 1535 PATIENTS EXPOSED TO THERAPEUTIC IRRADIATION FOR BENIGN CONDITIONS IN CHILDHOOD. Carroll, R.G. (Univ. of Pittsburgh). Pa. Med.; 79: No. 4, 27-31(Apr 1976).

In the United States there are over 1 million individuals who have been irradiated for benign conditions in the head and neck. Many recent reports document conclusively that individuals who have had head and neck radiation for benign conditions have markedly increased risk of thyroid, salivary, and perhaps breast cancer as compared to the general population. Although the relative risk as compared to the general population is high, the risk that any one individual who has had head or neck irradiation will develop a subsequent malignancy is relatively low. Identification of these patients through some type of screening procedure may be beneficial in terms of prevention of subsequent mortality and morbidity from cancer, especially thyroid and salivary cancer. The American Medical Association and the American Hospital Association issued a joint statement of October 17, 1975, urging hospitals and physicians to work together in their communities to develop guidelines and procedures for screening of exposed individuals and for public education.

- 1536 (COO--1024-55) COMPARISON OF THE CYTOLOGICAL EFFECTS PRODUCED BY IONIZING RADIATIONS OF DIFFERENT LET. PROGRESS REPORT, APRIL 1975--APRIL 1976. Riley, E.F. Jr. (Iowa Univ., Iowa City (USA). Radiation Research Lab.). Apr 1976. Contract E(11-1)-1024. 23p. Dep. NTIS \$3.50.

Rat eyes were irradiated with a single dose of 1000, 850, 700, or 550 rads of x-radiation or 225, 200, 175, 150, or 125 rads of fission neutron radiation. Some eyes are being examined periodically for cataracts; others were tested by wounding the lens at 3, 14, or 28 days after irradiation. At 10 months after irradiation, the 1000-rad-X cataracts were a bit more advanced than the 225-rad-n group; this suggests an RBE of about 4. Wounding the lens initiated a "wave" of DNA synthesis followed by a "wave" of mitotic activity. Radiation partially suppressed the response to wounding. The magnitude of the response was inversely related to the x-ray dose; the magnitude increased with increased time between irradiation and wounding. We are accumulating data to compare neutron and x-irradiated epithelia. Equal percentages of abnormal mitoses were observed after wounding at 3 days after 1000 rad-X or 222 rad-n; this suggests an

RBE of 4.4. X-irradiated cells recovered continually during the first 28 days after irradiation. Neutron irradiated cells recovered very little in the first two weeks, but then "caught up" to X-irradiated cells. Shielding half of a lens from 1000 rads of x-rays slightly decreased the immediate effects on irradiated cells and enabled the cells to recover faster.

- 1537 (COO--1024-56) COMPARISON OF THE CYTOLOGICAL EFFECTS PRODUCED BY IONIZING RADIATIONS OF DIFFERENT LET. THREE-YEAR SUMMARY OF PROJECT ACTIVITIES FROM APRIL 1973--APRIL 1976. Riley, E.F. Jr. (Iowa Univ., Iowa City (USA). Radiation Research Lab.). Apr 1976. Contract E(11-1)-1024. 29p. Dep. NTIS \$4.00.

In the past 3 years, we have irradiated about 600 mice with single or fractionated doses of x-rays or fission neutrons and have tested the lens epithelia by wounding at 1 hour, 1 week, 2 weeks, or 4 weeks post-irradiation, irradiated about 900 rats with a single dose from a graded series of single doses of x-rays or fission neutrons and tested the lens epithelia by wounding at 3, 14, or 28 days post-irradiation (plus about 100 control lens epithelia), irradiated either half of a rat lens or the entire lens to compare the immediate effects on the wound response and recovery rates in the half-irradiated and whole-irradiated epithelia, and done a pilot study on cAMP and RNA synthesis in the hours soon after wounding. Most of our results indicate an RBE from 4 to 5. Our data usually show a continual recovery during the first month after x-irradiation. The neutron irradiated tissues often show little recovery during the first week or two, but then "catch up" to the recovering x-irradiated tissues. Fractionation usually results in a "sparing effect" but fractionation of neutron doses enhanced the effect on a cell population with a slow, but steady cell turnover rate. Shielding half a lens enables the irradiated cells to recover faster.

- 1538 X-RAY INDUCED CHROMOSOME ABERRATIONS IN MOUSE DICTYATE OOCYTES. TIME AND DOSE RELATIONSHIPS, PT. 1. Brewen, J.G.; Payne, H.S.; Preston, R.J. (Oak Ridge National Lab., Tenn. (USA). Biology Div.). Mutat. Res.; 35: No. 1, 111-119 (Apr 1976).

Structural chromosome aberrations were analyzed in superovulated metaphase-I oocytes of the mouse, *Mus musculus*, at various times after a single acute dose of 200 R of x-rays. The aberrations seen were of the chromatid type, i.e., chromatid interchanges, isochromatid deletions and chromatid deletions. The aberration frequency was low during the interval 24 h to 5 days between irradiation and ovulation; peak frequency was reached when irradiation was given 14 days prior to ovulation. A dose-response study was made 14 days prior to ovulation at doses of 50, 100, 200, 300 and 400 R. A curve of these data indicated that a significant two-track component was present for both interchanges and deletions. Centromere staining revealed that symmetrical and asymmetrical interchanges occurred at approximately equal frequency and also that the asymmetrical equivalent of crossing-over was induced at a measurable frequency.

- 1539 DOMINANT LETHALS FOLLOWING ACUTE SPERMATOGONIAL X-IRRADIATION IN THE RAT. Baev, I.; Bairakova, A. (Nauchno-Issledovatel'sk Inst. po Radiologiya i Radiatsionna Khigiena,

Sofia (Bulgaria)). Strahlentherapie; 151: No. 4, 382-385 (Apr 1976).

1 tab.; 19 refs..

Spermatogonial x irradiation with 0, 400 or 600 R in adult rats and 200 R in fetal rats was carried out to assess genetic damage by the test of induced dominant lethality. From postimplantation embryonic losses observed, dominant lethal rates were established to be significantly raised by a dose of 400 or 600 R. With 200 R given either to adult or to fetal rats, no excess was detected in embryonic death rates.

- 1540 EFFECTS OF X IRRADIATION ON COLLAGEN METABOLISM IN RAT SKIN. De Loecker, W.; Van Der Schueren, E.; Stas, M.L.; Doms, D. (Louvain Univ. (Belgium)). Int. J. Radiat. Biol.; 29: No. 4, 351-358 (Apr 1976).

Collagen metabolism in rat skin and the response to x radiation were studied during three consecutive hair-cycles. Collagen biosynthesis and turnover, assessed by the hydroxylation of [^3H]-proline, proceeded as a function of the periodic hair-growth phenomenon. A single x radiation treatment to the skin did not affect the amino-acid composition of collagen, but reduced the proline hydroxylation capacity of the fibroblasts. The initial damage to the tissue, resulting in a reduced collagen concentration of the skin, particularly noticeable after several hair-cycles was at least partially responsible for the delayed skin lesions after irradiation.

- 1541 EFFECTS OF BETA-ADRENERGIC STIMULATION ON BONE-MARROW FUNCTION IN NORMAL AND SUBLETHALLY IRRADIATED MICE. I. THE EFFECT OF ISOPROTERENOL ON cAMP CONTENT IN BONE-MARROW CELLS IN VIVO AND IN VITRO. Lipski, S. (Institute of Hygiene and Epidemiology, Warsaw (Poland). Dept. of Radiobiology). Int. J. Radiat. Biol.; 29: No. 4, 359-366 (Apr 1976).

The effect of isoproterenol (IPR) on bone-marrow cAMP content was investigated in vivo and in vitro. In unirradiated CFW mice, the bone-marrow cAMP content was found to be elevated by the administration of noradrenaline, adrenaline and isoproterenol. After IPR administration, the increase in cAMP was biphasic with maxima at 1 and 15 min. An increase in cAMP content was also noted in bone-marrow of sublethally-irradiated mice, but no further increase was observed 15 min after the administration of IPR. Elevation of cAMP by either IPR or radiation was prevented by pretreatment with the β -adrenergic blocking agent - propranolol. IPR was also effective in increasing the cAMP content when added to suspension of bone-marrow cells. This effect was abolished by propranolol. IPR did not increase cAMP levels in bone-marrow cells isolated from irradiated animals. The results suggest that the differential bone-marrow cells have β -adrenergic receptors.

- 1542 KINETICS OF CELL POPULATIONS IN THE INTESTINAL EPITHELIUM OF MICE AFTER PARTIAL-BODY IRRADIATIONS WITH X-RAYS AND NEUTRONS. Shiragai, A.; Sato, F.; Hiraoka, T.; Inada, T.; Kawashima, K.; Matsuzawa, H. (National Inst. of Radiological Sciences, Chiba (Japan)). Int. J. Radiat. Biol.; 29: No. 4, 377-383 (Apr 1976).

Single-dose irradiation to the trunk alone of anaesthetized mice either with 200kV x rays at 26.2 rad/min (473 to 1890 rad) or with ^9Be (d,n) fast neutrons at 9.2 rad/min (200 rad neutrons with 30 rad γ -contamination) was used in an investigation of cell populations in the

intestinal epithelium up to 10 days after exposure. Cell counts were made on transverse sections of duodenum for each villus and crypt, from base to tip for all mucosal cells. In every case, the numbers of crypt and villus cells showed overshoots after early reductions, returning later to the control levels. Neutron irradiation shifted the values of the cell-counts to later times than did x irradiation. The curves indicated that the life-span of villus cells for x irradiated mice was 3 days, and for neutron-irradiated mice 4 days, whereas the transit time of villus cells in control mice was found to be 2.4 ± 0.2 days. A two-compartment model with a feed-back term was fitted to the experimental cell-counts. A damped-oscillation type of recovery was shown for both crypt and villus, in agreement with the experimental results for the extent and time of overshoot. The crypt cell-counts suggested that its recovery may have a single overshoot followed by a damped return to steady state, whereas the villus cell-counts agreed better with the damped oscillation model. The theoretical model with a feed-back term seems to possess some of the essential features of the dynamics of cell renewal in the intestinal epithelium.

- 1543 CYTOLOGICAL AND HISTOLOGICAL CHANGES IN THE SPLEEN OF CONTINUOUSLY IRRADIATED RATS. Praslicka, M.; Chlebovsky, O. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katadra Vseobecnej Biologie). Folia Biol. (Prague); 22: No. 2, 125-139 (Apr 1976).

The study evaluates quantitative cytological and histological changes in splenic white and red pulp of rats continuously irradiated for up to 140 days with daily doses ranging from 0.5 R to 82.5 R. A significant reduction of lymphocyte incidence begins at 5 R/day and it continues to drop with every further increase in the dose rate until a steady state of about 5 per cent is reached at 82.5 R/day. Small lymphocytes are relatively more affected. Irradiated animals show a wave-like increase in ectopic erythropoiesis in spleen red pulp from day 30 on even with the lowest dose rates of 0.5 and 1 R/day. The ratio or relative incidences of haemocytoblasts and erythroblasts increases approximately twofold, indicating that a substantial reduction of stem cells is compensated to a large extent already at an early stage of erythropoiesis. The incidence of myeloid elements rises, from the 40th day of exposure, the increase being more apparent at medium dose rates for eosinophils than for neutrophils. Both the red and white splenic pulps of exposed animals display an increased incidence of plasma cells.

- 1544 EFFECT OF TOPICAL INDOMETHACIN ON UVR-INDUCED REDNESS AND PROSTAGLANDIN E LEVELS IN SUNBURNED GUINEA PIG SKIN. Snyder, D.S. (Univ. of Miami, FL). Prostaglandins; 11: No. 4, 631-643 (Apr 1976).

Prostaglandin E (PGE) levels in the skin have been shown to be elevated during the 24 hr. period following exposure of guinea pig skin to ultraviolet radiation from 280 to 320 nm in the so-called UVB or "sunburn spectrum." The development of increased PGE levels paralleled the development of the delayed phase of erythema. When applied immediately after UVB exposure, one topical application of 2.5 percent indomethacin (IM) simultaneously decreased the redness and PGE levels in the skin to near normal within one hr. of treatment. The IM effect persisted for approximately 24 hrs. By 48 hrs. the PGE level in the sunburned skin was near normal whether or not the skin had been treated with IM. The

redness which was evident at 48 hrs. did not respond to additional topical IM treatment. This suggests that a substance(s) other than PGE may be involved in this latter portion of UVB-induced erythema. A major role for PGE as an early mediator or potentiator of UVB-induced erythema has been demonstrated. Any involvement of PGE with UVB-induced cell death or alterations in DNA synthesis seems unlikely.

- 1545 (FS--75-12-T, pp 467-490) PREVENTIVE URINE MONITORING FOR NATURAL URANIUM. IMPORTANCE, INFORMATIVE VALUE, ALTERNATIVES. Beyer, D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Strahlenschutz). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

9 figs.; 16 refs..

Monitoring personnel exposure. Targets, methods, results and evaluation.

A general view of the monitoring methods used in Europe today shows that monitoring for uranium is frequently seen as random test, carried out as semi-annual test and that the result is given as monitoring result. To obtain an impression of the evidence of monitoring by excretion analysis a monitoring model is introduced in which the preconditions resulting of the contact and the metabolic behaviour of uranium are taken into consideration and reconciled with each other. This shows that urin monitoring is suitable for detecting biologically transportable uranium-compounds. For incorporation of hardly transportable uranium-compounds however faeces monitoring should be preferred. The results of this case study uncertain the meaning even of an optimally organized incorporation monitoring because of the high expenditure and the low informative value and let a systematic monitoring related to the event seem more favourable.

- 1546 (FS--75-12-T, pp 452-457) ¹²⁵I AND ¹²³I MONITORING AT THE WORKING-PLACES OF THE EIDG. INSTITUT FUER REAKTORFORSCHUNG (EIR) AT WUERENLINGEN (SWITZERLAND). Goerlich, W.; Baechli, H.R.; Baur, W.; Koch, H. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland). Abt. Strahlenueberwachung). Apr 1976. (In German).

From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).

Monitoring personnel exposure. Targets, methods, results and evaluation.

A group of persons exposed to radiation for professional reasons was monitored in EIR by means of thyroid and urin tests during one year. To determine the incorporation risk at the working-place wipe tests and air filter samples were carried out daily during the same time. The activities determined in the urin vary between 0,3% and 6% of the thyroid depot. The urin measurements are suitable for the manifestation of the incorporation. But to evaluate these the individual iod-excretion-rate must be determined before. The results of the measurements, the measuring devices, and the methods are explained. Incorporation was caused by improper storage of preparations and wastes, insufficient aeration, and imperfect methods.

- 1547 (LA--6313-PR) BIOMEDICAL AND ENVIRONMENTAL RESEARCH PROGRAM OF THE LASL HEALTH DIVISION. PROGRESS REPORT, JANUARY--DECEMBER 1975. Petersen, D.F.; Sullivan, E.M.

- (comps.). (Los Alamos Scientific Lab., N.Mex. (USA)). Apr 1976. Contract W-7405-ENG-36. 84p. Dep. NTIS \$5.00.
Separate abstracts were prepared for the six sections of the report. (HLW)
- 1548 (LA--6313-PR, pp 1-14) MAMMALIAN BIOLOGY GROUP. Apr 1976.
Biomedical and Environmental Research Program of the LASL Health Division. Progress report, January--December 1975.
Opposition to accelerated nuclear power development is based largely on concern that the potential health hazards of transuranium elements are excessive and that current health protection standards are inadequate. Because no cancer ascribable to plutonium has occurred to date in occupationally exposed populations, an attempt to estimate carcinogenicity in experimental animals has been initiated. Plutonium-bearing ceramic microspheres have been administered by both intravenous and endotracheal routes, and polonium-210 sols have been insufflated for the purpose of comparing localized "hot particles" and diffuse irradiation on lifetime tumor incidence. Additional studies involve life shortening, measurement of delayed radiation injury, and histopathological and chromosomal damage as criteria for assessing the hazards of various conditions of radiation exposure. The retention patterns for specific radionuclides in several species are now being extended to include other potential environmental toxic agents.
- 1549 (SAAS--197, pp 2-7) ON THE ESTIMATION OF INTERNAL EXPOSURE DUE TO STAYING IN CONTAMINATED AREAS. Bendel, F. Apr 1976. (In German).
Report of the Board of Nuclear Safety and Radiation Protection of the GDR.
A simple method is presented for estimating the internal exposure due to inhalation of resuspended radioactive particles while staying in a contaminated area.
- 1550 POISON EMITTING RADIATION. HOW DANGEROUS IS PLUTONIUM. Seidel, A. Bild Wiss.; 13: No. 4, 68-74 (Apr 1976). (In German).
1 tab.; with figs..
Plutonium is one of the most important and most dangerous radionuclides in nuclear engineering. The isotope ^{239}Pu , which shows a high radiotoxicity, is of special importance. The radiolesions caused by ^{239}Pu in the human organism depend on the type of incorporation. The most frequent forms of incorporation are inhalation and wound contamination. Plutonium is quickly resorbed by and only slowly eliminated from the body. It is very difficult to eliminate inhaled $^{239}\text{PuO}_2$ by therapeutical measures. In case of inhalation of soluble ^{239}Pu -compounds therapy is more likely to succeed. Pu is bound to the transferrin in the blood and is later to a great part deposited on the skeleton where it has a (biological) half-life of some years. There it is distributed inhomogeneously and shows a specific binding to the glycoproteids of the matrix of the bone. There the development of osteosarcomas may take place, probably caused by degeneration of the osteoblasts. The dose absorbed is manifested in animal experiments using film dosimetry of the bone sections or cellulose nitrate foils which are appropriate for the quantitative computerized evaluation. Pu is deposited not only on the skeleton but also on the liver. But this deposition is homogeneous. The time of residue differs according to the species. In the liver the Pu is bound to the ferritin and to certain organelles, especially to lysosomes. Later tumor can develop in the liver. Inhaled $^{239}\text{PuO}_2$ has a long staying-time in the lung and can so also cause tumors there. The acute radiolesions occurring after incorporation of Pu mainly affect blood and bone marrow, but they only appear after incorporation of high doses, thus being hardly of importance for man. The maximum permissible ^{239}Pu -burden in the human body is 40 nCi at present. This is based upon the data about the development of osteosarcomas after incorporation of radium.
- 1551 TISSUE CULTURE OF OSTEOGENIC SARCOMA IN RATS, INDUCED BY RADIOACTIVE PHOSPHORUS P-32 AND THE EFFECT OF THE ANTI-CANCEROUS AGENTS ON THESE TUMOR CELLS UNDER TISSUE CULTURE. Osaka, S. (Nihon Univ., Tokyo. School of Medicine). Nippon Seikei Geka Gakkai Zasshi; 50: No. 4, 227-236 (Apr 1976). (In Japanese).
Small pieces of osteogenic sarcoma, induced into albino rats of the C.F. Wistar strain by injection of radioactive phosphorus ^{32}P , were cultured in mixtures of Eagle's minimum essential medium and 20% calf serum. The tumor cells cultured in this way were transplanted into the subcutaneous tissue or the intraabdominal cavity to healthy albino rats. The effect of the anticancerous agents was evaluated by the decrease of nucleic acid composition in these cultured tumor cells. As anti-cancerous agents, cyclophosphamide (CPA), mitomycin C (MMC), and 5-fluorouracil (5-FU) were put into contact with the tumor cells in cultures for two hours under the following dilutions: CPA; 10^{-6} , 10^{-5} , 10^{-4} g/ml. MMC; 2×10^{-6} , 2×10^{-7} , 2×10^{-6} g/ml. 5-FU; 2×10^{-6} , 2×10^{-5} , 2×10^{-4} g/ml. The results are as follows: Three of the seven osteogenic sarcomas in rats were successfully cultured, one of them through more than eighteen generations. After about five hundred thousand cultured cells had been transplanted into the subcutaneous tissues or abdominal cavities of rats, tumors grew in all of them. The histological findings of the tumors in the second generation were quite similar to those of the original tumor. The same process was repeated three times and the tumor showed histological findings similar to those of the original ones. The capability of nucleic acid synthesis in these cells was decreased at twenty fours after CPA contact and at forty eight hours after MMC.
- 1552 (FS--75-12-T, pp 405-414) CONCEPTS FOR DETERMINING THE MAXIMUM PERMISSIBLE ACTIVITY INCORPORATION INTO THE HUMAN BODY. Jacobi, W. Apr 1976. (In German).
From 9. annual meeting of the Fachverband fuer Strahlenschutz e.V.; Alpbach, Austria (6 Oct 1975).
2 figs.; 1 tab.; 15 refs..
Monitoring personnel exposure. Targets, methods, results and evaluation.
First the author briefly describes the method which is to be applied by the ICRP in future for the calculation of organ doses by means of incorporated radio-active substances. In connection with these plans for the derivation of the maximum permissible values for the activity applied to the body are discussed. The following two questions arise in this connection: 1) Is the average dose in an organ or tissue a reasonable quantity for the evaluation of the risk of delayed radiation damage, when the dose is distributed in an organ or tissue very inhomogeneously. This question occurs in connection with 'hot particles'. 2) Is the conception of the critical organ used until today still useful when several organs or tissues of the body are irradiated. These problems are discussed with

examples. A plan to combine organ doses is set up showing its practical consequences.

PHARYNX; RADIATION ACCIDENTS; RADIONUCLIDE KINETICS; RETENTION; RUTHENIUM OXIDES; RUTHENIUM 103; WHOLE-BODY COUNTING; WOMEN

- 1553 (SSI--1976-011) EXCRETION OF RADIONUCLIDES IN MOTHER'S MILK. Larsson, A.; Lundehn, I.; Aasard, P.E. (Statens Strålskyddsinstitut, Stockholm (Sweden)). Apr 1976. 9p. (In Swedish). NTIS (US Sales Only).

The excretion of radionuclides in mother's milk in connection with isotope diagnostics was discussed at a meeting between hospital physists in Sweden. It was decided that efforts would be made to collect experiences from different Swedish hospitals. Three hospitals have contributed to this report. The intention with this report is not to give any recommendations or advice concerning pauses in the breast feeding at diagnostic investigations with radionuclides. Some of the mentioned references contain such advice, however.

- 1554 DISTRIBUTION AND RETENTION OF ^{35}S -SODIUM SULFATE IN MAN. Woodard, H.Q.; Pentlow, K.S.; Mayer, K.; Laughlin, J.S.; Marcove, R.C. (Sloan-Kettering Cancer Center, New York). J. Nucl. Med.; 17: No. 4, 285-289 (Apr 1976).

Measurements were made of the ^{35}S content of tissues obtained from biopsies and autopsies made during and up to 6 months after treatment of chondrosarcoma or chordoma with carrier-free $\text{Na}_2^{35}\text{SO}_4$. Usually 70 to 90 percent of an intravenous dose was excreted in the urine during the first 3 days. The major component of the blood concentration had a biologic half-time of 0.4 to 0.7 days. The initial uptakes in chondrosarcoma, chordoma, and red bone marrow were high and nearly equal, but the rates of loss differed greatly. Uptake in epiphyseal cartilage was comparable to that in chondrosarcoma; uptake in other types of cartilage was lower, but subsequent loss was very slow. For an administered dose of 1 mCi per kilogram of body weight, the integrated radiation doses were 2.4 rads for blood, 33 rads for red bone marrow, 155 rads for chondrosarcoma, 49 rads for chordoma, and 135 rads for normal cartilage. Doses to muscle, skin, and fibrous tissue were 7 to 15 rads. (auth)

- 1555 THYROID UPTAKE OF ^{131}I : FURTHER COMPARISONS OF CAPSULES AND LIQUID PREPARATIONS. Green, J.P.; Wilcox, J.R.; Marriott, J.D.; Halpern, S.E.; Crews, Q.E. Jr. (Naval Regional Medical Center, San Diego, CA). J. Nucl. Med.; 17: No. 4, 310-312 (Apr 1976).

Comparisons were made of thyroid uptake of three commercially available preparations of ^{131}I , using a double-blind design, in 125 patients with normal thyroid function. Uptakes with Squibb Iodotope Diagnostic capsules were significantly lower than those with Squibb Iodotope Oral liquid at 4 hr (p less than 0.01) and 24 hr (p less than 0.05) after ingestion in both the general population and in all patients less than 45 years of age. Uptakes of Radiocaps I-131 (Abbott Laboratories) and Iodotope Oral liquid were indistinguishable under identical conditions. Our findings indicate that interference with either absorption or metabolism of a pharmaceutical can result from the vehicle used to administer it. (auth)

- 1556 ACCIDENTAL HUMAN INHALATION OF RUTHENIUM TETROXIDE. Webber, C.E.; Harvey, J.W. (McMaster Univ., Hamilton, Ontario (Canada)). Health Phys.; 30: No. 4, 352-355 (Apr 1976).

Brief note.

CRITICAL ORGANS; INHALATION; NOSE; ORAL CAVITY;

- 1557 TRITIUM IN BIOLOGICAL AND MEDICINAL STUDIES. Khuravlev, V.F.; Katsapov, I.S. Med. Radiol.; 21: No. 4, 73-78 (Apr 1976). (In Russian).

This review article deals with the kinetics of exchange and the distribution of various tritium compounds. Tritium doses to various organs and to biological systems are presented. Tritiated DOPA, being a precursor of melanin, actually localizes in a melanoma. The role of tritiated thymidine in chromosomal work is reviewed. The absorption of tritiated water through the lungs and skin are reviewed. The exchange kinetics of tritiated water with various organs and body structures is discussed. Various stages in the biological half-life of tritium are reviewed with half-lives of 2.2, 4.2, 12.6, and 57 days which are in agreement with various metabolic paths. 50 refs.

- 1558 EXCRETION OF RADIOACTIVITY IN BREAST MILK FOLLOWING ^{99}Tc /SUP M/-SN POLYPHOSPHATE. O'Connell, M.E.A.; Sutton, H. (University Coll. Hospital, London (UK)). Br. J. Radiol.; 49: No. 580, 377-379 (Apr 1976).

Case report.

EXCRETION; INFANTS; LACTATION; MAMMARY GLANDS; MILK; RADIATION DOSES; RADIATION HAZARDS; RADIONUCLIDE KINETICS; RADIOPHARMACEUTICALS; TECHNETIUM COMPLEXES; TECHNETIUM 99; WOMEN

- 1559 HYPERPROLACTINAEMIA AS A CAUSE OF GALLIUM-67 UPTAKE IN THE BREAST. Stepanas, A.V.; Maisey, M.N. (Guy's Hospital, London (UK)). Br. J. Radiol.; 49: No. 580, 379-380 (Apr 1976).

Case report.

CHEMOTHERAPY; DRUGS; GALLIUM 67; KIDNEYS; LTH; MAMMARY GLANDS; PATIENTS; QUANTITY RATIO; RADIONUCLIDE KINETICS; RADIOPHARMACEUTICALS; SIDE EFFECTS; UPTAKE

- 1560 (ORNL/TM--5358) LABORATORY SERVICES SERIES A SAFETY SHOWER TEST AND MAINTENANCE PROGRAM. Fields, J.W.; Keese, H.F. (Oak Ridge National Lab., Tenn. (USA)). Apr 1976. Contract W-7405-ENG-26. 24p. Dep. NTIS \$4.00.

Assuring reliable operation, when needed, of approximately 600 safety showers and eyewash fountains is an essential factor in an emergency preparedness program at any laboratory. Historical development and current practices of the ORNL safety-shower test program are described, including necessary personnel, equipment, and cataloging, scheduling, and testing techniques. (auth)

- 1561 UNITS FOR PHYSICAL QUANTITIES USED IN DOSIMETRY AND RADIATION PROTECTION. Taubert, R.; Wagner, S. PTB Mitt.; 86: No. 2, 102-103 (Apr 1976). (In German).

1 tab.; 7 refs..

The 15th General Conference on Weights and Measures (1975) decided to introduce the name Becquerel for the SI unit of the quantity activity (1 Bq = 1 s⁻¹) and the name Gray for the SI unit of ionizing radiations (1 Gy = 1 J/kg). The consequences of this latter decision are discussed. The Bundesanstalt is of the opinion that no further names for this unit should be introduced, but that the Gray should be used also for other quantities of the same dimension, especially for the dose equivalent.

562 (ERDA--76/89) LIVING WITH RADIATION. THE PROBLEMS OF THE NUCLEAR AGE FOR THE LAYMAN. Brannigan, F.L. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Safety, Standards and Compliance). Spr 1976. 58p. Dep. NTIS \$4.50.

Factors that contribute to the hazards of ionizing radiations for man and methods for radiation protection are discussed in non-technical language and illustrated. Definitions of 101 atomic terms and data on the radioactivity of some commonly used radioisotopes are included. This publication is an excellent source of basic data for the layman. (CH)

1563 (COO--119-251, pp 8-143) CURRENT CENSUS OF THE BEAGLE COLONY. 31 Mar 1976.

Research in radiobiology. Annual report of work in progress in the internal irradiation program.

Data are presented on the health status of beagles following a single injection of various doses of ^{226}Ra , ^{239}Pu , ^{228}Ra , ^{228}Th , ^{90}Sr , or ^{241}Am . (CH)

1564 (COO--119-251, pp 144-166) ^{241}Am INDUCED THYROID LESIONS IN THE BEAGLE: INTERIM OBSERVATIONS. Taylor, G.N.; Zizumbo, I.; Angus, W.; Jones, A.; Elliot, D. 31 Mar 1976.

Research in radiobiology. Annual report of work in progress in the internal irradiation program.

Injected doses of 2.88, 0.91 or 0.296 μCi $^{241}\text{Am}/\text{kg}$ in young adult beagles produced morphological changes in the thyroid gland and produce lower concentrations of thyroxin in the sera. Interstitial fibrosis without functional impairment was induced by the 0.099 μCi $^{241}\text{Am}/\text{kg}$ dose level. Clinical symptoms of hypothyroidism were not observed, even in those dogs with the most extreme thyroid lesions. The changes were characterized by a decrease in thyroid weight, interfollicular fibrosis, loss of colloid, loss of follicular epithelium, and hypertrophy and hyperplasia of the residual epithelium. Thus far, thyroid tumors have not been observed, however, a significant percentage of the animals in the lower dose levels are still living.

1565 (DOCKET-50245--679) MILLSTONE NUCLEAR POWER STATION, UNIT 1. REPORTABLE OCCURRENCE REPORT: A CONTAMINATED RADWASTE SHIPPING CASK WAS RECEIVED AT THE SITE. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 30 Mar 1976. 2p.

Contaminated radwaste shipping cask was received at the site. MILLSTONE-1 REACTOR; CASKS; RADIOACTIVE WASTES; CONTAMINATION; PERSONNEL; RADIATION DOSES; DECONTAMINATION

1566 (DOCKET-50309--473) MAINE YANKEE ATOMIC POWER PLANT. SEMIANNUAL OPERATING REPORT, JULY--DECEMBER 1975. (Maine Yankee Atomic Power Co., Westboro, Mass. (USA)). 30 Mar 1976. 59p. Dep. NTIS \$3.50.

Net electrical power generated was 2,848,186 MWH(e) with the generator on line 4,244 hrs. Information is presented concerning operations, power generation, shutdowns, corrective maintenance, primary coolant chemistry, occupational radiation exposure, release of radioactive materials, and abnormal occurrences. (FS)

1567 (DOCKET-50219--845) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. IE INSPECTION REPORT NO. 76-01, NOTICE OF VIOLATION AND REPLY. (Jersey Central Power and Light Co., Morristown, N.J. (USA)). 29 Mar 1976. 18p. Inspection of radiation safety. OYSTER CREEK-1 REACTOR; INSPECTION; RADIATION PROTECTION; CONTROL ELEMENTS; MECHANICAL STRUCTURES; RADIATION DOSES; PERSONNEL; PROTECTIVE CLOTHING; CONTAMINATION; CONTROL

1568 (DOCKET-50334--317) BEAVER VALLEY POWER STATION, UNIT 1. ADDITIONAL APPENDIX I INFORMATION. (Duquesne Light Co., Pittsburgh, Pa. (USA)). 26 Mar 1976. 3p.

Evaluation of radiation doses to the public to be submitted by June 4, 1976. BEAVER VALLEY-1 REACTOR; PERSONNEL; RADIATION DOSES; BACKGROUND RADIATION; ACTIVITY LEVELS; RADIOACTIVE EFFLUENTS

1569 (DOCKET-50220--559) NINE MILE POINT NUCLEAR STATION, UNIT 1. IE INSPECTION REPORT NO. 76-02 AND NOTICE OF VIOLATIONS. (Niagara Mohawk Power Corp., Syracuse, N.Y. (USA)). 25 Mar 1976. 17p.

Inspection of radiological protection. NINE MILE POINT-1 REACTOR; INSPECTION; RADIATION DOSES; PERSONNEL; COBALT 60; ACTIVITY LEVELS; RESPIRATORS; RADIATION PROTECTION; DOCUMENTATION; PERSONNEL; HEATERS; STACKS; EDUCATION; RADIATION SOURCES; LEAKS; WATER CHEMISTRY; PH VALUE

1570 (DOCKET-50331--650) DUANE ARNOLD ENERGY CENTER, UNIT 1. IE INSPECTION REPORT NO. 76-04. (Iowa Electric Light and Power Co., Cedar Rapids (USA)). 25 Mar 1976. 8p.

Inspection of radiation protection program implementation during refueling and outage. DUANE ARNOLD-1 REACTOR; INSPECTION; REACTOR FUELING; MAINTENANCE; REACTOR MAINTENANCE; RADIATION PROTECTION; PERSONNEL; RADIATION DOSES; EQUIPMENT; RADIATION MONITORS

1571 (DOCKET-50133--351) HUMBOLDT BAY POWER PLANT, UNIT 3. NOTICE OF A MEETING ON APRIL 1, 1976 TO DISCUSS APPENDIX I, 10 CFR PART 50. (Pacific Gas and Electric Co., San Francisco, Calif. (USA)). 24 Mar 1976. 2p.

Notice of a meeting on April 1, 1976 to discuss appendix I, 10 CFR part 50 concerning radwaste treatment and effluent control systems, site meteorology, hydrology, and radiation dose. HUMBOLDT BAY REACTOR; RADIOACTIVE WASTE PROCESSING; RADIOACTIVE EFFLUENTS; CONTROL SYSTEMS; MEETINGS; REACTOR SITES; METEOROLOGY; HYDROLOGY; PERSONNEL; RADIATION DOSES

1572 (DOCKET-50133--352) HUMBOLDT BAY POWER PLANT, UNIT 3. ANNUAL PERSONNEL EXPOSURE REPORT, JANUARY 15, 1975 TO JANUARY 14, 1976. (Pacific Gas and Electric Co., San Francisco, Calif. (USA)). 24 Mar 1976. 2p.

Annual personnel exposure report, January 15, 1975 to January 14, 1976. HUMBOLDT BAY REACTOR; PERSONNEL; RADIATION DOSES

1573 (DOCKET-50309--458) MAINE YANKEE ATOMIC POWER PLANT. SEMIANNUAL OCCUPATIONAL RADIATION EXPOSURE REPORT, JANUARY--JUNE 1975, ERRATA. (Maine Yankee Atomic Power Co., Westboro, Mass. (USA)). 22 Mar 1976. 13p.

Semiannual occupational radiation exposure report, January-June 1975, errata; tabulation of exposure in excess of 500 MREM. MAINE YANKEE REACTOR; RADIATION DOSES; PERSONNEL

1574 (DOCKET-50409--368) LACROSSE BOILING WATER REACTOR. IE INSPECTION REPORT NO. 76-02, REPLY. (Dairyland Power Cooperative, La Crosse, Wis. (USA)). 22 Mar 1976. 8p.
Inspection of personnel radiation doses.
LACBWR REACTOR;PERSONNEL;RADIATION DOSES;INSPECTION

1575 PROFESSIONAL INJURIES DUE TO IONIZING RADIATION. Sobota, J.; Naus, A. (Karlova Universita, Prague (Czechoslovakia). Lekarska Fakulta Hygienicka); Novak, M. (Dermatologicka Klinika Fakultni Nemocnice, Prague (Czechoslovakia)). Prakt. Lek.; 56: No. 6, 237-238(20 Mar 1976). (In Czech).
Letter-to-the-editor.
MEDICAL PERSONNEL;OCCUPATIONAL DISEASES;RADIODERMATITIS;RADIOLOGICAL PERSONNEL;X RADIATION;RADIATION INJURIES

1576 (DOCKET-50155--500) BIG ROCK POINT NUCLEAR PLANT. IE INSPECTION REPORT NO. 76-05. (Consumers Power Co., Jackson, Mich. (USA)). 19 Mar 1976. 8p.
Inspection of refueling and radiation protection during refueling. BIG ROCK POINT REACTOR;INSPECTION;REACTOR FUELING;RADIATION PROTECTION;BUBBLES;RADIOACTIVE WASTES;GASEOUS WASTES;AIR SAMPLERS;IODINE 131;RADIATION DOSES;PERSONNEL;FISSION PRODUCT RELEASE;DOCUMENTATION

1577 (DOCKET-50305--389) KEWAUNEE NUCLEAR POWER PLANT, UNIT 1. NOTIFICATION OF THE APPARENT EXPOSURE OF AN INDIVIDUAL TO CONCENTRATIONS OF RADIOACTIVE MATERIAL IN EXCESS OF LIMITS. (Wisconsin Public Service Corp., Green Bay (USA)). 19 Mar 1976. 3p.
Notification of the apparent exposure of an individual to concentrations of radioactive material in excess of limits. KEWAUNEE REACTOR;PERSONNEL;RADIATION DOSES;REACTOR FUELING;CLEANING;PRESSURE VESSELS;OPENINGS;RADIOACTIVE MATERIALS

1578 (DOCKET-50269--627) OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3. IE INSPECTION REPORT NO. 76-02; REPLIES. (Duke Power Co., Charlotte, N.C. (USA)). 18 Mar 1976. 34p.
(DOCKET-50270--588; DOCKET-50287--506).
Inspection of Unit 1 refueling and specimen holder tubes. OCONEE-1 REACTOR;OCONEE-2 REACTOR;OCONEE-3 REACTOR;INSPECTION;RADIOACTIVE EFFLUENTS;RELEASE LIMITS;MONITORING;REACTOR FUELING;VALVES;VENTS;GASEOUS WASTES;RADIATION MONITORS;WATER;MILK;CALIBRATION;PERSONNEL;EDUCATION;IRRADIATION CAPSULES;SAMPLE HOLDERS;FIRE PREVENTION;ELECTRICAL EQUIPMENT;MEASURING INSTRUMENTS;ELECTRIC CABLES;REMOTE HANDLING;FUEL ELEMENTS;RADIATION DOSES;TRANSPORT;RADIOACTIVE MATERIALS;AIR FILTERS;TESTING;QUALITY CONTROL

1579 INHIBITION OF ERYTHROID CELL GROWTH IN IRRADIATED MICE BY ALLOGENEIC LYMPHOID CELLS: SPECIFICITY OF THE RESPONSE. Lundegardh, G.; Lilliehook, B.; Blomgren, H. (Karolinska Institutet, Stockholm). Cell. Immunol.; 22: No. 2, 389-393(15 Mar 1976).
Allogeneic lymphocytes can inhibit proliferation of erythroid cells in the spleens of irradiated mice grafted with syngeneic bone marrow cells. Since there is a linear relationship between the number of injected lymphocytes and erythroid activity, the method is frequently used as a graft-vs-host assay. In this investigation we show that the reduction of erythroid activity is due to both a reaction of the lymphocytes against the tissues of the host and against the grafted bone marrow cells.

Thus, reduced erythropoietic activity does not necessarily indicate that the bone marrow targets possess antigens against which the lymphocytes are reactive.

1580 (DOCKET-50537--100) CLINCH RIVER BREEDER REACTOR PLANT. NATURAL RESOURCES DEFENSE COUNCIL, ET AL COMMENTS ON THE DRAFT ENVIRONMENTAL STATEMENT. (Project Management Corp., Chicago, Ill. (USA)). 13 Mar 1976. 84p.
Natural Resources Defense Council, et al comments on the draft environmental statement. CLINCH RIVER BREEDER REACTOR;ENVIRONMENTAL EFFECTS;PLUTONIUM;TOXICITY;RADIATION EFFECTS;PIPELINES;RUPTURES;REACTOR ACCIDENTS;REACTOR CORE DISRUPTION;COST BENEFIT ANALYSIS;COST;GEOLOGY;REACTOR SITES;SEISMOLOGY;EARTHQUAKES;GROUND MOTION;METEOROLOGY;RADIOACTIVE WASTE MANAGEMENT;FISSION PRODUCT RELEASE;RADIATION DOSES;PERSONNEL;TRANSPORT;FUEL CYCLE;ENVIRONMENT;RADIATION MONITORING;DESIGN;CORE CATCHERS;ENGINEERED SAFETY SYSTEMS;POWER DEMAND

1581 DIAGNOSTIC X-RAYS IN PREGNANCY. Saafan, S.T.A. (Broadgreen Hospital, Liverpool (UK). Dept. of Obstetrics and Gynaecology); Darwish, D.H. Lancet; 1: No. 7959, 596(13 Mar 1976).
Letter to the editor.
BIOMEDICAL RADIOGRAPHY;CARCINOGENESIS;DIAGNOSTIC TECHNIQUES;FETUSES;PERFORMANCE;PREGNANCY;RADIATION HAZARDS;WOMEN;X RADIATION

1582 (DOCKET-50313--489) ARKANSAS NUCLEAR ONE, UNIT 1. SEMIANNUAL OPERATING REPORT, JULY--DECEMBER 1975. (Arkansas Power and Light Co., Little Rock (USA)). 5 Mar 1976. 62p. Dep. NTIS \$4.50.
Net electrical power generated was 2,857,559 MWh(e) with the reactor on line 3,751.6 hrs. Information is presented concerning operations, power generation, shutdowns, corrective maintenance, occupational radiation exposure, release of radioactive materials, design changes, fuel performance, and results of leak rate tests. (FS)

1583 (DOCKET-50133--499) HUMBOLDT BAY POWER PLANT, UNIT 3. ANNUAL OPERATING REPORT FOR 1976. (Pacific Gas and Electric Co., San Francisco, Calif. (USA)). 3 Mar 1976. 44p.
Net electrical power generated was 196,742 MWh with the reactor on line 4078 hrs. Information is presented concerning operations, power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, and reportable occurrences. (FS)

1584 (UCRL--51879(Rev.1)) EXTERNAL DOSE ESTIMATES FOR FUTURE BIKINI ATOLL INHABITANTS. Gudiksen, P.H.; Crites, T.R.; Robison, W.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Mar 1976. Contract W-7405-ENG-48. 37p. Dep. NTIS \$4.00.
To evaluate the potential radiation doses that may be received by the returning Bikinians, we surveyed the residual radioactivity on Bikini and Eneu Islands in June of 1975. An integral part of the survey included measurements of gamma-ray exposure rates which are used to estimate external gamma-ray doses. The survey showed that on Bikini Island the rates are highly variable: values near the shores are generally of the order of 10 to 20 μ R/h, while those within the interior average about 40 μ R/h with a range of roughly

- 30 to 100 $\mu\text{R/h}$. Eneu Island, however, is characterized by more or less uniformly distributed gamma radiation levels of less than 10 $\mu\text{R/h}$ over the entire island. These data, in conjunction with population statistics and expected life styles, allowed us to estimate the potential external gamma-ray doses associated with proposed housing locations along the lagoon road and within the interior portions of Bikini Island as well as along the lagoon side of Eneu Island. As expected, living on Eneu Island results in the lowest doses: 0.12 rem during the first year and 2.9 rem during 30 years. The highest values, 0.28 rem during the first year and 5.9 rem over 30 years, may potentially be received by inhabitants living within the interior of Bikini Island. Other options under consideration produce intermediate values.
- 1585 (DOCKET-50213--494) HADDAM NECK PLANT. IE INSPECTION REPORT NO. 76-01, NOTICE OF VIOLATION AND REPLY. (Connecticut Yankee Atomic Power Co., Hartford (USA)). 2 Mar 1976. 21p.
Inspection of emergency planning. CONNECTICUT YANKEE REACTOR; INSPECTION; METEOROLOGY; MEASURING INSTRUMENTS; CALIBRATION; MAINTENANCE; PERSONNEL; EDUCATION; EMERGENCY PLAN; RADIATION DOSES; STEAM GENERATORS; LEAKS; REPAIR
- 1586 (DOCKET-50304--516) ZION NUCLEAR PLANT, UNIT 2. SEMIANNUAL REPORT, JANUARY--JUNE 1975, ERRATA. (Commonwealth Edison Co., Chicago, Ill. (USA)). 2 Mar 1976. 3p.
Semiannual report, January--June 1975, errata concerning radioactive waste, environmental monitoring and occupational personnel radiation exposure. ZION-2 REACTOR; REACTOR OPERATION; RADIOACTIVE WASTES; ENVIRONMENT; MONITORING; PERSONNEL; RADIATION DOSES
- 1587 RADIOLOGICAL PROTECTIVE SCREEN. Flaugnatti, R.B. US Patent 3,942,023. 2 Mar 1976. Filed date 27 Dec 1973. 6p.
A radiological screen for placing on a patient's skin is discussed, comprising a flat jacket containing a fine particulate filler and a settable resin binder, the fine particulate filler being of a material which absorbs medical radiation, and the jacket including a window to transmit such radiation through the flat jacket. 16 claims, 4 drawing figures.
- 1588 (DOCKET-50029--577) YANKEE NUCLEAR POWER STATION. SEMIANNUAL OPERATING REPORT, JULY--DECEMBER 1975. (Yankee Atomic Electric Co., Westboro, Mass. (USA)). 1 Mar 1976. 67p. Dep. NTIS \$4.50.
Net electrical power generated was 1,193,419,764 MWh(e) with the reactor on line 7,214.13 hrs. Information is presented concerning operation, power generation, shutdowns, corrective maintenance, primary coolant chemistry, occupational radiation exposure, release of radioactive materials, and reportable occurrences. (FS)
- 1589 (DOCKET-50213--673) HADDAM NECK PLANT. ANNUAL OPERATING REPORT: JANUARY--DECEMBER 1976. (Connecticut Yankee Atomic Power Co., Hartford (USA)). 1 Mar 1976. 58p.
Net electric power generated was 4,026,168.66 MWh with the reactor on line 7,248.60 hrs. Information is presented concerning operations, design changes, start-up physics testing, steam generator eddy current examination, corrective maintenance, shutdowns and power reductions, coolant chemistry, personnel radiation exposure, power generation and fuel performance. (FS)
- 1590 (DOCKET-50263--601) MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1. SEMIANNUAL OPERATING REPORT, JULY--DECEMBER 1975. (Northern States Power Co., Minneapolis, Minn. (USA)). 1 Mar 1976. 76p. Dep. NTIS \$5.00.
Net electrical power generated was 1,103,754 MWh(e) with the reactor on line 2,743 hrs. Information is presented concerning power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, occupational radiation exposure, release of radioactive materials, and environmental radiation monitoring. (FS)
- 1591 (DOCKET-50289--591) THREE MILE ISLAND NUCLEAR STATION, UNIT 1. SEMIANNUAL OPERATING REPORT NO. 4, JULY--DECEMBER 1975. (Metropolitan Edison Co., Reading, Pa. (USA)). 1 Mar 1976. 50p. Dep. NTIS \$4.00.
Information is presented concerning operations, shutdowns, maintenance, changes, tests, experiments, radioactive effluent releases, solid radioactive waste, primary coolant chemistry, personnel radiation, and refueling. Histograms of thermal power vs. time are included. (FS)
- 1592 (DOCKET-50298--530) COOPER NUCLEAR STATION. ANNUAL OPERATING REPORT 1975. (Nebraska Public Power District, Columbus (USA)). 1 Mar 1976. 42p. Dep. NTIS \$4.00.
Net electrical power generated was 1,495,920 MWh(e) with the generator on line 1,174.8 hrs. Information is presented concerning operations, power generation; shutdowns; corrective maintenance; fuel performance; occupational radiation exposure; vessel transient condition events; and facility changes. (FS)
- 1593 (GEAP--14034-6) RADIOLOGICAL ASSESSMENT MODELS. SIXTH QUARTERLY REPORT, DECEMBER 1975--FEBRUARY 1976. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Mar 1976. Contract E(04-3)-893. 48p. AT.
Progress during December 1975, January and February 1976, in the Radiological Assessments Program is reported. The objectives of the program are to develop models for analyzing and evaluating postulated radiological sources, aerosol dynamics, sodium fires, and radiological dosages arising from hypothetical core disruptive accidents in liquid metal fast breeder reactors.
- 1594 HEALTH PHYSICS IN NUCLEAR POWER STATIONS. Beau, P. (Electricite de France, 93 - Saint-Denis. Dept. de Radioprotection); Gachot, B. (Electricite de France, 92 - Courbevoie. Service Etudes et Projets Thermiques et Nucleaires); Schaeffer, R. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires). Ann. Mines; 182: No. 3, 47-60 (Mar 1976). (In French).
Workers in a nuclear power station can be exposed to three main sources of radiation: the reactor core, the circuits containing radioactive fluids and the unloaded irradiated fuel elements. The protection systems include the measures foreseen during the power stations design stage and the measures taken when operating. These systems are described in detail. On an average, individual doses received by workers in graphite-gas nuclear

stations and light water stations remained clearly below authorized limits. The amount of those doses (collective dose) characterizes the operating and maintenance conditions for each installation. Its development during the first years of operation for both stations as well in France as in the States is herein studied. E.D.F. has undertaken studies in order to reduce even more those doses.

- 1595 (DP--1415) ENVIRONMENTAL EFFECTS OF A TRITIUM GAS RELEASE FROM THE SAVANNAH RIVER PLANT ON DECEMBER 31, 1975. Jacobsen, W.R. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Mar 1976. Contract AT(07-2)-1. 34p. Dep. NTIS \$5.00.

At 10:00 p.m. EST on December 31, 1975, 182,000 Ci of tritium gas was released within about 1.5 min from a tritium processing facility at the Savannah River Plant. The release was caused by the failure of a vacuum gage and was exhausted to the atmosphere by way of a 200-ft-high stack. Winds averaging 20 mph carried the tritium offplant toward the east. Calculations indicate that the puff passed out to sea about 35 miles north of Charleston, South Carolina, about 7 hr after the release occurred. Samples from the facility exhaust system indicated that 99.4 percent of the tritium was in elemental form and 0.6 percent was in the more biologically active oxide (water) form. The maximum potential dose to a person (from inhalation and skin absorption) at the puff centerline on the plant boundary was calculated to be 0.014 mrem, or about 0.01 percent of the annual dose received from natural radioactivity. The integrated dose to the population under the release path was calculated to be 0.2 man-rem before the tritium passed out to sea. Over 300 environmental samples were collected and analyzed following the release. These samples included air moisture, atmospheric hydrogen, vegetation, soil, surface water, milk, and human urine. Positive results were obtained in some onplant and plant perimeter samples; these results aided in confirming the close-in puff trajectory. Tritium concentrations in nearly all samples taken beyond the plant perimeter fell within normal ranges; no urine samples indicated any tritium uptakes as a result of the release. Two milk samples did indicate a measurable tritium uptake; the maximum potential dose to an individual drinking this milk was calculated to be about 0.1 mrem. Because calculated doses from assumed exposure to the tritium are low and analyses of environmental samples indicated no significant accumulation of tritium, it is concluded that no significant environmental effects resulted from the December 31, 1975, tritium release. (auth)

- 1596 (ORNL--4992) METHODOLOGY FOR CALCULATING RADIATION DOSES FROM RADIOACTIVITY RELEASED TO THE ENVIRONMENT. Killough, G.G.; McKay, L.R. (Oak Ridge National Lab., Tenn. (USA)). Mar 1976. Contract W-7405-ENG-26. vp. Dep. NTIS \$12.50.

This document represents a compilation of the principal environmental transport and dosimetry models developed, adapted, and implemented by the Radiological Analyses and Applications Group of the Environmental Sciences Division of the Oak Ridge National Laboratory. The transport of released radioactivity through the natural environment is discussed in four sections: atmospheric dispersion, resuspension of material by wind action, terrestrial transport, and movement of material in underground water seepage. The discussion of dose to man and biota is divided

into internal and external exposure sections. And finally, a developmental model (CONDOS) which estimates the dose to a population resulting from the manufacture, storage, distribution, use, and disposal of consumer products which contain radioactivity is described. Numerous tables are included. (auth)

- 1597 FACTORS USED FOR THE ESTIMATION OF RADIOACTIVE NUCLIDE INTAKE THROUGH FOODSTUFFS BY INHABITANTS IN COASTAL AREA OF IBARAKI PREFECTURE. IV. CONSUMPTION OF MARINE FOODS IN KUJI TOWN AND TOKAI VILLAGE. Sumiya, M.; Ohmomo, Y. (National Inst. of Radiological Sciences, Nakaminato, Ibaraki (Japan). Marine Radioecological Research Station). Hoken Butsuri; 11: No. 1, 57-64 (Mar 1976).

The consumption of marine foods such as fish, cephalopod, crustacea, shellfish, algae and processed was surveyed on three kinds of families in Kuji town and Tokai village. The average daily intake through a year was 224 g/d/p for fisherman's families in Kuji, 131 g/d/p for native's families in Tokai and 89 g/d/p for immigrant's families from city to Tokai village, respectively. Fish accounted for about one-half of whole consumption of marine foods. Fisherman's families showed the highest consumption of all kinds of marine foods except algae through a year. Algae was consumed much by the natives in Tokai.

- 1598 (COO--2031-4) RADIOPHARMACEUTICALS FOR DIAGNOSIS AND TREATMENT. PROGRESS REPORT, AUGUST 1, 1976--JULY 31, 1977. Beierwaltes, W.H. (Michigan Univ., Ann Arbor (USA)). Mar 1976. Contract E(11-1)-2031. 17p. Dep. NTIS \$3.50.

Progress is reported on the following research projects: diagnosis of adrenal cortex diseases using ^{131}I -19-iodocholesterol, NP-59 or 6 β -I-131-iodo-methyl-19-norcholesterol-5(10)-enol, Se-75-19-selenocholesterol, Se-75-6 β -benzyl-selenomethyl-19-norcholesterol-5(10)-en-3 β -ol, and radiolabeled enzyme inhibitors; diagnosis of adrenal medulla diseases using radiolabeled cholesterols and enzyme inhibitors and dopamine analogs; tissue distribution of ^{14}C -, ^{125}I -, and ^{131}I -diphenylhydantoin in the toadfish, rat, and human with insulinomas of the pancreas; concentration of ^{14}C and ^{125}I -labeled quinoline analogs in malignant melanomas of mice; calcium, phosphorus, and magnesium content of mammary cancers and normal mammary tissue of women in relation to uptake of ^{32}P labeled bone scanning agents; and development of purified immunoglobulins with specific antibody reactivity to tumor-associated antigens, labeled with ^{125}I or ^{131}I . (HLW)

- 1599 BONE MARROW SCANNING WITH ^{52}Fe . REGENERATION AND EXTENSION OF MARROW AFTER ABLATIVE DOSES OF RADIOTHERAPY. Knospe, W.H.; Rayudu, V.M.S.; Cardello, M.; Friedman, A.M.; Fordham, E.W. (Rush-Presbyterian-St. Luke's Medical Center, Chicago). Cancer; 37: No. 3, 1432-1442 (Mar 1976).

Extensively irradiated patients were studied from 0 to 73 months after irradiation by ^{52}Fe bone marrow scanning. Marrow regeneration was observed in most patients after intervals of 12 months or longer. The degree of recovery was not dose-related and the marrow ablative dose was not defined with doses of 4000-5000 rads. Degree of recovery depended more upon the anatomic region and/or sequence of fields treated; the last field treated invariably showed poorer regeneration when recovery was uneven. Active erythropoiesis expanded into distal inactive erythropoietic sites from 3 to

12 months after irradiation and then decreased thereafter. Blood count cytopenias were almost always restricted to the first year after irradiation.

- 1600 HYBRIDIZABILITY OF GAMMA-IRRADIATED LACTIC DEHYDROGENASE. Saito, M. (Kyoto Univ., Osaka). *Radiat. Res.*; 65: No. 3, 490-499(Mar 1976).

The hybridizabilities of the gamma-irradiated chicken heart and pig muscle lactic dehydrogenases were estimated by hybridizing the irradiated enzymes with the unirradiated pig heart lactic dehydrogenase. The disc gel electrophoretic patterns of the inter- and intraspecific hybrids showed that the LDH activity of the pig heart isozyme band increased as a function of dose. This observation was analyzed upon the binomial redistribution pattern of the recombined subunits. The result shows that the hybridizabilities of both the chicken heart and pig muscle isozymes decreased along with the loss of catalytic activity and the release from substrate inhibition. The titration of free SH groups of the irradiated chicken isozyme suggested that the unfolding of the peptide chain destroyed the specific tertiary structure needed for the binding of subunits. (auth)

- 1601 CELL DIVISION REQUIREMENT FOR ACTIVATION OF MURINE LEUKEMIA VIRUS IN CELL CULTURE BY IRRADIATION. Otten, J.A.; Quarles, J.M.; Tennant, R.W. (Oak Ridge National Lab., TN). *Virology*; 70: No. 1, 80-87(Mar 1976).

Actively dividing cultures of AKR mouse cells were exposed to relatively low dose-rates of γ radiation and tested for activation of endogenous leukemia viruses. Efficient and reproducible induction of virus was obtained with actively dividing cells, but cultures deprived of serum to inhibit cell division before and during γ irradiation were not activated, even when medium with serum was added immediately after irradiation. These results show that cell division was required for virus induction but that a stable intermediate similar to the state induced by halogenated pyrimidines was not formed. In actively dividing AKR cell cultures, virus activation appeared to be proportional to the dose of γ radiation; the estimated frequency of activation was $1-8 \times 10^{-5}$ per exposed cell and the efficiency of activation was approximately 0.012 inductions per cell per rad. Other normal primary and established mouse cell cultures tested were not activated by γ radiation. The requirement of cell division for radiation and chemical activation may reflect some common mechanism for initiation of virus expression.

- 1602 X-RAY-INDUCED MUTANTS RESISTANT TO 8-AZAGUANINE. EFFECTS OF CELL DENSITY AND EXPRESSION TIME, PT. 1. Carver, J.H.; Dewey, W.C.; Hopwood, L.E. (Colorado State Univ., Fort Collins USA). *Dept. of Radiology and Radiation Biology*. *Mutat. Res.*; 34: No. 3, 447-463(Mar 1976).

Asynchronous Chinese hamster ovary cells were irradiated and colony survival in Alpha MEM medium with dialyzed serum was determined with or without 15 μ g/ml 8-Azaguanine (AG). Data indicated that a reproducible assay for the system was dependent upon controlling cell density at least two days prior to induction as well as throughout the expression period. Generally, spontaneous and radiation-induced mutant frequencies decreased when cell densities exceeded a critical density of $3-6 \times 10^4$ cells/cm². Infrequently, the critical density was exceeded by a factor of two with no

observed decrease, possibly correlated with a longer cell doubling time. Drug depletion artifacts can occur because of drug degradation, or because wild-type cells utilize the drug or produce conditions which reduce uptake of the drug. Thus, as the effective drug concentration is lowered, the observed mutant frequency increases because a spectrum of mutants resistant to only low concentrations can now survive. In fact, refeeding with AG at intervals during the incubation period lowered spontaneous and radiation-induced frequencies approx. 5-fold. Therefore, to standardize conditions, cells were trypsinized at the end of the expression time and replated at a constant cell number for mutant selection by AG. Over two generations of growth during the expression period were required for optimal manifestation of induced mutants, and when densities were kept below 4×10^4 cells/cm² at all times, observed mutant frequencies did not change significantly over a period between 80 and 140 h post-induction (over 4 generations for irradiated cells and over 6 generations for controls). Previous reports of observed mutant frequencies decreasing beyond three generations may be due to cell interaction prior to mutant selection.

- 1603 X-RAY INDUCED MUTANTS RESISTANT TO 8-AZAGUANINE. CELL CYCLE DOSE RESPONSE, PT. 2. Carver, J.J.; Dewey, W.C.; Hopwood, L.E. (Colorado State Univ., Fort Collins USA). *Dept. of Radiology and Radiation Biology*. *Mutat. Res.*; 34: No. 3, 465-479(Mar 1976).

Synchronous Chinese hamster ovary cells were irradiated in G₁ or S phase. Colony survival in Alpha MEM medium with dialyzed serum was determined with or without 15 μ g/ml 8-azaguanine (AG). An expression period of over three generations (multiplicity of 20) was utilized, with expression times ranging from 58 to 114 h. Both G₁ and S phase were practically identical in sensitivity to X-ray-induced mutations, with mutant frequency/viable cell/rad ranging from 1×10^{-7} (75 to 100 rad) to 8×10^{-7} (1000 rad). The spontaneous mutation rate, shown by Luria-Delbruck fluctuation analysis, was 5×10^{-7} per generation. Thirty-three mutants, isolated at random and grown for over 30 generations in the absence of AG, were analyzed for plating efficiency (PE) in different concentrations of AG or in hypoxanthine-aminopterin-thymidine (HAT) medium. Of these, 64% were resistant (PE > 0.1) to 7.5 μ g/ml AG, 85% to 5.0 μ g/ml, and 91% to 3.5 μ g/ml. Only 42% showed possible hypoxanthine-phosphoribosyltransferase (HPRTase) deficiency as evidenced by HAT sensitivity (PE < 0.1). Wild type controls exhibited PE's in 3.5 μ g/ml AG of < 0.001 and in HAT of > 0.5. Of ten mutants studied, all demonstrated survival response to radiation similar to wild type cells (D tilde of approx. 120 rad). For radiation protection standards, the radiation dose required to induce mutations at a rate equal to that occurring spontaneously is called the doubling dose. The doubling dose observed for acute irradiation was about 3 rad and was estimated to be 10 to 60 rad for chronic irradiation, similar to that often reported for in vivo studies.

- 1604 OXYGEN-DEPENDENCE OF NEAR UV (365 NM) LETHALITY AND THE INTERACTION OF NEAR UV AND X-RAYS IN TWO MAMMALIAN CELL LINES. Danpure, H.J. (Hammersmith Hospital, London UK). *M.R.C. Cyclotron Unit*; Tyrrell, R.M. *Photochem. Photobiol.*; 23: No. 3, 171-177(Mar 1976).

The colony-forming ability of Chinese hamster cells (V-79) and HeLa cells has been measured after near-ultraviolet (uv)

irradiation, predominantly at 365 nm. To avoid production of toxic photoproducts, cells were irradiated in an inorganic buffer rather than in tissue culture medium. Under these circumstances near-uv lethality was strongly oxygen-dependent. Both cell lines were approximately 10^4 times more sensitive to 254 nm irradiation than to 365 nm radiation aerobically. Pretreatment with 6×10^5 Jm⁻² 365 nm radiation sensitised the HeLa, but not the V-79 cell line to subsequent x irradiation. Pretreatment of cells with 17 Jm⁻² 254 nm radiation, a dose calculated to produce twenty times more pyrimidine dimers than the 365 dose, produced only slight sensitisation to x rays. It is suggested that the sensitisation to x rays seen in the HeLa cells after 365 nm treatment was not the result of lesions induced in DNA by the near-uv radiation, but may have reflected the disruption of DNA-repair systems.

- 1605 EFFECT OF REPEATED SMALL DOSES OF RADIATION ON RECOVERY FROM SUB-LETHAL DAMAGE BY CHINESE HAMSTER CELLS IRRADIATED IN THE PLATEAU PHASE OF GROWTH. McNally, N.J.; De Ronde, J. (Mount Vernon Hospital, Northwood (UK)). Int. J. Radiat. Biol.; 29: No. 3, 221-234 (Mar 1976).

Unfed plateau-phase cells have been irradiated with either single doses or up to ten fractions of X-rays 6 hours apart. The single-dose survival curve had an extrapolation number of 11.4, and the oxygen-enhancement ratio (o.e.r.) was 3.1. Cells were exposed to multiple fractions of 200 rad or 150 rad in air and 600 rad or 450 rad in hypoxia. The resulting survival curves did not fit a multi-target, single-hit model of cell survival, being much steeper than that would predict. The curves were exponential up to five fractions of X-rays, but tended to bend downwards with increasing number of fractions. Cells that had survived five fractions of 200 rad (or 600 rad in hypoxia) 6 hours apart, were less able to absorb damage as sub-lethal than those which had not previously been exposed to radiation. The ratio of the initial slopes of the fractionated survival curves for irradiation in air and hypoxia was 2.1, implying that the o.e.r. 'on the shoulder' may be less than that in the exponential region of survival.

- 1606 ENHANCING EFFECT OF FRACTIONATED WHOLE-BODY X-IRRADIATION ON REPLICATION OF ENDOGENOUS LEUKEMIA VIRUSES IN BALB/C MICE. Takamori, Y.; Okumoto, M.; Iwai, M.; Iwai, Yoshiaki (Radiation Center of Osaka Prefecture, Sakai (Japan)). Annu. Rep. Radiat. Center Osaka Prefect.; 16: 78-82 (Mar 1976).

The incidence of leukemia, changes in the tissue weight of spleen and thymus, and the expression of endogenous viruses were examined with BALB/c mice following 4 weekly fractionated whole-body x-irradiation of 170 R each, starting at 4 weeks of age. The leukemia incidence was quite low for the unirradiated controls, while 60% of the irradiated male mice developed thymic lymphoma. The virus-positive cells appeared earlier in the spleen than in the thymus and bone marrow, and increased with aging. The time of appearance of virus-positive cells in these tissues was remarkably promoted by the fractionated x-irradiation, and its frequency was also enhanced.

- 1607 (IRI--190-76-01) RADIATION DOSE TO THE OVARIES CAUSED BY THREE SPECIFIC X-RAY INVESTIGATIONS. van't Riet, A. (Interuniversitair Reactor Instituut, Delft (Netherlands)). Mar 1976. 36p. (In Dutch). NTIS (US Sales Only).

15 refs., 13 figs., 7 tables, 2 apps..

In nine Dutch hospitals, the radiation dose to the ovaries, caused by routine X-ray radiography of kidneys and abdomen, was derived from skin doses measured with lithium fluoride thermoluminescent dosimeters. The highest mean dose, approximately 500 mrad, was obtained during intravenous pyelography.

- 1608 (ORNL--5113) BIBLIOGRAPHY OF THE LITERATURE OF THE HEALTH PHYSICS DIVISION THROUGH CALENDAR YEAR 1975. Dixon, M.N. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Mar 1976. Contract W-7405-ENG-26. 283p. Dep. NTIS \$9.25.

The literature of the Health Physics Division is documented. The bibliography contains open literature publications, report literature, and special literature. An author index and separate listings of theses and patents are included. (HLW)

- 1609 (ORNL/TM--5337) RADIATION INSULT TO THE ACTIVE BONE MARROW AS PREDICTED BY A METHOD OF CHORDS. Jones, T.D. (Oak Ridge National Lab., Tenn. (USA)). Mar 1976. Contract W-7405-ENG-26. 29p. Dep. NTIS \$4.00.

Critical Human Organ Radiation Dosimetry (CHORD) probability density functions for A-P, P-A, bilateral, rotational, and isotropic incidence, plus simple depth-dose data, permit the rapid estimation of the radiation insult to the active red bone marrow system of the ICRP Reference Man. The CHORD concept follows the variations in the microscopic processes of absorption, attenuation, and scattering on a macroscopic level so that it is not necessary to attempt detailed calculations for each and every case of interest. Similar techniques have been applied to reactor criticality calculations and the general logic of the CHORD process can be applied to any cause-response type situation which can be described in terms of variation with distance in the medium of interest. Doses to active bone marrow from exposures to photons and neutrons are presented and excellent agreement was found with the few available experimental results.

- 1610 (PAEC(D)--76004) DETERMINATION OF POLONIUM IN URINE OF FILIPINO NON-SMOKERS AND SMOKERS. Juan, N.B.; Ballelos, E. (Philippine Atomic Energy Commission, Diliman, Quezon City). Mar 1976. 4p. NTIS (US Sales Only).

Po²¹⁰, a decay product of Ra²²⁶, is a pure alpha emitter with an energy of 5.3 MeV decaying with a half-life of 138.4 days. It is a natural contaminant of tobacco and hence a health hazard to smokers. Previous study on Philippine cigarettes revealed that the average Po²¹⁰ activity of local brands is 0.0071 pCi/g, while that of foreign brands is 0.0129 pCi/g. Other studies indicate that approximately 0.13% of the total Po²¹⁰ in the body is excreted in the urine daily. Po urinalysis can serve as a rough index of the body burden of Po²¹⁰ and Ra²²⁶ or any one of its daughters absorbed in case of exposures. In this study, the Po²¹⁰ content in urine of smokers is compared with that of non-smokers. Twenty samples from non-smokers and twenty samples from smokers were analyzed for Po²¹⁰ activity. The average Po content of the urine of smokers, 0.2673±0.107 pCi/24h appears to be higher than the mean Po activity in urine of non-smokers, 0.1877±0.1200. The t-value obtained from the comparison of the means was 2.205. This exceeds the t-value at the 0.05 significance level (degrees of freedom equal 19) which is 1.725. Therefore, there exists a significant

difference in the Po content in the urine of non-smokers to that of smokers.

- 1611 (PB--258167) RECOMMENDATIONS ON GUIDANCE FOR DIAGNOSTIC X-RAY STUDIES IN FEDERAL HEALTH CARE FACILITIES. BACKGROUND REPORT. (Environmental Protection Agency, Washington, D.C. (USA)). Mar 1976. 40p. (EPA--520/4-76/002). NTIS \$4.00.

One of the most significant aspects of good medical care is the use of x-rays to diagnose and define the extent of disease or physical injury. The per capita use of x-rays in medicine and dentistry has expanded rapidly in the United States due to wider availability of services, new equipment, and an increase in sophisticated diagnostic examinations. Although many procedures now produce less exposure per film, the increased number of procedures has increased the radiation exposure to the population. The most important factor in reducing radiation exposure is to eliminate clinically unproductive procedures. The factors involved in accomplishing this goal were examined by the Subcommittee on Prescription of Exposure to X-rays which was made up of physicians, dentists, and physicists from the three military services, the Veterans Administration, and the Environmental Protection Agency. (GRA)

- 1612 (SAAS--195) STATE AND TENDENCIES OF CHEMICAL PROTECTION AGAINST IONIZING RADIATION. A LITERATURE SURVEY 1974. Siegel, G.; Tapp, E.; Haehn, J.; Hannig, H.; Dlaske, R. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Mar 1976. 76p. (In German). INIS.

289 refs..

Papers published in 1974 in the field of chemical protection against ionizing radiation are reviewed. Protection studies in vitro and in vivo, the biochemical, pharmacological and toxic effects, the mechanisms of protection of radioprotective agents and the trends in this field of research are described.

- 1613 (SGAE--2592) NATURAL RADIATION ENVIRONMENT OF MAN. Altmann, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Mar 1976. 11p. (In German). (BL--169/76). Dep. NTIS (US Sales Only), PC A02/MF A01.

The natural radioactivity occurring in the normal environment of human life is briefly reviewed. The radiation burden due to internal and external sources is described. The enzymatic repair systems which come into operation on occurrence of radiation-induced mutations in genetic material are outlined. It is shown that the human organism is well adapted for natural radiation, but much less to the action of mutagenic agents which are dangerous, especially if they inhibit the repair enzymes.

- 1614 RADIATION-INDUCED RENOVASCULAR HYPERTENSION. Staab, G.E.; Tegtmeyer, C.J.; Constable, W.C. Am. J. Roentgenol., Radium Ther. Nucl. Med.; 126: No. 3, 634-637 (Mar 1976).

Radiation is known to produce changes in the small vessels and interstitium of the kidneys resulting in hypertension. Two cases of renal artery stenosis and resultant hypertension secondary to abdominal irradiation are reported and the literature is reviewed.

- 1615 LATE EFFECTS OF X-IRRADIATION IN PATIENTS TREATED FOR METROPATHIA HAEMORRHAGICA. Smith, P.G.; Doll, R. (Department of Health and Social Security, Cancer Epidemiology and Clinical Trials Unit, 9 Keble Road, Oxford (UK)). Br. J. Radiol.; 49: No. 579, 224-232 (Mar 1976).

The causes of death among 2,068 patients treated with X-irradiation for metropathia haemorrhagica at three Scottish radiotherapy centres between 1940 and 1960 have previously been reported. (Doll, R., and Smith, P.G., 1968, Br. J. Radiol., vol. 41, 362). This cohort of women has now been followed up for a further seven years. 500 (24 per cent) women have now died, 78 (3.8 per cent) have emigrated and 25 (1.2 per cent) could not be traced. The numbers of deaths from different causes have been compared with the numbers expected in a population of similar age and sex exposed to the Scottish national mortality rates over the same period. An excess of deaths from leukaemia (7 observed, 2.3 expected) and of cancers of the heavily irradiated sites (59 observed, 40.1 expected) continues to be observed five or more years after treatment. There is no indication of any change in the excess death rate, due to cancers of sites in the radiation field, with time since treatment up to at least 20 years after the radiation exposure. Over the same period the number of deaths from cancer of the breast was below expectation (10 observed, 22.3 expected) and no increased mortality from coronary disease was seen (102 observed, 100.9 expected). The mean dose of radiation to the bone marrow has been determined for each woman and it is estimated that the excess rate of leukaemia in the first 20 years after treatment is about 1.1 per million women per year per rad. This figure is in accord with the estimates derived from the survivors of the atomic bomb explosions in Hiroshima and Nagasaki and among patients with ankylosing spondylitis treated with X-irradiation. However, the simple assumption of a linear dose response relationship for leukaemia is probably incorrect, at least when high doses of radiation are delivered to a small volume of marrow.

- 1616 RADIATION EXPOSURE TO THE PATIENT IN XERORADIOGRAPHY. Boag, J.W.; Stacey, A.J.; Davis, R. (Royal Marsden Hospital, London (UK)). Br. J. Radiol.; 49: No. 579, 253-261 (Mar 1976).

Measurements are presented of the radiation exposure required in xeroradiography of the breast and of the extremities. The nature of the radiation hazard and the most appropriate quantity by which to assess it are discussed, and it is shown that for a number of radiological procedures xeroradiographs can be taken for about the same radiation exposure to the patient as that required by conventional film techniques.

- 1617 DEPTH ABSORBED DOSE DISTRIBUTIONS FOR ELECTRONS. Brahme, A. (Radiofysiska Institutionen, Stockholm (Sweden)); Svensson, H. Phys. Med. Biol.; 21: No. 2, 304-306 (Mar 1976).

Letter to the editor.

BUILDUP; COMPARATIVE EVALUATIONS; DEPTH DOSE DISTRIBUTIONS; ELECTRONS; ELECTRON DOSIMETRY; ERRORS; LINEAR ACCELERATORS; LIQUID IONIZATION CHAMBERS; MICROTRONS; PERFORMANCE; RADIATION DOSES; RADIOTHERAPY; SILICON DIODES

- 1618 LYMPHOCYTE AS A BIOLOGICAL DOSIMETER: A DIFFERENT APPROACH. Madhvanath, U. (Bhabha

Atomic Research Centre, Bombay (India)).
Health Phys.; 30: No. 3, 296-299(Mar 1976).
Brief note.

ACUTE IRRADIATION; BIOLOGICAL DOSEMETERS;
BIOLOGICAL INDICATORS; CHROMOSOMAL ABERRATIONS;
COMPARATIVE EVALUATIONS; LYMPHOCYTES; RADIATION
SYNDROME; SURVIVAL CURVES

- 1619 IMPLEMENTING THE REQUIREMENT TO REDUCE RADIATION EXPOSURE TO 'AS LOW AS PRACTICABLE' AT THE LAWRENCE BERKELEY LABORATORY. Thomas, R.H. (California Univ., Berkeley (USA)). Lawrence Berkeley Lab.). Health Phys.; 30: No. 3, 271-279(Mar 1976).

The work of the Health Physics Department of the Lawrence Berkeley Laboratory in limiting radiation exposures, over the past 25 yr, both to laboratory personnel and the surrounding population, is reviewed. The radiation environments and the environmental impact of the four particle accelerators are discussed. Despite an increasing potential for the production of radiation with the beam intensity of the Bevatron increasing since its first operation in 1954, site boundary radiation levels have shown a steady decline since 1959. Estimates of population dose are described and shown to be comparable with the collective dose to radiation workers. The collective dose to personnel involved in accelerator operations and maintenance has shown a small decline. Cost effectiveness studies of shielding show that the cost of removing radiation exposure by providing a roof shield for the Bevatron has been \$40 to 85 per man-rem. For the 88-in. cyclotron, projections over 10 yr estimate the cost of the provision of additional roof shielding to be between \$200 and 450 per man-rem.

- 1620 EFFECTS OF TESTICULAR RADIATION. Clubb, B.; Carter, J. (Saint Vincent's Hospital, Darlinghurst (Australia)). Australas. Radiol.; 20: No. 1, 64-68(Mar 1976).

Three important consequences of testicular radiation are examined: (1) the effect on the male germinal epithelium, (2) the effect on male fertility, (3) the effect on the genetic health of the offspring. Threshold single testicular radiation exposures causing structural damage of spermatogonia and spermatocytes in man were defined as was a threshold singular radiation exposure for aspermia. It appears that fractionation of a testicular radiation dose enhances the degree of germinal epithelial damage as well as lowering the threshold dose for aspermia. It was found the prediction of male fertility following testicular irradiation was difficult and unreliable and estimates of germinal epithelium function can prove misleading. The genetic hazard associated with testicular radiation does not appear to be great.

- 1621 RADIATION PROTECTION LAWS IMPROVED BY A NEW RADIATION PROTECTION ORDINANCE. Umwelt (Inf. Bundesminist. Innern); No. 47, 8-13(Mar 1976). (In German).

Report on the draft of a new Radiation Protection Ordinance which has been published according to the stipulations of the EURATOM Treaty of the Commission of the EC. It is intended that the Ordinance will come into force not later than the end of this year, its handing-over to the Bundesrat being scheduled for April 1976.

- 1622 FETAL DOSE IN OBSTETRIC RADIOGRAPHY. Ardran, G.M. (UKAEA Research Group, Harwell.

Atomic Energy Research Establishment); Crooks, H.E. Radiography; 42: No. 495, 61-62(Mar 1976).

The fetal dose in obstetric radiography varies with the procedure used, and it is therefore difficult to compare published data for radiation doses to the fetus. The orthodiagraphic pelvimetry technique is applied in principle in many radiography centres; an alternative technique is available for examination of the whole abdomen. Those procedures have been simulated by means of a 24 cm Mix D manikin containing a bony skeleton with a measurement point 14 cm from the tube side of the 'patient', to give measurements of fetal dose at variance with published estimates. The accuracy of fetal dose estimation methods is examined. Errors can be introduced by extrapolation of curves when at least one of the scales is non-linear. There have been misconceptions concerning the conditions required to minimize the fetal dose.

- 1623 HEALTH PHYSICS PROBLEMS IN URANIUM MINES. Pradel, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection); Koch, L. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France)). Ann. Mines; 182: No. 3, 37-46(Mar 1976). (In French).

Prospecting and mining of radioactive ore deposits expose the staff and surrounding population to radiations which extension should be limited. Distinction is made between external irradiation from β and γ rays emitted by ores and internal contamination through breathing ore dust and radon (and its daughter products), a radioactive gas permanently emanating from uranium ores. Radiation levels encountered are described as well as methods of controlling miners on individual basis and surveying surrounding populations. Regulations and standards are detailed and the results achieved in Commissariat a l'Energie Atomique mines are given out. As a conclusion, it is emphasized that radon and daughter products constitute the most dangerous risk. Nevertheless it should be possible, provided that a steadfast effort and rigorous surveillance are observed, to comply with current regulations on miner working conditions and that, taking into account the latest data which stipulate that workers should be protected from any damage.

- 1624 EFFECT OF EXPOSURE ON HEALTH OF ATOMIC BOMB SURVIVORS. Fujitomi, Y.; Ueno, Y.; Nozaki, T.; Kawaguchi, F.; Ishida, S. (Nagasaki Univ. (Japan). School of Medicine). Hiroshima Igaku; 29: No. 3, 204-209(Mar 1976). (In Japanese).

The effects of exposure on vital functions of survivors 30 years after exposure were analyzed, including somatic, psychic, and social factors. Of the survivors living in Nagasaki City, a short-distance exposure group (within 1 km, above 925 rad) and a long-distance exposure group (30 km, 0.6 rad) were selected. The questionnaire included acute symptoms at the time of exposure and present subjective symptoms as indicating vital functions, and psychic factors and medical treatment of exposure as social factors. More of the short-distance exposure group complained of decreased vital functions than did those of the long-distance exposure group. Anxiety was mentioned as one of the causes of the present subjective symptoms. It was not thought that there was relationship between the acute symptoms and the present symptoms. A tendency toward decreased hemoglobin was observed in some of the subjects.

can not be neglected.

1625 STATISTICAL STUDY OF AUTOPSY CASES IN HIROSHIMA ATOMIC BOMB HOSPITAL 1956-1975. Hamada, T.; Ishida, S. (H. ma Atomic Bomb Hospital (Japan)); Matsushita, Hiroshi. Hiroshima Igaku; 29: No. 3, 223-229(Mar 1976). (In Japanese).

In order to study the differences in the incidence of a variety of disease (excluding tumors), between the cases exposed to the atomic bomb and those who were unexposed, main lesions were studied statistically by autopsy. The subjects were 1230 cases autopsied at the Hiroshima Atomic Bomb Hospital or the Hiroshima Red-Cross Hospital. They were divided into 318 cases exposed at a short distance from the bombed area (within 2 km), and 420 cases exposed at a long distance from that area (more than 2 km), including those who had come to Hiroshima later. Four hundred twenty nine unexposed cases were selected as controls. The incidence of tumor, disturbance of circulation, disturbance of the blood vessels in the brain, blood disease, and respiratory disease was higher in the exposed cases than in the unexposed cases. The incidence of cirrhosis of the liver was higher in females than in males, and was lower in cases farther from the bombed area. Cardiac infarction, valvular disease, and endocarditis were more often seen in the cases exposed near the bombed area. The incidence of the blood vessels in the brain was highest in the exposed cases near the bombed area. The incidence of disturbance of circulation, and disturbance of the blood vessels in the brain had a tendency to be higher in the exposed cases than in the unexposed cases. This is considered to be due to the advanced age in the exposed cases.

1626 MALIGNANT TUMORS IN PEOPLE EXPOSED AS CHILDREN TO ATOMIC BOMB IN NAGASAKI. Ikeda, T.; Matsuo, T.; Mori, Y.; Nonaka, M.; Oribe, T. (Nagasaki Univ., Japan). Hiroshima Igaku; 29: No. 3, 264-269(Mar 1976). (In Japanese).

In order to determine both the conditions under which malignant tumors occurred and the pathological specificity of those tumors in people exposed as children (at the age of 0 to 9) to the atomic bomb in Nagasaki, a comparative study was made of malignant tumors (including brain tumor but excluding leukemia) in 88 exposed cases taken from the data of the committee for the statistical analysis of tumors in Nagasaki and from other literature, and in unexposed cases of malignancy. The following items were analyzed; the distance from the bombed area (doses), the age at the time that the disease occurred, the latent period, the annual incidence of disease, the site of tumor, and the type of tissue. The results are summarized as follows, although they are inconclusive because of the small number of cases. The incidence of malignant lymphoma, cancer of the thyroid gland, brain tumor, sarcoma, and cancer of the ovary had a tendency to be higher in the exposed cases than in the unexposed cases. From the standpoint of sex, there was a tendency that cancer of the stomach and malignant lymphoma occurred more often in females than in males. On the other hand, sarcoma and brain tumor were seen more often in males. From the standpoint of the relationships among these factors: the distance from the bombed area, the latent period, and the type of tumor, it was suggested that cancer of the thyroid gland, brain tumor, and cancer of the stomach were observed especially in cases which had been exposed as children. In addition, it was considered that the influence of not only a short distance from the bombed area but also a middle distance from that area

1627 CLINICAL OBSERVATIONS OVER 20 YEARS PERIOD OF BIKINI VICTIMS. Kumatori, T. (National Inst. of Radiological Sciences, Chiba (Japan)). Hiroshima Igaku; 29: No. 3, 311-316(Mar 1976). (In Japanese).

The author outlined the results of medical examinations performed in a period of 20 years on the Japanese fishermen who were exposed at Bikini in 1954. Exposure doses were estimated, and the progress of medical examinations for skin injury, hematological changes, cytogenetic changes, and spermatogenic disturbance was described. In view of internal exposure, none of the long half-life nuclides was retained in the body. The victims were compared with the victims exposed in Marshall Islands.

1628 AUTOPSIED CASE OF MYELOFIBROSIS WHICH HAD BEEN EXPOSED TO THE ATOMIC BOMB NEAR THE SITE OF BLAST (1,112M FROM THAT AREA). Matsuo, K.; Takeshita, K.; Shikatani, T.; Toyoda, N.; Anpi, S. (Nagasaki Atomic Bomb Hospital (Japan)). Hiroshima Igaku; 29: No. 3, 245-248(Mar 1976). (In Japanese).

A study was made on the autopsy of a subject who had been exposed at the age of 10 months old to the atomic bomb at a distance of 1,112 m from a bombed area, and who found to have myelofibrosis which followed aplastic anemia-like symptoms. The autopsy findings showed 400 ml of bloody ascites, hyperplastic bone marrow in which no fatty cells were observed but many reticular cell-like cells and granular hematopoiesis were observed, and diffuse proliferation of reticular fibers without remarkable new bone findings in the trabecula. The liver was enlarged to the weight of 3.18 g, and showed extramedullary hematopoiesis. Infiltration of lymphocytes, slight fibrosis, and marked accumulation of hemosiderin (caused by the transfusion of the blood) were seen in the Glisson's sheath. The spleen, which was enlarged to the weight of 1.54 g, was brown, and showed fibrosis, extramedullary hematopoiesis and many plasma cells. Lymphatic glands were swollen in the mesentery, in the retroperitoneum, around the gastro-pancreatic area, and at the bifurcation of the trachea, where marked extramedullary hematopoiesis and many giant globuli were observed. Extramedullary hematopoiesis was also seen in other sites such as the subdura, both of the renal pelvises, and in a hyperplastic polyp in the gastric pit. Therefore, this patient was diagnosed as having myelofibrosis and hematopoietic dysplasia caused by radiation.

1629 STATISTICAL STUDIES ON HEART DISEASE OF THE PATHOLOGICAL AUTOPSY CASES IN THE ATOMIC BOMB HOSPITAL. Matsushita, H. (Hiroshima Red Cross Hospital (Japan)); Hamada, T.; Ishida, S. Hiroshima Igaku; 29: No. 3, 230-234(Mar 1976). (In Japanese).

Of 1230 autopsied cases in the Atomic Bomb Hospital and in the Red-Cross Hospital from 1956 to March, 1975, a statistical study was made on 118 cases in which primary or secondary heart disease had been found. The results are as follows. The incidence of myocardial infarction was 2.4 times higher in the group exposed to the atomic bomb within 2 km distance from the bombed area than that it was in the unexposed group. The incidence of acquired valvular disease was 4.1 times higher in the exposed group than in the unexposed group. From the standpoint of the incidence of myocardiosis, there was no difference between the groups. The incidence of pericarditis was 1.5 times higher in the exposed group than in

the unexposed group. The incidence of cor pulmonale was 1.8 times higher in the exposed group than in the unexposed group. The incidence of other heart disease including congenital disease was, however, 1.6 times higher in the unexposed group than in the exposed group. The incidence of general heart disease was 1.7 times higher in the exposed group than in the unexposed group. The incidence of hypertrophy of the heart (more than 400 g) was 1.2 times higher in the exposed group than in the unexposed group.

- 1630 AGING STUDY ON ATOMIC BOMB SURVIVORS. Okajima, S.; Aoyama, T.; Norimura, T.; Nishimori, I.; Shiomi, T. (Nagasaki Univ. (Japan). School of Medicine). Hiroshima Igaku; 29: No. 3, 217-221(Mar 1976). (In Japanese).

This is an ad interim report on the survey which is being performed at the Atomic Disease Institute, Nagasaki University School of Medicine for the acceleration of aging in atomic bomb survivors. The survivors group consisted of 50 females between 40 and 49 years of age who were exposed somewhere within 1.4 km where exposure dose could be estimated accurately and whose mean estimated exposure dose was 225.9+-176.8 rads. The control group consisted of females of the same age group who were exposed at sites more than 2.5 km apart (atmospheric dose 2.9 rads). The items for the judgement of aging included physical measurements, external findings, functional findings, and special tests (urine, blood, pattern of serum protein fraction, and chromosome aberrations). As far as chromosome aberrations were concerned, the number of cells with stable aberrations, Cs, showed differences between the two groups, and the number of cells with exchange-type aberrations was large in the survivors group. No significant differences were observed in the other tests.

- 1631 PAROTID GLAND TUMORS, OBSERVED IN RESEARCH INSTITUTE FOR NUCLEAR MEDICINE AND BIOLOGY, HIROSHIMA UNIVERSITY. Takeichi, N.; Hirose, F.; Inoue, S.; Nilmoto, M.; Hattori, T. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and biology). Gan No Rinsho; 22: No. 4, 307-311(Mar 1976). (In Japanese).

Between 1962 and 1971, 18 patients were admitted to the Surgical service of the Research Institute and underwent surgery for parotid gland tumors. Of these, 10 patients were atomic bomb survivors. Among the inpatients the rate of parotid gland tumors was higher in atomic bomb survivors than in the nonexposed. Malignant tumors were particularly increased among the A-bomb survivors. This is the first report to indicate the high incidence of salivary gland tumors among atomic bomb survivors.

- 1632 CYTOGENETIC STUDIES ON BONE MARROW CELLS OF THE ATOMIC BOMB SURVIVORS IN NAGASAKI. Tomonaga, Y.; Sadamori, N.; Matsunaga, M.; Tagawa, M.; Ichimaru, M. (Nagasaki Univ. (Japan). School of Medicine). Hiroshima Igaku; 29: No. 3, 239-244(Mar 1976). (In Japanese).

A study was made of chromosomes of bone marrow cells in 30 atomic bomb survivors, consisting of 9 cases exposed to atomic bomb within 1000 m from the bombed area in Group I, 11 cases exposed at a distance of 1001-2500 m from that place in Group II, and 10 cases exposed more than 2500 from that place in Group III. They ranged in age from 47 to 92 years (average age 74.5 years). Chromosome count was 46 in all cases. The average of modality percentage was 92.5% in Group I, 94.2% in Group 2, and 91.6% in Group 3, showing that there was

no significant difference among these groups. From the standpoint of frequency of chromosome aberration, no hyperdiploid cells of the aneuploid cells were observed in any case, but hypodiploid cells were observed in about 6% of each group. Therefore, there was no significant difference among them. Among 82 hypodiploid cells, 44 abnormal chromosomes were observed in G or Y. This abnormality was obtained in 2 cases of Group 1, and 1 case of Group 3. All cases were old males aged 77, 82 and 92 years, respectively. Although the loss of chromosomes in C was seen in 1 female in Group 2, the chromosomic type was unknown. In other chromosome abnormalities, unstable abnormal cells were observed in one case of Group III, and stable abnormal cells in 2 cases of Group I. Each abnormality was seen in only one cell. There was no case in which more than two cells having the same stable chromosome abnormality were observed in one case. These results showed that the frequency of chromosome abnormality was low in all cases, showing that there was no significant difference among them.

- 1633 PATIENT WITH PURE RED CELL APLASIA WHO WAS EXPOSED TO THE ATOMIC BOMB NEAR THE SITE OF BLAST. Toyoda, N.; Matsukuma, G.; Uchiyama, E.; Tsunoo, S.; Anpi, S. (Nagasaki Atomic Bomb Hospital (Japan)). Hiroshima Igaku; 29: No. 3, 249-255(Mar 1976). (In Japanese).

This paper describes a female patient who had been exposed at the age of 26 to the atomic bomb at a distance of 1.3 km from the bombed area. She was pointed out to have anemia and the disturbance of the liver in 1961. In 1963, she had iron deficiency, hypoleucocytosis, and hyper- γ globulinemia, and showed a high value of serum colloids. In 1969, she had more frequently anemia together with hyper- γ globulinemia. The erythrocyte sedimentation rate and serum colloids were still high. The positive reaction to the LE cells began to appear. The liver biopsy findings showed proliferation of Kupper cells in the lobule, decidual degeneration of some liver cells, infiltration of many round cells in the Glisson's sheath. Therefore, she was diagnosed as having pure red cell aplasia and lupoid hepatitis. However, in 1970 she was suspected of having pulmonary valvular insufficiency caused by pulmonary hypertension in spite of the continuous steroid therapy. In 1974, she died of jaundice, hyper- γ -globulinemia which accompanied urea in the blood and the increased values of nitrogen and NH_3 . This patient was considered to be interested on the assumption of the relationships between exposure to the atomic bomb and disturbance of immunity.

- 1634 CHROMOSOMAL ESTIMATION OF RADIATION EFFECTS IN MAN. Ishihara, T. (National Inst. of Radiological Sciences, Chiba (Japan)). Hiroshima Igaku; 29: No. 3, 307-310(Mar 1976). (In Japanese).

The estimation of exposure dose based on chromosome aberrations was described. The results of estimation of exposure dose based on chromosome aberrations of peripheral lymphocytes on individuals exposed to ^{132}Ir by accident, Bikini victims, and atomic bomb survivors were divided into subjects who had been observed from immediately after exposure and those who were observed after the lapse of many years, for comparison. In cases soon after exposure, results of very high precision were obtained as far as the low dose range. In cases after the lapse of many years, quantitative estimation to a considerable extent was also possible.

1635 EPIDEMIOLOGY OF APLASTIC ANEMIA IN JAPANESE RADIOLOGICAL TECHNICIANS. Kitabatake, T.; Watanabe, T.; Saito, A. (Niigata Univ. (Japan). School of Medicine); Nakamura, M. Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 3, 225-228(Mar 1976). (In Japanese).

Among Japanese radiological technicians, four deaths from aplastic anemia have been recorded. Based on this fact, some epidemiological considerations are tried. During the period from 1930 to 1960, the population of radiological technicians is estimated to be 74,400 man-years, in which 0.5 aplastic anemias are expected. However actually three died from aplastic anemia. This difference is statistically significant at the 1% level. On the other hand, in the period from 1961 to 1973, the observed value is 1 against 0.7 expected. It is concluded that aplastic anemia had been frequently induced among Japanese radiological technicians in the era when there was much exposure to occupational radiation.

1636 CLINICAL SURVEY OF BLOOD DYSCRASIAS AMONG HIROSHIMA A-BOMB SURVIVORS BY THE PERIODICAL HEALTH EXAMINATION. Taketomi, Y.; Kamada, N.; Uchino, H.; Takahashi, H.; Ohkita, T. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Hiroshima Igaku; 29: No. 3, 235-238(Mar 1976). (In Japanese).

For investigation of delayed effects on atomic bomb survivors, age, the association with exposure conditions, and individual pathological conditions were examined on 200 survivors for whom hypoplastic anemia was suspected in a year, April 1, 1972-March 31, 1973. Anemia was prevalent among the aged: in the females (170 cases) the incidence according to age was 1.2% in those aged 29 or below, 8.8% in those aged between 30 and 39, 12.4% in those aged between 40 and 49, 21.2% in those aged between 50 and 59, 28.8% in those aged between 60 and 69, and 24.1% aged between 70 and 79. In the males (30 cases) it was 73.3% in those aged 60 or above. The incidence according to exposure distance in the females was 4.1% in the group of 0.9km or less, 36.5% in the group of 1.9km or less, and 41.8% in the group of 2km or more, and the incidence in the males was 43.3% in the group of 1.9km or less. Anemia was not necessarily frequent among the short-distance victims. As for the distribution of hemoglobin, anemia with 10g/dl or less was found in 18%, and a white blood cell count of less than 3000 was rather infrequent (12%). Although, according to age, the amount of hemoglobin showed a slight increase in the subjects aged 70 or above, there was no significant difference. Neither of the values showed any particular decrease in relation to exposure distance. Up to present, however, anemia has not been improved in many of the subjects in whom a mean of more than 10 years has elapsed. In addition to senile anemia, iron deficiency anemia and posthemorrhagic anemia represented most cases. There were 22 cases of hypoplastic anemia, of which three were aplastic. The exposure distance in these three cases was 1.3km, 1.5km, and 2.5km, but its relation to the incidence was not found because of the small number.

1637 LATE EFFECT OF ATOMIC-BOMB RADIATION AT NISHIYAMA DISTRICT. Ichimaru, M. (Nagasaki Univ. (Japan). School of Medicine). Hiroshima Igaku; 29: No. 3, 294-297(Mar 1976). (In Japanese).

This paper summarizes the present survey concerning the specificity of exposure

conditions for the residual activity caused by radioactive fall-out, and the late effect of atomic-bomb radiation on the abnormal blood findings and on the incidence of leukemia at the Nishiyama district (where the primary radioactivity is negligible) in Nagasaki. It was found that radioactivity was significantly higher in the soil of the Nishiyama district than in the other districts. Leukocytes tended to be increased for a long period of time in many inhabitants in this district. This tended to appear more frequently in younger inhabitants than in older inhabitants. Two patients out of 200 inhabitants with chronic myelogenous leukemia were studied further. The inhabitants were considered to be exposed for a long period of time to residual radioactivity, and external or internal irradiation which accompanied it. It was suggested that the exposure process was similar to that in people who work in the x-ray equipments. The fact that the inhabitants in this district are very different from those in the other bombed districts is valuable for the study of the effects of radiation on human body.

1638 PROTECTION OF GONADS IN RADIOGRAPHY OF THE PELVIS. Correll, R.; Plischke, U.; Dresel, H.; Joos, M. (Freiburg Univ. (F.R. Germany). Inst. fuer Roentgendiagnostik). Roentgen Bl.; 29: No. 3, 137-142(Mar 1976). (In German).

3 figs.; 2 tabs.; 8 refs..

The effectiveness of a new device for the protection of gonads has been tested by measuring doses on the water-phantom and on patients. The lead protector is applied below the light-source and protects the gonads in pelvic radiography. The reduction of dosage corresponds to the usual leadprotectors. It should be particularly useful in orthopedics, since it is simple and hygienic.

1639 RELATION OF RADIATION OF GASTRIC CARCINOMA OBSERVED IN AUTOPSY CASES IN A FIXED POPULATION HIROSHIMA AND NAGASAKI. Shimizu, Y.; Yamamoto, T. (Radiation Effect Research Foundation (Japan)). Hiroshima Igaku; 29: No. 3, 270-271(Mar 1976). (In Japanese).

The relationship between exposure dose and the occurrence of stomach cancer, especially the histological type of the cancer was studied in 535 autopsy cases which had died of stomach cancer from 1961 to 1974 in the Radiation Effect Research Foundation. The incidence of stomach cancer tended to be higher in the group with high exposure dose in Hiroshima, and only in the group with 300 - 399 rads in Nagasaki. The relationship between the incidence of stomach cancer by age at the exposure and the exposure dose was studied by the relative risk (200-499 rads/ 0 rads) of the incidence of stomach cancer by age. The relative risk was 1.56 in the group which had been more than 50 years old at exposure in both Hiroshima and Nagasaki. The risk of stomach cancer was higher in more aged persons at the exposure. From the aspect of the relationship between histological type of stomach cancer and exposure dose, the incidence of intestinal type or diffuse type tended to be higher in the persons who had much more doses. Because there were small number of cases, there was no statistically significant differences between the incidence of stomach cancer and the exposure dose.

1640 CLINICAL EXPERIENCE OF THE LIPOSARCOMA FOUND IN ATOMIC BOMB VICTIMS. Yakeishi, Y.; Norimune, S.; Shiramizu, T.; Hamada, T. (Hiroshima Atomic Bomb Hospital (Japan)); Okamoto, S. Hiroshima Igaku; 29: No. 3, 278-

280(Mar 1976). (In Japanese).

This report deals with the course of the therapy, the metastatic site, changes in the degree of histological malignancy, and autopsy findings in one atomic bomb survivor with liposarcoma. He had liposarcoma in the left thigh at the age of 37, and died of systemic metastases one year later in spite of various therapies during hospitalization. There seems to be only one case of liposarcoma previously reported by Monzen out of atomic bomb survivors. This is the first case that especially the course and the effect of the therapy were reported.

- 1641 RADIATION BURDEN OF PERSONNEL FROM SURGICAL AND OTHER ATYPICAL ROENTGENOLOGICAL PERFORMANCES. Doubravsky, J. (Palackeho Universita, Olomouc (Czechoslovakia). Lekarska Fakulta); Kukacka, R. (Krajska Hygienicka Stanice, Ostrava (Czechoslovakia)). Cesk. Radiol.; 30: No. 2, 125-131(Mar 1976). (In Czech).

The radiation burden was investigated of the working team during surgical treatment of a fracture of the collum femoris and during instrumental urological radiodiagnostic performances. Film dosimetry was used. It was found that the radiation burden of personnel may reach considerable values. Suggestions for proper working procedures are given.

- 1642 ESTIMATION OF POPULATION DOSES FROM DIAGNOSTIC MEDICAL EXAMINATIONS IN JAPAN, 1974. II. ESTIMATION OF GENETICALLY SIGNIFICANT DOSE. Hashizume, T.; Maruyama, T.; Kumamoto, Y. (National Inst. of Radiological Sciences, Chiba (Japan)). Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 3, 208-215(Mar 1976). (In Japanese).

The genetically significant dose from radiographic and fluoroscopic examination in Japan has been estimated based on a 1974 nation wide survey of randomly sampled hospitals and clinics. The gonad dose during x-ray diagnosis was determined with an ionization chamber placed at the positions of ovary and testis in a Rando phantom. The instrumented phantom was irradiated with medical diagnostic x-rays on the basis of the exposure data on the patients selected in the nation wide survey. In the calculation of the genetically significant dose, the child expectancy of the patients that undergo each particular type of examination was assumed to be same as that of the general population. The resultant genetically significant dose was 11.1 and 5.43 mrad per person per year for radiography and fluoroscopy, respectively. These values were compared with those of 1960 and 1969. Though the number of examinations per year shows a yearly increase, the genetically significant dose is gradually on the decrease. This may be due to technical improvements in medical radiological practices.

- 1643 ESTIMATION OF POPULATION DOSES FROM DIAGNOSTIC MEDICAL EXAMINATIONS IN JAPAN, 1974. III. PER CAPUT MEAN MARROW DOSE AND LEUKEMIA SIGNIFICANT DOSE. Hashizume, T.; Maruyama, T.; Kumamoto, Y. (National Inst. of Radiological Sciences, Chiba (Japan)). Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 3, 216-224(Mar 1976). (In Japanese).

The mean per capita marrow dose and leukemia-significant dose from radiographic and fluoroscopic examinations in Japan have been estimated based on a 1974 nation wide survey of randomly sampled hospitals and clinics. To determine the mean marrow dose to an individual from a certain exposure of a given type of

examination, the active marrow in the whole body was divided into 119 parts for an adult and 103 for a child. Dosimetric points on which the individual marrow doses were determined were set up in the center of each marrow part. The individual marrow doses at the dosimetric points in the beams of practical diagnostic x-rays were calculated on the basis of the exposure data on the patients selected in the nation wide survey, using depth dose curves experimentally determined for diagnostic x-rays. The mean individual marrow dose was averaged over the active marrow by summing, for each dosimetric point, the product of the fraction of active marrow exposed and the individual marrow dose at the dosimetric point. The leukemia significant dose was calculated by adopting a weighting factor that is, a leukemia significant factor. The factor was determined from the shape of the time-incidence curve for radiation-induced leukemia from the Hiroshima A-bomb and from the survival statistics for the average population. The resultant mean per capita marrow dose from radiographic and fluoroscopic examination was 37.0 and 70.0 mrad/person/year, respectively, with a total of 107.05 mrad/person/year. The leukemia significant dose was 32.1 mrad/person/year for radiographic examination and 61.2 mrad/person/year, with a total of 93.3. These values were compared with those of 1960 and 1969.

- 1644 REDUCING RADIATION EXPOSURE TO PATIENT AND OPERATOR. Hinds, L.M. J. Natl. Med. Assoc.; 68: No. 2, 115-116, 152(Mar 1976).

From 80. annual convention and scientific assembly of the National Medical Association; Miami Beach, FL, USA (14 Aug 1975).

Methods and systems are described for obtaining exposure reductions to patients and operators during fluoroscopic procedures. Among the systems described are the Polarix/image store system and the Fluoricon Videomatic system. (ERB)

- 1645 LEUKEMIA, MALIGNANT LYMPHOMA AND MULTIPLE MYELOMA IN ATOMIC BOMB SURVIVORS TREATED IN THIS HOSPITAL LATELY. Niimi, M.; Orimen, A.; Ota, T.; Aisaka, T. (Hiroshima City Funairi Hospital (Japan)). Hiroshima Igaku; 29: No. 3, 256-263(Mar 1976). (In Japanese).

This paper describes atomic bomb survivors with leukemia and various leukemia like diseases in Hiroshima City Funairi Hospital. The patients who had been exposed near the bombed area (1 - 3.4 km) consisted of 3 with leukemia, 4 with malignant lymphoma and 2 with multiple myeloma. These diseases seems to tend to be still increased now in the survivors exposed near the bombed area.

- 1646 EXPERIMENTAL PATIENTS OF DRUG TREATMENT FOR CATARACTA IN THE PERSONS EXPOSED TO AN ATOMIC BOMB NEAR THE EXPLOSION. Sugimoto, Shigenori (Hiroshima City (Japan)). Hiroshima Igaku; 29: No. 3, 281-284(Mar 1976). (In Japanese).

This paper describes the clinical process of 4 persons exposed to an atomic bomb near the explosion in Nagasaki who have received chemotherapy because of incipient senile cataracta associated by cataracta due to an atomic bomb. The dropping of Catalin and Tathion in the eyes, oral administration of Thiola, and injection of Glutathione were done. Dramatic results were not obtained. However, when the administration was done at the time of slight corneal opacity, it did not developed. Therefore, it can't be denied now that the chemotherapy is effective.

1647 SOCIO-MEDICAL TENDENCY OF LONG-LIVED

EXPOSURE IN HIROSHIMA SURVIVORS HOME. I. Shimizu, K. (Atomic Bomb Survivors Relief Organization, Hiroshima (Japan)). Hiroshima Igaku; 29: No. 3, 210-216 (Mar 1976). (In Japanese).

The author is continuing to observe socio-medically long-lived survivors over 90 years of age who are in the Hiroshima Survivors' Home, and this is the first report on them. In spite of a fairly large number of survivors of short-distance exposure, unexpectedly few showed a high dose. There were few medical findings suggestive of the effect of exposure. Although chronic diseases due to aging were observed prominently, no basis suggestive of the promotion of aging due to exposure was obtained. In view of social environments, born in rural districts, many of them tended to be rather unyielding and have endured low-income life, and their body had been hardened by physical labor. Most of them had rather mild somatic disturbances, and unexpectedly few needed complete help or diapers. Very few were judged to be DE by the ADL table. Of the total number of deaths (77) in 5 years, only 5 were above 90 years of age, and the cause was heart disease in 3 and senility in 2.

1648 SOME EXAMINATION ON THE A-BOMB EXPOSED POPULATION AND THE NUMBER DECEASED THROUGH THE POPULATION CHANGES IN CENSUS. I. METHODS AND OUTLINE OF THE ESTIMATED RESULTS, HIROSHIMA. Yuzaki, M.; Ueoka, H. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Hiroshima Igaku; 29: No. 3, 193-203 (Mar 1976). (In Japanese).

The rise and fall of population of Hiroshima City before and after 1945 and a movement of population in suburban districts, towns and villages corresponding to it were discussed mainly from census in 1944 and 1945, and A-bomb exposed population and the number decreased were estimated. Population in Hiroshima City after A-bomb exposure decreased by two hundred and six thousand which was 60% of that before A-bomb exposure. In contrast with this, population in suburban districts increased 21.8%. Population of the whole prefecture decreased by seventy-seven thousand. Furthermore, the number decreased was estimated in consideration of the general movement of population after the war. As a result, it was estimated that the number decreased of the whole prefecture was one hundred and ten thousand and that of Hiroshima City ranged from eighty-four thousand to one hundred and four thousand.

1649 DOSES TO EARLY ENTRANTS TO THE A-BOMBED AREAS AND TO RESIDENTS OF THE FALLOUT AREAS AND ^{137}Cs IN SOIL OF THE 'BLACK RAIN' AREA IN HIROSHIMA. Takeshita, K. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Hiroshima Igaku; 29: No. 3, 298-306 (Mar 1976). (In Japanese).

An external exposure dose from residual activity (induced radioactivity in the fallout areas and radioactive fallout in the 'black rain' area) caused by an atomic bomb in Hiroshima was estimated. The integrated doses to the infinite time averaged 101 rads in the atomic bombed area of Hiroshima and 32 rads in that area of Nagasaki. According to the measurement by investigators, the integrated doses of the external exposure dose due to radioactive fallout averaged 13 rads. The amount of ^{137}Cs in soils was determined in the southeast slanting surface and the uncultivated land. The cesium distribution showed 2 - 3 times higher levels in the mountains and the

high reaches than in the flatland in Hiroshima.

1650 PROPHYLAXIS AND THERAPY OF RADIATION INJURIES. Schmaehl, D. (Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Inst. fuer Toxikologie und Chemotherapie). Geburtshilfe Frauenheilkd.; 36: No. 3, 207-209 (Mar 1976). (In German).

According to the present state of knowledge, only megavolt equipment (telecobalt, linear accelerators, betatron) should be used for percutaneous curative radiotherapy. For this reason, the number of radiotherapy centers should be increased so that all patients may be treated by the latest therapeutical methods. Moreover, a better training of students, general practitioners, and specialists ought to be a major concern, and, in addition, information of the public and intensive medical care of the patient are necessary for an objective assessment of the possibilities and effects of radiotherapy.

1651 (COO--3017-25) RADIATION CARCINOGENESIS. PROGRESS REPORT III, 15 MARCH 1975--15 MARCH 1976. Warren, S.; Gates, O. (New England Deaconess Hospital, Boston, Mass. (USA)). Mar 1976. Contract E(11-1)-3017. 17p. Dep. NTIS \$3.50.

The attention of forensic pathologists has been drawn to the criteria essential for the recognition of radiation death or injury in the hope that such cases will be better recognized and that some false claims of radiation damage might be prevented at the local level. The results of experiments on parabiont rats, one of which had been irradiated with 1000 R of 250 kVp x-ray, the other shielded, are reviewed. With controls and related special studies the total is over 3000 pairs equally divided as to sex. Much information on the relative sensitivity of different tissues and organs to tumor induction is available and is being statistically analyzed. These experiments have provided further evidence of the effectiveness of parabiosis in assuring survival after 1000 R x-radiation and have enabled us to learn of the types of problems that might be expected in the way of late effects in heavily irradiated individuals should they be enabled by effective therapy to survive the acute phases of the radiation syndrome. Additional evidence has been brought out that carcinogenesis in some hormonally dependent tissues and organs is not so much a direct effect of radiation as it is a summation of this effect and of alterations caused by changes in hormonal balance brought about by the radiation.

1652 (IAEA-R--1189-F) EFFECTS OF FAST NEUTRON IRRADIATION ON MOUSE AND LEUKEMIC. FINAL REPORT FOR THE PERIOD 1 JUNE 1972--30 SEPTEMBER 1975. Broerse, J. (International Atomic Energy Agency, Vienna (Austria)). Mar 1976. 5p. NTIS (US Sales Only).

Studies were made on the radiation response of the mouse L5178Y leukaemia, as well as on an easily transplantable myeloid leukaemia growing in the Brown-Norway rat, induced by dimethylbenzanthracene. It showed striking similarities with human acute myeloid leukaemia, regarding slow growth, disappearance of CFU-c during leukaemia development and inability of leukaemic cells to grow in vitro. The D_0 for 300 kV X-rays was found to be 110 rad. Daily whole-body irradiations with doses of 5 rad of 300 kV X-rays (flash) induced a depression in peripheral blood count of transplanted leukaemic cells, without significant change in survival time of the host. The irradiated rats live significantly

longer (mean survival time: 40 vs. 32 days for controls). Daily low dose whole-body irradiation effectively reduces the total tumour cell load. Irradiation-induced proliferation is substantiated by the rapid rise in cell number observed after cessation of whole-body irradiation. A doubling time of 1.5 days in this exponential growth phase was calculated, whereas the cell population in the control group doubles in about 3.5 to 6 days.

- 1653 BRIGHTNESS DISCRIMINATION LEARNING IN A SKINNER BOX IN PRENATALLY X-IRRADIATED RATS. Tamaki, Y.; Inouye, M. (Aichi Prefectural Colony, Kasugai (Japan). Inst. for Developmental Research). *Physiol. Behav.*; 16: No. 3, 343-348(Mar 1976).

Male MP 1 albino rats were exposed to x-irradiation in utero at a single dose of 200 R on day 17 of gestation. The light-dark discrimination training in a Skinner box was continued until the animals attained a learning criterion of 0.80 correct response ratio for 3 consecutive days. Although during the unreinforced baseline sessions the total number of bar pressings in the irradiated animals was superior to that in the controls, performance between the control and the irradiated animals did not differ significantly in (a) the number of training days required to attain the learning criterion, (b) the total number of days on which the animals produced a correct response ratio more than 0.80, and (c) the number of consecutive days during which the correct response ratio was more than 0.75. The results obtained suggest that the irradiated animals were able to discriminate in brightness cues as well, or nearly as well, as the controls. The cortical-subcortical system mediating brightness discrimination in the irradiated animals is discussed.

- 1654 SYNERGISM BETWEEN NEUTRON RADIATION AND DIETHYLSTILBESTROL IN THE PRODUCTION OF MAMMARY ADENOCARCINOMAS IN THE RAT. Shellabarger, C.J.; Stone, J.P.; Holtzman, S. (Brookhaven National Lab., Upton, NY). *Cancer Res.*; 36: No. 3, 1019-1022(Mar 1976).

When young female A x C rats were given 9.6 rads of 0.43-MeV neutrons, 32 of 33 survived a 50-week follow-up period, 2 rats developed a total of 3 mammary adenocarcinomas, and 3 rats developed a total of 4 mammary fibroadenomas. For 25 rats implanted with a 20-mg pellet containing 5 mg diethylstilbestrol and 15 mg cholesterol, average survival was 284 days; 22 rats developed a total of 182 mammary adenocarcinomas, and 21 rats developed a pituitary tumor. When diethylstilbestrol was given 2 days before neutron radiation to 35 rats, the average survival was 239 days; 32 rats developed a total of 842 mammary adenocarcinomas, 1 rat developed a single mammary fibroadenoma, and 34 rats developed a pituitary tumor. All of the 31 control rats survived the 50-week study period, and none developed tumors. Twenty-one of the rats that received both diethylstilbestrol and neutron radiation and 1 rat that received only diethylstilbestrol exhibited a multiple mammary adenocarcinoma response with a range of 18 to 72 mammary adenocarcinomas per rat. These results were interpreted to mean that a synergistic interaction between diethylstilbestrol and neutron radiation on mammary adenocarcinoma formation occurs in terms of an earlier onset and a larger number of mammary adenocarcinomas. These results confirm and complement a previously reported synergistic interaction between diethylstilbestrol and X-radiation on mammary adenocarcinoma formation A x C female rats.

- 1655 (ORNL/TM--5293) MATHEMATICAL DESCRIPTIONS OF A ONE- AND FIVE-YEAR OLD CHILD FOR USE IN DOSIMETRY CALCULATIONS. Hwang, J.M.L.; Shoup, R.L.; Warner, G.G.; Poston, J.W. (Oak Ridge National Lab., Tenn. (USA)). Mar 1976. Contract W-7405-ENG-26. 108p. Dep. NTIS \$5.50.

Thesis. Submitted by J.M.L. Hwang to Univ. of Tennessee, Knoxville.

Mathematical representations for estimating the absorbed radiation dose from external and internal radiation sources of a one-year old and a five-year old human have been designed. The phantoms used consist of head, trunk and leg regions with a skeletal system and twenty-two internal organs, each. The mathematical descriptions of these phantoms have been coded into Fortran computer language for use with a Monte-Carlo photon transport code. This computer code was used to calculate absorbed fractions of energy deposited in different targets organs from a radionuclide deposited uniformly in a source organ. Absorbed dose calculations were performed for two ^{99m}Tc -labeled pharmaceuticals. Photon absorbed fraction estimates for the pediatric phantoms from Monte-Carlo calculations were combined with biological data to estimate dose distributions in one-year old and five-year old children. (CH)

- 1656 ANGIOGRAPHIC DIAGNOSIS OF A CARCINOMA OF THE RENAL PELVIS DUE TO THOROTRAST. Oser, W. (Graz Univ. (Austria). Radiologische Klinik); Fladerer, H. (Graz Univ. (Austria). Pathologisch-Anatomisches Inst.). *Roentgen Bl.*; 29: No. 3, 115-118(Mar 1976). (In German).

4 figs.; 20 refs..

The angiographic and histological findings of a carcinoma of the renal pelvis caused by thorotrast, i.e. a radiation-induced carcinoma, are given. The vascular changes resemble those of carcinomas of the renal pelvis due to poor vascularisation. Angiography succeeds in detecting the tumour and in giving an exact picture of its site of origin and its spatial relationship to the contrast medium extravasation.

- 1657 PLUTONIUM. Le Quinio, R. (Ministere de l'Industrie et de la Recherche, 75 - Paris (France). Service Central de Surete des Installations Nucleaires); Coulon, R.; Nenot, J.C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). *Ann. Mines*; 182: No. 3, 69-84(Mar 1976). (In French).

Problems arising from plutonium are described in a first section, in which its importance among other technical progress penalties is brought down to a position nearer from truth. Consequently, after having recalled its origin and properties, a survey is made on various forms of its potential aggressions. In a second section, full account is given about the present state of knowledge concerning different ways through which this radionuclide can reach man, biological consequences which can follow, and even therapeutics of possible contamination.

- 1658 ESTIMATION OF EXPOSED DOSE, 1. INTERNAL RADIOACTIVITY. Okajima, S. (Nagasaki Univ. (Japan). School of Medicine). *Hiroshima Igaku*; 29: No. 3, 288-293(Mar 1976). (In Japanese).

Radioactive atomic fallouts in Nishiyama district of Nagasaki Prefecture are reported on

- the basis of the survey since 1969. In 1969, the amount of ^{137}Cs in the body of 50 inhabitants in Nishiyama district was measured using human counter, and was compared with that of non-exposed group. The average value of ^{137}Cs ($\mu\text{Ci/kg}$) was higher in inhabitants in Nishiyama district (38.5 in men and 24.9 in females) than in the controls (25.5 in men and 14.9 in females). The resurvey in 1971 showed that the amount of ^{137}Cs was decreased to 76% in men and 60% in females. When the amount of ^{137}Cs in the body was calculated from the chemical analysis of urine, it was 29.0 ± 8.2 in men and 29.4 ± 26.2 in females in Nishiyama district, and 29.9 ± 8.2 in men and 29.4 ± 11.7 in females in the controls. The content of ^{137}Cs in soils and crops (potato etc.) was higher in Nishiyama district than in the controls. When the internal exposure dose per year was calculated from the amount of ^{137}Cs in the body in 1969, it was 0.29 mrad/year in men and 0.19 mrad/year in females. Finally, the internal exposure dose immediately after the explosion was estimated.
- 1659 GENETIC EFFECTS OF LOW-LEVEL TRITIUM. MAINLY ON THE CHROMOSOME ABERRATIONS INDUCED BY TRITIUM. Hori, T.; Nakai, S. (National Inst. of Radiological Sciences, Chiba (Japan)). Hoken Butsuri; 11: No. 1, 1-11(Mar 1976). (In Japanese).
- Genetic risk assessment for potential hazard from environmental tritium to man becomes important with increasing nuclear-power industry. The purpose of this short review is to discuss the possible genetic effects of tritium from a view of genetic risk estimation. The discussion is based mainly on our experimental results on the chromosome aberrations induced in human lymphocytes by tritium at the very low-level. The types of chromosome aberrations induced by radiation from tritium incorporated into the cells are mostly chromatid types. The most interesting finding is that the dose-response relationship observed in both tritiated-water and tritiated-thymidine is composed of two phases. The examination on the nature of two-phase dose-response relationship is very important not only for the mechanisms of chromosome aberrations, but also for the evaluation of genetic risk from low-level radiation.
- 1660 (LF-tr--121) EXPERIMENTAL RESEARCH ON THE EFFECTS OF INHALATION OF TWO BETA EMITTERS: CERIUM-144 AND CERIUM-141. STUDY OF SHORTENING OF LIFE AND INDUCEMENT OF CANCER. EFFECT OF DOSE AND CARRIER. Skupinski, W.; Masse, R.; Lafuna, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Mar 1976. Translation of IAEA-SM--202/401. 12p. Dep. NTIS \$3.50.
- The toxic effects of beta emitters following inhalation were compared with those of alpha emitters administered in the same way. One hundred rats were contaminated with acidic cerium-144 chloride by inhalation. The initial activities deposited ranged from 0.5 to 10 microcuries, exposing the animals to doses ranging from 500 to 5,000 rads. The lifetime was shortened as a function of the dose administered, and lung cancer was induced in about ten animals which had received the highest doses. Another experiment is currently being performed on cerium-141, an activate which has been inhaled in the form of an oxide or chloride. The doses administered have ranged from 50 to 2,000 rads. Other animals have inhaled stable cerium oxide. The onset of lung cancer has already been observed in the animals having inhaled cerium-141. The localization and histologic type of the cancer induced by the
- three beta emitters are comparable to those observed after inhalation of an alpha emitter.
- 1661 GENETIC EFFECTS OF ^{239}Pu SALT INJECTIONS IN MALE MICE. Luening, K.G.; Froelen, H.; Nilsson, A. (Research Inst. of National Defense, Sundbyberg (Sweden). Div. of Radiobiology). Mutat. Res.; 34: No. 3, 539-542(Mar 1976).
- Published in summary form only.
- CITRATES;DOSE-RESPONSE RELATIONSHIPS;FETUSES; GENETIC EFFECTS;GENETIC RADIATION EFFECTS; INTRAVENOUS INJECTION;MALES;MICE;MORTALITY; PLUTONIUM COMPOUNDS;PLUTONIUM NITRATES; PLUTONIUM 239;PROGENY;RADIATION DOSES;STERILITY
- 1662 INFLUENCE OF ^{241}Am AND DTPA ON MORPHOMETRIC PARAMETERS OF THE RAT FEMUR. Polig, E. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Strahlenbiologie). Radiat. Environ. Biophys.; 13: No. 1, 27-41(Mar 1976).
- 8 figs.; 23 refs..
- Microradiographically detectable alterations of the bone structure in the femur of young rats induced by monomeric $^{241}\text{Am(III)}$ (i.v., 30 $\mu\text{Ci/kg}$) were studied. The morphometric and dosimetric measurements were carried out by means of an electronic image analyzer. 8 weeks after injection of ^{241}Am a characteristic alteration of the frequency distribution of the chord lengths over the trabeculae in the epiphysis and over the metaphyseal marrow spaces was found. The structure of the spongiosa is irregular with both large, coarse and small fragmented trabeculae. The complexity of the bone architecture and the area of the endosteal surfaces is reduced. The surface/volume ratio in control animals varies between 36 mm^{-1} in the epiphysis and 64 mm^{-1} in the region of the epiphyseal cartilage plate. From the specific surface burden ($\mu\text{Ci/mm}^2$) the average dose rates were determined. There is no significant difference between the calcified tissue fraction in controls and animals with ^{241}Am , with the exception of the metaphyseal band where the locally high dose rates cause a devitalization of the tissue with inhibition of bone resorption as well as an abnormal trabeculation in the metaphysis. Treatment by Ca-DTPA reduces the ^{241}Am deposition nonuniformly and the pathological manifestations are markedly less pronounced. The mean trabecular width is about 100 μm in the epiphysis and has a minimum of 40 μm in the central part of the epiphyseal plate. The mean chord length over the marrow spaces varies between 90 and 210 μm .
- 1663 EFFECT OF RADIOPHOSPHORUS ON THE DEVELOPING ENDOCRINE GLANDS OF SWISS ALBINO MICE. I. A STUDY ON THE THYROID GLAND. Dev, P.K.; Srivastava, P.N. (Rajasthan Univ., Jaipur (India). Radiation Biology Lab.). Strahlentherapie; 151: No. 3, 258-273(Mar 1976).
- 22 figs.; 1 tab.; with refs..
- A study has been made on the effects of P-32 on the developing thyroid gland. Injection of P-32 at a dose rate of 1.0 $\mu\text{Ci/g}$ body-weight to the seven-day pregnant mouse has almost no effect on the 18-day foetus or as late as 14-day postnatal thyroid. With the same dose, when given to one-day-old mouse, signs of dead mitotic figures are noticed. The effects are more pronounced in the beginning, but after the fourth week no morphological changes are seen. When a seven-day-old animal is injected with the same dose, dead cells are found in the earlier stages followed by the damage to the vascular structure of the epithelium. The 14-

day injected group shows damage to the epithelium in the form of condensed nuclei and loss of colloid from the follicles. Replacement of follicles by fatty degeneration is evident. A maximum susceptibility to P-32 irradiation is shown by 21-day-old injected animals, where epithelial desquamation and replacement of follicles by fatty degeneration are easily marked one week after the injection. In the last group, where P-32 is given at the 28th day after parturition, there may be a tendency of the thickening of the blood vessels. The females show a greater damage to P-32 injection than the males in the postnatal period studied.

- 1664 EARLY AND DELAYED EFFECTS OF PUSUP(239) ADMINISTERED TO YOUNG RATS. Ovcharenko, E.P.; Buldakov, L.A.; Pesternikov, V.M.; Sinyakov, E.G.; Tsygankova, A.Ya. Radiobiologiya; 16: No. 2, 315(Mar 1976). (In Russian).

AGE GROUPS;BLOOD PLATELETS;COMPARATIVE EVALUATIONS;DELAYED RADIATION EFFECTS;DOSE-RESPONSE RELATIONSHIPS;EARLY RADIATION EFFECTS; INTAKE;LIFE SPAN;LYMPHOCYTES;OSTEOSARCOMAS; PLUTONIUM 239;PROGENY;RATS;RETICULOCYTES

- 1665 (BNWL-B--462) DIGITAL SIMULATION OF TWO MODELS OF THE BIOLOGICAL DISPOSITION OF INHALED PLUTONIUM. Dionne, P.J.; Harrington, T.P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Mar 1976. Contract E(45-1)-1830. vp. Dep. NTIS \$5.50.

Two mathematical models which describe the retention and translocation of inhaled plutonium were simulated on BNW's minicomputer system MINERVA. Equation parameters are obtained by matching the simulation to data gathered by several studies at BNW. Interactive graphics techniques are described which facilitate the data fitting process. This document is meant to serve as a progress report on a continuing effort towards development of mathematical models to describe the disposition of inhaled plutonium. The tabular and graphical results found in the appendices of this report do not represent what we feel are the best possible data fits but only samples of output available from the model. At this time we feel that additional model development will probably be required to best fit the data.

- 1666 (PAEC(D)--76008) BODY-BURDEN OF ^{131}I AMONG RADIATION WORKERS. PRELIMINARY REPORT. Juan, N.B.; Ballelos, E. (Philippine Atomic Energy Commission, Diliman, Quezon City). Mar 1976. 4p. NTIS (US Sales Only).

Urine samples were collected from personnel processing radioisotopes and counted directly using Ge-Li detector. Samples were also collected from the same persons during certain periods when no processing is made to determine the biological half-life of the radionuclides. Three persons directly involved in the processing of radioisotopes were monitored regularly. Of the various isotopes processed namely ^{131}I , ^{24}Na , and ^{198}Au , only ^{131}I could be detected and measured quantitatively by direct counting of urine samples using Ge-Li detector. The average body-burden of ^{131}I obtained from the three radiation workers monitored was 1.5066 ± 1.7970 uCi which appears to be negligible. However, one of the radiation workers who is more involved in isotope processing had an average body burden of 2.4008 ± 1.8657 uCi which is more than three times the maximum permissible body burden of ^{131}I (0.7 uCi). A follow up of the ^{131}I body burden made when there is no isotope processing showed a biological half-life of 29 days. The analysis of urine samples from radiation workers directly involved in isotope processing

will be continued to obtain better statistics of the results. Another follow-up of the ^{131}I should be made to confirm the biological half-life of ^{131}I obtained which is 29 days.

- 1667 (SSI--1976-004) CESIUM-137 BODY BURDEN OF A CONTROL GROUP IN STOCKHOLM, 1975. Hagberg, N.; Eklund, G. (Statens Stralskyddsinstitut, Stockholm (Sweden)). Mar 1976. 8p. (In Swedish). NTIS (US Sales Only).

Measurements of the ^{137}Cs content in a control group consisting of 20-30 persons have been carried out since 1959 (1,4,6,7,9,10). Until 1966 the measurements were made in an open-booth type whole-body counter (Fig. 1) (2). From observation series 30 the measurements were made in the three-crystal counter (Fig. 1) in the new low-activity laboratory described in refs. (3) and (5). The use of individual weighting factors for each member of the group makes it possible to calculate a weighted mean of the ^{137}Cs level (1,5), to compensate for the changes in the control group during the years. The calculation includes a correction for RaC contamination. During 1975 measurements were made on 25 members of the group, 14 men and 11 women. The mean age and weight were 44 years and 71 kg respectively for men and 51 years and 61 kg respectively for women. For all the measured persons the mean age was 47 years and the mean weight was 67 kg. Measured content of potassium was 1.95 ± 0.20 g/kg body weight (1 sigma) for the men and 1.60 ± 0.15 g/kg body weight for the women of the group. Table 1 shows the results of the ^{137}Cs measurements obtained with the three-crystal counter. Fig. 2 shows these results together with earlier results from the open-booth counter. The weighted mean and the highest and the lowest values within the group are indicated. The total error of the weighted mean and the highest value 1975 are about 10 percent and 16 percent respectively. For the last few years the cesium content has been below the detection limit, 10-15 pCi/gK, for some members of the group.

- 1668 CESIUM-137 BODY BURDENS AND HALF-LIFE IN A GROUP OF ADULT MALES IN CINCINNATI, OHIO. Lewis, J.T.; Grossman, L.W. (Bureau of Radiological Health, Cincinnati, Ohio (USA)); Kereiakes, J.G.; Saenger, E.L. Health Phys.; 30: No. 3, 315-318(Mar 1976).

Brief note.

BIOLOGICAL HALF-LIFE;BODY BURDEN;CESIUM 137; FALLOUT;MEN;OHIO;PERSONNEL;TIME DEPENDENCE

- 1669 DERIVED LIMITS FOR ^{35}S IN FOOD AND AIR. Vennart, J.; Ash, P.J.N.D. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). Health Phys.; 30: No. 3, 291-294(Mar 1976).

Since ^{35}S can be discharged from nuclear power stations and be incorporated into food it would be useful to have values for the derived limit on intake of ^{35}S in air and food by members of the public. Previous assessments are reviewed and it is concluded that derived limits should be based on the dose equivalent averaged throughout the whole body, for which the currently recommended limit is 0.5 rem in a year. The derived limit for ingestion of ^{35}S incorporated into food is then 170 uCi in a year for adults and 45 uCi for infants in the first year of life. For infants the limit on the integrated concentrations of ^{35}S in milk is 65 uCi-day l^{-1} in a year and the corresponding limit for continuous ingestion 180 nCi l^{-1} . For air, and independent of age, the limit on the integrated concentration of ^{35}S in forms

likely to be discharged from nuclear reactors is in the range 0.7 to 7 Ci-sec m⁻³ equivalent to a concentration of 0.02 to 0.2 µCi m⁻³ for continuous exposure.

- 1670 CALIFORNIUM STUDIES IN BEAGLES. Lloyd, R.D.; Mays, C.W.; McFarland, S.S.; Atherton, D.R.; Williams, J.L. (Univ. of Utah, Salt Lake City). Radiat. Res.; 65: No. 3, 462-473(Mar 1976).

Measurements of californium retention in the total body and the liver of living beagles have been made from 0 to 1546 days after intravenous injection of 0.005 to 2.8 µCi ²⁴⁹Cf/kg or 0.016 to 2.9 µCi ²⁵²Cf/kg as Cf(III) citrate. The indicated biological half-times were about 8.5 yr in the total body and 4.2 yr in the liver. No important differences could be established between the retention of ²⁴⁹Cf and ²⁵²Cf. Californium was found in almost every tissue of four dogs sacrificed at 7 to 36 days after injection. Liver and skeleton had the highest concentrations, with thyroid and kidney exhibiting somewhat lower values. The concentrations of most other tissues were considerably lower. Iodine isotopes resulting from the spontaneous fission of ²⁵²Cf were identified in the thyroid glands of ²⁵²Cf-injected dogs. Utilizing the fission γ rays of ²⁵²Cf seems to be a satisfactory method of assay for this radionuclide despite the minor contribution from photon radiation of fission products. Redeposition onto bone surfaces of californium lost from liver tissue probably contributes to the irradiation of cells that are believed to be most sensitive to bone sarcoma formation. The fission fragment radiation of ²⁵²Cf appears to be much less effective per rad in bone sarcoma induction than alpha radiation. (auth)

- 1671 (ORNL/TM--5277) TESTIMONY PRESENTED TO THE COMMITTEE ON SCIENCE AND TECHNOLOGY'S SUBCOMMITTEE ON ENVIRONMENT AND THE ATMOSPHERE. Richmond, C.R. (Oak Ridge National Lab., Tenn. (USA)). Mar 1976. Contract W-7405-ENG-26. 40p. Dep. NTIS \$4.00.

This report contains the basis for oral testimony to the House Committee on Science and Technology's Subcommittee on Environment and the Atmosphere in November 1975. The subject of the hearings was "Effects and Costs of Long-term Exposure to Low Levels of Manmade Pollutants" and the purpose of the hearings was to increase the awareness of low-level pollution and its impacts on human health, agriculture and climate. This report contains information related to impacts of low-level pollutants on human health. I have attempted to point out the major adverse health effects (e.g., carcinogenic, mutagenic and teratogenic) that may result from chronic exposure to low-level pollutants. Also addressed are important questions such as what do we know about dose-response relations for chronic exposure to pollutants and how can we establish comparisons with knowledge obtained from exposure to ionizing radiations. The report also considers the wisdom of extrapolating from health effects data obtained from acute, high-level exposures to chronic, low-level exposure conditions. Lastly, a few examples of the societal costs related to low-level pollutant exposure are presented. (auth)

- 1672 RADIATION PROTECTION REQUIREMENTS FOR DENTAL X-RAY DIAGNOSTIC FACILITIES. Taschner, P.; Koenig, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)); Andreas, M. (Karl-Marx-Universitaet, Leipzig (German

Democratic Republic)). Fachrichtung Stomatologie); Trinius, W. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic)). Radiologische Klinik). Stomatol. DDR; 26: No. 3, 184-190(Mar 1976). (In German).

On the basis of radiation protection regulations the planning of dental X-ray facilities is discussed considering organizational, technical and structural measures suitable for fulfilling protection requirements. Finally, instructions are given aimed at reducing radiation doses to personnel and patients.

- 1673 NONRANDOM DISTRIBUTION OF CHROMOSOME BREAKS IN CULTURED LYMPHOCYTES OF NORMAL SUBJECTS. Ayme, S.; Mattei, J.F.; Mattei, M.G.; Aurran, Y.; Giraud, F. (Groupe Hospitalier de la Timone, Marseille Cedex, France). Humangenetik; 31: No. 2, 161-175(29 Feb 1976).

Breakpoint distribution was studied from cultured lymphocytes on 7653 metaphases from 524 subjects whose karyotypes were normal. The mean break rate was 5% in both sexes. The frequency increased significantly after 40 years and varied during the year. The location of the breaks was very different from the expected random distribution. The break frequency for each chromosome was different according to the type of break (chromatid, simple chromosomal and chromosomal involving rearrangements). The location of the breaks was also studied according to the type of band and with respect to the centromere. A comparison between spontaneous breaks, x-ray induced breaks, breaks in Fanconi's anemia and in congenital rearrangements, show very significant differences.

- 1674 DIAGNOSTIC X-RAYS IN PREGNANCY. Russell, J.G.B. (Saint Mary's Hospital, Manchester (UK)); Swinhoe, J.R. Lancet; 1: No. 7957, 478-479(28 Feb 1976).

Letter to the editor.

BIOMEDICAL RADIOGRAPHY; FETUSES; LIABILITIES; LOW DOSE IRRADIATION; PREGNANCY; PRENATAL IRRADIATION; RADIATION DOSES; RADIATION HAZARDS; STATISTICS; WOMEN; X-RAY RADIOGRAPHY

- 1675 (DOCKET-50250--474) TURKEY POINT PLANT, UNITS 3 AND 4. SEMIANNUAL OPERATING REPORT NO. 7, JULY--DECEMBER 1975. (Florida Power and Light Co., Miami (USA)). 27 Feb 1976. 181p. (DOCKET-50251--455).

Unit 3 generated 1,968,074 MWh(e) net electric power and the generator was on line 2,802.9 hrs. Unit 4 generated 2,560,476 MWh(e) and was on line 3,944.8 hrs. Information is presented concerning operations, power generation, shutdowns, maintenance, changes, tests, experiments, radioactive effluent releases, radiological environmental monitoring, and occupational personnel radiation monitoring. (FS)

- 1676 (DOCKET-50293--629) PILGRIM NUCLEAR POWER STATION, UNIT 1. ANNUAL OPERATING REPORT, 1975. (Boston Edison Co., Mass. (USA)). 27 Feb 1976. 40p.

Net electric power generated in 1975 was 1,074,401 MW(e) with the generator on line 4,680.7 hrs. Information is presented concerning operations, maintenance, radioactive effluents and waste shipments, health physics, shutdowns, and personnel exposures. (FS)

- 1677 (DOCKET-50271--630) VERMONT YANKEE

NUCLEAR POWER STATION. ANNUAL OPERATING REPORT, 1975. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 26 Feb 1976. 33p. Dep. NTIS \$4.00.

Net electrical power generated was 3,560,206 MWh(e) with the reactor on line 7,689 hrs. Information is presented concerning operations power generation, shutdowns, corrective maintenance, primary coolant chemistry, occupational radiation exposure, reportable occurrences, core spray welds inspection, loss of start-up transformer, and union strike. (FS)

- 1678 (INIS-mf--3518) INFLUENCE OF X-RADIATION ON THE RENAL FUNCTION AS STUDIED IN THE UNILATERALLY NEPHRECTOMIZED RAT. Sittner, A. (Wuerzburg Univ. (Germany, F.R.). Fachbereich Medizin). 26 Feb 1976. 43p. (In German). Dep. NTIS (US Sales Only), PC AXX/MF A01.

6 figs.; 84 refs..

The effects of X-ray radiation on the renal function was studied in 83 Wistar rats. The rats received either only whole-body irradiation or were exposed to whole-body irradiation at certain intervals after unilateral nephrectomy. When the interval between operation and irradiation was shortened from 10 to 2 days, early lethality increased, although it has not yet been established whether the operation or the lack of a kidney plays a greater role here. The weight behaviour of non-nephrectomized or unilaterally nephrectomized rats is a function of the radiation dose; inappetence, dehydration and decreased intestinal absorption are influencing factors. Animals that died had exhibited another loss of weight after the 10th day p.r. The non-nephrectomized rats having undergone whole-body irradiation exhibited a decrease in serum urea on the 2nd and 10th day p.r. Animals unilaterally nephrectomized and then exposed to whole-body irradiation exhibited an increase in serum urea which was the more pronounced the earlier irradiation had taken place after unilateral nephrectomy. This raised urea level in the nephrectomized animals may be attributed to the compensatory hypertrophy not yet existing and to the reduced filtrate.

- 1679 (DOCKET-50293--587) PILGRIM NUCLEAR POWER STATION, UNIT 1. IE INSPECTION REPORT NO. 75-25, NOTICE OF VIOLATION AND REPLY. (Boston Edison Co., Mass. (USA)). 20 Feb 1976. 21p.

Inspection of environmental program activities and records. PILGRIM-1 REACTOR; INSPECTION; DISCHARGE CANALS; CHLORINE; MONITORING; CHEMICAL EFFLUENTS; SCREENS; FISHES; IMPINGEMENT; RADIOACTIVE EFFLUENTS; RADIATION MONITORING; IODINE 131; GASEOUS WASTES; FILTERS; CHARCOAL; PERSONNEL; RADIATION DOSES; QUALITY CONTROL

- 1680 (DOCKET-50245--626) MILLSTONE NUCLEAR POWER STATION, UNIT 1. INFORMATION RE THE EXPOSURE OF THREE INDIVIDUALS TO RADIATION. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 19 Feb 1976. 5p.

Exposure of three individuals to radiation. MILLSTONE-1 REACTOR; PERSONNEL; RADIATION DOSES

- 1681 (DOCKET-50245--627) MILLSTONE NUCLEAR POWER STATION, UNIT 1. REPORTABLE OCCURRENCE REPORT: EXPOSURE OF INDIVIDUALS TO RADIATION IN EXCESS OF SPECIFIED LIMITS. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 19 Feb 1976. 3p.

Exposure of individuals to radiation in excess of specified limits. MILLSTONE-1 REACTOR; PERSONNEL; RADIATION DOSES

- 1682 QUANTITATIVE ASSESSMENT OF CARCINOGENIC RISKS ASSOCIATED WITH 'HOT PARTICLES'. Mayneord, M.V. (London Univ. (UK). Inst. of Cancer Research); Clarke, R.H. Nature (London); 259: No. 5544, 535-539 (19 Feb 1976).

The hot particle problem is examined in terms of the number of irradiated cells and the doses to which they are subjected, assuming both linear and nonlinear dose-response functions typical of those reported in the radiobiological literature. The risks associated with point sources of α , β and γ activity compared with uniform irradiation, as well as the effects of fractionation of a single particle, and the change in risk if the particle moves, are assessed. Finally, although the biological data are insufficient for firm estimates, absolute risks in these various situations are assessed.

- 1683 HAZARDS OF PLUTONIUM WITH SPECIAL REFERENCE TO THE SKELETON. Spiers, F.W. (Cookridge Hospital, Leeds (UK)); Vaughan, J. Nature (London); 259: No. 5544, 531-534 (19 Feb 1976).

In the past attempts have been made to deduce plutonium toxicity in man from studies based on animal experimentation. An alternative method is to use the comparative dosimetry of plutonium and radium in man, with results broadly in agreement with maximum levels set by the International Commission on Radiological Protection.

- 1684 ASPECTS OF THE DOSIMETRY OF PLUTONIUM IN BONE. Thorne, M.C. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). Nature (London); 259: No. 5544, 539-541 (19 Feb 1976).

It is stated that after animals have been exposed to plutonium it eventually becomes distributed unevenly throughout the bone tissue. There is therefore a need to study the dosimetry of plutonium, particularly ^{239}Pu , as a function of its depth of burial in bone. A simple approach to the problem is discussed, together with the magnitude of some of the possible errors involved.

- 1685 Zur Toxizität inhalierter heisser Partikel insbesondere von Plutonium. Empfehlung der Strahlenschutzkommission. (TOXICITY OF INHALED HOT PARTICLES, IN PARTICULAR PLUTONIUM. RECOMMENDATION OF THE 'STRALENSCHUTZKOMMISSION'). Cologne; Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V. (19 Feb 1976). 18p. (In German).

1 tab.; 36 refs..

Statement by the SSK: 1) Plutonium has been in use in the USA for more than 30 years, and not a single case of lung cancer in Pu workers due to Pu incorporation has yet been reported. 2) The animal experiments performed do not indicate an increased risk of lung cancer after inhalation of hot particles as compared to homogeneous irradiation of the lungs. 3) The arguments of TAMPLIN and COCHRAN are based on a misinterpretation of the findings of other authors concerning the production of skin cancer in animals by external irradiation. Such studies have shown that the risk of skin cancer is lower with inhomogeneous irradiation than with homogeneous irradiation. 4) The knowledge and experience gained in the last few years validate the opinion voiced in ICRP Publication 14, paragraph 41. 5) At the present state of knowledge, the members of the Strahlenschutzkommission therefore see no

reason why the concept of a mean organ dose, used in the 1st Radiation Protection Ordinance to determine limiting values for the uptake of radioactive substances in the human body, should be abandoned in the case of inhalation of hot α particles.

- 1686 (DOCKET-50295--625) ZION NUCLEAR PLANT, UNITS 1 AND 2. SEMIANNUAL REPORT ON RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION EXPOSURE, JULY--DECEMBER 1975. (Commonwealth Edison Co., Chicago, Ill. (USA)). 18 Feb 1976. 89p. (DOCKET-50304--538).

Semiannual report on radioactive waste, environmental monitoring and occupational personnel radiation exposure, July--December 1975. ZION-1 REACTOR; ZION-2 REACTOR; RADIOACTIVE EFFLUENTS; RADIOACTIVE WASTES; ENVIRONMENT; RADIATION DOSES; PERSONNEL; RADIATION MONITORING

- 1687 (DOCKET-50010--523) DRESDEN NUCLEAR POWER STATION, UNITS 1, 2, AND 3. SEMIANNUAL REPORT ON RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION EXPOSURE, JULY--DECEMBER 1975. (Commonwealth Edison Co., Chicago, Ill. (USA)). 17 Feb 1976. 110p. (DOCKET-50237--962; DOCKET-50249--783).

Semiannual report on radioactive waste, environmental monitoring and occupational personnel radiation exposure, July--December 1975. DRESDEN-1 REACTOR; DRESDEN-2 REACTOR; DRESDEN-3 REACTOR; ENVIRONMENT; MONITORING; PERSONNEL; RADIATION MONITORING; RADIATION DOSES; RADIOACTIVE WASTES; RADIOACTIVE EFFLUENTS; GAMMA RADIATION; IODINE 131; MILK; ATMOSPHERIC PRECIPITATIONS; PLANTS; GROUND WATER; METEOROLOGY; DATA; RADIATION EFFECTS

- 1688 (DOCKET-50254--771) QUAD-CITIES STATION, UNITS 1 AND 2. SEMIANNUAL REPORT ON RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION EXPOSURE, JULY--DECEMBER 1975. (Commonwealth Edison Co., Chicago, Ill. (USA)). 17 Feb 1976. 98p. (DOCKET-50265--747).

Semiannual report on radioactive waste, environmental monitoring and occupational personnel radiation, July--December 1975. QUAD CITIES-1 REACTOR; QUAD CITIES-2 REACTOR; RADIOACTIVE WASTE MANAGEMENT; ENVIRONMENT; ENVIRONMENTAL EFFECTS; RADIATION MONITORING; PERSONNEL; RADIATION DOSES; RADIOACTIVE EFFLUENTS; STRONTIUM 89; STRONTIUM 90; GASEOUS WASTES; LIQUID WASTES; METEOROLOGY; IODINE 131; MILK; GRASS; ATMOSPHERIC PRECIPITATIONS; GROUND WATER

- 1689 DIAGNOSTIC X-RAYS IN LATE PREGNANCY AND IN THE NEONATE. Carmichael, J.H.E.; Berry, R.J. (Broadgreen Hospital, Liverpool (UK)). Lancet; 1: No. 7955, 351-352 (14 Feb 1976).

A survey has been carried out of current practice of radiology in late pregnancy and in neonates in the U.K. In major hospital centres up to 34.8% of all pregnancies are still X-rayed, as well as up to 10% of neonates. It is suggested that criteria for X-ray examinations in late pregnancy and of the neonate need closer scrutiny.

- 1690 (DOCKET-50389--152) ST. LUCIE PLANT, UNIT 2. SUMMARY OF MEETING HELD ON JANUARY 20 AND 21, 1976 WITH THE STATE OF FLORIDA, DEPARTMENT OF ENVIRONMENTAL REGULATION. (Florida Power and Light Co., Miami (USA)). 11 Feb 1976. 3p.

Summary of meeting held on January 20 and 21, 1976 with the State of Florida, Department

of Environmental Regulation. LUCIE-2 REACTOR; MEETINGS; HYDROLOGY; PERSONNEL; RADIATION EFFECTS; RADIATION DOSES

- 1691 (DOCKET-50313--484) ARKANSAS NUCLEAR ONE, UNIT 1. REPORTABLE OCCURRENCE REPORT: EXPOSURE OF FIVE INDIVIDUALS TO AIRBORNE RADIOACTIVE MATERIAL. (Arkansas Power and Light Co., Little Rock (USA)). 10 Feb 1976. 3p.

Exposure of five individuals to airborne radioactive material. ARKANSAS-1 REACTOR; PERSONNEL; RADIATION DOSES

- 1692 (DOCKET-50309--433) MAINE YANKEE ATOMIC POWER PLANT. IE INSPECTION REPORT NO. 75-21, NOTICE OF VIOLATION AND REPLY. (Maine Yankee Atomic Power Co., Westboro, Mass. (USA)). 4 Feb 1976. 28p.

Inspection of training, retraining, emergency plan, and emergency drill. MAINE YANKEE REACTOR; INSPECTION; EMERGENCY PLAN; EDUCATION; PERSONNEL; DECONTAMINATION; WELDING; FIRES; RADIATION DOSES

- 1693 (DOCKET-50298--488) COOPER NUCLEAR STATION. IE INSPECTION REPORT NO. 75-14. (Nebraska Public Power District, Columbus (USA)). 3 Feb 1976. 8p.

Inspection of circumstances which resulted in injury to employee. COOPER REACTOR; INSPECTION; PERSONNEL; ACCIDENTS; EXPLOSIONS; PUMPS; STACKS; VALVES; RADIATION DOSES

- 1694 (DOCKET-50324--572) BRUNSWICK STEAM ELECTRIC PLANT, UNIT 2. REPORTABLE OCCURRENCE REPORT NO. RO-76-13: AN EXPLOSION OCCURRED IN THE STACK FILTER HOUSE. (Carolina Power and Light Co., Raleigh, N.C. (USA)). 2 Feb 1976. 10p.

Explosion in the stack filter house. BRUNSWICK-2 REACTOR; STACKS; AIR FILTERS; MECHANICAL STRUCTURES; RADIATION MONITORS; PERSONNEL; RADIATION DOSES; OFF-GAS SYSTEMS; SEALS; EXPLOSIONS; SWITCHES; CALIBRATION; FREEZING; PIPELINES; FIRE PREVENTION

- 1695 (PB--259784) EXPOSURE OF AIRPORT WORKERS TO RADIATION FROM SHIPMENTS OF RADIOACTIVE MATERIALS. A REVIEW OF STUDIES CONDUCTED AT SIX MAJOR AIRPORTS. TECHNICAL REPORT. Shapiro, J. (Harvard Univ., Cambridge, Mass. (USA); Nuclear Regulatory Commission, Washington, D.C. (USA)). Feb 1976. Contract NUREG-DR-75-1505. 32p. NTIS, PC A03/MF A01.

The radiation exposure of airport workers handling shipments of radioactive materials was studied at six airports. Descriptions were obtained of the handling and arrangement of the packages, dose distributions were mapped around groupings of packages, and doses received by workers were evaluated both on the basis of time-motion studies and through readings of personal monitoring devices. Results of dosimeters worn over extended periods indicated that no workers were expected to receive exposures in excess of 500 millirems per year and most were expected to receive less than 100 millirems per year. No evidence was found in any of the six airport studies to suggest that members of the public received any exposure of significance relative to the natural background radiation.

- 1696 (DOCKET-50206--533) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. EMERGENCY PLAN, VOLUME 1. (Southern California Edison Co.,

- Rosemead (USA)). Feb 1976. 150p.
Emergency plan, Volume 1. SAN ONOFRÉ-1 REACTOR; EMERGENCY PLAN; PERSONNEL; EDUCATION; REACTOR ACCIDENTS; MANAGEMENT; PERSONNEL; COMMUNICATIONS; RADIATION DOSES; HOSPITALS; TRANSPORT; MEDICINE; RADIATION MONITORS
- 1697 Biologische Schädien durch Atomkraftwerke und energiereiche Strahlen. (BIOLOGICAL DAMAGE CAUSED BY NUCLEAR POWER PLANTS AND HIGH-ENERGY RADIATION). Strohm, H. (ed.). Hamburg, F.R. Germany; Association (Feb 1976). 119p. (In German).
Main topics: Criticism of the 'Physicians' memorandum concerning the commercial utilization of nuclear energy. 'International and national limiting values for radiation protection (Scheer, J.). Plutonium and public health (Geesamon, D.P.). Damage caused by low-level radiation (Sternglass, E.). Nuclear energy and its somatic risks (Manstein, B.). Effects of wet cooling towers on the local climate in low-exchange areas. (v. Rudloff, H.). Population exposure to ionizing radiation in diagnostics and therapy (Strohm, H.). Health hazards of colour TV sets and microfurnaces (Strempe, T., Strohm, H.) (HP).
- 1698 (RD/B/M--3608) COMMENTS ON THE MEDICAL RESEARCH COUNCIL REPORT, 'CRITERIA FOR CONTROLLING RADIATION DOSES TO THE PUBLIC AFTER ACCIDENTAL ESCAPE OF RADIOACTIVE MATERIAL'. Clarke, R.H.; Wheatley, B.M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1976. 11p. INIS.
The recent MRC report of the establishment of Emergency Reference Levels (ERLs) of dose, and of the derived ERLs for particular nuclides in various environments, is reviewed and its relevance to CEGB reactor situations is examined.
- 1699 (FDA--76-8027) USE OF ELECTRON LINEAR ACCELERATORS IN MEDICAL RADIATION THERAPY: PHYSICAL CHARACTERISTICS. OVERVIEW REPORT NO. 1. (Safety Sciences, San Diego, Calif. (USA)). Feb 1976. 97p. GPO.
This report presents an overview of the physical characteristics of electron linear accelerators used in medical radiation therapy. Particular attention is given to those physical characteristics and performance parameters that are related to delivery of a useful, properly controlled prescription dose of radiation to the patient or to delivery of a potentially harmful dose of radiation to the patient, machine operators, or others in the vicinity of the accelerator. The purpose of the study, of which this report is a part, was to provide a data base which will assist the Bureau of Radiological Health in evaluating the need for a performance standard for medical linear accelerators and the priority which should be assigned to such a standard should one be required. (auth)
- 1700 THE ACTION SPECTRUM AND DOSE RESPONSE STUDIES OF UNSCHEDULED DNA SYNTHESIS IN NORMAL HUMAN FIBROBLASTS. Ichihashi, M.; Ramsay, C.A. (Institute of Dermatology, London (UK). Dept. of Photobiology). Photochem. Photobiol. 23: No. 2, 103-106 (Feb 1976).
Excision repair of DNA damage by UV has been assessed in normal human fibroblasts in culture by measuring unscheduled DNA synthesis. Dose response experiments indicated that the same chromophore was involved in UV-induced damage and excision repair at three different wavelengths between 260 and 300 nm. Action spectra for unscheduled DNA synthesis were determined at wavelengths between 260 and 320 nm 30 min after irradiation using 2 doses of UV. 100 Jm⁻² and 10 Jm⁻². Experiments at the lower dose were carried out because it appeared that repair was saturated with the higher dose at 260 and 280 nm. To explore this part of the spectrum further, experiments were performed with different doses at 260 and 280 nm and unscheduled DNA synthesis assessed 30 min and 24 h after irradiation. At 24 hr after irradiation a significantly greater amount of unscheduled DNA synthesis occurred at 280 nm. It is suggested, therefore, that both DNA and protein are concerned in the absorption of UV which leads to DNA damage and excision repair.
- 1701 THE EFFECT OF A CHANGE IN RADIATION QUALITY ON THE ABILITY OF ELECTRON AFFINIC SENSITIZERS TO SENSITIZE HYPOXIC CELLS. McNally, N.J. (Mount Vernon Hospital, Northwood (UK)). Int. J. Radiat. Biol. 29: No. 2, 191-196 (Feb 1976).
Letter to the editor.
ACETOPHENONE; ANIMAL CELLS; BIOLOGICAL RADIATION EFFECTS; CELL CULTURES; COMPARATIVE EVALUATIONS; FURANS; HAMSTERS; IMIDAZOLES; NEUTRON BEAMS; NITRO COMPOUNDS; OXYGEN ENHANCEMENT RATIO; PERFORMANCE; RADIATION QUALITY; RADIOSENSITIZERS; SURVIVAL CURVES; X RADIATION
- 1702 OVER-CONCERN CAN EQUAL HYSTERIA: THYROID CANCER. Tristan, T.A. Pa. Med. 79: No. 2, 49-51 (Feb 1976).
A method for screening patients for thyroid cancer is discussed. If the patient is known to have had prior irradiation, a thyroid scan must be performed. A set of guidelines are presented for screening patients. (ERB)
- 1703 (BNWL--2000(Pt.4), pp 91-93) CONSIDERATIONS AND METHODOLOGIES FOR STUDIES CONCERNING THE EFFECT OF LOW-LEVEL EXPOSURES TO ENVIRONMENTAL CONTAMINANTS. Feb 1976.
Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research.
The overall purpose of this project is to assemble and review relevant information, define inherent difficulties of low-level radiation exposure studies, discuss the tractability of these problems, and evaluate and adapt epidemiological and statistical methods for studying them. The primary focus is on studies where ionizing radiation is of concern. Data are included from an analyses of Hanford mortality data, an undertaking in which we not only hope to elicit considerable information on the relationship of radiation exposure to mortality patterns, but also one in which we expect to gain experience and develop methods for dealing with this type of data.
- 1704 (KFK--2259) TOPOGRAPHY OF π^- -IRRADIATED VOLUMES. Bueche, G. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Experimentelle Kernphysik). Feb 1976. 25p. INIS.
10 figs.; with refs..
The charge exchange reaction $\pi^-p \rightarrow \pi^0n$ and the radiative capture of negative pions $\pi^-p \rightarrow \gamma n$ can be used to control the range of π^- in matter like human tissue. The calculations reported in this paper demonstrate that it is possible to construct range monitors which allow the radiation therapist immediate control of the π^- beam setting with respect to the tumor volume. This monitoring of range can be achieved from outside the body within short times compared to irradiation times which are

typical in therapy.

- 705 (PB--262211) EXPOSURE OF AIRPORT WORKERS TO RADIATION FROM SHIPMENTS OF RADIOACTIVE MATERIALS. A REVIEW OF STUDIES CONDUCTED AT SIX MAJOR AIRPORTS. TECHNICAL REPORT. Shapiro, J. (Harvard Univ., Cambridge, Mass. (USA)). Feb 1976. Contract NUREG-DR-75-1505. 32p. NTIS, PC A03/MF A01.

The radiation exposure of airport workers handling shipments of radioactive materials was studied at six airports. Descriptions were obtained of the handling and arrangement of the packages, dose distributions were mapped around groupings of packages, and doses received by workers were evaluated both on the basis of time-motion studies and through readings of personal monitoring devices. Results of dosimeters worn over extended periods indicated that no workers were expected to receive exposures in excess of 500 millirems per year and most were expected to receive less than 100 millirems per year. No evidence was found in any of the six airport studies to suggest that members of the public received any exposure of significance relative to the natural background radiation.

- 1706 (SAAS--194) SIGNIFICANCY OF RADIATION BIOLOGY FOR BASIC AND ADVANCED TRAINING IN RADIATION PROTECTION. Neumeister, K. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Feb 1976. 8p. (In German). INIS.

Within the scope of training in radiation protection the conveyance of radiobiological knowledge is intended to promote the understanding of radiation protection measures. The paper deals with the main aspects of the radiobiological training, the use of model tests to illustrate radiation injuries and general methodic questions of instruction.

- 1707 COMPUTERIZED RADIATION PROTECTION ASSESSMENTS FOR DIAGNOSTIC AND THERAPEUTIC X-RAY ROOMS. Henson, P.W. (Royal Perth Hospital (Australia). Dept. of Medical Physics). Australas. Bull. Med. Phys. Biophys.; No. 66, 15-17 (Feb 1976).

Procedures for calculating radiation barrier protective values are well established for conventional diagnostic and therapeutic x-ray rooms. Calculation and curve reading, however, can be tedious, particularly when large new departments are being planned. Existing departments are subject to modernisation processes, producing changes in equipment, techniques as well as the number and size of rooms. To deal with a steady demand for protection assessments computer programmes have been written, the purpose of this paper being to briefly describe their functioning and output. The programmes are written in FORTRAN 4 and run on a Digital Equipment Corporation PDP 11/40 computer using disc storage. The programme for the diagnostic x-ray room assesses protection requirements for a 125 kV primary beam and uses approximately 6 kilobytes of core.

- 1708 RADIATION DOSIMETRY IN NUCLEAR MEDICINE - RECENT DEVELOPMENTS. Hetherington, E.L.R.; Wood, N.R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Isotope Div.). Australas. Bull. Med. Phys. Biophys.; No. 66, 7-14 (Feb 1976).

This paper reviews developments in radiation dosimetry in Nuclear Medicine over the past few years. The practical scope of the Medical

Internal Radiation Dose (MIRD) Committee's Schema for dose determination has been extended by the development of more realistic mathematical models of the human body, together with the improvement in basic physical data used in dose calculations. Apart from the use of the Adult Human Phantom as the basis for dose determination, models have been developed for the estimation of doses to children and to the developing foetus. The Schema has been extended to permit calculations of the dose to dynamic organs, particularly the bladder. The principle of Monte Carlo photon history simulation, which forms the basis of much of the MIRD Schema's published data, has been used at the Australian Atomic Energy Commission for the determination of complete photon dose distributions. These are more meaningful in many cases than the average doses determined by the absorbed fraction method.

- 1709 INFLUENCE OF DIAGNOSTIC ROENTGEN DOSES ON HUMAN CHROMOSOMES AND INFLUENCE OF AGE ON THE ABERRATION YIELD. Kucerova, M.; Plivkova, Z.; Hradcova, L. (Postgraduate Medical Institute, Pediatric Department, and Genetic Laboratory, Prague, Czechoslovakia; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). Acta Radiol., Ther., Phys., Biol.; 15: No. 1, 91-96 (Feb 1976).

Urography was performed in 2 groups of patients (one comprising patients aged 7 to 18 years, the other patients aged 8 to 32 months) under constant conditions. The skin dose ranged between 1 and 4 R. Blood samples were taken before, immediately after and 24 hours after the irradiation. A significantly increased number of aberrant cells was found only in the blood samples taken 24 hours after irradiation. No age-dependent influence on the radiation sensitivity in vivo was found.

- 1710 BANDING TECHNIQUE USED FOR THE DETECTION OF CHROMOSOMAL ABERRATIONS INDUCED BY RADIATION AND ALKYLATING AGENTS TEPA AND EPICHLOROHYDRIN. Kucerova, M.; Plivkova, Z. (Postgraduate Medical Inst., Prague (Czechoslovakia). Pediatric Dept.; Inst. of Hygiene and Epidemiology, Prague (Czechoslovakia). Genetic Lab.). Mutat. Res.; 34: No. 2, 279-290 (Feb 1976).

Blood samples from two healthy donors were exposed, (1) to 200 R of X-rays in G_0 and G_1S phases of the cell cycle, and (2) to epichlorohydrin $10^{-6}M$ and TEPA $10^{-6}M$ in G_0 and/or in G_1S and G_2 phases. Part of the cells was processed for chromosome studies conventionally and the other part by the trypsinization banding technique. Detailed chromosomal analysis showed that after irradiation 38.2% of aberrations in G_0 and 18.7% in G_1S phases escaped cytogenetic detection when the conventional technique was used. After exposures to TEPA and ECHH 10.9% of aberrations were undetectable in G_0 and 3.3% in G_1S and G_2 phases. The distribution of chromosome breaks was non-random both after irradiation and after exposure to alkylating agents. However, it differed according to the mutagen used. Some chromosomal segments were broken significantly more frequently than the others (e.g. 9q12), some were resistant to breakage (e.g. the whole Y chromosome). The segments represented by G-negative bands were more fragile than the G-positive and G-variable segments.

- 1711 CHROMOSOME ABERRATIONS INDUCED IN HUMAN LYMPHOCYTES BY NEUTRON IRRADIATION. Lloyd, D.C.; Purrott, R.J.; Dolphin, G.W.; Edwards, A.A. (National Radiological Protection Board, Harwell (UK)). Int. J. Radiat. Biol.; 29:

No. 2, 169-182(Feb 1976).

In vitro dose-response curves of unstable chromosome aberrations in human lymphocytes have been obtained for neutron spectra of mean energies 0.7, 0.9, 7.6 and 14.7 MeV. The aberration yields have been fitted to the quadratic function $Y = \alpha D + \beta D^2$, which is consistent with the single-track and two-track model of aberration formation. However with high-LET radiation, the linear component of yield, corresponding to damage caused by single tracks, predominates, and this term becomes more dominant with increasing LET, so that for fission spectrum neutrons the relationship is linear, $Y = \alpha D$. At low doses, such as those received by radiation workers, limiting RBE values between 13 and 47 were obtained relative to ^{60}Co γ -radiation. At higher doses, as used in radiotherapy, the values were much lower; ranging from 2.7 to 8 at 200 rad of equivalent γ -radiation. Both sets of RBE values correlated well with track-averaged LET but not with dose-averaged LET. When the numbers of cells without aberrations were plotted against radiation dose, curves were obtained which are similar in shape to those for conventional cell-survival experiments with comparable neutron spectra. The D_0 values obtained in the present study are close to those from other cell systems.

to radiations and chemically induced mutations has been accepted as an increased mutation rate of 25%. A linear dose-effect relationship has been assumed and from the experimentally obtained mutation rate due to irradiation of mouse spermatogonia, the following risk factors were obtained: 1) The doubling dose for specific locus in the mouse is representative of recessive conditions. 2) The mutation rate depends on dose rate and fractionation of the irradiation. 3) The extrapolation factor for using these mammalian results in man is about 1.2. 4) The results of specific locus investigations are representative of all the mutation-types in a mouse that have been investigated 5) Both sexes are similarly affected. On the above premises, a radiation dose of approximately 75 mrem per annum would increase the spontaneous mutation rate in man by about 9% per generation. The risk due to chemical mutagens should not exceed that due to radiation. Methods similar to those used for radiation risks are able to estimate the chemical risk to the population.

- 1712 DEFECTIVE REPAIR OF GAMMA-RAY-INDUCED DNA DAMAGE IN XERODERMA PIGMENTOSUM CELLS. Setlow, R.B.; Faulcon, F.M.; Regan, J.D. (Oak Ridge National Lab., Tenn. (USA)). Int. J. Radiat. Biol.; 29: No. 2, 125-136(Feb 1976).

The bromouracil-photolysis technique has been used to estimate the sizes of the repaired regions in normal human and xeroderma pigmentosum (XP) cells irradiated by γ -rays aerobically or anoxically. After one and a half hours of incubation, single-strand breaks were repaired and the repaired regions were small - one to two BrUra residues - for cells irradiated aerobically or anoxically. After a 20-hour incubation, the repaired region in normal cells showed a component mimicking U.V.-repair. There were large patches (approximately 30 BrUra residues) in the approximate ratios of one per six chain breaks for aerobic irradiation and one per three chain breaks for anoxic irradiation. XP cells, however, only showed large patches at 20 hours if they had been irradiated aerobically. Such regions could not be detected in XP cells irradiated anoxically. These results indicate (1) that some part of ionizing damage mimics excision of U.V. damage in that the repair patches are large and the repair takes an appreciable time; (2) the types of such damage depend on whether the irradiation is done aerobically or anoxically; and (3) XP cells are defective in repairing a component of anoxic damage.

- 1713 NEW STANDARDS FOR RADIATION PROTECTION IN MEDICAL ELECTRON ACCELERATOR PLANTS. WITH REFERENCE TO STANDARD DRAFTS DIN 6847 PART 1 AND 2. Berger, H. Strahlentherapie; 151: No. 2, 192-194(Feb 1976). (In German).

Brief outline of the contents of both drafts on the basis of the BMI-guidelines dated March 1973 and of the amendment of the 1st Radiation Protection Ordinance.

- 1714 GENETIC HAZARDS IN A TECHNOLOGICAL AGE. Ehling, U.H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Abt. fuer Genetik). Fortschr. Geb. Roentgenstr. Nuklearmed.; 124: No. 2, 166-171(Feb 1976). (In German).

4 tabs.; 58 refs..

The maximal tolerable risk for mankind due

- 1715 MAN AND RADIATION. Taubert, R. PTB Mitt.; 86: No. 1, 2-12(Feb 1976). (In German).

8 figs.; 2 tabs.; 23 refs..

Man has always been exposed to ionizing radiation. Today, apart from the natural sources of radiation, man-made sources are also in existence: fall-out after nuclear explosions, medical applications in radiation therapy and diagnosis, technical applications. The major part of man-made radiation exposure is caused by X-ray diagnosis. The contribution of nuclear fall-out, nuclear energy and other technical applications amounts to less than 10 percent of the natural radiation exposure. As long as the official dose limits are observed by nuclear energy installations, the radiation risk is considered to be small in comparison with other risks. A natural limit of energy production is given by the risk of inducing severe climatic changes. If an annual increase of 3.3 percent is assumed, the consumption of primary energy in the Federal Republic of Germany would amount to 10 percent of the average solar radiation in about 80 years. In the discussion of the occurrence and application of ionizing radiation, some relevant PTB-activities in this field are emphasized.

- 1716 RADIOBIOLOGICAL CHARACTERISTICS OF CERVICAL CANCER. Kagabu, T.; Kobayashi, T.; Nanayama, K. (Iwate Medical Coll., Morioka (Japan). School of Medicine). Nippon Sanka Fujinka Gakkai Zasshi; 28: No. 2, 113-120(Feb 1976). (In Japanese).

In order to observe the radiobiological characteristics of cervical cancer, the author carried out irradiation of ^{60}Co in 16 cases of cervical cancer. The primary lesion of each case was exposed to radiation of 100 R once a day, 40 times in sequence, totaling 4,000 R. To evaluate this results, the vaginal smears were obtained everyday and examined for changes in cancerous cells caused by the irradiation. The results of our study showed that cervical cancer could be classified into three groups according to the radiosensitivity of its cancerous cells. In the group of low-radiosensitivity (11 cases of 16), the cancerous cells decreased gradually, and enlargement of the nuclei of the cancerous cells was observed from 2,000 R of irradiation, but the majority of the cancerous cells were those of nucleus after the irradiation of 4,000 R. In all of the 5 uterus removed, residual cancer lesion was noted. The radiocurability was

unfavourable. In the group of high-radiosensitivity (4 cases of 16), the cancerous cells decreased remarkably. Enlargement of nucleus was noted from 1,000 R of the irradiation, the cancerous cells of small-sized nucleus appeared with the irradiation of 3,000 R but the cancerous cells almost disappeared with the irradiation of 4,000 R. The radiocurability was favourable. In the group of combination of high-radiosensitivity and low-radiosensitivity portions (one case of 16), the cancerous cells decreased remarkably until the exposure to the radiation of 2,000 R but thereafter did slowly. In a removed uterus, the cancer lesion was noted, but the prognosis was favourable. The foregoing results suggest that changes in the nuclear diameter of the cancerous cells in vaginal smears during irradiation can tell the radiosensitivity of the cancerous cells.

- 1717 EARLY DIAGNOSIS OF GASTRIC CANCER FROM RADIOLOGICAL VIEW. Richter, K. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)). Dtsch. Gesundheitswes.; 31: No. 9, 401-404 (Feb 1976). (In German).

By the help of successes achieved in Japan in the control of gastrosarcoma, tasks, possibilities and limits in X-ray diagnostics are outlined, strategically holding hitherto a key position in the recording of patients with early carcinoma of the stomach. X-ray symptoms, the classification of tumor-finding, X-ray examination-methods, their relation to gastroscopy as well as the radiation dose and problems of economy of X-ray examinations are discussed. On account of the achieved recognition prophylactic examinations are to be concentrated to risk groups (anaemia perniciosa, polyposis ventriculi, late state after gastrectomy, ulcus ventriculi).

- 1718 LOCALIZED URETERAL FIBROSIS: AN UNRECOGNIZED COMPLICATION OF RADIATION THERAPY FOR PROSTATIC CARCINOMA. Jacobs, J.A.; Rosenthal, R.S.; Shaw, J.L. (Abington Memorial Hospital, PA). J. Urol.; 115: No. 2, 610-611 (Feb 1976).

Complications of radiation therapy for prostatic carcinoma are frequent but usually minor. A patient is described in whom localized ureteral fibrosis developed following curative radiation therapy, which subsequently required a reconstructive operation. An analogous situation regarding patients with carcinoma of the cervix is examined and possible etiologies are discussed. This complication should be recognized so that proper management can be instituted.

- 1719 HEALTH PROBLEMS OF INDUSTRIAL APPLICATIONS OF RADIOISOTOPES. Kudrna, J. (Ustav Narodniho Zdravi, Prague (Czechoslovakia). Hygienicka Stanice Narodniho Vyboru Hlavniho Mesta Prahy). Radiol. 17: No. 1, 1-9 (Feb 1976). (In Czech).

From 5. national conference on industrial applications of radionuclides; Jicin, Czechoslovakia (29 Sep 1975).

Radiation hygiene problems of industrial radioisotope applications are discussed. The observance of regulations is emphasized. Radiation protection is based on the principle of preventing early radiation damage and limiting late radiation damage to an acceptable level. The basic requirement is that the cumulated dose should be as low as possible, i.e., as low as is practically feasible in considering economic and social aspects. Notices 59/72 and 65/72, Collection of Laws,

rule that if the limit of 3/10 of the maximum permissible dose is likely to be reached, control zones should be defined and marked at places of work where radioisotopes are handled. The characteristics of such a control zone are listed and the measures to be taken in case of accident are outlined.

- 1720 TREATMENT OF HEMORRHAGIC RADIATION CYSTITIS WITH FORMALIN. Belis, J.A.; Milam, D.F. (West Virginia Univ., Morgantown). W. Va. Med. J.; 72: No. 2, 31-35 (Feb 1976).

Two patients with intractable vesical hemorrhage secondary to pelvic irradiation were treated at West Virginia University Medical Center. Technique, indications, complications, and controversies associated with formalin therapy are discussed.

- 1721 (BNWL--2000(Pt.2), pp 199-205) TERRESTRIAL ANIMAL ECOLOGY. Feb 1976.

Pacific Northwest Laboratory annual report for 1975 to the USERDA Division of Biomedical and Environmental Research.

The Animal Ecology project is an integral part of the terrestrial ecology program. For convenience, it is reported separately because of the specialized nature of its techniques. It includes studies to characterize faunal populations taxonomically and ecologically and to estimate density and biomass of important mammal, bird, herpetofauna, and invertebrate populations. Extensive studies of small mammal populations conducted in past years are being summarized for open literature publication. Methodology and techniques developed in the animal ecology program are expected to be vital to studies to be initiated under a newly funded 189 entitled Radioecology of Waste Management Zones. These kinds of supportive studies will be needed to determine dietary habits of important animals inhabiting waste management zones, construction of realistic food chain models, and estimating radioactivity doses to biota.

- 1722 CAN X-RAYS BE USED TO INCREASE LITTER SIZE IN THE MOUSE. Rugh, R. (Dept. of Health, Education, and Welfare, Rockville, MD). Biol. Bull.; 150: No. 1, 107-117 (Feb 1976).

The average litter size for normal CF₁ mice is close to 10.5, varying in the experiments from 9.75 to 11.73. Separate groups of controls were provided for each of the three major experiments. Resorptions were found even among the control groups, with an average of 1.5 percent. Among litters from matings immediately after (whole-body) x radiation from 10 to 200r, the variations in resorptions over exposure levels was minimal, while variation in average litter size was within the range of normal experience for these mice. Even among mice mated one week after exposure the differences in litter sizes were small and the statistical significance tenuous. It was found that even a maximum exposure of 200R altered neither the resorption rate or production of anomalies, nor induced any significant increase in litter size. When the various phases of the estrous cycle were segregated for irradiation to 100R it was found that those in estrus showed somewhat smaller mean litter size than those which were x irradiated during diestrus or metestrus. However, when compared with the control group, which probably included all phases of the estrous cycle, there was no statistically significant change. On the basis of the study of some 8000 offspring, there is no evidence of significant change in ova production following whole-body x radiation from 10R to 200R of mature CF₁ female mice, and

no evidence of superovulation. (auth)

- 1723 MORPHOLOGIC AND MORPHOMETRIC ANALYSIS OF THE EARLY EFFECTS OF X-RAY AND HEAVY-ION IRRADIATION OF HAMSTER LUNG. Woodruff, K.H.; Leith, J.T.; Lyman, J.T.; Tobias, C.A. (Univ. of California, San Francisco). Am. J. Pathol.; 82: No. 2, 287-294(Feb 1976).

Morphometric methods were used to compare the early effects of graded single doses of x rays with accelerated heavy particle (helium or neon) irradiation of hamster lung. Increased values in the volume densities of both capillary lumina and inflammatory cells at 2 weeks postirradiation were observed. Neon-ion irradiation was statistically different from x-irradiation at all dose levels, while helium-ion irradiation showed significant increases only at high doses (1000 to 1500 rads). At 1 month postirradiation, the volume densities of capillary lumina after heavy particle irradiation began to return to control values, while those in x-irradiated lungs continued to be elevated. The volume density of inflammatory cells remained increased for all types of irradiation, and the highest values were obtained in neon-ion irradiated lungs. Accelerated heavy particle irradiation would therefore appear to elicit a more intense early radiation response than does x irradiation, but the chronic significance of these findings is not yet known. (auth)

- 1724 BODY TISSUE ENZYMES IN RADIATION EFFECTS. Surinov, B.P. Med. Radiol.; 21: No. 2, 80-90(Feb 1976). (In Russian).

This review covers the change in content of the following enzymes in organisms after the use of radiation: the lactate dehydrogenases, the aspartate-aminotransferases, the alkali phosphatases, the esterases of carboxylic acid ethers, and the amylases. The mechanisms of radiation damage to these various enzymes are elucidated. The behavior of tissue enzymes during radiation therapy is reviewed. 85 references.

- 1725 (SRL--76002) SAFETY ANALYSIS OF DOUBLY ENCAPSULATED ^{252}Cf MEDICAL SOURCES (MODELS ALC, SALC, AT). Permar, P.H. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Feb 1976. 20p. Dep. NTIS \$3.50.

This document describes the doubly encapsulated ^{252}Cf neutron sources prepared for use in cancer therapy. These neutron sources are classed as "special form radioactive material" and as such must meet certain regulations prescribed by the US Department of Transportation. This document describes the tests that have been performed and shows that this group of medical sources does meet the applicable DOT regulations. The doubly encapsulated neutron sources are fabricated by the Savannah River Laboratory and are loaned by the US Energy Research and Development Administration under contract agreement to medical organizations for evaluation of ^{252}Cf in the treatment of cancer.

- 1726 (SRL--76003) SAFETY ANALYSIS OF SINGLY ENCAPSULATED ^{252}Cf MEDICAL SOURCES, MODEL ALC-PXC. Permar, P.H. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Feb 1976. 20p. Dep. NTIS \$3.50.

The document describes the singly encapsulated ^{252}Cf neutron sources used in cancer therapy. These sources are fabricated by the Savannah River Laboratory and are loaned by

the U. S. Energy Research and Development Administration under contract agreement to medical organizations for evaluation of ^{252}Cf in the treatment of cancer. These neutron sources are classed as special form radioactive materials and as such must meet certain Regulations prescribed by the U. S. Department of Transportation. The document describes the tests that have been performed and shows that these medical sources do meet the applicable DOT Regulations. The document is written to demonstrate compliance with appropriate paragraphs in Sections VII, VIII of "Regulations for Safe Transport of Radioactive Materials, IAEA Safety Standards, Safety Series No. 6--1973 Revised Edition."

- 1727 ABSORBED DOSE TO THE BLADDER FROM $^{99}\text{Tc}/\text{SUP M}/\text{DTPA}$. Diffey, B.L. (Kent and Canterbury Hospital (UK)); Hilson, A.J.W. Br. J. Radiol.; 49: No. 578, 196-198(Feb 1976).

Letter to the editor.

BIOLOGICAL HALF-LIFE;BLADDER;BLOOD-PLASMA CLEARANCE;DTPA;EXCRETION;ISOMERIC NUCLEI; KIDNEYS;MATHEMATICAL MODELS;PATIENTS;RADIATION DOSES;RADIOPHARMACEUTICALS;SCINTISCANNING; TECHNETIUM 99;TIME DEPENDENCE;URINE

- 1728 EVALUATION AND DOSIMETRY OF A SUP(99M)TC-SN-MAA LUNG IMAGING AGENT IN HUMANS. Robbins, P.J.; Feller, P.A.; Nishiyama, H. (Bureau of Radiological Health, Cincinnati, Ohio (USA)). Health Phys.; 30: No. 2, 173-178(Feb 1976).

A kit preparation of sup(99m)Tc-Sn-MAA for lung imaging was evaluated for absorbed radiation dose in five individuals by the acquisition of biological data. The disappearance of sup(99m)Tc from the lungs followed a two component exponential curve with effective half-lives of 10.1 min and 2.66 hr. The absorbed radiation doses to the lungs, liver, kidneys, testes, ovaries and total body were calculated to be 0.112, 0.042, 0.061, 0.0088, 0.0096 and 0.0121 rad/mCi, respectively. The lower dose to the lungs, compared to commercially available kits, results from these short half-lives. The results of the study of this kit preparation are compared to results from studies of similar commercial kit preparations.

- 1729 WEAKENING OF BONE BY OSTEOLYTIC LESIONS IN A RADIUM CASE. Seggen, W.W. von; Schlenker, R.A.; Farnham, J.E. (Argonne National Lab., Ill. (USA)). Health Phys.; 30: No. 2, 243-245(Feb 1976).

Brief note.

BIOLOGICAL RADIATION EFFECTS;BONE FRACTURES; MINERALS;RADIUM;SKELETON;WOMEN

- 1730 (BNWL--2000(Pt.4), pp 83-86) DOSIMETRY OF INTERNAL EMITTERS. Feb 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research.

The distribution of radiation dose in the walls of the G. I. tract from ingested, insoluble beta emitters was both calculated and measured. The median lethal ingested ^{106}Ru - ^{106}Rh activity concentration in adult dogs was about 3 mCi/kg (2.75 mCi/kg produced a delayed death, $^{10}\text{LD}_{50}$, whereas 3.5 mCi/kg produced an acute death, $^{10}\text{LD}_{50}$). The median lethal concentrations in rats for acute death were about 9 mCi/kg ^{106}Ru - ^{106}Rh ; 17 mCi/kg ^{90}Y and 5000 mCi/kg ^{147}Pm . The LD_{50} dose to critical tissue (crypt cells) in the dog gut was about 4000 rads with a 95 percent confidence interval of 1500-6500 rads. The LD_{50} dose to critical tissue in rats was about 3300 rads with a 95

percent confidence interval of 2500 to 4100 rads; values very close to those determined for the dog.

- 1731 PATHOLOGY OF AMERICIUM 241. Nilsson, A.; Broome-Karlsson, A. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Acta Radiol., Ther., Phys., Biol.; 15: No. 1, 49-70 (Feb 1976).

Male CBA-mice were injected intraperitoneally with different doses of ^{241}Am -citrate (16, 8, 0.4, 0.2, 0.04 $\mu\text{Ci/kg}$). The two highest doses were highly destructive of the hematopoietic tissues, testes and bone tissue. The highest frequency of induced tumors of the skeleton and hematopoietic tissue was found in the 8 μCi group. In the liver, adrenal glands, kidney and heart degenerative lesions were found mainly in the higher dose groups. In the lower dose groups degenerative lesions seemed to appear earlier and at a higher frequency than in the control group.

- 1732 EFFICACY OF SOME SORBENTS IN DECREASE OF RESORPTION OF RADIOACTIVE SR IN THE GASTRO-INTESTINAL TRACT OF MAN. Ilyin, L.A.; Likhtarev, I.A.; Razumovskii, N.O.; Borisov, V.P.; Shamov, V.P. Med. Radiol.; 21: No. 2, 42-49 (Feb 1976). (In Russian).

In observations made on volunteer patients the authors studied the efficacy of 3 sorbents, adsobar, calcium alginate, and vocacite, in the decrease of radioactive strontium (^{90}Sr) in the gastro-intestinal tract. A total of 44 persons took part in the experiment. The preparations were prescribed to be administered once four hours before the taking of a radioactive compound simultaneously and one hour after per os administration of ^{90}Sr . High efficacy of these drugs was established when they were prescribed in doses of 20 to 25 g immediately after intake of ^{90}Sr . Vocacite proved to be the most resultant in prophylactic treatment. In one hour postponed administration of the preparations adsobar and vocacite were more effective than alginate.

- 1733 EFFICACY OF ZN-DTPA IN REMOVING PLUTONIUM FROM THE HUMAN BODY.

Ohlenschlaeger, L. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F.R. Germany)). Health Phys.; 30: No. 2, 249-250 (Feb 1976).

Brief note.

CALCIUM;COMPARATIVE EVALUATIONS; DECONTAMINATION;DTPA;EXCRETION;MAN;PLUTONIUM 239;WOUNDS;ZINC

- 1734 RADIOCESIUM IN NATIVE RESIDENTS OF ANAKTUVUK PASS, ALASKA, 1970-1974. Hedlund, J.D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Health Phys.; 30: No. 2, 245-247 (Feb 1976).

Brief note.

AGE GROUPS;ALASKA;ANNUAL VARIATIONS;BODY BURDEN;CESIUM 137;DEER;DIET;ECONOMICS;FALLOUT DEPOSITS;HUMAN POPULATIONS;SEASONAL VARIATIONS; TIME DEPENDENCE;RADIONUCLIDE KINETICS; DISTRIBUTION

- 1735 ESTIMATED TOXICITY OF CA-DTPA TO THE HUMAN FETUS. Mays, C.W.; Taylor, G.N.; Fisher, D.R. (Utah Univ., Salt Lake City (USA). Radiobiology Div.). Health Phys.; 30: No. 2, 247-249 (Feb 1976).

Brief note.

CALCIUM;DTPA;FETUSES;MICE;PREGNANCY;RATS; TOXICITY;WOMEN

- 1736 (CEA-R--4722) METABOLISM OF TRITIATED THYMIDINE IN THE RAT. A RADIATION PROTECTION APPROACH. Jeanmaire, L.; Vernois, Y.; Bullier, D.; Gros, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Feb 1976. 55p. (In French). INIS.

For a radiation protection purpose, the metabolism of tritiated thymidine was studied during some 500 days following ingestion and intraperitoneal administration to rats. The data relative to urinary and fecal excretion, uptake of retained and volatile activities in 24 tissues or organs, cumulative activities are presented and discussed. A comparison of the results of the two routes of administration showed that I.P. administration resulted in a more significant uptake than ingestion together with a preferential deposit in the organs contained in the abdomen and sometimes in the thorax. The results are in good agreement with the results of other authors in a study of shorter duration and concerning fewer organs. Radiation doses were calculated, using various assumptions.

- 1737 DISTRIBUTION OF INJECTED ^{226}Ra AND ^{90}Sr IN THE BEAGLE SKELETON. Lloyd, R.D.; Mays, C.W.; Atherton, D.R. (Utah Univ., Salt Lake City (USA). Radiobiology Div.). Health Phys.; 30: No. 2, 183-189 (Feb 1976).

Beagles given ^{226}Ra or ^{90}Sr and sacrificed at various times after injection have provided an opportunity to determine and compare the distribution for the injected Ra and Sr and naturally occurring Ca. The ^{226}Ra and ^{90}Sr were administered in a single intravenous injection in a citric acid sodium citrate buffer solution of pH approximately equal to 3.5 when the animals were about 1.5 yr old. The analysis indicates that the gross skeletal distribution of radium and strontium is not greatly different. In addition, the gross skeletal distribution of these two alkaline earth elements is similar to that of their metabolic analog, calcium. For dogs injected as young adults, cortical bone takes up ^{90}Sr less avidly than does trabecular bone. Since cortical bone turns over more slowly, this marked difference in labelling is not seen at times long after injection. There is a difference in the relative distribution of retained activity among the bones of animals injected with 10 μCi of $^{226}\text{Ra/kg}$ and those given less. After about 1 month, these differences are substantial and are attributable to radiation damage to the bone remodeling processes in the high-level dogs.

- 1738 (GA-A--13617(Vol.7)) HTGR ACCIDENT INITIATION AND PROGRESSION ANALYSIS STATUS REPORT. VOLUME VII. OCCUPATIONAL RADIATION EXPOSURES FROM GAS-BORNE AND PLATEOUT ACTIVITIES. (General Atomic Co., San Diego, Calif. (USA)). 30 Jan 1976. Contract E(04-3)-167. vp. Dep. NTIS \$4.50.

As a part of the Accident Initiation and Progression Analysis (AIPA) program, calculations were performed of the occupational dose rates and man-rem exposures from gas-borne and plateout activities in a reference 3000-MW(t) HTGR plant. The study included a preliminary survey to determine the most important contributors by operation or radiation source to the man-rem exposures. This survey was followed by detailed calculations for the most important cases. Median and 95 percent-confidence-level man-rem exposures per year were obtained for the gaseous activity in the containment building, moisture monitor system, analytic instrumentation, helium

regeneration system, gas waste system, and reflector-block shipping. Median and 95 percent-confidence-level man-rem exposures per operation were obtained for the main-circulator removal, steam-generator tube plugging, and steam-generator removal and replacement. For each of these cases, the contributions to the man-rem exposures were calculated for the important isotopes.

- 1739 SYSTEM FOR PROTECTION FROM LASER RADIATION. Poulsen, P.D. (to General Dynamics Corp.). US Patent Application 527,669. 13 Jan 1976. Filed date 27 Nov 1974. 8p.

A protective window for use with high-energy infrared radiation sources, such as lasers, is described, together with a method for manufacturing the window. For visual applications, the window basically includes a sheet of light transmitting material such as glass or quartz, which has a partially-reflecting surface coating, such as gold, which primarily reflects infrared radiation while transmitting visible light. The reflectivity of the coating may be improved by an infrared laser scanning technique. Finally, one or both surfaces of the window are coated with a visible-light transmitting synthetic resin which, if rapidly heated to a suitable temperature, vaporizes without leaving any residue. This vaporization carries away any contamination, such as dirt or dust, on the resin coating, leaving a very clean reflection surface. In order to further protect the window, channels may be formed within the window through which a cooling fluid may be circulated to carry away any heat absorbed by the window when subjected to infrared irradiation. This window has a variety of uses, such as the protection of laboratory or factory workers using high-energy infrared radiation sources, defenses against laser weapons, in intermittent laser signaling devices, etc. 10 claims, 2 drawing figures.

- 1740 MORTAR-BASE SHIELD FOR USE IN RADIOLOGY. Flaughnatti, R.B. German (FRG) Patent 2,430,895/A/. 8 Jan 1976. 15p. (In German). 4 figs..

A shield is described which is placed on the skin of a patient to protect it from radiation injuries. In a very flat container (of polyamide, elastomer, or tissue) which has an opening in the center to allow the penetration of the radiation, there is a thermosetting resin (epoxy, polyester, or phenol resin) which is mixed with radiation-absorbing materials (BaSO_4 , Sb_2O_3 , SiO_2 , PbO_2) as well as, if necessary, a wetting agent, which can be released before use. The form of the container is described in detail.

- 1741 EXPERIMENTAL REORGANIZATION OF THE CEREBELLAR CORTEX. VII. EFFECTS OF LATE X-IRRADIATION SCHEDULES THAT INTERFERE WITH CELL ACQUISITION AFTER STELLATE CELLS ARE FORMED. Altman, J. (Purdue Univ., Lafayette, IN). J. Comp. Neurol.; 165: No. 1, 65-75(1 Jan 1976).

In Long-Evans rats the area of the cerebellum was irradiated with multiple doses of low-level x ray beginning on day 12 after the bulk of stellate cells were acquired. The treatment spared basket, stellate and early-forming granule cells but led to a substantial reduction in the total granule cell population and a correlated miniaturization of the cerebellar cortex. Nevertheless most Purkinje cells had normally shaped planar dendritic arbors, with an upward directed stem dendrite,

several smooth branches and a multitude of spiny branchlets. The frequent piling up of spiny branchlets near the surface was attributed to the truncation of the bed of parallel fibers by this radiation schedule. In this last paper of the series the accumulated results are summarized and evaluated. The hypothesis is offered that while the growth of the Purkinje cell perikaryon is an autonomous process, the oriented perpendicular growth of a single stem dendrite depends on the presence of basket cell axons, the outgrowth of smooth branches on the presence of stellate cell axons, and the proliferation of spiny branchlets on interaction with parallel fibers. The parallel fibers are responsible for the orthogonal, planar growth of the dendritic arbor and a hypothesis is offered about the mechanisms involved. (auth)

- 1742 EXPERIMENTAL REORGANIZATION OF THE CEREBELLAR CORTEX. VI. EFFECTS OF X-IRRADIATION SCHEDULES THAT ALLOW OR PREVENT CELL ACQUISITION AFTER BASKET CELLS ARE FORMED. Altman, J. (Purdue Univ., Lafayette, IN). J. Comp. Neurol.; 165: No. 1, 49-63(1 Jan 1976).

In Long-Evans rats the area of the cerebellum was X-irradiated with two schedules beginning on day 8 by which time the bulk of basket cells were formed. The shorter schedule of four successive daily doses of 200 R between 8 to 11 days was designed to allow some cell recovery; the longer schedule between 8 to 15 days was expected to prevent. Neither of the schedules interfered with the differentiation of basket cells. Purkinje cells remained aligned in a monocellular layer and formed singularly long, upright stem dendrites which were surrounded by the descending collaterals of basket cell axons. This supported the hypothesis that the directed growth of Purkinje cell stem dendrite is promoted by morphogenic interaction with basket cells. The upright stem dendrites had few or no smooth branches where cell recovery was prevented or had few such branches where recovery occurred. It was postulated that the outgrowth of smooth branches is dependent on interaction with stellate cells which form after the acquisition of basket cells. The absence or scarcity of smooth branches did not prevent the formation of spiny branchlets which grew downward to establish synaptic contacts with the spared parallel fibers of granule cells formed before the start of irradiation. In the group with some granule cell recovery, spiny branchlets grew to a limited extent upward into the pile of parallel fibers formed after the irradiation. (auth)

- 1743 EXPERIMENTAL REORGANIZATION OF THE CEREBELLAR CORTEX. V. EFFECTS OF EARLY X-IRRADIATION SCHEDULES THAT ALLOW OR PREVENT THE ACQUISITION OF BASKET CELLS. Altman, J. (Purdue Univ., Lafayette, IN). J. Comp. Neurol.; 165: No. 1, 31-47(1 Jan 1976).

In neonate and infant rats the area of the cerebellum was irradiated with different schedules of single or multiple doses of low-level X-ray. One set of schedules allowed the early recovery of the external germinal layer and the differentiation of all the postnatally-forming cell types while the other selectively prevented the acquisition of basket cells. The first schedule did not interfere with the development of normally oriented and arborizing Purkinje cells. The second schedule led to the growth of twisted and entwined stem dendrites even when, in association with the recovered granule cells, parallel fibers were present in the molecular layer together with Purkinje cell

spiny branchlets. Evidence was presented that the alignment of Purkinje cell perikarya in a monolayer does not guarantee the normal growth of Purkinje cell stem dendrites which may be dependent on the presence of basket cells. The problem was discussed whether cell differentiation in the cerebellar cortex is governed by a chronological or sequential principle. (auth)

the effects of energy sources on the environment and public health. Effects of chemical and radioactive effluents, air pollution, water pollution, and toxic materials on aquatic and terrestrial ecosystems; biological effects of radiation, with emphasis on internal irradiation; and the biological effects of ingested or inhaled toxic materials are covered.

- 1744 (EPA--520/1-76-001) POTENTIAL RADIOLOGICAL IMPACT OF AIRBORNE RELEASES AND DIRECT GAMMA RADIATION TO INDIVIDUALS LIVING NEAR INACTIVE URANIUM MILL TAILINGS PILES. Swift, J.J.; Hardin, J.M.; Calley, H.W. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). Jan 1976. 44p. Environmental Protection Agency, Washington, DC.

As part of a program to determine which measures to use to control radioactivity from tailings piles at inactive uranium mills, the U. S. Environmental Protection Agency has prepared estimates of the potential for exposure to radioactivity presented by those piles. The γ radiation field and the radon-222 release rate are estimated on the basis of the radium-226 concentration in each pile. Potential exposures to airborne particulate uranium, thorium-230 and radium-226 are estimated from field measurements. Dispersion of airborne material was calculated with adaptations of computer codes which use common models for annual-average and single-plume dispersion. (auth)

- 1745 (AECL--5388) REDUCING RADIATION EXPOSURE IN CANDU POWER PLANTS. Legg, G.G. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1976. 8p. Atomic Energy of Canada Ltd., Chalk River, Ontario.

The overall objective of the program was to reduce the exposure to a level that would permit the station regular staff to handle all station operational and maintenance work without reinforcement by additional staff. The objective therefore was primarily economic. Procedures adopted at the design state for the Bruce Generating Station are outlined. As a result of improvements designed into Bruce, the total station dose was reduced by 60%. The programs have been effective also in promoting work in other areas of research and development. Examples of this are the development of remotely-controlled inspection equipment, explosive plugging of boiler tubes, research into decontamination methods and studies on the movement of radioactive deposits in process systems.

- 1746 SOME ASPECTS OF THE CASE FOR NUCLEAR POWER. Baxter, J.P. Proc. R. Aust. Chem. Inst.; 43: No. 1, 16-21 (Jan 1976).

A case for the development of nuclear power is presented. It is argued that risks arising from the processing of uranium, reactor accidents, fission products, plutonium, and the terrorist use of nuclear materials are acceptable and that alternative energy sources are not viable.

- 747 (PB--265127(Pt.2)) INVENTORY OF ENERGY RESEARCH AND DEVELOPMENT: 1973--1975. VOLUME III. SERIAL U. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-ENG-26. vp. (NSF/RA--760495(Pt.2)). NTIS, PC E99.

Brief summaries are presented of USA research studies during 1973 through 1975 on

- 1748 (WaBoLu--32/76) RADIOACTIVE SUBSTANCES IN WASTE WATERS DUE TO THE USE OF RADIONUCLIDES. REPORT ON A STATISTIC FROM BERLIN (WEST). Aurand, K.; Gans, I.; Ruehle, H.; Wolter, R. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). Jan 1976. 19p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

It has been found that the relative amounts of radionuclides and also, approximatively, the activities of the waste water may be determined by asking the user of unsealed radioactive substances to supply written information. At the moment, the most important radionuclide from the point of view of radiation protection is ^{131}I . The activities of this isotope in waste waters may be a finite contribution to the hypothetical radiation exposure of the population (thyroid dose). For an assessment of the actual radiation exposure, however, further measurements of the ^{131}I concentration in the effluents from sewage treatment plants or in the drainage ditches themselves would be required.

- 1749 (BNWL--2000(Pt.1), pp 165) RADIATION-INDUCED CELL DAMAGE. Felix, W.D.; Schneiderman, M.H. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

The addition of irradiated crystals of galactose to Chinese hamster ovary cells resulted in mitotic delay, whereas exposure to nonirradiated crystals resulted in no detectable delay. The inference from this preliminary data is that free radicals or other transient irradiation products have reacted with external cellular components.

- 1750 (IAEA-R--1160-F) DIFFERENT RADIOSENSITIZATION EFFECTS OF THE HALOGENATED COMPOUNDS ON THE HUMAN CHROMOSOME IN VITRO. Kang, Y.S. (International Atomic Energy Agency, Vienna (Austria)). Jan 1976. 75p. NTIS (US Sales Only).

Unscheduled DNA synthesis and chromosome aberrations were compared following x- or uv-irradiation or methyl methanesulfonate treatment in cultures of HeLa S_3 or KB cells or human and rabbit lymphocytes. The sensitization by incorporation of the halouridines BUDR and IUdR was also investigated. Unscheduled DNA synthesis occurred in two established cell lines after irradiation with 0 to 10 kR of X-rays. The rate of unscheduled synthesis was dose dependent and differed for the two cell lines. The unscheduled synthesis was not correlated with the modal chromosome number nor with the number of aberrations produced. UV-irradiated rabbit lymphocytes exhibited unscheduled DNA synthesis which saturated after a dose of 250 ergs/mm². In contrast the incorporation of BUDR or IUdR eliminated this saturation and caused an increasing effect with increasing dose up to 1000 ergs/mm². The degree of sensitization varied between the two halouridines, BUDR being more effective at high doses while IUdR was a more potent sensitizer at low doses. Chromosome aberrations were not

directly related to unscheduled DNA synthesis but were sensitized by halo-uridine incorporation. In this case IUdR was more potent than BUdR at all doses studied. Methyl methanesulfonate was an effective producer of chromosome aberration in human lymphocytes of both the chromosome and chromatid type. Prior incorporation of BUdR or IUdR did not increase the total aberration produced but did increase the number of chromosome type aberration at the expense of the chromatid type.

- 1751 THE EFFECTS OF LOW-DOSE γ IRRADIATION ON THE WHOLESOMENESS OF MANGOES (MANGIFERA INDICA) AS DETERMINED BY SHORT-TERM FEEDING STUDIES USING RATS. Horton, G.M.J. (Pretoria Univ. (South Africa). Faculty of Veterinary Science). Br. J. Nutr.; 35: No. 1, 67-75 (Jan 1976).

A control diet and diets containing 150 g non-irradiated or 150 g irradiated mango-pulp/kg were given to female rats from day 15 of the gestation period until weaning in two trials and from 40 d before mating until 28 d post weaning in a third trial. Food intake and dry-matter digestibility were similar with all diets. There were no significant differences between animals given the different dietary regimens in the daily body-weight changes of weanling males, pups, nursing females or females during the immediate postlactation period. No difference in haematological or blood chemistry values were found which could be attributed to the ingestion of irradiated mangoes. There was no evidence for the presence of any toxic substances in the irradiated-mango-pulp diet. Gross pathological observations revealed no aberrations which could be related to the ingestion of irradiated mangoes. It may be concluded that the wholesomeness of mangoes was not affected by γ -irradiation at a dose of 75 krad.

- 1752 DOMINANT LETHAL MUTATIONS IN RATS FED ON IRRADIATED WHEAT. Vijayalaxmi; Rao, K.V. (Indian Council of Medical Research, Jamai-Osmania (India). National Inst. of Nutrition). Int. J. Radiat. Biol.; 29: No. 1, 93-98 (Jan 1976).

Letter to the editor.

GENETIC RADIATION EFFECTS;DIET;EMBRYOS;GAMMA RADIATION;GERM CELLS;HEALTH HAZARDS;LETHAL MUTATIONS;MALES;MUTAGENESIS;NUTRITIONAL DEFICIENCY;PROTEINS;QUANTITY RATIO;RATS; RESPONSE MODIFYING FACTORS;WHEAT; RADIOPRESERVATION

- 1753 LETTER: INTRAORAL X-RAY EXAMINATION EXPOSURES. Paul, I.R. N.Y. J. Dent.; 46: No. 1, 14-15 (Jan 1976).

A pilot study in two states led to the establishment of the Dental Exposure Normalization Technique (DENT) program. This, in brief, is an exposure reduction and quality assurance program for radiological health agencies. The health agency sends X-ray exposure cards to dental X-ray facilities. These are exposed by the dentist and returned for analysis. Facilities which show excessive exposure are then visited to demonstrate the changes in exposure and processing necessary to produce diagnostic quality radiographs with minimum patient exposure.

- 1754 (FDA--76-8035) REGULATIONS FOR THE ADMINISTRATION AND ENFORCEMENT OF THE RADIATION CONTROL FOR HEALTH AND SAFETY ACT OF 1968. (Bureau of Radiological Health, Rockville, Md. (USA)). Jan 1976. 63p. Bureau of Radiological Health, Rockville, MD.

The Radiation Control for Health and Safety

Act was signed by the President on October 18, 1968. The purpose of this Act was to protect the public from unnecessary exposure to radiation from electronic products. Radiation covered in the Act was called electronic product radiation and was defined to mean any ionizing or nonionizing electromagnetic or particulate radiation or any sonic, infrasonic, or ultrasonic wave which is emitted from an electronic product as the result of the operation of an electronic circuit in such product. The provisions of the Act give the Secretary, Department of Health, Education, and Welfare, authority to establish and carry out an electronic product radiation control program which shall include performance standards for electronic products. The regulations contained herein have been promulgated under that authority. The Bureau of Radiological Health is responsible for the day-to-day operation in carrying out the Act's mandate for an electronic product radiation control program. A principal objective of the program is to protect the public health through setting and enforcing electronic product radiation emission performance standards. This compilation is revised periodically, and efforts are made to provide an accurate reproduction of the regulations. This publication contains those regulations published in the FEDERAL REGISTER through December 1975.

- 1755 (INIS-mf--3156) REPORT REORGANISATION RADIATION PROTECTION R.U.L.-A.Z.L.-I.R.S. (Rijksuniversiteit Leiden (Netherlands); Cohen (J.A.) Instituut voor Radiopathologie en Stralenscherming, Leiden (Netherlands)). Jan 1976. 35p. (In Dutch). INIS.

2 appendices.

In this report a radiation-protection organization is proposed for hospitals. The financial, material and personal consequences are indicated. Legal aspects are taken into consideration, and regulations are proposed.

- 1756 (NP--21126) ESTIMATED POPULATION EXPOSURE FROM NUCLEAR POWER PRODUCTION AND OTHER RADIATION SOURCES. Pochin, E.E. (Organization for Economic Co-Operation and Development, 75 - Paris (France)). Jan 1976. 48p. Dep. NTIS (US Sales Only), PC A03/MF A91.

Estimates are given of the total radiation dose from all forms of ionizing radiation resulting from nuclear power production. A power consumption of 1 kW per head of population, derived entirely from nuclear energy, would increase the average radiation exposure of the whole population from 100 mrem per year from natural sources (plus about 40 mrem per year from medical procedures and other artificial causes) by about 6 mrem per year. The genetically significant component of this increase would be about 4 mrem per year. Available estimates of harm from radiation would indicate that this would give a risk per year per million of population of about 1 fatal induced malignancy, about the same number of malignancies fully treatable by operation, and, after many generations, about the same number of inherited defects, of greater or less severity, per year. Accidental injuries, particularly in constructional and mining work, would cause an estimated 1 fatality and 50 other accidents annually. Indications are given of the number of fatalities and accidents involved in equal power production by alternative methods, and of the value and limitations of such numerical comparisons in reaching decisions on the development of future power programs.

1757 (NRPB-R--41) STUDY OF CHROMOSOME ABERRATION YIELD IN HUMAN LYMPHOCYTES AS AN INDICATOR OF RADIATION DOSE. 6. A REVIEW OF CASES INVESTIGATED: 1975. Purrott, R.J.; Lloyd, D.C.; Prosser, J.S.; Dolphin, G.W.; Tipper, P.A.; Reeder, E.J.; White, C.M.; Cooper, S.J.; Stephenson, B.D. (National Radiological Protection Board, Harwell (UK)). Jan 1976. 15p. NTIS (US Sales Only).

Available from H.M. Stationery Office, price Pound0.50.

Results from cytogenetic investigations into 37 cases of suspected over-exposure to radiation during 1975 are reviewed. This report is the fifth in an annual series which together contain data on 206 studies. Results from all 206 investigations have been pooled for general analysis. Brief accounts are given in an appendix of the circumstances behind the past year's 37 investigations and where possible physical estimates of dose have been included for comparison. A short review is given of recently completed experiments to determine the effects of dose rate and dose fractionation on the aberration yield, and the importance of these variables for chromosome dosimetry is discussed. A brief outline is also given of those aspects of the current research programme which are aimed at improving the techniques of cytogenetic dosimetry.

1758 (RD/B/M--3593) THE FIFTH SYMPOSIUM ON MICRODOSIMETRY 22-26TH SEPTEMBER, 1975 VERBANIA PALLANZA, ITALY. Charles, M.W. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jan 1976. 24p. INIS.

The fifth in a series of bi-annual symposia on microdosimetry is reviewed with particular attention to those aspects relevant to radiation protection. Consideration is given primarily to advances in the development of biological models and experimental techniques, which formed a large part of the programme and were of particular personal interest.

1759 ROLE OF NATURAL RADIATIONS IN HUMAN LEUKEMOGENESIS. Jacobson, A.P. (Univ. of Michigan, Ann Arbor); Plato, P.A.; Frigerio, N.A. Am. J. Public Health; 66: No. 1, 31-36 (Jan 1976).

The study attempts to determine to what extent background radiations are responsible for human disease, namely leukemia. Dose rate data were compared with data on all forms of leukemia in the 50 United States for four population subgroups. For the total U.S., no relation between background radiation and leukemia is apparent. A positive correlation appears, however, if various states are deleted from the analysis. It appears that conditions relative to populations and their environment could mask a radiation effect if in fact one is present. (auth)

1760 HOW SAFE IS SAFE ENOUGH. Tattersall, J.D. Nucl. Act.; No. 14, 18-19 (Jan 1976).

Occupational accident risk has been reduced by the nuclear industry to at least two orders of magnitude less than in any other activity.

1761 LACK OF SYNERGISTIC EFFECT BETWEEN X-RAY AND UV IRRADIATION ON THE FREQUENCY OF CHROMOSOME ABERRATIONS IN PHA-STIMULATED HUMAN LYMPHOCYTES IN THE G₁ STAGE. Holmberg, M. (Research Inst. of National Defence, Stockholm (Sweden); Karolinska Hospital, Stockholm (Sweden). Dept. of Clinical Genetics). Mutat. Res.; 34: No. 1, 141-147 (Jan 1976).

PHA-stimulated human lymphocytes in the G₁ stage were irradiated with UV radiation and X-rays, and the cells were analysed for chromosomal aberrations in the first mitotic division. The frequency of dicentric chromosomes after single X radiation in the G₁ stage was about twice the yield in the G₀ stage. No increase in the yield of dicentrics was observed after combined irradiation with UV and X-rays. This is contrary to the finding for G₀ lymphocytes, where a 2-fold increase of chromosome aberrations was observed. UV irradiation of G₁ lymphocytes induced chromatid-type aberrations whereas no significant yield of dicentric chromosomes was observed. This in agreement with previous findings in Chinese hamster cells in the G₁ stage. Irradiation of G₀ lymphocytes with UV radiation induce a low frequency of dicentric chromosomes. Thus, the present data indicate that the ratio between chromosome-type and chromatid-type aberrations is different in the G₁ and G₀ stages in human lymphocytes irradiated with UV radiation.

1762 ACCIDENTAL EXPOSURE OF A MAINTENANCE ENGINEER. Green, N. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 14, 14-15 (Jan 1976).

A maintenance engineer was carrying out routine maintenance on an X-ray fluorescence spectrometer. The electrical interlock systems had been overridden by means of a key to permit access to the equipment. It is estimated that the engineer, who was not wearing a film badge, had received a body dose of about 0.5 rem and a dose to his right hand of 1.2 rem while attempting to free the jammed shutter of the X-ray tube. The supervisor was able to prevent a significant overexposure when he checked progress and noticed that the tube was still energized, although the warning light bulb had failed. It is recommended that interlock keys should be kept by a responsible person, and precise written instructions should be provided for any work requiring interference with interlocks. Maintenance should where possible be carried out with the tube de-energized. Warning lights should either be of the fail-to-safety type, or consist of two bulbs in parallel. Film badges should be worn at all times during work in which exposure to ionizing radiations is possible.

1763 RADIOLOGICAL PROTECTION AND THE FIRE SERVICE. Holliday, B. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 14, 16-17 (Jan 1976).

A basic training is given to fire brigade officers at the Fire Service Technical College, to enable them to recognise the hazards and to cope with those emergencies where radiological protection has to be considered. This training is necessary since radioactive materials are widely used in industry, medicine and science; some equipment, e.g. americium-241 fire detectors, and static eliminators, is specifically designed for use where there is a high potential fire risk. The recommended procedures can generally be applied without significantly interfering with the normal fire-fighting techniques. The fire brigade may also be required to erect a barrier defining a radiation dose rate contour or limit the extent of contamination spread. Although fire brigades already have the names and addresses of all premises containing radioactive sources of any consequence, radiological protection officers, safety officers, etc. have the responsibility of ensuring that the Fire Brigade has up-to-date and prior information concerning the locations and range of hazards from ionizing radiations that could exist within an

establishment, and what protective measures would be required to reduce the risk. This is particularly necessary if the levels of activity warrant the automatic wearing of respiratory protection. Firemen have been instructed to maintain a low profile regarding radiological protection procedures under circumstances where qualified staff are available.

- 1764 ROLE OF THE IEC AND ISO IN RADIOLOGICAL PROTECTION. White, D.F. (National Radiological Protection Board, Harwell (UK)). Radiol. Prot. Bull.; No. 14, 4-9 (Jan 1976).

The history, objectives, structures and functions of the International Electrotechnical Commission (IEC) and the International Organisation for Standardisation (ISO) are summarized. The IEC is affiliated to the ISO as its electrical division, but has technical and financial autonomy. Member countries of the EEC may be committed to the adoption of their formal agreements ('Standards') if these become incorporated as Directives. The national standardisation organisations, such as BSI in the U.K., form national committees and are responsible for submitting to the IEC the co-ordinated national viewpoints on particular subjects. The overall links between the technical committees and sub-committees of the ISO, IEC and BSI in the field of radiological protection are tabulated, and the relevant International Standards produced, or in the course of preparation, by the appropriate committees of the ISO and the IEC are listed. The bulk of the effort of the BSI committees is now aimed at the production of acceptable international standards. Compatible national standards then follow. This policy is in contrast to the earlier initial emphasis on national standards, and the improved international collaboration has had two welcome effects. The selection of proposals for standards is more critical, and compatibility with the relevant ICRP and ICRU publications is almost a prerequisite for any international standard.

- 1765 EXPOSURE AND ROENTGEN-AREA-PRODUCT IN XEROMAMMOGRAPHY AND CONVENTIONAL MAMMOGRAPHY. Baxt, J.H.; Bushong, S.C.; Glaze, S.; Kothari, S. (Baylor Univ., Houston, Tex. (USA)). Coll. of Medicine. Health Phys.; 30: No. 1, 91-94 (Jan 1976).

X-ray mammography is assuming increasing importance in the early detection of breast cancer. The principal disadvantage to conventional mammography is high patient dose. Xeromammography offers three advantages over conventional mammography: (a) lower patient dose, (b) better image quality and (c) no special mammography tube required. A transmission ionization chamber and thermoluminescent dosimeters were used to measure the roentgen-area-product and the exposure for three view examination. Average roentgen-area-product values of 6500 and 4200 R-cm² were observed for conventional mammography and xeromammography respectively. The medial surface of the breast received the highest radiation exposure for both types of examinations and this was shown to be 11.5 and 5.1 R respectively. Omission of the axillary view from the examination reduces the patient dose in both types by approximately 60 %.

- 1766 MODIFIED GEOMETRIC FACTOR APPROACH TO INTERNAL GAMMA RAY DOSIMETRY. Gupta, M.M.; Reddy, A.R.; Gupta, P.C.; Nagaratnam, A. (Institute of Nuclear Medicine and Allied Sciences, Delhi (India)). Dept. of Health

Physics and Instrumentation). Br. J. Radiol.; 49: No. 577, 71-75 (Jan 1976).

In internal gamma-ray dosimetry, the conventional geometric factor approach, where the 'effective absorption coefficient' is taken as 0 or 0.028 cm⁻¹, irrespective of source energy, leads to significant errors especially in the low energy region. An attempt has been made to modify the approach to increase the accuracy of calculation and to extend its usefulness to low energies while retaining its inherent simplicity. The modification consists in replacing the effective absorption coefficient by the attenuation coefficients appropriate to the source energies and taking into account the effects due to multiple scattering by using point source build-up factor. The method has been applied for the particular case of dosimetry of a sphere. Comparison of the results obtained by this method with those got from Monte Carlo computations indicated excellent agreement at higher energies and a departure of around 15 per cent only at lower energies (as against a variation of 400 per cent when conventional geometric factor approach was used).

- 1767 FILM VS TLD: A CHOICE FOR A COUNTRYWIDE PERSONNEL MONITORING PROGRAMME. Madhvanath, U.; Patel, P.H.; Dhond, R.V.; Shenoy, K.S.; Kadam, A.B. (Bhabha Atomic Research Centre, Bombay (India)). Health Phys.; 30: No. 1, 119-124 (Jan 1976).

In the light of recent developments in the design and sophistication of TL and RPL dosimetry systems for personnel monitoring, the place of photographic film method is analysed. In controlled areas where a health physicist or a radiological safety officer evaluates the personnel exposures, TL and RPL dosimeters provide the best choice on the basis of their better precision of dose measurements. However, in uncontrolled areas such as medical radiology departments and industrial radiography installations, the information content of a photographic film which helps in almost all cases of high exposures to decide the genuineness of exposure, outweighs the dosimetric characteristics, and the film method appears to be the best choice. It is recommended that developing countries starting a personnel monitoring programme in a centralized place, should use photographic film badges to bring back information regarding the working habits in addition to dose estimates of the individuals concerned. Analysis of 62 cases of fortnightly exposures in excess of 5 rem encountered during 1973 in a personnel monitoring service using photographic films, revealed that 54 cases were non-genuine exposures.

- 1768 DISTRIBUTION OF ABSORBED DOSE-RATES IN HUMANS FROM EXPOSURE TO ENVIRONMENTAL GAMMA RAYS. O'Brien, K.; Sanna, R. (USAEC Health and Safety Lab., New York). Health Phys.; 30: No. 1, 71-78 (Jan 1976).

The propagation of environmental γ rays through the human body was calculated using the 3-dimensional Monte-Carlo code DISDOS. These calculations were performed with the aim of determining the gonadal dose with a statistical accuracy of 10 % or less for each of the energies considered. The ratio of exposure to absorbed dose in the human body averages about 0.6. A mean annual gonadal dose produced by environmental γ rays in the U.S. was calculated to be 32 $\pm$ 4 % mrad/yr. The mean annual dose to the red marrow was calculated to be 29 $\pm$ 0.1 % mrad/yr (the errors cited being purely statistical).

1769 MULTIPLE SIMULTANEOUS EVENT MODEL FOR RADIATION CARCINOGENESIS. Baum, J.W. (Brookhaven National Lab., Upton, N.Y. (USA)). Health Phys.; 30: No. 1, 85-90 (Jan 1976).

A mathematical model is proposed which postulates that cancer induction is a multi-event process, that these events occur naturally, usually one at a time in any cell, and that radiation frequently causes two of these events to occur simultaneously. Microdosimetric considerations dictate that for high LET radiations the simultaneous events are associated with a single particle or track. The model predicts: (a) linear dose-effect relations for early times after irradiation with small doses, (b) approximate power functions of dose (i.e. $D^{sup}(x)$) having exponent less than one for populations of mixed age examined at short times after irradiation with small doses, (c) saturation of effect at either long times after irradiation with small doses or for all times after irradiation with large doses, and (d) a net increase in incidence which is dependent on age of observation but independent of age at irradiation. Data of Vogel, for neutron induced mammary tumors in rats, are used to illustrate the validity of the formulation. This model provides a quantitative framework to explain several unexpected results obtained by Vogel. It also provides a logical framework to explain the dose-effect relations observed in the Japanese survivors of the atomic bombs.

1770 SIMPLIFIED RBE-DOSE CALCULATIONS FOR MIXED RADIATION FIELDS. Katz, R.; Fullerton, B.G. Jr.; Roth, R.A.; Sharma, S.C. (Nebraska Univ., Lincoln (USA)). Health Phys.; 30: No. 1, 148-150 (Jan 1976).

Brief note.

ALGORITHMS;ANIMAL CELLS;BIOLOGICAL RADIATION EFFECTS;LET;NEUTRON BEAMS;OXYGEN ENHANCEMENT RATIO;PION BEAMS;RADIATION DOSES;RBE

1771 RADIATION DOSES FROM IODINE-129 IN THE ENVIRONMENT. Soldat, J.K. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Health Phys.; 30: No. 1, 61-70 (Jan 1976).

Recently, renewed attention has been drawn to ^{129}I , a radionuclide which, because of its long half-life (1.6×10^7 yr), has a potential for long-term accumulation in the environment from low level chronic releases at nuclear facilities. The transfer of ^{129}I through the biosphere and the resultant radiation doses to man are discussed. Metabolic parameters are tabulated for four ages; 1, 4, 14 and adult. These parameters include fractional uptake via inhalation and ingestion, breathing rate, mass, radius and iodine content of the thyroid, and the energy absorbed per disintegration of ^{129}I vs thyroid size. Factors are presented for calculation of doses from intake or concentration of ^{129}I in the thyroid. Factors are also derived for estimating thyroid doses from ^{129}I air concentration via the inhalation, leafy vegetable, milk or meat pathways. Analysis of the atom ratios of ^{129}I : ^{127}I in the thyroid required to yield a dose rate of 1500 mrem/yr reveals that on this basis the adult thyroid reaches the limiting dose rate at a ratio of 1:48 ($3.6 \mu\text{Ci } ^{129}\text{I/g}$ iodine). However, a higher ratio of 1:11 ($15 \mu\text{Ci/g I}$) is required for the infant thyroid to receive the same dose rate. The reason for this difference is the higher stable iodine concentration in the adult thyroid (350 ppm) than in the infant thyroid (90 ppm). In all instances, however, a dose rate of 1500 mrem/yr would result from a concentration of $1.3 \times 10^{-3} \mu\text{Ci } ^{129}\text{I/g}$ of thyroid.

1772 HESSE: ENFORCEMENT OF THE X-RAY ORDINANCE AND THE 1ST RADIATION PROTECTION ORDINANCE IN THE FIELDS OF MEDICINE, DENTISTRY, AND VETERINARY MEDICINE. Arbeitsschutz (Cologne); No. 1, 22 (Jan 1976). (In German).
Short communication only.
GERMAN FEDERAL REPUBLIC;RADIATION PROTECTION; RADIOLOGY;REGULATIONS;X RADIATION

1773 A PATH TO SPATIAL IRRADIATION PLANNING. 3. FURTHER INFORMATION UPON THE METHOD TO OBTAIN DOSE HOMOGENEITY BY USE OF RAY BEAMS WITHIN DIFFERENT PLANES OF INCIDENCE; EXPERIMENTAL VERIFICATION OF THE METHOD. Sonntag, A. (Ulm Univ. (F.R. Germany). Dept. Radiologie). Strahlentherapie; 151: No. 1, 10-24 (Jan 1976). (In German).

8 figs.; 2 tabs..

The method is based on the following principle: single, initially unsettled parameters of irradiation are determined by explicit calculation in such a way that the dose gradient resulting from the dose gradients of the single ray beams in the point of intersection of their axes becomes zero. The separation or addition of components of the gradients is performed by use of co-ordinates for the ray beam as well as for the body. The following parameters can be determined explicitly: first, the weights of the partial doses which are to form the total dose in the point of intersection and/or second, the angles of the wedges and/or third, the rotational angles of the wedge filters, i.e. the angles of rotation of the wedge filters about an axis corresponding to the central ray. In the course of the following experimental verification of the method, maximally possible dose homogeneity results within the area of the crossing ray beams. Moreover, the advantages of field arrangements with different planes of incidence are coming into view.

1774 A PATH TO SPATIAL IRRADIATION PLANNING. 4. EXAMPLES FROM THE PRACTICE OF RADIATION THERAPY AND CONCLUSIONS. Sonntag, A. (Ulm Univ. (F.R. Germany). Dept. Radiologie). Strahlentherapie; 151: No. 1, 26-46 (Jan 1976). (In German).

19 figs.; 122 refs..

The method described in detail in part III of this paper aims at an optimization of dose distributions with regard to homogeneity within the common area of intersection of the ray beams concerned; now, practical planning is achieved with good results. Common clinical examples are treated, but of such a kind that dose homogeneity is not to be obtained without difficulty, either because of the chosen arrangement of fields within different planes of incidence or on other grounds. Finally, the advantages, practical, possibilities and limits of the method indicated are thoroughly discussed.

1775 DODGING BOARD FOR GASTROINTESTINAL SERIES AIMED AT REDUCING THE EXPOSURE DOSE OF PATIENTS. Hamasato, K. (Hamasato Radiology Hospital, Nagasaki (Japan)). Rinsho Hoshasen; 21: No. 1, 61-67 (Jan 1976). (In Japanese).

A dodging board was produced to reduce the exposure dose of patients. The shadow of this board did not interfere with diagnosing in more than 2,500 patients. The exposure dose of patients was reduced to 82% at the time of roentgenography. By exposing the sheltered area appropriately, the area of observation could be extended. It is concluded therefore that this dodging board is very useful in

gastrointestinal series which is performed frequently and which requires large exposure doses.

- 1776 PRESENT CONDITION AND PROBLEMS OF TOLERANCE DOSE AND EXPOSURE LEVEL. Kato, Y. (National Inst. of Radiological Sciences, Chiba (Japan)). Niigata Igakkai Zasshi; 90: No. 1, 1-4 (Jan 1976). (In Japanese).

Recommendations of the ICRP were quoted in relation to the changes in the concept of tolerance dose. The maximum permissible dose and the maximum permissible accumulation dose in Japan were described. The estimation of levels of risk in individuals and in groups was described. The present condition of the exposure levels of the Japanese by various radiation sources was reported.

- 1777 EXPOSURE DUE TO RADIODIAGNOSIS AND ITS CONTROL. Kurokawa, S. (Niigata Univ. (Japan). School of Medicine). Niigata Igakkai Zasshi; 90: No. 1, 4-7 (Jan 1976). (In Japanese).

The following characteristics of medical exposure in radiodiagnosis were mentioned: exposure of great mass, difficulty in discussing the causal relationship between exposure at individual level and the injury which has occurred, the absence of threshold values for the dose-effect relationships of carcinogenesis and hereditary injury. The necessity of and measures for the reduction of medical exposure were described. The annual frequency of x-ray examinations and the present conditions of upper gastrointestinal series in Japan were described.

- 1778 ESTIMATION OF POPULATION DOSES FROM DIAGNOSTIC MEDICAL EXAMINATIONS IN JAPAN, 1974. I. THE NUMBER OF RADIOGRAPHS, RADIOGRAPHIC AND FLUOROSCOPIC EXAMINATIONS. Hashizume, T.; Maruyama, T.; Kumamoto, Y. (National Inst. of Radiological Sciences, Chiba (Japan)). Nippon Igaku Hoshasen Gakkai Zasshi; 36: No. 1, 47-55 (Jan 1976). (In Japanese).

The number of examinations and radiographs per year have been estimated based on a 1974 nation wide survey of randomly sampled hospitals and clinics. The number of radiographs per year was 117.3 million for males and 86.57 million for females, a total of 203.9 million. Fluoroscopic examinations amounted to 8.075 million for males and 6.37 million for females, a total of 14.45 million. The number of x-ray examinations was 39.54 million for males and 33.42 million for females, a total of 72.96 million. The ratio of the number of radiographs of 1974 to that of 1969 was about 1.13. The number of radiographs per x-ray examination was about 7 for gastrointestinal examination and about 2.8 for other examinations.

- 1779 HISTORICAL SURVEY OF RADIOBIOLOGY AND RADIOTHERAPY WITH FAST NEUTRONS. Field, S.B. (Hammersmith Hospital, London (UK). M.R.C. Cyclotron Unit). Curr. Top. Radiat. Res.; 11: No. 1, 1-86 (Jan 1976).

216 refs..

A survey is given of attempts to use fast neutrons as a radiotherapeutic agent. Experiments performed on the skin of man, pig, mouse and rat have shown that the RBE of fast neutrons increases as the dose per fraction decreases, but the relationship between RBE and dose per fraction is the same for all species. There are indications that there might be a wide variation in RBE from tumour to tumour. There is no evidence indicating any special dangers from neutron irradiation, and their

likely advantage is that they may provide a more reliable method of radiotherapy as well as sterilizing some tumours which are normally resistant to X-rays.

- 1780 GENERAL ASPECTS OF PERSONAL MONITORING. Julius, H.W. Rayonnem. Ionis. Tech. Mes. Prot.; No. 1, 5-10 (Jan 1976). (In French). From 3. European congress of the International Radiation Protection Association. Criteria for radiation protection; Amsterdam, Netherlands (13 May 1975).

The public discussions upon the radiation dose limits lead to a review of the basic requirements and the possible evolution of personal monitoring.

- 1781 GONADAL SHIELDING AND COLLIMATION INFORMATION FOR PELVIC RADIOGRAPHY IN PODIATRIC PRACTICE. Kalin, A.G. J. Am. Podiatry Assoc.; 66: No. 1, 1-14 (Jan 1976).

Pelvic x-rays are often necessary in podiatric practice, to aid in the diagnosis of podiatric and foot-related disorders. The disorders which warrant such x-rays are reviewed. The author urges caution in the administration of pelvic x-rays, citing the possible genetic effects of gonadal exposure to x-rays. Various methods of dose reduction are discussed, with special emphasis on collimators to confine radiation to the smallest body area and gonadal shields to protect the gonads when they fall within the direct x-ray beam.

- 1782 RADIATION HAZARDS: A GUIDE TO GOOD PRACTICE. Cent. Afr. J. Med.; 22: No. 1, 15-17 (Jan 1976).

In Rhodesia due to long distances, therefore limited radiological services, there has been an unavoidable necessity to set up small X-ray units all over the country. This has inevitably led to them being used by people either completely untrained or with less knowledge of the hazards of radiation than is available in the larger centres. This, the first of two articles, will, it is hoped, be a means of pointing out to all people who may use X-ray equipment the hazards of radiation, meanwhile suggesting practical methods by which better results can be obtained to benefit both the practitioner and the patient.

- 1783 WOMEN AND X-RAYS. Dunkley, P.A.; Stewart, J.H. N.Z. Nurs. J.; 69: No. 1, 18p. (Jan 1976).

When a woman comes to an X-Ray Department it is usually necessary to know the present stage of her menstrual cycle. X-Rays may have an adverse effect on the embryo, especially in early pregnancy. However, exposure to X-Rays at any stage may be associated with a slightly increased incidence of malignant disease in childhood. The International Commission on Radiological Protection recommends that in women of child-bearing age (in some cases as young as 11 years), non-urgent diagnostic radiography be confined to the preovulatory phase of the menstrual cycle: that is, 14 days following the first day of the last menstrual period.

- 1784 ANALYSIS OF COMBINED EFFECTS OF BENZENE WITH RADIATION ON CHROMOSOMES IN CULTURED HUMAN LEUKOCYTES. Morimoto, K. (Tokyo Univ.). Sangyo Igaku; 18: No. 1, 23-24 (Jan 1976).

Three experiments were carried out on 53-hr cultured human leukocytes on chromosome mutagenicity of benzene with particular reference to combined effects with gamma-

radiation and inhibitory effect on rejoining of radiation-induced chromosome breaks. The results and their analyses were summarized as follows: (1) Benzene can induce mainly chromatid-type deletions, especially gaps, suggesting that the cells in their late S-G2 stage have a higher susceptibility to chromosome breakage by benzene. (2) The aberration yield of dicentric and rings induced by 100 rads irradiation can significantly be enhanced by the treatment of benzene equal to or in excess of 0.2 mM. (3) Quantitative analyses using newly defined "Synergistic effect factor" revealed that combined cytogenetic effect of benzene with radiation could be synergistic exclusively in dicentric and rings, being almost additive in the other types of aberration. (4) The experiment with dosage fractionation method showed that the more strongly benzene could inhibit the rejoining of radiation-induced chromosome breaks, the higher concentration it was treated at. Related with these results, possible inducible, and the repair and its inhibition of radiation-induced DNA-strand(s) breaks. Further studies for related effects by benzene are needed on protein synthesis, activities of repair enzymes and fine structure of chromosomes.

- 1785 CHROMOSOME REARRANGEMENTS FROM SPERMATOGONIAL CHRONIC NEUTRON IRRADIATION IN MICE. Bajrakova, A.; Khadzhieva, T.; Vasilev, G. (Inst. of Radiobiology and Radiation Hygiene, Sofia (Bulgaria)). *Mutat. Res.*; 34: No. 1, 159-162 (Jan 1976).

Adult male mice were given a range of neutron doses at 80 $\pm$ 20 mrad/h from a plutonium-beryllium source. Cytogenetic analysis indicated that chronic spermatogonial exposure to a mean total dose of 10, 30, 52, 98 or 150 rad produced translocations, sampled in spermatocytes four months later, amounting to 0.32, 0.99, 1.69, 1.91 and 1.65%, respectively. The dose response for the 0-52 rad range was linear. For higher doses, a better fit to the data was an expression with dose exponent above unity.

- 1786 RBE OF DIFFERENT ENERGY NEUTRONS AS MEASURED BY THE HAEMATOPOIETIC SPLEEN-COLONY TECHNIQUE. Carsten, A.L.; Bond, V.P.; Thompson, K. (Brookhaven National Lab., Upton, N.Y. (USA)). *Int. J. Radiat. Biol.*; 29: No. 1, 65-70 (Jan 1976).

The spleen colony technique has been used for determining the relative biological effectiveness (RBE) for several energies of neutron radiation. Donor mice were exposed to fission and accelerator-generated neutrons at a variety of doses and energies. Immediately after exposure, donor bone-marrow was removed from the hind legs, and standard amounts were injected intravenously into lethally X-irradiated recipients. After 7 days the recipients spleens were evaluated for surface colonies. Dose-response curves were obtained for each type of radiation and the D_0 was determined. The neutron RBE values from the D_0 compared with 250 kVp X-rays were: reactor 1.58, ^{252}Cf 1.59, and accelerator varied from 2.85 at 1.0 MeV to 0.85 at 13.4 MeV.

- 1787 DOSE FRACTIONATION AND REDUCTION OF DAMAGE TO NORMAL TISSUES. Kawamura, F.; Takegawa, Y.; Kawano, S.; Fujiwara, K.; Amou, K. (Tokushima Univ. (Japan). School of Medicine). *Gan No Rinsho*; 22: No. 2, 107-110 (Jan 1976). (In Japanese).

Results of the treatment for primary lung cancer with smaller daily dose of 100 rad were

analysed. The survival rate and median survival time of the cases irradiated with daily doses of 100 rad were more improved than those cases irradiated with daily doses of 200 rad. The effects of two fractionated irradiations with a short interval of 3 to 4 hours, on lethality or weight loss of the mice, were equal to those of irradiation with an interval of one day or with continuous irradiation.

- 1788 SOME RESULTS OF A THEORETICAL ANALYSIS OF A RADIATION INJURY TO THE ORGANISM. Akoev, I.G. (AN SSSR, Pushchino-na-Oke. Inst. Biologicheskoy Fiziki). *Izv. Akad. Nauk SSSR, Ser. Biol.*; No. 1, 41-52 (Jan 1976). (In Russian).

The paper presents a review of some results of a theoretical analysis on radiation injuries to the body, the results being of importance for solving practical problems of radiobiology and nuclear medicine. The necessity is emphasized of a simultaneous consideration of processes, occurring at different levels of the body integration, and the importance of proper biological premises for theoretical modelling as well. The radiation model allows to reveal certain general biological regulations in the formation of pathological and recovery processes in the body.

- 1789 EFFECT OF CHRONIC LOW DOSES OF IONIZING RADIATION ON THE EXCRETION OF GASEOUS METABOLITES IN WHITE RATS. Tiunov, L.A.; Kolosova, T.S.; Lazurenko, D.T.; Apukhtina, R.S. *Kosm. Biol. Aviakosmicheskaya Med.*; 10: No. 1, 61-66 (Jan 1976). (In Russian).

For English translation see the journal *Environ. Space Sci.*

A three-month long bioassay with white rats, placed in hermetic chambers, consisted in studies on the effect of chronic gamma radiation (100 mR/day) on the excretion of certain biological products by the animals: ammonia, acetone, carbon oxide, phenol and a sum of organic substances determined from their oxidizability. The results of studies have shown that a chronic low dose gamma radiation causes a decrease in the acetone- and organic substances sum excretion. At the same time an enhanced excretion of carbon oxide, phenol and ammonia is exhibited. A possible mechanism of the phenomena observed is discussed.

- 1790 (DP--1412, pp 39.1-41.2) DOSE-TO-MAN STUDIES. Jan 1976.

Savannah River Laboratory environmental transport and effects research. Annual report, 1975.

Dose-to-Man Studies focused on developing computer data handling and computer modules which permit easy, rapid assessment of the dose to southeastern United States populations from routine or accidental releases of radionuclides to atmospheric and stream systems. (auth)

- 1791 IMPORTANCE OF INITIAL MANAGEMENT OF PERSONS INTERNALLY CONTAMINATED WITH RADIONUCLIDES. Lincoln, T.A. (Oak Ridge National Lab., TN). *Am. Ind. Hyg. Assoc. J.*; 37: No. 1, 16-21 (Jan 1976).

The prompt use of blocking agents, isotopic dilution or chelating agents can reduce or prevent the uptake of radionuclides following internal contamination. A table of radionuclide contaminants and medications useful in preventing their uptake is provided.

- 1792 STANDARD FIELD METHODS FOR DETERMINING ^{137}CS AND ^{131}I IN VIVO. Palmer, H.E.

(Battelle Pacific Northwest Labs., Richland, Wash. (USA)); Branson, B.M.; Cohn, S.H.; Dean, P.N.; Eckart, J.A.; Lloyd, R.D.; Miller, C.E. Health Phys.; 30: No. 1, 113-118 (Jan 1976).

Methods have been developed for measuring the body content of ^{137}Cs and the thyroid content of ^{131}I using rather simple, compact equipment. Procedures for calibrating the equipment were designed to provide reproducible results with a variety of counting equipment and environmental conditions. The methods and calibrations were tested by interlaboratory comparison among seven laboratories throughout the U.S. These methods should find application for measuring ^{137}Cs and ^{131}I in those people who do not have access to an established whole-body counting facility.

- 1793 CALCULATED BETA-RAY DOSE FACTORS FOR TRABECULAR BONE. Whitwell, J.R.; Spiers, F.W. (Cookridge Hospital, Leeds (UK)). Phys. Med. Biol.; 21: No. 1, 16-38 (Jan 1976).

Mean dose factors have been calculated for those tissues in bone that are relevant to the induction of late irradiation effects; namely, red bone marrow and endosteal tissues lining trabecular bone surfaces. The calculations are based on a Monte Carlo computer method for beta-emitting radionuclides which are distributed uniformly throughout the volume of mineralized bone. Results are given for the radionuclides ^{14}C , ^{45}Ca , ^{22}Na , ^{18}F , ^{32}P , ^{90}Y and ^{90}Sr + ^{90}Y (all considered for this purpose as volume-seekers) for seven bones from the adult human skeleton and calculations are also presented of average skeletal dose factors. Where possible, results are compared with those derived from other methods based on simple geometrical models.

- 1794 INJURY DUE TO THOROTRAST. Mori, T. (Yokohama City Univ. (Japan). Faculty of Medicine). Niigata Igakkai Zasshi; 90: No. 1, 8-12 (Jan 1976). (In Japanese).

A synthetic study was performed on some of those to whom Thorotrast had been injected, in Japan. In the epidemiological study of 147 war wounded to whom Thorotrast had been injected, it was noted that the Thorotrast injection increased the mortality rate and the incidences of malignant hepatic tumor, liver cirrhosis, and hematological diseases. Clinical study of 44 of them showed that the Thorotrast injection resulted in liver and hematopoietic hypofunctions. Analysis of the dissection of the injected area in 118 cases showed malignant hepatic tumor in 63.5%, liver cirrhosis in 14.4% and hematological diseases in 10.2%. The total of the three types of disease was 88.1%. Histological classification showed that of the malignant hepatic tumors due to Thorotrast, hepatobiliary cancer and hemangioendothelioma of the liver were frequent. By the comparison of the absorbed dose in the liver of the malignant hepatic tumors due to Thorotrast with that of the cancers developed in animal experiments, it was noted that the carcinogenic dose was a mean of 2,000 - 3,000 rad by accumulated dose. It was elucidated that carcinogenesis and fibrination were primary in injury due to Thorotrast, i.e., late injury due to Thorotrast, and that the increase in the accumulated dose in organs and the increase of the local dose due to the gigantic growth of Thorotrast granules in organs greatly influenced carcinogenesis and fibrination.

- 1795 HISTOLOGICAL CHANGES OF THE THYROID GLAND AFTER ^{131}I TREATMENT FOR HYPERTHYROIDISM. I. ANALYSIS BY THE FREQUENCY OF ADMINISTRATION AND DOSAGE OF ^{131}I . Takeichi, N.; Inoue, S.;

Niimoto, M.; Nagata, N. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology); Yasuda, K. Hiroshima Igaku; 29: No. 1, 56-62 (Jan 1976). (In Japanese).

The histological changes of the thyroid tissues due to ^{131}I treatment were classified by the frequency of administration and dosage of ^{131}I , and the chronological changes were examined. The histopathological findings including nuclear alteration, tissue infiltration, vascular alteration and regeneration of the follicular epithelium were examined. In the cases which received 2-3 doses, there were many atypical regeneration of the follicular epithelium, and in the cases with long observation duration, Askanazy cells and fibrotic proliferation were observed. These histological changes indicated the possibility of the occurrence of tumor due to the administration of ^{131}I .

- 1796 EXPOSURE OF THE NATION DUE TO INTERNAL IRRADIATION. Takeshita, A. (Niigata Univ. (Japan). School of Medicine). Niigata Igakkai Zasshi; 90: No. 1, 15-17 (Jan 1976). (In Japanese).

The genetically significant dose of the nation due to internal irradiation is thought to increase unless short half-life nuclides such as $^{99\text{m}}\text{Tc}$ are used; the value of 0.26 m rem/year in 1971 will increase greatly. Radiopharmaceuticals, even of test dose, will definitely pose problems as to the nation's exposure to radiation due to environmental contamination unless they are used in completely equipped facilities under sufficient radiation control. Accordingly, RI should be used for medical purposes only in fully equipped hospitals after consideration of their geographical stationing.

- 1797 (BNWL--2000(Pt.1), pp 11-17) DOSE-EFFECT STUDIES WITH INHALED PLUTONIUM OXIDE IN BEAGLES. Park, J.F.; Buschbom, R.L.; Case, A.C. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

Beagle dogs given single exposure to $^{239}\text{PuO}_2$ or $^{238}\text{PuO}_2$ aerosols are being observed for life-span dose-effect relationships. The ^{239}Pu body burden of the nine dogs dying due to pulmonary fibrosis-induced insufficiency during the first 3 years after exposure was 1 to 12 μCi . One of these dogs had a pulmonary tumor. Three additional dogs with body burdens of 0.7 to 1.8 μCi died due to pulmonary neoplasia 4-1/2 years after exposure. None of the dogs exposed to ^{238}Pu have died during the first two postexposure years. After inhalation of $^{239}\text{PuO}_2$ or $^{238}\text{PuO}_2$ lymphocytopenia was the earliest observed effect, occurring 0.5 to 2 years after deposition of greater than or equal to 80 nCi plutonium in the lungs.

- 1798 (BNWL--2000(Pt.1), pp 18-22) LATE EFFECTS OF INHALED $^{238}\text{PuO}_2$ IN BEAGLES. Park, J.F.; Case, A.C.; Catt, D.L.; Hackett, P.L.; Lund, J.E.; Powers, G.J.; Ragan, H.A.; Watson, C.R. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

Osteosarcomas were the primary cause of death in beagle dogs 4 to 8 years after inhalation of $^{238}\text{PuO}_2$. The plutonium body burden at death ranged from 0.4 to 2.6 μCi with 32 to 55 percent of the plutonium in the skeleton. Pulmonary neoplasia was observed in

three of the bone-tumor-bearing dogs.

99 (BNWL--2000(Pt.1), pp 35-36) LATE EFFECTS OF INHALED $\text{Pu}(\text{NO}_3)_4$ AND $^{253}\text{Es}(\text{NO}_3)_3$ IN RATS. Ballou, J.E.; Dagle, G.E.; McDonald, K.E. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

Preliminary results indicate that lung tumors will be more numerous than bone tumors in rats administered inhaled $^{239}\text{Pu}(\text{NO}_3)_4$, $^{238}\text{Pu}(\text{NO}_3)_4$, or $^{253}\text{Es}(\text{NO}_3)_3$ aerosols.

1800 (BNWL--2000(Pt.1), pp 53-54) DOSIMETRIC STUDIES OF INHALED RADON DAUGHTERS IN DOGS. Palmer, R.F.; Jackson, P.O.; Gaven, J.C.; Stuart, B.O. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

Radon daughter exposure-chamber aerosol parameters and dose rates to respiratory tracts of dogs breathing these aerosols are reported.

1801 (BNWL--2000(Pt.1), pp 57-59) DOSE-RATE STUDIES OF RESPONSE TO INHALED URANIUM MINE AIR CONTAMINANTS IN RODENTS. Gaven, J.C.; Palmer, R.F.; Stuart, B.O. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

Hamsters and rats were exposed to radon daughters, with and without concomitant uranium ore dust, 84 hours per week for five months. Results will be compared with those from earlier studies to evaluate dose-rate effects.

1802 (BNWL--2000(Pt.1), pp 81-82) INFLUENCE OF TEMPORAL DISTRIBUTION OF ALPHA DOSE IN BONE TUMOR INDUCTION. Mahlum, D.D.; Sikov, M.R.; Hungate, F.P. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

Bone tumor induction data from adult and weanling rats intravenously injected with ^{239}Pu and ^{253}Es were compared. Most of the radiation dose to the skeleton from ^{253}Es was received during the first month postexposure, while that from ^{239}Pu was distributed over the 30 months of the study. The results suggest that the shorter duration radiation dose is less conducive to the induction of bone tumors than the dose delivered at a lower rate over a longer period of time.

1803 (BNWL--2000(Pt.1), pp 97-101) ACUTE TOXICITY IN RATS AND DOGS OF INGESTED PROMETHIUM-147 AND RUTHENIUM-106. Sullivan, M.F.; Mahony, T.D.; Cross, F.T. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

The oral LD_{50} in rats for the weak beta-emitter ^{147}Pm was about 6 Ci/kg. A combination of one-half that dose with one-half the LD_{50} (9 mCi/kg) of the high energy beta-emitter, ^{106}Ru - ^{106}Rh , caused similar mortality. Death was due to large bowel damage as a consequence of the long residence time in that segment. Dogs fed doses in excess of 3.2 mCi/kg of ^{106}Ru - ^{106}Rh died of extensive large bowel injury. Dogs given doses between 2.75 and 3.2 mCi/kg often

survived for several weeks with persistent anorexia and diarrhea before dying of irreparable injury to the large bowel.

1804 (BNWL--2000(Pt.1), pp 107-108) HEMATOLOGIC EFFECTS OF $^{239}\text{PuO}_2$ INHALATION IN RATS. Ragan, H.A. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

In rats, mean lung burdens of about 800 nCi of ^{239}Pu resulted in a significant lymphocyte depression by 30 days postexposure. This was followed by a marked and progressive neutrophilia over the next 60 days. Extrapulmonary ^{239}Pu concentrations were less than 5 percent of the lung burden.

1805 (BNWL--2000(Pt.1), pp 109-110) DENSITY GRADIENT SEPARATION AND SIZE DISTRIBUTION OF BEAGLE LYMPHOCYTES. Ragan, H.A. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

Density gradient techniques for obtaining pure, single-cell suspensions of peripheral blood mononuclear cells were applied to beagle dogs that had inhaled plutonium. There was a tendency toward a loss of intermediate-size lymphocytes in dogs with ^{239}Pu lung burdens, and a shift to larger cells when compared with control dogs.

1806 (BNWL--2000(Pt.1), pp 111) EFFECTS OF PLUTONIUM ON THE IMMUNE SYSTEM: IMMUNOGLOBULIN-M IN BEAGLE DOGS EXPOSED TO PLUTONIUM AND IN UNEXPOSED CONTROLS. Morris, J.E. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

Serum Immunoglobulin-M (IgM) levels in plutonium-oxide-exposed and unexposed beagle dogs were measured with a Mancini assay. With this assay, there was no apparent difference in IgM levels between the control group and groups of dogs with differing amounts of $^{238}\text{PuO}_2$ or $^{239}\text{PuO}_2$ deposited in the lung.

1807 (BNWL--2000(Pt.1), pp 154-155) IRRADIATION OF BLOOD BY ^{239}Pu ALPHA PARTICLES. Hungate, F.P.; Riemath, W.F.; Culver, G.G.; Gillis, M.F.; Ragan, H.A. Jan 1976.

Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.

A developmental ^{238}Pu blood irradiator produced no evidence of lymphopenia in a dog. Irradiation continued for a year at an estimated rate of about 100 rads/day, but this dosimetry is highly uncertain.

1808 COMPARISON OF THE DOSE TO CELLS ON TRABECULAR BONE SURFACES FROM PLUTONIUM-239 AND RADIUM-226 BASED ON EXPERIMENTAL ALPHA ABSORPTION MEASUREMENTS. Harley, N.H.; Pasternack, B.S. (New York Univ., N.Y. (USA). Inst. of Environmental Medicine). Health Phys.; 30: No. 1, 35-46 (Jan 1976).

The α dose to cell nuclei on human trabecular bone surfaces critical to osteosarcoma production has been computed. The dose calculations are performed for ^{226}Ra and its daughters, and for ^{239}Pu incorporated into bone. The dose rates are computed utilizing measured values of the α energy loss (stopping

- power) in polycarbonate which has an ionization potential similar to tissue. Recent data such as the ICRP Task Group radium retention (ICRP, 1973) for trabecular bone have been incorporated into the model. Trabecular bone cell dose rates are also calculated for the mouse and beagle dog and the results agree with observed individual toxicities and relative Pu/Ra toxicities. Results for human bone indicate that the accumulated dose to cells on trabecular bone surfaces is highly dependent upon the burial of plutonium due to bone growth. A sustained ICRP maximum permissible body burden of 0.1 μCi of ^{226}Ra will give 8 rads to these cells in 10 yr whereas a maximum permissible body burden of 0.04 μCi of ^{239}Pu yields 18 rads. The 30-yr values for these sustained skeletal burden are 25 and 30 rads respectively.
- 1809 ^{90}Sr - ^{90}Y DOSE DISTRIBUTION IN BEAGLES: INJECTION RELATIVE TO INGESTION. Momeni, M.H.; Jow, N.; Bradley, E. (California Univ., Davis (USA). Radiobiology Lab.). Health Phys.; 30: No. 1, 3-19 (Jan 1976).
- The ^{90}Sr body burden ingested as a constant fraction of dietary calcium in 1.5 yr ^{90}Sr - ^{90}Y feeding was analyzed for uptake and retention. Retention times were compared to that for a single intravenous injection of ^{90}Sr at t_0 1.5 yr of age. The uptake parameters were compared with skeletal and body growth rates. No significant differences in body weight pattern of 452 beagles were observed between the controls and ^{90}Sr -fed dogs. The retention parameters in the singly injected beagles were compared with those for ^{90}Sr inhalation studies; no difference was observed. The average skeletal dose rate and the time-integrated dose were calculated from the mean body burden as a function of age and skeletal/body weight ratios. The local dose rates and dose were compared to the average skeletal dose and dose rate. The local dose to marrow at the proximal humerus was always overestimated by the average skeletal dose and dose rate. The local dose rate overestimated the dose to hematopoietic tissue for the first 5 yr of life partially due to averaging of the higher ^{90}Sr concentration in cortical bone with the lower concentration in trabecular bones. Autoradiographic and local measurement of ^{90}Sr in bone revealed that a uniformly labeled skeleton (constant $^{90}\text{Sr}/\text{g}$ of ash) was obtained in 1.5 yr of ^{90}Sr feeding. For periods $t > t_0$ the fast local turnover at the proximal region relative to cortical bone produced cold spots and low activity regions of cancellous bone. In contrast, the injected cortical bones showed hot spot areas on a diffuse background.
- 1810 LOCAL DOSIMETRY AND QUALITATIVE CHANGES IN ^{226}Ra - AND ^{90}Sr - ^{90}Y -LABELED BEAGLE HUMERI. Momeni, M.H.; Williams, R.J.R.; Fisher, G.L.; Rosenblatt, L.S. (California Univ., Davis (USA). Radiobiology Lab.). Health Phys.; 30: No. 1, 21-34 (Jan 1976).
- Changes in ^{226}Ra - or ^{90}Sr - ^{90}Y -labeled beagle humeri were measured radiographically and by a photon absorptiometric density technique. Quantitative autoradiography and local dose measured by thermoluminescent dosimetry were compared with the average regional dose. Radium-226-labeled humeri manifested bone damage for levels as low as 8 ng/kg of body weight corresponding to a time-integrated dose of 300 rad by 10 yr of age. Whereas, ^{90}Sr -labeled humeri manifested bone damage for dose levels of about 4 μCi ^{90}Sr - ^{90}Y or more average daily ingestion from midgestation to 18 months of age. These dogs accumulated a dose in excess of 7 krad by 10 yr of age. Thus, based on average time-integrated dose, a factor of 23-times more dose of ^{90}Sr - ^{90}Y relative to ^{226}Ra is required to induce a radiographically detectable skeletal change by 10 yr of age.
- 1811 (BNWL--2000(Pt.1), pp 127-128) EVALUATION OF POSTMORTEM TISSUE SAMPLES. Nelson, I.C.; Kirby, L.J.; Thomas, V.W. Jr. Jan 1976.
- Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.
- Collection and radiochemical analysis of postmortem tissue samples (lung, liver, bone and tracheobronchial lymph nodes) from individuals formerly residing in the vicinity of the Hanford project continued during the past year. Postmortem tissue samples and blood samples were also analyzed for the U. S. Transuranium Registry (USTR). During the year commencing November 1, 1974, 85 analyses for plutonium-238 and plutonium-239+240 were performed on samples from the Hanford locality, and 41 analyses for plutonium-238 and plutonium-239+240 on samples obtained from the USTR. Plutonium-242 is the tracer of choice for yield determination in the alpha energy analysis of tissues for ^{238}Pu and ^{239}Pu .
- 1812 (BNWL--2000(Pt.1), pp 128) DEPOSITION OF RADON DAUGHTERS IN THE TRACHEOBRONCHIAL TREE. Nelson, I.C. Jan 1976.
- Pacific Northwest Laboratory annual report for 1975 to the ERDA Division of Biomedical and Environmental Research. Part 1. Biomedical Sciences.
- Studies of the deposition of radon daughters on the mucosa of the proximal bronchi of the tracheobronchial tree centered on completing a comparison of deposition in the various airways using a diffusion equation and the Weibel Regular and Irregular Dichotomous Lung Models. It was concluded from this study that proximal to the subsegmental bronchi, the difference in calculated area deposition in the variously sized tubes was not sufficient to permit identification of preferential sites of deposition, which presumably would imply preferential sites of tumorigenesis. Although particle removal times, depth of sensitive tissues, etc., were not taken into account, it was concluded that the less complicated Weibel Regular Lung Model would suffice for most applications in uranium miner lung dosimetry.
- 1813 ^{144}Ce IN TISSUE OF BEAGLE DOGS AFTER INHALATION OF CeCl_3 WITH SPECIAL EMPHASIS ON ENDOCRINE GLANDS AND REPRODUCTIVE ORGANS. Cuddihy, R.G.; Boecker, B.B.; McClellan, R.O.; Kanapilly, G.M. (Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. (USA)). Health Phys.; 30: No. 1, 53-59 (Jan 1976).
- Beagle dogs inhaled aerosols containing $^{144}\text{CeCl}_3$. Deposition of ^{144}Ce in tissues was determined in serially sacrificed dogs to characterize radiation dose patterns at early times after exposure. Uptakes of ^{144}Ce in endocrine glands and reproductive organs were also measured; radiation doses were calculated and those doses were compared with the doses to the major organs of deposition - lung, liver and skeleton. Integrated radiation doses in pituitary and adrenal glands, pancreas, ovaries, testes, prostate and uterus were less than 2 % of those in lung and liver, while the thyroid dose was about 30 % of the dose in liver. These findings were consistent with previously reported biological responses in beagle dogs exposed to high levels of $^{144}\text{CeCl}_3$.

wherein no radiation effects related to endocrine glands or the reproductive system have been observed. Use of these results in predicting the dosimetry of ^{14}C in exposed humans re-emphasized the importance of radiation damage to lung, liver, skeleton and gastrointestinal tract compared to other organ systems.

summer 1971 with the long time disposal of solid and solidified low-level wastes. The disposal of intermediate-level wastes is still in an experimental phase. With the next development step, we would like to start in 1979 by using the cavity technique. Preparations are underway for the test disposal of high-level, heat generating wastes. The first two steps are temperature-measuring fields and the disposal of 100,000 pebbles--they are limited--of burned carbide fuel elements from the AVR test reactor at Julich. One thousand of these non-reprocessed fuel elements generate only a heat of 70 watts. The radiation-exposure of the disposal personnel could be minimized by the development of the disposal-techniques in spite of increasing quantities and specific activities of the wastes. At present time we have only an average radiation exposure of nearly 40 mrem per man per month.

- 1814 (CONF-761103--17) COSTS AND THE ENVIRONMENTAL IMPACT OF RADIOACTIVE WASTE TREATMENT IN REPROCESSING HIGH-TEMPERATURE GAS-COOLED REACTOR FUEL. Davis, W. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1976. Contract W-7405-ENG-26. 17p. Dep. NTIS \$3.50.

From ANS winter meeting; Washington, DC, USA (15 Nov 1976).

A cost-benefit analysis and an analysis of the reduction in population dose from the use of different decontamination equipment in the off-gas system of a model plant for processing spent fuel from HTGR type reactors are presented. (JSR)

- 1815 TRANSPORTATION OF NUCLEAR MATERIALS. Eichholz, G.G. pp 187-200 of Environmental impact of nuclear power plants. Karam, R.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1976).

From Conference on environmental impact of nuclear power plants; Atlanta, GA, USA (26 Nov 1974).

See CONF-741193--.

The population dose in the transport of nuclear materials is evaluated for the shipment of uranium concentrate to the fuel fabricator, shipment of fuel assemblies, shipment of spent fuels to reprocessing plants, and shipment of waste materials for storage. The possibilities of accident during each of these shipments are considered. It is concluded that both individual and population dose are quite small under the present safety regulations. (JSR)

- 1816 (CONF-760822--P1, pp 51-69) INCINERATOR FOR POWER REACTOR LOW-LEVEL RADIOACTIVE WASTE. Drolet, T.S.; Sovka, J.A. (Ontario Hydro, Toronto). 1976.

From 14. US ERDA air cleaning conference; Sun Valley, ID, USA (2 Aug 1976).

Proceedings of the fourteenth ERDA air cleaning conference.

The technique chosen for volume reduction of combustible waste is incineration by a propane-fired unit. Noncombustible material will be compacted into 200 liter drums. A program of segregation of wastes at the producing nuclear stations was instituted. The design and operation of the incinerator, dose limits to the public, and derived release limits for airborne effluents are discussed.

- 1817 (CONF-761020-- , pp 283-302) DEVELOPMENT OF RADIOACTIVE WASTES DISPOSAL-TECHNIQUES AND THE RADIATION-EXPOSURE OF THE PERSONNEL AT ASSE PILOT PLANT. Albrecht, E. (Gesellschaft fuer Strahlen- und Umweltforschung, Munich); Braest, H.C. 1976. From Symposium on waste management; Tucson, AZ, USA (3 Oct 1976).

Waste Management 76.

In the Federal Republic of Germany radioactive wastes should be disposed in rock salt formations of the deep geological underground. In the pilot plant Asse near Braunschweig suitable methods will be tested. The respectively founded experiences will be used for the development of the disposal-techniques. Therefore we were able to start in

- 1818 DISPOSAL OF LIQUID RADIOACTIVE WASTE - DISCHARGE OF RADIOACTIVE WASTE WATERS FROM HOSPITALS. Ludwig, F. (Gewerbeaufsicht des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.). Zentralstelle fuer Sicherheitstechnik, Strahlenschutz und Kerntechnik). pp 233-241 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Spezielle Beitrage der Medizin zum Strahlenschutz. Braun, H. (ed.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

3 tabs.; 20 refs..

A survey is given about legal prescriptions in the FRG concerning composition and amount of the liquid waste substances and waste water disposal by emitting into the sewerage, waste water decay systems and collecting and storage of patients excretions. The radiation exposure of the population due to drainage of radioactive waste water from hospitals is lower by more than two orders than the mean exposure due to nuclear-medical use.

- 1819 ENVIRONMENTAL IMPACT OF ^{14}C RELEASED BY A NUCLEAR FUEL-REPROCESSING PLANT. Veluri, V.R. (Clark Coll., Atlanta); Boone, F.W.; Palms, J.M. Nucl. Saf.; 17: No. 5, 580-590(1976).

The environmental impact of the predicted ^{14}C release by the Barnwell Nuclear Fuel Plant (BNFP) is assessed. The external dose and the whole-body doses due to inhalation and ingestion of ^{14}C are calculated. For a predicted release of 1065 Ci/year, the external dose rate at the site boundary is 2.9×10^4 mrem/year, the whole-body inhalation dose rate is 7.0×10^{-5} mrem/year, and the whole-body dose rate via ingestion of food materials is 0.28 mrem/year. These rates compare with an average annual dose rate per person of 135 mrems/year due to natural background radiation. The long-term aspects of global releases of ^{14}C from the nuclear industry are briefly discussed. The 25-year dose commitment to a person due to ^{14}C discharges from the total world nuclear facilities during the period 1975 to 2000 is estimated to be approximately 1.4 mrems. During the same 25-year period, the BNFP contribution will be approximately 0.02 mrem of the 1.4 mrems. The dose commitment to a person for the estimated 40-year lifetime of BNFP will be approximately 0.08 mrem.

- 1820 (CONF-760701-- , pp 489-505) RADIATION EXPOSURES TO MAN FROM RELEASES OF RADIOACTIVE EFFLUENTS. Morley, F.; Bryant, P.M.

(National Radiological Protection Board, Harwell, England). 1976.

From International symposium on management of waste from the LWR fuel cycle; Denver, CO, USA (11 Jul 1976).

Proceedings of the international symposium on the management of wastes from the LWR fuel cycle.

The radiation doses received by the public from releases of radioactive effluents are usually assessed by indirect methods involving environmental modeling for two sets of circumstances. In the first, measurements of radioactivity released or present in environmental materials are available for specific sites. In the second, this information is not available, either because the necessary measurements have not or cannot be made or because the estimates needed are for future doses from new or expanding nuclear power programs not specified in detailed terms. Reliable dose estimates can be made, even in the absence of measurements, although the need to make assumptions on such matters as program size, reactor type, and waste-management practices may be a complicating factor. The population groups for which dose estimates are required are classified as local, regional, and global. Depending on the situation, the estimates may be for doses to individuals or collective doses to specified population groups. The most recent comprehensive review of the radiation exposure of man from the normal operation of nuclear-fuel-cycle facilities is that of the United Nations Scientific Committee on the Effects of Atomic Radiation, in its 1972 report. Some of the dose estimates reported by the Committee are described in this paper, together with more recent Western European estimates. Also included is a summary of the methodology of dose assessment, with recent examples of its application. Detailed information is provided on present and future dose estimates for the United Kingdom.

- 1821 IMPACTS OF THE NUCLEAR ENERGY INDUSTRY ON HUMAN HEALTH AND SAFETY. Cohen, B.L. (Univ. of Pittsburgh). Am. Sci.; 64: No. 5, 550-559(1976).

Although many people believe that the effects of radiation on human health are poorly understood, at least the upper limits of these effects are well known from incidents in which people have received large doses of radiation. The data have been analyzed in reports by two prestigious groups of radiation biomedical experts: (1) the National Academy of Sciences-National Research Council Committee on Biological Effects of Ionizing Radiation (BEIR); and (2) the United Nations Scientific Committee on Effects of Atomic Radiation (UNSCEAR). In addition, there is continuing surveillance of the information by the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP), groups mainly concerned with setting standards for maximum permissible exposure. Their conclusions are used here to estimate the effects on human health of radioactivity released into the environment by various aspects of the nuclear energy industry.

- 1822 ENVIRONMENTAL RADIATION EXPOSURES AND ASSOCIATED RISKS FROM FUEL REPROCESSING PLANTS. Kahn, B. (Georgia Inst. of Tech., Atlanta). pp 197-220 of Energy and the environment cost-benefit analysis. Karam, R.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1976).

From Proceedings of energy and the environment - cost benefit analysis; Atlanta, GA, USA (23 Jun 1975).

See CONF-750697--.

Radionuclide source and effluent amounts and associated population radiation exposure are reviewed for commercial plants reprocessing nuclear fuel from light water reactors in the United States. Radionuclide data and doses computed from effluent and environmental radionuclide measurements are available for the Nuclear Fuel Services reprocessing plant. Also presented are effluent and dose predictions for the Barnwell Nuclear Fuel Plant and for model plants considered by the AEC and EPA in their analyses of the environmental impact of the nuclear fuel cycle. The radionuclides in air-borne effluents that are predicted to cause maximum exposures of persons are I-129 and I-131 to thyroids, Kr-85 to skin, and Ru-106 to the gastrointestinal tract. The highest population dose is predicted from C-14, Kr-85, and H-3 distributed worldwide. Although detailed calculational evaluations have been undertaken of the in-plant process, waste treatment, environmental transfers, and uptake of radionuclides as they affect radiation doses to the population, direct observations of these factors at operating plants are needed to confirm these results.

- 1823 MANUAL ON RADIOLOGICAL SAFETY IN URANIUM AND THORIUM MINES AND MILLS. Vienna; IAEA (1976). 82p.

The manual describes the personnel radiation hazards in uranium and thorium mines and mills. Measures which should be taken in order to protect the workers are outlined. The problems of air born radioactivity, external radiation, surface contamination and radioactive waste are treated. Safety standards in relation to the above mentioned subjects are given. An outline is given for monitoring programme. Monitoring methods, control methods and means of medical control are given.

- 1824 RESPIRATORY DISEASE MORTALITY AMONG URANIUM MINERS. Archer, V.E.; Gillam, J.D.; Wagoner, J.K. (National Inst. for Occupational Safety and Health, Salt Lake City). Ann. N.Y. Acad. Sci.; 271: 280-293(1976).

A mortality analysis of a group of white and Indian uranium miners was done by a life-table method. A significant excess of respiratory cancer among both whites and Indians was found. Nonmalignant respiratory disease deaths among the whites are approaching cancer in importance as a cause of death, probably as a result of diffuse parenchymal radiation damage. Exposure-response curves for nonsmokers are linear for both respiratory cancer and "other respiratory disease". Cigaret smoking elevates and distorts that curve. Light cigarette smokers appear to be most vulnerable to lung parenchymal damage. The predominant histologic cancer among nonsmokers is small-cell undifferentiated, just as it is among cigarette smokers.

- 1825 RADIATION LOAD IN THE AVR TEST PLANT. Ziermann, E.; Kneuer, H. (Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Juelich (F.R. Germany)). pp 758-761 of Reactor conference, Duesseldorf, 30.3.-2.4.1976. Section 3: Design, construction and operation of nuclear power plants and their components. Eggenstein-Leopoldshafen, F.R. Germany; ZAED (1976). (In German)

From Reactor meeting; Duesseldorf, F.R. Germany (30 Mar 1976).

4 figs.; 5 refs. Short communication only.
AVR REACTOR; INSPECTION; PERSONNEL; RADIATION
DOSES; REACTOR MAINTENANCE; REACTOR OPERATION;
REPAIR

826 OBJECTIVES OF AND OPERATING EXPERIENCE WITH THE A-1 NUCLEAR POWER PLANT. Kostovsky, K. (Atomova Elektraren, Jaslovske Bohunice (Czechoslovakia)). Kernenergie; 19: No. 2, 51-54(1976). (In German).

A brief review is given of the objectives pursued in developing the first Czechoslovakian nuclear power plant with a gas cooled heavy water moderated reactor and of the problems that had come forward in design and construction. Operating experience confirms the designed values and showed reliable operation of the nuclear power plant. Radiation exposure of personnel is low. The potentialities of this type of reactor are indicated.

1827 DESIGNING TO MINIMIZE RADIATION EXPOSURE. Legg, G.G. Chalk River, Ont.; Atomic Energy of Canada Ltd. (1976). 15p.

On early CANDU stations, radiation exposure received by the staff was higher than originally anticipated. Reviews to reduce exposure were started in 1969 and these have evolved into a formal program which defines specific objectives, classifies radiation levels, reviews designs and implements improvements where necessary. This paper outlines the program developed at AECL-PP (Power Projects) for use during the design of CANDU stations.

1828 RADIOLOGICAL SIGNIFICANCE OF TRANSURANIUM RADIOISOTOPES RELEASED TO THE ENVIRONMENT DURING OPERATION OF THE LMFBR FUEL CYCLE. Barr, N.F. (Energy Research and Development Administration, Washington, D.C. (USA)). pp 649-655 of Transuranium nuclides in the environment. Vienna; IAEA (1976).

From Symposium on transuranium nuclides in the environment; San Francisco, Calif., USA (17 - 21 Nov 1975).

Estimates based on current knowledge and conservative assumptions indicate that release of transuranium elements from the Liquid Metal Fast Breeder Reactor (LMFBR) fuel cycle are likely to produce population dose commitments small compared to those produced by naturally occurring alpha emitters and globally dispersed transuranium radioisotopes from tests of nuclear weapons in the atmosphere. Potential health consequences of these releases to current and future generations are estimated to be very small compared to risks associated with the production of energy by fossil fuels. The estimates are subject to a number of uncertainties imposed by lack of knowledge. Some of the uncertainties are not likely to be greatly reduced until LMFBR facilities are designed and operated. Others may be significantly reduced prior to facility design and operation. The paper discusses the sensitivity of the estimates to uncertainties and approaches to reducing those uncertainties that strongly influence the estimates.

1829 (DOCKET-50254--1006) QUAD-CITIES STATION, UNITS 1 AND 2. ANNUAL OPERATING REPORT FOR 1976. (Commonwealth Edison Co., Chicago, Ill. (USA)). 1976. 154p. (DOCKET-50265--975).

Net electrical power generated by Unit 1 was 3,393,062 MWH with the generator on line 5,703.0 hrs. Unit 2 generated 4,304,684 MWH with the generator on line 7,145.3 hrs. Information is presented concerning modifications, maintenance, power generation, shutdowns, occupational radiation exposures, and organization. (FS)

1830 (DOCKET-50267--436) FORT ST. VRAIN NUCLEAR GENERATING STATION. SEMIANNUAL OPERATIONS REPORT NO. 4, JULY--DECEMBER 1976. (Public Service Co. of Colorado, Denver (USA)). 1976. 65p. Dep. NTIS \$4.50.

Operations including changes in facility design, procedures, tests, experiments, and personnel are described. Information is presented concerning training, surveillance, maintenance, primary coolant chemistry, occupational personnel radiation exposures, radioactive effluents, and environmental monitoring. The reactor was shut down during the entire period. (FS)

1831 (DOCKET-50277--613) PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3. SEMIANNUAL OPERATING REPORT NO. 5, JULY--DECEMBER 1975. (Philadelphia Electric Co., Pa. (USA)). 1976. 51p. (DOCKET-50278--531). Dep. NTIS \$4.50.

Net electrical power generated by Unit 2 was 2,070,655 MWh(e) with the generator on line 3,508 hrs while Unit 3 generated 2,309,418 MWh(e) with the generator on line 4,102 hrs. Information is presented concerning operations, equipment, maintenance, radioactive waste, personnel exposures, organization changes, and training. (FS)

1832 (DOCKET-50295--858) ZION NUCLEAR PLANT, UNITS 1 AND 2. RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND OCCUPATIONAL PERSONNEL RADIATION EXPOSURE: JANUARY--DECEMBER 1976. (Commonwealth Edison Co., Chicago, Ill. (USA)). 1976. 147p. (DOCKET-50304--738).

Radioactive waste, environmental monitoring and occupational personnel radiation exposure: January--December 1976. ZION-1 REACTOR; ZION-2 REACTOR; ENVIRONMENT; RADIATION MONITORING; RADIOACTIVE WASTE MANAGEMENT; SOLID WASTES; TRANSPORT; LIQUID WASTES; GASEOUS WASTES; RADIATION DOSES; PERSONNEL; GAMMA RADIATION; IODINE 131; ACTIVITY LEVELS; PARTICLES; AEROSOLS; MILK; GRASS; RAIN; SOILS; VEGETABLES; GROUND WATER; METEOROLOGY; SAMPLING

1833 (DOCKET-50322--101) SHOREHAM NUCLEAR POWER STATION, UNIT 1. LICENSE APPLICATION, FSAR, VOLUME 10. (Long Island Lighting Co., Hicksville, N.Y. (USA)). 1976. 574p.

FSAR Volume 10; radioactive waste management; radiation protection; conduct of operations; initial tests and operation. SHOREHAM REACTOR; RADIOACTIVE WASTE MANAGEMENT; RADIATION PROTECTION; REACTOR OPERATION; TESTING; REACTOR START-UP; RADIOACTIVE EFFLUENTS; LIQUID WASTES; GASEOUS WASTES; SOLID WASTES; RADIATION MONITORING; RADIATION DOSES; EDUCATION; EMERGENCY PLAN; SECURITY; PERSONNEL; TRANSPORT

1834 (DOCKET-STN-50477--169) ATLANTIC GENERATING STATION, UNITS 1 AND 2. U.S. DEPT. OF HEALTH, EDUCATION AND WELFARE COMMENTS ON REVISED DRAFT ENVIRONMENTAL STATEMENT. (Public Service Electric and Gas Co., Newark, N.J. (USA)). 1976. 6p. (DOCKET-STN-50478--167).

HEW comments on revised draft environmental statement. ATLANTIC-1 REACTOR; ATLANTIC-2 REACTOR; ENVIRONMENTAL EFFECTS; PERSONNEL; RADIATION DOSES; REACTOR CORES; MELTING; FISHES; ATLANTIC OCEAN; REACTOR ACCIDENTS; RADIATION ACCIDENTS

1835 FACTORS GOVERNING SITE SELECTION OF NUCLEAR PLANTS. Hafez, M.B. (Atomic Energy

Establishment, Cairo (Egypt)).

Radioprotection; 11: No. 3, 157-163(1976).

The basic technical and economic criteria for the siting of nuclear power stations are discussed. These criteria are based on the emergency exposure of the general population to direct radiation, inhalation and environmental contamination. A regime is discussed to provide standards for site selection; the atmospheric release of biologically significant radionuclides is the most important factor. A number of other factors will influence the judgement, for example, population distribution, local geography, topography, hydrology, seismology and soil analysis. A careful economic evaluation of location at different alternative sites is necessary, taking into account the cost of cooling water-works, foundations and other engineering and social aspects.

- 1836 (INIS-mf--3431) PREDICTION OF ENVIRONMENTAL RADIOACTIVE CONTAMINATION LEVELS TO FOLLOW THE COMMISSIONING OF 'KOZLODUJ' NUCLEAR POWER STATION. Khristova, M.D. (Meditsinska Akademiya, Sofia (Bulgaria). Nauchen Inst. po Rentgenologiya i Radiobiologiya). 1976. 49p. (In Bulgarian). Dep. NTIS (US Sales Only), PC A03/MF A01.

Thesis.

The primary objective of the dissertation work was the prediction of radiological situations to be expected after commissioning the Kozloduj NPS, for specific weather, terrain relief, and soil properties. To this end, a pre-operational analysis was carried out of natural background radiation and airborne radioactivity. Based on pre-operational estimates of radionuclide releases, predictions were elaborated for expected radioactivity levels in air, the earth's surface, soils, plants, and some food types with regard to both total radioactivity and selected isotopes of biological interest, namely strontium 90, iodine 131, and cesium 137. As a criterion of radiation safety, computations were made of absorbed doses from external exposure to airborne or surface-deposited man-made radionuclides and from internal exposure to nuclides inhaled or ingested. Human exposure was evaluated in terms of 'health effect'. Environmental iodine 131 levels from accidental releases were predicted for a number of release rates and weather conditions. Thyroid doses from iodine 131 inhaled or ingested with contaminated milk were calculated. The general conclusion was that normal operation of the Kozloduj NPS should have no deleterious effects on the population. The expected impact on man and his environment was found to be comparable to that of global radioactive fallout.

- 1837 THE FUTURE ENVIRONMENTAL LOAD IN THE FRG DUE TO OPERATIONAL EMISSIONS FROM NUCLEAR FACILITIES. 2ND PARTIAL REPORT. DETERMINATION OF THE RADIATION EXPOSURE BY AIR. Brenk, H.D.; Vogt, K.J. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Zentralabteilung Strahlenschutz); Bonka, H.; Schwarz, G. (Technische Hochschule Aachen (F.R. Germany). Lehrstuhl fuer Reaktortechnik). pp 743-746 of Reactor conference, Duesseldorf, 30.3.-2.4.1976. Section 3: Design, construction and operation of nuclear power plants and their components. Eggenstein-Leopoldshafen, F.R. Germany; ZAED (1976). (In German)
- From Reactor meeting; Duesseldorf, F.R. Germany (30 Mar 1976).
- 5 figs.; 3 refs. Short communication only.
- ENVIRONMENTAL EXPOSURE PATHWAY;FISSION PRODUCT RELEASE;GASEOUS WASTES;GERMAN FEDERAL

REPUBLIC;HUMAN POPULATIONS;METEOROLOGY;NUCLEAR FACILITIES;OPERATION;RADIATION DOSES; RADIOACTIVE WASTE DISPOSAL;REACTOR SITES;STACK DISPOSAL

- 1838 THE FUTURE ENVIRONMENTAL LOAD IN THE FRG DUE TO OPERATIONAL EMISSIONS FROM NUCLEAR FACILITIES. 3RD PARTIAL REPORT. DETERMINATION OF THE RADIATION EXPOSURE BY WATER. Bruessermann, K.; Bonka, H. (Technische Hochschule Aachen (F.R. Germany). Lehrstuhl fuer Reaktortechnik). pp 739-742 of Reactor conference, Duesseldorf, 30.3.-2.4.1976. Section 3: Design, construction and operation of nuclear power plants and their components. Eggenstein-Leopoldshafen, F.R. Germany; ZAED (1976). (In German)

From Reactor meeting; Duesseldorf, F.R. Germany (30 Mar 1976).

6 figs.; 3 refs. Short communication only.

ENVIRONMENTAL EXPOSURE PATHWAY;FOOD CHAINS; GERMAN FEDERAL REPUBLIC;HUMAN POPULATIONS; LIQUID WASTES;NUCLEAR FACILITIES;RADIATION DOSES;RADIOACTIVE EFFLUENTS;RADIOACTIVE WASTE DISPOSAL;REACTOR OPERATION;SURFACE WATERS

- 1839 THE FUTURE ENVIRONMENTAL LOAD IN THE FRG DUE TO OPERATIONAL EMISSIONS FROM NUCLEAR FACILITIES. 4TH PARTIAL REPORT. RESULTS OF THE RADIOECOLOGICAL ANALYSIS. Schwarz, G.; Bonka, H.; Bruessermann, K. (Technische Hochschule Aachen (F.R. Germany). Lehrstuhl fuer Reaktortechnik); Brenk, D.; Vogt, K.J. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Zentralabteilung Strahlenschutz). pp 735-738 of Reactor conference, Duesseldorf, 30.3.-2.4.1976. Section 3: Design, construction and operation of nuclear power plants and their components. Eggenstein-Leopoldshafen, F.R. Germany; ZAED (1976). (In German)

From Reactor meeting; Duesseldorf, F.R. Germany (30 Mar 1976).

8 figs.; 3 tabs.; 1 ref. Short communication only.

ENVIRONMENT;ENVIRONMENTAL EXPOSURE PATHWAY; FISSION PRODUCT RELEASE;GASEOUS WASTES;GERMAN FEDERAL REPUBLIC;HUMAN POPULATIONS;LIQUID WASTES;NUCLEAR FACILITIES;RADIATION DOSES; RADIOACTIVE WASTE DISPOSAL;RADIOACTIVE EFFLUENTS;RADIOECOLOGY;STACK DISPOSAL

- 1840 SIMULATION MODELLING OF ENVIRONMENTAL TRANSPORT AND HEALTH CONSEQUENCES OF RADIOACTIVE EFFLUENTS FROM NUCLEAR POWER SYSTEMS. Cuddihy, R.G.; McClellan, R.O. (Inhalation Toxicology Research Inst., Lovelace Biomedical and Environmental Research Inst., Albuquerque, N. Mex., USA); Chapman, L.D.; Wayland, J.R.; Dugan, V.L. (Sandia Labs., Albuquerque, N.Mex. (USA)). pp 657-666 of Transuranium nuclides in the environment. Vienna; IAEA (1976).

From Symposium on transuranium nuclides in the environment; San Francisco, Calif., USA (17 - 21 Nov 1975).

Developing programs for widespread production of electrical power from nuclear reactor systems require detailed analyses of anticipated radioactivity releases, environmental contamination and potential impact upon human health. This report describes a simulation model of the environment, including man, developed to study evaluations of risks associated with radioactive releases from nuclear fuel cycle facilities. The model provides predictions of the time-related development of potential health effects in human populations and facilitates the determination of the sensitivity of resulting risk estimates to the many rate constants,

physical variables and siting assumptions incorporated into the model. Initial modelling efforts have been directed toward releases of transuranic elements from the Liquid Metal Fast Breeder Reactor fuel cycle including ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Am , ^{242}Cm and ^{244}Cm . Output from the model includes estimates of tumor and genetic defect incidences related to projected growth of nuclear reactor programs through future generations. This information and the sensitivity analyses are directed toward determining the more important model pathways to man and identifying areas of the analysis where fundamental information is lacking.

- 1841 (CONF-760822--P2, pp 811-828)
EVALUATION OF CONTROL ROOM RADIATION EXPOSURE.
Byoun, T.Y.; Conway, J.N. (Burns and Roe,
Inc., Oradell, NJ). 1976.

From 14. US ERDA air cleaning conference;
Sun Valley, ID, USA (2 Aug 1976).

Proceedings of the fourteenth ERDA air
cleaning conference.

The development and practical test
applications of a computer program "AID"
(Accident Inhalation Dose) are discussed. The
"AID" computer code calculates the external
cloud doses (gamma, whole body and beta skin)
and the resultant inhalation doses after a
radiological release based upon site
meteorological data and a wide range of
possible ventilation and filtration designs.

- 1842 CONSTRUCTIVE MEASURES IN THE HHT PLANT
TO ACHIEVE A LOW RADIATION DOSE IN TESTS,
INSPECTIONS AND REPAIR. Hendrich, K.;
Wahsweiler, H.G. (Hochtemperatur-Reaktorbau
G.m.b.H., Mannheim (F.R. Germany)). pp 897-
900 of Reactor conference, Duesseldorf, 30.3.-
2.4.1976. Section 4: Reactor concepts and
economics. Eggenstein-Leopoldshafen, F.R.
Germany; ZAED (1976). (In German)

From Reactor meeting; Duesseldorf, F.R.
Germany (30 Mar 1976).

2 figs.; 1 tab.; 2 refs. Short communication
only.

CONSTRUCTION; GAS TURBINES; HTGR TYPE REACTORS;
INSPECTION; PERSONNEL; PLANNING; RADIATION DOSES;
REACTOR MAINTENANCE; REPAIR; SAFETY ENGINEERING

- 1843 OCCUPATIONAL RADIATION EXPOSURES AT
LICENSED FACILITIES, 1974. Brooks, B.G.
(Nuclear Regulatory Commission, Washington,
DC). Nucl. Saf.; 17: No. 6, 743-746(1976).

Personnel occupational radiation exposures
for calendar year 1974 were obtained from
annual and termination reports submitted by
certain types of AEC licensees, i.e., operating
nuclear power facilities, industrial
radiographers; fuel processors, fabricators,
and reproducers; commercial processors; and
distributors of specified quantities of by-
product materials. Reports from 421 licensees
indicated that 85,097 individuals were
monitored for exposure to radiation during 1974
and that 17,627 individuals terminated their
employment or work assignment with licensees in
1974. Both figures show an increase of about 23
percent over those of 1973. Despite the
increase in the number of individuals monitored
during the 7 years, the number of the more
significant exposures has remained fairly
constant.

- 1844 SELECTED SAFETY-RELATED OCCURRENCES
REPORTED IN JULY AND AUGUST 1976. Casto, W.R.
(comp.). Nucl. Saf.; 17: No. 6, 746-
748(1976).

The following safety related occurrences are
reviewed because of their interest to nuclear

operations: (1) an operator's error, while he
was moving control rods, caused an increase of
off-gas activity at Dresden 1; (2) a supervisor
received an estimated exposure of 8 R while
making an inspection at Zion 1; and (3) an
operator entered a 600 R/hr field at Indian
Point 2.

- 1845 HOW SAFE ARE NUCLEAR POWER PLANTS.
Danzmann, H.J. (Institut fuer Reaktorsicherheit
der Technischen Ueberwachungs-Vereine e.V.,
Koeln (Germany, F.R.)). Elektro-Anz.; 29:
No. 8, 177-178(1976). (In German).

1 fig..

The question 'how safe are nuclear power
plants' can be answered differently - it
depends on how the term 'safety' is understood.
If the 'safety of supply' is left out as a
possibility of interpretation, then the
alternative views remain: Operational safety in
the sense of reliability and safety of
personnel and population.

- 1846 ESTIMATED POPULATION EXPOSURE FROM
NUCLEAR POWER PRODUCTION AND OTHER RADIATION.
Pochin, E.E. Paris; OECD Publications (1976).
48p. OECD Publications Center, Suite 1207,
1750 Pennsylvania Ave., NW, Washington, DC
20006 \$3.50.

When increased power production is planned,
health costs must be considered in deciding
what sources of energy to use. Health aspects
of nuclear power are reviewed and a comparable
review of other fuels is urged. Average
radiation exposure from all natural sources
totals 100 mrem/year, with another 40 mrem/yr
from radiological procedures and other
artificial causes. Per capita increase in
nuclear powered energy consumption of 1kW would
increase exposure 6 mrem/yr, of which 4 mrem/yr
would be genetically significant. Harmful
effects of this increase would result in one
fatal and one curable malignant disease, one
fatal and 50 disabling accidents, and 1 to 1.5
genetic defects (after a 50 year period). Risk
from disease is probably overestimated because
statistics have only been measurable from
higher dose exposure. Risks of genetic
abnormalities are based on animal
experimentation. (26 references) (DCK)

- 1847 IN-VIVO DETERMINATION OF CALCIUM AFTER
NEUTRON IRRADIATION WITH CALIFORNIUM 252.
Guey, A.; Leitienne, Ph.; Zech, P.Y.; Meary,
M.F.; Claveyrolas, P. pp 143-153 of
Radioaktive Isotope in Klinik und Forschung.
Bd. 12. Hoefer, R. (ed.). Wien; H. Egermann
(1976). (In French)

From International symposium on radioactive
isotope in clinical medicine and research; Bad
Gastein, Austria (12 Jan 1976).

11 refs..

Californium-252 presents itself as a neutron
source whose nuclear characteristics: flux,
average energy of neutrons, dose of gamma
radiation are likely to be used in hospitals.
The authors present the achieved results that
have permitted to determine the physical
characteristics of a block, which allows
homogeneous irradiation of thick animal or
human biological targets (hands) thanks to
 ^{252}Cf . The variations of the thermal flux
measured by means of irradiated manganese (with
or without cadmium screen) and samples of
calcium, show that a homogeneity superior
to $\pm 5\%$ is obtained for a depth of field
ranging about 6 cm. The screen used, is chosen
with a density superior to 1, so as to reduce
the rate of thermal neutron production in
comparison with a more hydrogenized material.
The quantitative and qualitative study of

spectra induced 'in vivo' obtained with a Ge (Li) junction compared with those obtained thanks to 2 crystals (6x4 inch) allows to justify the use of detectors. The results obtained on a group of 40 normal patients and of 70 patients in chronic renal deficiency show the possibilities and the limits of such a measure in clinical routine.

- 1848 EXPERIENCE ON RADIATION PROTECTION AT THE CERN SUPER ACCELERATOR. Goebel, K. (European Organization for Nuclear Research, Geneva (Switzerland). Radiation Group). Atomkernenergie; 28: No. 3, 221-224(1976). (In German).

1 fig.; 3 tabs.; 4 refs..

The radiation protection problems connected with the 300-GeV accelerator are discussed and the radiation protection system of the 300 GeV, which is based on the experience from the smaller CERN accelerators, is described.

- 1849 SINGLE-PULSE ELECTRONS FROM A LINEAR ACCELERATOR. Antoku, S.; Sunayashiki, T.; Takeoka, S.; Kato, K. (Hiroshima). pp 105-108 of Proceedings of the Hiroshima University. Hiroshima Univ.; Research Inst. for Nuclear Medicine and Biology (1976). (In Japanese)

The electronic circuits of a 35-MeV linear accelerator in Hiroshima University were modified to produce single-pulse electrons. Single-pulse electrons were obtained by synchronizing one of eight pulses from an electron gun modulator, 120 pps, to a microwave pulse from a klystron, 15 pps. After the single-pulse electrons were discharged, a signal was relayed to a stop-gate circuit from a binary scaler which was connected to the gun modulator. Although reproducibility of single-pulse electrons and stability of electron output per pulse were not completely satisfactory, the beam could be used for radiobiological studies. Biological effects of single-pulse electrons (energy: 25 MeV, dose rate: 10^{10} rad/min) or cultured mammalian cells and mice were nearly equal to multipulse electrons (25 MeV, 10^7 rad/min) and Co-60 γ -rays (dose rate: 100 rad/min).

- 1850 BIOMEDICAL PROBE USING A FIBER-OPTIC COUPLED SCINTILLATOR. Swinth, K.L. (Battelle Pacific Northwest Lab., Richland, WA); Ewins, J.H. Med. Phys.; 3: No. 2, 109-112(1976).

A high-sensitivity biomedical radiation probe which employs a fiber-optic coupled NaI(Tl) scintillator as a detector is described. It was developed for in vivo counting of low-energy ^{239}Pu photons from material located in the tracheobronchial lymph nodes. This probe is 20 times as sensitive as a solid-state probe (avalanche diode) previously developed for this application. Tests with ^{99m}Tc show a sensitivity more than 90 times greater than biomedical probes using DcTe of GaAs ; however, the improved sensitivity is largely due to an increased sensitive volume. Probes were evaluated in animals and phantoms for detection of ^{239}Pu and for location of lung tumors labeled with ^{111}In .

- 1851 (INIS-mf--3305, pp 10-11) INITIAL DOSIMETRY WITH THE STANFORD MEDICAL PION GENERATOR (SMPG). Boyd, D.; Fessenden, P.; Luxton, G.; Astenna, D.A. (Stanford Univ., Calif. (USA). Dept. of Radiology); Broerse, J.J. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Instituut TNO). 1976.

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REP annual report 1975.
DOSE RATES; ELECTRON BEAMS; LET; MEV RANGE 10-100; MEV RANGE 100-1000; PION DOSIMETRY; PIONS; RADIOBIOLOGY; RADIOTHERAPY; RBE; SPATIAL DOSE DISTRIBUTIONS; PION BEAMS

- 1852 Hoshasen kanri keisokuho. (RADIATION MEASURING METHODS IN THE CONTROL). Ishihara, T. (ed.); Yamamoto, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); Kato, Akira; Maruyama, Ryuji. Tokyo, Japan; Japan Health Physics Society, Tokyo (1976). 127p. (In Japanese).

Radiation control is generally carried out in control of exposures and evaluation of exposure doses. Measuring methods of alpha, beta, X, gamma and neutron rays in the radiation control are described. Contents are the following: principles of the radiation detectors, characteristics and general problems of the detectors, characteristics and general problems of the measuring instruments, radiation, monitoring, etc.

- 1853 ABOUT THE EFFICIENCY OF THE INDIVIDUAL DOSIMETRIC CONTROL IN WAR NUCLEAR AND RADIATION AREA. Manolov, K.; Boyadzhiev, S. Voenno Med. Delo; 30: No. 3, 11-16(1976). (In Bulgarian).

During rescue and war operations in the nuclear and radiation area a general and individual dosimetric control is carried out. The individual dosimetric control is performed mainly by means of dosimeters working on ionizing principles, which according to the authors are not quite efficient. In order to avoid errors the authors suggest that the individual dosimeters should be placed in a lower position and horizontally: in order to measure the dose and existing beta radiation screened and nonscreened individual dosimeters working on luminescent principle should be used. The error due to absorption of part of the radiation should be removed by correcting coefficients. For better reliability it is necessary that general and individual dosimetric controls should be carried out according to the methods suggested by the authors.

- 1854 (CONF-740921-- , pp 945-959) RELATION BETWEEN SOIL CONTAMINATION AND LUNG BURDEN, AND IMPLICATIONS TO RESUSPENSION EXPERIMENTAL DESIGN. Engelmann, R.J. (National Oceanic and Atmospheric Administration, Boulder, CO). 1976.

From Atmosphere - surface exchange of particulate and gaseous pollutants symposium; Richland, WA, USA (4 Sep 1974).

Atmosphere-surface exchange of particulate and gaseous pollutants (1974).

A method is proposed for predicting exposure and lung burden of radioactivity from contaminated soil without direct measurement of airborne radioactivity. The method is applied in calculating the lung burden from ^{239}Pu and ^{240}Pu particles. It is proposed that airborne radioactivity from resuspension can be calculated using concentrations of radioactivity in resuspendable soil and using data on resuspension of similar soil under similar land use. The calculations of airborne soil are made for each particle size, and hence may then be used as input to predictions of amount of contamination in the lung. The paper includes the formulation used to predict lung contamination, a suggestion on appropriate soil sampling depth, an equation for extrapolating soil concentration to obtain concentration right at the surface, and a suggestion that

large particles be discarded in the sampling. The elementary formula relating airborne soil measured on towers to the upward flux of soil through a horizontal plane is presented, and inferences drawn for design of an experimental program. (auth)

- 1855 (CONF-740921-- , pp 960-963) SUMMARY AND CONCLUDING COMMENTS TO DEPOSITION-- RESUSPENSION 1974. Engelmann, R.J. (National Oceanic and Atmospheric Administration, Boulder, CO). 1976.

From Atmosphere - surface exchange of particulate and gaseous pollutants symposium; Richland, WA, USA (4 Sep 1974).

Atmosphere-surface exchange of particulate and gaseous pollutants (1974).

Recent developments in atmospheric particle sampling are reviewed. Research programs needed in the fields of meteorology and biology to elucidate the role of atmosphere-surface exchange of particulate and gaseous pollutants in the health hazards due to the inhalation of toxic or radioactive particles are suggested. (CH)

- 1856 (CONF-760701-- , pp 524-538) TERRESTRIAL EXPOSURE PATHWAYS: POTENTIAL EXPOSURES OF MAN FROM THE ENVIRONMENTAL TRANSPORT OF WASTE NUCLIDES. Hoffman, F.O.; Kaye, S.V. (Oak Ridge National Lab., TN). 1976.

From International symposium on management of waste from the LWR fuel cycle; Denver, CO, USA (11 Jul 1976).

Proceedings of the international symposium on the management of wastes from the LWR fuel cycle.

In this analysis of the nuclear fuel cycle the principal terrestrial exposure pathways to man are identified for the normal release of airborne wastes from a model uranium mill; model uranium conversion, enrichment, and fuel fabrication facilities; model light-water reactors; and a model fuel-reprocessing plant. The potential importance of an exposure pathway is determined by relating the calculated maximum individual exposure to the recommended dose limits of the International Commission on Radiological Protection, the proposed LWR fuel-cycle standards issued by the U.S. Environmental Protection Agency, and the LWR design objectives promulgated by the U.S. Nuclear Regulatory Commission. The results of this study are generic; therefore site-specific investigations must be relied on in the final analysis before decisions relative to the implementation of additional radiological protection measures and facility modifications are made.

- 1857 (DPSPU--77-30-1) ENVIRONMENTAL MONITORING IN THE VICINITY OF THE SAVANNAH RIVER PLANT. ANNUAL REPORT, 1976. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Plant). 1976. Contract EY-76-C-09-0001. 66p. Dep. NTIS, PC A04/MF A01.

A continuous monitoring program has been maintained since 1951 (before plant start-up) to determine concentrations of radioactive materials in a 1200-square-mile area outside SRP. Although some gaseous and liquid radioactive materials are discharged from SRP operations, concentrations and doses to the surrounding population continued to be far below levels considered significant from a public health viewpoint. The concentration of radioactivity added by SRP to its environs during 1976 was too small to be distinguished from natural background radiation and fallout from worldwide nuclear weapons tests. Beta

activity in particulate air filters was about 1.5 times the 1975 level and was due entirely to global fallout. This concentration, both at the plant perimeter and 25 miles away (0.07 pCi/m³), represents 0.07% of the Concentration Guide (CG) (defined in the Applicable Standards section which follows). Tritium oxide in air at the plant perimeter was greater than in air at more distant locations; the average concentration at the plant perimeter (50 pCi/m³) was less than 0.1 of the Concentration Guide. Tritium, cesium-137, and strontium-90 were the only radionuclides of plant origin detectable in river water by routine analyses. Special research programs using ultra-low-level techniques have detected trace quantities of other radionuclides of plant origin. Radioactive materials in river fish also continued very low. Monitoring in a five-square-mile swamp bordering the Savannah River immediately below the SRP boundary has shown radioactivity (primarily cesium-137) above the natural background level in soil and vegetation.

- 1858 (ORNL/TM--5251) ASSESSMENT OF RADIOLOGICAL IMPACT OF THE INACTIVE URANIUM-MILL TAILINGS PILE AT SALT LAKE CITY, UTAH. Haywood, F.F.; Goldsmith, W.A.; Perdue, P.T.; Fox, W.F.; Shinpaugh, W.H. (Oak Ridge National Lab., Tenn. (USA)). 1976. Contract W-7405-ENG-26. 106p. Dep. NTIS, PC A06/MF A01.

One of the largest inactive uranium mill tailings piles in the United States is located within metropolitan Salt Lake City, Utah. A radiological survey was performed at this site during the fall of 1975. A series of field and laboratory analyses were performed to characterize the spread of contamination from the tailings pile to surrounding areas. These analyses provided a basis for discussion of the important pathways for transport of radioactivity to man. Measurements of radionuclide concentrations in soil indicated that radium had migrated up to one meter into soil beneath the tailings. Tailings material was found out to distances of several hundred meters, mostly in the prevailing wind directions. Elevated levels of ²²⁶Ra, ²³⁸U, ²³⁰Th, and ²¹⁰Pb were found in sediments of streams running through the mill site; but in Jordan River samples, radionuclide concentrations were of the same magnitude as background samples collected in other parts of the Salt Lake Valley. Atmospheric dispersion of radon gas, which emanates from the pile continuously, was calculated. Potential health effects for continuous exposure to radon progeny and external gamma radiation from the pile in its current state were estimated using risk estimators presented in the BEIR report. For the 400,000 residents within 11 km (7 mi) of the pile, 0.4 cases of lung cancer per year were estimated. For the same population exposed to natural levels of radon progeny, 7.2 cases per year were estimated.

- 1859 (TID--27286) NUCLEAR ENERGY: HEALTH IMPACT OF CARBON-14. Pohl, R.D. (Cornell Univ., Ithaca, N.Y. (USA). Lab. of Atomic and Solid State Physics). 1976. Contract E(11-1)-3151. 23p. Dep. NTIS \$3.50.

Estimates are presented on the carbon-14 generation rates in several reactor types and in peaceful nuclear explosions. The population radiation dose rate caused by light water reactor generated carbon-14 is estimated to be equal to that resulting from krypton-85 and from tritium, if all is released. Because of the long half-life, the radiation dose commitment and the dose rate resulting from the

environmental build-up of carbon-14 are considerably larger than those of the two other radionuclides.

1860 RADIOLOGICAL ASPECTS OF ENVIRONMENTAL TRITIUM. Rohwer, P.S.; Wilcox, W.H. Nucl. Saf.; 17: No. 2, 216-223(1976).

The potential radiological implications of tritium released to the environment must be assessed to develop a policy for managing the tritium inventory projected for the nuclear power industry, which already produces tritium in megacurie quantities annually. Development of fusion reactors will create large potential sources for continuous and pulse releases of tritium, much of it as tritium gas. At present 90 percent of the tritium produced is released in gaseous and liquid effluents to be deposited in the hydrosphere as tritiated water. Two alternatives must be considered relative to a long-term policy for tritium management. One method is to dilute and disperse the tritium from power stations and nuclear fuel-reprocessing plants at a rate commensurate with production at the facility, and the second method is to take steps to contain the tritium for storage. A number of factors that influence the magnitude of the estimated radiological impact of tritium on man are discussed, and key points concerning the behavior of tritium along the exposure pathways to man are summarized. (auth)

1861 ATMOSPHERIC DISPERSION MODEL AS USED IN THE REACTOR SAFETY STUDY, WASH-1400. Church, H.W. (Sandia Labs., Albuquerque, NM). pp 188-193 of Third symposium on atmospheric turbulence, diffusion, and air quality. Preprints. Boston; American Meteorological Society (1976).

From Symposium on atmospheric turbulence, diffusion, and air quality; Raleigh, NC, USA (19 Oct 1976).

See CONF-761003--.

The Reactor Safety Study, WASH-1400, was published in final form in October, 1975, by the U.S. Nuclear Regulatory Commission. This study represents as complete an assessment of accident risks in the U.S. commercial nuclear power plants as the state-of-the-art permits. Appendix VI of WASH-1400, Calculation of Reactor Accident Consequences, describes the input data and mathematical models used to calculate the consequences of a potential release of radioactive material to the environment in the event of a nuclear power plant accident. The primary goal of the study was to assess risk from commercial nuclear power plants as realistically as possible in order to provide proper perspective of potential risk comparison. The objective of predicting consequences of a given radioactivity release was accomplished through construction and execution of a computerized model which accounted for the manner in which radioactivity is dispersed in the environment, the number of people and amount of property exposed, the effects of radiation exposure on people, and property contamination. The basic elements of the model, release characteristics, atmospheric dispersion, dosimetry, population, health effects, and property damage are shown schematically. The computer code (COMO for COsequence MOdel), used in dose calculations, is discussed.

1862 RADIOLOGICAL SIGNIFICANCE OF TRANSURANIUM RADIOISOTOPES RELEASED TO THE ENVIRONMENT DURING OPERATION OF THE LMFBR FUEL CYCLE. Barr, N.F. (Energy Research and Development Administration, Washington, D.C.

(USA)). pp 649-655 of Transuranium nuclides in the environment. Vienna; International Atomic Energy Agency (1976).

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, CA, USA (17 Nov 1975).

See CONF-751105--.

Estimates based on current knowledge and conservative assumptions indicate that release of transuranium elements from the Liquid Metal Fast Breeder Reactor (LMFBR) fuel cycle are likely to produce population dose commitments small compared to those produced by naturally occurring alpha emitters and globally dispersed transuranium radioisotopes from tests of nuclear weapons in the atmosphere. Potential health consequences of these releases to current and future generations are estimated to be very small compared to risks associated with the production of energy by fossil fuels. The estimates are subject to a number of uncertainties imposed by lack of knowledge. Some of the uncertainties are not likely to be greatly reduced until LMFBR facilities are designed and operated. Others may be significantly reduced prior to facility design and operation. The paper discusses the sensitivity of the estimates to uncertainties and approaches to reducing those uncertainties that strongly influence the estimates.

1863 SIMULATION MODELLING OF ENVIRONMENTAL TRANSPORT AND HEALTH CONSEQUENCES OF RADIOACTIVE EFFLUENTS FROM NUCLEAR POWER SYSTEMS. Cuddihy, R.G.; McClellan, R.O. (Inhalation Toxicology Research Inst., Lovelace Biomedical and Environmental Research Inst., Albuquerque, N. Mex., USA); Chapman, L.D.; Wayland, J.R.; Dugan, V.L. (Sandia Labs., Albuquerque, N.Mex. (USA)). pp 657-666 of Transuranium nuclides in the environment. Vienna; International Atomic Energy Agency (1976).

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, CA, USA (17 Nov 1975).

See CONF-751105--.

Developing programs for widespread production of electrical power from nuclear reactor systems require detailed analyses of anticipated radioactivity releases, environmental contamination and potential impact upon human health. This report describes a simulation model of the environment, including man, developed to study evaluations of risks associated with radioactive releases from nuclear fuel cycle facilities. The model provides predictions of the time-related development of potential health effects in human populations and facilitates the determination of the sensitivity of resulting risk estimates to the many rate constants, physical variables and siting assumptions incorporated into the model. Initial modelling efforts have been directed toward releases of transuranic elements from the Liquid Metal Fast Breeder Reactor fuel cycle including ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Am , ^{242}Cm and ^{244}Cm . Output from the model includes estimates of tumor and genetic defect incidences related to projected growth of nuclear reactor program through future generations. This information and the sensitivity analyses are directed toward determining the more important model pathways to man and identifying areas of the analysis where fundamental information is lacking.

1864 (CONF-761031--3) NATURAL AND MAN-MADE RADIONUCLIDE CONCENTRATIONS IN TENNESSEE SOILS. Oakes, T.W.; Shank, K.E.; Easterly, C.E. (Oak Ridge National Lab., Tenn. (USA)). 1976. Contract W-7405-ENG-26. 13p. Dep. NTIS

\$3.50.

From 10. midyear symposium for Health Physics Society; New York, NY, USA (11 Oct 1976).

Soil samples from sites in eastern and central Tennessee, at distances from 35 to 210 km from the Oak Ridge National Laboratory, have been analyzed to determine their radionuclide composition. The soils were analyzed for naturally-occurring radionuclides and the now ubiquitous man-made radioisotopes ^{60}Co , ^{90}Sr , ^{106}Ru , ^{125}Sb , and ^{137}Cs present due to fallout from weapons tests. The radioanalyses consisted of a combination of gamma-ray spectroscopy and radiochemical separation techniques followed by analyses using solid-state and low-level beta detectors. The results are used to quantify the natural external exposure conditions for the population surrounding the Energy Research and Development Administration's Oak Ridge facilities.

1865 CONCENTRATIONS OF DAUGHTER-PRODUCTS OF RADON IN PREMISES OF PRIVATE OR PUBLIC ESTABLISHMENTS IN THE TOWN OF RUSE AND THE DETERMINATION OF THE ABSORBED PULMONARY DOSES. Kovachev, D.; Penchev, A.; Dimitrov, M. (Khigienne-Epidemiologichen Institut, Ruse (Bulgaria)). Letopisi Khig. Epidemiol. Inst.: 9: No. 3, 32-39(1976). (In Bulgarian).

Specific volume activities of short-lived radioactive aerosols of natural origin are determined in the air of premises in solid brick buildings and many-stored monolith concrete buildings. The changes of the values of the "latent" energy of alpha-decomposition of radioactive daughter-products were day-and-night traced, in the premises and cut of them. On the basis of the received data are estimated the equivalent absorbed doses in different parts of the lung in definite initial conditions. It is mentioned, that the potential danger of irradiation for the inhabitants of the solid brick-structure enterprises is higher than for that of the monolith-concrete buildings, which is evident from the measured abnormally high content of radon decomposed products in the air of the premises. The sources of radon elimination are still not specified, but probably they are connected with the material of which the bricks are made and the sand, which is used in the plaster and concrete. Recommendation is given for making card-index for these and similar establishments and regular airing or building of air-conditional systems when possible.

1866 MEASURED PLUTONIUM RESUSPENSION AND RESULTING DOSE FROM AGRICULTURAL OPERATIONS ON AN OLD FIELD AT THE SAVANNAH RIVER PLANT IN THE SOUTHEASTERN UNITED STATES OF AMERICA. Milham, R.C.; Schubert, J.F.; Watts, J.R.; Boni, A.L.; Corey, J.C. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). pp p.409-420 of Transuranium nuclides in the environment. Vienna: International Atomic Energy Agency (1976).

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, CA, USA (17 Nov 1975).

See CONF-751105--.

Plutonium resuspension, based on air-sample activity, were measured during field preparation and planting of winter wheat at the Savannah River Plant (SRP). Plutonium was originally deposited in the field during the previous twenty years as a result of atmospheric releases from SRP's nuclear fuel processing facility located adjacent to the field, and from global fall-out following nuclear weapons tests conducted at other sites. During soil cultivation when the prevailing

wind speed ranged from 0 to 6.3 m/s airborne plutonium upwind of the field consistently averaged 1.7 fCi/m^3 . Airborne plutonium concentrations during the various activities associated with site preparation and planting averaged 210 fCi/m^3 at 7.6 m and 10 fCi/m^3 at 30.5 m downwind from the edge of the field. The air at face level on the tractor contained 49 fCi/m^3 . The average concentration of plutonium in the 0-5 cm soil layer following cultivation was 3100 fCi/g . Dose calculations based on measurements of resuspended plutonium indicated that the 70-year bone-dose commitment to an agricultural worker after one hundred 8-hour days would be 49, 210 or 1.8 mrem, depending on whether the worker remained in the tractor seat, 7.6 m downwind of the edge of the field or 7.6 m upwind of the edge of the field. Resuspension factors for the agricultural activities were $103 \times 10^{-8} \text{ m}^{-1}$ at 7.6 m downwind, $5 \times 10^{-8} \text{ m}^{-1}$ at 30.5 m downwind from the edge of the field, and $24 \times 10^{-8} \text{ m}^{-1}$ at the tractor location.

1867 (EUR--5441) RADIOACTIVE CONTAMINATION LEVELS IN THE AMBIENT MEDIUM AND IN THE FOOD CHAIN. QUADRIENNIAL REPORT, 1972--1975. (Commission of the European Communities, Brussels (Belgium)). 1976. 162p. (In French). NTIS (US Sales Only).

Prepared by Centre d'Etudes Nucleaires de Fontenay-aux-Roses (France). Dept. de Protection.

In the period 1972-1975, the EURATON-CEA Association continued its research in the following fields: human biology (study of iodine metabolism and its variability, study of the mineral composition of the human body); transfers of contamination from sources of pollution to man (dry and moist deposits of iodine on grass, transfers of Cr, Zn and Cd in aquatic chains, transfers of heavy metals in marine chains, transfers of iodine and mercury from soil and sediments, transfers in foodstuffs during processing and distribution); studies of the assessment of the radiological capacity of the environment and methods of assessing individual and collective doses.

1868 CONTENT OF ^{90}Sr IN THE BONE TISSUE OF THE POPULATION OF THE SOVIET UNION (1959 TO 1971). THE BASIC LAWS OF ITS ACCUMULATION AND DISTRIBUTION. Marei, A.N.; Borisov, B.K.; Petukhova, E.V. (Institut Biofiziki, Moscow (USSR)). J. Hyg., Epidemiol., Microbiol., Immunol.; 20: No. 3, 257-265(1976).

Based on the results of long-term observations, general laws were set up determining the dynamics of the ^{90}Sr concentration in the bone tissue of the population of the USSR between 1959 and 1971, the peculiarities of ^{90}Sr accumulation in different age groups and the inter-connections and dependences of ^{90}Sr intake and content in the human organism. Maximum ^{90}Sr concentrations were found in children born in the year when nuclear tests were carried out. The distribution of the frequency of cases showing different ^{90}Sr levels in uniform population groups was determined. Characteristic features of ^{90}Sr distribution in different bones of the skeleton and its changes in the course of time were demonstrated.

1869 PLUTONIUM TRANSPORT AND DOSE ESTIMATION MODEL. Martin, W.E.; Bloom, S.G. (Battelle Columbus Labs., Ohio (USA)). pp 385-398 of Transuranium nuclides in the environment. Vienna: International Atomic Energy Agency (1976).

From IAEA international symposium on

transuranium nuclides in the environment; San Francisco, CA, USA (17 Nov 1975).

See CONF-751105--.

A Standard Man is assumed to live in and obtain most of his food from a Pu-contaminated area at NTS. A Pu-transport model, based on the results of other studies at NTS, provides a basis for estimating rates of ^{239}Pu inhalation and ingestion as functions of the average concentration of ^{239}Pu ($C_{\text{sub}}(s) = \text{pCi/g}$) in the surface soil of the reference area. Assuming the transport system to be in equilibrium, the estimated inhalation and ingestion rates (pCi/d) are $0.002C_{\text{sub}}(s)$ and $0.269C_{\text{sub}}(s)$, respectively. A dose estimation model, based on parameters recommended in ICRP publications, is used to estimate organ burdens, accumulated doses, and dose commitments as functions of exposure time. Estimated doses (rems) due to inhalation and ingestion of ^{239}Pu for 50 years at the rates indicated above are: thoracic lymph nodes, $0.6C_{\text{sub}}(s)$; lung, $0.025C_{\text{sub}}(s)$; bone, $0.015C_{\text{sub}}(s)$; liver, $0.01C_{\text{sub}}(s)$; kidneys, $0.003C_{\text{sub}}(s)$; total body, $0.0007C_{\text{sub}}(s)$; and gastrointestinal tract (LLI), $0.0003C_{\text{sub}}(s)$. Inhalation accounts for 100% of the predicted dose to thoracic lymph nodes and lungs and for about 94% of the predicted dose to bone, liver, kidneys, and total body. According to ICRP recommendations for individual members of the public, the dose rate to the lungs should not exceed 1.5rem/a . According to the proposed model, the average concentration of ^{239}Pu in the soils of contaminated areas at NTS which would result in a predicted dose rate of 1.5rem/a to the lung is approximately 3nCi/g or about $170\mu\text{Ci/m}^2$.

1870 (CONF-760701-- , pp 539-553) AQUATIC EXPOSURE PATHWAYS: POTENTIAL EXPOSURE OF MAN FROM ENVIRONMENTAL TRANSPORT OF WASTE RADIONUCLIDES. Soldat, J.K. (Battelle Pacific Northwest Labs., Richland, WA). 1976.

From International symposium on management of waste from the LWR fuel cycle; Denver, CO, USA (11 Jul 1976).

Proceedings of the international symposium on the management of wastes from the LWR fuel cycle.

Radioactive wastes can reach the aquatic environment from normal liquid effluents of nuclear facilities, from acute accidental releases from such facilities, from transportation accidents, and from materials leached from underground disposal and transported to surface or well waters. Evaluation of aquatic exposure pathways requires knowledge of the release rates of the effluent, the chemical and physical form of the radionuclides, the type of receiving water (river, lake, estuary, ocean), and the usage of the waters by man. The potential aquatic pathways include drinking water, aquatic foods, swimming and boating, contaminated sediments, and crops and animal products from irrigated farms. Parameters and mathematical models for estimating exposure via these several pathways are discussed, and sample calculations are presented.

1871 (DP-MS--75-126) MODELING OF RADIATION DOSES FROM CHRONIC AQUEOUS RELEASES. Watts, J.R. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). 1976. Contract AT(07-2)-1. 14p. (CONF-760652--1). Dep. NTIS \$3.50.

From Health Physics Society meeting; San Francisco, CA, USA (27 Jun 1976).

A general model and corresponding computer code were developed to calculate personnel dose estimates from chronic releases via aqueous pathways. Potential internal dose pathways are

consumption of water, fish, crustacean, and mollusk. Dose prediction from consumption of fish, crustacean, or mollusk is based on the calculated radionuclide content of the water and applicable bioaccumulation factor. 70-year dose commitments are calculated for whole body, bone, lower large intestine of the gastrointestinal tract, and six internal organs. In addition, the code identifies the largest dose contributor and the dose percentages for each organ-radionuclide combination in the source term. The 1974 radionuclide release data from the Savannah River Plant were used to evaluate the dose models. The dose predicted from the model was compared to the dose calculated from radiometric analysis of water and fish samples. The whole body dose from water consumption was 0.45 mrem calculated from monitoring data and 0.61 mrem predicted from the model. Tritium contributed 99 percent of this dose. The whole body dose from fish consumption was 0.20 mrem calculated from monitoring data and 0.14 mrem from the model. Cesium-134,137 was the principal contributor to the 70-year whole body dose from fish consumption.

1872 SYSTEMS ANALYSIS MODEL FOR CALCULATING RADIONUCLIDE TRANSPORT BETWEEN RECEIVING WATERS AND BOTTOM SEDIMENTS. Booth, R.S. (Oak Ridge National Lab., TN). pp 133-164 of Environmental toxicity of aquatic radionuclides: models and mechanisms. Miller, M.W.; Stannard, J.N. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers Inc. (1976).

From 8. international conference on environmental toxicology; Rochester, NY, USA (2 Jun 1975).

See CONF-750672--.

Equilibrium radionuclide concentrations in waters receiving radioactive effluents and in bottom sediments associated with the receiving waters were calculated so that potential doses to man and biota and radionuclide buildup in the environment could be determined realistically. These calculations were performed to test the accuracy of simpler models, where receiving water concentrations were determined by neglecting the influence of bottom sediments. The simplified calculations were incorporated into environmental impact statements for nuclear power stations prepared by Oak Ridge National Laboratory (ORNL) for the U.S. Nuclear Regulatory Commission. A four-compartment systems analysis model was developed to predict dynamic radionuclide transfer. The dependent variables of the model are the receiving water, interstitial water intermingled with the bottom sediments, bottom sediment particles that undergo sorption-desorption reactions with the interstitial water, and bottom sediment particles that undergo only sorption reactions with the interstitial water. The model was used to generate two tables. The first table gives equilibrium radionuclide concentrations in the receiving water when radionuclide transfers to bottom sediments are possible, divided by the receiving water concentrations when transfers to bottom sediments are ignored. These factors are always less than unity, since radioactivity must be conserved, and adding sediments to the system adds another compartment where radionuclide concentrations will equilibrate. The other table lists ratios of equilibrium radionuclide concentrations in sediments, divided by their corresponding receiving water concentrations. These concentrations in the sediments can be used to calculate external doses to a person sunbathing or fishing.

THE AQUATIC ENVIRONMENT FROM THE NUCLEAR POWER INDUSTRY. Wrenn, M.E.; Jinks, S.M. (New York Univ. Medical Center). pp 229-265 of Environmental toxicity of aquatic radionuclides: models and mechanisms. Miller, M.W.; Stannard, J.N. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers Inc. (1976).

From 8. international conference on environmental toxicology; Rochester, NY, USA (2 Jun 1975).

See CONF-750672--.

The dosimetric implications from releases of radioactive materials to the aquatic environment from the nuclear power industry are evaluated in terms of the average per capita doses to substantial population groups associated with fuel cycle facilities. Past experience is used to make estimates of exposures which might be obtained circa 1982 from single or collective groups of facilities. This approach may be considered a critical path approach for substantial populations. The nuclides considered include the natural radionuclides, uranium and radium-226, and the man-made nuclides, ^{137}Cs , ^{134}Cs , ^{90}Sr , ^{131}I , ^{60}Co , ^{54}Mn , ^3H and other fission and activation products. Fuel cycle activities include mining and milling, fuel fabrication (no plutonium recycle), power generation, and fuel reprocessing. The largest per capita doses to substantial populations are one to ten millirems/year from ^{226}Ra resulting from uranium milling operations, past, present and future.

- 1874 REMOVAL OF PLUTONIUM FROM DRINKING WATER BY COMMUNITY WATER TREATMENT FACILITIES. Corey, J.C.; Boni, A.L. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). pp 401-408 of Transuranium nuclides in the environment. Vienna; IAEA (1976).

From Symposium on transuranium nuclides in the environment; San Francisco, Calif., USA (17 - 21 Nov 1975).

Plutonium removal factors (RF) averaged 14+-10 during a study of the effectiveness of three drinking-water treatment plants for removing plutonium from Savannah River water. Plutonium concentrations between 0.1 and 3.5 fCi/l were measured in raw and finished water samples. From 50 to 10000 litre samples of water were concentrated by ion exchange techniques and processed to determine the concentrations of plutonium-239, 240 and to derive plutonium RFs. The similarity between RFs observed for both plutonium and suspended solids suggests a colloidal behaviour for plutonium. Flocculation and filtration appear to be the primary factors in the water treatment process contributing to plutonium removal. The similarity between the plutonium contents of finished water from treatment facilities upstream and downstream of the Savannah River Plant (SRP) indicates that there is no measurable dose-to-man from SRP plutonium releases in the water. The 70-year bone dose commitment to an individual from consumption for one year of 1.65 litres per day of treated Savannah River water, based on the plutonium concentrations of finished waters from the three treatment facilities, is 5×10^{-5} mrem.

- 1875 RADIOACTIVE WASTE IN THE FRESHWATER ENVIRONMENT. Nelson, D.J. (Oak Ridge National Lab., TN). pp 262-272 of Energy and the environment cost-benefit analysis. Karam, R.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1976).

From Proceedings of energy and the environment - cost benefit analysis; Atlanta, GA, USA (23 Jun 1975).

See CONF-750697--.

The purpose of this paper is to review some of the research concerning radioactive waste releases to freshwater environments and to place these in perspective with respect to present and future needs for assessments of environmental costs.

- 1876 RADIOACTIVE WASTE IN THE MARINE ENVIRONMENT. Lowman, F.G. (Puerto Rico Nuclear Center, Mayaguez). pp 273-289 of Energy and the environment cost-benefit analysis. Karam, R.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1976).

From Proceedings of energy and the environment - cost benefit analysis; Atlanta, GA, USA (23 Jun 1975).

See CONF-750697--.

The introduction of radionuclides into near-shore marine areas is considered in relation to Federal Regulations and to the hazards posed to man and to marine organisms living near the site of introduction of the contaminants. The use of the critical pathway concept for evaluating hazards to man from radionuclides in his food is discussed, and the specific activity concept is applied to demonstrate the degree of hazard to man which could result from normal reactor operation using seawater for the coolant. The relative hazards to marine organisms from naturally occurring and reactor-produced radionuclides are also evaluated.

- 1877 ENVIRONMENTAL AND PUBLIC HEALTH CONSEQUENCES OF THE CONTROLLED DISPOSAL OF TRANSURANIC ELEMENTS TO THE MARINE ENVIRONMENT. Hetherington, J.A.; Jefferies, D.F.; Mitchell, N.T.; Pentreath, R.J.; Woodhead, D.S. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Fisheries Radiobiological Lab.). pp 139-153 of Transuranium nuclides in the environment. Vienna; International Atomic Energy Agency (1976).

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, CA, USA (17 Nov 1975).

See CONF-751105--.

Experience from the controlled disposal of liquid radioactive wastes from the nuclear power programme of the United Kingdom has shown that the only releases of transuranic elements of potential environmental significance occur following fuel reprocessing. In this context attention has been directed principally to plutonium because of its long half-life and high radiotoxicity, although the next most important transuranic element, americium, has also been studied. The paper reviews the radiological significance of these radionuclides following discharge to the marine environment, in terms of both dose to man and to environmental resources. Both plutonium and americium are found in each of the three compartments, water, seabed sediment and biota, the highest concentrations being found in sediment, particularly the fine mud found in estuaries close to the Windscale outfall. Both elements have been detected in a range of biota including seaweeds, fish and shellfish. The public health significance of those biota which represent potential human exposure pathways has been evaluated and estimates of the dose rate to critical groups from current discharges have been made. In parallel studies attention has been focussed on the exposure of fish and shellfish stocks. The dose rates have been estimated by use of environmental data on contamination levels combined with simple dosimetry models, and the results and their significance are discussed.

1878 COST-BENEFIT AS WEIGHED ON GENETIC SCALES. Grahn, D. (Argonne National Lab., IL). pp 371-386 of Energy and the environment cost-benefit analysis. Karam, R.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1976).
From Proceedings of energy and the environment - cost benefit analysis; Atlanta, GA, USA (23 Jun 1975).

See CONF-750697--.

The genetic cost that may be incurred by exposure to mutagenic agents in the coal and nuclear fuel cycles is assessed, using as a point of departure the presently estimated burden of spontaneously occurring genetic defects in human populations. Risk estimates are necessarily derived from radiation studies, but chemical mutagenic hazards can probably be evaluated relative to the known dose-response relationships of radiation exposure. Cost-benefit analyses for the coal and nuclear fuel cycles are discussed and translated into monetary terms. Coal-associated risks are almost entirely somatic while nuclear risks are somatic and genetic in equal proportions. Dollar costs per man-rem are concluded to be in the \$100 range. Pollution abatement costs for the nuclear cycle lie in the range of several hundreds to many thousands of dollars per man-rem reduction. It is considered appropriate to incur such costs, because genetic risks to future generations involve primarily societal and ethical issues rather than economic considerations.

1879 (CONF-760912--1) RADIATION EXPOSURE AND THE WOMAN WORKER: BIOLOGICAL AND LEGAL PARAMETERS. Carver, J.S. (Oak Ridge National Lab., Tenn. (USA)). 1976. Contract W-7405-ENG-26. 6p. Dep. NTIS \$3.50.

From Women at work symposium; Duarte, CA, USA (29 Sep 1976).

The interpretation of federal and state legislation and regulations concerning the radiation protection of women in the workplace has not been a clear and straightforward procedure. On one hand, the safety of all workers, independent of sex, imposes a specific directive for the enforcement of working standards in general. On the other hand, must allowance be made in setting radiation standards for the particular biological characteristics of workers, some of whom are women. Title VII of the Civil Rights Act provides equal employment opportunity for women and is now being enforced. All legal questions aside, men and women are decidedly different in one aspect; only women can conceive and carry a fetus and studies have shown that, in humans, the most radiosensitive stage of the fetus is during the first trimester of pregnancy. Possible legal and socio-economic aspects of questions posed by the employment of women by the nuclear industry are considered. (CH)

1880 (CONF-7610137--1) COMMENTS ON MUTAGENESIS RISK ESTIMATION. Russell, W.L. (Oak Ridge National Lab., Tenn. (USA)). 1976. Contract W-7405-ENG-26. 15p. Dep. NTIS, PC A02/MF A01.

From Workshop on methods in mammalian mutagenesis; Bar Harbor, ME, USA (6 Oct 1976).

Several hypotheses and concepts have tended to oversimplify the problem of mutagenesis and can be misleading when used for genetic risk estimation. These include: the hypothesis that radiation-induced mutation frequency depends primarily on the DNA content per haploid genome, the extension of this concept to chemical mutagenesis, the view that, since DNA is DNA, mutational effects can be expected to be qualitatively similar in all organisms, the

REC unit, and the view that mutation rates from chronic irradiation can be theoretically and accurately predicted from acute irradiation data. Therefore, direct determination of frequencies of transmitted mutations in mammals continues to be important for risk estimation, and the specific-locus method in mice is shown to be not as expensive as is commonly supposed for many of the chemical testing requirements.

1881 PRACTICAL EVALUATION OF MUTAGENICITY DATA IN MAMMALS FOR ESTIMATING HUMAN RISK. Brewen, J.G. (Oak Ridge National Lab., TN). Mutat. Res.; 41: 15-24(1976).

Chromosomal aberrations are known to constitute a significant portion of the genetic risk from practically all mutagenic agents. These effects are diverse in both nature and in the stage of the germ cells' life cycle at which they are produced. Arguments are made pointing out many of the problem areas in our understanding the significance of chromosomal aberrations in relation to genetic risk. Data are summarized that offer explanations as to why so few chromosomal effects are recovered after treating spermatogonial stem cells, how chromosome damage and dominant lethality are correlated when postmeiotic germ-cell stages are treated with MMS, and why so few reciprocal translocations are recovered after irradiation of oocytes.

1882 (AED-Conf--76-134-048) MONITORING OF PATIENTS WITH ELECTRICAL CARDIAC PACEMAKERS IN RADIOTHERAPY. Stockberg, H.; Bisping, H.J. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Roentgenologie und Strahlenheilkunde, Abt. Radiologie). 1976. 10p. (In German). (CONF-760592--50). TIC.

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976). 2 figs.; 7 refs..

Within the framework of radiotherapy, the influences due to radiation and other disturbing sources on the function of implanted cardiac pacemakers on the one hand, and the differing interference susceptibility of various versions of pacemakers on the other hand, are theoretically and practically examined. Patients, or pacemakers, were monitored continuously over a long period of time with a measuring device described more closely here. Even if no damaging effects to the pacemaker function through relatively high radiation doses could be detected, slight transferable interference pulses and in one case, the thus caused interference on the stimulation system, were observed on the touchable surface of a therapy system. It is thus advisable to perform an E.C.G. or pulse control of the patient.

1883 BENEFIT: RISK COMPARISONS IN DIAGNOSTIC RADIOLOGY. Oosterkamp, W.J. (Philips Research Labs., Eindhoven, Netherlands). Medicamundi; 21: No. 1, 2-6(1976).

Benefit and risks in radiodiagnostic examination, either with x-rays or with radioactive isotopes, can be expressed in restored health and health impaired by radiation or lives saved and estimated lives lost as a result of genetic or somatic radiation damage. Published data on benefit-risk comparisons for mass stomach and chest surveys show a considerable benefit surplus. It is demonstrated that this is also true in the case of clinical examinations of the sick. Efforts should be concentrated on better ways and means to reduce the number of diagnostic errors. Risk estimates should be made as

realistic as possible.

- 1884 (AED-Conf--76-168-001) PHARMACOLOGICAL AND BIOKINETIC VALUES OF SUP(99m)TC-PHOSPHORUS COMPLEXES. Kriegel, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Abt. fuer Nuklearbiologie). 1976. 8p. (In German). (CONF-760593--15). Dep. NTIS (US Sales Only), PC A02/MF A01.

From Germany X-ray Congress; Essen, F.R. Germany (13 May 1976).

6 figs.; 4 tabs.; 29 refs..

The study deals with the diagnostic value of some Tc compounds for skeleton scintiscanning. The following sup(99m)Tc compounds were studied with regard to organ distribution, organ concentrations, and biological behaviour in the skeleton and the organs: sup(99m)TcO₄, sup(99m)TcO₄ + Na₂H₂ (EHDP), sup(99m)TcO₄ + SnCl₂. The biological behaviour of the different sup(99m)Tc complexes in the kidneys, the liver, the lungs, the muscles and the skeleton is compared. A radiopharmaceutical is particularly suitable for diagnostics in a special organ when it reaches a high concentration in this organ and at the same time has a high tissue and blood clearance rate. Apart from this, the acute toxicity dose, i.e. the LD 50%/30 for mice and rabbits is given for these radiopharmaceuticals, and the values are compared critically. The increased radiation exposure due to skeleton scintiscanning with these radiopharmaceuticals is also critically compared for the different compounds.

- 1885 (BNL--21313) DOSIMETRIC CONSIDERATIONS RELATIVE TO RADIONUCLIDES FOR THYROID DIAGNOSIS AND THERAPY. Atkins, H.L. (Brookhaven National Lab., Upton, N.Y. (USA)). 1976. 12p. (CONF-760444--8). Dep. NTIS \$3.50.

From Symposium on radiopharmaceutical dosimetry; Oak Ridge, TN, USA (26 Apr 1976).

Recent changes have occurred in the radionuclidic approach to the diagnosis and therapy of thyroid diseases. These changes have been directed toward reduction of radiation dose by the use of short-lived radionuclides for imaging and toward better control of late effects of therapy by substituting iodine-125 for iodine-131. Imaging of the thyroid is now widely performed following the administration of technetium-99m or iodine-123. Some problems exist relative to the use of technetium-99m in that the distribution of radioactivity in the thyroid is not always identical to the distribution of radioiodine. Iodine-123 represents a substantial advance over iodine-131 despite contamination of the former with small amounts of other radioiodines. The high incidence of induced hypothyroidism following iodine-131 therapy of thyrotoxicosis has spurred interest in the use of iodine-125. The biological effectiveness of iodine-125 is believed to be greater because of the high abundance of Auger electrons and possibly because of chemical effects following molecular disruption. Clinical results to date are discussed. (auth)

- 1886 (COO--3173-16) PATHOPHYSIOLOGIC EFFECTS OF STABLE IODINE USED AS A THYROIDAL BLOCKING AGENT TO REDUCE THYROID RADIATION EXPOSURE. PROGRESS REPORT, NOVEMBER 1, 1975--OCTOBER 31, 1976. Becker, D.V.; Hurley, J.R. (Cornell Univ., New York (USA). Dept. of Medicine). 1976. Contract E(11-1)-3173. 8p. Dep. NTIS \$3.50.

In an effort to determine whether iodide administration in man can induce injury to

thyroid follicular cells similar to that demonstrated in lower animals, this study measures thyroglobulin, thyroxine and triiodothyronine and thyroid autoantibodies in the serum before and after administration of iodine in a variety of patients. In the last eight months primary efforts have been devoted to the development of a high specificity and sensitivity radioimmunoassay of thyroglobulin and its preliminary clinical application. Human thyroglobulin obtained from operative specimens was purified and its identity and purity established. Rabbits were injected with thyroglobulin for 30 weeks with the appearance of significant titres of antibodies within 6 weeks. The antibody developed was examined for immunological purity and used in a radioimmunoassay system with thyroglobulin labeled in this Laboratory with ¹²⁵I.

- 1887 (DEU--76-16) X-RAY DIAGNOSTICS, X-RAY THERAPY, DIAGNOSTICS AND THERAPY WITH RADIOACTIVE MATERIALS IN FREE MEDICAL PRACTICE. Setzer, H.D. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Strahlenhygiene). 1976. 101p. (In German). INIS.

24 figs.; 16 tabs.; 57 refs. Available from ZAED.

On the basis of the documents of the Kassenaerztliche Vereinigung Niederbayerns in Straubing, the work of the established general practitioners in the fields of X-ray and nuclear medicine was investigated for the 1st quarter of 1971, and the X-ray diagnostic services rendered were evaluated according to age and sex. 2/3 of all doctors participating in a health insurance plan in Lower Bavaria are general practitioners; all other fields are represented less often than in Munich. The values for the whole Federal Republic are in between. Internal specialists, radiologists, and urologists together carry out 85.7% of the ten examinations which contribute most to the total gonadal dose. An application of the data on the 1st quarter to the annual value is only possible by allowing for an error of 13.1%. All in all, 6% more X-ray services are administered to men than to women. For both sexes, the genetically most important group of 15-34 resp. 15-39 years of age is highly represented, although young men receive X-ray diagnostics more frequently. X-ray therapy makes up only about 0.5% of all services. Nuclear medical diagnostics is employed to the same extent by radiologists and internal specialists, while therapy with radioactive substances is almost exclusively provided by radiologists. Relative to the population density, radioactive substances are more often used in Lower Bavaria than in West Berlin.

- 1888 (TNO-RD-I--7609-178) SEMINAR ON THE PROBLEMS OF PREPARATION AND APPLICATION OF RADIOPHARMACEUTICALS. van Stekelenburg, L.H.M. (Gezondheidsorganisatie TNO, Arnhem (Netherlands). Radiologische Dienst). 1976. 5p. (In Dutch). Dep. NTIS (US Sales Only), PC A02/MF A01.

Due to the ample availability of short-living radioisotopes, their application in radiopharmaceuticals has increased quantitatively. As a consequence, the radiation burden for patients has diminished but the hazards for personnel have increased. Legislation cannot keep the pace with development. It is suggested to compare the new legislation of all European community countries and strive for unification. It is recommended that future legislation take into account medical personnel and their protection in regional medical centres, as well as the patients and the conditions for their dismissal

from hospitals after radioactive treatment, and the people at home surrounding the patient and their protection from contamination.

1889 REDUCTION OF DOSE IN TOMOGRAPHY.

Pagano, C. (Ospedale Galliera, Genoa (Italy). *Reporta Radiologia*). pp 337-340 of *New image in tomography*. Oliva, L.; Berry, R.J. (eds.). Amsterdam, Netherlands; *Excerpta Medica* (1976).

From Symposium *Actualitatis Tomographiae*; Genoa, Italy (11 - 13 Sep 1975).

4 figs..

A reduction of the dose absorbed by the patient during tomographic X-ray investigations can be obtained by using intensifying screens made of rare earths of the lanthanide group.

1890 RADIATION DOSE TO HUMANS FROM /SUP 99M/ TC LABELED DIHYDROTHIOCTIC ACID (DHTA).

Vanek, K.N. Gainesville, FL; Univ. of Florida (1976). 12Sp. University Microfilms Order No. 77-8233.

Thesis (Ph. D.).

Dihydrothioctic acid (DHTA) is a new /sup 99m/Tc-labeled hepatobiliary imaging agent for liver/gall bladder visualization and for diagnosing acute cholecystitis. Nineteen patients with normal liver function were denied oral intake of food or drink after midnight and injected intravenously the following morning with 4mCi /sup 99m/Tc-DHTA, prepared from a commercial kit. Each patient was scanned in a supine position from the mid-thoracic to mid-thigh regions. Scans were performed at various times from 0.25 to 12 hours after DHTA administration; 3 to 10 scans being recorded for each patient. The patients were allowed to eat fatty meals at the normal noon and evening meal times thereby inducing the gall bladder to empty. A dual five-inch rectilinear scanner interfaced to a PDP-8/I computer with 16K of core memory was used for data collection. Data were recorded as the number of counts detected by each probe over a 6.35mm segment. Scanner speed was set so the area of interest could be scanned within 15 minutes. New concepts and methods for organ boundary definitions and compensation for overlapping organs were developed and utilized to obtain the counts within each source organ for each detector. A geometric means of the counts from the two detectors was then calculated for use in cumulated activity determinations.

1891 SHORTLIVING RADIOISOTOPES USED IN

HOSPITALS. Fallais, C.J. (Institut National des Radioelements, Brussels (Belgium)). *Ann. Biol. Anim. Biochim., Biophys.*; 1: No. 3, 235-251(1976). (In French).

Different short-lived radioisotopes used in nuclear medicine are described not only in terms of preparation, medical interest, but also in respect of the radiation dose for the hospital workers. Specially the actual use (radioisotope generators) and the future medicine with cyclotron products are discussed.

1892 (NP--21325) DEPOSITION OF AEROSOLS IN THE HUMAN AIRWAYS.

Ferron, G.A. (Technische Hogeschool Delft (Netherlands)). 1976. 120p. Dep. NTIS (US Sales Only), PC A06/MF A01.

Thesis.

Experimental models of the human respiratory system were used to study the deposition of polydisperse aerosols by gravity, Brownian motion, or impaction. It is pointed out that the relative importance of each deposition mechanism depends upon particle size, solubility, and unit density. A spiral

centrifuge used to generate aerosols is described, equations to calculate deposition of aerosols are included, and results of studies using radioactive and nonradioactive aerosols are reported. Applications of the respiratory tract model for nuclear medicine diagnostic studies and for environmental aerosol toxicity studies are suggested.

1893 (CONF-751022--), pp 65-74)

CARCINOGENESIS AS AN END POINT IN HEALTH IMPACT ASSESSMENT. Schneiderman, M.A. (National Cancer Inst., Bethesda, MD). 1976.

From 3. life sciences symposium; Los Alamos, NM, USA (15 Oct 1975).

Impact of energy production on human health: an evaluation of means for assessment.

All sources of energy production, with perhaps the exception of falling water, wind, and geothermal sources, appear to have associated carcinogenic hazards. Epidemiological information does not allow us to pinpoint single "causes," but urban dwellers, coal miners, and petroleum refinery workers all appear to be at increased risk of cancer. Radiation--cancer relationships have been shown in exposed populations, and work is currently under way assessing the risks of former Atomic Energy Commission workers. With the exception of radiation exposure, there are few human data for estimating dose--response relationships to environmental carcinogens. At very low doses for add-on type exposures, safety-oriented behavior leads us to assume no thresholds and to operate as if the dose--response curve in man is likely to be linear.

1894 (AED-Conf--76-168-008) RADIATION EFFECTS ON HIGH-MOLECULAR RIBONUCLEIC ACID.

Schmitt, G.; Seeber, S.; Ewen, K.; Reinecke, V. (Essen Univ. (Gesamthochschule) (Germany, F.R.)). *Strahlenklin.*. 1976. 4p. (In German). (CONF-760593--6). INIS.

From Germany X-ray Congress; Essen, F.R. Germany (13 May 1976).

Experimental findings concerning radiation effects on RNA are sparse and sometimes contradictory. This paper therefore investigated the influence of various kinds of weakly ionizing radiation (300 kV X-rays, ⁶⁰Co γ-rays, 43 MV X-rays, 43 MeV electrons) and one kind of highly ionizing radiation (neutrons with a mean energy of 10 MeV) on high-molecular RNA of the Novikoff ascites hepatoma of the rat. 6 hours after partial-body irradiation, high-molecular RNA was labelled in vitro with ³²P-orthophosphate. Dose effect relations for the specific activities of 45 S of nuclear RNA and 18 S and 28 S of ribosomal RNA as well as changes in the nucleotide composition were analyzed. The RBW values calculated from D₀ are of the same order of magnitude as the data known for other biological parameters (e.g. the ability to form clones).

1895 (ERDA-tr--227, pp 37-42) CHANGES IN DNA METABOLISM IN RADIOSENSITIVE TISSUES OF RATS WITH CHRONIC RADIATION LESION.

Elkina, N.I. 1976. Translated from *Radiobiologiya*; 16: No. 4, 513-517(1976).

Radiobiology. A study was made of DNA metabolism in bone marrow, spleen and thymus of rats exposed to prolonged daily γ-radiation at the rate of 25 R per day. Some decline in DNA content per gram tissue was observed in bone marrow. Increased biosynthesis of DNA in this tissue was observed within the first 10 days of exposure. More marked changes in DNA metabolism were observed in the spleen and thymus, and they progressed with accumulation of radiation doses.

- 1896 (BNL--21711) CARCINOGENIC EFFECTS OF RADIATION-INTRODUCTION. Setlow, R.B. (Brookhaven National Lab., Upton, N.Y. (USA)). 1976. Contract E(30-1)-16. Sp. (CONF-760861--1). Dep. NTIS \$3.50.

From 7. international congress on photobiology; Rome, Italy (29 Aug 1976).

The weight of experimental evidence reviewed indicates that UV damage to DNA, probably pyrimidine dimers, is the best molecular candidate for the initiating damage that leads to skin cancer. It is postulated that the carcinogenic action spectrum should be similar to the DNA action spectrum filtered through the upper layer of skin.

- 1897 (COO--2066-28) PROGRESS REPORT, SEPTEMBER 1, 1975--APRIL 1, 1976. Borek, E. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). 1976. Contract E(11-1)-2066. 6p. Dep. NTIS \$3.50.

Hypermethylation of the DNA of mammalian cells exposed to uv irradiation was demonstrated. The extent of hypermethylation is a function of the log of the uv dose. The synthesis in vitro of a specific protein, ovalbumin, is potentiated by the addition of tRNAs from the oviduct of mature laying hens or from the oviduct of immature chicks which have been previously stimulated by estrogen. Ethionine, a hepatocarcinogen in female rats, can simulate the effect of an estrogen, both cytological and in ovalbumin synthesizing capacity, in the oviduct of the immature chick.

- 1898 (GWI-R--2-76) RELATIVE BIOLOGICAL EFFICIENCY OF INTERMEDIATE ENERGY NEUTRONS AND ^{60}Co RAYS FOR INDUCTION OF CHROMOSOMAL ABERRATIONS IN CHINESE HAMSTER FIBROBLASTS. Sturelid, S.; Bergman, R. (Uppsala Univ. (Sweden). Gustaf Werner Institutet). 1976. 19p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Intermediate energy neutrons are unique in that a considerable fraction of critical interactions and of dose absorbed is not associated with ionization but with atomic collision. It is still unknown to what extent the qualitative difference in primary damage after atomic collision compared to that of ionization and excitation becomes expressed at biological levels. Chromosomal aberrations were studied in Chinese hamster fibroblasts exposed for 5-8 hours at 22 degree C to intermediate energy neutrons, mean energy 8.5 keV, or to ^{60}Co -gamma rays. RBE at the 10 per cent aberration frequency level in S-phase were 2.2+-0.6 for total aberrations, 2.1+-0.6 for chromatid breaks and 1.8+-0.5 for exchanges. For each chromatid aberration observed after recovery, about 200 bondbreaking atomic collisions besides 3000 primary ionizations should have occurred in DNA. However, the extent to which the aberration response is due to atomic collisions is not clear.

- 1899 ULTRAVIOLET IRRADIATION EFFECT ON HUMAN PLATELET FUNCTION. Lawler, J.W. Chestnut Hill, MA; Boston Coll. (1976). 165p. University Microfilms Order No. 76-10,388. Thesis (Ph. D.).

Treatment of human blood platelets with ultraviolet light (uv) results in changes of several physiological functions. When uv-treated platelets are stirred in the presence of fibrinogen and calcium ions aggregation occurs. The amount of aggregation is dependent upon the uv dosage and wavelength, the

fibrinogen concentration and the calcium concentration. Maximum aggregation occurs with a 250 joule/m² dosage at 245 nm wavelength in the presence of 0.5 mg/ml fibrinogen and 2 mM calcium ion. Aggregation induced by uv is partially inhibited by apyrase or by metabolic inhibitors. Hirudin, a potent inhibitor of thrombin action, did not inhibit uv-induced aggregation. Pretreatment with uv decreases the ability of platelets to support clot retraction. An action spectrum for the effect has maxima at 210 nm and at 280 nm indicating the chromophore is a protein containing aromatic amino acids. Dosages greater than 120 seconds of exposure to a Hanovia High-Pressure Quartz Mercury-Vapor Lamp render the platelets incapable of supporting retraction of fibrin clots induced by thrombin. Irradiation with 250 nm uv has the ability to stimulate retraction of fibrin clots induced by reptilase. Thrombin-mediated platelet functions, including binding, release and aggregation are also inhibited by uv irradiation. The number of binding sites per platelet is reduced by 43 percent with a 90 second dose of uv. For the same dose, the total amount of serotonin released is decreased from 81 percent to 41 percent while the thrombin-induced aggregation is completely inhibited. An action spectra contains two maxima, at 245 nm and 280 nm. The effect of uv is compared with the effect of dithiothreitol (DTT) as a test of the hypothesis that uv-induced aggregation is mediated by disulfide bond disruption. (Diss. Abstr. Int., B)

- 1900 RECOVERY DURING RADIATION MUTAGENESIS. Deen, D.F.; Shaw, E.I. (Kansas Univ., Lawrence (USA)). pp v.1 p.19-28 of Biological and environmental effects of low-level radiation. Proceedings of a symposium on biological effects of low-level radiation pertinent to protection of man and his environment organized by the IAEA and the WHO and held in Chicago, 3-7 November 1975. Vienna; IAEA (1976). From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Many variables (e.g. cell inoculum size, mutagen dose, expression time, and concentration of the selective agent) are known to affect the induced mutation frequency obtained in cultured mammalian cells. The authors have studied the effects of several parameters on the frequency of radiation-induced resistance to 8-azaguanine in asynchronous V79-171B hamster cells. Inoculation with 10⁵ cells was followed by graded doses of radiation, expression times were optimized to maximize mutation frequency, and then the treated cells were challenged with 8-azaguanine for ten days. The optimal expression times which maximized mutation frequency were dose dependent and are in the range of 14-24, 24, and 24-36 hours respectively for doses of 250, 40 and 800 rads. A time interval of 24 hours between two 250-rad fractions resulted in a mutation frequency smaller than that obtained from administration of a single 500-rad dose. With 36 hours between halves of the dose, the induced mutation frequency was an order of magnitude lower than that produced by a single dose and actually below the unirradiated (spontaneous) frequency. Maintenance of cells after irradiation first at 18°C for 24 hours, and then allowance of expression at 37°C for 24 hours, increased both the spontaneous and induced mutation frequency. A one-hour postirradiation balanced salt-solution treatment did not affect the number of spontaneous mutants that arose, but reduced the number of induced mutants. Thus, the balanced salt treatment lowers the induced mutation

frequency about a factor of two. The possible significance of these results are discussed with respect to the role of radiation repair mechanisms during mutagenesis, and to recovery at low dose rates. A working hypothesis is advanced to explain the possible mechanism which causes expression time to vary as a function of the dose of mutagen.

- 1901 ONCOGENIC TRANSFORMATION IN VITRO BY X-RAYS: INFLUENCE OF REPAIR PROCESSES. Terzaghi, M.; Little, J.B. (Harvard School of Public Health, Boston). pp 327-334 of Biology of radiation carcinogenesis. Yuhas, J.M. (ed.). New York; Raven Press (1976).

From Conference on the biology of radiation carcinogenesis; Gatlinburg, TN, USA (7 Apr 1975).

See CONF-750443--.

X-ray induced oncogenic transformation has been demonstrated in a C3H mouse embryo derived cell line. The transformation appears to be produced by a specific effect of the radiation on the cells rather than by an effect mediated by nonspecific cell killing. An exponential increase in transformants per surviving cell with doses of radiation between 50 and 400 rad was observed. At doses above 400 rad delivered to exponentially growing cells, the transformation frequency remained at approximately two transformants/ 10^3 surviving cells. Little decline in survival occurred at doses below 300 rad. Survival declined exponentially at higher doses with a D_0 of 180 rad. When cells were irradiated in density-inhibited plateau-phase growth and allowed to repair potentially lethal radiation damage by delaying subculture for 3 hr post-irradiation, D_0 of the survival curve increased to 250 rad. Under these conditions, the transformation frequency continued to increase exponentially with doses up to 1,000 rad. Analogous trends in the kinetics of cell survival and oncogenic cell transformation make possible a preliminary examination of the possible role of repair or misrepair in the process of oncogenic transformation in vitro.

- 1902 EFFECT OF CALF THYMUS EXTRACT ON RADIATION-INDUCED CHANGES IN LYSOSOMAL ACID PHOSPHATASE ACTIVITY IN POLYMORPHONUCLEARS IN MICE. Aleksandrowicz, J.; Wazewska-Czyzewska, M.; Lisiewicz, J.; Bodzon, A.; Sasiadek, U.; Plonka, I. (Medical Academy and Dept. of Biology, Krakow). Acta Med. Pol.; 17: No. 4, 249-254(1976).

It was found that the thymus extract (TFX) administered intraperitoneally in a dose of 0.5 mg in 0.1 mm³ of 0.9 percent NaCl caused in Albino-Swiss mice a statistically significant rise in the activity of lysosomal acid phosphatase (AP) determined by the cytochemical method of Barka and Anderson in peripheral blood neutrophils. TFX prevented radiation-induced (450 r) fall in the number of these cells observed 14 days after radiation exposure. TFX modified, moreover, changes in the activity of this enzyme during radiation exposure. In the irradiated mice in the control group a rise was observed in AP activity. In mice receiving TFX a significant fall on this activity occurred. After 64 days from radiation exposure no statistically significant changes were observed between the control irradiated group and the group receiving TFX.

- 1903 EFFECTS OF RADIATION AND PORPHYRIN ON MITOSIS AND CHROMOSOMES IN HUMAN HEMATOPOIETIC CELL LINES. Tan, J.C. (Valaparaíso Univ., IN); Huang, C.C.; Fiel, R.J. J. Med. (Westbury, N.Y.); 7: No. 2, 169-176(1976).

The effect on mitosis of a human hematopoietic cell line RPMI-1788 treated with a metal chelate (Zn^{++}) of meso-tetra (p-carboxyphenyl) porphine (Zn-TCPP) alone at various concentrations or in combination with gamma-irradiation at various doses were studied. The results showed that both Zn-TCPP and radiation were effective in interfering with normal mitosis and that the effect of radiation was relatively more effective. Data also suggest interacting effects between Zn-TCPP and gamma-irradiation. At low doses of radiation, Zn-TCPP potentiated the effect of radiation. The reverse seemed to be true at a high dose of radiation. The effects of two porphyrins (Zn-TCPP and hematoporphyrin) and radiation on chromosomes were also studied. Chromosomal aberrations characteristic of radiation were observed. The porphyrins were found not to be effective chromosome-breaking agents under the experimental conditions tested.

- 1904 INHIBITION OF REPAIR OF RADIATION-INDUCED CHROMOSOME BREAKS. EFFECT OF PHENOL IN CULTURED HUMAN LEUKOCYTES. Sangyo Igaku; 18: No. 5, 478-479(1976).

It was previously reported that rejoining of radiation-induced chromosome breaks was inhibited by benzene in vitro. Benzene is known to be metabolized quickly in the tissue into some of phenols, among which phenol is the most predominant metabolite. In the present study, therefore, phenol was tested on its inhibitory effect on rejoining of radiation-induced chromosome breaks in cultured human leukocytes by the use of dosage fractionation method.

- 1905 (ORO--4568-3) ALTERATIONS INDUCED BY X-RAYS AND ULTRAVIOLET LIGHT ON THE SYNTHESIS AND MAINTENANCE OF MACROMOLECULAR COMPONENTS WITHIN CELLS. PROGRESS REPORT, MARCH 1, 1975--FEBRUARY 1, 1976. Billen, D. (Tennessee Univ., Knoxville (USA)). 1976. Contract AT(40-1)-4568. 18p. Dep. NTIS \$3.50.

Progress is reported on the following research projects: role of DNA polymerases and DNA ligase in repair synthesis in *Escherichia coli* and *Bacillus subtilis* following exposure to x radiation; effects of Tween-80 on permeability of hamster ovary cells to nucleotides; effects of uv radiation on DNA metabolism in *B. subtilis*; and studies on the nature of repair-deficient mutants of *B. subtilis*. (HLW)

- 1906 EFFECT OF LOW-DOSE GAMMA IRRADIATION ON ENTEROTOXIN-POSITIVE STRAINS OF CLOSTRIDIUM PERFRINGENS TYPE A. Barnhart, H.M. Jr. Lincoln, NE; Univ. of Nebraska (1976). 105p. University Microfilms Order No. 77-897.

Thesis (Ph. D.).

The effect of low-dose gamma irradiation on selected enterotoxin producing strains of *Clostridium perfringens* Type A was studied. The radioresistance of three strains NCTC-8239, NCTC-10239 and NCTC-8798 in 0.1 percent peptone water, beef gravy and ground beef was determined for both vegetative cells and spores. D_{10} values were approximately 30 Krad in 0.1 percent peptone water and 175 Krad in beef menstrooms. D_{10} values for spores were approximately 250 Krad in 0.1 percent peptone water and 335 Krad in beef. Low-level irradiation induced a 2 hr lag for cell recovery at 37°C following irradiation though this was strain dependent. Heat resistance of vegetative cells decreased following irradiation, although one strain was stimulated in growth response and unaltered in its heat resistance. Spore activation and germination

were not affected by low-level irradiation. Spores were not significantly inactivated at this level. Irradiation had no effect on subsequent survival of vegetative cells stored at cold temperatures. Enterotoxin production by irradiated cultures was not affected by the irradiation treatment. A method for quantitating *C. perfringens* enterotoxin using crossed-immunoelectrophoresis was developed. It was found that this technique could detect at least .05 g of enterotoxin, could utilize crude enterotoxin preparations and was more sensitive than other methods based on biological activity.

- 1907 ORGANOLEPTIC CHANGES IN THE BOVINE AND SWINE FATS FOLLOWING TREATMENT WITH GAMMA-RAYS. Jordanov, I. (Akademiya na Selskostopanskite Nauki, Sofia (Bulgaria). Veterinaren Institut za Infektsiozni i Parazitni Bolesti). Vet. Med. Nauki (Sofia); 13: No. 2, 66-71(1976). (In Bulgarian).

Studied were bovine and swine fats that had been treated with gamma-rays at the rates of 0.10 to 2.00 Mrad, in the presence of oxygen and in an atmosphere containing no oxygen as well as under storage conditions at 2 to 4 deg C, and -18 and up to -20 deg C, for 45 and 90 days, respectively. When doses of 0.25 Mrad were used no changes in the organoleptic properties were observed. Fats that were treated at the rate of more than 0.25 Mrad in the presence of oxygen assumed 'side' smell and taste. If irradiation was carried out in the absence of oxygen no such deviations from the normal taste and odor were noted - at rates of up to 0.70 Mrad for the swine fats, and at rates of more than 0.50 Mrad for the bovine fats. Destruction of the yellow pigment in the bovine fats was observed with doses higher than 0.70 Mrad. The changes in the organoleptic properties corresponded to the changes taking place with the peroxides, the water soluble fatty acids, and the epihydrinaldehyde. Changes in the organoleptic properties (odor and taste) in the bovine fats took place at lower doses of irradiation than in the swine fats.

- 1908 (AED-Conf--76-073-002) PRACTICAL RADIATION PROTECTION. Kiefer, H. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). 1976. 2p. (In German). (CONF-760388--3). TIC.

From Safety week on safety as a task for engineers; Karlsruhe, F.R. Germany (29 Mar 1976).

The paper discusses protective measures against external radiation and against the incorporation of radioactive substances and describes methods of environmental monitoring.

- 1909 (AED-Conf--76-073-003) PRINCIPLES OF RADIATION PROTECTION AND THE RADIATION PROTECTION ORDINANCE. Koelzer, W. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). 1976. 6p. (In German). INIS.

From Safety week on safety as a task for engineers; Karlsruhe, F.R. Germany (29 Mar 1976).

7 refs..

Brief survey of the principles of the ICRP recommendations, the X-Ray Ordinance, and the Radiation Protection Ordinance and its amendment.

- 1910 (AED-Conf--76-134-013) RADIATION PROTECTION IN NUCLEAR MEDICINE. MEASUREMENT ASPECTS. Maushart, R. (BF-Vertriebs-

G.m.b.H. fuer Messtechnik, Karlsruhe (Germany, F.R.)). 1976. 29p. (In German). (CONF-760592--47). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

10 tabs.; 9 refs..

In the present report, the various scopes of the radiation protection measuring techniques particularly related to nuclear medical requirements are presented and the most modern and useful methods and equipment described. Particular importance is donated to the technique of contamination measurements as these represent the fundamentals of preventive radiation protection in nuclear medicine.

- 1911 (AED-Conf--76-134-015) INVESTIGATIONS OF THE RADIATION EXPOSURE OF THE HEAD DURING COMPUTERIZED AXIAL TOMOGRAPHY. Nemec, H.W.; Roth, J. (Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Eggenstein-Leopoldshafen (Germany, F.R.)). 1976. 8p. (In German). (CONF-760592--11). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

5 figs.; 4 refs..

Various head phantoms and patients were used to measure, by means of thermoluminescence and film dosimetry, the radiation exposure of the head, especially of the eye lenses, in computerized axial tomography with the EMI scanner. The form of the isodoses and the dependence on position of the exposure dose in the region of the eyes were confirmed by calculations with a computer program.

- 1912 (AED-Conf--76-134-016) PHYSICAL AND BIOPHYSICAL PROBLEMS IN RADIOTHERAPY. Pohlitz, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Frankfurt am Main (Germany, F.R.)). 1976. 12p. (In German). (CONF-760592--24). TIC.

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

6 figs.; 6 refs..

The physical problems in radiotherapy are briefly dealt with, especially the influence of the course of the depth dose curve and the spreading of the useful beam in the patient, as well as the influence of inhomogeneities in the useful beam. It is shown that radiation types exhibiting the ideal physical properties for tumour therapy are found amongst the loose as well as dense types of beam. The decisive factor regarding which to use are the costs. The biological properties of these kinds of radiation are presented and their influence on the result of the radiation treatment is discussed. In order to better understand these procedures, the radiation effect in live cells is dealt with more closely by means of numerous examples. It is shown how methods for the practical application in radiotherapy can be developed from the analysis of the procedures in irradiation of the live cells and how they can contribute to the optimization of the irradiation planning together with the favourable conditions from the physical aspect.

- 1913 (AED-Conf--76-134-021) NEW INDIVIDUAL TISSUE COMPENSATORS FOR LARGE-FIELD IRRADIATIONS WITH HIGH-ENERGY PHOTONS. Quast, U.; Krause, K. (Essen Univ. (Gesamthochschule) (Germany, F.R.). Abt. fuer Klinische Strahlenphysik). 1976. 10p. (In German). (CONF-760592--17). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche

Gesellschaft fuer Medizinische Physik e.V.;
Heidelberg, F.R. Germany (5 May 1976).

11 figs.; 18 refs..

One of the preconditions to successful radiotherapy is the implementation of a very uniform dose distribution in any kind of target volume while inflicting a minimum of damage upon the ambient tissue. For this reason, individual tissue compensators are required to offset irregular contours of the body or the target volume, to take into account tissue inhomogeneities or previous irradiations in percutaneous radiotherapy with high energy photons. This report introduces a new, more rational technique which allows the preparation of individual tissue compensators for stationary field irradiations. The results of first pre-clinical study tests are outlined.

- 1914 (AED-Conf--76-134-027) SHORT-DISTANCE TUMOUR IRRADIATION SYSTEM FOR INTERSTITIAL AND INTRACAVITARY USE, WITH PRESELECTABLE ISODOSE PROGRAMME. Sauerwein, K. (Isotopen Technik Dr. Sauerwein G.m.b.H., Duesseldorf (Germany, F.R.)). 1976. 14p. (In German). (CONF-760592--19). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

12 figs.; 17 refs..

The report describes a new development of the short distance irradiation system for interstitial and intracavitary use, GammaMedsup(R)). First, the main data of GammaMed I are summarized. Next, the development in cooperation with M. Busch of the Essen University Radiation Clinic of GammaMed II is outlined. The new unit includes an Ir-192 point source emitter which scans the applicator probe in accordance with a computer program which can be preselected at random. In this way, all isodose distributions can be achieved which are needed in practice.

- 1915 (AED-Conf--76-134-031) RADIATION PROTECTION MEASURES IN CASE OF ^{125}I INCORPORATION. Strobelt, W. (Glessen Univ. (Germany, F.R.). Inst. fuer Biophysik). 1976. 7p. (In German). (CONF-760592--12). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

3 figs.; 1 tab.; 10 refs..

Thyroid measurements were performed on members of the scientific staff in the whole body counter of the Glessen Radiation Center with an aluminium encapsulated 3" x 3" dia. NaI(Tl) detector; the personnel under investigation comprised those persons who either handled major quantities of ^{125}I or worked in the controlled area. The measuring setup, phantom calibration and the limits of measurement that can be attained are discussed. In a few cases of incorporation the effective half-life was determined. The radiation exposure was calculated by the absorbed fractions concept. A hazard is encountered almost exclusively in the iodization of the test substances.

- 1916 (AED-Conf--76-134-044) RADIATION PROTECTION IN NUCLEAR MEDICINE: FUNDAMENTALS AND METHODS. Kaul, A.; Roedler, H.D. (Freie Univ. Berlin (Germany, F.R.). Klinikum Steglitz). 1976. 17p. (In German). (CONF-760592--31). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

1 fig.; 6 tabs.; 21 refs..

Consequences for the protection of patients, protection of persons, and protection of the public are derived from the recommendations of the ICRP and the legal requirements for the handling of unsealed radioactive substances in diagnostics and therapy according to the First Radiation Protection Ordinance and its amended version, as well as from the 'guidelines for radiation protection when using radioactive substances in medicine'.

- 1917 (AED-Conf--76-134-047) RADIATION PROTECTION IN X-RAY DIAGNOSIS AND RADIOTHERAPY. Stieve, F.E. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). 1976. 24p. (In German). (CONF-760592--33). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

8 figs.; 65 refs..

Requirements made on radiation protection concerning equipment, persons occupationally exposed to radiation, and patients, take their origin in the ICRP recommendations, the regulations contained in the Euratom radiation protection basic norms, and the principles laid down - the Atomic Energy Act and the Ordinances concerning the handling of ionizing radiation deriving from X-ray sources, accelerator facilities, and sealed radioactive substances. In contrast to the application of unsealed radioactive substances, radioprotection of the general public only plays a minor role. It is dealt with in this context only with radiation protection in connection with apparatus.

- 1918 (AED-Conf--76-134-055) METHOD OF RADIATION SCATTERING FOR THE LARGE FIELD IRRADIATION OF LYMPHORETICULAR TUMOURS. Ammon, J.; Karstens, J.H.; Mitlacher, H.; Stockberg, H. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Roentgenologie und Strahlenheilkunde, Abt. Radiologie). 1976. 22p. (In German). (CONF-760592--34). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

5 figs.; 3 tabs.; with refs..

The technique of large field irradiation for the treatment of lymphogranulomatosis has been extended to the other lymphoreticular tumours. High voltage equipment with three different screening systems was used: 1) satellite diaphragms close to the equipment, 2) screening systems focussed and individually adapted to the patient, 3) collimation on a satellite table close to the patient with uniformly shaped lead blocks. Calculations and film-densitometric measurements were carried out in this connection. The results obtained show that of the three systems, the collimation, close to patients with non-focussing lead blocks keeps the influence of the penumbra sufficiently small on the telecobalt equipment as well as on the betatron. Furthermore, the collimator system is the most flexible for various sizes of tumours. The choice of radiation quality is influenced by the position of the critical organ in the corresponding depth dose curve. The collimator system can also be used unchanged with the chosen lead thickness for 42 MV bremsstrahlung.

- 1919 (AED-Conf--76-134-058) RADIATION EXPOSURE OF THE PERSONNEL IN THE DIAGNOSTIC APPLICATION OF RADIOACTIVE NOBLE GASES. Kaul, A.; Herzberg, B. (Freie Univ. Berlin (Germany, F.R.). Abt. fuer Nuklearmedizin). 1976. 12p. (In German). (CONF-760592--

30). TIC.

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

1 fig.; 9 tabs.; with refs..

The application of radioactive noble gases in nuclear medicine is essentially limited to the radionuclides ^{85}Kr and ^{133}Xe for perfusion and ventilation investigations. In general, between 2 and 5 mCi of radioactive noble gas are applied here, occasionally ^{133}Xe is used with an activity up to 25 mCi per investigation. The average activity concentration is 75 $\mu\text{Ci}/\text{m}^3$ during an 8-hour day. The average external radiation exposure of the personnel by ^{85}Kr or ^{133}Xe for an 8-hour day is calculated as 90 mrd or 32.5 mrd for the skin; the external radiation exposure by ^{133}Xe is 9.5 mrd/d or 12 mrd/d for lungs or whole body. The internal radiation exposure can be neglected compared to the latter; it is a maximum of 1 mrd/d. The results are discussed from the viewpoint of the maximum permissible professional radiation exposure and the maximum permissible concentrations for ^{85}Kr and ^{133}Xe in air.

- 1920 (AED-Conf--76-134-059) RELATION OF SURFACE AND BODY DOSE IN X-RAY DIAGNOSTICS. Kramer, R.; Drexler, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.)). 1976. 12p. (In German). (CONF-760592--32). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976).

7 figs.; 2 tabs.; 6 refs..

The photon transport calculations (Monte-Carlo method) which have been successfully applied to shielding problems in radiation protection for a long time now, have also become of interest for the estimation of the radiation exposure of the patient due to the construction of mathematical human phantoms. Irradiation conditions of X-ray diagnostics are simulated on a phantom with a Monte-Carlo computer programme. For the frequent kind of pictures such as lungs, pelvis and lumbar vertebral column, it is investigated how deviations from focus-film distance, field size and energy influence the ratio of the tissue surface dose on the radiation entrance side to the dose in the whole body and in the organs - red bone marrow, thyroid, gonads.

- 1921 (AED-Conf--76-168-003) RADIATION PROTECTION IN RADIOLOGICAL-UROLOGICAL DIAGNOSTICS IN INFANTS. Fendel, H. (Muenchen Univ. (Germany, F.R.). Kinderklinik). 1976. 5p. (In German). (CONF-760593--8). INIS.

From Germany X-ray Congress; Essen, F.R. Germany (13 May 1976).

New measurements of the female and male gonadal doses were made with thermoluminescent dosimeters. The female gonadal dose was measured intrarectally and the male gonadal dose 'in the crotch' outside the lead capsules which in reality protected the testicles. The male point of reference in excretion urography was outside the field in all cases. The median value of the number of radiographs was 1 + 2.43, less than 1 + 2 radiographs in 76% of all cases. The initial voltage was 70 kV, and conventional foils of normal intensification were used. For the male gonadal dose there is a median of 12.5 mrad per investigation, with 75% of the values below 21 mrad and 97% below 62 mrad. The female gonadal dose was: median 40 mrad, 75% below 53 mrad and 97% below 100 mrad.

- 1922 (AED-Conf--76-168-012) QUALITY OF STRAY RADIATION IN THE OVARIAN REGION IN DIAGNOSTIC X-RAY EXAMINATIONS. Ewen, K.; Fiebach, B.J.O.; Fischer, P.G.; Loehr, E. (Gewerbeaufsicht des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). Zentralstelle fuer Sicherheitstechnik, Strahlenschutz und Kerntechnik. 1976. 5p. (In German). (CONF-760593--1). INIS.

From Germany X-ray Congress; Essen, F.R. Germany (13 May 1976).

7 figs. Available from ZAED. Will be published in Fortschr. Geb. Roentgenstr. Nuklearmed..

Dose measurements (LiF-TLD) and recordings of stray radiation spectra (Ge(Li)-Detectors) in a phantom show that shielding of the ovaries against stray radiation is advisable even though the effectivity of this measure decreases at higher tube voltages. The exposure of the ovaries to stray radiation increases with increasing tube voltage; the radiation quality of the stray radiation is, for the most part, independent of the filter value.

- 1923 (AED-Conf--76-345-000, pp 5-25) LEGAL FUNDAMENTALS OF RADIATION PROTECTION. Scheffler, M. (Landesamt fuer Arbeitsschutz und Technische Sicherheit, Berlin (Germany, F.R.)). 1976. (In German).

From 14. international annual meeting of the Gesellschaft fuer Nuklearmedizin e.V.; Berlin, Germany, F.R. (15 Sep 1976).

6 refs..

Radiation protection and measures in case of accidents in nuclear medicine.

A short survey is presented of national radiation protection law in the FRG (First Radiation Protection Ordinance, X-Ray Ordinance), international radiation protection law (EURATOM basic standards, OECD norms, ILO Conventions, international recommendations (ICRP, ICRU), and of guidelines and regulations in science and technology. Dealt with in more detail are the chapters of the amendment amending the Radiation Protection Ordinance, the sections applying to medical technologists and hospital nursing staff being looked at in particular.

- 1924 (AED-Conf--76-345-000) RADIATION PROTECTION AND MEASURES IN CASE OF ACCIDENTS IN NUCLEAR MEDICINE. (Gesellschaft fuer Nuklearmedizin e.V. (Germany, F.R.)). 1976. vp. (AED-Conf--76-345-003; CONF-7609111--). NTIS (US Sales Only).

From 14. International Annual meeting of the Gesellschaft fuer Nuklearmedizin e.V.; Berlin, F.R. Germany (15 Sep 1976).

Separate abstracts were prepared for individual papers. (ERB)

- 1925 (AED-Conf--76-345-002, pp 26-51) RADIATION PROTECTION MEASURES FOR DIAGNOSTICS AND THERAPY IN THE FIELD OF NUCLEAR MEDICINE. Ammon, J. (Technische Hochschule Aachen (Germany, F.R.). Abt. Radiologie). 1976. (In German).

From 14. international annual meeting of the Gesellschaft fuer Nuklearmedizin e.V.; Berlin, Germany, F.R. (15 Sep 1976).

2 figs.; 5 tabs.; 8 refs..

Radiation protection and measures in case of accidents in nuclear medicine.

The best provisions for the radiation protection of the patient are always made in the case of indication, selection of the radioactive substance most suitable, and application of an optimal measuring technique supplementing each other. In the case of

radiation protection of personnel and environment, avoiding incorporations is of prominence, whereas in the case of therapy, the problems of external irradiation can be of importance.

- 1926 (AED-Conf--76-345-003, pp 52-70)
RADIATION PROTECTION MEASURES IN THE CASE OF INCIDENTS AND RADIATION ACCIDENTS. Herzberg, B. (Freie Univ. Berlin (Germany, F.R.). Nuklearmedizinische Abt.). 1976. (In German).

From 14. International Annual meeting of the Gesellschaft fuer Nuklearmedizin e.V.; Berlin, F.R. Germany (15 Sep 1976).

14 refs..

Radiation protection and measures in case of accidents in nuclear medicine.

Measures to be taken in the case of radiation accidents connected with an unusually high radiation exposure to persons, the amounts of which exceed the limiting values, with depend on whether there has been an external or an internal exposure. In order to give further treatment in the case of whole-body or partial-body irradiation, it is necessary to estimate the exposure dose. In nuclear medicine the accident doses are generally low, i.e. acute radiation damage does not occur here, and immediate measures are not necessary. Therapeutic measures in the case of incorporation accidents are only necessary when the maximum amounts for the nuclide in question recommended by the ICRP has been reached or exceeded in the organism. However, decontamination measures ought to be carried out only by qualified radiation protection physicians. The type of radiation accident which occurs most frequently in nuclear medicine is radiation exposure as a result of contamination. If in the case of contamination of a person the measurement exceeds the radioactivity limit, the decontamination measures are necessary. In the present contribution, these measures for cases without injuries are described in detail.

- 1927 (AED-Conf--76-345-004, pp 71-90)
RADIATION RISKS FOR PATIENT AND PERSONNEL. Kaul, A. (Freie Univ. Berlin (Germany, F.R.). Nuklearmedizinische Abt.). 1976. (In German).

From 14. international annual meeting of the Gesellschaft fuer Nuklearmedizin e.V.; Berlin, Germany, F.R. (15 Sep 1976).

5 tabs.; 23 refs..

Radiation protection and measures in case of accidents in nuclear medicine.

The maximum somatic risk to be expected for the patient - in dependency of the examination method - is of the 5th-6th order; however, for radioactive iodine patients the risk of spontaneous cancer of the thyroid is expected to be three times as high. The upper limit of the genetic risk is of the 4th order; on the average, a genetic risk of the 6th-7th order is to be expected. With regard to radiation risks to persons occupied in nuclear medicine, the following can be said: The somatic X-ray cancer risk (including leukaemia) to be expected, with about $2 \times 10^{-2}\%$, is small compared to the spontaneous cancer risk of about 20% at present. The genetic risk for the direct descendants of persons occupationally exposed to radiation, with a maximum of 1 mutation induced by radiation in 1,000 live births, is small compared to a spontaneous risk of 1 in 100.

- 1928 (AED-Conf--76-419-002) CONTENT AND CONSEQUENCES OF SECTION 13 X-RAY ORDINANCE.

Eckerl, H.; Drexler, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Strahlenschutz). 1976. 5p. (In German). NTIS (US Sales Only).

From Autumn meeting of the Bayerische Roentgengesellschaft; Bamberg, Germany, F.R. (17 Sep 1976).

2 refs..

Section 13 of the X-Ray Ordinance reads: 'Measurement of the dose rate of X-ray equipment for the treatment of humans'. Two guidelines, issued by the Federal Ministry for Youth, Family Affairs and Health, elaborate on the requirements spelled out here. The dose rate has to be measured along the tube, the measurement itself has to be repeated every 6 months with a dosimeter sanctioned by the authorities. Some problems which have cropped up during 3 years of experience, such as the requirements made on the accuracy of the measurements, connection of the dosimeters with acknowledged measuring arrangement (calibration or primary standard), are discussed.

- 1929 (AED-Conf--76-430-013) METHODOLOGICAL ASPECTS OF EPIDEMIOLOGICAL INQUIRIES IN CLINICAL RADIO-BIOLOGY. Martin, J.; Bertrand, A. (Centre Hospitalier Universitaire, 54 - Nancy (France)). 1976. 2p. NTIS (US Sales Only).

From 2. international symposium on biological effects of Ra-224; Neuherberg/Muenchen, Germany, F.R. (20 Sep 1976).

Short communication only.

BIOLOGICAL RADIATION EFFECTS; EPIDEMIOLOGY; ORGANS; PATIENTS; RADIATION DOSES; RADIOBIOLOGY; RADIOTHERAPY; RADIUM 224; RECOMMENDATIONS

- 1930 (AED-Conf--76-430-018) THERAPEUTICAL RESULTS IN A FOLLOW-UP STUDY ON RA-224 THERAPY OF A. SP. Schmitt, E. (Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Eggenstein-Leopoldshafen (Germany, F.R.)). 1976. 2p. (CONF-760992--9). NTIS (US Sales Only).

From 2. international symposium on biological effects of Ra-224; Neuherberg/Muenchen, F.R. Germany (20 Sep 1976).

Short communication only.

no radiation damage found. PATIENTS; RADIOTHERAPY; RADIUM 224; SIDE EFFECTS; SPONDYLITIS

- 1931 (AED-Conf--76-447-001, pp v)
OBJECTIVES OF RADIOLOGICAL ENVIRONMENT PROTECTION IN NUCLEAR FACILITIES. Oberhausen, E. (Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.). Abt. fuer Nuklearmedizin und Medizinische Physik). 1976. (In German).
From Recent developments in the radiological environmental protection of nuclear facilities. IRS experts' talk 1976; Koeln, Germany, F.R. (28 Oct 1976).

3 refs..

Recent development in the radiological environmental protection of nuclear facilities.

The aim of the radiological environment protection is to avoid risks to the health of the population. But the risks from radiation can only be considered in connection with spontaneously occurring malignancies. The comparison shows that according to the maximum permissible doses in the German Ordinance of Radiation Protection the risks of radiation injury are so low that they cannot be detected relative to the spontaneous malignancies.

- 1932 (AED-Conf--76-447-005, pp v) JUDICIAL AND TECHNICAL RULES IN THE FIELD OF RADIATION

PROTECTION IN NUCLEAR FACILITIES.

Pfaffelhuber, J. (Bundesministerium des Innern, Bonn (Germany, F.R.)). 1976. (In German).

From Recent developments in the radiological environmental protection of nuclear facilities. IRS experts' talk 1976; Koeln, Germany, F.R. (28 Oct 1976).

20 refs..

Recent developments in the radiological environmental protection of nuclear facilities. IRS experts' talk 1976. Lecture manuscripts.

The author deals in more detail with the contents of the amendment to the First Radiation Protection Ordinance in particular with technical rules and regulations in mind: Immission protection concept section 45, immission limits principle and land-register section 46 (regulation and supervision of passed out radioactive substances, accident planning values), persons responsible for radiation protection according to section 38, disposal of radioactive wastes according to section 47.

1933 (AED-Conf--76-447-005) RECENT DEVELOPMENTS IN THE RADIOLOGICAL ENVIRONMENTAL PROTECTION OF NUCLEAR FACILITIES. IRS EXPERTS' TALK 1976. LECTURE MANUSCRIPTS.

(Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (Germany, F.R.)). 1976. vp. (In German). TIC.

Separate abstracts were prepared for individual papers. (ERB)

1934 (AED-Conf--76-530-003) BIOLOGICAL IN VIVO DOSIMETRY WITH AN EXTERNAL MEASURING TECHNIQUE UNDER APPLICATION OF A LABELLED DNA-PRECURSOR (IODINE-125-DESOXYURIDINE). Porschen, W.; Zamboglou, N.; Muehlensiepen, H.; Feinendagen, L.E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Inst. fuer Medizin. 1976. 4p. (In German). (CONF-7610112--). Dep. NTIS (US Sales Only), PC A02/MF A01.

From Annual meeting of the Deutsche Gesellschaft fuer Biophysik e. V.; Regensburg, F.R. Germany (4 Oct 1976).

3 figs.; 15 refs..

The depression of the incorporation rate of IDU in the whole body or in the bone marrow is a sensitive indicator for a whole-body irradiation. It was found that the maximum effect is observed some 4 hours after irradiation. For this reason, bone marrow cells were labelled in vitro with IDU 4 hours after whole-body irradiation. This method proved to be extraordinarily sensitive and resulted in reproducible effects which occurred already at doses below 5 rad. All the other biological methods of dosimetry known so far are less sensitive. Although the theory explaining these results is not yet fully clarified, this method of dosimetry appears to offer practical possibilities of application.

1935 (BNL--21924) SUMMARY OF THYROID FINDINGS IN MARSHALLESE 22 YEARS AFTER EXPOSURE TO RADIOACTIVE FALLOUT. Conard, R.A. (Brookhaven National Lab., Upton, N.Y. (USA)). 1976. Contract E(30-1)-16. 19p. (CONF-760939--1). Dep. NTIS \$3.50.

From Conference on radiation in associated thyroid cancer; Chicago, IL, USA (30 Sep 1976).

Inhabitants of several atolls in the Marshall Islands were accidentally exposed to fallout radiation following a detonation of a high yield thermonuclear device during experiments at Bikini in the Pacific Proving Grounds in March 1954. The most serious acute

effects of the exposure were due to penetrating gamma radiation. Contamination of the skin in the Rongelap group resulted in widespread beta burns and epilation. These lesions healed and hair regrew normally within several months. Radiochemical urine analyses revealed that measurable amounts of radionuclides, including ^{131}I , were absorbed internally from ingestion of contaminated food and water and from inhalation. No acute effects due to this internal exposure were seen. Late thyroid effects from radioiodine absorption are described. Follow-up examinations have revealed, except for one fatal case of leukemia and extensive thyroid lesions, only a few findings that might be related to radiation exposure. A group of more than 200 Rongelap people who were relatives of exposed people, but had been away from the island at the time of the accident, moved back with the exposed people to their home island in 1957 and have served as an ideal comparison population for the studies. Results of medical examinations carried out on these populations for the past 22 years are reviewed.

1936 (BNL--22841) COMPARISON OF THE LIGHT FLASH PHENOMENA OBSERVED IN SPACE AND IN LABORATORY EXPERIMENTS. McNulty, P.J.; Pease, V.P.; Bond, V.P. (Brookhaven National Lab., Upton, N.Y. (USA)). 1976. Contract EY-76-C-02-0016. 14p. Dep. NTIS, PC A02/MF A01.

Astronauts on Apollo and Skylab missions have reported observing a variety of visual phenomena when their eyes were closed and adapted to darkness. These observations were studied under controlled conditions during a number of sessions on board Apollo and Skylab spacecraft and the data available to date on these so-called light flashes is in the form of descriptions of the phenomena and frequency of occurrence. Similar visual phenomena have been demonstrated in a number of laboratories by exposing the eyes of human subjects to beams of neutrons, alphas, pions, and protons. More than one physical mechanism is involved in the laboratory and space phenomena. No direct comparison of the laboratory and space observations has been made by observers who have experienced both. However, the range of visual phenomena observed in the laboratory is consistent with the Apollo and Skylab observations. Measured detection efficiencies can be used to estimate the frequencies with which various phenomena would be observed if the subject was exposed to cosmic rays in space.

1937 (BNWL-SA--5521) RADIATION MONITORING CONSIDERATIONS FOR RADIOBIOLOGY FACILITIES. McClelland, T.W.; McFall, E.D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1976. Contract E(45-1)-1830. 9p. (CONF-760202--34). Dep. NTIS \$3.50.

From 9. topical symposium on operational health physics; Denver, CO, USA (9 Feb 1976).

Battelle, Pacific Northwest Laboratories, conducts a wide variety of radiobiology and radioecology research in a number of facilities on the Hanford Reservation. Review of radiation monitoring problems associated with storage, plant and animal experiments, waste handling and sterile facilities shows that careful monitoring, strict procedural controls and innovative techniques are required to minimize occupational exposure and control contamination. Although a wide variety of radioactivity levels are involved, much of the work is with extremely low level materials. Monitoring low level work is mundane and often impractical but cannot be ignored in today's ever tightening controls.

- 1938 (BNWL-SA--5816) PROBABILISTIC APPROACH TO EXTERNAL CLOUD DOSE CALCULATIONS USING ONSITE METEOROLOGICAL DATA. Strenge, D.L.; Watson, E.C.; Bander, T.J.; Kennedy, W.E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1976. Contract E(45-1)-1830. 10p. (CONF-760652--3). Dep. NTIS \$3.50.

From Health Physics Society meeting; San Francisco, CA, USA (27 Jun 1976).

A method is described for calculation of external total body and skin doses from accidental atmospheric releases of radionuclides based on hourly onsite meteorological data. The method involves calculation of dose values from a finite size cloud for each hourly observation for a given radionuclide inventory. These values are then used to determine the probability of occurrence of dose levels for specified release times ranging from one hour to 30 days.

- 1939 (CEA-CONF--3509) STUDY AND FABRICATION OF ^{252}Cf SOURCES FOR RADIOTHERAPY. Boucher, R.; Barthelemy, P.; Letang, R.; Perret, F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). 1976. 15p. (In French). (CONF-760436--9). NTIS (US Sales Only).

From International symposium on californium-252 utilization; Paris, France (26 Apr 1976).

For a practical and safe use of neutron sources in cancer therapy, ^{252}Cf sources have been developed. The following properties are required: very small size, high accuracy in neutron fluence definition, easy positioning in working conditions by means of a remote loading system. Each individual source contains 0.32 μg of ^{252}Cf enclosed in a 0.70mm diameter, 4.5mm long, platinum tube welded at both ends. The source-holders are made of stainless steel spiral springs and are loaded with 3, 4, 5 or 6 ^{252}Cf sources. The californium 252 source and the source assembly have passed the safety qualification tests specified by the Radioisotope Subcommittee of the International Standardization Organisation (NF 61002 and ISO/DIS 2919/2). The different steps of the source production are described.

- 1940 (CONF-760114--(Absts.)) THIRD ANNUAL CONFERENCE ON RADIATION PROTECTION, VIGYAN BHAVAN, NEW DELHI, JANUARY 19--21, 1976. PROGRAMME AND SYNOPSIS. (Indian Association for Radiation Protection, Bombay). 1976. 53p. Indian Association for Radiation Protection, Bombay.

From 3. annual conference on radiation protection; Vigyan Bhavan, New Delhi, India (19 Jan 1976).

Abstracts are presented of papers in the following areas of research: radiation protection, medical uses of radiation, industrial uses of radiation, instrumentation, nuclear industry, and radiation physics. (HLW)

- 1941 (CONF-760701--1, pp 506-513) IMPLICATIONS OF THE 'MAN-REM CONCEPT'. Taylor, L.S. (National Council on Radiation Protection and Measurements, Bethesda, MD); Wyckoff, H.O. 1976.

From International symposium on management of waste from the LWR fuel cycle; Denver, CO, USA (11 Jul 1976).

Proceedings of the international symposium on the management of wastes from the LWR fuel cycle.

Because the measurement of doses to individuals in the population is impractical

under present circumstances, any assessment of individual or group risks must be obtained indirectly through the use of some kind of dose-averaging procedure. The alternative solution is necessarily through an administrative process such as that traditionally used by national and international protection bodies, where the effect is taken to be related to both the dose and the number of people who are exposed. The product of the average dose and the number of people exposed has led to the development of the 'man-rem concept' as a means for computing the presumed hazard through the use of a single parameter. The assumptions necessary for the development of risk criteria are not always explicitly stated. First, it is assumed that the probability of a specified injury to an individual is proportional to the average absorbed dose he receives in the pertinent organ of his body. Second, it is assumed that one can compute the dose received by each individual in the pertinent organ from the limited amount of experimentally determined information about the radiation.

- 1942 (CONF-760701--1, pp 554-564) TRANSFER OF PLUTONIUM FROM THE ENVIRONMENT TO MAN. Bennett, B.G. (U.S. Energy Research and Development Administration, New York, NY). 1976.

From International symposium on management of waste from the LWR fuel cycle; Denver, CO, USA (11 Jul 1976).

Proceedings of the international symposium on the management of wastes from the LWR fuel cycle.

The environmental impact of plutonium in the nuclear fuel cycle receives special consideration because of the physical and biological characteristics of plutonium and its importance in recycle fuel and in fast breeder reactors. Plutonium is widespread at low levels in the environment due to atmospheric weapons testing. The data from fallout measurements provide the opportunity to evaluate the environmental behavior and trace the transfer of plutonium through air and diet to man. An estimated 325 kCi of plutonium-239 and plutonium-240 produced during weapons testing was globally dispersed. Inhalation intake, determined from measured or inferred air concentrations, has totaled somewhat over 40 pCi through 1975. The lung model of the International Commission on Radiological Protection gives reasonable estimates of retention in lung and transfer to blood from which organ distributions may be estimated. The adult body is currently about 2.4 pCi. Ingestion intake in 1972-1974, determined from complete diet samplings, was 1.6 $\pm$ 0.3 pCi/yr. Due to low uptake from the gastrointestinal tract, the contribution to the body burden from ingestion is negligible.

- 1943 (CONF-761153--1) IMAGE QUALITY IN MAMMOGRAPHY. Haus, A.G.; Doi, K.; Metz, C.E. Bernstein, J. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1976. Contract EY-76-C-02-0069;USPHS-GM-18940. 29p. Dep. NTIS \$4.00.

From 62. annual meeting of radiologic advances in breast cancer; Chicago, IL, USA (15 Nov 1976).

In mammography, image quality is a function of the shape, size, and x-ray absorption properties of the anatomic part to be radiographed and of the lesion to be detected; it also depends on geometric unsharpness, and the resolution, characteristic curve and noise properties of the recording system. X-ray energy spectra, modulation transfer functions, Wiener spectra, characteristic and gradient

curves, and radiographs of a breast phantom and of a resected breast specimen containing microcalcifications are used in a review of some current considerations of the factors, and the complex relationship among factors, that affect image quality in mammography. Image quality and patient radiation exposure in mammography are interrelated. An approach to the problem of evaluating the trade-off between diagnostic certainty and the cost or risk of performing a breast imaging procedure is discussed.

- 1944 (CONF-761153--3) DETERMINATION OF X-RAY SPECTRA INCIDENT ON AND TRANSMITTED THROUGH WHOLE EXCISED BREAST FOR IMPROVED MAMMOGRAPHIC EXPOSING TECHNIQUE. Haus, A.G.; Metz, C.E.; Doi, K.; Bernstein, J. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1976. Contract EY-76-C-02-0069;USPHS-GM-18940. 13p. Dep. NTIS \$3.50.

From 62. annual meeting of radiologic advances in breast cancer; Chicago, IL, USA (15 Nov 1976).

Measurements were made of x-ray spectra incident on and transmitted through whole excised fresh breast tissue. The spectra and corresponding radiographs show that hardening of the x-ray beam from a molybdenum anode x-ray tube by a 0.5 mm Al filter instead of the conventional 0.03 mm Mo filter allows shorter exposure times and reduces patient radiation exposure. With the Al filter, acceptable image contrast is preserved in mammography of thick or dense breasts.

- 1945 (CONF-761230--1) WHY IS A HIGH ACCURACY NEEDED IN DOSIMETRY. Lanzl, L.H. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1976. Contract EY-76-C-02-0069. 11p. Dep. NTIS, PC A02/MF A01.

From Advisory group meeting on intercomparison and standardization procedures in the dosimetry of Co-60 gamma radiation and x-rays; Vienna, Austria (6 Dec 1976).

Dose and exposure intercomparisons on a national or international basis have become an important component of quality assurance in the practice of good radiotherapy. A high degree of accuracy of γ and x radiation dosimetry is essential in our international society, where medical information is so readily exchanged and used. The value of accurate dosimetry lies mainly in the avoidance of complications in normal tissue and an optimal degree of tumor control.

- 1946 (CONF-770321--4) NEED FOR IMPROVED STANDARDS IN NEUTRON PERSONNEL DOSIMETRY. Auxier, J.A. (Oak Ridge National Lab., Tenn. (USA)). 1976. Contract W-7405-ENG-26. 8p. Dep. NTIS, PC A02/MF A01.

From NBS international specialists symposium on neutron standards and applications; Gaithersburg, MD, USA (28 Mar 1977).

There is a continuing need for standards in neutron monitoring. A discussion of special problem areas and the benefits of intercomparisons is given. The RBE for leukemia induction in the survivors of the nuclear bombings of Hiroshima and Nagasaki is greater than ten for absorbed doses in the bone marrow of less than 100 rads; this may have an important impact on neutron standards preparation.

- 1947 (EUR--5460) STUDY ON RADIOACTIVITY IN CONSUMER GOODS. (Commission of the European Communities, Luxembourg). 1976. 146p. (In German). Dep. NTIS (US Sales Only), PC A07/MF

A01.

Consumer goods containing radionuclides are increasingly utilized, sometimes for having chemical or technological properties which nonradioactive materials cannot fulfill (e.g. uranium paints) or it may be that radioactivity is especially required (e.g. fluorescent paints, fire-alarm-boxes, electronic instruments). The present study makes a compilation of consumer goods containing radioactive substances which are available to the general public in the nine countries of the Community, carries out a medium and long term study to assess how accumulated radiation from these goods could affect the population as a whole, and proposes measures to minimize the effects of such accumulation.

- 1948 (EUR--5524) RADIOACTIVE ISOTOPES IN OCCUPATIONAL HEALTH. Favino, A. (Commission of the European Communities, Luxembourg). 1976. 731p. Dep. NTIS (US Sales Only), PC A99/MF A01.

It is highly desirable today to know and use for industrial medicine purposes all scientific and technological data available in the field of nuclear medicine. The present textbook is an inventory of all possibilities given to occupational doctors in order to pronounce a judgement of ability to work on the occasion of preemployment or routine medical examinations. Such applications require a high degree of competence in radiological protection and also require observation of the basic Safety Standards of Euratom and of the recommendations of the International Committee on Radiological Protection, the same safety principles having been incorporated in all the legislations of the Member States of the Community. In this book a number of chapters are devoted to the description of the basic principles for maximum permissible doses, dosimetric surveillance, medical supervision of workers exposed to ionizing radiations, and medical treatments to be used after a radioactive contamination. In addition a small number of preventive measures are described for all utilisations of radioactive substances for diagnostic or therapeutic purposes.

- 1949 (EUR--5624) PROBLEMS RELATING TO THE EVALUATION OF THE FITNESS OF OCCUPATIONALLY EXPOSED PERSONNEL. Strambi, E. (Commission of the European Communities, Luxembourg). 1976. 108p. (In French). Dep. NTIS (US Sales Only), PC A06/MF A01.

The medical officer must consider the fitness of workers from two points of view: psycho-physic characteristics required to make a given work; ability to support the specific risks associated with this work. Workers whose exposure may exceed 3/10 of the Maximum Permissible Doses may require more detailed surveillance to detect any conditions contra-indicating employment on specific tasks. Four groups of clinical conditions, which should be taken into account, by the medical officer, for the evaluation of the fitness of occupationally exposed personnel, are considered. Practical examples are shown for each group. Several aspects of the methodology of routine medical examination, are also discussed. Concerning the fitness of personnel after accidental overexposure, two possibilities are considered, as a function of the presence or absence of invalidating after-effects.

- 1950 (GKSS--76/E/47) MEDICAL AND BIOLOGICAL PROBLEMS OF RADIATION EXPOSURES. Meissner, J. (ed.); Rausch, L. (ed.); Buenemann, D. (ed.). (Gesellschaft fuer Kernenergieverwertung in

Schiffbau und Schifffahrt m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1976. 60p. (In German). (CONF-7505122--2). NTIS (US Sales Only), PC A04/MF A01.

From Conference of the medical and biological problems of radiation exposure; Borstel, F.R. Germany (30 May 1975).

Reprint from the journal 'Atomkernenergie', v. 28 (1976), no. 1, p. 1-55.

- 1951 (HEDL-SA--1087) TENNESSEE AND CUMBERLAND RIVER BASINS RADIONUCLIDE TRANSPORT: A CASE STUDY. Dotson, W.L.; Peterson, D.E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1976. Contract E(45-1)-2170. 4p. (CONF-760622--54). Dep. NTIS \$3.50.

From American Nuclear Society 1976 annual meeting; Toronto, Ontario, Canada (13 Jun 1976).

The current estimates of increased utilization of nuclear power have brought into focus the problem of the cumulative interaction of several nuclear facilities with the biosphere of a region. An engineering analysis tool to make the necessary calculations from which reasonable estimates of potential radiation dose and dose commitment to individuals and population groups in such a region has been devised by Hanford Engineering Development Laboratory (HEDL). This paper discusses the application of the radionuclide transport elements of this computer code to the Tennessee and Cumberland River Basins. The radionuclide transport simulator codes (HERMES) were designed to evaluate the environment impact of nuclear facilities in or near the year 2000.

- 1952 (INIS-mf--3159) PROGRAMME AND ABSTRACTS. (South African Association of Physicists in Medicine and Biology, Pretoria). 1976. 34p. (CONF-760392--(absts.)). INIS. From Annual congress; Pretoria, South Africa (24 Mar 1976).

Abstracts of the 40 papers presented at the congress are given. Topics included are: radiotherapy, radiobiology, biophysics, radiation protection and nuclear medicine.

- 1953 (INIS-mf--3315, pp 34) CYTOGENETIC STUDIES IN FEMALE X-RAY ASSISTANTS WITH MENSTRUAL DISTURBANCES. Marinova, G.; Dimcheva, M.; Kincheva, V. (Nauchno-Izledovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). 1976. (In Bulgarian).

From 2. national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases; Varna, Bulgaria (2 Oct 1976).

Second national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases. Abstracts.

Cytogenetic analyses were performed in thirty, otherwise genitally and extragenitally unaffected, female x-ray assistants with menstrual disturbances (oligomenorrhea, secondary amenorrhea, irregular bleedings, hypermenorrhea) developing in the course of occupational experience under intermittent, chronic, low-level exposure conditions, the dose accumulated remaining below the maximum permissible dose. Seventeen of these subjects showed changes in chromosome constitution, namely: aneuploidy, up to 34.2%; breaks, 2 - 14.3%; gaps, 5.6 to 16.7; and dicentrics, in one case, 2.8%. Increase in occupational

experience was found to be associated with increase in percentage of menstrual disturbances and in chromosome aberrations.

- 1954 (INIS-mf--3315, pp 40) CYTOGENETIC STUDIES OF PERIPHERAL LYMPHOCYTES FROM SUBJECTS OCCUPATIONALLY EXPOSED TO IONIZING RADIATION. Praskova, L.; Ivanov, B.; Bulanova, M.; Mileva, M.; Georgieva, I.; Mikhailov, M. (Nauchno-Izledovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). 1976. (In Bulgarian).

From 2. national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases; Varna, Bulgaria (2 Oct 1976).

Second national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases. Abstracts.

Cytogenetic analysis involved 59 subjects occupationally exposed to ionizing radiation over periods ranging from 1 to 30 years. The total number of metaphase spreads examined was 5435. The results on chromosome anomalies in occupationally exposed subjects were compared with data on spontaneous aberration frequencies as observed on a total of 16267 control cells. Statistically significant differences ($t = 2.40$; $p < 0.02$) were found in aberrant cell yields. The amounts of individual structural aberration types did not differ significantly between occupationally exposed persons and controls. The only exception in this respect was a case with occupational experience of above 26-year duration, where high percentages of both aberrant cells and structural chromosome anomalies were observed.

- 1955 (INIS-mf--3663, pp 123-124) RADIATION DOSES TO THE PAROTID AND THYROID GLAND AFTER TREATMENT FOR TINEA CAPITIS. Werner, A.; Ron, E.; Modan, B. (Sheba Medical Center, Tel Hashomer (Israel)). 1976.

From Meeting of the Israel Nuclear Societies; Beersheba, Israel (23 Dec 1976).

Transactions of the Nuclear Societies of Israel. Volume 4. Joint annual meeting 1976, Ben Gurion University of the Negev, December 23-24, 1976.

BRAIN;CHILDREN;DELAYED RADIATION EFFECTS; DOSE-RESPONSE RELATIONSHIPS;HEAD;LOW DOSE IRRADIATION;NEOPLASMS;PHANTOMS;RADIATION DOSES; THYROID;SALIVARY GLANDS;RADIOTHERAPY;SIDE EFFECTS

- 1956 (INIS-mf--3663, pp 110-113) COMPUTER ASSISTED METHOD FOR INTRACAVITARY RADIOTHERAPY OF CANCER OF THE UTERINE CERVIX. Kuten, A.; Palti, S.; Tatcher, M. (Technion-Israel Inst. of Tech., Haifa. Aba Khoushy Medical School). 1976.

From Meeting of the Israel Nuclear Societies; Beersheba, Israel (23 Dec 1976).

Transactions of the Nuclear Societies of Israel. Volume 4. Joint annual meeting 1976, Ben Gurion University of the Negev, December 23-24, 1976.

BIOMEDICAL RADIOGRAPHY;COMPUTER GRAPHICS; NEOPLASMS;PROGRAMMING;RADIATION EFFECTS; RADIOTHERAPY;UTERUS;PATIENTS

- 1957 (INIS-mf--3663, pp 165-166) PRACTICAL IMPLICATION OF NEW APPROACHES IN EVALUATING RISKS FROM IONIZING RADIATIONS. Feige, Y.; Kahan, R.S. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1976. From Meeting of the Israel Nuclear Societies;

Beersheba, Israel (23 Dec 1976).

Transactions of the Nuclear Societies of Israel. Volume 4. Joint annual meeting 1976, Ben Gurion University of the Negev, December 23-24, 1976.

GAMMA RADIATION; HEAD; HUMAN POPULATIONS; LEUKEMIA; LOW DOSE IRRADIATION; RADIATION DOSES; RADIATION HAZARDS; THYROID; GAMMA RADIATION; HUMAN POPULATIONS; LEUKEMIA; LOW DOSE IRRADIATION; LUNGS; PLUTONIUM COMPOUNDS; RADIATION DOSES; RADIATION HAZARDS

1958 (INIS-mf--3789, pp 15-19) ASSESSMENT OF RISK FROM RADIATION SOURCES. Subbaratnam, T.; Madhvanath, U.; Somasundaram, S. (Bhabha Atomic Research Centre, Bombay (India)). 1976.

From Meeting on protection from modern industrial and environmental risks; Bombay, India (26 Jun 1976).

Protection from modern industrial and environmental risks - lessons from nuclear industry : Programme and synopses [for the topical meeting held at Bombay on 26 June 1976].

Assessment of risk from exposure to ionizing radiations from man-made radiation sources and nuclear installations has to be viewed from three aspects, namely, dose-effect relationship (genetic and somatic) for humans, calculation of doses or dose-committments to population groups, assessment of risk to radiation workers and the population at large from the current levels of exposure from nuclear industry and comparison of risk estimates with other industries in a modern society. These aspects are discussed in brief. On the basis of available data, it is shown that estimated incidence of genetic diseases and cancers due to exposure of population to radiation from nuclear industry is negligible in comparison with their natural incidence, and radiation risks to the workers in nuclear industry are much lower than the risks in other occupations.

1959 (INIS-mf--3789, pp 11-13) SCIENTIFIC BASIS FOR THE DEVELOPMENT OF RADIATION PROTECTION STANDARDS. Vohra, K.G. (Bhabha Atomic Research Centre, Bombay (India). Div. of Radiation Protection). 1976.

From Meeting on protection from modern industrial and environmental risks; Bombay, India (26 Jun 1976).

Protection from modern industrial and environmental risks - lessons from nuclear industry : Programme and synopses [for the topical meeting held at Bombay on 26 June 1976].

The present ICRP recommendations for maximum permissible doses from occupational exposure to ionizing radiations and for tolerance levels for average population groups are fairly conservative. The likely increase in genetic injury and incidence of cancers is estimated to be negligibly small as compared to the natural occurrence of these phenomena. Any further reduction in permissible doses and tolerance levels will lead to increase in the cost of nuclear operations which will not be justifiable in terms of benefits that would not be otherwise received. Moreover the environmental risks due to the present level of chemical pollution are greater than the risks involved in the ICRP recommendations.

1960 (INIS-mf--3789) PROTECTION FROM MODERN INDUSTRIAL AND ENVIRONMENTAL RISKS. LESSONS FROM NUCLEAR INDUSTRY: PROGRAMME AND SYNOPSSES. (Indian Association for Radiation Protection, Bombay; Society for Clean Environment, Bombay (India); Environmental Mutagen Society of

India, Bombay). 1976. vp. (CONF-7606164--). NTIS.

From Meeting on protection from modern industrial and environmental risks; Bombay, India (26 Jun 1976).

Separate abstracts were prepared for individual papers. (ERB)

1961 (ORO--3857-4) CHEST FLUOROSCOPY AND NEOPLASIA IN TUBERCULOSIS PATIENTS: A RETROSPECTIVE SURVEY. PROGRESS REPORT, JULY 1, 1975--JUNE 30, 1976. Battigelli, M.C. (North Carolina Univ., Chapel Hill (USA). School of Medicine). 1976. 20p. Dep. NTIS \$3.50.

An historical cohort study is being conducted to assess the cancer risk of cumulative exposure to fluoroscopic irradiation. Of approximately 30,000 patients admitted to three tuberculosis sanatoria in North Carolina, between 1930-55, 4,800 were treated by pneumothorax and/or pneumoperitoneum, entailing regular, repeated air re-fill and fluoroscopic examination. The number of fluoroscopic examinations ranged from 1 to about 300. An equal number of control patients, treated non-invasively, have been randomly selected, and found - as anticipated from a pilot survey - to have similar distributions of potential confounding factors (age at admission, sex, race, smoking habits, occupation, and date of admission). The two groups differ mildly with respect to diagnosed severity of tuberculosis. This characteristic, if found to be an independent risk indicator for some (or all) cancers within this study population, will be a primary variable for stratification in data analysis. North Carolina mortality data, through 1975, provide the initial basis of comparison between the two patient populations. Preliminary age-standardized proportional mortality analysis has revealed a moderate relative excess of cancer deaths in the fluoroscopy-treated patients, with this excess being greatest for deaths occurring at least 15 years after initial exposure, and for deaths in patients with the highest cumulative exposure. Bias due to patient loss-to-follow-up is being assessed and preliminary calculations of death rates, via life-table mortality analyses, are being carried out.

1962 (RLO/2405--2) EFFECT OF GRADED DOSES OF IONIZING RADIATION ON THE HUMAN TESTIS. PROGRESS REPORT, OCTOBER 1, 1975--SEPTEMBER 30, 1976. Rowley, M.J. (Swedish Hospital Medical Center, Seattle, Wash. (USA)). 1976. Contract EY-76-S-06-2405. 71p. Dep. NTIS, PC A04/MF A01.

A 17-year study on the effects of acute x irradiation on testicular function of man is discussed. The subjects were healthy normal volunteers between the ages of 25 and 52 years who were long-term inmates of a state penitentiary. Total radiation doses ranged from 8R to 600R. Serial testicular biopsy samples, sperm counts, and measurements of urinary and plasma gonadotropins and steroid hormones were made. A list is included of 19 publications that report the medical findings, including an overview published in Radiation Research 59:665-678 (1974).

1963 (STH--1/76) RISKS AND BENEFIT IN X-RAY DIAGNOSTICS. Stieve, F.E. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene; Bundesgesundheitsamt, Berlin (Germany, F.R.)). 1976. 14p. (In German). (CONF-760257--1). Dep. NTIS (US Sales Only), PC A02/MF A01.

From Annual meeting of the Finnish X-ray Society; Helsinki, Finland (6 Feb 1976).
1 fig.; 6 tabs.; with refs. Available from ZAED.

Comparing the risks connected with X-ray diagnostics with other risks occurring in medical practice we can state that in the individual case the risk is acceptable when compared with the advantages (leaving out exceptional cases) although the radiation exposure due to X-ray diagnostics represents the main part of radiation exposure produced or used by man and the volume of X-ray diagnostics is increasing. A precondition is, however, the keeping of those rules of radiation protection which have led to a safe utilization during the 80 years of carrying out X-ray diagnostic measures. The persons prescribing and applying this method must be sufficiently informed about the real benefits. The terms 'risk' and 'benefit' are explained in detail. Using some practical examples, the author shows how to keep radiation exposure within limits where (even under optimal conditions) diagnosing is also possible.

- 1964 (STH--12/76) AMBULANT TREATMENT AND PROTECTION OF PERSONS OUTSIDE OF HOSPITALS. Kaul, A.; Stieve, F.E. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Strahlenhygiene). 1976. 14p. (In German). (CONF-7609145--1). Dep. NTIS (US Sales Only), PC A02/MF A01.

From Seminar on radiation protection problems in connection with the preparation and use of pharmaceuticals containing radioactive substances; Luxembourg, Luxembourg (27 Sep 1976).

Radiation exposure of the population, which is not to be underestimated, can occur on account of the use of radioactive substances for diagnostic purposes, in particular if the number of examinations increases to the same extent as in the last decade. Radiation exposure of the population in connection with the treatment of patients with radioactive substances can be avoided to a great extent if these patients are retained for at least 48 hours after application in controlled areas, and if they are discharged only if the residual activity does not exceed the various limits laid down. Finally, an increased population exposure is possible through radioactive contaminated corpses. In these cases, too, unnecessary population exposure can be avoided by interpreting the radiation protection regulations in a purposeful way.

- 1965 TRICHO SYSTEM: HYPERTRICHOSIS, RADIATION, AND CANCER. Lapidus, S.M. (Hamot Medical Center, Erie, PA). J. Surg. Oncol.; 8: No. 3, 267-274(1976).

Five women in their 6th to 8th decades were treated for facial hypertrichosis in Erie, Pennsylvania, 30 to 40 years ago. The epilations were performed with an x-ray device called Tricho System, which was manufactured, sold, and proclaimed safe by its physician-inventor. The beauty shop operator who administered these treatments may or may not have received instruction by the company in the operation of the equipment. At varying intervals, each of the 5 women developed radiodermatitis and basal cell and/or squamous cell carcinoma at the sites of epilation. All presented to the plastic surgical service at the Hamot Medical Center in Erie, Pennsylvania. Two underwent massive radical resective surgery, 2 required extensive excision and resurfacing, and 1 refused resective surgery although she had had a previous surgical attempt 17 years earlier. Case histories are

presented in detail. This series is representative of the epidemic nature of Tricho-System-induced disease. (auth)

- 1966 POTENTIAL RADIATION HAZARDS IN GAMMA RADIOGRAPHY EQUIPMENT. Anger, K.; Eisenreich, M.; Gruen, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Technik (Berlin); 31: No. 1, 52-53(1976). (In German).

Two unusual occurrences are selected to show possible overexposures to ionizing radiation in gamma radiography. Particular emphasis is laid on improper handling of the irradiation device as the cause of such occurrences. Instructions aimed at avoiding them are given.

- 1967 MICRO-DOSIMETRIC APPROACH TO DETERMINATION OF QUALITY FACTOR OF RADIATION. Filushkin, I.V. At. Energ. (USSR); 40: No. 3, 227(1976). (In Russian).

Permissible levels of highly ionizing radiation are based on recommended values of quality factors (QF) which are poorly substantiated radiobiologically. Well-substantiated QF-values should be determined from RBE values of highly ionizing radiation for doses of the order of maximum permissible values. Such data cannot be obtained experimentally. The microdosimetric concept of dual radiation action, modified by the author, is used to obtain RBE values for low doses. The necessary parameters of equations were estimated on the basis of available survival data for human kidney cells after medium and large doses of radiation. For a low mitotic index of the cell system, maximal RBE-values reach 800. For a system that is an intensely proliferating one, this value does not exceed 40. 4 figures, 1 table, 14 references.

- 1968 FOLLOW-UP STUDY OF PATIENTS TREATED BY X-RAY EPILATION FOR TINEA CAPITIS. Shore, R.E.; Albert, R.E.; Pasternack, B.S. (New York Univ. Medical Center). Arch. Environ. Health; 31: No. 1, 21-28(1976).

This is the second follow-up study of 2,215 persons who during childhood between 1940 and 1959 had been given x-ray therapy for tinea capitis and of 1,395 persons well matched for age, sex, and race who were treated for the same disease during the same period without the use of x-ray therapy. The major finding of the study was an excess incidence in the irradiated cases of tumors of the head and neck including the skin, brain, thyroid, and parotid. However, between the groups there was no difference in death due to malignant neoplasms or any other cause. Among white patients, a 40 percent excess of treated psychiatric disorders was observed in the irradiated group, but there was no difference among blacks.

- 1969 DOSE CONSEQUENCES FROM AIRBORNE RADIOISOTOPES. Cohen, B.L. pp 9.1-9.17 of Controlling airborne effluents from fuel cycle plants. Hinsdale, IL; American Nuclear Society (1976).

From Meeting on controlling airborne effluents from fuel cycle plants; Sun Valley, ID, USA (5 Aug 1976).

See CONF-760806--.

When airborne radioactive particulate is inhaled, it may deposit and thereby administer a radiation dose to various parts of the respiratory system. The variations in this process with the nature of the particulate and with the physiology of the inhaler are very wide, but for purposes of making dose

estimates, models have been developed. The dose to the respiratory system depends on the product of the amount of radioactivity deposited and the time it remains there, so the models must give estimates of these. Once the material leaves the respiratory system it may concentrate in various other body organs exposing them to radiation; here again, the models must give estimates of the amount of radioactivity reaching each organ and its time of residence there. This information is then combined to give the radiation dose to various body organs per microcurie inhaled of any given radionuclide. Models are presented that calculate radiation doses to various body locations.

- 1970 MEDICAL CONTROL EXAMINATIONS AND PROCEDURES OF TREATMENTS. Stieve, F. (Bundesgesundheitsamt, Berlin (F.R. Germany). Abt. fuer Strahlenhygiene). Atomkernenergie; 28: No. 1, 49-55(1976). (In German).

From Symposium on medical and biological problems of radiation exposure; Borstel, F.R. Germany (30 May 1975).

1 fig..

The paper deals with protection regulations concerning handling ionising radiations especially with regard to the conditions in nuclear plants. The report is based on the official regulations on radiological protection (Strahlenschutzverordnung) in the FRG, which are in accordance with the recommendations of the ICRP and the basic norms of Euratom. Informations are presented about the different areas in the plants and around them, the admissible doses for persons, occupied in controlled areas and about methods of radiation survey and monitoring. With regard to the health surveillance of the personnel in radiation work the rules for pre-employment and routine medical examinations are discussed. In case of radiation accidents special organisational and medical instructions for operation are necessary. These problems are part of the field of actions of authorized medical officers for health surveillance, which necessitates a special training for them. Finally the report gives some details about the concerning control and registering functions of the Federal Health Office of Germany (Bundesgesundheitsamt).

- 1971 GENETIC TOPICS IN RADIATION PROTECTION. Traut, H. (Muenster Univ. (F.R. Germany). Inst. fuer Strahlenbiologie). Atomkernenergie; 28: No. 1, 23-27(1976). (In German).

From Symposium on medical and biological problems of radiation exposure; Borstel, F.R. Germany (30 May 1975).

1 fig.; with refs..

The effects of mutations induced by ionizing radiation on human health can be subdivided into decrease of general viability, malformations and embryonic death. Reasons are given for the recommendation why a man whose gonads had been exposed to radiation should refrain from procreation for a couple of months. An analysis of the frequency of chromosome aberrations induced in lymphocytes can provide an estimate of the dose received during an accidental exposure. Radiation induced chronic myeloid leukaemia is probably based on the induction of an aberration involving chromosome 22 in a bone marrow cell (deletion, translocation). The relationship between the frequency of radiation induced point mutations and the DNA content of the genome of the species studied so far is discussed.

- 1972 FUTURE RADIOLOGICAL LOADS DUE TO NUCLEAR FACILITIES IN THE CATCHMENT-BASIN OF THE UPPER RHINE. PT. 1. LOADS BY AIR. Bayer, A.; Kalckbrenner, R.; Schueckler, M. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). pp 727-730 of Reactor conference, Duesseldorf, 30.3.-2.4.1976. Section 3: Design, construction and operation of nuclear power plants and their components. Eggenstein-Leopoldshafen, F.R. Germany; ZAED (1976). (In German)

From Reactor meeting; Duesseldorf, F.R. Germany (30 Mar 1976).

3 figs.; 2 tabs.; 7 refs. Short communication only.

CHILDREN; COMPUTER CALCULATIONS; DOSE RATES; ENVIRONMENTAL EXPOSURE PATHWAY; FISSION PRODUCT RELEASE; FOOD CHAINS; FORECASTING; GASEOUS WASTES; HUMAN POPULATIONS; ICRP CRITICAL GROUP; IODINE ISOTOPES; NUCLEAR FACILITIES; RADIATION DOSES; RADIOACTIVE WASTE DISPOSAL; REACTOR OPERATION; RHINE RIVER

- 1973 ANALYSIS AND THERAPY OF EXCEEDING EXPOSURE TO IONIZING RADIATION. Flidner, T.M. (Ulm Univ. (F.R. Germany). Abt. Klinische Physiologie). Atomkernenergie; 28: No. 1, 39-47(1976). (In German).

From Symposium on medical and biological problems of radiation exposure; Borstel, F.R. Germany (30 May 1975).

3 figs.; 15 refs..

The analysis of the data obtained in persons accidentally whole body exposed to ionizing radiation indicates that their pathophysiology is quite well known and appreciated. There is a major involvement of the epithelial and of the hematopoietic cell renewal systems. Their response is related to the radiation dose, the dose rate and the quality of radiation but also to the radiation sensitivity of the different cell types of a particular cell renewal system. Low dose radiation exposures and longterm irradiation with low dose rates can be tolerated by cell renewal systems quite remarkably for long periods of time. The increased cell loss is being compensated for by an increased cell production. Radiation exposures with a high dose rate and a large dose may result in reversible or irreversible damage, especially of the stem cell pools and of the microenvironment of the proliferating cells. The damage of hematopoietic systems may be overcome by stem cell transfusion and gnotobiotic technics. The cell system physiology approach of the characterization of the consequences of unexpected radiation exposure results in new aspects for their diagnosis and therapy.

- 1974 INFORMATION FOR PHYSICIANS ON IRRADIATION-RELATED THYROID CANCER. Cancer; 26: No. 3, 150-159(1976).

The purpose of the workshop was to determine the present status of knowledge on this subject, and to develop guidelines for detection, diagnosis, treatment and follow-up of radiation-related thyroid cancers which might be of value to practicing physicians.

- 1975 FUTURE RADIOLOGICAL LOADS DUE TO NUCLEAR FACILITIES IN THE CATCHMENT-BASIN OF THE UPPER RHINE. PT. 2. LOADS BY THE WATER PATH. Schueckler, M.; Kalckbrenner, R.; Bayer, A. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). pp 723-726 of Reactor conference, Duesseldorf, 30.3.-2.4.1976. Section 3: Design, construction and operation of nuclear power plants and their components.

- Eggenstein-Leopoldshafen, F.R. Germany; ZAED (1976). (In German)
 From Reactor meeting; Duesseldorf, F.R. Germany (30 Mar 1976).
 3 figs.; 3 tabs.; 7 refs. Short communication only.
 AQUATIC ECOSYSTEMS; COMPUTER CALCULATIONS; CONTAMINATION; ENVIRONMENTAL EXPOSURE PATHWAY; FISSION PRODUCT RELEASE; FOOD CHAINS; FORECASTING; HUMAN POPULATIONS; LIQUID WASTES; MAN; NUCLEAR FACILITIES; RADIATION DOSES; RADIOACTIVE WASTE DISPOSAL; RHINE RIVER; ENVIRONMENTAL EFFECTS
- 1976 PATIENT RADIATION EXPOSURE IN COMPUTERIZED AXIAL TOMOGRAPHY. Linke, G.; Pauli, K.; Pfeiler, M. (Siemens A.G., Erlangen (F.R. Germany). Bereich Medizinische Technik). Electromedica; 44: No. 1, 15-18(1976). (In German).
 From 56. meeting of the Deutsche Roentgengesellschaft - Gesellschaft fuer Medizinische Radiologie, Strahlenbiologie und Nuklearmedizin e.V.; Berlin, F.R. Germany (1 May 1975).
 8 figs.; 4 refs..
 Principles of the cross-section X-ray, estimation and measurement of a patient's dose for an cross-section X-ray, comparison with conventional film-foil pictures.
- 1977 BASES FOR STANDARDS AND REGULATIONS. Morgan, K.Z. (Georgia Inst. of Tech., Atlanta). pp 276-297 of Environmental impact of nuclear power plants. Karam, R.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1976).
 From Conference on environmental impact of nuclear power plants; Atlanta, GA, USA (26 Nov 1974).
 See CONF-741193--.
 Some topics discussed are as follows: historical review of exposure of man to ionizing radiation; recommendations of the NCR and ICRP; nomenclature and classification of radiation standards; evolution of indices of radiation risk or permissible exposure; data used as the basis of standards; and linear vs. threshold hypothesis as a basis of standards. (HLW)
- 1978 CONCEPT OF 'AS LOW AS PRACTICABLE' AND BALANCING THE BENEFITS AGAINST THE RISKS. Rogers, L. (U.S. Atomic Energy Commission, Washington, DC). pp 298-312 of Environmental impact of nuclear power plants. Karam, R.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1975).
 From Conference on environmental impact of nuclear power plants; Atlanta, GA, USA (26 Nov 1974).
 See CONF-741193--.
 Some topics discussed are as follows: background on radiation protection standards; and an excerpt from ICRP publication 22 including the basis of the Commission's recommendations; the practical application of paragraph 52 of publication 9; conclusions; and explanation of terms. (HLW)
- 1979 HEALTH RISKS BY LOW AND LOWEST RADIATION DOSES. Fritz-Niggli, H. (Zurich Univ. (Switzerland). Strahlenbiologisches Inst.). Atomkernenergie; 27: No. 3, 209-211(1976). (In German).
 1 fig.; 3 tabs. Paper read at the Collegium Generale of Bern Univ. on November 17th, 1975.
 As the biological effects depend on the distribution of dose in time and space, we must differentiate between risks of concentrated and diluted radiation, of low dose and very low dose. A different shape of dose-effect curves with low and very low doses is possible as 2 different mechanisms may lead to damage: The singular type (1 event) leads to the effect and the multiple type (only several events together lead to the effect). For very low diluted doses (represented by burden of natural radiation or exposure of population by power production from nuclear fission) a practically innocuous for multiple mechanisms dose could exist. For low (acute) doses, represented by medical exposure the minimum of necessary energy for multiple reactions will be mostly exceeded. The risks factors are estimated under the postulation of a linear dose effect relation. They can be reality or overestimation and also underestimation, as low doses under certain circumstances could be relatively more efficient than high doses by protection of cells with sublethal damages, mitotic multiplication of damage.
- 1980 Schutz gegen ionisierende Strahlung aus aeusseren Quellen. (PROTECTION AGAINST IONIZING RADIATION FROM EXTERNAL SOURCES). Stuttgart, F.R. Germany; Gustav Fischer (1976). 56p. (In German).
 20 refs..
 This document is the German translation of the 15th ICRP publication. It contains recommendations for the erection and operation of radiation sources as well as the basic safety measures for the protection of patients and personnel. Apart from the extensive recommendations for medical applications in diagnostics and therapy, there are also recommendations for the fields of veterinary medicine, industry, and research.
- 1981 RADIATION PROTECTION OF PERSONNEL IN NUCLEAR POWER PLANTS. Albrecht, L.; Krueger, F.W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Technik (Berlin); 30: No. 8, 511-514(1976). (In German).
 An outline of the protection of nuclear power plant personnel is given. The following topics are dealt with: 1) protection against internal and external irradiation; 2) organizational and technological radiation protection measures; 3) radiation monitoring inside the plant and personnel dosimetry; 4) education and medical supervision of the personnel; 5) evaluation of the effectiveness of the protective measures.
- 1982 SUGGESTED MATHEMATICAL MODEL FOR THE DOSE-EFFECT RELATIONSHIP. Wolber, G. (Electricite de France, 75 - Paris). pp v.1 p.265-274 of Biological and environmental effects of low-level radiation. Proceedings of a symposium on biological effects of low-level radiation pertinent to protection of man and his environment organized by the IAEA and the WHO and held in Chicago, 3-7 November 1975. Vienna; IAEA (1976). (In French)
 From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).
 On the basis of the experimental data available in 1958, a linear relationship was assumed to obtain between the risk of harmful effect and cumulative dose. However, this was significant only for doses above 100 rad. In the circumstances the ICRP used this model and, adopting a conservative approach, extended it to lower doses (Publication No.1, 1959). The existence of possibilities of repair of damage due to irradiation leads to the consideration of models which take account of this fact, thus permitting new estimates to be made. Two

hypotheses were chosen for this purpose. The first assumes that the organism's potential for repair is independent of irradiation; the second that the repair potential is proportional to the existing damage with saturation of the repair mechanism. The irradiation is continuous and of finite duration. Observation of effects commences on completion of irradiation and continues for an unlimited period. In both cases the dose rate has a very important effect and there is a threshold for the latter beyond which there is no longer a linear relationship between dose and effect. There is even a zero effect for the first model. These models have been verified experimentally with satisfactory approximation, but they do not account for all the observed findings, such as dose fractionation and certain so-called paradoxical effects. The important finding is still the fact that there is an incompatibility between the ICRP's linear relationship hypothesis and the existence of repair phenomena in an organism. A more sophisticated model, in which account is taken of the kinetics of defence and repair mechanisms, is now under study.

1983 TIME FACTOR IN DOSE-EFFECT RELATIONSHIPS. Jones, H.B.; Grendon, A.; White, M.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; California Univ., Berkeley (USA). Donner Lab.). pp v.1 p.319-324 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The assumption that carcinogenic risk is proportional to dose fails to consider that probable time of actual cancer incidence. The time lag between exposure and carcinogenic effect for radiation and chemical agents varies as $D_{sup}(-1/n)$, with n approximately 3. A model is offered explaining that concentration of initially altered cells depends on dose, whereas their chance for development into tumours on their proximity, which varies as $D_{sup}(-1/3)$. Because of biological variability, n has a range of values. The model implies that tumours resulting from a single exposure should be closely distributed in time, producing a pulse of cases and subsequently being essentially without effect. Testing of the $D_{sup}(-1/3)$ rule was extended and its model, by further refinement of methods, applied to radiogenic leukaemia risk and to the effect of urethan in inducing lung tumours in mice with and without radiation exposure as a possible cocarcinogen. Radiation did not affect the tumour yield from urethan in mice. Radiogenic leukaemia and lung tumours induced by urethan both occur in proportion to exposure, but the time of their occurrence is limited to a short interval in relation to life span. Similarly, in murine or in human radiogenic leukaemia, leukaemia risk occurs in proportion to exposure, but the time of occurrences is limited to a short interval in relation to life span. In both sets of observations the peak of occurrence or the mean latent period is roughly inversely related to $D_{sup}(-1/3)$. Applied to lung tumours and leukaemia, the spread of cases about the peak incidence was found to be typically less than a fifth of the life span. Exposure risks do not continue to act over life span. Neoplastic disease risk from carcinogens levels too low to be tested experimentally, theoretically usually lies beyond the life span. The social and economic consequences of a theoretically calculated number of deaths due to those carcinogens depend on when they occur.

1984 NEW RELATIVE HAZARD INDEX. Smith, C.F.; Burnett, T.W.T.; Kastenberger, W.E. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). pp 325-332 of Biological and environmental effects of low-level radiation. Vol. 1. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Several indexes for the evaluation of relative radionuclide hazards have been previously developed. In this paper, a new relative hazard index is derived for use in the assessment of the future burden to mankind from the presence of radionuclides in the environment. Important features of this hazard index are that it takes into account multiple decay schemes, non-equilibrium conditions, and finite time periods. As an application of this hazard index, a comparison is made between thermal reactor radioactive waste and the uranium required as fuel with the following conclusions: (1) For short time intervals ($d \leq 5000$ years), the waste hazard index equals the uranium ore hazard index for a release time of 2000 years or less. (2) For short time intervals of concern, the waste hazard index equals the consumed uranium index at a release time of approximately 20 000 years. An important factor is the consumption of ^{235}U breaking the uranium decay chain. (3) For long time intervals of concern ($d \geq 500\,000$ years), the reactor waste and consumed uranium indexes are equal after a much shorter decay time (approximately 10 years.) (author).

1985 Daten zum Schutz gegen ionisierende Strahlung aus aeusseren Quellen. (DATA FOR PROTECTION AGAINST IONIZING RADIATION FROM EXTERNAL SOURCES). Stuttgart, F.R. Germany; Gustav Fischer (1976). 80p. (In German). 59 figs.; 21 tabs.; with refs..

This document is the German translation of ICRP publication 21. It is a supplement to ICRP publication 15 and contains information for the practical application of the recommendation for radiation protection from radiation sources in medical, dental, and veterinary radiology as well as in industry and research. A substantial part of this supplement is dedicated to shielding data with extensive bibliography. It does not cover shielding problems in nuclear reactors and ultra-high energy accelerators.

1986 THYROID CANCER ASSOCIATED WITH RADIATION EXPOSURE. DOSE-EFFECT RELATIONSHIP. Colman, M.; Simpson, L.R.; Patterson, L.K.; Cohen, L. (Michael Reese Hospital, Chicago, Ill. (USA)). pp 285-288 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

An increased incidence of thyroid cancer has been reported in survivors of the nuclear disasters at Hiroshima and Nagasaki, in the Marshall Islands accidentally exposed to fallout and among children treated with medical X-ray exposure for benign conditions in the head and neck area. The latter group, having received a known exposure usually given by a standardized technique, provide an opportunity to determine fairly accurately the influence of radiation dose on the incidence of thyroid cancer. A follow-up programme currently under way directed towards over 5000 people who were irradiated between 1938 and 1955 has resulted in nearly 1200 people coming forward for

examination. A significant "abnormality" was found in 288 subjects (24.2%) of whom 186 have undergone surgery so far with a finding of cancer in 61 people (5.1%). Radiation exposure dose was established for each subject using appropriate depth-dose data, Roentgen-to-rad conversion and back-scatter factors. Correlations were found between the incidences of detectable "abnormalities" and thyroid cancers with radiation dose. The projected incidence of cancer was 8.6% (+1.2%) at 700-750 rads and 19.4% (+6.1%) at 1350-1500 rads based on findings in the patients who have undergone surgery so far. The overall projected incidence of thyroid cancer in relation to dose (mean dose 783 rads, range 50-1500 rads) and period of follow-up (mean follow-up 28 years, range 19-35 years) was 3.7 cases per million at risk per rad per year. These findings are discussed in relation to the observations of other authors.

- 1987 ASSUMED GENETIC EFFECTS OF LOW LEVEL IRRADIATION CN MAN. Dutrillaux, B. (Paris-6 Univ., 75 (France)). Radioprotection; 11: No. 2, 127-136(1976). (In French).

From Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

The significance of human genetic pathology is stated and a study is made of the assumed effect of low level ionizing radiations. The theoretical notions thus derived are compared to experimental data which are poor. A quick survey of the literature shows that it has not yet been possible to establish a direct relationship between an increase of exposure and any genetic effect on man. However, this must not lead to conclude on the innocuousness of radiation but rather shows how such analyses are difficult in as much as the effect investigated is necessarily low.

- 1988 LONG-TERM EFFECTS OF PRENATAL X RAY ON DEVELOPMENT AND FERTILITY OF HUMAN FEMALES. Meyer, M.B.; Tonascia, J.A.; Merz, T. (Johns Hopkins Univ., Baltimore, Md. (USA). School of Hygiene and Public Health). pp 273-284 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

This continuing epidemiologic study investigates possible effects of X-ray exposure during foetal life on the subsequent development and fertility of human females and on their offspring. The study population comprises 1458 females exposed in utero to maternal diagnostic X ray such as pelvimetry, and 1458 unexposed controls matched by hospital of birth, parity, race and birthdate (1947-1952). Phase I of the study showed a 10-15% increase in fertility in young exposed women, based on ascertainment of live births and foetal deaths registered in Baltimore City. This statistically significant difference ($p=0.011$) remained after adjustment for differences between exposed and control women in economic, social and medical factors. Phase II of the study, a direct follow-up of exposed control pairs of women now aged 22-28, continues to show more total pregnancies among exposed women. Exposed-in-utero women had 15% more total pregnancies than controls in 1960-1969, and 7% more in 1970-1975. Exposed and control women are similar in number of siblings, number of children wanted, contraceptive use, and frequency of therapeutic abortion. Other findings suggest possible exposed-control differences in growth, development and behaviour. Exposed women have

completed fewer grades of school, have poorer general health, more menstrual problems, more of certain diseases and accidents, and are heavier for height than controls.

- 1989 INVESTIGATION OF EFFECTS OF PRENATAL EXPOSURE TO DIAGNOSTIC X RAYS. Oppenheim, B.E.; Griem, M.L.; Meier, P. (Chicago Univ., Ill. (USA); Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). pp 249-258 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

A number of epidemiological studies have demonstrated a relationship between prenatal or preconceptual exposure to diagnostic X rays and the incidence of leukaemia or other forms of cancer. Radiation exposure in these studies was always prompted by a medical indication, and this may have introduced biases in the selection process to which the observed effects might be attributed. A prospective long-term follow-up study was carried out of about 1000 children exposed in utero to routine pelvimetry examinations at the Chicago Lying-In Hospital, along with suitable controls. This study should have been relatively free of bias since medical indication played no role in the selection process. Data on all significant illnesses and hospitalizations were collected and analysed, and no conclusive evidence of a radiation effect was found. These results were compared with those of Diamond and Lilienfeld, who found a doubling of the gross death rate among the white children in their study who were exposed to diagnostic X rays in utero. No such effect was found; furthermore, the discrepancy between the results of Diamond and Lilienfeld and of the present authors is statistically significant. Differences in the methods of selection appear to account for this discrepancy. The authors also compared other studies of effects of diagnostic X rays with studies in which exposure occurred on a non-selective basis from atomic bomb radiation, and found discrepant results in each instance. This suggests that the various reported effects of exposure to diagnostic X rays might actually be attributable to biases introduced by the selection process.

- 1990 EVALUATION OF SOMATIC RISKS ASSOCIATED WITH LOW DOSES. Delpla, M. (Electricite de France, 75 - Paris). pp 351-358 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976). (In French)

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Epidemiological observations at Nagasaki from 1950 to 1970 suggest that whole-body γ radiation of short duration, where it was not fatal, is not cancerogenic from the statistical point of view for any site except the bone marrow and this only in the category that received an average dose of about 400 rem. It would appear that irradiation with a dose of around 50 rem added a negative risk of leukaemogenesis. In the case of Hiroshima, the interpretation is complicated by the presence of neutrons. It would undoubtedly be of value to compare these observations with those for Nagasaki.

- 1991 INVESTIGATIONS ON HUMAN POPULATIONS RESIDING IN HIGH BACKGROUND-RADIATION AREAS OF

KERALA AND ADJOINING REGIONS. George, K.P.; Sundaram, K.; Mistry, K.; Gopal-Ayengar, A.R. (Bhabha Atomic Research Centre, Bombay (India). Bio-medical Group). pp v.2 p.325-329 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Investigations on human populations residing in monazite-bearing high-background radiation areas of Kerala and adjoining regions, reported earlier, are brought up to date. The object of the investigation is to evaluate long-term effects of chronic radiation exposure in man. Demographic data, including fertility history, of 13355 households (approximately 70000 individuals) in a approximately 55-km long strip had been collected. A radiation dosimetric survey of nearly 20% of this population, using calcium fluoride thermoluminescent dose meters, had been completed. Chromosomal analyses on 35 cord blood samples from new-borns of parents resident in high-background radiation areas as well as areas with normal background radiation levels have been completed so far. The data as such did not indicate any significant differences in chromosomal abnormalities such as chromosome/chromatid breaks, acentric fragments and chromosome/chromatid gaps between samples from high and low radiation areas. Dicentric, rings, etc., have not been observed in any of these samples. Confirmation of these preliminary results would have to await the results of extensive studies now in progress.

1992 PROBLEMS ARISING FROM EFFECTS OF LOW RADIATION DOSES IN EARLY PREGNANCY.

Neumeister, K. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). pp 261-271 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

From 1970 to 1974, 37 expert opinions concerning interruption of pregnancy because of radiation stress of the foetus had to be given at the Centre for Clinical Radiobiology of the Karl-Marx University, Leipzig. In the cases investigated, radiation stress occurred between the first and tenth week of pregnancy at a maximum amount of approximately 20 R. X-ray diagnostic measures had been taken in the abdominal range or a tumour radiotherapy had been made, all in cases of unknown pregnancy. The individual determination of the foetal dose showed that different doses result, depending on the setting technique of photographs, physico-technical conditions and body size. In no case did anamnesis show special features. At the given doses an interruption seemed necessary only in one case (radiotherapy). According to this survey, diagnostic radiation stresses in early pregnancy almost always show radiation doses which, at the present stage of knowledge, do not make an interruption seem necessary. Individual differences of dose values for the same exposures, however, make it necessary to calculate exactly the radiation stress of the foetus in each case and to make the corresponding decision. As recent literature agrees in negating a so-called threshold dose for early damage, it is, apart from genetic considerations, necessary to avoid radiation stresses in early pregnancy for this reason also. In the author's opinion, an indication for an interruption is given at

doses above 10 R (see also Hammer-Jacobsen, 1959). At lower radiation stresses, an interruption should be recommended in case of simultaneous additional noxae. This paper communicates the results of the check-ups of children who had been subject to a radiation stress of below 7 R in utero in the above cases.

1993 LOW-DOSE IONIZING RADIATION:

CARCINOGENIC EFFECTS IN MAN. Silverman, C.; Shore, M.L. (Bureau of Radiological Health, Rockville, Md. (USA); Food and Drug Administration, Rockville, Md. (USA)). pp 395-401 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

From epidemiologic studies, carcinogenic effects associated with radiation doses under 50 rads are presented, dose-effect relationships are considered, and potentials for making further observations in human populations are reviewed. Malignant lesions reported to be associated with doses of less than 50 rads are leukaemia and thyroid cancer; dose-effect information for these neoplasms is presented. Some studies suggest there may be low-dose associations with several other types of malignancies. The studies reviewed had periods of observation of 16-29 years post-exposure. It is important that studies which are capable of providing data about low-dose effects of dose-response relationships ranging from high to low doses be carried out for as long a period of follow-up as possible.

1994 PRESENT AND FUTURE RESEARCH PROGRAMME OF THE RADIATION EFFECTS RESEARCH FOUNDATION (RERF): FORMERLY THE ATOMIC BOMB CASUALTY COMMISSION (ABCC). Yamashita, H. (Radiation Effects Research Foundation, Hiroshima, Japan). pp 403-417 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

A summary of major scientific achievements so far obtained by the Atomic Bomb Casualty Commission (ABCC) on the long-term effects on man of atomic bomb exposure are presented as well as research programmes to be carried out by the newly established Radiation Effects Research Foundation (RERF), which has replaced the original ABCC.

1995 CHROMOSOME ABERRATIONS IN PERIPHERAL BLOOD LYMPHOCYTES DEPENDENT ON VARIOUS DOSE LEVELS OF NATURAL RADIOACTIVITY. Pohl-Rueling, J. (Research Institute Gasteln of the Austrian Academy of Sciences, Salzburg, Austria); Fischer, P. (Vienna Univ. (Austria)); Pohl, E. (Salzburg Univ. (Austria). Inst. of Biophysics). pp 317-323 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The additional α blood dose, due to inhalation of air containing an elevated amount of ^{222}Rn , to the population in the area of the 600-year-old radon spa Badgastein (Austria) encompasses mean values from 2 mrad/a for groups of residents, up to 1500 mrad/a for

workers in a special treatment centre, located in a former gold mine. The external dose caused by terrestrial sources, subsoil, building materials and radon decay products, and by cosmic rays (sea-level 800 - 1250 m) ranges from 80 to 300 mrad/a. Chromosomal aberrations in the peripheral blood lymphocytes have been investigated in 122 persons, with 30590 cells scored. The dose rates, accumulated in the last six months before sampling, were estimated individually for every single person, taking into account the various times spent at different locations, the respiratorial minute volume during their activities, and the significant mean values for the radon and decay product concentrations in the air at these locations. For people who received an ($\alpha + \gamma$) dose <100 mrad and an α dose <5 mrad the age dependence for each kind of aberration was calculated. For all other cases the aberrations have been corrected for age and their dose dependence was then analysed. A non-linear relationship was found with an initial sharp increase up to 200 mrad, followed by a flattening of the curve for chromosome aberrations, whereas the chromatid aberrations showed no dose dependence.

- 1996 METHODOLOGY OF MEASUREMENT AND STATISTICAL EVALUATION OF RADIATION BURDEN TO VARIOUS POPULATION GROUPS FROM ALL INTERNAL AND EXTERNAL NATURAL SOURCES. Pohl, E.; Steinhäusler, F.; Hofmann, W. (Salzburg Univ. (Austria). Inst. of Biophysics); Pohl-Rueling, J. (Research Institute Gastein of the Austrian Academy of Sciences, Salzburg, Austria). pp 305-314 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Knowledge of the radiation burden from natural sources to man in his normal environment is of great importance in our time. However, it is not sufficient to estimate only the average dose for a large population; it is desirable to know the dose to all organs and tissues with high radiation sensitivity for different groups of the population. Knowledge of such a dose distribution pattern for various population groups would enable future epidemiological studies to be carried out on possible biological effects due to low-level irradiation. The following components have to be investigated: (1) Cosmic rays. (2) External radiation from subsoil, building materials and air. These measurements should be carried out not only outdoors, but mainly in living, working and sleeping rooms. (3) Content in the air of ^{222}Rn , ^{220}Rn and their short- and long-lived decay products, both outdoors and indoors. This component causes the largest radiation burden from natural radioactivity to some tissues. These measurements are complicated by the fact that indoors and outdoors there are not only large local variations (up to a factor 300) but also temporal fluctuations at the single sites up to a factor 10. A suitable method for obtaining temporal significant means from grab-sampling is presented. (4) Radioactivity of drinking water and food. With these results the frequency distribution of the mean dose values in different organs for groups of a given population can be calculated. The statistical treatment of the data and the necessity to consider additional parameters about the population are discussed.

- 1997 RADIATION AND THE PUBLIC. Dunster,

H.J. (Health and Safety Executive, London (UK)). pp 7-13 of Nuclear power and the public interest: the implication for business. London; Financial Times (1976).

From Nuclear power and the public interest - the implication for business; London, UK (8 Jul 1976).

The biological effects of ionizing radiation are summarized. The principles and practice of radiation protection, as applied to human populations, are described with reference to the ICRP recommendations for 'justification, optimization and dose limits'.

- 1998 PERSONAL (ACCIDENTAL) DOSIMETRY IN MIXED NEUTRON-GAMMA-FIELD. Zarand, P. (Orszagos Rontgen es Sugarfizikai Intezet, Budapest (Hungary)). Izotoptechnika; 18: No. 9, 376-384 (1976). (In Hungarian).

4 refs..

Some dosimetrical rudiments and requirements layed to personal dosimeters are reviewed. The working principle of the following detectors being applicable for dosimetry is described: gamma detectors for personal dosimetry as film dosimeter, dosimetry by RFL glasses, TL dosimeters, dosimetry with ionisation chamber; neutron detectors used for personal dosimetry as dosimetry with nuclear emulsion, threshold detectors, resonant detectors, fissionable material detectors, albedo dosimeters, measuring ^{24}Na -activity of the body, using ionization chambers filled with body-equivalent gas; biological detectors as dosimeters based on the alteration of alcoholic elements in blood, determining the excreta in urine and the examination of chromosome aberration.

- 1999 LIST OF PHYSICIANS AUTHORIZED TO CARRY OUT EXAMINATIONS ACCORDING TO SECTION 46 OF THE FIRST RADIATION PROTECTION ORDINANCE AND TO SECTION 42 OF THE X-RAY ORDINANCE (AS PER 31ST OCTOBER 1975). Niedersachs. Ministerialbl.; No. 52, 1817-1819 (1976). (In German).

List of the physicians in the Land Lower Saxony authorized to carry out the medical surveillance of persons according to section 46 of the First Radiation Protection Ordinance and section 42 of the X-Ray Ordinance.

- 2000 APTITUDE TO WORK WITH IONIZING RADIATION AND MEDICAL SUPERVISION OF RADIATION WORKERS. Letard, H. (Electricite de France, 75 - Paris). pp 372-388 of Les concepts de faible dose de rayonnements ionisants en radiobiologie et en radioprotection. II. Cayet-Pennaneac'h, O. (ed.). Montrouge; Societe Francaise de Radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

The responsibilities of the occupational physician in charge of Medical examination before and during employment of radiation workers are examined: specifications of radiation hazards related to the job, medical history of the worker, over exposure above the MPD and assessment of dose-effect relationships in the case of occupational diseases.

- 2001 XERODERMA PIGMENTOSUM, DNA REPAIR AND CARCINOGENESIS. Cleaver, J.E. pp 111-121 of Cancer genetics. Lynch, H.T. (ed.). Springfield, IL; Charles C. Thomas Publisher (1976).

The following topics are reviewed: Symptoms of xeroderma pigmentosum; xeroderma pigmentosum as a defect in the biochemistry of repair of radiation damage; major classes of DNA damage and repair mechanisms; excision repair in relation to biochemical steps and the XP defect;

sensitivity of xeroderma pigmentosum cells; host-cell reactivation of UV-damaged viruses; excision of pyrimidine dimers from human cells; formation and sealing of single strand breaks during dimer excision; insertion of new bases to repair DNA; and DNA repair, carcinogens, and carcinogenesis. (HLW)

- 2002 CARCINOGENIC AND GENETIC HAZARD FROM BACKGROUND RADIATION. Frigerio, N.A.; Stowe, R.S. (Argonne National Lab., Ill. (USA)). pp 385-391 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Various models and predictions of the carcinogenic and genetic hazards of low-level, low-rate ionizing radiation were examined and compared with actual experience in population in the United States of America and elsewhere. All the models predicted a significant increment in malignant mortality, and mortality from genetic disorders, with increasing background. Populations were first examined for malignant mortality, for various age and geographic groups, for all malignancies (ICD 140-205). They were then re-examined for groups of malignancies (e.g. 140-159, 160-164, etc.), and for each of 56 separate malignancy types. These groups and their malignancy rates were compared with the radiation background characteristic of each geographic group. Simultaneous regressions were also performed against over 40 other geographical, social, medical, meteorological, economic, educational, ethnic and pollution parameters. Observation of the populations at risk showed not only no increment in malignant mortality with increasing background, but a consistent and continuous decrement. Similar results were obtained for mortality from congenital malformations. The question of whether low-level radiation, at rates of the order of 0.5 rem/a and below, constitutes a significant environmental hazard is discussed.

- 2003 JUSTIFICATION OF DOSE LIMITING VALUES WITH A VIEW TO MEDICINE AND BIOLOGY. Manstein, B. pp 301-308 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

With refs..

Theses on the dilemma between economic intentions and predetermined biological limits.

- 2004 OVARIAN FUNCTION OF WOMEN OCCUPATIONALLY EXPOSED TO PERMISSIBLE RADIATION DOSES.

Vusik, I.M.; Kogan, I.A. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). Radiobiol. Radiother.; 17: No. 2, 259-263(1976). (In German).

The oestrogen function of the ovaries of occupationally exposed women in the generative age with normal duration of the menstrual period of 28-32 days was investigated. It was shown that in women exposed to doses of 5 - 30 R the oestrogen excretion did not differ quantitatively as well as according to the kind of dynamic changes during the menstrual period from the adequate control. With doses of 30 - 70 R a disturbed synchronization of the excretion of some oestrogen fractions could be observed. Furthermore, a later occurrence of the ovulation peak, its immediate transition into the lutein peak without intermediate

decrease as well as a significant increase in the most active oestrogen fraction - the oestradiol - was also found. The detected changes in oestrogen excretion give evidence of the modified metabolism of sexual hormones in this category of women.

- 2005 PROTECTIVE REGULATIONS FOR AIR, WATER, AND SOIL. Aurand, K. (Bundesgesundheitsamt, Berlin (Germany, F.R.)); Schwibach, J. (Bundesgesundheitsamt, Neuherberg/Muenchen (Germany, F.R.)). pp 345-351 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

The regulations and numerical limitations of the activity or activity concentration of radioactive materials as well as the exposure to radiation of persons of the population which are dealt with in the new draft of the Radiation Protection Ordinance sect. 43 and 44, mean an enormous tightening up as compared with the state of the First Radiation Protection Ordinance or comparable regulations of other countries. Principally, such low limits should be more correctly designated as planning values. The concrete proof that these limits are observed means high requirements as to planning and operation of the plants as well as to supervisory steps. It will be necessary to elaborate practicable technical rules. Under consideration of radiation protection, these limits mean a very restrictive interpretation of the principle of limiting radiation exposure of human beings to what is possible.

- 2006 PROTECTIVE REGULATIONS FOR AIR, WATER, AND SOIL. Rauschnig, D. pp 353-359 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

The author welcomes the concept of the new standardization of the directions for protecting water, air and soil. However, the mode of calculation of the total radiation exposure in sect. 43 sub-section 3 of the draft cannot be accepted for both legal and technical reasons. The draft's wording has to be gone over again.

- 2007 ASPECTS OF THE EVALUATION FROM THE VIEW OF GENETICS OF LIMITING VALUES CONCERNING RADIATION LOADS. Barthelmess, A. (Muenchen Univ. (Germany, F.R.)). pp 309-316 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

2 tabs.; with refs..

Genetic science cannot indicate any determined limit which would be harmless for individuals and the population from genetic aspects. However, for legal reasons limits must be fixed, though they ought to be as low as possible. The most important limits from the view of genetics for those professionally exposed to radiation and for the neighbouring population of nuclear facilities are compared in tables subdivided into the First Radiation Protection Ordinance and its amendment. The approximate value for the first group is taken to be 20 rem as an accumulated dose during a life span (annual dose of 0.5 rem for 25 years of occupational activity in the control area). For the second group, the limit for internal plus external radiation charges can be said to

be the value of 30 mrem p.a. which is already applied in the licensing practice and which is stipulated in sect. 43 (3) of the draft.

- 2008 PROTECTION OF PERSONS OCCUPATIONALLY EXPOSED TO RADIATION AND OF PATIENTS. Meyer, P.H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). pp 339-343 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

Short communication only.

DOCUMENTATION;GERMAN FEDERAL REPUBLIC; OCCUPATIONS;OPTIMIZATION;PERSONNEL;RADIATION PROTECTION;RECORDING SYSTEMS;REGULATIONS; BIOMEDICAL RADIOGRAPHY;DOCUMENTATION;GERMAN FEDERAL REPUBLIC;OPTIMIZATION;PATIENTS; RADIATION PROTECTION;RADIOTHERAPY;RECORDING SYSTEMS;REGULATIONS

- 2009 PROTECTION OF PERSONS OCCUPATIONALLY EXPOSED TO RADIATION AND OF PATIENTS. Schmitz-Feuerhake, I. (Bremen Univ. (Germany, F.R.)). pp 335-338 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

As to employees and patients, first of all the individual risk must be observed, i.e. in figures: 10^{-6} for 1 mrem 1% probability to get cancer per additional rem. Welcome changes in the present draft are the obligation for documentation by the authorized physicist and the radiation passport for the employees, the obligation of documentation in case of radiation application on patients by the doctor. This will contribute to valuating accumulated doses. The result of this documentation should be a more efficient self-control of those concerned and a reduction of the individual risk. In the sense of an effective protective function, however, such documentation will remain insufficient if the data are not supplied to an evaluation and if they do not serve for further supervision.

- 2010 PROTECTION OF PERSONS OCCUPATIONALLY EXPOSED TO RADIATION AND OF PATIENTS. Stieve, F.E. (Bundesgesundheitsamt, Berlin (Germany, F.R.)). pp 317-334 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

19 refs..

The experiences of the last ten years have shown that the measures of the First Radiation Protection Ordinance generally proved to be sufficient for the protection of the employed or of the patients. They had to be amended in so far as the exposure to radiation for those occupationally exposed can be reduced. This results in changes to the regulations so that certain groups of persons can also be effectively controlled. The recognition that medical supervision for radiation protection reasons is reasonable only if exposure has occurred should be additionally utilized in the regulations if the Euratom standards make this possible. The protection of patients attains some new rules which can be derived from handling and from therapeutical use. In this case too experience resulted in a more reasonable application of ionizing radiation and radioactive materials than was expected when the First Radiation Protection Ordinance was issued.

- 2011 INTERNAL DOSIMETRY FOR NUCLEAR MEDICINE FROM THE VIEWPOINT OF MIRD RECOMMENDATIONS. Tautz, M.; Ertl, S. (Städtisches Klinikum Berlin-Buch (German Democratic Republic). Radiologisches Zentrum). Radiobiol. Radiother.; 17: No. 1, 65-70(1976). (In German)

The advantages of MIRD recommendations are represented. The definitions of absorbed dose constants and of the absorbed fraction are especially discussed. Improvements are introduced by omitting the energy-independent average geometric factor in the sense of Marinelli and by renouncing mean beta energy by including all disintegration components and their probabilities into the dose calculation. The application of the MIRD concept is explained with the aid of two examples: 1. In radioiodine therapy of the thyroid there is a difference in dose values of only about 1 per cent compared with the classical method. Differences in the whole-body dose arise from the geometric factor. 2. For ^{125}I the dose difference to the classical method of calculation is considerable (factor of about 2.5), which can be explained by the complete inclusion of all disintegration components. Organ unburdening by the radionuclide ^{125}I has been overestimated in the past.

- 2012 SIGNIFICANCE OF THE RADIATION PROTECTION PRINCIPLES. Basse, H. (Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany, F.R.)). pp 87-98 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Koeln, Germany, F.R.; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

34 refs..

The requirements of sect. 28 of the draft are based on the new ICRP recommendations and the EURATOM and OECD(NEA) basic standards. The application range of the basic principle of this section (any unnecessary exposure to radiation or contamination has to be avoided and has to be kept as far as possible below the fixed dose limit) as well as the consequences therefrom are discussed on the basis of three individual cases: 1) uranium-containing enamel colours; 2) ionisation fire alarm; 3) treatment and removal of radioactive waste materials (example: radioactive sewage sludge disposal on the Leopoldshafen dump).

- 2013 INTERNATIONAL LEGAL BASIS FOR THE DRAFT OF THE RADIATION PROTECTION ORDINANCE. Bischof, W. pp 39-59 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

84 refs..

A brief survey of the international legal bases to be considered for the amendment is given: 1) UNSCEAR reports; 2) ILO regulations; 3) WHO standards; 4) IAEA standards; 5) NEA regulations; 6) amendment of the EURATOM basic standards; 7) international regulations on the transport of radioactive materials; 8) international maritime law on disposal of radioactive materials in the sea; 9) international conventions for keeping rivers and waters clean; 10) use of SI units in test technology; 11) recent recommendations of ICRP and ICRU as well ISO standards.

2014 EXIT DOSE MEASUREMENTS IN ASSESSMENT OF EFFECTIVE BODY THICKNESS. Agarwal, M.S.; Pant, G.C.; Srinivasan, S.; Sood, P.C. (Banaras Hindu Univ. (India)). pp 429-438 of Proceedings of the national symposium on thermoluminescence and its applications. Bombay; Bhabha Atomic Research Centre (1976). From National symposium on thermoluminescence and its applications; Kalpakkam, India (12 Feb 1975).

14 refs..

Exit dose measurements play an important role in the dose assessment during radiotherapy. Many reports on this subject are available and practically all of them deal with such measurements in cases of body in homogeneities. In the absence of any known air cavity or high density media in the treatment field, it is customary to consider the irradiated volume to be made up of unit density soft tissue and the doses are calculated on that basis. The high recurrence rate of about 20-25% observed in the treated cases of carcinoma of cervix raises the question whether the pelvic region really behaves like a unit density material as is thought of for dose calculations. The exit dose measurements in 50 such cases revealed that the effective body thickness is more in majority of the cases and the dose received by them is about 7% lower than planned dose on the basis of measured body thickness.

2015 AUTOMATIC DETERMINATION OF ISODOSES IN HUMAN RADIOTHERAPY USING WHOLEBODY COMPUTERTOMOGRAPHY. Bagge, E. (Kiel Univ. (Germany, F.R.). Inst. fuer Reine und Angewandte Kernphysik); Duehnke, E.; Gremmel, H. (Kiel Univ. (Germany, F.R.). Radiologische Klinik). Atomkernenergie; 28: No. 4, 283-288(1976). (In German).

5 figs.; 1 tab.; 12 refs..

The computertomograph produces a matrix of absorption coefficients over any investigated cross-section of a human body. These absorption coefficients are the result of the photo and Compton scattering of the analysing X-rays. If one operates the X-ray tube at two different voltages and/or if one is gathering the penetrating quanta of different energies in separated channels at the detector side, it is possible in principle to get two or more matrices of absorption coefficients for different energies of the quanta and this will permit us by help of the theoretical formulae for photo and Compton effect to get the distribution of the electron densities and the corresponding pattern of local mean atomic numbers Z separately over this cross-section. This signifies that one calculate now the curves of the isodoses for any other therapeutic radiation (electrons, X-rays and gamma rays) and it would allow us to use the same computer which generates the original matrices of absorption coefficients to calculate directly in a second step also the curves of the isodoses to be used immediately for therapeutic purposes.

2016 NEGLIGIBLE AND NON-NEGLIGIBLE RISKS IN RADIODIAGNOSTIC EXAMINATION OF PATIENTS. Scholte, P.J.L. (Free Univ. Hospital, Amsterdam); van der Wielen, A.W.; Ruys, P.N. Radiol. Clin. Biol.; 45: No. 2-4, 315-325(1976).

Ionizing radiation is regarded as a health hazard, but one is prepared to neglect this factor on the basis of certain motives. In 1975, Knox published an analysis of these motives, none of which proved tenable. He concluded that a situation which in daily usage is described as safe, is one which entails

risks considered to be negligible so that no safety measures are taken. It can be empirically established that in various health-endangering situations a health hazard of less than 1×10^{-5} is being neglected. This article studies the risk factors to the individual patient in radiodiagnostic examinations involving low, medium and high radiation exposures. The estimates show that radiohygienic measures on behalf of the patient are advisable.

2017 IMMUNOSUPPRESSIVE EFFECT OF EXTRACORPOREAL IRRADIATION OF THE BLOOD USING A PORTABLE ^{90}Sr - ^{90}Y SOURCE AND SMALL TRANSIT DOSES. Birkeland, S.A. (Odense Univ. Hospital (Denmark). Institute of Pathology). Scand. J. Immunol.; 5: No. 4, 323-329(1976).

17 references.

The immunosuppressive effect of extracorporeal irradiation of the blood (ECIB) using small transit doses (TD) over a long time period was studied. The blood of 15 uremic patients undergoing hemodialysis in preparation for kidney transplantation was treated with 15-, 25-, or 41-rad TDs for a total of 150 h, using the beta-emitting radioisotope ^{90}Sr - ^{90}Y . The number of blood volumes (BV) irradiated ranged from 159 to 265. The irradiation resulted in selective lymphocytopenia, but the effect on the immune response of lymphocytes, as measured in vitro with lymphocyte transformation tests, varied. Six kidney transplantations were performed resulting in rejection in two cases, one of which was easily reversed, and one with many rejection episodes, resulting in death. Thus treatment with small TDs over long periods can reduce lymphocyte counts, but any subsequent immunosuppressive effect is uncertain. The results do not support the hypothesis that such irradiation can influence the immune response of lymphocytes without destroying the cells.

2018 THYROID NEAPLASIA: A DELAYED COMPLICATION OF LOW-DOSE HEAD AND NECK IRRADIATION. Guansing, A.R.; Engbring, N.; Cerletty, J.; Holmes, R.; Wilson, S.; Komorowski, R.; Shetty, K.R. (Medical Coll. of Wisconsin, Milwaukee (USA)). pp 561-564 of Thyroid research. Robbins, J.; Braverman, L.E. (eds.). Amsterdam; Excerpta Medica (1976).

From 7. International Thyroid Conference; Boston, Massachusetts, USA (9 Jun 1975).

Published in summary form only; 9 refs., 1 fig., 2 tables.

CARCINOMAS; DELAYED RADIATION EFFECTS; HEAD; LOW DOSE IRRADIATION; MAN; NECK; RADIOISOTOPE SCANNING; RADIOTHERAPY; TECHNETIUM 99; THYMUS; THYROID; TSH; RADIOINDUCTION

2019 IN VIVO EVALUATION OF STANDARD MAN MODEL DOSE CALCULATIONS USING ^{99m}Tc -SULFUR COLLOID. Jones, J.P. Nashville; Vanderbilt Univ. (1976). 220p. University Microfilms Order No. 76-22,348.

Thesis (Ph. D.).

The purpose of this research is to evaluate the applicability of the absorbed fraction data presented in MIRD Pamphlets No. 5 and 11 for calculating patient dose. These data have been computed using a model of the human body geometry, but since this model is an idealization, it is important to check its accuracy directly with patients. This was done for the radiopharmaceutical ^{99m}Tc -sulfur colloid, which concentrates in the liver and spleen. The dose to a five centimeter square slab of lithium fluoride, located on the skin anterior to the center of the liver, was

measured with lithium fluoride thermoluminescence dosimeters for each patient studied. The corresponding dose per emitted photon had been calculated for the model through the courtesy of Dr. W. S. Snyder and Dr. J.W. Poston of Oak Ridge National Laboratory. Therefore, the calculated dose for each patient was obtained by multiplying this dose per photon by the number of photons emitted (the cumulated activity), and the model evaluated by comparing these measured and calculated doses for several patients. For a proper evaluation, the dose and cumulated activity must be accurately measured, so careful attention was paid to these measurements. The method of dose measurement was evaluated with repeated exposures to both ^{99m}Tc and ^{137}Cs sources, and felt to have an absolute accuracy of ± 8 percent, and reproducibility of ± 3 percent. The cumulated activity was determined from serial activity measurements, and was evaluated using both analytical considerations and repeated heterogeneous phantom measurements, which together implied an uncertainty of ± 10 percent. Therefore, patient discrepancies on the order of ± 18 percent might be masked by experimental errors, but larger discrepancies could be (and were) discerned.

2020 BASIC PHYSICS OF RADIATION THERAPY.

Selman, J. (ed.). Springfield, IL; Charles C Thomas, Publisher (1976). 762p. \$25.75.

The subject is discussed under the following chapter headings: simple mathematics gradation therapy; matter and energy; the nature of radiation; reactions between radiation and matter; x-ray production and control; high-energy therapy units and particle accelerators; quantity of x rays and γ rays; x-ray quality; dosage in x-ray and γ -ray therapy; therapy planning; radioactivity and nuclear physics; implant therapy with radium, radon, and artificial radionuclides; surface therapy with β particles; medical use of radionuclides; radiobiology; radiotherapy with heavy particles; and protection in radiotherapy-health physics. (ERB)

2021 RADIATION PROTECTION FOR MEDICAL AND ALLIED HEALTH PERSONNEL. Washington, DC; National Council on Radiation Protection and Measurements (1976). 80p. (NCRP--48).

With the ever-increasing use of x rays and radioactive materials, more and more persons may be exposed to ionizing radiations in the course of their work. The professional status of these individuals ranges from the highly-trained radiation specialist to the casual interdepartmental messenger. Many of these people have very little information about the possible biological effects of radiation or about the amounts which may be significant. Their attitudes toward possible exposure vary from indifference to almost pathological fear. Frequently they have questions about radiation and radiation protection practices but are reluctant or unable to seek out those who could provide answers. Their concern and interest, however, should not be ignored. This report seeks to meet their needs.

2022 LEGAL POSITION OF THOSE RESPONSIBLE FOR RADIATION PROTECTION. Ellerkmann, W. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). pp 99-105 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

The report is subdivided into a description of the legal and appointed persons responsible for radiation protection, their qualification, obligations and rights and indicates some ideas for amending the draft, the legal position of the person appointed being discussed mainly.

2023 AMENDMENT OF THE EURATOM BASIC STANDARDS AND THE RADIATION PROTECTION ORDINANCE DRAFT. Eriskat, H. (Commission of the European Communities, Luxembourg. Directorate for Health Protection). pp 61-68 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975). 13 refs..

The draft for the amendment of the First Radiation Protection Ordinance principally corresponds to the minimum requirements fixed by the new EURATOM basic standards. It is only doubted whether national regulations exceeding the requirements of the basic standards will not affect proper functioning of the Common Market and will not be contradictory to Art. 3, chapter h and 100 and the following of the EEC agreement.

2024 CONSTITUTIONALITY OF DOSE LIMITING VALUES. Goetz, V. pp 177-186 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975). 16 refs..

The fundamental right according to Art. 2 par. 2 sentence 1 of the German Constitution is relevant for the set-up and application of radiation protection law. Resulting from Art. 2 par. 2 sentence 1 of the Constitution it is a general obligation of the state to protect life (Federal Constitutional Court, judgment of 25th Feb., 1975, BVerfGE 39:1) and physical soundness. The subjective basic right of everybody to defend against official encroachments his personal integrity corresponds to the right of the individual within the framework of the official obligation for protection from the state (to ward off danger). The term of danger, as to the degree of its determination, corresponds to that of the encroachment. To speak of danger in a legal sense, the causal connection between a certain source of danger and certain damage must be ascertained and proved. Topical controversies as to the admissibility of activity discharges of low doses range in the field of risk reduction and thus in the field of the duty of the state to take precautionary steps against risks (Art. 2 par. 2 sentence 1 of the Constitution). The constitution, however, does not contain any basic right that every risk has to be avoided. On the other hand, the necessity of cautions valuation of radiation risks can be derived from the Constitution. The fixation of dose limits and their application in connection with general radiation protection principles (paragraph 28 E of the Radiation Protection Ordinance) do not contain any 'interference' with the basic right in the sense of Art. 2 par. 2 sentence 3 of the Constitution. Neither from aspects of the principle of the legal state nor from Art. 80 par. 1 of the Constitution can the use of the legal form of the Ordinance be doubted.

2025 LEGAL PROVISIONS CONCERNING PROTECTIVE MEASURES IN CASE OF ACCIDENTS AND INCIDENTS. Gross, R. pp 245-249 of Viertes deutsches

Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

It is tried to show the systematic connection between the new regulations and the existing radiation protection regulations. The present legal situation is briefly discussed and also the stipulations of the Radiation Protection Ordinance draft from the view of the designer.

2026 CONSTITUTIONALITY OF THE DOSE LIMITS. REMARKS WITH REFERENCE TO FUNDAMENTAL LAW ON A DRAFT BY THE MINISTRY OF THE INTERIOR OF AN ORDINANCE ON THE PROTECTION AGAINST DAMAGE THROUGH IONIZING RADIATION. DRAFT FROM 24TH MAR 1975. Hinz, M.O. (Bremen Univ. (Germany, F.R.)). pp 165-175 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

27 refs..

The following items are primarily discussed: 1) the problem of constitutionality of standard dose values; 2) individual points exemplified by the draft of the new Radiation Protection Ordinance (annual total body equivalent dose, differentiation in the determination of limiting values, fixation of tasks) and 3) acceptability of fixation of limiting values.

2027 POSITION OF THE RADIATION PROTECTION ORDINANCE IN NUCLEAR LAW. Mennicken, A. pp 25-30 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

The relations of the present draft of a new Radiation Protection Ordinance to the nuclear law and the importance of a Radiation Protection Ordinance de lege lata and de lege ferenda are briefly discussed.

2028 LEGAL PROVISIONS CONCERNING PROTECTIVE MEASURES IN CASE OF ACCIDENTS AND INCIDENTS. Mutschler, U. (Muenster Univ. (Germany, F.R.)). pp 251-257 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

With refs..

The drafts of sections 35-37 of the Radiation Protection Ordinance have the purpose of realizing licensing standards provided in sections 6,7,9, AtG and in the draft. The compatibility between licensing regulations according to sect. 7 AtG and the above-mentioned sections of the draft is analysed.

2029 LEGAL ADMISSIBILITY OF TESTS WITH RADIOPHARMACEUTICALS AND WITH PHARMACEUTICALS MARKED RADIOACTIVE FOR RESEARCH PURPOSES. Pabel, H. (Bundesministerium fuer Jugend, Familie und Gesundheit, Bonn-Bad Godesberg (Germany, F.R.)). pp 113-118 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

Presentation of the present and future legal position: 1) Tests with radiopharmaceuticals and marked medicine are absolutely necessary in the interest of the protection of the patient.

2) According to the valid radiation protection law such tests must be allowed. Restrictions can be decreed according to sect. 17 of the Atomic Energy Act. 3) According to the draft of the new Radiation Protection Ordinance, a licence may be refused in view of opposing primarily public interests. It is doubtful whether the rules provided in sect. 40 is covered by the authorizing standard. 4) The draft of a law for a reform of medicine law offers the possibility to issue detailed regulations on the testing of medicine. 5) The prohibition in sect. 7 of the medicine law also covers medicine, which is intended for experiments. The regulation according to sect. 7, however, admits release to hospitals and scientific research facilities.

2030 DRAFT OF A NEW RADIATION PROTECTION ORDINANCE. Pfaffelhuber, J.K. pp 17-24 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

One of the many drafts for the planned amendment to the First Radiation Protection Ordinance is introduced. Note: the final bill meanwhile is available as Bundesratsdrucksache 375/76.

2031 JUSTIFICATION OF DOSE LIMITING VALUES WITH A VIEW TO MEDICINE AND BIOLOGY. Rausch, L. (Giessen Univ. (Germany, F.R.)). pp 277-299 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

3 figs.; 6 tabs.; 99 refs..

As there is a certain relation between the dose limits for limited groups and those for the total population with the maximum admissible person doses for those professionally exposed to radiation (1 : 30 or 1 : 90), the grounds for general dose limits and for limits for those professionally exposed to radiation are discussed together. It is shown why empirical data must be completed by risk estimates where minimum and small radiation doses (0 to 1 rem; 1 to 10 rem) are concerned. In this connection a maximum calculable risk is ascertained as a result of cautious assumptions of ICRP, which as a rule overestimates the actual risk to a large extent. Furthermore, the established values in most cases are used partly only. Therefore, the dose limits and maximum person doses include additional safety reserves. These statements are documented by tables and graphs. A comparison of maximum person doses and dose limits with professional and general life risks is provided, so as to see the quantitative dimension. Finally, a catalogue of direct or indirect objections against maximum general doses and maximum doses for persons occupationally exposed to radiation is provided. These statements are discussed and correlated with a typology of errors in medical science. It shows that most objections e.g. are based on overconsideration of hypotheses or are of a dogmatic nature or constitute inadmissible simplifications.

2032 JUDICIAL FACTS ON LICENSING AND SUPERVISORY PROCEDURES CONCERNING RADIATION PROTECTION LAW. Rosenbaum, O. (Ministerium fuer Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). pp 31-38 of Viertes deutsches Atomrechts-Symposium. Referate und

Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

With tabs..

Some statistical studies on the present licensing and supervision procedures are discussed, viz. on 1) owner of a licence accord. to sect. 3 and 4 of the 1st Radiation Protection Ordinance; 2) special licences according to section 1 of the Radiation Protection Ordinance for the release of radioactive materials in air and water (required in a very few cases only); 3) violations of the regulations were not of a severe nature (mostly from industry). The author concludes that the present regulations proved to be satisfactory. Minor corrections relating to licence-free handling, restriction of the requirements for a licence as well as to prohibition of illegal use of the radiation warning sign are desired.

- 2033 PROTECTIVE EFFECT OF CYSTEAMINE ON GAMMA IRRADIATED HUMAN ERYTHROCYTES. Pantev, T.; Kuzova, K. (Nauchno-Issledovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). *Rentgenol. Radiol.*; 15: No. 2, 82-86(1976). (In Bulgarian).

The effect of gamma rays in doses from 8 to 64 kR on the red cell membrane was studied. The percentage of cells undergone hemolysis after postirradiation 20 hours incubation of red cell-suspensions at 4deg C served as index of radiation injury. An attempt was made to modify radiation injury by means of cysteamine. Group '0', Rh(+) human glucose citrate blood after 15-30 days storage was used. Subhemolyses radiation doses followed by incubation at 4deg C for 20 hours resulted in red cell hemolysis which increased proportionally to the gamma ray dose. The percentage of hemolyzed cells was much lower among those irradiated in the presence of cysteamine. The dose-effect relation of irradiated red cells may satisfactorily be described with the indicative function $y = 40.8 \cdot 10^{-3} \cdot D_{sup}(1.59)$; under conditions of protection - with a second degree polynom $y = 59.15 \cdot 10^{-4} \cdot D^2 - 4.24 \cdot 10^{-2} \cdot D$ ('y' being the percentage of hemolyzed cells, 'D' the dose in kR).

- 2034 OCCURRENCE OF HEINZ-BODIES IN ERYTHROCYTES OF PERSONNEL OCCUPATIONALLY EXPOSED TO LOW DOSES. Jacobsohn, E.; Arndt, D.; Schuettmann, W.; Konopatzky, H. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). *Folia Haematol. (Leipzig)*; 103: No. 2, 191-195(1976). (In German).

274 persons were examined by the Heinz-body test according to Beutler. 168 of them were occupationally exposed to ionizing radiation. No correlation could be found between the presence of Heinz-bodies and the dose which was below the maximum permissible dose in nearly all cases. Only 4 persons were exposed to higher doses. The total doses obtained from summing up the annual doses were also considered.

- 2035 APPLICABILITY OF ALKALINE GRANULOCYTE PHOSPHATASE DETERMINATION IN THE DIAGNOSIS OF RADIATION DAMAGES CAUSED BY LOW DOSES. Jacobsohn, E.; Arndt, D.; Schuettmann, W.; Konopatzky, H. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). *Folia Haematol. (Leipzig)*; 103: No. 2, 196-200(1976). (In German).

In order to find dose-response relationships

the alkaline granulocyte phosphatase (AGP) indices were determined in 304 persons, 180 of them had been occupationally exposed to ionizing radiation. A certain trend expressible as a negative exponential function between the AGP and the dose could be observed in the range of 0.01 to 3.0 rem/yr.

- 2036 DETECTION OF CHRONIC RADIOLESIONS AND THEIR TREATMENT. Birkner, R.; Consentius, K. (Staedtisches Krankenhaus Moabit, Berlin (Germany, F.R.). Roentgeninstitut; Staedtisches Krankenhaus Moabit, Berlin (Germany, F.R.). Isotopeninstitut; Staedtisches Krankenhaus Moabit, Berlin (Germany, F.R.). Strahlentherapeutische Abt.). pp 65-76 of *Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Spezielle Beitrage der Medizin zum Strahlen- und Umweltschutz*. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrl, G.; Stieve, F.E. (eds.). Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

12 figs..

As clinicians the authors deal with the question of responsibility for radiolesions using examples from radiotherapy, X-ray diagnostics, and nuclear medicine.

- 2037 DIAGNOSIS IN CASES OF SUSPECTED RADIATION DAMAGE. Feinendegen, L.E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Medizin). pp 140-146 of *Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung*. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrl, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

29 refs..

It is manifested that commenting on eventual damage two aspects must be given preference to, especially in the critical case of low doses: 1) one should try to find out if irradiation has really taken place. The chromosomal analysis of the peripheral blood lymphocytes can be an additional help for this. 2) The risk estimation for the mostly unspecific effects of small dose rates and low doses must see somatic and genetic effects in the light of the extraordinarily high reparative capacity of the organism.

- 2038 OCCUPATIONAL RADIOLESIONS IN THE FRG BETWEEN 1953 AND 1969. Rahm, G. pp 126-139 of *Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung*. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrl, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

10 tabs..

Using statistic documents of the industrial boards following points were set up in tabular form: 1) distribution of the radiolesions in accordance to the Federal States; 2) distribution of the cases of radiation damage, sort of damage, industrial branches, and sources of damage; 3) distribution of all sorts of damage with regard to professions 4) risk assessment for persons exposed to radiation for occupational reasons.

- 2039 BIOLOGICAL EFFECTS OF LOW-LEVEL RADIATION PERTINENT TO PROTECTION OF MAN AND HIS ENVIRONMENT. REPORT ON THE INTERNATIONAL SYMPOSIUM HELD IN CHICAGO FROM 3 TO 7 NOVEMBER 1975. Sinclair, W.K. (Argonne National Lab., Ill. (USA)); Kobayashi, S.; Nishiwaki, Y. (International Atomic Energy Agency, Vienna (Austria)). At. Energy Rev.; 14: No. 1, 173-178 (1976).

Published in summary form only.

BIOLOGICAL RADIATION EFFECTS; ENVIRONMENT; GENETIC RADIATION EFFECTS; HUMAN POPULATIONS; LOW DOSE IRRADIATION; MEETINGS; RADIATION HAZARDS; REVIEWS

- 2040 VALUE OF PHYSICAL RADIATION PROTECTION CONTROL IN INCORPORATION MONITORING. Erlenbach, H.R. (Gewerbeaufsicht des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). Zentralstelle fuer Sicherheitstechnik, Strahlenschutz und Kerntechnik. pp 85-94 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

2 figs.; 9 refs..

The valuation of the incorporation monitoring given here (mainly whole-body counting for x-sources and urinalysis for β -sources) is based on the experiences of the ZfS of the trade inspection of North Rhine Westphalia. The high sensitivity achieved by practically all physical-chemical incorporation monitoring methods in their respective fields should not only be seen in the light of the total resulting internal radiation exposure, which is negligible in most of the known incorporation cases, since prophylaxis against a possible habituation to the incorporation risk and an impulse towards optimization of the working conditions for handling unsealed radioactive substances and nuclear fuels are aspects of equal importance.

- 2041 PSYCHOLOGICAL ATTITUDES OF NUCLEAR INDUSTRY WORKERS. Faes, M.; Stoppie, J. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). pp 389-406 of Les concepts de faible dose de rayonnements ionisants en radiobiologie et en radioprotection. II. Cayet-Pennaneac'h, O. (ed.). Montrouge; Societe Francaise de Radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

An investigation was carried out within the frame of occupational medicine on the psychological attitudes of workers in the nuclear industry towards ionizing radiations. Three aspects were considered: awareness of the danger; feeling of safety in the working environment; workers' feelings following incidents or accidents; satisfaction level felt by the workers in the plant.

- 2042 SPECIAL PHYSICAL METHODS OF EXAMINATION FOR PRACTICAL INDUSTRIAL MEDICINE IN THE FIELD OF RADIATION PROTECTION. Fruhmann, G. (Muenchen Univ. (Germany, F.R.)). Inst. und Poliklinik fuer Arbeitsmedizin. pp 32-36 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe,

Germany, F.R. (14 Jun 1974).

3 figs.; 1 tab.; 2 refs..

The topic is restricted to organs of the thorax. EKG on exertion and the exhalation test according to Tiefenau (capacity per second).

- 2043 PROBLEMS OF RADIATION PROTECTION IN CONNECTION WITH RADIOACTIVE CARCASSES AND CORPSES. Henseler, H. (Bayerisches Landesamt fuer Umweltschutz, Muenchen (Germany, F.R.)). pp 242-249 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

1 fig.; 2 tabs..

Problems of radiation protection and safety measures for the disposal of radioactive animal carcasses and for handling radioactive corpses, mainly from nuclear medical therapy, are explained, going into detail. While dealing with radioactive corpses two regulations ought to be taken into consideration: 1) If the residual activity of the radioactive substances in the corps is higher than 5 mCi, a person responsible for radiation protection should be in attendance during the autopsy, who is able to estimate the radiation exposure to be expected and who can undertake the necessary protection measures. If the residual activity is below 30 mCi, baling, burial and cremation is possible without particular protection measures. For the burial and the preparations for the burial of radioactive corpses, the author suggests 14 rules which should be paid attention to.

- 2044 RADIATION PROTECTION PROBLEMS IN HANDLING NUCLIDE GENERATORS. Herzberg, B.; Kaul, A. (Freie Univ. Berlin (Germany, F.R.)). Abt. fuer Nuklearmedizin. pp 223-232 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, H.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

4 figs.; 6 tabs.; 7 refs..

The studies on possible radiation exposure during handling $^{99}\text{Mo}/\text{sup}(99\text{m})\text{Tc}$ -generators show that the maximum radiation exposure during the processes 'labelling' and 'application' is to be seen on the hands of the persons concerned. The maximum possible number of processes per year and person, which is 500-600 and results with an average activity of 30 mCi; during the process of labelling, means that the maximum permitted dose of 60 rem per year is not exceeded during this process. As far as 'application' is concerned, however, the maximum permitted dose is likely to be transgressed on the hands during the course of a year. Granting 5 applications per person and day of 10 mCi each the maximum permitted dose on the hands can be reached after 90 days already. The radiation exposure of the whole body and eyes resulting from the single processes will not reach the maximum permitted dose of 5 rem per year thus not restricting the maximum possible number of processes per year and person. Ways to reduce the radiation exposure of the hands during the process of application are shown.

- 2045 NEUTRON MEASUREMENTS ON CARDIAC PACEMAKERS WITH ^{238}Pu BATTERIES. Kluge, H.;

Zill, H. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). pp 199-206 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

1 tab.; 10 refs..

Pacemakers, the energy need of which is met by the energy set free during the α -decay of ^{238}Pu , emit, besides photons, also neutrons which partly emerge from the spontaneous fission of ^{238}Pu , and partly from (α, n) -reactions on light nuclei. The maximum neutron flow emitted to a certain space angle and its energy distribution were measured. Using the results of the measuring we can determine the energy dose rates produced on certain points in the patient's tissue as well as the dose rates equivalents possible to occur in his environment with sufficiently low uncertainty.

2046 LOW DOSES AND ISOTOPIC PACEMAKERS.

Laurens, P. (Hopital Broussais, 75 - Paris (France)). pp 337-357 of Les concepts de faible dose de rayonnements ionisants en radiobiologie et en radioprotection. II. Cayet-Pennaneac'h, O. (ed.). Montrouge; Societe Francaise de Radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

A review is made of the conditions of pacemaker implants, calculation and experimental measurement of dose rate equivalents, the biological supervision of patients and their life expectancy.

2047 MEDICAL EVALUATION OF THE VALUES

MEASURED FOR RADIATION EXPOSURE. Oster, H. (Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.)). pp 94-99 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

The essay examines briefly: 1) how to assess the values obtained by personnel dosimetry and the points to be taken into account by the authorized physician; 2) how to take into consideration other radiation exposures; 3) which points must be considered for the medical examinations and the following measures to be taken by the authorized physician.

2048 RADIATION PROTECTION DURING WORKING WITH

SEALED RADIOACTIVE SUBSTANCES. Pape, U. (Städtisches Krankenhaus Moabit, Berlin (Germany, F.R.). Abt. fuer Strahlungsphysik). pp 171-177 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

Dealing with sealed radioactive substances of medium activity, avoidable dose exposure is in most cases due to carelessness and failure to comply with elementary rules of radiation protection in critical moments. The essay is to help to reduce the occurrence of disturbances as seen in the literature by showing mistakes

which turn up very frequently in practice.

2049 RADIATION EXPOSURE DUE TO IMPLANTED PACEMAKERS WITH ^{238}Pu -NUCLIDE BATTERIES.

Plesch, E. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). pp 192-199 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

5 figs.; 3 tabs.; 12 refs..

The radiation exposure of patients and environment due to neutron and γ -radiation was determined using the results of outdoor and model measurements and direct measurements carried out on 7 patients with implanted ^{238}Pu -pacemakers. For measuring the neutron dose equivalent a directly recording proportional counter was used, which was calibrated with a ^{238}Pu -neutron source for various tissue depths. The distribution of fluence in the tissue surrounding the neutron source was determined by means of 0,3 mm thick nuclear track etching detectors in a phantom. Corresponding measurements of γ -doses were carried out with LiF-dosimeters. The dose equivalent of neutrons and gamma radiation is determined as function of the distance from the source; the build-up and the attenuation in the tissue being taken into account. The radiation exposure of the patient and environment is compared with the long-term radiation exposure due to natural and civilizing factors.

2050 RADIATION PROTECTION IN THE OPERATION OF TELECURIE EQUIPMENT.

Pohle, G. (Städtisches Krankenhaus Moabit, Berlin (Germany, F.R.). Abt. fuer Strahlungsphysik). pp 162-170 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

9 figs..

Critical points and danger for attendants and patients which could be reported until today in handling telecurie equipment are pointed out.

2051 INQUIRY ON THE RADIATION EXPOSURE OF THE SWISS POPULATION BY X-RAY DIAGNOSIS.

Poretti, G.G. (Bern Univ. (Switzerland). Radium Inst.; Bern Univ. (Switzerland). Abt. fuer Medizinische Strahlenphysik); Jonesco-Farca, F. (Bern Univ. (Switzerland). Abt. fuer Medizinische Strahlenphysik); Lanz, W. (Bern Univ. (Switzerland). Radium Inst.). pp 147-156 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

3 tabs.; 2 refs..

The genetic load on a population is usually expressed in terms of the so-called 'Genetically Significant Dose' (GSD), i.e. the dose which, averaged over the total population, produces the same results as the varying amounts of radiation received in reality by the individuals making up the population. It may be

calculated taking into account the following parameters: 1) total number of male and female persons in the population per age group, including the fetuses, 2) average expectation of children per person, 3) number of persons having received a certain type of X-ray examination, and 4) experimental gonadal dose for this examination (for men, women and fetuses - not to be confused with the GSD). The GSD of the Swiss population for the year 1971 was calculated per age group on the basis of physicians' data on some 60,000 patients. The gonadal dose was determined experimentally in various hospitals by means of TLD dosimeters, sensitive high-pressure ionization chambers and normal chambers. The computer programme to calculate the GSD (PL/I language) is very time-consuming, but its structure allows a new selective investigation to be made later on by merely changing the input. The results show that in Switzerland as in other countries there is a 3-4% increase per year in X-ray examinations for diagnostic purposes. The GSD for 1971 is 42-43 mrad per person in Switzerland as compared to 22 mrad for 1957. The GSD percentage is about 57% for men, about 35% for women and about 8% for fetuses. The number of X-ray examinations is almost equal for general practitioners (53.8%) and hospitals (46.2%).

- 2052 RADIATION EXPOSURE OF THE EYE LENS DUE TO ROUTINE DIAGNOSTIC X-RAY EXAMINATIONS IN DENTAL PRACTICE. Schmidt, T.; Seibert, A. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Radiologie). pp 157-162 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)
From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

2 tabs.; 7 refs..

A table gives radiation doses to the eye near the cone or at a distance from it for various X-ray techniques in dental practice and in dental clinics, measured with a LiF-TLD.

- 2053 CONTRL OF THE BLOOD COUNT AND THE HAEMATOPOIETIC TISSUES. Schreml, W. (Ulm Univ. (Germany, F.R.). Abt. Haematologie). pp 49-55 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)
From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

2 figs.; 10 refs..

This chapter deals with the question in which level of radiation exposition existing haematologic routine methods are able to show damage. The author also refers to the question which methods are applicable or should be developed for early manifestation of damage in haematogenic tissues caused by low radiation doses.

- 2054 CHROMOSOMAL ANALYSIS TO DETERMINE THE EFFECT OF SMALL DOSES. Stephan, G. (Bundesgesundheitsamt, Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Strahlenhygiene). pp 56-65 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)
From 15. annual meeting of the Vereinigung

Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

6 figs.; 1 tab.; with refs..

The analysis of the metaphase-chromosome - count of dicentric chromosomes and ring chromosomes - has proved to be the best method to record radiation exposure quantitatively, especially in estimating low doses. Considerable efforts must be made to obtain reliable results since only little structural chromosomal changes are induced within this region and therefore a large number of metaphase plates must be evaluated. The band staining techniques which were developed recently offer the possibility of identifying chromosomes better.

- 2055 RADIATION PROTECTION FOR PACEMAKERS WITH RADIONUCLIDE BATTERIES. Stieve, F.E. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Abt. fuer Strahlenhygiene). pp 178-191 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)
From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

5 figs.; 3 tabs.; 35 refs..

Radionuclide batteries (^{147}Pm , ^{238}Pu) in pacemakers bring risks for the patient and the environment, if the radioactive material cannot be secured for subsequent application or for safe end storage. This is why the expenditure connected with pacemakers is very high. So the application of such pacemakers is only indicated when the patient's expectation of life is presumably higher than 5-10 years, when there are no other diseases besides cardiac dysrhythmia, and when the securing of the radionuclide batteries is guaranteed.

- 2056 SUPPLEMENTARY REMARKS ON THE SAFETY AND RISKS OF CARDIAC PACEMAKERS WITH RADIONUCLIDE BATTERIES. Kowalewsky, H. (Bundesanstalt fuer Materialpruefung, Berlin (Germany, F.R.)). pp 206-211 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)
From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

7 figs..

The BAM has undertaken the task of compiling the material and construction data and the main nuclide properties (^{147}Pm , ^{238}Pu), of carrying out mechanical safety tests and of measuring the γ -radiation field in the FRG for the equipment offered at present. The results obtained until today are positive.

- 2057 EFFECTS OF RADIATION ON MAN: NOW AND IN THE FUTURE. Morgan, K.Z. (Georgia Inst. of Tech., Atlanta). pp 251-261 of Energy and the environment cost-benefit analysis. Karam, R.A. (ed.). Elmsford, NY; Pergamon Press, Inc. (1976).

From Proceedings of energy and the environment - cost benefit analysis; Atlanta, GA, USA (23 Jun 1975).

See CONF-750697--.

Although much remains to be learned about chronic effects of ionizing radiation, we know more about these effects than those produced by other pollutants. Acute radiation damage requires a threshold dose before becoming manifest while chronic damage increases more-or-less linearly. Considerable human low dose

exposure data support the linear hypothesis. Evidence suggests the linear hypothesis is non-conservative for high LET radiations. Persons worried about population exposure should be concerned about unnecessary medical exposure. The radiation risk of nuclear power plants can be made acceptable but several improvements are required.

- 2058 DIRECTORY OF PERSONNEL RESPONSIBLE FOR RADIOLOGICAL HEALTH PROGRAMS. Rockville, MD; Department of Health, Education, and Welfare (1976). 32p.

Personnel responsible for radiological health programs are listed by state. Regional offices of radiological health programs are given and personnel listed. An alphabetical index of all personnel in radiological health programs is included. (ERB)

- 2059 ABOUT EPIDEMIOLOGIC STUDIES. Mechali, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 165-178 of Concepts of low doses of ionizing radiation in radiation biology and protection. Vol. 2. Cayet-Pennaneac'h, G. (ed.). Montrouge; Societe Francaise de Radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

The epidemiology surveys conducted to study the relationship between a number of malignant affections and ionizing radiation exposure are reviewed. The difficulties met in the conduction and interpretation of such surveys and the results are considered.

- 2060 RADIATION HYGIENE SUPERVISION OF X-RAY UNITS IN VETERINARY ESTABLISHMENTS OF THE SOUTH BOHEMIAN REGION. Trueille, M.A. Veterinarstvi; 26: No. 8, 371-372(1976). (In Czech).

The number of X-ray examinations increased after 1971 with the launching of the nationwide screening of breeding boars and sows for rhinitis. For this purpose the Regional Hygiene Officer permitted the use of CHIRAX X-ray apparatus in field-work. Blood sampling and medical check-ups are carried out of all workers by the Department of Occupational Diseases of the Regional Health Centre in Ceske Budejovice. All X-ray operators are equipped with film dosimeters. Hygienic inspection is regularly carried out by the Department of Radiation Hygiene of the Regional Hygiene Centre in Ceske Budejovice. The screenings are carried out in the pigsty or in the preparation room. The X-ray operators operate behind a Pb shield. The animal is tied up and the plate is inserted into its oral cavity. The auxiliary staff keeps as far away as possible from the X-ray apparatus. At a distance of 6 m from the X-ray apparatus the radiation intensity of 3 mR/h was measured. The harmful radiation dose is far below permissible values (5 rem/year).

- 2061 ASSESSMENT OF PHYSICAL RADIATION PROTECTION CONTROL: PERSONNEL DOSE MEASUREMENTS. Wachsmann, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Strahlenschutz). pp 77-85 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrl, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

5 figs.; 5 tabs..

The rightness of the prescriptions by the 1st Radiation Protection Ordinance and the X-ray ordinance referring to the personnel dosimetry for persons exposed to radiation for professional reasons is explained. The author shows furthermore to what extent today's methods are efficient and what can be expected from these methods. For this purpose he critically compares the dosimeters used.

- 2062 RESULTS OF MEDICAL EXAMINATIONS.

Zimmer, R. (Bayerisches Landesinstitut fuer Arbeitsmedizin, Muenchen (Germany, F.R.)). pp 120-125 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrl, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

3 tabs..

The medical surveillance of persons exposed to radiation consists of a direct and an indirect method. While the direct method involves the medical investigation of findings and the measuring of the personnel dose by external and internal radiation exposure, the indirect method lays stress on the knowledge of the place of work, the recognition of the sources of danger, i.e. facts of occupational medicine. The authorized physician must be able both to decide on the employment of persons working in the control field using the findings, and to give his opinion on evaluation results on physical and radiochemical basis. With respect to his special knowledge, he will be asked in case of improvements of the place of work and of corresponding protective measures.

- 2063 PROTECTURE MEASURES AGAINST RADIATION EXPOSURE DUE TO THE EMISSION OF RADIOACTIVE SUBSTANCES INTO THE AIR. Kretschko, J.; Wolf, I. (Technische Univ. Muenchen (Germany, F.R.). Nuklearmedizinische Klinik und Poliklinik). pp 214-220 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Spezielle Beitrage der Medizin zum Strahlen- und Umweltschutz. Braun, H. (ed.). Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

2 figs.; 3 tabs.; 10 refs..

In clinical practice problems of radiation protection are due to radioactivation of the air during the use of high-energy accelerators in radiotherapy, use of radioactive aerosols and gases in the nuclear-medical diagnosis, and production of radioactive solutions for application. Protection and surveillance measures referring to these points (such as air conditioning, equipment etc.) should already be taken when the clinics are being planned.

- 2064 THERMOLUMINESCENT MATERIALS IN PHYSIOLOGICAL AND DOSIMETRIC INVESTIGATIONS OF THE THYROID. Malone, J.F.; O'Connor, M.K.; Taaffe, J.K. (College of Technology, Dublin (Ireland)); Cullen, M.J. pp 575-579 of Physics in Industry. O'Mongain, E.; O'Toole, C.P. Oxford; Pergamon Press (1976).

From International conference on physics in industry; Dublin, Ireland (9 Mar 1976).

The use of LiF and Ca SO₄ thermoluminescent discs in monitoring the levels of ¹³¹I in the human thyroid is described. The former are suitable for monitoring high level therapy doses while the latter are sufficiently

sensitive for the small tracer doses used for diagnosis. The results show that use of these materials simplifies observation of iodine kinetics, to the extent that the measurements may be made by the patient in his own home. An excellent correlation is obtained between effective half-life measured by conventional techniques and measurements based on thermoluminescent discs. Other potential applications of the method are presented, in particular, an evaluation of the quantity of ^{131}I in the gland, and an alternative method of performing the TSH stimulation test.

In implementing radiation protection in the fields of X-ray application there are still lots of open points. This brochure, answering a series of frequently occurring questions, deals with the following topics: 1) questions about legal provisions in the field of radiation protection, 2) questions about physical and technical fundamentals, and 3) questions about X-ray applications. The booklet is intended to serve as a guide for radiation protection specialists and other groups of technical and medical personnel concerned with the operation of X-ray facilities.

- 2065 SURVEY ABOUT VALID LEGAL PRESCRIPTIONS AND NORMS. Pfaffelhuber, J.K. (Bundesministerium des Innern, Bonn (Germany, F.R.)). pp 1-3 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Spezielle Beiträge der Medizin zum Strahlen- und Umweltschutz. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

A survey about the valid legal prescriptions in the region of atomic energy and radiation protection law and the transport of radioactive substances in the FRG.

- 2066 TASKS AND DUTIES OF THE AUTHORIZED PHYSICIAN. Moehrle, G. (Badenwerk A.G., Karlsruhe (Germany, F.R.)). pp 11-15 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Spezielle Beiträge der Medizin zum Strahlen- und Umweltschutz. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

The essay shows the tasks and duties of the authorized physician emerging from the present rules, regulations, and guidelines as well as prospective new regulations.

- 2067 LEGAL FUNDAMENTALS, REGULATIONS AND BASIC NORMS, INTERNATIONAL RECOMMENDATIONS. Stieve, F.E. (Bundesgesundheitsamt, Berlin (Germany, F.R.)). Abt. fuer Strahlenhygiene. pp 18-27 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Spezielle Beiträge der Medizin zum Strahlen- und Umweltschutz. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, G.; Moehrle, G.; Stieve, F.E. (eds.). Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

1 tab.; 15 refs..

The task of this survey is to show the fundamentals which are reflected in the laws and regulations of the Federal Government. The development which might influence the actions in the future is briefly dealt with.

- 2068 Fragen und Antworten zum Strahlenschutz beim Betrieb von Röntgeneinrichtungen. (QUESTIONS AND ANSWERS CONCERNING RADIATION PROTECTION IN OPERATING X-RAY FACILITIES). Koenig, W.; Taschner, P.; Menzel, B.; Anger, K. (Staatliches Amt fuer Atomicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Berlin; Verlag Tribuene (1976). 173p. (In German).

- 2069 REDUCTION OF DOSE BY FILTRATION IN PEDIATRIC FLUOROSCOPY AND FLUOROGRAPHY. Heinrich, H.; Schuster, W. (Siemens A.G., Erlangen (F.R. Germany); Giessen Univ. (F.R. Germany). Zentrum fuer Radiologie). Ann. Radiol.; 19: No. 1, 57-66(1976).

The old idea of reducing the dose to the patient by filtering the primary X-ray beam has been taken up again. It was found that by using a 0.1mm molybdenum plate as a filter the skin dose can be reduced by a factor of 2 to 3, while the X-ray tube voltage remains unchanged, the exposure time doubles and the radiographic image quality changes only slightly. The reduction of the skin dose is due to the fact that the Mo-plate attenuates essentially the low-energy part of the spectrum.

- 2070 VARIABLES AND PARAMETERS OF RELEVANCE IN THE STUDY OF THE EFFECTS OF LOW-LEVEL RADIATION. Delattre, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie). pp v.1 p.275-301 of Biological and environmental effects of low-level radiation. Proceedings of a symposium on biological effects of low-level radiation pertinent to protection of man and his environment organized by the IAEA and the WHO and held in Chicago, 3-7 November 1975. Vienna; IAEA (1976). (In French)

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

For irradiation at relatively high levels, the amount of energy (dose D) absorbed by an irradiated system is a reference parameter as a function of which one can consider the observed effects at a suitable level of approximation. The phenomena involved can be assumed to occur in two distinct stages with completely different reaction (transformation) rates: a fast stage, where only radiation-induced transformations are significant; a slower stage, involving only the spontaneous reactions of the irradiated system. This represents only an approximation, less justified for irradiation at lower intensities, when the system's own kinetics begin to compete and interfere directly with the radiation-induced transformations. The two types of phenomenon must then be considered simultaneously. The theoretical necessity can be demonstrated for replacing the concept "dose" by two explicitly separated factors - the parameter "intensity" (or "dose rate") and the variable "time"; also, the fact that the dose rate cannot be regarded as a mere correction factor, but must be integrated into the theory as a fundamental parameter. The great variety of phenomena which can occur with low-intensity irradiation, in contrast to high-level irradiation is considered. With the theory is associated a procedure for model studies on the basis of experimental results which enables one to avoid a priori modelling, where it is always difficult to verify validity.

- 2071 **PROCEDURE FOR MODEL STUDIES WITHIN A THEORETICAL FRAMEWORK SUITED TO THE STUDY OF THE EFFECTS OF LOW-LEVEL RADIATION.** Delforge, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie). pp v.1 p.303-317 of Biological and environmental effects of low-level radiation. Proceedings of a symposium on biological effects of low-level radiation pertinent to protection of man and his environment organized by the IAEA and the WHO and held in Chicago, 3-7 November 1975. Vienna; IAEA (1976). (In French)

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

During study of the effects of low-level radiation, many phenomena not predictable on the basis of classical models developed for high-level radiation can occur. This means that the theoretician must revise his approach to the development of models and, in particular, demonstrates the need for a theory which is so general that all the phenomena observed - at high and low levels - can be interpreted within a single formalism. P. Delattre's theory relating to systems in which transformations occur (see paper IAEA-SM-202/503 of P. Delattre in the same symposium) provides a suitable theoretical framework. The author describes - at a time when the method in question is just starting to be applied in collaboration with several laboratories - the complete identification procedure as proposed for linear systems. Based on P. Delattre's theoretical approach, it enables a valid, precise model to be obtained. The model is valid because its development is based solely on information derived from experimental results obtained through close collaboration between the experimentalist and the theoretician. There is no a priori hypothesis as regards the internal structure of the model, and the uncertainties result for the greater part from experimental errors. Thanks to the numerical methods employed, the uncertainties can be limited and a precise model obtained by defining experimental conditions which permit minimization of the errors associated with the numerical values of the model parameters. Current studies should lead in most cases to a model possessing structural uniqueness.

- 2072 **LOW-LEVEL EFFECTS IN RELATION TO TRACK STRUCTURE THEORY.** Katz, R. (Nebraska Univ., Lincoln (USA). Dept. of Physics). pp v.1 p.343-360 of Biological and environmental effects of low-level radiation. Proceedings of a symposium on biological effects of low-level radiation pertinent to protection of man and his environment organized by the IAEA and the WHO and held in Chicago, 3-7 November 1975. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The delta-ray theory of track structure assigns the principal responsibility for many radiation effects to secondary and higher generation electrons, whatever the primary incident radiation. The "electron slowing-down spectrum" is taken to be relatively independent of the primary source. Thus, the dose-effect relationship obtained with gamma rays is used to translate the radial distribution in "local dose" about an ion's path into a radial distribution in probable effect. The shape of the gamma-ray dose-effect relationship plays an important role in the calculation of response to heavy ions,

especially the low-level part of the gamma-ray dose-response relationship. One-hit detectors display exponential response to gamma rays and, in turn, to radiations of all quality. The RBE is independent of dose, and declines with an increase in z^2/β^2 of an incident track-segment bombardment. As nuclear emulsions, detectors would not display electron tracks, but could be blackened by a beam of electrons or of gamma rays of sufficient intensity. Following irradiation with heavy ions the survival curves pass gradually from a shouldered survival curve, as after γ irradiation, to an apparent exponential curve with an increase in z^2/β^2 , as the ion-kill probability (for inactivation by a single passing ion) increases from 0 to 1. Here the RBE depends on dose, and on LET, passing through a maximum where P is approximately equal to 0.5. A possibility of producing higher generation electrons, exists everywhere along the path of an electron, hence end-of-track effects. If a single electron can activate the detector, its influence will dominate at all dose levels. The author has formally examined the "2-component model" and found that, if an initial slope is observable in the gamma-ray survival curve, the RBE is typically less than 1 at all LET.

- 2073 **LEGAL ADMISSIBILITY OF TESTS WITH RADIOPHARMACEUTICALS AND WITH PHARMACEUTICALS MARKED RADIOACTIVE FOR RESEARCH PURPOSES.** Schultz, C. (Hoffmann-La Roche (F.) and Co., Basel (Switzerland)). pp 119-137 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975). 1 tab.; 18 refs..

The drafts for governing experiments on human beings with radioactive marked pharmaceuticals, which exist in the Federal Republic of Germany and in Switzerland deal with fixing the principles of carrying out such tests - under consideration of the risks for the test person and the benefit for medical science and hence for the general public. They can be summarized as follows: 1) fixation of the maximum admissible radiation doses on the basis of the Radiation Protection Ordinance; 2) development of a clearly fixed authorization obligation for each single research project and determination of those responsible therefor as well as supervision of the experiments and recording of the results; 3) limitation to the testing of medicaments; 4) improvement of the protection of the test person consent is a very important personal right, no legal substitution possible for persons partly incapable or incapable of exercising rights).

- 2074 **LEGAL POSITION OF THE PERSON RESPONSIBLE FOR RADIATION PROTECTION IN PRACTICE.** Spang, A. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 107-111 of Viertes deutsches Atomrechts-Symposium. Referate und Diskussionsberichte. Cologne; Heymanns (1976). (In German)

From 4. German symposium on nuclear law; Goettingen, Germany, F.R. (26 May 1975).

The author states that the present First Radiation Protection Ordinance is difficult to understand for those responsible for radiation protection (most of them are technicians) but the new draft is even less understandable for those who are to apply the regulations in practice. He does not think it is right (it is wrong) that persons in question cannot directly and clearly infer their obligations and responsibility, their tasks and the breaches of the rule from the wording of the regulations

but that they can learn the contents only through legal comments or through their legal departments. Experience has shown that different interpretations induce confusion and make the technician develop his own interpretation, which might be legally doubtful but which might become general practice after all.

- 2075 PHYSICAL QUANTITIES IN RADIATION PROTECTION REGULATIONS AND THEIR MEASUREMENT. Wagner, S. (Physikalisch-Technische Bundesanstalt, Braunschweig (F.R. Germany)). pp 479-488 of Aspects fondamentaux et appliques de la dosimetrie. VIII. Congres international de la Societe Francaise de Radioprotection. Saclay, France, 23-26 Mars 1976. Montrouge, France; Societe Francaise de Radioprotection (1976).

From 8. International congress of the French Society for Radiation Protection: basic and applied aspects of dosimetry; Saclay, France (23 Mar 1976).

Legal regulations for the health protection of the public and workers exposed to ionizing radiation often fall short in providing a clear-cut guide to the necessary measurements and their interpretation. Even where these regulations conform to the recommendations of the ICRP, which are based on organ dose considerations, they fail in the translation of these recommendations into practicable rules. The organ dose can only be determined, if at all, at considerable metrological expense. Fortunately however, this is not necessary in routine radiation protection work, but only in the rare cases of gross accidental over-exposure, where the absorbed organ dose initiates further medical treatment. The quantities for routine work should therefore be easily and unequivocally measurable and provide a sufficiently safe estimate of the permissible ICRP limits for organ doses. The legal regulations should then state maximum permissible limits for these quantities, and not for such quantities which generally cannot and need not be measured. A suitable quantity serving this purpose is the individual or personal dose, defined as the dose equivalent at a point of the body which is representative of the radiation exposure of the worker. The further implications and consequences of this simplifying suggestion are discussed. It is shown, that most of the requirements of radiation protection can be fulfilled in this way.

- 2076 SOUTHERN ARIZONA: A SKIN CANCER FACTORY. Schreiber, M.M. Ariz. Med.; 33: No. 3, 191-192(1976).

More cancers occur on the skin than any other site of the human body. The most common types of skin cancer, Basal Cell Carcinoma and Squamous Cell Carcinoma, have their highest incidence in regions of the earth where sunlight is most intense and in areas of the body exposed most to the sunlight. For the past 70 years, it has been known that these two types of skin cancer are caused almost exclusively by solar ultraviolet radiation between 290 nm and 320 nm. Those wavelengths less than 290 nm are extremely dangerous to living tissue, so fortunately wavelengths less than this are completely absorbed by the ozone layer in our atmosphere. Of those light rays reaching the earth's surface, 99 percent are greater than 400 nm and 1 percent are between 290-400 nm. Of this, only .2 percent falls in the skin damaging range (290 to 320 nm). Many geographic and meteorological factors govern the amount of harmful radiation reaching the skin. The most important is latitude, the lower

the latitude in the Northern Hemisphere, the greater the damage. Other factors include altitude, time of the year, and time of day. The human factors include the type of skin, the amount of time spent in the sun, extent of coverage by clothing, and activity. Southern Arizona is unique in possessing all of these geographic, meteorologic, and human factors in optimum amounts providing for intense and prolonged sunlight exposure. Southern Arizona in 1969 had an incidence of 422 cancers per 100,000 population, which is much greater than other reported incidences in the United States.

- 2077 LEUKEMIA IN HIROSHIMA ATOMIC BOMB SURVIVORS FROM 1946 TO 1975. A SUMMARY OF THE FINDINGS AND RECENT TRENDS. Ohkita, T. (Hiroshima Univ.). pp 77-90 of Proceedings of the Hiroshima University. Hiroshima; Research Inst. for Nuclear Medicine and Biology (1976). (In Japanese)

The findings of studies for the period from 1946 to 1975 on the leukemia observed in Hiroshima atomic bomb survivors were summarized. In the last five years, 134 cases of death from leukemia among Hiroshima citizens were recorded. Of these, 23 cases (17 acute and 6 chronic types) were atomic bomb survivors exposed with 2000 m from the hypocenter. Fifteen of them (65 percent) were over 60 years of age. The frequency of chronic lymphocytic leukemia was still low. Although the risk of leukemia was greatly reduced since 1961, and the frequency of chronic granulocytic leukemia, one of the most characteristic type of Hiroshima atomic bomb-induced leukemia was also decreased, the death rate of leukemia as a whole among survivors exposed within 2000 m or 1500 m from the hypocenter was about 3 to 4 times higher than the mean death rate of all Japan. Therefore, careful and long-range follow-up surveillance should be continued. A brief review was also made of relevant studies such as the influences of environmental and host factors in the epidemiology of leukemia, the incidence of leukemia from children exposed in utero and leukemia in offspring of atomic bomb survivors.

- 2078 BIOLOGICAL EFFECTS OF DIAGNOSTIC IRRADIATION. Miller, P.E. Radiol. Technol.; 48: No. 1, 11-17(1976).

Medical radiation continues to be an area of concern to the patient. However, the technologist can reassure him that trained operators apply the radiation and that there are many built-in and accessory safety factors. Beyond that, however, the technologist can reassure himself that he is not responsible for unnecessary radiation by making full use of all safety measures, whether they are part of or accessory to the equipment, or are part of his judgment as to technique. To do this, he needs a sound knowledge of how damage occurs and a continual updating on research and equipment that will make his reassuring words to the patient honest ones.

- 2079 DEVELOPMENT TRENDS IN RADIATION PROTECTION STANDARDIZATION WITH REGARD TO MEDICAL ASPECTS. Mehl, J. (Bundesministerium des Innern, Bonn (Germany, F.R.)). pp 4-10 of Der ermächtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrl, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

31 refs..

A survey of the development tendencies in the region of radiation protection standardization in the FRG and internationally (ICRP, ICRU, ORCD/NEA EURATOM) which are important for the radiology.

2080 ENGAGEMENT AND CONTROL EXAMINATION.

Flach, H.D. (BASF A.G., Ludwigshafen am Rhein (Germany, F.R.)); Hinz, G. (Bundesgesundheitsamt, Berlin (Germany, F.R.)). Abt. fuer Strahlenhygiene. pp 27-32 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrl, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From 15. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Karlsruhe, Germany, F.R. (14 Jun 1974).

The legal provisions of the 1st radiation protection ordinance and of the X-ray ordinance valid in the FRG at present prescribe an engagement examination for persons who are exposed to radiation for professional reasons. These persons are also to be examined by authorized physicians at certain intervals. An employee may only be employed in the controlled area if this employment is not thought to cause any hazards to his health.

2081 RADIATION PROTECTION DURING WORKING WITH UNSEALED RADIOACTIVE SUBSTANCES.

Oberhausen, E. (Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.)). Abt. fuer Nuklearmedizin und Medizinische Physik. pp 212-214 of Der ermaechtigte Arzt im Sinne der Strahlenschutzgesetzgebung. Braun, H.; Ladner, H.A.; Mehl, J.; Messerschmidt, O.; Moehrl, G.; Stieve, F.E. (eds.). Stuttgart; Thieme (1976). (In German)

From Annual meeting of the Fachverband fuer Strahlenschutz e.V.; Helgoland, Germany, F.R. (27 Sep 1974).

3 refs. Short communication only.

GERMAN FEDERAL REPUBLIC; MATERIALS HANDLING; MEDICAL PERSONNEL; NUCLEAR MEDICINE; RADIATION PROTECTION; LAWS; RADIOISOTOPE GENERATORS; SPECIFICATIONS; UNSEALED SOURCES

2082 EXPERIENCE IN APPLYING AN IMAGE

INTENSIFIER SINGLE-PICTURE CAMERA IN HYSTEROSALPINGOGRAPHY. Nitzsche, H.; Klengel, G. (Medizinische Akademie, Dresden (German Democratic Republic)). Radiologische Klinik; Nitzsche, M. (Medizinische Akademie, Dresden (German Democratic Republic)). Frauenklinik. Radiol. Diagn.; 17: No. 3, 429-434 (1976). (In German)

The use of an image intensifier in hysterosalpingography is described. Comparative evaluations of picture quality and radiation exposure demonstrate the special advantages of this technique. The decrease of the gonad dose takes the first place and the application of this method in hysterosalpingography is recommended. The possibility to save films is an additional, economic advantage.

2083 CANCERS AT NAGASAKI AND HIROSHIMA.

Delpa, M. (Electricite de France, 75 - Paris. Comite de Radioprotection). pp 153-163 of Concepts of low doses of ionizing radiation in radiation biology and protection. II. . Cayet-Pennaneac'h, O. (ed.). Montrouge; Societe Francaise de Radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

Epidemiological surveys conducted at Nagasaki from 1950 to 1970 shows that whole-

body γ exposure of short duration, when it was not lethal is not statistically carcinogenic for any localization but for the bone-marrow and only in the 400 rem range class. A 50 rem exposure seems to have added a negative risk of leukemogenesis. At Hiroshima, interpretation of the data is more difficult on account of neutrons. It should then be all the more interesting to compare Nagasaki and Hiroshima data.

2084 MALIGNANCIES IN BLOOD-FORMING ORGANS FOLLOWING DIAGNOSTIC AND THERAPEUTIC PROCEDURES: A REVIEW.

Hodgkin, J.D.; Webster, P.D. (Veterans Administration Hospital, Augusta, GA). South. Med. J.; 69: No. 10, 1363 (1976). Ionizing radiation used for diagnosis or therapy has been associated with an increased incidence of malignancies of blood-forming organs. The increased incidence of hematopoietic malignancies following exposure to ionizing radiation obtained in the course of occupation, diagnosis and therapy of disease, or as a weapon of war is documented. The natural occurrence and the induced progression to acute leukemia of polycythemia rubra vera, Hodgkin's disease, multiple myeloma, Di Guglielmo's disease, and reticuloendothelial malignancies are discussed. The status of transplantation and immunodeficiency states and their relationship to acute leukemia is reviewed. Finally, drugs, toxins, and the use of cytotoxic radiomimetic agents for nonmalignant purposes are shown to lead to the development of acute leukemia. Background information relevant to the proper use of future diagnostic and therapeutic modalities is provided.

2085 RADIATION PROTECTION ASPECTS IN THE USE OF CALIFORNIUM-252 SOURCES.

Subrahmanian, G.; Venkataraman, G.; Madhvanath, U. (Bhabha Atomic Research Centre, Bombay (India). Div. of Radiation Protection). pp 207-236 of Some physical, dosimetry and biomedical aspects of californium-252. Vienna; IAEA (1976).

From Educational seminar on the uses of californium-252 in teaching and research; Karlsruhe, Germany, F.R. (14 - 18 Apr 1975). Californium-252 neutron sources are already being used in various fields including cancer therapy, industrial radiography, radiobiological research, and education and training programmes all over the world. However, one should not lose sight of the fast neutron hazard associated with them. This paper outlines the salient radiobiological data for protection purposes and discusses in detail radiation protection measures that are to be scrupulously followed. Although built-in safety can go a long way to minimizing risks in the industrial application of these sources, special situations involving exposure to the staff and public arise in brachytherapy departments at various stages of their use, storage, source preparation, transportation, application of the sources into patients, segregation and nursing care of patients. Other aspects such as leak-testing, damage to needles and tackling emergency situations arising out of loss or misplacing of needles are also discussed. Experience gained over the past 20 years in the use of radium-226 and, recently, cobalt-60 in various hospitals in India is extended to encompass the special problems encountered with ^{252}Cf . Details of the layout, structural shielding and other safety features in the use of large activity ^{252}Cf sources are also presented. Finally, the necessity for providing special training of personnel who intend to use ^{252}Cf sources is stressed.

- 2086 RADIATION PROTECTIVE SHIELD FOR USE DURING ARTHROGRAPHY. Johnson, N.E. (Eitel Hospital, Minneapolis). Radiol. Technol.; 48: No. 1, 35-38 (1976).

Protecting both the patient and hospital personnel against unnecessary radiation is one of the prime responsibilities of a radiologic technologist. Pertinent though it is to all radiologic procedures, it presents a specific problem during arthrography when the radiologist must work close to the patient. As a result of this challenge we devised a simple shield that is easily adapted for use in such procedures.

- 2087 PARTIAL-TARGET MUTAGENESIS AND CARCINOGENESIS. Von Borstel, R.C. (Alberta Univ., Edmonton (Canada)). pp v.1 p.361-368 of Biological and environmental effects of low-level radiation. Proceedings of a symposium on biological effects of low-level radiation pertinent to protection of man and his environment organized by the IAEA and the WHO and held in Chicago, 3-7 November 1975. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

As a first-order or second-order mutagenic or carcinogenic event arises from a spontaneous background, the first increases in frequency with dose appear superficially as partial-hit or partial-target kinetic events. This appearance does not necessarily reflect reality, for when one subtracts the spontaneous mutation frequency at each dose point, the first- or second-order dose-effect relation still obtains, continuing even below the spontaneous mutation level. On the other hand, even taking into consideration spontaneous events, partial-target mutagenic and carcinogenic dose-effect kinetics have been observed at low doses of ionizing radiation. The partial-target events can be explained by assuming (1) that mixtures of cells of different sensitivity are in the target population; (2) that energy must be absorbed in two or more closely involved cells for the event to take place; or (3) that cumulative damage is taking place in repair systems.

- 2088 NATURAL POPULATION LOAD FROM THE RADIOACTIVITY OF BUILDING MATERIALS. PART 1. ESTIMATION OF RADON-THORON DOSE. Toth, A. (Mecseki Ercbanyaszati Vallalat, Pecs II (Hungary)). Izotoptechnika; 19: No. 4, 148-160 (1976). (In Hungarian).

2 figs.; 11 refs.; 6 tabs..

Some factors influencing the radon, thoron and decomposition products' concentration in the air of a living room are reviewed as follows: enrichment time; perflation rate; the height of building and the role of cellars; meteorological factors (fluctuation of barometric pressure and velocity and direction of wind). On the base of 841 measurements the arithmetical mean values of the radon decomposition products recorded in the air of Hungarian non-ventilated living rooms on several stores are given as a function of the wall material. The respiratory, lungs and kidneys dosages caused by inhaling radon products are about 300, 50 and 2 mrad/a respectively. The dosages in the respiratory organs, lungs and kidneys brought about by thoron products are about 1.4, 6.3, and 1.1 mrad/a respectively.

TO THE POPULATION BY RADIATION AND CHEMICALS. Jacobi, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.)). Inst. fuer Strahlenschutz). pp 191-206 of Kernenergie und Umwelt. Aurand, K. (ed.) (Bundesgesundheitsamt, Berlin (Germany, F.R.)). Inst. fuer Wasser-, Boden- und Lufthygiene). Berlin; Schmidt (1976). (In German)

5 figs.; 20 refs..

The reflections on the risk of cancer indicate that radiation and carcinogens behave in a very similar way with regard to the dose-risk relation and the dose dependence of the cancer induction time. In contrast to radiation we are not yet in the position to estimate quantitatively the somatic risks of chemical environmental influences. For this reason, a numerical comparison of risks between nuclear power plants and power plants operating on fuel is only possible with difficulty at the moment. It has been estimated that under the same conditions the mortality risk, as a result of SO₂- and dust emission from an oil power plant, is about a factor 3 to 5 higher for the population than the risk of cancer due to radiation from a nuclear power plant of the same power. When the uncertainties in risk estimations, especially for the effects of SO₂ and dust, are considered, this difference should not be over-emphasized. It is on the one hand, premature to stress the harmlessness of nuclear power plants to the environment, but on the other hand, it would also be completely wrong to compare their dangers with those of oil- or coal-fired power plants. But as regards safety, the risks from both kinds of plants are small in comparison to other man-made risks.

- 2090 NUCLEAR ENERGY - ENVIRONMENTAL PROTECTION AND PUBLIC HEALTH SERVICE. Aurand, K. (Bundesgesundheitsamt, Berlin (Germany, F.R.)). Inst. fuer Wasser-, Boden- und Lufthygiene). pp 11-17 of Kernenergie und Umwelt. Aurand, K. (ed.) (Bundesgesundheitsamt, Berlin (Germany, F.R.)). Inst. fuer Wasser-, Boden- und Lufthygiene). Berlin; Schmidt (1976). (In German)

In connection with the discussion on the benefits and risks of nuclear power plants, the importance of radiation protection for the population and environment is pointed out and warning of overemphasizing the danger, given. With regard to nuclear power plants in routine operation, the radiation protection values are considerably below those elaborated by medicine and biology. They led also finally to sophisticated safety measures in order to further reduce accident risks. One of the main tasks of public health service nowadays is the radiation of monitoring in the field of medicine.

- 2091 NUCLEAR ENERGY AND THE ENVIRONMENT. Berg, J. (Bundesministerium des Innern, Bonn (Germany, F.R.)). pp 18-20 of Kernenergie und Umwelt. Aurand, K. (ed.) (Bundesgesundheitsamt, Berlin (Germany, F.R.)). Inst. fuer Wasser-, Boden- und Lufthygiene). Berlin; Schmidt (1976). (In German)

In a further education meeting, for members of the public health service, on information on nuclear energy and environment, their problems as a competent authority are outlined, namely to enlighten the population by presenting the hazards in an objective way and thus being a mediator between technical experts and the population.

- 2092 DOSE LIMITS IN RADIATION PROTECTION. Gans, I. (Bundesgesundheitsamt, Berlin)

- 2089 COMPARATIVE VIEWS ON THE SOMATIC RISKS

- (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). pp 173-178 of Kernenergie und Umwelt. Aurand, K. (ed.)
(Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). Berlin; Schmidt (1976). (In German)
4 tabs. Short communication only.
DOSE LIMITS; HUMAN POPULATIONS; ICRP CRITICAL GROUP; MAXIMUM PERMISSIBLE CONCENTRATION; MAXIMUM PERMISSIBLE DOSE; MAXIMUM PERMISSIBLE EXPOSURE; OCCUPATIONS; PERSONNEL; RADIATION PROTECTION
- 2093 NATURAL AND MAN-MADE RADIATION EXPOSITION OF MAN. Aurand, K.
(Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). pp 179-190 of Nuclear energy and the environment. Aurand, K. (ed.)
(Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). Berlin, Germany, F.R.; Schmidt (1976). (In German)
A short outline of the effects of genetically significant doses on the population in the FRG through natural radioactivity, radiology, nuclear energy, application of ionized radiation in research and technology, and occupational radiation exposure.
- 2094 Radiatsionnyi risk na zemle i v kosmose. (RADIATION DANGERS ON THE EARTH AND IN SPACE). Kovalev, E.E. Moscow; Atomizdat (1976). 256p.
Book was dedicated to the development and new approach to the problem of radiation protection of man upon cosmic flights. Basic to this approach lies the utilization of the conception of acceptable risk, that permits to establish unity for systems of cosmic ship safety criteria and can be used in other spheres of activities of man, connected to application of sources of ionizing radiations. The book was designed for scientific workers and engineers, workers in the field of cosmonautics, rocket technology and radiation safety, post-graduate students and students of associated specialties.
- 2095 REPORT ON THE 17TH ANNUAL MEETING OF THE ASSOCIATION OF GERMAN RADIATION PROTECTION PHYSICIANS AT GIESSEN, 11 AND 12 JUNE, 1976. Messerschmidt, O. Atomkernenergie; 28: No. 4, 299-300 (1976). (In German).
From 17. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte; Giessen, Germany, F.R. (11 Jun 1976).
To be published in 'Strahlenschutz in Forschung und Praxis', Georg Thieme Verlag, Stuttgart.
Main subjects: 1) experience from the point of view of the physician in radiation protection in nuclear facilities, 2) measures taken by physicians in case of incidents and accidents, 3) experience and consequences concerning radiation protection training and instruction in the field of medicine, 4) radiobiology, 5) theory and practice of radiation protection in x-ray diagnostics, 6) the usefulness of mammography (HP)..
- 2096 RADIATION DOSES AND BIOLOGICAL PROBLEMS DURING SPACEFLIGHT. Meissner, J.
(Forschungsinstitut Borstel (Germany, F.R.). Abt. Angewandte Radioaktivitaet und Nuklearmedizin). pp 20-30 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)
From 16. annual meeting of the Vereinigung
- Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).
8 figs.; 4 tabs.; 15 refs..
Comprehensive survey of problems concerning dosimetry in connection with cosmic rays, energy dose and equivalence dose of the primary galactic radiation, dose values within the range of flares and in the Van Allen belt, micro-dosimetric statements on heavy ions with extreme high LET.
- 2097 TERATOGENE HAZARDS OF MEDICAL RADIATION EXPOSURE. Michel, C. (Zurich Univ. (Switzerland). Strahlenbiologisches Inst.). pp 89-91 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)
From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).
1 tab.; 13 refs. Short communication only.
BIOLOGICAL RADIATION EFFECTS; BIOMEDICAL RADIOGRAPHY; CONGENITAL MALFORMATIONS; TERATOGENESIS
- 2098 GENETIC RISK OF MEDICAL APPLICATIONS. Stephan, G. (Bundesgesundheitsamt, Neuherberg/ Muenchen (Germany, F.R.). Inst. fuer Strahlenhygiene). pp 73-80 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)
From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).
1 fig.; 4 tabs.; 20 refs..
An attempt is made to find a relation between dose and genetic effect, and to estimate the risks.
- 2099 TERM 'RISK' AND ITS EVALUATION BASES. Brueckner, R. (Muenchen Univ. (Germany, F.R.). Mathematisches Inst.). pp 55-64 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)
From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).
The term risk, the risk itself and its application for radiation exposure in practised medicine is presented from the following points of view: Life expectation, susceptibility to sickness and permanent inability to work, impaired professional and earning capacity, work accident and sickness.
- 2100 REFLECTIONS ON RISK IN RADIOLOGICAL PRACTICE TAKING INTO ACCOUNT THE INDICATIONS OF X-RAY EXAMINATIONS. Beck, H.R. pp 98-110 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)
From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).
6 tabs.; 73 refs..
An attempt is made to contribute to reducing the tension between exaggerated fears of the effects of diagnostic radiation doses on the one hand, and much too light-hearted indication statements for X-ray diagnostics on the other. In this context, the lack of knowledge concerning the dose effect relations of low

doses become apparent.

year. There is also no notable radiation risk for the group of professionally radiation-exposed persons to be expected as long as one clearly keeps below the maximum permissible dose value as so far has been done.

- 2101 VALIDITY OF EXAMINATIONS WITH RADIOACTIVE MATERIALS AND X-RAYS AND THEIR RELEVANCE, IN PARTICULAR WITH REGARD TO RADIATION EXPOSURES. Breit, A. (Staedtisches Krankenhaus Passau (Germany, F.R.). Strahlenabteilung); Hinz, G. (Bundesgesundheitsamt, Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Strahlenhygiene). pp 158-163 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

7 tabs. Short communication only.
BIOMEDICAL RADIOGRAPHY; COMPARATIVE EVALUATIONS; DIAGNOSTIC TECHNIQUES; NUCLEAR MEDICINE; PATIENTS; RADIATION DOSES; RADIATION HAZARDS

- 2102 SOMATIC RISK. CONSIDERATIONS FOR LOW AND LOWEST DOSES. Fritz-Niggli, H. (Zurich Univ. (Switzerland). Strahlenbiologisches Inst.). pp 80-88 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

4 figs.; 5 tabs.; 6 refs..

As the medical exposure represents a concentrated irradiation with small doses, the pessimistic risk consideration of the assumption of a linear dose-effect relationship is justified. However for the smallest weakened beams, it is probable that a minimum of energy is necessary to produce measurable effects. This energy minimum is probably always exceeded in medical exposure so that there is a true danger which becomes complicated due to the possible combination effect regarding the sensitizing effect of other noxes.

- 2103 ENDANGERMENT RISK IN APPLYING RADIOACTIVE MATERIALS FOR THERAPEUTICAL PURPOSES. Herzberg, B.; Kaul, A. (Freie Univ. Berlin (Germany, F.R.). Klinik fuer Radiologie, Nuklearmedizin und Physikalische Therapie). pp 174-181 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

1 fig.; 3 tabs.; 13 refs..

For patients having undergone radionuclide therapy with a ^{131}I therapy, the individual risk for radiation induced thyroid carcinoma increases by an order of magnitude of 2 to 3 to a risk of the $3\text{sup}(\text{rd})$ order. In the therapy with ^{192}Ir , the thyroid carcinoma risk in an unfavourable case increases by an order to the $5\text{sup}(\text{th})$ order of risk. The therapy with ^{32}P does not increase the leukemia risk. An increase of the risks for genetical damage is not to be expected for the above mentioned therapy methods, as furthermore, the therapeutized patients in many cases are first treated from the $4\text{sup}(\text{th})$ decennium upwards. There is also no significantly recognizable increase of spontaneous cancer frequency for the total population as a result of the average radiation exposure of 0.17 rem per head and

- 2104 ENDANGERMENT RISK IN APPLYING RADIOACTIVE MATERIALS FOR DIAGNOSTICAL PURPOSES. Kaul, A.; Roedler, H.D. (Freie Univ. Berlin (Germany, F.R.). Klinik fuer Radiologie, Nuklearmedizin und Physikalische Therapie). pp 163-174 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

3 figs.; 6 tabs.; 14 refs..

By means of risk considerations and epidemiological investigations, a value of 1 mrd/a in the FRG has been estimated for the GSD. Compared to the height of the natural radiation exposure, it is deduced from the investigation of individuals in the population with radiodiagnostics that there is no genetic risk for the population in general.

- 2105 ENDANGERMENT RISK IN APPLYING IONIZING BEAMS AND RADIOACTIVE MATERIALS FOR PERSONS PROFESSIONALLY USING RADIATION. Kossel, F. (Bundesgesundheitsamt, Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Strahlenhygiene). pp 189-195 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

3 figs.; 3 tabs.; 4 refs..

From the results of the personnel dose monitoring by the authoritative measuring places in the FRG from the years 1962 to 1974 and from the information of the responsible authorities of the federal counties, it is seen that the number of professionally exposed and personnel dosimeter monitored persons has risen to 30,000 persons. The number is still small compared with the entire population. The average radiation exposure per person professionally dealing with radiation is between 250 and 400 mrem per year, the genetically significant dose of the population is 40 to 50 μrem per year. The closer examination by specific investigations of the obvious frequency of dose excesses in individual concerns is encouraged.

- 2106 FEW COMMENTS ON THE RISK OF ENDANGERMENT IN RADIATION THERAPY. Ladner, H.A. pp 152-158 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzaezte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

27 refs..

It is shown that the radiation treatment of tumour patients with special consideration to avoiding risks on the basis of new natural scientific and technical knowledge, is not merely the concern of a few therapists but a task of society. The radiation treatment can only then help mankind when it is shown how it can be humanized. In this way it is possible to summarize the human needs and the scientific

developments with all risks.

- 2107 RISK OF HAZARDS IN MASS RADIOLOGY. Liebschner, K. pp 138-142 of Risiko der Gefährdung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

1 fig.; 1 tab. Short communication only.

BIOMEDICAL RADIOGRAPHY; BRONCHI; CARCINOMAS; DISEASES; HUMAN POPULATIONS; LUNGS; PATIENTS; RADIATION DOSES; RADIATION HAZARDS

- 2108 ENDANGERMENT RISK IN THE INVESTIGATION WITH X-RAYS AND RADIOACTIVE MATERIALS FOR THE EARLY RECOGNITION OF TUMOURS. COMPARING RADIATION HAZARDS WITH HAZARDS DUE TO MISSED INVESTIGATIONS. Maurer, H.J. (Sankt-Josefs-Krankenhaus, Heidelberg (Germany, F.R.). Radiologische Abt.). pp 119-137 of Risiko der Gefährdung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

9 figs.; 7 tabs.; with refs..

The so-called radiation risk is supportable for the individual patient in order to diagnose a tumour sickness and to introduce a specific treatment. The known data on the lifetimes of non-treated cancer sick persons allow no other conclusion. Series investigations using ionizing radiation are to be planned with the help of the formula developed by Rausch. An unnecessary radiation risk can thus be avoided. Discrepancies in the literature on the question of radiation risks are indicated which render the judgement of the set problem very hard.

- 2109 RADIATION CANCER, SAFETY STANDARDS AND CURRENT LEVELS OF EXPOSURE. Mole, R.H. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). pp 191-203 of Pollution de l'environnement et risques cancérogènes. Rosenfeld, C.; Davis, W. (eds.). Paris, France; Institut National de la Santé et de la Recherche Médicale (1976).

From INSERM symposia on environmental pollution and carcinogenic risks; Lyon, France (3 - 5 Nov 1975).

Cancer can be induced by radiation in any tissue where cancer occurs naturally. The observation that antenatal diagnostic radiography causes a small but definite increase in childhood cancer is as good evidence as could be expected in support of the scientific expectation that there would be no threshold of dose for carcinogenesis. A linear relation between radiation dose and frequency of induced cancer is a necessary assumption for a system of radiological protection but is not necessarily a reasonable basis for realistic assessments of cancer risk. Indeed there are radiobiological and epidemiological reasons to the contrary. If the linear hypothesis is accepted then at the present time in the UK the routine practice of medicine is of about 2 orders of magnitude more important in causing cancer than environmental pollution by discharge of radio-activity. The acceptability of radiation safety standards for occupational exposure may be justified by comparison of radiation cancer risks with risks from fatal accidents in the safer industries. The acceptability of the corresponding standards for members of the public seems to require more

public discussion of the concept of negligible risk. Emotional reactions to uncontrolled releases of radio-activity are based at least in part on a failure to appreciate the hypothesis of linearity.

- 2110 APPLICATION OF VARIOUS CALCULATION METHODS TO THE ASSESSMENT OF THE DOSE FROM ²⁴¹AM PHOTONS, IN CASE OF LIVER CONTAMINATION. Nikpay-Aslie, P. (Teheran Univ. (Iran). Inst. of Nuclear Science and Technology); Le Grand, J.; Parmentier, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Service de Protection Sanitaire). Radioprotection; 11: No. 4, 285-303(1976). (In French).

In case of internal contamination, organ photon dose estimation is rather difficult. Many calculations can be made with different assumptions. Comparisons were made between the results obtained with different classical methods and an original one. This method simulated the organ by a cloud of points considered both as emitting points and targets simultaneously. Thus not only the mean dose to the organ but also the dose to some selected points were obtained. The case of liver uniformly contaminated by americium 241 was chosen as an example. Doses calculated by the different methods were compared to doses measured in a contaminated liver included in a tissue equivalent phantom. The doses obtained by Monte-Carlo method and points cloud method were in good agreement with experimental results.

- 2111 La radioprotection en chirurgie dentaire (radiodiagnostic). (RADIATION PROTECTION IN DENTAL RADIODIAGNOSTIC). Pellerin, Y. Paris, France; Julien Prelat (1976). 88p. (In French).

Medical irradiation, and mostly radiodiagnostic is, at present time, the most important artificial source of irradiation. Reasons of this importance are reviewed for dental radiodiagnostic and different solutions to decrease it, are considered. French regulations concerning standardization of dental X-ray equipment and agreement of installations are reported. Radiological practice associated with this equipment in accordance with radiation protection regulations are examined.

- 2112 MATHEMATICAL STATISTICAL MODELS OF THE RISK ASSESSMENT AND THEIR APPLICATION TO MEDICAL PROBLEMS. Pietzsch, W. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Strahlenhygiene). pp 92-98 of Risiko der Gefährdung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

9 figs.; 11 refs..

The assessment of the radiation cancer risk is to be taken note of: The observed irradiated population must be sufficiently large in order to acquire statistically reliable results. An additional radiation cancer risk can only be recognized when due to the former, a statistically significant increase of the spontaneous cancer risk occurs. To assess the radiation cancer risk in the region of small doses or dose-rates, one must probably depend on the observation of the effects with higher doses or dose-rates. In the region of small doses or dose-rates one should proceed

- according to the proposal of the ICRP for radiation protection observations, i.e. the risk-dose relationship is linear, and there is no threshold value for the dose or dose-rate.
- 2113 PROBLEMS OF MEDICAL RADIATION EXPOSURE IN SWITZERLAND. Renfer, H.R. (Bern Univ. (Switzerland). Roentgeninstitut). pp 181-189 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)
From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).
2 figs.; 6 tabs.; 14 refs..
The increase in GSD of the Swiss population from 1957-1971 is investigated critically. Some proposals are made to reduce the radiation doses, e.g. by improving the training of physicians.
- 2114 RISK OF HAZARDS THROUGH IONIZING RADIATION APPLIED IN MEDICINE AS COMPARED WITH OTHER APPLICATIONS. Stieve, F.E. pp 203-227 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)
From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).
6 figs.; 16 tabs.; with refs..
Despite values relatively high for medicine, the average GSD of the human population in the FRG as a result of all kinds of ionizing radiations produced and used by man only reached dose values which are only half as high as the average radiation exposure values from natural sources. Thus it remains below the maximum value from natural sources in the FRG. Endangering of the overall population is not to be assumed. The risk is to be seen in the exposure of the individual.
- 2115 RISK OF HAZARDS DUE TO THERAPY WITH IONIZING RADIATION AND SEALED RADIOACTIVE MATERIALS. Trott, K.R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Biologie). pp 142-146 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)
From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).
4 figs.; 7 refs. Short communication only.
ACCELERATORS;PATIENTS;RADIATION DOSES;
RADIATION HAZARDS;RADIOTHERAPY;SEALED SOURCES
- 2116 GENETIC RADIATION EFFECTS. Stephan, G. (Bundesgesundheitsamt, Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Strahlenhygiene). pp 163-172 of Kernenergie und Umwelt. Aurand, K. (ed.) (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). Berlin; Schmidt (1976). (In German)
3 figs.; 2 tabs.; with refs..
From the literature, several varying estimations on genetic radiation risks are given. It is stressed that it does not yet give an objective presentation of these risks, the reasons for which are pointed out.
- 2117 SOMATIC RADIATION EFFECTS. Trott, K.R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Abt. Strahlenbiologie und Biophysik). pp 158-162 of Kernenergie und Umwelt. Aurand, K. (ed.) (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). Berlin; Schmidt (1976). (In German)
2 refs. Short communication only.
DELAYED RADIATION EFFECTS;IONIZING RADIATIONS;NEOPLASMS;RADIATION INJURIES;SOMATIC MUTATIONS
- 2118 CYTOGENETIC STUDIES IN WOMEN WITH MENSTRUAL DISTURBANCES, WORKING IN AN ENVIRONMENT OF IONIZING RADIATION (EXTERNAL IRRADIATION). Marinova, G.; Dimcheva, M.; Kyncheva, V. (Meditsinska Akademiya, Institut po Akusherstvo i Ginekologiya, Sofia (Bulgaria)). Akush. Ginekol. (Sofia); 15: No. 6, 448-453(1976). (In Bulgarian).
Cytogenetic studies of peripheral blood lymphocytes involved a sample of 30 female radiation workers with menstrual disorders from a total of 400 subjects (female physicians, laboratory technicians, and attendant personnel) included in dispensary polyclinic supervision records for a five-year period. Clinical conditions were distributed as follows: 16 patients, with oligomenorrhea; 8, with irregular bleedings; 3, with hypermenorrhea; 2, with a history of obstetric pathology; and 1, with ovarian cyst. Length of occupational experience in a radiation environment (external exposure) varied from 2 to 25 years; patient age, from 21 to 45 years. Chromosome anomalies were found in 17 of the 30 subjects investigated. Types of chromosome abnormalities detected: aneuploidy, fragments and gaps, and in one case, dicentric aberrations. Amounts of chromosome damage induced were shown to be related to years at risk.
- 2119 CARCINOGENIC RISKS ASSOCIATED WITH RADIATION POLLUTION. Latarjet, R. (Fonation Curie-Institut du Radium, Paris). IARC Sci. Publ.; No. 13, 179-180(1976). (In French).
The cancerogenic pollution by non-ionizing radiations is limited to the case of solar ultraviolet, whose activity at ground level may be increased as a consequence of the stratospheric depletion of ozone, produced by certain chemical pollutants: nitrogen oxides from supersonic aircrafts, freon. As regards ionizing radiations, the discussion is focused on the fundamental problem of the threshold, and on the means by which one may obtain some quantitative data related to carcinogenesis by small radiation doses in man. A new concept, that of a practical threshold, is proposed. A theory which links radiocarcinogenesis, as well as chemical carcinogenesis, to errors produced in the repair of lesions in the DNA is discussed. The rads-equivalent project for chemical mutagens and carcinogens is described.
- 2120 RADIATION CANCER, SAFETY STANDARDS AND CURRENT LEVELS OF EXPOSURE. Mole, R.H. (MRC Radiobiology Unit, Harwell, Eng.). IARC Sci. Publ.; No. 13, 191-204(1976).
Cancer can be induced by radiation in any tissue where cancer occurs naturally. The observation that antenatal diagnostic radiography causes a small increase in childhood cancer is good evidence in support of the scientific expectation that there would be no threshold dose for carcinogenesis. A linear relation between radiation dose and frequency of induced cancer is a necessary assumption for a system of radiological protection but is not

necessarily a reasonable basis for realistic assessments of cancer risk. Indeed there are radiobiological and epidemiological reasons to the contrary. If the linear hypothesis is accepted then at the present time in the UK the routine practice of medicine is of about 2 orders of magnitude more important in causing cancer than environmental pollution by discharge of radio-activity. The acceptability of radiation safety standards for occupational exposure may be justified by comparison of radiation cancer risks with risks from fatal accidents in the safer industries. The acceptability of the corresponding standards for members of the public seems to require more public discussion of the concept of negligible risk.

- 2121 PRELEUKEMIC STATES IN ATOMIC BOMB SURVIVORS IN JAPAN. Kamada, N.; Uchino, H. (Hiroshima Univ.). *Nouv. Rev. Fr. Hematol./Blood Cells*; 17: No. 1-2, 57-65(1976).

Cytologic and cytogenetic studies were performed on the bone marrow cells in atomic bomb-exposed patients who had prolonged periods of blood disorders with termination of acute leukemia (group I, 6 cases) and without the termination (group II, 6 cases), and survivors who were in apparent good health (group III, 85 cases). All but one patient in group I, who were examined at the preleukemic state, had abnormal clones. In 4 out of 6 of group I patients, morphologic abnormalities of bone marrow cells taken 3-10 years before leukemic development were found, such as giant neutrophils or basophils, binucleated granulocytes or megakaryocytes, and bridge formation of chromatid in metaphases. All patients in group II had stable types of chromosome aberrations. The persistent and high percentages of cytologic and cytogenetic abnormalities in patients with prolonged periods of blood disorders, regardless of history of radiation exposure, would suggest a preleukemic state, and also give some clue to the problems of leukemogenesis.

- 2122 RADIATIONS AND PUBLIC HEALTH. Jammet, H.; M'echali, D.; N'etot, J.C.; Coulon, R. (Commissariat a l'Energie Atomique, Fontenay-aux-Roses, France). *Rev. Epidemiol. Sante Publique*; 24: No. 6, 509-522(1976).

A short review is made of the general characteristics of electromagnetic and corpuscular radiations to which man can be exposed. Following some considerations on the action of ionizing radiations and the radiobiological factors governing their effects on health, the overall characteristics of pathological effects differentiating stochastic from non-stochastic effects are summarized. The uncertainties remaining as to low-level exposures are stated as well as the cautious assumptions usually made in this field. The various sources of exposure to which the population is submitted are considered, i.e., exposures from natural, medical, domestic, industrial sources or from fallout from nuclear weapon tests; the present or predictable levels of exposure and their variations are given for each source. But for medical irradiation, all the exposures connected to human activities are much lower than natural exposure variations; such exposures should modify the incidence of certain affections but quite insignificantly as compared with the regional or local variations observed.

- 2123 IONIZING RADIATIONS AND THEIR IMPACT ON BASIC FUNCTIONS OF THE GENITAL SYSTEM ON THE WOMEN (EXTERNAL EXPOSURE). Marinova, G.

(Meditsinska Akademiya, Sofia (Bulgaria). Inst. po Akusherstvo i Ginekologiya). *Akush. Ginekol. (Sofia)*; 15: No. 5, 351-358(1976). (In Bulgarian).

Data were summarized from dispensary polyclinic follow-up records over the period September 1969 through 1975 for 400 female X-ray personnel and 90 control employees free of occupational radiation exposure. In 80% of subjects in the survey group, first employment in radiation work was at less than 30 years of age. Exposure rates, as estimated from dosimetry film records, ranged from 20 to 100 mR/month, and integrated doses in no case exceeded the permissible annual levels over the past 5 years. The proportion of subjects presenting with menstrual disturbances was 42% for radiation workers versus 7.7% for controls. Distribution by types of disorders was as follows: oligomenorrhea, 35%; hypermenorrhea, 29%; irregular cycles, 15%; secondary amenorrhea, 9%; and dysmenorrhea associated with oligo- or hypermenorrhea, 22%. In 30 subjects with menstrual disturbances developing during the follow-up period, examinations included vaginal microbiology, cyclic vaginal cytodiagnosics, and pregnandiol levels. Immunoserologic assays were conducted in a total of 275 subjects, with or without menstrual disturbances, who were matched to allow comparison of results. Cytogenetic analysis of peripheral blood lymphocytes in 30 subjects with menstrual disturbances indicated radiation-induced chromosome aberrations to be present in 17 cases. Benign tumors and cancer of genital organs were diagnosed in 7.5 and 8.0%, respectively, of radiation workers as compared with 10.0 and 0.0%, respectively, in controls. All of the 66 pregnancies observed ended at term with delivery of live, apparently normal, progeny and an uneventful placental period. Gross and microscopic examination of 20 placentas and 30 chorions from artificially interrupted pregnancies disclosed no pathologic alterations. For the total of subjects under dispensary observation, there was a high rate of abortions by request.

- 2124 RISK OF HAZARDS IN THE APPLICATION OF IONIZING RADIATION AND RADIOACTIVE SUBSTANCES REFLECTED IN INTERNATIONAL RECOMMENDATIONS AND NATIONAL LAW. Wendorff, D. (Sozialministerium des Landes Schleswig-Holstein, Kiel (Germany, F.R.)). pp 65-73 of *Risk of hazards due to radiation exposure in medicine. Radiation protection in aeronautics and astronautics*. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

Review in the light of the historic developments of the NCRP and ICRP recommendations and the UNSCEAR report, without EURATOM, NEA/OECD and German law.

- 2125 CARCINOGENIC RISKS ASSOCIATED TO POLLUTION BY RADIATIONS. Latarjet, Raymond (Institut du Radium, 75 - Paris (France)). pp 179-189 of *Pollution de l'environnement et risques cancerogènes*. Rosenfeld, Claude; Davis, Walter (eds.). Paris, France; Institut National de la Sante et de la Recherche Medicale (1976). (In French)

From INSERM symposia on environmental pollution and carcinogenic risks; Lyon, France (3 - 5 Nov 1975).

Four aspects of the problem of carcinogenic risks associated to pollution by radiations are taken into consideration: the carcinogenic pollution by non-ionizing radiations is limited to the case of solar ultraviolet, whose

activity at ground level may be increased as a consequence of the stratospheric depletion of ozone, itself produced by certain chemical pollutants: nitrogen oxides from supersonic aircrafts, freon. As regards ionizing radiations, the discussion is focused on the fundamental problem of the 'threshold', and on the means by which one may obtain some quantitative data related to carcinogenesis by small radiation doses in Man. A new concept, that of a 'practical threshold' is proposed. One discusses a theory which links radiocarcinogenesis, as well as chemical carcinogenesis, to errors produced in the repair of lesions in the DNA. One presents and discusses the 'rads-equivalent' project for chemical mutagens and carcinogens.

- 2126 Entwicklung der Nuklearmedizin in Berlin (West) 1953 bis 1975. (DEVELOPMENT OF NUCLEAR MEDICINE IN BERLIN (WEST) 1953 TO 1975). Hinz, G.; Pietzsch, W. Berlin, Germany, F.R.; BGA (1976). 34p. (In German).

Three investigations with all users of unsealed radioactive materials in clinics and practices have been carried out in West Berlin for the years 1953 to 1968, 1970 and 1975. The object of these inquiries was to be able to state in what form and to what extent, unsealed radioactive materials are being applied to people and in order to be able to make a determination of population or organ doses through nuclear medicine. The extraordinarily high annual growth rate in nuclear medical diagnostics, as well as the fact that similar investigations have so far not been carried out, called for the necessity of these inquiries. Nuclear-medical therapeutical applications of unsealed radioactive materials did not increase during the period of investigation. The value of the genetically significant dose for nuclear medicine has risen from about 0.1 mrad in 1968 to about 2 mrad in the year 1975. Calculations concerning the for leukemia significant dose were carried out for the years 1970 and 1975. The evaluated total application number for 1968 was 21,300, for 1970, 30,300 and for the year 1975, 64,700. The present report gives an analysis of the total applications from various aspects (e.g. type of radionuclides applied and their chemical compound, applied activity, age distribution of the patients, organ examined).

- 2127 RECOVERY OF THE HUMAN ORGANISM AFTER RADIATION EXPOSURE. PRINCIPLES AND RECOMMENDATIONS. Gerber, G.B. Zivilverteidigung; No. 4, 28-32(1976). (In German).

The repair of radiation damage in the human organism is reviewed. A distinction is made between the single repair steps, first the molecular repair of sublethal damage during the periods of 30 min to 2 h and several days to months, second the substitution of the whole cells during a period of reproduction which is specific for the kind and persistence of the cells. One example is the radiosensitive stem cell with a reproduction rate of 40% and a redoublication time of 10 d at 100 rads and the very low reproduction rate of 1% with redoublication time of 7 d after a dose of 400 rads. 5 rads seems to be acceptable for systems with recovery and repeated exposure, single doses normally should not exceed 25 rads, not 100 rads/d for to save human life, and not a total dose of 500 rads. About 20% of irradiation damage is not repaired and leads to late effects, for example the induction of tumors, the shortening of life span and an increase in embryonic mortality. The author recommends the acceptance of a radiation dose

leading to 20 additional cases of leucemia in the whole population of Germany and an increase of tumor frequency of 1%. The shortening of life span should not exceed 0.5%. The equivalent residual dose (ERD) can be calculated by the following equation: $ERD = \text{last effective dose} - 5 \text{ rads} \times \text{number of days}$.

- 2128 EVALUATION OF HUMAN GENETIC DAMAGES ASSOCIATED WITH AN EXPOSURE TO IONIZING RADIATIONS. Leonard, A. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Ann. Biol. Anim. Biochim., Biophys.; 1: No. 1, 77-100(1976). (In French).

In a normal human population 10 to 13% of all detectible conceptions are associated with chromosome anomalies. Most of them will result in prenatal loss but it is generally accepted that chromosome anomalies are observed in about ten per 1,000 live newborn infants. If one considers also the gene mutations one must admit that 6 to 10% of the population present genetic defects. It is normally expected that exposure to chemical or physical mutagens such as ionizing radiations will result in an increase of the incidence of such mutations. The extensive studies performed on man failed, however, to demonstrate the production of genetic effects by ionizing radiations. The difficulties in performing valid epidemiological studies leave, therefore, no alternative to using the results obtained with experimental animals. From these results it can be inferred that 5 rem per 30 year reproductive generation (the genetic dose-limit) appears to be safe.

- 2129 ROLE OF RADIATION IN HUMAN LEUKEMIA. Shatterly, L.W. Houston, TX; Univ. of Texas (1976). 469p. University Microfilms Order No. 77-9280.

Thesis (Ph. D.).

In the analysis of radiation induced leukemia only two studies (one on the survivors of the atomic bombing and the other the British series on ankylosing spondylitics) appear to show a causal relationship. In both studies, a peak in the occurrence of leukemia was reached about five years from the initial exposure: The dose-response curves were approximately linear between 50-450 rads (A-bomb survivors) and 300-1,500 rads (spondylitics), and their excess in leukemia incidence was about 1-2 cases/10⁶/year/rad. The cancer incidence of A-bomb survivors has shown that after a latency period of two or three years the number of cases of leukemias increased rapidly to peak in 1950-1952. During this period, leukemia deaths were more than 50 times normal in the highest dose group and by 1965-1970 were about eight times normal. For other cancers, by 1965-1970, deaths were about one and one-half times normal, i.e., an increase of about 50 percent among the survivors who had doses exceeding 100 rads. In ankylosing spondylitic patients treated with x-rays, certain trends were observed. In utero exposure to A-bomb irradiation involves five studies: Childhood cancer, sex ratios, mortality, growth and development, and mental retardation. No increase in the incidence rate of solid tumors and leukemia was observed during the first ten years after the bombings. The findings from the study of in utero exposure to clinical x-rays, radiation exposure to radiologists, and therapeutic irradiation to the pelvic region were all inconclusive. Although a common etiology for leukemia goes unidentified, evidence now available suggests that the mechanism of leukemogenesis in man involves a block or an aberration in one or more factors associated with white cell

maturation. A proposed sequence of events involving major potential leukemogenic factors such as radiation, viral, chemical, genetic, and hormonal factors is presented.

- 2130 SOMATIC AND GENETIC EFFECTS OF SMALL DOSES OF IONIZING RADIATIONS IN MAN. Goutier, R. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). J. Belge Radiol.; 59: No. 1, 21-33(1976). (In French).

Estimations on the somatic and genetic effects of small doses of ionizing radiations in Man have been proposed by the Advisory Committee on the Biological Effects of Ionizing Radiation, set up by the U.S. National Academy of Sciences. They have been published in an important report, issued in 1972, from which we briefly analyze here the Chapter dealing with the somatic effects. Small doses of radiations are expected to promote only carcinogenic effects. After a rapid survey of the human experience on which the estimations are based, as regards the latent period of cancers, the plateau region (period of high risk) and the absolute and relative risk expressed per rem, per 10⁶ persons, per year, for leukaemia (having the highest risk) and for the "other cancers". These estimations were obtained by linear extrapolation to the 1 rem level from observations made after irradiation at relatively high dose levels and much higher dose-rates. This extrapolation procedure, though relatively reliable for high LET radiations (α -rays, neutrons), would yield overestimated values when applied to X- and γ -rays, since the carcinogenic effects of low LET radiations: - do not follow a linear dose-response relationship; - are mostly apparent above a threshold dose; - are strongly dose-rate dependent.

- 2131 POST-THERAPEUTIC RADIATION INJURIES OF THE NERVOUS SYSTEM: REFLECTIONS ON THEIR PREVENTION. Zeman, W.; Shidnia, H. (Indiana Univ. Medical Center, Indianapolis). J. Neurol.; 212: 107-115(1976).

The introduction of the concept of Nominal Standard Dose and of Time, Dose Fractionation Factors ostensibly permits definition of tolerance doses for normal tissues in unequivocal terms. However, even with these refinements, tolerance doses remain, at best, guidelines, because radiobiologic effectiveness is governed not only by the effective dose, but also by individual factors, which will modify the response. Attention must be accorded to these biologic parameters, in order to prevent injury to healthy tissues. Of particular significance are the relative size or volume of the irradiated tissue, the possible presence of co-existing pathology in the exposed organ and the development of disease after the termination of the treatment. Even if these factors are properly respected, the risk of radiation injury cannot entirely be eliminated. The radiotherapist is therefore obligated to use an approach which minimizes the exposure of the healthy nervous tissue, a goal which has become attainable with the advent of modern accelerators as radiation sources.

- 2132 MEDICAL CONCERNS. Mettler, F.A. Jr. (Univ. of New Mexico, Albuquerque). pp 38p, Chapter IX of Proceedings of National Energy Forum. Volume I. Jackson, J.L. (ed.). Akron, OH; University of Akron (1976).
From National energy forum; Akron, OH, USA (26 Jul 1976).

See CONF-760761--P1.

A general review is given of the radiation hazards associated with nuclear power. Topics

covered include radiation levels in the environment, cancer studies, genetic radiation effects, dose-effect relationships, and risk-benefit considerations.

- 2133 MEDICAL CONCERNS: MINDLESS USE OF TECHNOLOGY: GENETIC DAMAGE FROM LOW LEVEL RADIATION. Bross, I.D.J. pp 32p, Chapter X of Proceedings of National Energy Forum. Volume I. Jackson, J.L. (ed.). Akron, OH; University of Akron (1976).

From National energy forum; Akron, OH, USA (26 Jul 1976).

See CONF-760761--P1.

A general review is given of the health hazards associated with low levels of ionizing radiations. The view is presented that present permissible doses are too high and that low levels are causing cancer and leukemia in the U.S. The hazards of medical radiology are also addressed.

- 2134 (AED-Conf--76-202-006) BIOLOGICAL EFFECTS OF RADIOACTIVE EMISSIONS. Trott, K.R. (Muenchen Univ. (Germany, F.R.)). Strahlenbiologisches Inst.). 1976. 1p. (In German). (CONF-7606108--3). NTIS (US Sales Only).

From Day of the Deutsches Atomforum at the Achema: radioactive effluents from nuclear power stations; Frankfurt Main, F.R. Germany (25 Jun 1976).

Short communication only.

BIOLOGICAL RADIATION EFFECTS; RADIOACTIVE EFFLUENTS; REACTOR OPERATION; NUCLEAR POWER PLANTS

- 2135 (CONF-760744--2) GENETIC EFFECTS OF RADIATION. Selby, P.B. (Oak Ridge National Lab., Tenn. (USA)). 1976. Contract W-7405-ENG-26. 13p. Dep. NTIS \$3.50.

From Conference on energy sources of the future; Oak Ridge, TN, USA (5 Jul 1976).

Data are reviewed from studies on the genetic effects of x radiation in mice and the extrapolation of the findings for estimating genetic hazards in man is discussed. Data are included on the frequency of mutation induction following acute or chronic irradiation of male or female mice at various doses and dose rates.

- 2136 (CONF-760947--3) EFFECT OF AGING AND RADIATION IN MICE OF DIFFERENT GENOTYPES. Storer, J.B. (Jackson Lab., Bar Harbor, Maine (USA); Oak Ridge National Lab., Tenn. (USA)). 1976. Contract E(11-1)-3267; W-7405-ENG-26. 22p. Dep. NTIS \$3.50.

From Conference on genetic effects on aging; Bar Harbor, ME, USA (12 Sep 1976).

Data are presented on the life span of nine inbred strains and five hybrid strains of mice based on 400 mice of each sex for inbred and 200 mice of each sex for hybrid. Some of these mice were exposed when 120 days old to 250 R or 450 R of x radiation delivered at a dose rate of 60 R/min. Data on strain, sample size, and mean survival times are presented in tables.

- 2137 (COO--3097-16) EFFECT OF RADIATION ON NORMAL HEMATOPOIESIS AND ON VIRAL INDUCED CANCERS OF THE HEMATOPOIETIC SYSTEM. THREE-YEAR TECHNICAL PROGRESS REPORT, AUGUST 1, 1973-APRIL 30, 1976. Okunewick, J.P. (Allegheny General Hospital, Pittsburgh, Pa. (USA). Cancer Research Unit). 1976. Contract E(11-1)-3097. 77p. Dep. NTIS \$5.00.

In studies conducted during the first three-year segment of this contract, it was observed that in the process of viral leukemogenesis the

affected animals became more radioresistant than normal. Initial studies into the reason for the enhanced radioresistance implicated an increase in the number of pluripotent stem cells as one possible cause. During the current period, studies were carried out to further define the effect of the virus on stem cells and their kinetics using exposure to tritiated thymidine ($^3\text{HTdR}$) in vivo and in vitro. In addition, separate studies were initiated in an attempt to determine if the immune system played a part in the radioresistance, as well as what the effects might be of immune manipulations on the disease during the oncogenic period. Finally, studies were also undertaken to assess the sensitivity of the virus itself to radiation in vitro and in vivo to radiation and treatment with cells transplanted from viral resistant mice.

such as the proliferative state of the hair follicles and epidermis at the time of and subsequent to irradiation. The interaction of radiation and other carcinogens, especially ultraviolet light, is under study because of epidemiologic evidence suggesting a potential synergism for induction of scalp tumors. Radiobiological recovery processes have been studied in tumor response experiments using split doses of radiation separated by various times. The recovery rate for electron induced tumors has been measured, and the oncogenic effects of high LET particles (proton, alpha, argon) are being investigated.

- 2138 (COO--3380-23) RAT SKIN CARCINOGENESIS AS A BASIS FOR ESTIMATING RISKS AT LOW DOSES AND DOSE RATES OF VARIOUS TYPES OF RADIATION. Burns, F.J.; Vanderlaan, M.; Strickland, P.; Albert, R.E. (New York Univ., N.Y. (USA). Inst. of Environmental Medicine). 1976. Contract E(11-1)-3380. 15p. (CONF-760445--4). Dep. NTIS \$3.50.

From 3. international symposium on detection and prevention of cancer; New York City, NY, USA (26 Apr 1976).

The recovery rate, age dependence and latent period for tumor induction in rat skin were measured for single and split doses of radiation, and the data were analyzed in terms of a general model in an attempt to estimate the expected tumor response for various types of radiation given at low dose rates for long periods of time. The dorsal skin of male rats was exposed to electrons, x rays, or protons in either single or split doses for several doses and the tumor responses were compared during 80 weeks of observation. A two stage model incorporating a reversible or recoverable mode was developed and various parameters in the model, including recovery rate, dose-response coefficients, and indices of age sensitivity, were evaluated experimentally. The measured parameters were then utilized to calculate expected tumor responses for exposure periods extending for duration of life. The calculations indicated that low dose rates could be markedly ($1/100$ to $1/1000$) less effective in producing tumors than the same dose given in a short or acute exposure, although the magnitude of the reduction in effectiveness declines as the dose declines.

- 2139 (COO--3380-26) TUMORIGENIC ACTION OF BETA, PROTON, ELECTRON AND ALPHA RADIATION IN RAT SKIN. COMPREHENSIVE PROGRESS REPORT, AUGUST 1, 1973--JULY 31, 1976. Burns, F.J.; Albert, R.E. (New York Univ., N.Y. (USA). Inst. of Environmental Medicine). 1976. Contract AT(11-1)-3380. 35p. Dep. NTIS \$4.00.

Rat skin has been studied for a number of years as a model of radiation carcinogenesis in a solid tissue. Accessibility of the skin enables the tumors to be detected early so that growth rate, proliferation rate, and onset times can be established accurately and, of course, the superficial location permits an accurate assessment of doses and a localization of the radiation to the tissue of interest. We have been attempting to establish as accurately as possible the nature of the dose response curve, i.e., the rate of tumor occurrence as of function of radiation dose, and the importance of tumor induction of radiologic factors, such as dose rate, fractionation, dose localization, linear energy transfer and of biologic factors,

- 2140 (COO--3380-27) TUMORIGENIC ACTION OF BETA, PROTON, ELECTRON AND ALPHA RADIATION IN RAT SKIN. PROGRESS REPORT, AUGUST 1, 1975--JULY 31, 1976. Burns, F.J.; Albert, R.E. (New York Univ., N.Y. (USA)). 1976. Contract AT(11-1)-3380. 20p. Dep. NTIS \$3.50.

The carcinogenic effect of ionizing radiation on rat skin was studied in an attempt to learn more about radiation carcinogenesis, especially how various parameters of the irradiation, such as dose distribution within the tissue and dose rate, affect the yield of tumors. It was found that when the dose was localized to a small region of skin, the tumor yield was reduced and the magnitude of the reduction indicated that the region of reduced response might extend about $150\ \mu$ into the irradiated zone. The proliferative state of the hair follicles at the time of irradiation had relatively little effect on tumor induction although old animals are less susceptible than young or newborn animals. The penetration requirement of at least 0.3 mm for producing tumors suggests that the hair follicle germ cells could be the oncogenic targets. The recovery rate for tumor induction measured by split-dose exposure protocols was 4 hours for electrons. Proton radiation exhibited nearly complete recovery at 24 hours PI. UVL promotion of electron induced tumors did not significantly alter tumor yields. Radioresistance to tumor induction appears to increase with age.

- 2141 (INIS-mf--3315, pp 30) GENETIC DAMAGE IN MICE FOLLOWING CHRONIC GAMMA IRRADIATION. Bajrakova, A. (Nauchno-Izledovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). 1976. (In Bulgarian).

From 2. national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases; Varna, Bulgaria (2 Oct 1976).

Published in summary form only. English abstract available.

Second national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases. Abstracts.

Adult mouse males were exposed continuously to a radium-266 source. Mean total doses ranging from 100 to 900 rad were delivered at an average dose rate of either 0.1 or 1.0 rad/hour. Three to four months postirradiation, diakinesis-metaphase I primary spermatocytes were examined cytogenetically to score multivalent configurations - rings or chains of 3, 4, etc. univalents - as an indication of translocations occurring between nonhomologous chromosomes in irradiated spermatogonial cells. Evidence was obtained for poor efficiency of chronic gamma irradiation in producing this type of genetic damage, and the hypothesis was supported that there may exist a threshold dose

rate (a few millirads per minute) under which chronic gamma rays will show no further change in efficiency.

- 2142 (INIS-mf--3315, pp 36) SOMATIC AND GERM-CELL CHROMOSOME ABERRATIONS IN RABBITS EXPOSED TO LOW-DOSE-RATE GAMMA RAYS. Benova, D.; Vyglenov, A.; Baev, I.; Karadzhev, A. (Nauchno-Izledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). 1976. (In Bulgarian).

From 2. national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases; Varna, Bulgaria (2 Oct 1976).

Second national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases. Abstracts.

Prediction of genetic risks involved in chronic irradiation is particularly important from a practical point of view. One possibility for risk assessment by means of a readily accessible somatic measure would be offered if a ratio could be ascertained between chromosome aberrations in peripheral lymphocytes and in spermatogonia for a number of mammals, and then extrapolated to man. In the present study, rabbits were exposed to ^{137}Cs gamma rays at 0.008 rad/min, the total dose delivered being 280 or 390 rad. The latter results, respectively, in 4 and 6.25% dicentrics for peripheral lymphocytes, and in 2.5 and 3.3% translocations for spermatogonia as assert in spermatocytes. The dicentric - to - translocation ratio was thus 1.5 to 2 : 1. Comparisons were made with the ratios for rabbits given acute exposure, as found in our and in other laboratories. As compared with acute exposure data, reduction in dose rate appears to lead to a decrease in the frequency of dicentrics in lymphocytes, while the frequency of translocations in spermatogonia remains unchanged.

- 2143 (ORO--4465-15) PRODUCTION, PURIFICATION AND ASSAY OF THROMBOPOIETIN. PROGRESS REPORT, AUGUST 1, 1975--JULY 31, 1976. McDonald, T.P. (Tennessee Univ., Knoxville (USA). Memorial Research Center and Hospital). 1976. Contract E(40-1)-4465. 29p. Dep. NTIS \$4.00.

Experiments were conducted which indicate that thrombopoietin can be detected by both a bioassay and an immunoassay in sera of patients with various platelet production disorders. Other studies have shown that the kidney appears to have a vital role in thrombopoietin production; the mechanism of how platelet-specific antisera causes thrombocytopenia has been investigated. Also, an investigation has been made into the preparation of assay mice and the different methods for the measurement of thrombopoietin. These studies indicate that mice in rebound-thrombocytosis are more sensitive to exogenous TSF than normal or platelet transfused mice. Also, ^{35}S incorporation into platelets of assay mice is the most sensitive measurement of thrombopoiesis. The effects of hypoxia on platelet production was also investigated along with the release of thrombopoietin in animals exposed to RAMPS and whole-body x-irradiation.

- 2144 (TID--27097) LOW-LEVEL X-IRRADIATION OF THE BRAIN DURING DEVELOPMENT: MORPHOLOGICAL, PHYSIOLOGICAL AND BEHAVIORAL CONSEQUENCES. PROGRESS REPORT, SEPTEMBER 1, 1975--AUGUST 31, 1976. Altman, J. (Purdue

Univ., Lafayette, Ind. (USA)). 1976. Contract AT(11-1)-2000. 13p. Dep. NTIS \$3.50.

Results are reported from a study of the effects of exposure of rat cerebellum at days 4 through 15 following birth to various doses of low-level x radiation on amino acid levels in brain tissues, development of the alfactory bulb, and motor performance. Functional recovery with age was also investigated. (CH)

- 2145 (UCD--472-123, pp 28-44) PATHOLOGY IN A LIFESPAN STUDY OF X-IRRADIATED ADULT FEMALE BEAGLES. Chrisp, C.E.; Phemister, R.D.; Andersen, A.C.; Rosenblatt, L.S.; Goldman, M. 1976.

Annual report, fiscal year 1976.

Both neoplastic and non-neoplastic disease contributed to decreased dose-related cumulative survival rates in female beagles exposed to various doses and dose rates of x radiation at one year of age. Increased dose-related cumulative incidence rates of deaths due to mammary tumors was seen in nulliparous but not in parous beagles. A markedly dose-related increase in incidence of uterine polyps was found. The importance of ovarian, thyroid, urinary bladder, and other neoplasms is discussed.

- 2146 (UCD--472-123, pp 50-52) FRACTIONATED X-IRRADIATION DAMAGE TO DEVELOPING OVARIES IN THE BONNET MONKEY (MACACA RADIATA). Andersen, A.C.; Hendrickx, A.G. 1976.

Annual report, fiscal year 1976.

Fractionated x-ray exposures of 11.5 rads each (total 200 rads) given twice weekly between 75 to 137 days postcoitum (pc) severely damaged the ovary of 8 out of 9 fetal bonnet monkeys. This radiation regimen delayed oogenesis in some instances and reduced follicle counts by 75 percent or more. Fractionated x-irradiation earlier in gestation (148 to 104 da pc) did not cause ovarian damage.

- 2147 (UCD--472-123, pp 67-82) HEMATOPOIETIC EFFECTS. Wilson, F.D.; Stitzel, K.A.; Munn, S.L. 1976.

Annual report, fiscal year 1976.

Progress is reported on studies on the internal radiation effects of ^{90}Sr and ^{226}Ra in beagles and investigation of leukemias induced by various doses of whole-body ^{60}Co γ . Newer studies on health effects of non-nuclear energy production, in particular the response of macrophage progenitors to particulate fly ash, are described. Previously developed bone marrow cloning techniques, which allow quantitation of bone marrow cell progenitors in vitro, were modified for quantitation of progenitors of alveolar macrophages. In view of the potential importance of silica components in particulate fly ash and the use of silica as an immunosuppressive agent during bone marrow transplantation therapy in experimental leukemia, pilot studies were initiated to investigate the effects of iv-administered silica on bone marrow, lymphoid, and macrophage cell populations in mice and dogs.

- 2148 CHANGES IN CHROMOSOME ABERRATION FREQUENCY IN CHINESE HAMSTER LIVER RELATED TO LET AND MICRODOSE DISTRIBUTION. Brooks, A.L.; McClellan, R.G. (Inhalation Toxicology Research Inst., Albuquerque, NM). pp 767-778 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and

toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The effect of radiation quality on the frequency of chromosome aberrations in liver cells was determined by exposing animals to either ^{60}Co gamma irradiation as a reference standard or to radionuclides that deposit in liver; ^{144}Ce , a beta emitter, ^{238}Pu , ^{239}Pu and ^{241}Am , alpha emitters, and ^{252}Cf , an isotope which emits alpha, fission fragments, neutrons, and gamma rays. All the radionuclides were injected as the citrate which resulted in a large fraction of their total activity being deposited in the liver. With the exception of acute gamma exposure, all dose response relationships could be adequately described by a linear equation. Quality factors for the different LET exposures were derived by comparing the slopes of the dose response curves. Using protracted ^{60}Co exposures as the reference, the quality factor for the beta emitter ^{144}Ce - ^{144}Pr is 1. Quality factors for the alpha emitters ^{238}Pu , ^{239}Pu and ^{241}Am ranged from 11 to 20 which seems to be higher than the value of 10 used in establishing radiation protection standards. The factor derived for ^{252}Cf was 10. The lower quality factor compared to pure alpha emitters was attributed to the ineffectiveness of fission fragments in producing measurable chromosome damage. (auth)

- 2149 (ERDA-tr--160, pp 75-81) INFLUENCE OF THE DEPTH DISTRIBUTION OF BASAL CELLS ON THEIR SURVIVAL IN THE IRRADIATION OF SKIN WITH BETA PARTICLES WITH VARIOUS ENERGIES. Osaov, D.P.; Rakova, V.A.; Klykov, G.V.; Filatov, V.V. 1976. Translated from Radiobiologiya; 16: No. 1, 59-63(1976).

Radiobiology. The distribution of basal cells within the skin of sexually immature pigs was investigated in the normal state and after irradiation with β particles of various energies. The results of the investigation permits an explanation of the peculiarities of the damage and repair of the skin after various radiation influences and a substantiation of the selection of the depth and thickness of the layers of skin within which it is advisable to determine the absorbed dose under set conditions of irradiation.

- 2150 (ERDA-tr--160, pp 151-154) EFFECTS OF X IRRADIATION ON THE 5'-NUCLEOTIDASE ACTIVITY OF THE PLASMA MEMBRANES OF THE RAT LIVER. Ryskulova, S.T. 1976. Translated from Radiobiologiya; 16: No. 1, 115-117(1976).

Radiobiology. The effects of x irradiation on the 5'-nucleotidase activity of the plasma membranes of the rat liver were investigated. The irradiation of rats leads to an increase in the activity of the enzyme of the liver plasma membranes in all the investigated periods. It is thought that the prolonged increase in activity may be a consequence of a complex of postradiation disruptions in the chain of intermediary metabolism. (ERB)

- 2151 (ERDA-tr--160, pp 155-158) USE OF THE METHOD OF MONOLAYER CULTURES OF THE GUINEA PIG SPLEEN FOR THE EVALUATION OF THE RADIOPROTECTIVE ACTION OF MEXAMINE ON THE SURVIVAL OF COLONY-FORMING CELLS. Baisogolov, G.D.; Rudakova, S.F.; Rudakov, I.A.; Konoplyannikov, A.G. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). 1976. Translated from Radiobiologiya; 16: No. 1, 117-120(1976).

Radiobiology. Data are presented on the

influence of mexamine on the survival of colony-forming guinea pig spleen cells under the conditions of γ irradiation in vitro. It was found that colony-forming spleen cells possess substantially greater radioresistance in comparison with colony-forming bone marrow cells. The dose reduction factor for mexamine in these experiments was found to be about 1.3. The results obtained indicate the possibility of using the method of monolayer cultures for a quantitative evaluation of the radioprotective action of various preparations on precursor cells in the hematopoietic organs of animals. (ERB)

- 2152 (ERDA-tr--160, pp 179-182) AUTOIMMUNIZING ACTION OF X IRRADIATION AND AN ANTIBIOTIC. Ter-Pogosyan, R.A.; Malikoyan, S.A. (Ministry of Health of the Armenian SSR, Erevan). 1976. Translated from Radiobiologiya; 16: No. 1, 134-137(1976).

Radiobiology. The peculiarities of the autoimmune process developing in the case of the combined use of ionizing radiation and a widely used antibiotic, penicillin, were studied. The experiments were conducted on guinea pigs using fractionated radiation. It was found that in the combination of fractionated irradiation and the injection of penicillin, both an intensification of the production of radiation autoantibodies and an increase in the sensitivity to penicillin were noted in the guinea pigs. (ERB)

- 2153 (ERDA-tr--160, pp 183-187) STUDY OF THE REPRODUCTIVE FUNCTION OF MONKEYS IN CHRONIC IRRADIATION. Artem'eva, N.S.; Kosichenko, L.P.; Andreeva, A.V.; Zvereva, G.A. (Scientific Research Lab. of Experimental Immunobiology, Moscow). 1976. Translated from Radiobiologiya; 16: No. 1, 137-140(1976).

Radiobiology. The functional activity, reproductive capacity, and structural changes in the ovaries of sexually mature and sexually immature female monkeys after chronic x irradiation were studied. Our observations of the influence of long-term chronic irradiation on monkeys confirm the data obtained on other animals (mice, rats, guinea pigs, rabbits) on substantial disruptions of the function of the ovaries, inhibition and total suppression of the reproductive capacity. In our investigations we were unable to establish an increase in the prenatal mortality, which was clearly shown on small laboratory animals. The cause of the decrease in fertility might be changes in the oviducts and uterus. However, the destructive processes that we observed in the ovaries of irradiated monkeys, which might be aggravated as the dose and period of irradiation are increased, might undoubtedly be the cause of the functional and structural pathological changes.

- 2154 PROLIFERATION AND DIFFERENTIATION OF HEMOPOIETIC STEM CELLS IN HYPOKINESIA. Portugalov, V.V.; Shvets, V.N. Byull. Eksp. Biol. Med.; No. 4, 501-503(1976). (In Russian).

Studies were performed to evaluate the effects of prolonged hypokinesia on proliferation and differentiation of hemopoietic stem cells. Female mice (20 to 22 g; (CBA x C57BL) F_1) mice were held in special low-volume containers; on the 1, 3, 7, 15, 30, and 45th day of limited movement, marrow was removed from their liver and spleen. A cell suspension was prepared from these samples and administered intravenously to the same mice which had been irradiated with 900 R gamma-rays ^{137}Cs . The course of differentiation of splenic

or marrow cells in recipient bone marrow followed expected patterns of differentiation while bone marrow cells from the donor showed an increase in erythropoietic differentiation in the recipient bone marrow.

- 2155 SOMATIC RADIATION EFFECTS. Konermann, G. (Freiburg Univ. (F.R. Germany). Inst. fuer Biophysik und Strahlenbiologie). Atomkernenergie; 28: No. 1, 3-21(1976). (In German).

From Symposium on medical and biological problems of radiation exposure; Borstel, F.R. Germany (30 May 1975).

21 figs.; 2 tabs.; with refs..

Mechanisms of the origin and the compensation of somatic radiation effects are discussed using experimental and some human data. Cell cultures or different tissues respectively serve as models in order to demonstrate the amount of doses, the quality of doses and the dose rate as the most important physical parameters as well as the activity of proliferation and the degree of differentiation and maturity as the most important biological parameters for the irradiation effects. Alterations at the level of organs are represented for testicles, ovary, intestine, haemopoietic system and the central nervous system. Furthermore, immediate and longtime sequelae of irradiation during development are shown for animals, with regard to their transferability to man. After a loss of cells the capacity of a compensating proliferation is estimated as an important determinant for acute somatic effects in both adult and growing organs. On the other hand, it can be deduced from curves for late effects (tissue degeneration, unspecific life shortening or carcinogenesis) that latent engrammes for these events are accumulated from doses which are insufficient for acute alterations.

- 2156 EFFECT OF ACUTE IRRADIATION ON THE DEVELOPMENT OF LIMBS IN SHEEP. Rajtova, V. (Institut fuer Normale Anatomie der Hochschule fuer Veterinaermedizin, Kosice, Czechoslovakia); Horak, J. Biologia (Bratislava); 31: No. 3, 171-178(1976). (In German).

The effect of acute irradiation on the limb development in sheep was studied. The pelvic area of a pregnant sheep was irradiated locally on the 28th, 29th and 30th days after fertilization. The fetus was removed on the 15th day after irradiation and treated histologically. A single exposure with 250 R (higher exposures killed the fetus) was found to cease the limb development on the 28th day after irradiation (the critical period of the sheep limb development), to induce persistence of the intermedial ray on the 29th and 30th days, an early disappearance of the side finger rays, an early disappearance, fusion or deformation of some carpal and tarsal elements on the 29th and the 30th days after irradiation.

- 2157 COMPARATIVE STUDIES OF RADIATION-INDUCED CHROMOSOME ABERRATIONS IN SEVERAL MAMMALIAN SPECIES. Muramatsu, S.; Matsuoka, O. (National Inst. of Radiological Sciences, Chiba (Japan)). pp v.1 p.229-236 of Biological and environmental effects of low-level radiation. Proceedings of a symposium on biological effects of low-level radiation pertinent to protection of man and his environment organized by the IAEA and the WHO and held in Chicago, 3-7 November 1975. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov

1975).

The dose-response relationship for inducing chromosome aberrations in peripheral lymphocytes of five mammalian species - man, cynomolgus monkey, rabbit, domestic cat and beagle dog - were studied comparatively by whole-blood microculture technique following in-vitro exposures at various doses with 200-kVp X rays. The yields of induced chromosome aberrations were dependent on exposure doses between 48 and 480 rads in all the species examined. The relationship between exposure dose (D in rads) and frequency of induced dicentric per cell (Y) was expressed by: $Y_{\text{sub}}(\text{man}) = 14.38 \times 10^{-6} D^{\text{sup}}(1.94)$; $Y_{\text{sub}}(\text{monkey}) = 18.12 \times 10^{-6} D^{\text{sup}}(1.86)$; $Y_{\text{sub}}(\text{rabbit}) = 1.88 \times 10^{-6} D^{\text{sup}}(2.06)$; $Y_{\text{sub}}(\text{cat}) = 78.66 \times 10^{-6} D^{\text{sup}}(1.35)$; $Y_{\text{sub}}(\text{dog}) = 46.13 \times 10^{-6} D^{\text{sup}}(1.37)$. Taking the frequency of dicentric in man as 1.00, the relative frequency in each species was estimated as 0.79, 0.24, 0.22 and 0.16 in monkey, rabbit, cat and dog, respectively. From these results the consistent relationship could not be discovered between X-ray doses and the dicentric yield based on the arm number effect proposed by Brewen et al., whereas the nuclear DNA contents and the arm number in all the species used are roughly similar to those in man. The authors considered that such interspecies differences may be derived from the cellular and/or physiological features of PHA-responsive lymphocytes (T-cells) in each species, and that may be due to the level of development of each species on the phylogenetic or evolutionary scale.

- 2158 LIFE SHORTENING, NEOPLASIA AND SYSTEMATIC INJURIES IN MICE AFTER SINGLE OR FRACTIONATED DOSES OF NEUTRON OR GAMMA RADIATION. Ainsworth, E.J.; Fry, R.J.M.; Brennan, P.C.; Stearner, S.P.; Rust, J.H.; Williamson, F.S. (Argonne National Lab., Ill. (USA)). pp v.1 p.77-92 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The late somatic effects of fission neutrons from the Janus reactor or of ^{60}Co γ radiation are being evaluated in hybrid B6Cf₁ mice (C57BL/6xBALB/c) of both sexes. The effects of dose, dose rate, number of radiation fractions, age at exposure, and quality of radiation were investigated. Principal end points include life shortening, age-specific rates of neoplastic and non-neoplastic diseases, and late manifestations of damage to the vasculature, cell-mediated immune responsiveness, and haematopoiesis. Over the range of single doses, from data now available, life shortening is inversely related to dose and the RBE ranges from approximately 2 to 7. Single doses were administered at 115, 190 or 280 days of age. Increased age affords some sparing effect for both neutron and γ radiations, but an increased RBE was observed at 270 days. When neutron or γ doses are protracted over 6 months, similar mortality (rates) result from weekly doses of 3.3 neutron and 35 γ rad; under these conditions the RBE is estimated at 10-13. Life shortening and age-specific death and tumour rates are compared when a total dose of 240 neutron rad is administered as a single dose or as fractionated doses distributed over 6 months; greater life shortening and higher age-specific death and tumour rates result from dose fractionation. The structural and functional integrity of the vasculature, assessed by clearance of ^{133}Xe after a single dose or fractionated doses of neutron or γ radiation,

indicates that the late effects of neutrons are at least total-dose-dependent, whereas a significant sparing effect is observed with fractionated γ irradiation. Late effects on cell-mediated immunity are evident in both γ and neutron-irradiated animals based on splenic repopulation by thymus-derived lymphocytes (T cells) and on the mitogen response of T cells that repopulate the spleen.

- 2159 BIOLOGICAL EFFECTS OF HADRONS AT VERY LOW DOSES. Baarli, J.; Bianchi, M.; Sullivan, A.H. (European Organization for Nuclear Research, Geneva (Switzerland)); Di Paola, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). pp v.1 p.195-203 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Several sensitive biological tests have been utilized to investigate any possible effects of hadron interactions in tissue. These include lens opacification in mice, testes weight loss in mice, inhibition of 10-day growth of *Vicia faba* bean roots, and type-B spermatogonia survival in mice. The radiations employed were 600- and 400-MeV neutron beams, a stopped negative pion beam, as well as Pu-Be and 14-MeV neutrons. The results obtained are summarized and discussed.

- 2160 RISK OF MAMMARY ONCOGENESIS FROM EXPOSURE TO NEUTRONS OR GAMMA RAYS: EXPERIMENTAL METHODOLOGY AND EARLY FINDINGS. Clifton, K.H.; Sridharan, B.N.; Gould, M.N. (Wisconsin Univ., Madison (USA)). pp v.1 p.205-211 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

A project has been initiated to define the risk of oncogenesis per rad of high or low linear energy transfer (LET) radiation per surviving mammary cell and its modification by hormones. This work was undertaken because: (a) mammary carcinoma is the principle neoplastic disease of American women; (b) rats have been demonstrated to be remarkably susceptible to mammary oncogenesis following neutron irradiation; (c) rats are similar to women in the importance of hormones to carcinoma induction and progression in their mammary glands; and (d) exposure to neutrons is likely to increase with increasing use of nuclear reactors and development of neutron radiotherapy sources. To measure mammary cell survival and, ultimately, postirradiation repair capacity, the authors are developing an in-vivo end-point dilution assay based on the formation of glandular structures after the transplantation of known numbers of monodispersed rat mammary epithelial cell suspensions. Such grafts initially give rise to alveolus-like spheres and, with time, to complete glands. Growth and secretion can be stimulated in them by hormonal manipulation. In the short-term assays and the longer-term carcinogenesis studies, elevated endogenous mammotropic hormone, prolactin (M_{TH}) levels have been induced by grafting of anterior pituitary tissue or of M_{TH} (M_{TH}-secreting pituitary tumours). Steroid hormone levels have been manipulated by surgical ablation or injection. Irradiations have been performed with a modified neutron fission spectrum generated by a Triga reactor, or with ¹³⁷Cs γ

rays. Results with two inbred rat strains indicate: (a) that the type (carcinoma or fibroadenoma), incidence and latency of mammary tumours is markedly influenced by the circulating levels of M_{TH}; and (b) that adrenal deficiency markedly enhances the induction of mammary carcinomas in irradiated rats with high endogenous M_{TH} levels. Further studies are in progress.

- 2161 EFFECTS OF CONTINUOUS PRENATAL γ RADIATION ON THE PIG AND RAT. Erickson, B.H.; Martin, P.G. (Comparative Animal Research Laboratory, Oak Ridge, Tenn., USA). pp v.1 p.111-117 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Little is known of the effects of continuous low-level irradiation applied prenatally to the long-lived mammal. As compared with the rodent, developmental events are protracted in long-lived species and consequently are at risk longer. Estimation of radiation risk to man therefore requires data from animals in which developmental events are similarly protracted. Pigs were irradiated continuously for the first 108 days of their 112-day gestation period at rates of 20, 9, 3 and 1.5 R per 22-hour day. Six pregnant gilts and six controls were employed at each dose rate. Foetal doses were 7, 3, 1 and 0.5 rad/d. Neither the health of the gilt nor the number of live births was affected by any exposure. Postnatal viability was also unaffected. Radiation effects on growth and organic development were assayed at birth, 70 and 150 days of age. Body weight and growth were unaffected by dose rates of 3 rad/d or less; and other than the gonad, only the weight of the brain was affected by 3 rad/d. At 1 rad/d or less only gonadal weight was reduced. The most spectacular finding at doses of 7 and 3 rad/d was sterility in both sexes. Following 1 rad/d, germ-cell number was reduced to 5% and 2% of control in the female and male, respectively. At 0.5 rad/d, germ cells were reduced to 43% of control in the female and 11% of control in the male. In contrast to the pig, 7 rad/d reduced the germ-cell population of male and female rats to only 49% and 35% of control, respectively, and 1 rad/d produced no apparent effect in either sex. It appears, therefore, that interspecific differences in the response to continuous γ radiation are large and that the germ cell is the most labile cell type.

- 2162 EFFECT OF PITUITARY ISOGRAFTS ON RADIATION CARCINOGENESIS IN MAMMARY AND HARDERIAN GLANDS OF MICE. Fry, R.J.M.; Garcia, A.G.; Allen, K.H.; Salliese, A.; Staffeldt, E.; Tahmisi, T.N.; Devine, R.L.; Lombard, L.S.; Ainsworth, E.J. (Argonne National Lab., Ill. (USA)). pp v.1 p.213-226 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The effects of single-dose fractionated and protracted exposures to ⁶⁰Co γ radiation and of single-dose and fractionated exposures to Janus reactor neutrons (fn) on mammary and Harderian gland tumorigenesis were studied in B6C₃F₁ mice. The incidence of mammary tumours is about 1% in the hybrid B6C₃F₁ mouse (C57BL/6JxBALB/cJ)_{F₁} and shows little increase with low-dose protracted γ irradiation. After exposure to

fission neutrons from the Janus reactor with single doses of 20, 80 and 240 rads, or with 80 and 240 rads given in 24 fractions, or to single and fractionated doses of γ irradiation, the incidence of mammary tumours increased somewhat. The influence of certain hormone levels on mammary and Harderian gland tumorigenesis were studied. The proliferative activity in the mammary and Harderian gland was determined by autoradiographic analysis after isografting two pituitaries under the spleen capsule or after administration of diethylstilbestrol diphosphate or prolactin. In the second type of experiment, mice with pituitary isografts were exposed to a single dose of 20 or 80 rad Janus fn, or to 90 or 269 rad γ radiation. Preliminary results indicated two major effects of the combined treatment of pituitary isografts and neutron irradiation on tumorigenesis: 1) a reduced latent period and increased incidence of mammary tumours; 2) (a) a reduced latent period for Harderian tumours, (b) a marked increase in their incidence (e.g. from 2.5% in controls to about 37% after a single dose of 80 rad fn), and (c) an increase in the fraction of Harderian gland tumours with metastases.

- 2163 SPERMATOGONIAL CELL RENEWAL UNDER CONTINUOUS IRRADIATION AT 1.8 AND 45 RADS PER DAY. Hsu, T.H.S. (University of Southern California, Los Angeles (USA). Dept. of Radiology); Fabrikant, J.I. (Montreal General Hospital, Quebec (Canada)). pp v.1 p.157-167 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The cell population kinetics and radiation response of continuously irradiated C57BL/6J mouse testes have been analysed. The changes in spermatogonial cell population sizes and cell kinetic parameters have provided information on the degree of radiosensitivity within the seminiferous epithelium at sublethal continuous irradiation doses and the manner in which the tissue responds. At 1.8 rad/d, spermatogonial cell renewal was maintained at near-normal levels through compensatory cell proliferation and recruitment from the Asub(s) stem cell pool. However, at 45 rad/d, depopulation of the testes took place through radiation depletion and maturation-differentiation of surviving elements. At this higher dose rate, the five type-A subpopulations were maintained at near-steady states of growth. The seminiferous epithelium displayed a remarkable capacity to recover. After two weeks of continuous irradiation at 45 rad/d, recovery commenced with proliferation from the Asub(s) spermatogonial stem cells, leading to full restoration of the seminiferous epithelium.

- 2164 MODULATION OF TUMOUR SPECTRA IN C 57 BLACK MICE FOLLOWING FAST-NEUTRON VERSUS CO IRRADIATION AT LOW DOSAGE. Mewissen, D.J.; Rust, J.H. (Chicago Univ., Ill. (USA). Dept. of Radiology; Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). pp v.1 p.181-193 of Biological and environmental effects on low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

A total of 7109 C 57 Black mice of either sex were either sham-, neutron- or cobalt-irradiated at the age of 33+-3 days. The dose range extended from 3.2 to 47.2 rads for neutrons and from 18 to 141 rads for γ rays.

This experiment was aimed at assessing relative biological effectiveness (RBE) and its possible dose dependence from radiation mortality and morbidity data, using actuarial statistics. The primary goal was to define the spontaneous or basic tumour spectrum in control animals of either sex, which included a major proportion of lymphocytic lymphomas, followed by reticulum cell lymphomas. A variety of other tumours were observed, among them various adenocarcinomas, squamous cell carcinomas and leiomyosarcomas of the gastrointestinal tract, liver and spleen hemangiomas, micro- and macrofollicular hyperplasia as well as papillary adenomas of the thyroid, fibromas and fibrosarcomas of connective tissue, muscles and bones, myomas and fibrosarcomas of uterus, luteomas and cysts of the ovary, papillary and transitional cell carcinomas of kidneys and an occasional mammary adenocarcinoma or skin epithelioma. Modulation of the basic tumour pattern by neutrons or cobalt was primarily operative on the reticular tissue. Age-specific incidence rates for combined mature and immature lymphocytic lymphomas decreased following neutron or cobalt irradiation at higher dose levels. In reticulum cell sarcomas, however, the tumour type evidently shifted almost entirely from the mature to the immature type. Furthermore, all rates increased markedly following irradiation at all dose levels. One major finding in all groups was the non-linearity of tumour response. Furthermore, it appeared that the control as well as the radiation-modulated tumour spectra were likely to proceed from intercompetitive stochastic processes rather than from some probabilistic random distribution. Some implications of these primary results are discussed.

- 2165 INTERSPECIES COMPARISON OF RESPONSES OF MICE AND DOGS TO CONTINUOUS ^{60}Co γ IRRADIATION. Norris, W.P.; Tyler, S.A.; Sacher, G.A. (Argonne National Lab., Ill. (USA)). pp v.1 p.147-155 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Young-adult purebred beagle dogs were exposed continuously, 22h/d, to ^{60}Co γ rays until they died. The daily dose rates ranged from 3.5 to 210 rad. At 3.5 rad/d the mean survival time was in excess of 1860 days (the study was still in progress in Nov.1975), while at 210 rad/d mean survival time was 13 days. The data are compared with those from previously published information from similarly irradiated mice. The comparison is made in terms of radiation-specific death rate, defined as $1/\text{MASsub}(i) - 1/\text{MASsub}(c)$, where $\text{MASsub}(i)$ and $\text{MASsub}(c)$ are the mean after-survival times of the irradiated and control populations, respectively. In both species, when log radiation-specific death rate is plotted against log dose rate, the response has a slope=2, i.e. the death rate increases with the square of dose rate. This occurs over the entire dose rate range where damage to haematopoietic tissues is the primary cause of death. In the mouse, at daily dose rates below 20 rad/d, haematopoietic injury is no longer a primary cause of death and the response curve shifts to slope=1 where injury is dependent only on total accumulated dose and is independent of dose rate. The data available so far suggest that a similar inflection may occur with the dog at dose rates below 3.5 rad/d. An experiment is being initiated to determine whether this will be the case. Statistical considerations, essential to the design of the

study, are presented.

- 166 EFFECT OF INSTANTANEOUS DOSE RATE ON SURVIVAL TIME OF MICE. Willhoit, D.G.; Wiggins, S.M. (North Carolina Univ., Chapel Hill (USA)). pp v.1 p.93-101 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The effect of instantaneous dose rate on the survival time of mice was studied for groups of LAF₁ mice receiving weekly γ radiation exposures, for duration of life, ranging from 150 to 300 R at instantaneous dose rates of 0.1, 1, 10 and 100 R/min. Two additional groups were irradiated at 100 R/min with weekly exposures of 150 and 250 R in which the dose was delivered in two equal fractions two hours apart. The range of weekly doses was selected with the anticipation that mean survival times would be in the range of 200 to 250 days, since the deaths associated with survival times in this range are due to tumours, leukaemia and degenerative diseases. The cause of death was not determined in this study since the primary purpose was to obtain survival time data from which leukaemia dose-rate studies could be designed. For comparison of the relative effectiveness of the instantaneous dose rates, the log median survival times were plotted as a function of weekly dose. The weekly dose to yield a median survival time of 200 days was determined, by interpolation, to be 228, 193 and 173 R/week for instantaneous dose rates of 0.1, 10 and 100 R/min, respectively. The results from the two groups which received the weekly dose in two fractions, separated by an interval of two hours, indicated a decrease in effectiveness equivalent to about 24% of the initial fraction. Similar comparisons between the 0.1 and 10 R/min groups and the 0.1 and 100 R/min groups indicated differences in effectiveness of 35 and 55 rad/fraction, respectively. It was concluded that the recovery kinetics operating during prolonged fractionation regimes have a dependence on instantaneous dose rate quantitatively similar to that observed in short-term LD_{50/30} studies.

- 2167 SPONTANEOUS AND EVOKED CEREBRAL ACTIVITY MODIFICATIONS ON WHOLE-BODY γ IRRADIATED ADULT RABBIT. Court, L.; Dufour, R.; Bassant, M.H.; Fatome, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection; Centre de Recherches du Service de Sante des Armees, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Radioprotection; 11: No. 2, 87-102(1976). (In French).

From Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

Whole-body γ -exposure from 150 to 850 rads (dose-rate: 14 rads.min⁻¹) delivered to adult rabbits chronically implanted with electrodes resulted in prompt and delayed changes of behavior, arousal and spontaneous and evoked electrical activities. Electrophysiological techniques of polygraphic recording and signal processing showed that the alterations were related to the absorbed dose. The threshold dose accompanied with transient changes of arousal should be in the range of 50 to 100 rads; below this range, to the exclusion of some possible behavior changes, exposure should act as a stimulation that would become nociceptive at higher doses only.

- 2168 RELATIONSHIP BETWEEN X-RAY IRRADIATION AND CHROMOSOMAL DAMAGE IN BONE MARROW TISSUE OF MICE. Chaubey, R.C.; George, K.P.; Sundaram, K. (Bhabha Atomic Research Centre, Bombay (India). Bio-medical Group). pp 205-222 of Proceedings of the symposium on structural and functional aspects of chromosomes, Bombay, March 25-26, 1975. Bombay; Department of Atomic Energy (1976).

From Symposium on structural and functional aspects of chromosomes; Bombay, India (25 Mar 1976).

15 refs., 10 figures.

X-ray induced chromosomal damage in bone-marrow tissue of male mice was studied using micronucleus technique. Dose response relationship was evaluated. Male Swiss mice received whole body x-ray irradiation at different doses from 25-1000 rads. Animals were sacrificed at the end of 24 hours, bone-marrow smears were made and stained in May-Grunwald-Giemsa. The preparations were scored for the following types of aberrations: micronuclei in young erythrocytes-polychromatic cells and in the mature erythrocytes-normochromatic cells. A dose dependent increase in the frequency of micronuclei in polychromatic cells up to a dose of 100 rads was observed. In addition the effect of post-irradiation duration on the frequency of micronuclei in polychromatic and normochromatic cells were studied. Male Swiss mice were exposed to 200 rads x-rays and were then sacrificed at different time intervals after irradiation and bone-marrow preparations were made and scored. Maximum polychromatic cells with micronuclei were observed in 24 hours post-irradiated animals, thereafter a decrease in the frequency of polychromatic cells with micronuclei was observed in 40 hours post irradiated animals. (author).

- 2169 MODIFICATION OF DEATH RATE OF IRRADIATED MICE BY B.C.G. Allain, P.; Chaleil, D.; Maingot, D. (Centre Hospitalier Universitaire, 49 - Angers (France)); Larra, F. (Centre de Lutte contre le Cancer Paul-Papin, 49 - Angers (France)). C. R. Soc. Biol.; 170: No. 1, 31-36(1976). (In French).

Freeze-dried Bacillus Calmette Guerin (BCG) of Institut Pasteur was given by intravenous route to mice at 1,2 and 4mg/kg before and after γ irradiation of animals by 1000 rad. B.C.G. 1 mg/kg injected the day or the day after irradiation has a protective effect (mortality reduced from 77% for controls to 58% and 50% for treated mice). B.C.G. given before irradiation in single or double doses increased mortality.

- 2170 USE OF PULMONARY MACROPHAGES AS INDICATOR OF RADIATION EXPOSURE. Gensicke, F.; Grigoroff, L.A. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Radiobiol. Radiother.; 17: No. 2, 265-268(1976). (In German).

After a single whole-body x irradiation of rats with 50, 100, 200, and 300 rad, pulmonary macrophages were obtained by endobronchial lavages after 3 and 24 hours. The mitotic index in the macrophage population and percentage frequency of the cells with aberrations were determined. At both times the results show a high decrease of the mitotic index with increasing dose. Three hours after doses of 50 rad only a stimulating effect is observed. The number of cells with aberrations increases 3 and 24 hours after irradiation with increasing dose. With time going on after irradiation with doses between 100 and 250 rad a reduction of aberrant cells is observed. After about 300 rad the number of cells with aberrations increases

essentially more whereas the time-dependent differences are reduced. The results show that pulmonary macrophages can be used for the demonstration of radiation damages.

rate of 25 to 100 R/day, the decrease in the DNP content over the investigated period proved irreversible. The observed data were compared with the changes in the DNP concentration and the weight of the organs.

- 2171 IN VIVO SURVIVAL OF GERM CELLS IN MALE RATS: APPLICATION TO THE ANALYSIS OF THE EFFECTS OF LOW DOSES. MODEL. Lemaire, Guy; Grillon, Gerard (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 103-140 of Concepts of low doses of ionizing radiation in radiation biology and protection. Vol. 2. Cayet-Pennaneac'h, D. (ed.). Montrouge; Societe Francaise de Radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

Gonadal weight involution of male rats after whole-body irradiation may be used to determine in vivo survival of germ cells. The method is applied to the analysis of low doses.

- 2172 (ERDA-tr--210, pp 11-16) DNA REPAIR, CHANGE IN THE DNA POLYMERASE AND DNA LIGASE ACTIVITIES IN THE REGENERATING LIVER OF GAMMA-IRRADIATED RATS. Zakrzhevskaya, D.T.; Vtyurin, N.N.; Gaziev, A.I. (Inst. of Biological Physics, Pushchino, USSR). 1976. Translated from Radiobiologiya; 16: No. 2, 171-174(1976).

Radiobiology. It was shown that in the regenerating liver of γ -irradiated rats, in a period of 3 hrs after irradiation, an incomplete repair of single-stranded breaks in DNA is observed. By 5 to 10 hrs after irradiation, the repair of breaks in DNA is not recorded, and a decrease in the activity of DNA polymerase and DNA ligase is observed. The change in the enzymes in the regenerating liver is correlated with the effectiveness of DNA repair and is not associated with the appearance of an inhibiting factor.

- 2173 (ERDA-tr--210, pp 17-22) INVESTIGATION OF THE PROCESS OF TRANSCRIPTION IN THYMUS CELLS OF RATS SUBJECTED TO X IRRADIATION. COMMUNICATION 2. INFLUENCE OF EXOGENOUS DEOXYRIBONUCLEIC ACIDS ON THE HYBRIDIZATION OF NUCLEAR RNA WITH REPETITIVE AND UNIQUE DNA SEQUENCES. Zhivotovskii, B.D.; Khanson, K.P. (Central Roentgeno-Radiological Scientific Research Inst., Leningrad). 1976. Translated from Radiobiologiya; 16: No. 2, 175-178(1976).

Radiobiology. The hybridization of heterogeneous nuclear RNA (hnRNA) of rat thymus cells, stimulated by PHA, under conditions of the reaction with a large excess of DNA, was studied. It was shown that x-irradiation of the animals at a dose of 40 rad suppresses the hydrolyzability of the hnRNA of the thymocytes in culture. The introduction of 2.5 μ g/ml exogenous nuclear and mitochondrial DNA into the medium does not lead to normalization of the process studied.

- 2174 (ERDA-tr--210, pp 43-49) CHANGE IN THE CONTENT OF DEOXYRIBONUCLEOPROTEIN IN THE RAT SPLEEN AND THYMUS IN THE CASE OF CHRONIC GAMMA IRRADIATION. Misurova, E.; Frasliska, M.; Mackova, N. (Inst. of General Biology, Kosice, Czech.). 1976. Translated from Radiobiologiya; 16: No. 2, 195-199(1976).

Radiobiology. Chronic irradiation of rats at dose rates up to 10 R/day, in 60 days of irradiation, produced only a temporary decrease in the content of deoxyribonucleoproteins (DNP) in the spleen and thymus; in the case of irradiation at a dose

- 2175 (ERDA-tr--210, pp 61-65) CHEMILUMINESCENCE OF LIVER MITOCHONDRIA OF RATS IRRADIATED WITH FAST NEUTRONS. Druzhina, N.A.; Chebotarev, E.E.; Ryabova, E.Z.; Serkiz, Ya.I. (Inst. of Problems of Oncology, Kiev). 1976. Translated from Radiobiologiya; 16: No. 2, 209-212(1976).

Radiobiology. The chemiluminescence of the liver mitochondria of rats irradiated with fast neutrons was studied in the work. Luminescence was induced with ferrous ions. The kinetics of the development of luminescence of the mitochondria during the early periods after irradiation (1 to 6 days) was demonstrated. As the development of radiation sickness progressed, an exponential increase in the intensity of the rapid flash was noted. Dilution of the mitochondria to a definite level leads to a decrease in the "radiation effect."

- 2176 (ERDA-tr--210, pp 66-72) RESTORATION OF THE NUMBER OF COLONY FORMING UNITS IN THE BONE MARROW AND SPLEEN OF DNA-TREATED IRRADIATED MICE. Luzanov, V.M. 1976. Translated from Radiobiologiya; 16: No. 2, 213-217(1976).

Radiobiology. It was shown by methods of endogenous and exogenous colonies that the introduction of isologous DNA promoted a more intensive restoration of the number of colony-forming units (CFU) in irradiated mice. Probably such an action of exogenous DNA occurs on account of an intensification of the proliferative activity of the CFU and an increase in their migration from the bone marrow into the spleen. The optimum doses of DNA were 0.3 to 0.7 mg per mouse.

- 2177 (ERDA-tr--210, pp 73-78) INFLUENCE OF CERTAIN BIOLOGICALLY ACTIVE PREPARATIONS ON A POPULATION OF CELLS OF THE STEM FRACTION OF HEMOPOIESIS AND ON THE SURVIVAL OF IRRADIATED MICE. COMMUNICATION 3. INTERFERON. Semina, O.V.; Neifakh, Yu.A.; Soboleva, E.L.; Konoplyannikov, A.G.; Poverennyi, A.M. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). 1976. Translated from Radiobiologiya; 16: No. 2, 218-222(1976).

Radiobiology. It has been established that when animals are administered partially purified exogenous interferon two days before irradiation, the yield of endogenous spleen colonies is increased, and the survival of the irradiated mice is increased. Incubation of a suspension of bone marrow cells of mice with interferon leads to a decrease in the yield of exogenous spleen colonies. Evidently such an action of interferon is associated with its influence on the cell cycle of the CFU. It is suggested that a great role in the mechanism of the action of poly I:C on a cell population of the stem fraction of hemopoiesis is played by the level of endogenous interferon.

- 2178 (ERDA-tr--210, pp 100-105) CERTAIN BIOCHEMICAL EFFECTS OF PARTIAL IRRADIATION OF THE ORGANISM UNDER THE COMBINED ACTION OF RADIATION. Matyushichev, V.B.; Taratukhin, V.R.; Yuzhakova, G.A. 1976. Translated from Radiobiologiya; 16: No. 2, 239-242(1976).

Radiobiology. The influence of x-irradiation at a dose of 50 R (total,

irradiation of the anterior third or posterior two-thirds of the body), as well as external β irradiation with ^{85}Kr at a dose of 3.05 krad, used separately and in combinations, on the ATPase and creatin kinase activity of aqueous extracts from the brain, liver, and spleen tissue of rats 5, 12, 19, and 26 days after irradiation was investigated. It was shown that under the conditions selected, the partial radiation loads are entirely comparable in their biochemical effectiveness with the effect of whole-body irradiation. Combined irradiation as a whole was less effective than separate irradiation.

- 2179 (ERDA-tr--210, pp 114-119) PECULIARITIES OF THE TOXICITY AND RADIOPROTECTIVE ACTIVITY OF AMINOPROPYL AMINOETHYL THIOPHOSPHATE. Terekhov, A.V.; Besedina, L.N.; Zharebchenko, P.G.; Znamenskii, V.V.; Suslikov, V.I.; Titov, B.A. 1976. Translated from Radiobiologiya; 16: No. 2, 249-252(1976).

Radiobiology. The toxicity and radioprotective activity of aminopropyl aminoethyl thiophosphate (APAETP) were studied in the work in comparison with cystaphos. It was shown that APAETP somewhat surpasses cystaphos in magnitude of the radioprotective effect, but in duration of action in the case of intraperitoneal injection, it is inferior to the latter. APAETP, in contrast to cystaphos and other sulfur-containing radioprotectors, does not cause spastic reactions in animals in toxic doses. The median lethal dose of APAETP in the molar expression is 1.5 times lower, and the optimum radioprotective dose almost three times lower than for cystaphos. Consequently, APAETP has almost twice the latitude of radioprotective action of cystaphos. APAETP, like cystaphos, exhibits a pronounced radioprotective effect not only at a high dose rate of γ radiation (355 R/min), but also at a comparatively low dose rate (10.7 R/min).

- 2180 (ERDA-tr--227, pp 24-30) EFFECTS OF PROLONGED EXPOSURE TO DIVIDED DOSES OF RADIATION ON LEVELS AND BIOSYNTHESIS OF NUCLEIC ACIDS IN THE RAT THYMUS. Kisel'gov, E.I.; Mushkacheva, G.S. 1976. Translated from Radiobiologiya; 16: No. 4, 502-507(1976).

Radiobiology. Repeated daily exposure of rats to 50 R radiation for 2.5 months resulted in decreased weight of thymus, decreased number of cells and nucleic acid content per gram tissue. The rate of DNA biosynthesis was increased, starting with a cumulative dose of 250 R. The intensity of tracer uptake in RNA was at the control level up to a cumulative dose of 1500 R and thereafter it showed a 50 percent decrease. The demonstrated changes in nucleic acid metabolism are indicative of a change in proliferation and differentiation of thymus cells after repeated exposure to divided doses of radiation.

- 2181 TRITIUM TOXICITY: INCREASED RELATIVE BIOLOGICAL EFFECTIVENESS OF ^3HOH WITH PROTRACTION OF EXPOSURE. Dobson, R.L.; Arrington, J.H.; Kwan, T.C. (Univ. of California, Livermore). pp 349-353 of Radioecology and energy resources. Cushing, C.E. Jr. (ed.). New York; Halsted Press (1976).

From 4. national symposium on radioecology; Corvallis, OR, USA (12 May 1975).

See CONF-750503--.

Concern with environmental tritium from nuclear energy operations relates primarily to possible effects of chronic, low-level exposure to ^3HOH . However, direct data on such exposure

are very limited. Information on protracted irradiation comes chiefly from gamma-ray studies, while data for tritium are mostly from higher-level, more acute exposures. Consequently, for realistic evaluation of potential ecological impact and biological hazard, it is necessary to examine, in these contrasting exposure conditions, tritium's relative biological effectiveness (RBE) compared to gamma rays. This is all the more important since tritium's RBE has been found not to be constant, but to rise at low doses. Such a study is reported here. Weanling mice were exposed to ^3HOH in body water at 20 $\mu\text{Ci/ml}$ for 5 days, receiving beta radiation to cells at 4.1 rads/day. Surviving primary oocytes were counted microscopically in ovaries and compared to controls; survival was 43 percent. For comparison, other weanlings were exposed to ^{60}Co gamma irradiation at 5.9 rads/day. Oocyte survival was again 43 percent. Comparison of the dose-responses indicated an RBE for tritium of 1.4. This contrasts with 2.0 found previously (at the same effective dose of gamma rays) in 14-day-old mice given continuous, protracted exposure from conception. Although the lower RBE found with short-term exposures may be due to the higher dose rates used, experimental and theoretical evidence questions this. Alternatively, the higher RBE with protracted exposure may reflect more effective microdistribution of tritium atoms within cells, from the longer time available for metabolic turn-over and incorporation. These results indicate that ^3HOH becomes increasingly more damaging compared to gamma rays when exposure is low-level and protracted. This has special significance from the standpoint of both health and environmental protection.

- 2182 WORKSHOP: RES-RADIOBIOLOGY AND ENVIRONMENTAL FACTORS. Flemming, K. (Univ. of Freiberg i.B., Ger.); Reichard, S.; Escobar, M. pp 437-440 of Reticuloendothelial system in health and disease: immunologic and pathologic aspects. Friedman, H. (ed.). New York; Plenum Press (1976).

From 7. international congress of the Reticuloendothelial Society; Pamplona, Spain (15 Sep 1975).

See CONF-7509172--P2; CONF-7509173--P2.

A phagocytic increase was observed in mice following whole-body x irradiation. This increase was thought to be derived from bacterial endotoxins or lipopolysaccharides that enter the blood through the damaged intestinal mucosa. To determine whether macrophages were injured by radiation the response of mice to phagocytosis-stimulating drugs, lipopolysaccharides, olive oil, triolein, was studied before and after irradiation. Results showed that the effectiveness of the drugs was reduced and it was concluded that activity of macrophages was depressed following whole-body irradiation. (HLW)

- 2183 PHYSIOLOGIC MECHANISMS IN RADIATION RESISTANCE. Reichard, S.M. (Medical Coll. of Georgia, Augusta). pp 440-443 of Reticuloendothelial system in health and disease: immunologic and pathologic aspects. Friedman, H. (ed.). New York; Plenum Press (1976).

From 7. international congress of the Reticuloendothelial Society; Pamplona, Spain (15 Sep 1975).

See CONF-7509172--P2; CONF-7509173--P2.

Some topics discussed are as follows: role of the reticuloendothelial system in the regeneration of the hematopoietic system;

- uptake of colloidal agents by liver and spleen cells following graded doses of x radiation; effects of x radiation on peritoneal macrophages of rats; stimulation of phagocytic activity of the reticuloendothelial system by estrogens, serum albumin, and bacterial endotoxins; and sequestration of particulate material within the reticuloendothelial organs following x irradiation. (HLW)
- 2184 (ERDA-tr--210, pp 147-151) PECULIARITIES OF THE DYNAMICS OF CERTAIN COUPLED ENZYMES OF AMINO NITROGEN METABOLISM IN THE LIVER OF THE IRRADIATED ORGANISM. Savitskii, V.I. (Odessa Medical Inst.). 1976. Translated from Radiobiologiya; 16: No. 2, 272-275(1976).
Radiobiology. The dynamics of five enzymes involved in amino nitrogen metabolism during the post radiation period as well as their intracellular distribution in the liver were studied in whole-body x irradiated rabbits. The data presented are evidence not only of definite changes in the activity of the investigated enzymes of amino nitrogen metabolism and their subcellular organization but also of time peculiarities in the changes in the activities of these enzymes, and to a definite degree, of a directedness of the reactions catalyzed by them. (ERB)
- 2185 (ERDA-tr--210, pp 157-162) FREQUENCY OF CHROMOSOME ABERRATIONS IN THE GERM CELLS OF MICE UNDER THE CHRONIC INFLUENCE OF GAMMA RAYS AT LOW DOSES. Bikkulov, R.I. (Leningrad Scientific Research Inst. of Radiation Hygiene). 1976. Translated from Radiobiologiya; 16: No. 2, 279-282(1976).
Radiobiology. The mutagenic aftereffects of multimonth irradiation, simulating radiation influences under occupational conditions were studied. It was found that in the case of chronic irradiation, simulating radiation influences under occupational conditions, the changes in the frequency of chromosome aberrations in the germ cells of mice depend on the age of the animals and the daily dose rate. A dependence on the value of the summary dose, on the other hand, is observed in the second age period, when an age increase in the frequency of chromosome aberrations is also noted for the control animals. (ERB)
- 2186 (ERDA-tr--210, pp 192-195) DEPENDENCE OF THE RESPONSE OF THE PITUITARY-ADRENAL CORTEX SYSTEM ON THE CONDITIONS OF THE INFLUENCE OF IONIZING RADIATION AT LOW DOSES. Taits, M.Yu.; Dudina, T.V. (Inst. of Physiology, Minsk). 1976. Translated from Radiobiologiya; 16: No. 2, 301-304(1976).
Radiobiology. The dynamics of the level of corticosterone in the peripheral blood plasma of animals after single, fractionated, and chronic influences of ionizing radiation in low doses were studied. It was found that under the influence of a chronic action of ionizing radiation at relatively low doses, in irradiated animals there are changes in the functional activity of the hypothalamo-pituitary-adrenal cortex system, determined chiefly by the state of its hypothalamo-pituitary link. (ERB)
- 2187 (ERDA-tr--227, pp 114-119) LONG-TERM SEQUELAE IN RATS OF EXTERNAL, LOW DOSE BETA RADIATION. Moskalev, Yu.I.; Shelesnova, V.I. 1976. Translated from Radiobiologiya; 16: No. 4, 576-580(1976).
Radiobiology. Exposure of mongrel, white female rats to whole-body radiation using ^{90}Sr - ^{90}Y β -rays in doses of 100, 200 and 400 rad increases the incidence and rate of development of benign and malignant tumors of the mammary gland and skin, without affecting mean survival time. The overall incidence of mammary gland tumors per rad constituted 0.09 percent, that of carcinoma of the mammary gland and skin, 0.0195 and 0.017 percent, respectively.
- 2188 (ERDA-tr--227, pp 120-126) MECHANISM OF DELETERIOUS EFFECT OF IONIZING RADIATION ON THE FETUS AND THE PROGENY. Kuz'mina, T.D. 1976. Translated from Radiobiologiya; 16: No. 4, 581-586(1976).
Radiobiology. It was established, in experiments on sheep exposed to 550 R γ rays and rats given 0.4 $\mu\text{Ci/Gm}$ ^{131}I , that along with antitissular antibodies to internal organs, irradiated pregnant animals develop antibodies to placental tissue. Administration of homologous and heterologous antiplacental antibodies to nonirradiated pregnant rats increases placental permeability to dyes and autoantibodies. Antitissular antibodies, including antiplacental ones, are transmitted to the offspring, not only through the placental barrier, but with ingestion of milk of an irradiated female.
- 2189 (ERDA-tr--227, pp 168-172) DIFFERENTIATION CAPACITY OF HEMOPOIETIC STEM CELLS AS RELATED TO DIFFERENT RADIATION DOSES. Shvets, V.N. 1976. Translated from Radiobiologiya; 16: No. 4, 618-622(1976).
Radiobiology. The objective of the present work was to make a comparative study of differentiation capacity of CFU in mice exposed to brief, prolonged and chronic radiation in the same dosage, 600 R. Differentiation of CFU in the direction of the three main types of hemopoiesis is rather similar after brief irradiation for 2 to 16 min and prolonged exposure for 2 to 12 days. The only exception was referable to precursor cells of erythropoiesis and myelopoiesis in mice irradiated at the rate of 300 and 50 R/day. In both instances, there was a reliable decrease in erythropoietic capability of stem cells, and with exposure at the rate of 300 R/day, of granulopoietic capacity as well, in stem cells settling in the recipient spleen. In the case of brief exposure at rates of 300 and 37 R/min, we merely observed a tendency toward diminished capacity of stem cells to form erythroid colonies in the recipient spleen. In the case of chronic irradiation at the rates of 10 and 2.5 R/day, differentiation of stem cells proliferating in both the spleen and bone marrow did not differ from differentiation of stem cells in intact animals. Thus, brief irradiation was associated with only a tendency toward diminished erythropoietic capacities of CFU, whereas prolonged exposure led to a reliable decrease in such capacities. Brief and prolonged radiation differed only with regard to effects on erythroid precursors, whereas both types of radiation had the same effect on thrombopoietic precursor cells, enhancing their capacity to form megakaryocyte colonies. However, it should be borne in mind that impairment of CFU differentiation under the influence of brief and prolonged radiation occurred only in the population of stem cells that settled in the recipient spleen. Those that settled in bone marrow did not show a change in nature of differentiation, regardless of radiation dose rate.
- 2190 (ERDA-tr--227, pp 179-193) EFFECTS OF

CHRONIC LOW DOSE GAMMA RADIATION ON THE COURSE OF CANDIDIASIS IN ALBINO RATS. Berchev, K.; Krushkov, I. (Scientific Research Inst. of Radiobiology and Radiation Hygiene, Sofia). 1976. Translated from Radiobiologiya; 16: No. 4, 627-631(1976).

Radiobiology. Small doses of ionizing radiation lead to microstructural lesions in the organism, which are not demonstrable with the existing investigative methods due to the compensatory capabilities of physiological and pathological repair. If, however, the organism submitted to small doses of chronic irradiation is exposed to increased loads (infection, fatigue, pregnancy, lactation, etc.), the compensatory reserves of different tissues, organs and systems, and their adaptational capabilities are impaired and depleted, and then the injurious effects of ionizing radiation become more prominent. Development of candidiasis in rats chronically exposed to small doses of radiation was investigated in order to assess both the reactivity of the irradiated macroorganism and conditions generated for development of conditionally pathogenic microorganisms, such as candida. On the basis of the demonstrated changes in animals infected with a candidal culture and previously exposed to small doses of γ rays, it is concluded that the developing candidemia rapidly leads to a state of cardiovascular insufficiency with interstitial and perivascular edema, dystrophic changes in parenchymatous organs that are most pronounced. The animals present considerably poorer resistance to candidal infection, for this reason there is no cellular reaction and no candidal granulomas develop in animals that die by the 4th day. A comparison to animals infected with candidal culture but not irradiated shows that the organism lyses bacteria, and only one rat developed candidal granuloma; it died primarily of renal insufficiency.

- 2191 GENETIC RISK AT LOW DOSES. Vignes, S. (Electricite de France, 75 - Paris). pp 361-371 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976). (In French)

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

How are we to assess the genetic risk to man resulting from exposure to low doses of irradiation from the environment of nuclear power plants. The team of Brewen and Preston showed that there was a decrease by a factor of four in the rate of chromosomal aberrations existing in germinal cell line as compared with somatic cell (leukocyte) line. They subsequently demonstrated the importance of the selection process taking place at the time of gametogenesis. However, their study went only as far as a 50-rem dose. Applying fractionation of a 275-rem dose (55 daily sessions of 5 rem each), Sheridan was unable to induce in mice either dominant or recessive mutations in quantities greater than in the controls; the recessives would appear to have been fewer, but the difference was not significant. Nor did experiments by various teams involving systematic irradiation (either chronic or acute) of several tens of generations of mice and rats succeed in producing mutants over the different generations. In order to affect fertility and also mortality before weaning, it is necessary to achieve single doses of the order of 500 rem. Results of this kind, which show the existence of both repair and selection, are reassuring, although they are obtained at dose rates that have nothing in

common with those which are relevant to the environment. They support the assumption that no deleterious effect is present in the latter case.

- 2192 STUDY OF THE DIELECTRIC PARAMETERS OF BLOOD PLASMA OF RATS PROTECTED BY ADETURONE AND EXPOSED TO X RAYS. Bancheva, E. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 15: No. 1, 22-26(1976). (In Bulgarian).

The frequency dispersion of the dielectric parameters of the blood plasma of rats protected with adeturone (S-2-aminoethyl-isothiuronium bromide hydrobromide adenosine triphosphate) and X-irradiated with doses of 200 R, 400 R and 600 R in the spectral interval 0,6 MHz - 3,5 MHz was studied. Electric conduction and plasma dielectric constant were measured by means of alternate current admittance measurer type SWM-2 on the first, third and tenth day after cessation of irradiation. The results of this study on the effect of ionizing radiation on the dielectric parameters of blood plasma of irradiated rats are analyzed and the possible mechanism of action of adeturone discussed.

- 2193 INFLUENCE OF ADETURONE ON THE RADIATION INJURY IN TWO MICE STRAIN EXPOSED TO CHRONIC GAMMA IRRADIATION. Nikolov, I.; Pantev, T.; Bajrakova, A.; Pavlova, V.; Kirov, Ch. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 15: No. 3, 165-169(1976). (In Bulgarian).

The radioprotective properties of adeturone (adenosine triphosphate salt of AET), on chronically irradiated mice of lines C57BL and H were studied. The experimental and control animals were gamma-irradiated (226-radium) with a dose rate of 1.0 $\pm$ 0.1 R per hour. The total dose for C57BL mice was 600 R (for 26 days) and for H mice - 900 R (for 39 days). During the irradiation the experimental animals were given a daily dose of 300 mg of adeturone. Once the irradiation course was completed, the content of nucleic acids (NA) in peripheral blood leucocytic mass was determined. The changes in the leucocyte counts and the white blood formula were repeatedly checked up from the onset of irradiation till the 170th day. There was a statistically significant rise in the blood NA concentration in adeturone-protected animals, as compared with control ones. Radiation leucopenia was essentially milder in mice receiving daily adeturone. After completion of the radiation course the leucocyte counts returned to normal for a much shorter period in adeturone-treated animals than in the control ones.

- 2194 GENETIC EFFECTS OF IONIZING RADIATIONS IN EUKARYOCYTES. Jullien, P. (Institut du Radium, 91 - Orsay (France)). pp 65-79 of Les concepts de faible dose de rayonnements ionisants en radiobiologie et en radioprotection. 2. Cayet-Pennaneac'h, D. (ed.). Mont rouge; Societe Francaise de Radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

The literature on the genetic effects of ionizing radiations is reviewed, especially as concerns specific loci or chromosome mutations. Extrapolation from one species to another is considered as well as extra-nuclear mutations.

- 2195 CHROMOSOME ABERRATIONS INDUCED IN MOUSE

SPERMATOGONIA BY EXPOSURE TO NEUTRONS OF VERY HIGH ENERGY. Pecrot, M.; Wambersie, A.; Meulders, J. (Louvain Univ. (Belgium)); Leonard, A. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). C. R. Soc. Biol.; 170: No. 2, 474-476(1976). (In French).

The incidence of reciprocal translocations induced in mouse spermatogonia has been studied in CBA mice given X-ray or neutron exposure. Analysis of dividing spermatocytes at diakinesis-first metaphase stage of meiosis shows that in X-irradiated mice there is a linear dose-response relationship. After exposure to fast neutrons the yield of translocations follows a humped curve with a maximum of chromosome exchanges after exposure to 100 rad.

2196 BIOPHYSICAL MODEL AND LOW DOSES.

Parmentier, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 43-55 of Concepts of low doses of ionizing radiation in radiation biology and protection. II. Cayet-Pennaneac'h, O. (ed.). Montrouge; Societe Francaise de Radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

Many models have attempted to explain the mode of action of radiations, especially in the case of cellular death. Two examples of dose-effect relationships (chromosome aberrations, survival curves) are given as an illustration.

2197 (ERDA-tr--222) RADIOBIOLOGY.

Translation of Radiobiologiya; 16: No. 3, 323-480(1976). 204p. Dep. NTIS \$7.75.

Separate abstracts were prepared for the 37 papers presented in this English translation of Radiobiologiya. Reviews of three books are also presented. (HLW)

2198 (ERDA-tr--222, pp 14-20) INCORPORATION OF EXOGENOUS DNA IN TISSUE OF IRRADIATED ANIMALS. Rusinova, G.G.; Libinon, R.E. 1976. Translated from Radiobiologiya; 16: No. 3, 333-338(1976).

Radiobiology. Exposure of rats to γ -rays in doses of 100, 300 and 800 R inhibited incorporation of exogenous, homologous ^3H -DNA administered immediately after irradiation into bone marrow, spleen and mucosa of the small intestine at the rate of 1 Gm tissue per cell. As compared to immediate administration of the biopolymer after exposure to ionizing radiation, later administration led to increased uptake of the biopolymer by bone marrow and mucosa of the small intestine, as determined per cell.

2199 (ERDA-tr--222, pp 38-42) INHIBITORY EFFECT OF BLOOD SERUM FROM IRRADIATED ANIMALS ON IN VITRO INCORPORATION OF ^3H -THYMIDINE IN RAT THYMOCYTE DNA. Sizhenikina, L.V.; Mikhaillets, L.P.; Kuzin, A.M. (Inst. of Biological Physics, Pushchino, USSR). 1976. Translated from Radiobiologiya; 16: No. 3, 353-356(1976).

Radiobiology. It was demonstrated that blood serum of irradiated animals (rats, guinea pigs) has an inhibitory effect on incorporation of ^3H -thymidine in DNA of isolated thymocytes of rats. Maximum inhibition was observed 4-8 hours after irradiation of rats, and it was less marked by the 24th hour. It was established that there is a strict correlation between the inhibitory effect and magnitude of dosage in the range of 30-200 R. Studies were pursued to identify the nature of the

inhibitory factor.

2200 (ERDA-tr--222, pp 66-71) EFFECTS OF PROLONGED IRRADIATION AT LOW DAILY DOSE RATES ON HEMOPOIETIC STEM CELLS AND PERIPHERAL BLOOD OF MICE. Praslicka, M.A.; Kalina, I. (Univ., Kosice, Czech.). 1976. Translated from Radiobiologiya; 16: No. 3, 376-380(1976).

Radiobiology. Changes were observed in number of stem cells (CFU--colony forming units), number of bone marrow cells and peripheral blood elements in mice exposed to prolonged (23 hours per day) radiation for 130 days at dose rates of 1, 3, 6 and 10 R per day. It was established that 3 R/day is the critical limit at which a decline of CFU and agranulocytes is observed; 3 to 6 R/day is the critical dose rate at which there is a decrease in medullary cells and thrombocytes. The decline of these indices is constant at a dose rate of 10 R/day. In this case, the number of erythrocytes and agranulocytes does not change, but there is a 60 percent drop of the CFU index.

2201 INTERFERENCE WITH ANTIBODY-FEEDBACK BY IRRADIATION, THYMUS CELLS, THE ALLOGENEIC EFFECT, AND SERUM FACTORS. Sinclair, N.R.S.; Lees, R.K.; Chan, P.L. (Univ. of Western Ontario, London). Adv. Exp. Med. Biol.; 66: 623-633(1976).

Low doses of irradiation, increased number of T cells, increased T cell activity as in the allogeneic effect, or early activation of an in vitro cell-mediated immune response all confer resistance to antibody feedback. In some of these systems, the resistance is directed against immunosuppression by intact IgG antibody whereas suppression by F(ab')_2 antibody is either not changed or increased. These forms of interference with immunosuppression by antibody are explained in terms of an Fc-dependent model for antibody-feedback regulation.

2202 LEUKAEMOGENESIS BY LOW-LEVEL RADIATION. Warren, S.; Gates, O. (New England Deaconess Hospital, Boston, Mass. (USA). Cancer Research Inst.). pp v.1 p.169-180 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Intermittent X radiation administered in 3-R doses for ten successive weeks to RAP mice did not increase the incidence of leukaemia. A total dose of 100 R (10 R weekly) significantly increased the level. A total dose of 300 R (30 R weekly) increased the incidence of leukaemia only slightly but not significantly over that induced by the 100-R total dose. The two leukaemogenic doses of X radiation (100 and 300 R) yielded incidences of leukaemia comparable to those following mean doses of perinatal γ exposure at 200 and 1000 rads. However, continuous lifetime exposure of five successive generations to 30 rads was by far more effective than the higher doses of γ or X radiation. In these wide discrepancies between leukaemogenic effects of equal low doses of γ and X radiation, there are two disparate factors: chronic versus intermittent exposure and the populations at risk - young adult mice versus mice exposed from conception to death. Evidence of a greater sensitivity of immature compared with mature mice is not reflected in the leukaemic incidence or in the projected lifespan of non-leukaemic mice following 1000 rads perinatal γ exposure. Apart from the

possible greater effectiveness of chronic exposure, the importance of indirect effects is suggested by the greatly extended lifespan of the 30-R X-irradiated mice as compared with those receiving 30 rads γ . The force of constitutional factors and/or an inhibitory influence of high doses is apparent in the response of rats (NEDH strain) to whole-body single doses within the range 700 to 1100 R. Single rats, or one of a parabiotic pair thus treated, showed only marginal differences in incidence of leukaemia compared with control rats, and parabiosis alone yielded a comparable incidence of leukaemia.

- 2203 LIPID COMPONENTS OF PLASMA OBTAINED FROM DIFFERENT SITES OF RABBIT CARDIOVASCULAR SYSTEM DURING EXPERIMENTAL ACUTE URAEMIA. Madry, K.; Lutz, W.; Lepertand, R.; Papiernik, E. (Military Medical Academy, Lodz, Poland). *Acta Med. Pol.*; 17: No. 4, 241-247(1976).

It was found that the thymus extract (TFX) administered intraperitoneally in a dose of 0.5 mg in 0.1 mm³ of 0.9 percent NaCl caused in Albino-Swiss mice a statistically significant rise in the activity of lysosomal acid phosphatase (AP) determined by the cytochemical method of Barka and Anderson in peripheral blood neutrophils. TFX prevented radiation-induced (450 r) fall in the number of these cells observed 14 days after radiation exposure. TFX modified, moreover, changes in the activity of this enzyme during radiation exposure. In the irradiated mice in the control group a rise was observed in AP activity, in mice receiving TFX a significant fall in this activity occurred. After 64 days from radiation exposure no statistically significant changes were observed between the control irradiated group and the group receiving TFX.

- 2204 LATE EFFECTS OF IN UTERO EXPOSURE TO CARCINOGENS IN RATS, WITH SPECIAL REFERENCE TO POSTNATAL GROWTH AND TUMORIGENESIS. Naito, Y.; Takizawa, S.; Watanabe, H.; Hirose, F. (Hiroshima Univ.). pp 126-136 of Proceedings of the Hiroshima University. Hiroshima; Research Inst. for Nuclear Medicine and Biology (1976). (In Japanese)

The 15th-day pregnant Wistar/Furth rats were irradiated with 100 rads of x-ray or fast neutrons (14.1 MeV). Fast neutrons were found to be more effective in reducing the number of live-births and in retarding the postnatal growth of the offspring than x-ray. Among the various organs examined, the brain, uterus, spleen and gonads were highly radiosensitive in terms of organ weight. Microscopic examination revealed a marked dysplasia of the ovary in the fast neutron-irradiated rats. Pre-conception irradiation did not cause any deleterious effects on the offspring. No substantial difference was noted on the peripheral blood pictures and on the tumor incidence in rats born from the irradiated female rats. On the other hand, it was noteworthy that N-butyl nitrosourea given transplacentally induced 3 cases of brain tumor. The incidence of leukemia and mammary tumor was significantly higher in the irradiated or carcinogen-treated, pregnant rats.

- 2205 FINE STRUCTURE OF IRRADIATED MOUSE HEART. Yang, V.V.; Stearner, S.P. (Argonne National Lab., IL). pp 184-185 of Thirty-fourth annual meeting, Electron Microscopy Society of America. Bailey, G.W. (ed.). Baton Rouge, LA; Claitor's Publishing Div. (1976).

From 34. Electron Microscopy Society of America annual meeting; Miami Beach, FL, USA (9

Aug 1976).

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Mice were exposed to 240 rad fission neutrons and 788 rad gamma rays and killed at intervals up to 18 months later. Electron microscope studies of the heart showed abnormal capillaries, degenerating muscle fibers, and other ultrastructural changes. Quantitative estimations of myofibrillar and capillary degeneration revealed that damage was most severe at 1 to 3 months in both neutron- and gamma-irradiated groups. (HLW)

- 2206 (ERDA-tr--222, pp 175-178) QUANTITATIVE PATTERNS OF INJURY AND RECOVERY OF BLOOD FOLLOWING SINGLE AND CHRONIC EXTERNAL γ -IRRADIATION. Zapol'skaya, N.A.; Borisova, V.V.; Yakovleva, N.G. (Leningrad Scientific Research Inst. of Radiation Hygiene). 1976. Translated from *Radiobiologiya*; 16: No. 3, 462-464(1976).

Radiobiology. Two groups of rats were used. One group was exposed once to 300 R gamma radiation while the other was exposed to daily irradiation at the rate of 5R/day for 2 yrs. Observations were made on the morphological composition of peripheral blood and incidence of aberrant mitoses in hematopoietic cells of bone marrow. Results showed that rates of recovery of peripheral blood cells and hematopoietic cells with aberrant mitoses were about 50 percent lower with chronic irradiation than with single exposure. (HLW)

- 2207 CORRELATION BETWEEN THE RELATIVE AMOUNT OF THYMINE CLUSTERS IN THE DNA OF THE ORGANISM AND ITS RADIOSENSITIVITY. Kritskii, G.A.; Lakhtin, V.M.; Aleksandrov, S.V. (Inst. of Biochemistry, Moscow). *Dokl. Biochem. (Engl. Transl.)*; 226: No. 1-6, 91-94(1976).

Translated from *Dokl. Akad. Nauk SSSR*; 226: No. 6, 1459-1462(Feb 1976).

DNA was isolated from hemopoietic tissues of guinea pigs, cattle, rats, chicks, and rabbits. Column chromatography was used for separation of hydrolysis products of DNA. A table is presented to show variation in content of pyrimidine oligonucleotide fragments of rabbit bone marrow and spleen DNA after whole-body gamma radiation. A significant correlation was detected between the radiosensitivity of the organism and the relative content of comparatively long thymine-enriched pyrimidine oligonucleotide fragments of DNA. (HLW)

- 2208 (ERDA-tr--241, pp 79-84) EFFECTS OF LYMPHOCYTES ON HEMOPOIESIS IN THE IRRADIATED ORGANISM. Shvets, V.N. 1976. Translated from *Radiobiologiya*; 16: No. 5, 707-711(1976).

Radiobiology, Vol. 16, No. 5, 1976. A study was made of the effect of lymphocytes of lymph nodes and the thymus on differentiation of hemopoietic stem cells in mice. It was established that primarily colonies of the erythroid type were formed with interaction of medullary and thymus cells in the spleen and medullary canal of syngenic recipients. Cortisone-resistant thymus cells exercised such an effect. Lymph node cells had an analogous property. In a nonsyngenic organism (parent-hybrid), thymus and lymph node lymphocytes did not have the same properties. The thymus cells, like in the syngenic variant of the experiment, intensified differentiation of stem cells in the erythroid direction, regardless of the site of their proliferation (spleen, bone marrow). In the case of interaction between lymph node cells and bone marrow of the parental genotype, the effect consisted of redifferentiation of stem cells from the erythroid to the myeloid route.

- 2209 (ERDA-tr--241, pp 102-107) EVALUATION OF FUNCTIONAL ACTIVITY OF CANINE TESTES CONTINUOUSLY EXPOSED TO GAMMA RADIATION FOR SIX YEARS. Fedorova, N.L. 1976. Translated from Radiobiologiya; 16: No. 5, 727-731(1976). Radiobiology, Vol. 16, No. 5, 1976. Male dogs were exposed to chronic γ irradiation for 6 years, at the rate of 0.06, 0.17 and 0.34 rad/day (cumulative doses of 126, 380 and 750 rad). The functional changes in the testes were related more to the dose rate than cumulative dosage, and they were distinctly manifested in animals exposed to a dosage of 0.34 rad/day with accumulation of 80-100 rad. During the experiment, there was lower function of spermatogenic epithelium of these male dogs.
- 2210 (ERDA-tr--241, pp 122-130) COMBINED EFFECT OF ACCELERATION AND TWO-FOLD EXPOSURE TO RADIATION IN DOSES OF 50 AND 100 R ON CONDITIONED REFLEXES OF RATS AND ON TRANSFER OF MAZE EXPERIENCE. Meizerov, E.S. 1976. Translated from Radiobiologiya; 16: No. 5, 744-749(1976). Radiobiology, Vol. 16, No. 5, 1976. Conditioned reflexes are the most sensitive to two-fold irradiation in a total dosage of 150 R, lateral accelerations (10 g, 4 min) and the combined effect of these factors. The capacity to transfer maze experience is somewhat less sensitive, and a developed maze skill is considerably more resistant. The combined effect of radiation followed by acceleration was more marked than exposure to the same factors in reverse order.
- 2211 (ERDA-tr--241, pp 138-141) EFFECTS OF IONIZING RADIATION ON ION TRANSPORT PROCESSES IN HEPATIC MITOCHONDRIA. Medvedev, B.I.; Evtodienko, Yu.V.; Kuzin, A.M. (Inst. of Biological Physics, Pushchino, USSR). 1976. Translated from Radiobiologiya; 16: No. 5, 756-759(1976). Radiobiology, Vol. 16, No. 5, 1976. According to structural metabolic theory, an important stage in radiation lesion to the cell is impairment of processes of energy conversion in the mitochondria. A considerable part of the published works dealing with the effects of radiation on mitochondrial function describes changes in rate of respiration and phosphorylation, and the P/O coefficient. However, the mechanism of the changes observed is still not entirely clear. According to current conceptions, the processes of energy conversion in mitochondria (including ATP synthesis) are based on reactions of membrane potential generation and electrogenic transport of H^+ ions. For this reason, it is interesting to demonstrate possible changes in permeability of mitochondrial membranes and ion transport in mitochondria under the influence of ionizing radiation. In the present work, we investigated the effects of ionizing radiation on oxidative phosphorylation, magnitude of membrane potential and ion transport in mitochondria of the rat liver. The results obtained show that, at the early postradiation stages, one can demonstrate distinct changes in the system of energy conversion in hepatic mitochondria, in particular in the ion transport system. The observed increase in rate of ATP synthesis 3 hours after irradiation may be interpreted as a compensatory process related to an increased energy demand. The postradiation increase in "calcium capacity" and decrease in permeability of potassium ions in mitochondria are perhaps the consequence of radiation damage to the system of energy transformation in cells.
- 2212 (ERDA-tr--241, pp 142-144) EFFECTS OF EXPOSURE TO DIVIDED DOSES OF X-RAYS, AS WELL AS CHRONIC RADIATION AND CHRONIC RADIATION COMBINED WITH ACUTE COBALT-60 GAMMA RADIATION, ON CATECHOLAMINE CONTENT OF RAT MYOCARDIUM. Karpovich, N.V. (Inst. of Physiology, Minsk). 1976. Translated from Radiobiologiya; 16: No. 5, 759-761(1976). Radiobiology, Vol. 16, No. 5, 1976. The significance of catecholamines as regulators of adaptational reactions of the heart is determined, first of all, by their capacity to activate metabolic processes in the myocardium and intensify access of nutrient and energy substrates from other organs and tissues. At the present time it can be considered proven that the concentration of catecholamines in the myocardium is related to capture of biogenous amines from circulating blood, synthesis and secretion thereof from sympathetic nerve endings and extraneuronal deposition. Most of the monoamines demonstrated in the mammalian heart consist of norepinephrine, while the concentration of dopamine is much lower. Analysis of the literature of recent years warrants the statement that the myocardium is relatively resistant to diverse stressors. However, there is extremely limited information concerning the effects of ionizing radiation on catecholamine content of the myocardium. At the same time, it is known that radiobiochemical changes are observed in the myocardium under the influence of acute and chronic ^{60}Co γ radiation, as well as x radiation. For this reason, it was interesting to investigate the concentration of norepinephrine and dopamine in the myocardium of white rats during and after exposure to ionizing radiation in small doses. Analysis of the obtained results indicates that the changes demonstrated in each series of experiments are far from identical, either in intensity or direction, and they are related not only to cumulative dosage, but largely to the nature of the radiation factor. The changes established in catecholamine content of the myocardium under the above experimental conditions should be taken into consideration when assessing the radiobiochemical changes that occur in the organism at different postradiation times.
- 2213 (ERDA-tr--241, pp 151-155) EFFECT OF HETEROLOGOUS HIGH POLYMER DNA ON RESTORATION OF COLONY-FORMING UNITS IN HEMOPOIETIC TISSUES OF IRRADIATED MICE. Luzanov, V.M. 1976. Translated from Radiobiologiya; 16: No. 5, 767-770(1976). Radiobiology, Vol. 16, No. 5, 1976. It is imperative to investigate the effects of DNA preparations on colony-forming units (CFU) in order to comprehend processes of recovery of hemopoiesis in irradiated and DNA-treated animals. The data in the literature dealing with this question are sparse and contradictory. In this work, we studied the effect of heterologous DNA obtained from the calf thymus and fish milt on restoration of CFU in bone marrow and spleen of irradiated mice. Restoration of CFU should be directed, first of all, toward normalization of cellular composition of bone marrow and spleen. The number of myelokaryocytes in bone marrow was higher between the 6th and 20th days in treated mice than in untreated animals. Probably this was due to increased differentiation of CFU. Thus, administration of heterologous DNA to irradiated mice accelerated recovery of CFU in bone marrow and spleen, due to the effect of this biopolymer on processes of proliferation and migration of colony-forming units.

- 2214 (ERDA-tr--241, pp 156-159) ERYTHROPOIETIC ACTIVITY OF PLASMA OF IRRADIATED ANIMALS. Gritsak, A.N.; Starodub, N.F.; Rekun, G.M.; Shur'yan, I.M. (Inst. of Molecular Biology and Genetics, Kiev). 1976. Translated from Radiobiologiya; 16: No. 5, 770-773(1976).

Radiobiology, Vol. 16, No. 5, 1976. In the recent literature, there is discussion of the role of erythropoiesis-stimulating factors, the presence of which has been demonstrated in human and animal blood. There is a sharp increase in erythropoietin production following bloodletting, in the presence of hypoxia and diverse types of anemia. Yet, there are only isolated works dealing with erythropoietic activity of plasma of animals with postradiation anemia, and their findings are quite contradictory. In this work, we submit experimental data on the effects of ionizing radiation on erythropoietic activity of rat plasma, in vivo and in vitro, which is a mandatory stage in learning about the mechanism of postradiation injury to the hemopoietic system, bearing in mind the role of erythropoietic factors in maintaining the quantitative parameters of erythron. The combination of x-rays and phenylhydrazine elicits a somewhat lesser effect than each factor separately. Thus, in the course of radiation sickness in rats, a decline in erythropoietic activity of plasma was observed on the 1st day after 3-fold injections to irradiated animals. In the dosage we used, phenylhydrazine probably has a radioprotective effect. In this regard, of interest are data to the effect that phenylhydrazine, in small doses (10 mg/kg), has a radioprotective effect and stimulates cell division in hemopoietic tissue regardless of time of administration, whereas in a dosage of 100 mg/kg it increases radiosensitivity and inhibits erythropoiesis. Yet, there is a report that there was a high level of erythropoietin in the plasma of mice exposed successively to 100 R x rays and phenylhydrazine (up to 80 mg/kg). Thus, in the course of radiation sickness in rats, as in the case of phenylhydrazine anemia, a reliable increase is observed in erythropoietic activity of plasma.

- 2215 (ERDA-tr--241, pp 160-163) ROLE OF TOCOPHEROL (VITAMIN E) IN THE CONCOMITANT DELETERIOUS EFFECT OF POSTRADIATION HYPEROXIA. Ivanov, I.F. (Kiev Scientific-Research Inst. of Roentgenoradiology and Oncology). 1976. Translated from Radiobiologiya; 16: No. 5, 773-776(1976).

Radiobiology, Vol. 16, No. 5, 1976. One of the best known natural antioxidants that is consistently present in the organism is vitamin E (tocopherol). It is not synthesized de novo in animal tissues, so that the organism's vitamin E requirements are met by means of exogenous sources. Tocopherol is ingested in a biologically inactive form and then undergoes several enzymatic conversions. Under experimental conditions, following intraperitoneal injection of tocopherol, a maximum increase in hepatic lipids, in biologically active (free) form occurred by the 18th hour. After administration per os tocopherol is stored in various organs, particularly in the liver where a maximum is demonstrable in 6 hours. It is assumed that conversion of tocopherol into active form is relatively easier in this instance, as compared to intraperitoneal administration, due to processing thereof by secretions of gastrointestinal glands. On the basis of the foregoing, our objective was to make a quantitative evaluation of the effect of

tocopherol on postradiation hyperoxia when given both before and after irradiation. The obtained data demonstrated unequivocally that, in the integral organism of warm-blood animals, the additional deleterious effect of postradiation hyperoxia can be averted by means of preliminary (6 to 18 hours before irradiation) administration of tocopherol. The existence of a latency period in tocopherol action is, apparently, due to the need for it to change into a biologically active form. The duration of this period coincides with the time of conversion into free form with antioxidant properties. For this reason, we cannot rule out the possibility that the additional deleterious effect of postradiation hyperoxia is due to activation by oxygen of free oxidation in irradiated tissues and, in particular, peroxidation, in the reactions of which tocopherol is a specific blocking factor.

- 2216 (ERDA-tr--241, pp 164-167) DYNAMICS OF MYELOKARYOCYTES DURING PROLONGED AND REPEATED GAMMA IRRADIATION. Voronin, V.S.; Murzina, L.D.; Sukhodoev, V.V. 1976. Translated from Radiobiologiya; 16: No. 5, 777-779(1976).

Radiobiology, Vol. 16, No. 5, 1976. Changes in number of myelokaryocytes with irradiation of small laboratory animals are evaluated by counting medullary cells in the femur. However, in the case of protracted irradiation, when irradiated animals gain weight at an appreciably slower rate than intact ones, the use of this method may distort the true results. Hence, the objective of the present work was to make a dynamic study of myelokaryocytes in the entire skeleton in the course of prolonged irradiation of rats, and to compare these data to the change in number of cells in the femur. There was a difference in dynamics of bone marrow cell content of the rat skeleton with the two different daily doses of radiation. While no changes in number of myelokaryocytes, as compared to intact animals, were noted with exposure to 25 R/day for 8 months, with a daily dose of 50 R their number declined from the very start of the experiment. These differences are, apparently, due to less destruction of medullary cells with the low daily dosage and more profound injury to compensatory mechanisms with 50 R/day. Other investigators have also reported differences in change in number of myelokaryocytes with different daily doses of radiation. It is important to mention that, with both doses used, the dynamics of quantitative composition of femoral bone marrow cells, with consideration of the correction factor, reflected quite accurately the nature of change in number of karyocytes in the entire skeleton of the animal.

- 2217 (ERDA-tr--241, pp 179-183) TESTICULAR REACTION TO COMBINED RADIATION. Kondratenko, V.G.; Ganzenko, L.F. (Inst. of Biological Physics, Pushchino, USSR). 1976. Translated from Radiobiologiya; 16: No. 5, 788-791(1976).

Radiobiology, Vol. 16, No. 5, 1976. In view of the broad development of atomic energy and possible use of space stations, it is interesting to investigate the effects of chronic radiation in low doses combined with a single dose of irradiation. In this work, we investigated the testicular reaction of animals exposed to combined radiation. The testicular reaction to combined radiation resembles the one seen with delivery of divided doses of radiation to these organs. However, it should be stressed, that this is only an external similarity, since there are more profound disturbances in the seminiferous tubules with combined radiation, they are manifested with

- lower doses and when the intervals between exposures are considerably longer. All this is indicative of the specific reaction of the testes to combined radiation. In our opinion, the described changes in the spermatogenic epithelium induced by ionizing radiation cannot be interpreted as being merely the result of local disturbances. They are apparently determined by impairment of complex neurohormonal mechanisms of regulation of spermatogenesis.
- 2218 (ERDA-tr--241, pp 62-67) CHANGES IN NUMBER AND PROLIFERATIVE ACTIVITY OF HEMOPOIETIC STEM CELLS DURING PROLONGED EXTERNAL GAMMA-IRRADIATION. Muksinova, K.N. 1976. Translated from Radiobiologiya; 16: No. 5, 693-698(1976).
Radiobiology, Vol. 16, No. 5, 1976.
Prolonged daily exposure of BALB/c mice to 25 and 50 R/day radiation (at the rate of 10 R/min) led to appreciable depletion of CFC [colony-forming cells] population in the bone marrow and spleen. The rate and severity of CFC decline were more marked in the group of animals exposed to 50 R/day. A significant increase in proliferative pool of CFC maintained the population of these cellular elements throughout a long period of irradiation. The authors discuss the possible mechanisms of the demonstrated changes in number of CFC and their functional state.
- 2219 (ERDA-tr--241, pp 68-72) CHANGES IN KINETICS OF ERYTHRONORMOBLAST PROLIFERATION DURING PROLONGED GAMMA IRRADIATION. Voronin, V.S.; Murzina, L.D. 1976. Translated from Radiobiologiya; 16: No. 5, 699-702(1976).
Radiobiology, Vol. 16, No. 5, 1976. No decrease in number of erythronormoblasts was demonstrable after exposing Wistar rats to 48.5 rad/day radiation for 70 days. Compensation of erythropoiesis may be related to faster proliferation of erythropoietic elements of bone marrow. This process is due to 25--30 percent reduction of erythronormoblast generation time and increased number of divisions of erythroblasts and basophil normoblasts.
- 2220 RADIATION DAMAGE AND REPAIR. Pauly, H. Zivilverteidigung; No. 3, 26-34(1976). (In German).
10 figs.; with refs..
This survey intends to show that the reversible component of radiation damage has again become of interest. Although there was no need for living organisms in the course of their development to develop special means of repairing the damage caused by a high amount of ionizing radiation, they are able to do so in a high degree.
- 2221 (ERDA-tr--266, pp 117-119) INVESTIGATION OF EFFECTS OF LOW MOLECULAR DNA ON THE GENOME OF SOMATIC CELLS OF HEALTHY AND IRRADIATED ANIMALS. Nikolaevskaya, N.G. 1976. Translated from Radiobiologiya; 16: No. 6, 897-899(1976).
Radiobiology. It has been shown in several works that high molecular DNA lowers the incidence of chromosomal radiation damage in somatic cells of irradiated animals. The present work was undertaken to determine the significance of molecular weight in lowering the incidence of radiation damage to chromosomes. At the same time, we investigated the effect of low molecular DNA on the genome of somatic cells of healthy animals. The influence of exogenous DNA on incidence of chromosomal aberrations is determined largely by the molecular weight of the biopolymer. In our opinion, the lack of beneficial effect of low molecular DNA, with respect to reducing the radiation-induced chromosomal aberrations, is indicative of the prime significance of complementary fragments of the administered biopolymer in the mechanism of action of exogenous DNA on repair of chromosomes.
- 2222 CHANGES IN THE ACTIVITIES OF BLOOD AND TISSUE ADENOSINETRIPHOSPHATASE AND LACTATE DEHYDROGENASE AFTER EXPOSURE TO ^{60}Co GAMMA-RAYS IN ASSOCIATION WITH SOME DRUG TREATMENTS. Pausescu, E.; Teodosiu, T.; Paun, C.; Duduggian, L.M. (Fundeni Clinical Hospital, Bucharest). Rev. Roum. Morphol., Embryol. Physiol., Physiol.; 13: No. 1, 61-66(1976).
Experiments in rats exposed to a moderate dose of ^{60}Co gamma-radiation and treated with either cystamine, AET, complamin or alpha-methyldopa suggested that the efficiency of a radioprotective drug might be related to its ability to maintain low levels of ATP-ase activity in blood and tissues after irradiation.
- 2223 INFERENCES FROM THE COLLABORATION IN THE FIELD OF PHARMACO-CHEMICAL PROTECTION AND TREATMENT OF RADIATION INJURY ACCORDING TO THE 'INTERCOSMOS' PROGRAM. STUDY OF NEW PROPHYLACTIC AND THERAPEUTIC AGENTS TO MANAGE RADIATION DISEASE FROM PROTRACTED EXPOSURE. TOPIC 5. Rogozkin, D.D. (Institut Biofiziki, Moscow (USSR)). Rentgenol. Radiol.; 15: No. 1, 55(1976). (In Russian).
From Meeting of the working groups of scientists from socialist countries on cosmic biology and medicine; Varna, Bulgaria (19 - 25 May 1975).
Primary consideration was given to agents promoting general systemic resistance. In short-term or protracted irradiation experiments, confirmatory evidence was obtained for antiradiation effects produced by amitetravit, urease, and yeast polysaccharides. On Ehrlich ascites tumor cells and lymphosarcoma cells, exogenous DNA was shown to enhance repair of the DNA molecule, even with regard to double-strand breaks. Usefulness of serum globulins as an antiradiation agent was substantiated in acute experiments on rabbits, where survival of animals was seen to rise and natural immunity factors to be normalized and stimulated. A similar favorable effect of serum globulins was demonstrated on hemopoiesis in mice, where incidence of autoinfections was also decreased. Studies are continuing to elucidate mechanisms underlying hemopoiesis protection by hypoxic hypoxia and hypoxic hypothermy in mice. Minimum amounts of protective preparations needed to produce an appreciable effect on mouse stem cells were determined. ATP and noradrenalin were found to act largely through their influence on blood formation.
- 2224 GENETIC DAMAGE FROM CHRONIC GAMMA IRRADIATION. Bajrakova, A. (Nauchno-Izledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Suvrem. Med.; 27: No. 11, 9-12(1976). (In Bulgarian).
Human irradiation occurs to a large extent under protracted, low-dose-rate exposure conditions. In assessing the genetic risk thereby incurred one has, by necessity, to rely primarily on information gained from animal experiments. Review of the evidence obtained indicates that chronic relative to acute gamma irradiation is less effective with regard to both gene mutation and chromosome aberration

- induction. When delivered under chronic exposure conditions, gamma radiation to spermatogonia has been found to produce one-third the gene mutations and one-fifth the chromosome translocations resulting from acute exposure. Dose-rate effects have been observed in irradiation of spermatogonia and oocytes, that is gametogenesis stages that cumulate life-long doses, largely from protracted exposures. The reduction in effect with decreasing dose rate is perceivable until a certain low 'threshold' level is attained, which is estimated to be of the order of magnitude of some tens of R/min for gene mutations and a few mR/min for chromosome aberrations.
- 2225 EXPERIMENTAL ADIASPIROMYCOSIS IN ANIMALS WITH A MODIFIED REACTIVITY (ALBINO MICE) AFTER IRRADIATION. Zlatanov, Z.; Michev, A. (Republikanska Protivoepidemichna Stantsiya, Sofia (Bulgaria)). *Epidemiol., Mikrobiol. Infekts. Boles.*; 13: No. 4, 310-315(1976). (In Bulgarian).
The nature of the pathologic process in experimental adiaspiromycosis, following intraperitoneal inoculation with elements of the mycelium phase of *Emmonsia crescens* Emmons et Jellison (1960), depends on the reactivity of the experimental animals. Compared with a control group of animals, inoculated albino mice (with a single dose of 250 rad) contracted adiaspiromycosis more readily, there was a higher incidence of positive findings, aleiropore dissemination to distant organs outside the abdominal cavity occurred earlier, the intensity of tissue and organ insemination of the host was much higher. The results of these studies show that individuals with low resistance and increased susceptibility to infection are particularly liable to contract adiaspiromycosis.
- 2226 ACTIVITY OF LYSOSOMAL ACID PHOSPHATASE IN THE PERIPHERAL BLOOD LYMPHOCYTES OF MICE IRRADIATED WITH GAMMA RAYS. Aleksandrowicz, J.; Wazewska-Czyzewska, M.; Szybinski, Z.; Bodzon, A.; Plonka, I.; Sasiadek, U.; Lisiewicz, J. (Akademia Medyczna, Krakow (Poland)). *Postepy Fiz. Med.*; 11: No. 2, 87-96(1976). (In Polish).
In the peripheral blood lymphocytes of Albino-Swiss mice after irradiation with 450 R an intracellular increase in the acid phosphatase activity was determined with Barka and Anderson's cytochemical method. The increase in the enzyme activity was accompanied by the increase in the absolute count of enzyme-positive lymphocytes exhibiting high activity of the enzyme, i.e. containing more than five enzyme-positive lysosomal granules. The absolute count of cells of diffuse enzymatic reaction type did not increase after irradiation.
- 2227 RADIATION-INDUCED FETAL TESTICULAR DAMAGE IN THE MONKEY (*MACACA RADIATA*). Johnson, M.I.; Newman, L. (Univ. of California, Davis). *J. Med. Primatol.*; 5: No. 3, 195-199(1976).
The testes of five monkeys (*Macaca radiata*) were examined histologically for evidence of damage, following in utero fractionated x-irradiation. Radiation-induced damage was found in the testes of animals beginning at total exposures of 170 R, when compared to controls.
- 2228 EFFECT OF X-RAY SMALL DOSE FRACTIONATION ON THE SURVIVAL RATE OF MICE OOCYTES. Rudnicki, T.; Sloninska, B. (Akademia Medyczna, Poznan (Poland)). *Postepy Fiz. Med.*; 11: No. 1, 9-15(1976). (In Polish).
By using the method of double irradiation the effect of the length of the intervals between split doses on the number of oocytes in mice has been studied. The damaging effect was found to depend on the accumulated dose rather than on its distribution in time. No recovery in oocytes even for the dose of 5 R has been observed.
- 2229 RESEARCH ON HEPATIC AND OVERALL COLLAGEN METABOLISM IN IRRADIATED RATS. Vladescu, C.; Gheorghe, N.; Ganea, E.; Petrescu, L. *Pathol.-Biol.*; 24: No. 10, 671-676(1976). (In French).
The effects of ionizing radiations on hepatic and overall collagen metabolism in rats were studied. Doses of 100 and 250 rads produced a reduction in urinary hydroxyproline while doses of 500 and 700 rads produced an increase. These results may be interpreted in favour of an increase in reticulation in the first case and in the second case, destruction of inter-molecular bonds. The quantity of total and insoluble collagen increases proportionally to the dose 40 days after the irradiation. This proportional relationship is not observed during the first few days after the irradiation. Prolonged irradiation with 700 rads produces a marked reduction in all collagen fractions, compared with 4 days after acute irradiation. Among the substances studied 'folcisteine' had the best radio-protective effect when administered before irradiation with 700 rads.
- 2230 ETIOLOGIC RELATED STUDIES OF ULTRAVIOLET LIGHT-MEDIATED CARCINOGENESIS. Black, H.S.; Chan, J.T. (Veterans Administration Hospital, Houston, TX). *Oncology*; 33: No. 3, 119-122(1976).
Comparisons were made of cholesterol-5 α 6 α -epoxide (CAE) levels in skin of hairless mice maintained on a regular or antioxidant supplemented diet and receiving chronic ultraviolet light (UVL) radiation over an 18-week period. Cholesterol-5 α , 6 α -epoxide levels in skin of animals on antioxidant supplemented diet, while reaching a peak four weeks after that of animals on regular diet, thereafter were consistently higher. Dietary antioxidants nevertheless had an inhibitory effect on UVL-induced tumors. These data are inconsistent with the theory of CAE involvement as an ultimate carcinogen in UVL-mediated carcinogenesis.
- 2231 CHANGES IN FUNCTIONAL VASCULARITY AND CELL NUMBER FOLLOWING X IRRADIATION OF A MURINE CARCINOMA. Clement, J.J.; Song, C.W.; Levitt, S.H. (Univ. of Minnesota Medical School, Minneapolis). *Int. J. Radiat. Oncol., Biol. Phys.*; 1: No. 7-8, 671-678(1976).
Post-irradiation changes in vascular function and cell number in the transplantable SCL carcinoma of A/J mice were examined. Vascular volume/g tumor, as measured by ⁵¹Cr-labeled red blood cell dilution, increased within 1 day after 1000 or 2000 rad and then decreased. The number of living cells/g tumor, estimated from single-cell preparations, declined to a minimum at day three post-irradiation with 1000 or 2000 rad. Calculation of vascularity on a per living cell basis indicated that the vascular volume increased to 197 percent and 286 percent of controls 3 days after irradiation with 1000 and 2000 rad, respectively. These data indicate that post-irradiation reoxygenation of hypoxic tumor cells may be caused by a decrease in oxygen consuming cells which is greater in magnitude

than the corresponding decrease in functional vascularity.

- 2232 EFFECT OF ACUTE AND FRACTIONATED PARTIAL BODY X-IRRADIATION ON CIRCULATING IMMUNOGLOBULIN LEVELS IN MICE. Markoe, A.M.; Asbell, S.O.; Weidanz, W.P.; Saluk, P.; Antoniadis, K.; Brady, L.W. (Hahnemann Medical Coll. and Hospital, Philadelphia). Int. J. Radiat. Oncol., Biol. Phys.; 1: No. 5-6, 465-470(1976).

Circulating immunoglobulin (Ig) levels of normal SJL/J mice were measured following total- or half-body x irradiation 12 days after a single exposure of 875 R (an LD95/30 exposure) or on the 12th and final day of fractionated irradiation to a total of 2000 R (200 R fraction, 10 fractions in 12 elapsed days). IgG₁ and IgG₂ were markedly depressed following total body acute exposure but were also reduced after the fractionated half-body exposure (representing no hematopoietic repopulation based on spleen and thymic weights). Irradiation below the diaphragm caused a greater depression than above the diaphragm. However, 12 days after acute half-body exposure, IgG levels were within the control range. IgM levels were depressed significantly only after acute total body exposure. IgA levels were not greatly altered by any mode of x irradiation. Serum IgG levels may change after x irradiation by virtue of intestinal damage resulting in abnormal losses or of depression of IgG-secreting plasmacytes. In the case of IgM, intestinal dependency is not shown. Moreover, compensatory IgM secretion may occur from plasmacytes located in the unirradiated half of the body and is, thus, independent of hematopoietic repopulation. The failure of IgA levels to change markedly after total or partial body irradiation remains unexplained.

- 2233 CHANGES IN PLATELET AND MICROCIRCULATION FUNCTION INDUCED BY IONIZING RADIATION TO THE LIVER. Bicher, H.I.; Ashbrook, D.W.; Harris, D.R.; Dalrymple, G.V. (Univ. of Arkansas for Medical Sciences Campus, Little Rock). Int. J. Radiat. Oncol., Biol. Phys.; 1: No. 7-8, 679-685(1976).

Platelet aggregation and adhesiveness, as well as partial pressure of oxygen in tissue (TpO₂) responses to hypoxia, were measured as microcirculation parameters in beagle dogs who were subjected to ⁶⁰Co ionizing radiation to a dose of 4600 rad in 5 weeks. Simultaneously, changes in blood chemistry and coagulation also were determined. Marked changes in tissue oxygenation and an increase in platelet aggregation in the post-irradiation period led to the conclusion that radiation liver damage is, at least in part, mediated through microcirculation function disturbances.

- 2234 EFFECT OF RADIATION IN UTERO ON MOUSE TESTES LACTATE DEHYDROGENASE-X. Prasad, N.; Prasad, R.; Bushong, S.C. (Baylor Coll. of Medicine and Veterans Administration Hospital, Houston, TX). Int. J. Radiat. Oncol., Biol. Phys.; 1: No. 3/4, 285-287(1976).

Lactate dehydrogenase-X(LDH-X), a sperm specific isozyme of mammals, can be used as a marker for active spermatogenesis. LDH-X electrophoretic patterns may also be affected in radiation-induced sterility following in utero irradiation. To investigate this relationship pregnant female mice were given 100 rad x radiation on day 10, 13, and 17 following gestation. All male offspring were sacrificed 20 days after birth and testes tissues obtained. The testes were homogenized

to obtain crude extracts for starch gel electrophoresis and zymogram staining for LDH-X. Results to date show that the LDH-X is not expressed in the testis when fetal irradiation occurred at 10 and 13 days following gestation. Faint bands of LDH-X were observed in testes homogenates of mice whose mothers were irradiated 17 days following gestation. Pronounced LDH-X bands were present in all control preparations.

- 2235 (HEDL-SA--1086-FP) YEAR 2000 ESTIMATED POPULATION DOSE FOR THE TENNESSEE VALLEY REGION. Fletcher, J.F.; Strauch, S.; Siegel, G.R.; Witherspoon, J.P. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1976. Contract E(45-1)-2170. 21p. (CONF-760622--42). Dep. NTIS \$3.50.

From American Nuclear Society 1976 annual meeting; Toronto, Ontario, Canada (13 Jun 1976).

A comprehensive study has recently been completed of the potential regional radiological dose in the Tennessee and Cumberland river basins in the year 2000, resulting from the operation of nuclear facilities. This study, sponsored jointly by the U.S. Energy Research and Development Administration and the Tennessee Valley Authority, was performed by the Hanford Engineering Development Laboratory (HEDL), the Oak Ridge National Laboratory (ORNL), and the Atmospheric Turbulence and Diffusion Laboratory (ATDL). This study considered the operation in the year 2000 of 33,000 MWe of nuclear capacity within the study area, and of 110,000 MWe in adjacent areas, together with supporting nuclear fuel fabrication and reprocessing facilities. Air and water transport models used and methods for calculating nuclide concentrations on the ground are discussed. (CH)

- 2236 (AED-Conf--76-134-023) ¹²⁵I THERAPY OF HYPERTHYROIDISM. Reddy, A.R. (Freie Univ. Berlin (Germany, F.R.). Klinikum Steglitz). 1976. 14p. (CONF-760592--5). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976). 1 fig.; 1 tab.; 24 refs..

In recent years increasing interest is shown in the use of ¹²⁵I for the therapy of hyperthyroidism, instead of the traditional ¹³¹I, based on the postulate that there is a relative sparing of the reproductive integrity of the thyroid follicular cell and a consequent possibility of smaller incidence of hypothyroidism after therapy. Dosimetric and radiobiological bases of this postulate are first described in this paper and then a brief review of the results of the pilot clinical trials conducted at different centers using ¹²⁵I for the management of hyperthyroidism is given.

- 2237 (AED-Conf--76-430-004) PROBLEMS IN RADIOLOGICAL PROTECTION INVOLVING ALPHA EMITTERS IN BONE. Dolphin, G.W. (National Radiological Protection Board, Harwell (UK)). 1976. 16p. (CONF-760992--16). NTIS (US Sales Only).

From 2. international symposium on biological effects of Ra-224; Neuherberg/Muenchen, F.R. Germany (20 Sep 1976). 4 tabs.; with refs..

Quantitative dose/effect relationships for humans exposed to alpha emitters can only be established from data on humans exposed to this type of radiation. The risk of bone sarcoma

from exposure to plutonium-239 may be established from the data on the human cases exposed to radium-226 either by consideration of the radiation dose to the osteoprogenitor cells or by use of the average bone dose together with a modifying factor to take into account the greater toxicity of plutonium relative to radium. The relative toxicity can be evaluated from the data on osteosarcoma incidence in animals. Both methods of risk estimation are given and criticised in the paper. In future recommendations, ICRP will not use the critical organ concept and the late effects from α emitters deposited in organs other than the bone will have to be taken into account in setting maximum permissible annual intakes. The implications of this and other proposed changes in ICRP concepts are discussed.

- 2238 (AED-Conf--76-430-011) INTRAVENOUS INJECTION OF RA-224 AS A TREATMENT IN MORBUS PAGET. Koch, W. (Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Eggenstein-Leopoldshafen (Germany, F.R.)). 1976. 7p. (CONF-760992--11). TIC.

From 2. international symposium on biological effects of Ra-224; Neuherberg/Muenchen, F.R. Germany (20 Sep 1976).

Between 1956 and 1973, 21 patients with histologically verified Morbus Paget were treated at the author's hospital with low dosage ^{224}Ra . In none of these patients an immediate or late impairment of the hematogenic or parenchymal organs was observed.

- 2239 (ANL--76-88(Pt.2)) RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT, JULY 1975--JUNE 1976. (Argonne National Lab., Ill. (USA)). 1976. Contract W-31-109-ENG-38. 183p. Dep. NTIS \$7.50.

Separate abstracts were prepared for eighteen sections of the report. Abstracts of an additional nine items are also included in the report as well as appendices presenting exposure data for radium patients and radium-induced malignancies. (HLW)

- 2240 (ANL--76-88(Pt.2), pp 26) LONG-TERM EFFECTS OF RADIUM EXPOSURE IN FEMALE DIAL WORKERS: HEMATOCRIT AND BLOOD PRESSURE. Polodnak, A.P. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

Statistically significant results were obtained using univariate and multivariate (multiple regression) analyses for women aged 65 to 84. The effect (i.e., lower hematocrit at higher doses) appeared to be greatest in the highest dose group, especially at 1000+ rad. It did not, however, involve a higher frequency of 'low' hematocrit suggestive of anemia. No apparent effect of dose on blood pressure was evident in the women exposed in 1913 to 1929. In women exposed in 1930 to 1954, dose was a significant predictor of systolic blood pressure in 45- to 54-year olds, but not in the 55- to 64-year olds. Analysis of longitudinal data on these populations will be required.

- 2241 (ANL--76-88(Pt.2), pp 30-37) CHROMOSOME ABERRATIONS IN THE PERIPHERAL LYMPHOCYTES OF THORIUM WORKERS WITH LOW BODY BURDENS OF ^{212}Bi . Hoegerman, S.F. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

Cytogenetic analysis of 8 thorium workers and 3 controls has not shown a significant elevation in the level of chromosome breakage in the workers' peripheral lymphocytes. This

finding is consistent with an estimate of the amount of damage to be expected in these cases, based on the level of chromosome breakage observed in Thorotrast cases with measured ^{212}Bi burdens.

- 2242 (ANL--76-88(Pt.2), pp 38-39) GROSS DISTRIBUTION OF ^{226}Ra IN MAN FROM EXTERNAL COUNTING. Rundo, J.; Essling, M.A.; Huff, D.R. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

When the first γ -ray measurements of a radium patient's body radioactivity indicate a content in excess of about 20 nCi of ^{214}Bi (RaC), a '7-position scan' is made. Measurements are made with two detectors, above and below the supine subject, at seven equally spaced positions along the length. The spacing is set at 15% of the subject's height. Such scans have been made for 40 different patients, and although the detectors are uncollimated, a surprising amount of information on the distribution is revealed. In general, the distribution could be assigned fairly unambiguously to one of four categories. In Category I (18 cases) a clear maximum of activity was observed in the lowest third of the body. Category II (12 cases) was the reverse; the highest counting-rate was observed from the uppermost third of the body. Rough symmetry of activity distribution down the length of the body was seen in the other two categories. In Category III (7 cases) the counting-rate was at a maximum near the middle of the body, while it was at a minimum for Category IV (3 cases). There was considerable variability within any one category, and no correlation between body content of radium, or mode of intake, and category.

- 2243 (ANL--76-88(Pt.2), pp 40) MACRODISTRIBUTION OF ^{226}Ra IN THE SKELETON OF A RADIUM DIAL PAINTER. Holtzman, R.B.; Simmons, D.J. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

The concentrations of ^{226}Ra were determined in 190 samples of bone and in four teeth from a woman who had worked for two years as a radium dial painter 52 years prior to her death. The terminal body content of ^{226}Ra was 200 nCi. The weighted mean concentration of activity in bone was 146 ± 11 pCi/g ash, with a range of 12 to 1000 pCi/g ash. The mean level in cortical bone was 116 ± 14 pCi/g ash, while that in porous bone (trabecular and eroded cortex) was 227 ± 25 pCi/g ash.

- 2244 (ANL--76-88(Pt.2), pp 47-53) VARIABILITY IN THE EXHALATION RATE OF RADON. Rundo, J.; Markun, F.; Sha, J.Y.; Cameron, P. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

In a day-long study, twenty-eight 10-min samples of breath were collected from a former radium dial painter and were analyzed for radon. The radon exhalation rate showed good short-term reproducibility, but there was a dramatic short-lived increase in the first samples collected after lunch and a slow but steady increase during the course of the day.

- 2245 (ANL--76-88(Pt.2), pp 70-79) MACRODISTRIBUTION OF ^{226}Ra IN THE HUMAN SKELETON AS DETERMINED IN VITRO BY GAMMA-RAY SPECTROMETRY. Essling, M.A.; Huff, D.R. 1976.

Radiological and Environmental Research

Division annual report, July 1975--June 1976.

A large number of γ -ray measurements of ^{226}Ra in human bone has been made both at MIT and CHR-ANL. These data are analyzed for correlations of the specific activity ratio of a bone group with other parameters, an interlaboratory comparison of the measurements, and an estimate of the errors expected when a whole-body content is calculated from the ^{226}Ra determination on a partial skeleton.

2246 (ANL--76-88(Pt.2), pp 82-85) USE OF ^{103}Pd AS A CALIBRATION SOURCE FOR THE DETERMINATION OF ^{239}Pu IN VIVO. Toohey, R.E. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

As one component of mock plutonium, ^{103}Pd is frequently used as a calibration source for the determination of ^{239}Pu . Some considerations involved in its use are discussed; it is shown that the plutonium calibration curve derived from ^{103}Pd agrees well with that from ^{238}Pu .

2247 (ANL--76-88(Pt.2), pp 17-21) HAZARD PLOTTING AND ESTIMATES FOR THE TUMOR RATE AND THE TUMOR GROWTH TIME FOR RADIOGENIC OSTEOSARCOMAS IN MAN. Groer, P.G.; Marshall, J.H. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

The tumor rate (hazard rate) and the tumor growth time were estimated from a multiply censored sample of observed tumor appearance times in persons with an initial intake of ^{226}Ra and ^{228}Ra larger than about 230 $\mu\text{Ci/kg}$ bone. The tumor appearance times in these individuals appear to be exponentially distributed and follow, therefore, a straight line if plotted against the cumulative hazard on linear paper, the hazard paper for an exponential failure time distribution. This implies a constant dose independent tumor rate for osteosarcoma induction in the limit of large radiation doses. An expression for tumor rate from a stochastic model, described earlier in detail showing this behavior, is discussed briefly.

2248 (ANL--76-88(Pt.2), pp 22-25) VARIANCE OF THE NUMBER OF TUMORS IN A MODEL FOR THE INDUCTION OF OSTEOSARCOMA BY ALPHA RADIATION. Groer, P.G.; Marshall, J.H. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

An earlier report on a model for the induction of osteosarcoma by alpha radiation gave differential equations for the mean numbers of normal, transformed, and malignant cells. In this report we show that for a constant dose rate the variance of the number of cells at each stage and time is equal to the corresponding mean, so the numbers of tumors predicted by the model have a Poisson distribution about their mean values.

2249 (BNWL-SA--5523) FOOD: AN INTERACTIVE CODE TO CALCULATE INTERNAL RADIATION DOSES FROM CONTAMINATED FOOD PRODUCTS. Baker, D.A.; Hoenes, G.R.; Soldat, J.K. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1976. Contract E(45-1)-1830. 8p. (CONF-760407--3). Dep. NTIS \$3.50.

From Conference on environmental modeling and simulation; Cincinnati, OH, USA (20 Apr 1976).

An interactive code, FOOD, has been written in BASIC for the UNIVAC 1108 to facilitate calculation of internal radiation doses to man from radionuclides in food products. In the

dose model, vegetation may be contaminated by either air or irrigation water containing radionuclides. The model considers two mechanisms for radionuclide contamination of vegetation: direct deposition on leaves and uptake from soil through the root system. The user may select up to 14 food categories with corresponding consumption rates, growing periods and either irrigation rates or atmospheric deposition rates. These foods include various kinds of produce, grains and animal products. At present, doses may be calculated for the skin, total body and five internal organs from 190 radionuclides. Dose summaries can be displayed at the local terminal. Further details on percent contribution to dose by nuclide and by food type are available from an auxiliary high-speed printer. This output also includes estimated radionuclide concentrations in soil, plants and animal products.

2250 (BNWL-SA--5659) ASSESSMENT OF A CERIUM--PRASEODYMIUM-144 INHALATION CASE. Glenn, R.D.; Heid, K.R.; Houston, J.R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1976. Contract E(45-1)-1830. 21p. (CONF-760652--6). Dep. NTIS \$3.50.

From Health Physics Society meeting; San Francisco, CA, USA (27 Jun 1976).

A case involving an acute exposure to a ^{144}Ce - ^{144}Pr contaminated atmosphere is presented with a discussion of the treatment and evaluation of data collected out to 800 days post intake. Treatment included irrigation of the upper nasal passages with normal saline, nebulization with normal saline mist and DTPA therapy. Assessment of the deposition and the resulting dose commitment was based on in vivo measurements and excretion data. The initial pulmonary burden, which cleared with three distinct half times, was estimated at 2.1 μCi of ^{144}Ce .

2251 (CONF-760444--1) FIFTY YEAR DOSE COMMITMENT TO VARIOUS ORGANS AND TISSUES FROM INHALATION OF ^{133}Xe . Bernard, S.R.; Snyder, W.S. (Oak Ridge National Lab., Tenn. (USA)). 1976. 16p. Dep. NTIS \$3.50.

From Symposium on radiopharmaceutical dosimetry; Oak Ridge, TN, USA (26 Apr 1976).

A metabolic model for a single inhalation of ^{133}Xe , together with the computer code in use at this Laboratory, was employed for estimating dose commitments to various organs and tissues in the adult human body. The code uses Monte Carlo data for photons and assumes complete absorption of the energy from the emitted electrons in organs and tissues. For bone, a model was used to estimate dose to red and yellow marrow and to endosteal cells of both trabecular and cortical bone. For a single inhalation of 1 mCi of ^{133}Xe , the 50 year dose to gonads was about 0.4 mrad. The dose to lungs from ^{133}Xe dissolved in tissues is about the same, but the dose to the lungs from ^{133}Xe in air spaces was about 1 mrad. (auth)

2252 (CONF-760444--2) DOSE TO THE STOMACH WALL FROM INJECTED /SUP 99M/TC PERTECHNETATE. Ford, M.R.; Deus, S.F.; Snyder, W.S. (Oak Ridge National Lab., Tenn. (USA)). 1976. 12p. Dep. NTIS \$3.50.

From Symposium on radiopharmaceutical dosimetry; Oak Ridge, TN, USA (26 Apr 1976).

In estimating the radiation dose to the gastrointestinal tract (GIT) it has been assumed generally that the measured activity in the tract, i.e., in the walls, is present in the contents. This assumption has been necessary because absorbed fractions for

photons were available only for the source in the contents. During the past year and a half, however, absorbed fractions, or specific absorbed fractions, have been estimated for photon emitters in the walls. In the work presented here new values are applied to estimate dose to the walls of the GIT from administration of ^{99m}Tc pertechnetate. The dose to the stomach wall from photons is found to be less than the dose from nonpenetrating radiation, assuming complete absorption of energy. Thus, a correct estimation of average dose to the wall requires use of absorbed fractions of energy for electrons as well as for photons. The problem is discussed and values of absorbed fractions for electrons are given which are based on a uniform distribution of the activity. However, a final resolution of the problem will require further biological data on the fraction of activity in the wall and the fraction in the contents. (auth)

- 2253 (CONF-760444--4) EFFECTS OF BODY AND ORGAN SIZE ON ABSORBED DOSE: THERE IS NO STANDARD PATIENT. Poston, J.W. (Oak Ridge National Lab., Tenn. (USA)). 1976. 32p. Dep. NTIS \$4.00.

From Symposium on radiopharmaceutical dosimetry; Oak Ridge, TN, USA (26 Apr 1976). The problem of estimating the absorbed dose to organs and tissues of the human body due to the presence of a radiopharmaceutical in one or more organs is discussed. Complications are introduced by the fact that the body is not homogeneous and in many cases the organ shapes are not regular. Publications of the MIRD Committee have provided a direct means of estimating the absorbed dose (or absorbed fraction) for a number of radioisotopes. These estimates are based on Monte Carlo calculations for monoenergetic photons distributed uniformly in organs of an adult phantom. The medical physicist finds that his patient does not resemble the adult phantom. In addition, the absorbed fractions for the adult are not reasonable values for the child. This paper examines how these absorbed fraction estimates apply to a nonstandard patient. (auth)

- 2254 (CONF-760444--5) ESTIMATION OF DOSE TO THE URINARY BLADDER AND TO THE GONADS. Snyder, W.S.; Ford, M.R. (Oak Ridge National Lab., Tenn. (USA)). 1976. 33p. Dep. NTIS \$4.00.

From Symposium on radiopharmaceutical dosimetry; Oak Ridge, TN, USA (26 Apr 1976). Radiation dose to the bladder from a radionuclide emitter present in the contents varies with many parameters such as radioactive half-life, biological half-lives of activity entering the bladder from other sites, rate of urine production, distention of the bladder, and individual habits. These are discussed and some practical rules are formulated for estimation of dose from photon emitters or beta emitters present in urine. A new point kernel for electrons due to Berger which takes straggling and bremsstrahlung into account has been tried and procedures are given for estimation of dose from a radioactive daughter. This is illustrated particularly for radionuclides of short radioactive half-life. Estimates of genetic dose due to internally deposited radionuclides are generally inaccurate as data on uptake of activity in the gonads are not documented in sufficient detail. (auth)

- 2255 (CONF-760444--6) DEVELOPMENT OF A MATHEMATICAL PHANTOM REPRESENTING A 10-YEAR-OLD

CHILD FOR USE IN INTERNAL DOSIMETRY CALCULATIONS. Deus, S.F.; Poston, J.W. (Oak Ridge National Lab., Tenn. (USA)). 1976. 14p. Dep. NTIS \$3.50.

From Symposium on radiopharmaceutical dosimetry; Oak Ridge, TN, USA (26 Apr 1976).

With the increased growth of nuclear energy generating facilities, estimates of absorbed radiation dose to human population groups (e.g., children) are required. In addition, children are being exposed to many nuclear medicine procedures and accurate dose estimates are needed. The main purpose of this research is to design a mathematical phantom representing as closely as possible a 10-year old child. (auth)

- 2256 (CONF-760992--17) MODEL FOR THE INDUCTION OF BONE CANCER BY ^{224}Ra . Groer, P.G.; Marshall, J.H. (Argonne National Lab., Ill. (USA)). 1976. Contract W-31-109-ENG-38. 14p. Dep. NTIS, PC A02/MF A01.

From 2. international symposium on biological effects of Ra-224 ; Neuherberg/Muenchen, F.R. Germany (20 Sep 1976).

A mathematical model for the transformation of normal endosteal cells into malignant tumor cells by α irradiation is applied to ^{224}Ra . The model postulates that a normal endosteal cell near the bone surface is transformed into a malignant cell by three consecutive events. The first two events are the initiation events. The probability of their occurrence is proportional to the absorbed endosteal dose and they generate dormant tumor cells. These dormant tumor cells are promoted by the third event, the promotion event. The probability of this last event is proportional to the rate of bone remodeling but independent of the radiation dose. In competition with these transforming events is the killing of any endosteal cell by α irradiation. Killing is balanced by replacement of killed endosteal cells by normal stem cells. This model provides the following interesting predictions for the human ^{224}Ra cases: after the decay of ^{224}Ra the tumor rate decreases exponentially at a rate proportional to the bone turnover rate; for exposure to the same dose the model predicts an increased number of tumors for protracted exposure (i.e., exposure at a lower dose rate). Implications of this model for the therapy of ankylosing spondylitis are discussed. Statistical procedures are suggested for comparison of this theoretical model with the existing data on the induction of osteosarcomas by ^{224}Ra in man.

- 2257 (CONF-770101--2) NEED FOR COLLECTION OF QUANTITATIVE DISTRIBUTION DATA FOR DOSIMETRY AND METABOLIC MODELING. Lathrop, K.A. (Chicago Univ., Ill. (USA). Dept. of Radiology; Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1976. Contract EY-76-C-02-0069. 8p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on sharing of computer programs and technology in nuclear medicine, computer assisted data processing; Atlanta, GA, USA (16 Jan 1977).

Problems in radiation dose distribution studies in humans are discussed. Data show the effective half-times for ^{7}Be and ^{75}Se in the mouse, rat, monkey, dog, and human show no correlation with weight, body surface, or other readily apparent factor that could be used to equate nonhuman and human data. Another problem sometimes encountered in attempting to extrapolate animal data to humans involves equivalent doses of the radiopharmaceutical. A usual human dose for a radiopharmaceutical is 1 ml or 0.017 mg/kg. The same solution injected into a mouse in a convenient volume of 0.1 ml results in a dose of 4 ml/kg or 240 times that

received by the human. The effect on whole body retention produced by a dose difference of similar magnitude for selenium in the rat shows the retention is at least twice as great with the smaller amount. With the development of methods for the collection of data throughout the body representing the fractional distribution of radioactivity versus time, not only can more realistic dose estimates be made, but also the tools will be provided for the study of physiological and biochemical interrelationships in the intact subject from which compartmental models may be made which have diagnostic significance. The unique requirement for quantitative biologic data needed for calculation of radiation absorbed doses is the same as the unique scientific contribution that nuclear medicine can make, which is the quantitative *in vivo* study of physiologic and biochemical processes. The technique involved is not the same as quantitation of a radionuclide image, but is a step beyond.

- 2258 (FMI--1000-763) RECENT PROGRESS IN CALIFORNIUM-252 DOSIMETRY. Lanzl, L.H.; Rozenfeld, M.; Bednarek, D.; Oswald, R.; Moser, F.; Koch, R.; Mewissen, D.J. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1976. 7p. (CONF-760436--5). Dep. NTIS \$3.50.

From International symposium on californium-252 utilization; Paris, France (26 Apr 1976).

Studies are being conducted on increasing the accuracy of dose determinations in irradiated animals with small implanted tumors. Three experimental methods of *in-phantom* dosimetry are being employed in this work since any one method thus far has not led to a determination of dose to an accuracy within 5 percent at distances close to a source and since each method has distinct advantages for a given problem. Descriptions are given of these methods which are as follows: dosimetry using dielectric ionization chambers; dose contribution from moderated neutrons near a Cf source; and measurement of dose at various locations in a tumor-mouse radiobiological system. (HLW)

- 2259 (FMI--1000-764) ACQUISITION OF QUANTITATIVE BIOLOGIC DATA IN HUMANS FOR RADIATION ABSORBED DOSE ESTIMATES. Lathrop, K.A.; Harper, P.V.; Charleston, D.B.; Atkins, F.B.; Mock, B.H. (Chicago Univ., Ill. (USA)). 1976. 10p. (CONF-760444--7). Dep. NTIS \$3.50.

From Symposium on radiopharmaceutical dosimetry; Oak Ridge, TN, USA (26 Apr 1976).

Guidelines are presented for the collection in humans of quantitative *in vivo* biokinetic data suitable for the estimation of radiation absorbed doses. Technique and instrumentation are discussed. Internal checks built into the procedures are described which assure accountability for 100 percent of the radioactivity. (auth)

- 2260 (INIS-mf--3315, pp 33) CHROMOSOME ANOMALIES IN THE PERIPHERAL BLOOD OF PATIENTS RECEIVING DIAGNOSTIC DOSES OF RADIOACTIVE GOLD. Grigorov, L.A.; Khristova, O.; Yaneva, M. (Vissh Meditsinski Inst., Plovdiv (Bulgaria)). 1976. (In Bulgarian).

From 2. national conference on medical biology and genetics with international participation and symposium on population genetics and demography of hereditary diseases; Varna, Bulgaria (2 Oct 1976).

Second national conference on medical biology and genetics with international

participation and symposium on population genetics and demography of hereditary diseases. Abstracts.

Chromosome analysis of peripheral lymphocytes was carried out in patients injected intravenously for the purpose of hepatic scanning, with 200 to 300 μ Ci of radioactive gold. Control blood samples, taken from each subject prior to radionuclide administration, generally indicated but the presence of isolated chromosome fragments (0.3%). Three hours following ^{198}Au administration, types and amounts of chromosome anomalies were found to be increased over control figures. All patients displayed one-break (5.9%) and two-break (1.7%) aberrations, chromosome fragments (4.8%), acentric and centric rings (0.3%), and dicentric (1.4%). It must be concluded that the above ^{198}Au activities do cause chromosomal damage to peripheral lymphocytes.

- 2261 (LA-UR--76-1718) CALIBRATION PROCEDURES FOR IN-VIVO SODIUM IODIDE SPECTROMETRY OF PLUTONIUM AND AMERICIUM IN THE HUMAN LUNGS. Umbarger, C.J.; Jett, J.H. (Los Alamos Scientific Lab., N.Mex. (USA)). 1976. Contract W-7405-ENG-36. 18p. (CONF-760634--5). Dep. NTIS \$3.50.

From Pacific regional symposium; Seattle, WA, USA (24 Jun 1976).

This paper described the calibration techniques and associated error analysis for the *in-vivo* measurement by NaI spectrometry of heavy elements in the lung of personnel, specifically ^{238}Pu , ^{239}Pu and ^{241}Am . A very brief description of the instrumentation system is included.

- 2262 (LA-UR--76-2097) CESIUM-137 WHOLE-BODY CONTENT IN A NORMAL NEW MEXICO POPULATION. Thomas, R.G.; Richmond, C.R.; Furchner, J.E.; Anderson, E.C. (Los Alamos Scientific Lab., N.Mex. (USA)). 1976. Contract W-7405-ENG-36. 14p. (CONF-761031--5). Dep. NTIS \$3.50.

From 10. midyear symposium for Health Physics Society; New York, NY, USA (11 Oct 1976).

A fairly consistent population of normal New Mexicans has been whole body counted periodically, for almost 20 years. Availability of the same individuals has not always been possible but the size of any group over one counting period has rarely been below 40 individuals. Nanocuries of cesium-137 and grams of potassium have been the primary measurements, the latter determined through potassium-40 counting. The whole-body gamma ray counting has been performed using a large liquid scintillation detector, designed and built at the Los Alamos Scientific Laboratory. The data are generally expressed in terms of picocuries of cesium-137 per gram of body potassium (pCi/gK). Following the peaks of high level atmospheric testing (early to mid-1960s) the levels rose, approaching 120 pCi/gK. For the five year period beginning in 1964 there was a steady decline. During the years of 1969 through 1973 the whole-body levels were essentially constant at approximately 20 pCi/gK. A gradual decline occurred over the next two years, reaching the current level of about 10 pCi/gK. A group of 100 individuals was counted during the summer of 1976 and these data are presented, showing that they follow a normal distribution.

- 2263 (MLM--2347(OP)) SOME RECENT CHANGES IN TRITIUM HANDLING AND CONTROL AT MOUND LABORATORY. Rhinehammer, T.B. (Mound Lab.,

Miamisburg, Ohio (USA)). 1976. Contract EY-76-C-04-0053. 7p. (CONF-7606114--1). Dep. NTIS \$3.50.

From Review of SLL Tritium Research Laboratory; Livermore, CA, USA (22 Jun 1976).

Significant reductions in tritium effluents and personnel exposures at Mound Laboratory have been made during the past 5 yr. Yearly effluents are less than 3 percent of former levels and personnel exposures have been reduced by a factor of 300. Several recent changes which have contributed to these reductions include lowered tritium levels in gloveboxes, and the efficiency and capacity of Mound's new effluent removal system. Personnel exposures have been reduced dramatically by changing to precious metal catalytic converters or oxidizers for use with the glovebox gas purification system. Unlike some former systems using hot copper or proprietary reactants for oxygen removal, a catalyst provides very effective removal of both oxygen and tritium. Both oxygen and tritium can be monitored and, if necessary, increments of hydrogen in argon can be added until the oxygen level is brought down to the desired value.

- 2264 (MLM--2365(OP)) MOUND LABORATORY RESPIRATORY PROTECTION PROGRAM. Wright, E.M. (Mound Lab., Miamisburg, Ohio (USA)). 1976. Contract E(33-1)-GEN-53. 12p. (CONF-760967--1). Dep. NTIS \$3.50.

From Loss prevention conference; St. Louis, MO, USA (27 Sep 1976).

The Mound Laboratory Respiratory Protection Program provides quality assurance to ensure that equipment is approved (U.S. Bureau of Mines) and adequate orientation and training, respirator fitting, maintenance of equipment, and records maintenance.

- 2265 (ORO--2401-87) IN-VIVO EVALUATION OF STANDARD MAN MODEL ABSORBED FRACTIONS USING / SUP 99M/Tc-SULFUR COLLOID. Jones, J.P.; Wagner, J.; Brill, A.B. (Vanderbilt Univ., Nashville, Tenn. (USA). Div. of Nuclear Medicine and Biophysics). 1976. Contract E(40-1)-2401. 8p. (CONF-760444--3). Dep. NTIS \$3.50.

From Symposium on radiopharmaceutical dosimetry; Oak Ridge, TN, USA (26 Apr 1976).

Results are reported from a study performed to check how well the calculated absorbed radiation dose fraction data (S-factors) given in MIRD Pamphlet No. 5 and related reports apply to living patients administered radionuclides. An external target region was defined on the skin of the Snyder-Fisher phantom, anterior to and overlaying the center of the liver. This target was a 5 cm square by 0.089 cm thick slab of LiF, and the S-factors were computed for this target and uniform distributions of /sup 99m/Tc in the liver and spleen. Experimentally, this target was represented by placing thirteen LiF TLD's of the same thickness in a correspondingly positioned 5 cm square area. An experiment performed with the Mr. Adam phantom showed good agreement between the measured (TLD) and calculated (S-factor) doses. In the patient studies, the group of thirteen TLD's was correspondingly positioned, and the measured TLD dose compared to that calculated from the patient cumulated activity and the Snyder-Fisher phantom S-factors. In most cases, these doses agreed to within 30 percent, although larger discrepancies were observed with non-standard sized patients. Based upon these results, it is desirable to make further investigations of this type, especially with lower energy gamma emitters, and the methods of dose and activity measurement used in this

study should be useful unless the photon energy is too low, or the source activity changes rapidly with time. (auth)

- 2266 (UCD--472-123, pp 120-121) DOSE LIMITATIONS TO HUMANS FROM ¹²⁹I. Book, S.A. 1976.

Annual report, fiscal year 1976.

From metabolic data on humans, suppression of thyroidal uptake of ¹²⁹I was predicted, and doses subsequently were calculated. Doses were estimated to be on the order of 7 mrem/nCi ¹²⁹I up to single oral dosages of 1 nCi, declining thereafter. Beyond 10 nCi, the dose/nCi decreased markedly, dropping below 1 mrem/nCi at dosages in excess of 1000 nCi.

- 2267 SURVIVAL, CAUSES OF DEATH, AND ESTIMATED TISSUE DOSES IN A GROUP OF HUMAN BEINGS INJECTED WITH PLUTONIUM. Rowland, R.E. (Argonne National Lab., IL); Durbin, P.W. pp 329-341 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

To determine the relationship between urinary excretion and plutonium body content, 18 patients of short life expectancy were injected with ²³⁹Pu between 1945 and 1947. Seventeen of these 18 individuals have been identified; eight were found to have survived for at least eight years and four are still alive today (1975). The causes of death of 13 of these individuals have been determined from death certificates; none appear to be related to the administered Pu. Doses to the liver and to the cells on the surface of bone were calculated for these Pu cases. The liver doses do not appear to be high enough to be carcinogenic, but comparison of the bone-surface doses with radium doses that have induced bone tumors indicates that six of these cases have received doses high enough to be considered carcinogenic. However, no bone tumors have yet appeared. (auth)

- 2268 ESTIMATED RISK TO HUMAN BONE FROM ²³⁹Pu. Mays, C.W. (Univ. of Utah Coll. of Medicine, Salt Lake City); Spiess, H.; Taylor, G.N. pp 343-362 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The cumulative risk in terms of average skeletal dose from ²³⁹Pu, was tentatively estimated on a linear model to be about 200 bone sarcomas/10⁶ person . rad. This estimate predicts that about 200 cases of bone sarcoma may be induced during the lifetime of 1,000,000 persons each receiving one rad to the skeleton from ²³⁹Pu. The risk estimate is based on the observed incidence of bone sarcomas in German patients receiving long protracted irradiation from repeated injections of 3.62-day ²²⁴Ra, an α-emitter which like ²³⁹Pu decays to a large extent on bone surfaces. Independent support for this risk estimate comes from the fact that it exceeds the bone sarcoma risk from 1600-yr ²²⁶Ra in man by roughly the same factor as the risk from bone-surface seeking ²³⁹Pu exceeds that from bone-volume seeking ²²⁶Ra in experimental animals. The risk estimate is restricted to protracted irradiation from bone-surface seeking α-emitters, such as ²²⁴Ra, ²³⁹Pu, and ²⁴¹Am at cumulative doses not to

exceed a few thousand rad. It should not be used for the bone-volume seekers nor for the β -emitters. The risk estimate must be regarded as provisional and open to future revision. (auth)

2269 PLUTONIUM TOXICOLOGY AND OTHER

TOXICOLOGY. Stannard, J.N. (Univ. of Rochester, New York). pp 363-372 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The acute and chronic toxicity and carcinogenicity of ^{239}Pu are compared with that of a number of chemical poisons, biological toxins, and selected radionuclides. It is concluded that the acute toxicity of Pu is less than that of many other substances but that the long half-life of Pu makes it a potent carcinogen in man. (CH)

2270 MALIGNANCIES IN PATIENTS CONTAMINATED WITH RADIUM. Brues, A.M. (Argonne National Lab., IL). pp 451-455 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The frequency of known radiogenic tumors and other malignancies in relation to mean radiation dose to the skeleton was examined based on clinical and pathologic data obtained from records of those persons (patients and dial painters) whose radium burdens (^{226}Ra) have been measured. This preliminary survey indicates that the total excess of malignant tumors seen in patients receiving 500 rads and above can be accounted for by those of bone and the air cavities of the head. (auth)

2271 CHRONIC RADIUM INTOXICATION: MORPHOLOGY OF BONE AND MARROW INFARCTS. Sharpe, W.D. (Cabrini Health Care Center, New York). pp 457-483 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Using direct and polarized light microscopy and a variety of standard histologic stains, the morphology of two groups of bone and marrow infarcts are compared. One group is from patients whose infarcts can, with confidence, be related to ischemia, trauma, or embolization and whose histories exclude radium ingestion or exposure. The second group is from radium dial painters whose pre-terminal body burdens of ^{226}Ra ranged from 1.67 μCi to some value equal to or below 0.0042 μCi . The individual bone or marrow infarct among the radium cases does not differ radically from those in the ischemia-injury group, although taken as a whole, the radium-related infarcts are marked by less osteogenetic activity, a less prominent blood supply, much less cellular fibrous tissue and more extensive deposits of basophilic bone debris than the ischemia-injury group. (auth)

2272 IMMUNOLOGICAL STUDIES IN THE HUMAN RADIUM POPULATION. Lloyd, E.L.; Menon, M. (Argonne National Lab., IL). pp 485-496 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of

Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Sera from patients carrying high body burdens of radium were evaluated by indirect immunofluorescence for antibodies reactive with tissue culture cell lines derived from five osteosarcomas and one malignant melanoma. These were compared with the sera from normal controls and patients with sarcomas and other malignancies. No significant difference could be detected between the number of reactions seen with the radium patients and the controls. By contrast, cross reactions between sera from all the tumor patients tested were greatly increased over the controls. With one osteosarcoma cell line, RPMI-41, 11 out of 12 of the tumor patients' sera reacted compared with 6 out of 17 for the controls. In addition, 30 out of 32 of the tumor patients' sera reacted with the malignant melanoma cell line compared with only 3 out of 12 for the controls. This suggests that if serum from a radium patient could be shown to cross react with a large number of carefully selected cell lines, the presence of a tumor might be suspected. (auth)

2273 SOME SIMILARITIES OF RADIUM AND PLUTONIUM TOXICITY IN THE BEAGLE AND MAN. Taylor, G.N.; Jee, W.S.S.; Mays, C.W. (Univ. of Utah Coll. of Medicine, Salt Lake City). pp 523-536 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The value of many toxicity studies, involving various experimental animals, is contingent on how reliably the data can be related to man. An equation has been proposed for extrapolating the Pu syndrome from dog studies to man. It employs the extensive human radium experience and a plutonium-radium toxicity ratio in the dog. The validity of this method is contingent on similar target tissues for both Pu and Ra and approximately equal RBE's for Pu relative to Ra in both man and the dog. Thus, although the radiosensitivity might be significantly different, the endpoints within a given tissue in man and the animal model must necessarily be comparative. The degree of parallelism in the radium-induced syndromes of man and the beagle are examined in order to assess the practicability of estimating Pu risk in man through use of a Pu-Ra toxicity ratio in the beagles. (auth)

2274 DOSIMETRY OF ^{239}Pu AND ^{226}Ra IN MAN AND ANIMALS. Spliers, F.W.; Whitwell, J.R. (Cookridge Hospital, Leeds, Eng.). pp 537-552 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Calculations of the absorbed dose rates to the tissues of bone from ^{226}Ra and ^{239}Pu were made on the basis of measured distributions of linear path lengths through the marrow spaces and trabeculae of specimens of human and animal bone (beagle and miniature swine). These show that differences occur, particularly in the dose rates to marrow, between man and animals because of differences in their bone structure. Evidence is presented relating to tumour

occurrence and trabecular surface area that shows the radiosensitivity of the endosteum in cortical bone to be much less than that in trabecular bone. Finally some estimates are made, in terms of dose rates to relevant tissues of the total risk to bone tissues from ^{226}Ra and ^{239}Pu as well as estimates of the consequent maximum permissible body burdens.

2275 PLUTONIUM: A POSSIBLE LEUKAEMIC RISK.

Vaughan, J. (Bone Research Lab., Oxford). pp 691-705 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Information about the retention and pattern of distribution of plutonium in the bone marrow is reviewed together with a summary of experimental and clinical evidence that leukemia or associated blood dyscrasias may occur as a result of a Pu body burden. The importance of thorotrast studies in assessing plutonium hazards is discussed. (auth)

2276 RNA-INSTRUCTED DNA POLYMERASE ACTIVITY

IN RADIATION-INDUCED OSTEOSARCOMAS. Frazier, M.E. (Battelle Pacific Northwest Labs., Richland, WA); Park, J.F.; Jee, W.S.S.; Taylor, G. pp 707-716 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Viruses of the RNA tumor group are etiologic agents of spontaneously occurring neoplastic disease in a number of animal species. These oncornaviruses possess certain biochemical properties which permit them to be easily detected in infected cells, including RNA-instructed DNA polymerase (RIDP) and a closely associated 70S RNA genome in a cytoplasmic particulate fraction having a density of 1.15-1.20 g/ml. Tissues from three dogs with radiation-induced lung tumors and four dogs without tumors did not contain RIDP. However, RIDP was detected in materials prepared from five beagles with radiation-induced osteosarcomas. (auth)

2277 THEORY OF THE INDUCTION OF BONE CANCER

BY ALPHA RADIATION: A SUMMARY. Marshall, J.H.; Groer, P.G. (Argonne National Lab., IL). pp 717-728 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

A theory of the induction of osteosarcoma by alpha particles is summarized. When the postulates of the theory have been written as a set of four differential equations, they have been found to provide acceptable fits to the dose-time-response surface for ^{226}Ra - ^{228}Ra in man and for ^{226}Ra in dogs. That is, the theory appears to fit not only the cumulative incidence as a function of radium intake for man and dog over the whole range of dose, but also the distribution of appearance times of the tumors at each dose level. (auth)

2278 RELATIONSHIP OF LUNG CANCER INDUCTION TO INHALATION OF SUBMICRON PARTICLES, EITHER STABLE OR RADIOACTIVE.

Huth, G.C. (Univ. of

California, Los Angeles); Dugas, D.J. pp 729-750 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

A number of plutonium inhalation experiments with ostensibly conflicting results are actually consistent if interpreted on the basis of the evolving knowledge of tumor immunology. A hypothesis was developed which proposes that lung cancer is induced by the long term inhalation specifically of submicron sized particles. The hypothesis can probably accommodate both radioactive and non-radioactive particles. In the postulated sequence of events, chronically inhaled, submicron particulates, which are in the size range that is known to be cleared through the lymphatic system, act to impede the normal feedback of the lymphatic-immune system to insulated regions of the bronchial tree or lung. Such particulates act as irritants, either in transit through the epithelial layer, in lymph channels, or even transferred to lymph nodes causing a fibrosing response in these reticular tissues which eventually impedes the movement of immunological cells. The carcinogenic insult can then occur from a variety of sources with the resulting tumor lesion growing unimpeded from immune attack. If the particles are radioactive the induction of fibrosis is much enhanced with the additional possibility that the radioactivity furnishes the insult for carcinogenesis. (auth)

2279 CYTOGENETIC EFFECTS OF INTERNAL ALPHA

EMITTERS ON HUMAN LYMPHOCYTES. Hoegerman, S.F. (Argonne National Lab., IL). pp 779-791 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

A review and analysis of several papers on the cytogenetic effects of ^{226}Ra , ^{239}Pu , ^{222}Rn , ^{212}Pb , and Thorotrast (colloidal $^{232}\text{ThO}_2$), is presented. Examples of calculations of the dose to cultured lymphocytes and an overview of attendant practical and statistical problems are given. (auth)

2280 IS THE BODY'S URANIUM THE CAUSE OF

BENDS. Nor. Olje Revy; 2: No. 2, 27(1976). (In Norwegian).

The symptoms of the 'bends' and its more serious forms the 'staggers' and the 'chokes', are briefly described. It has been found that 6% of divers and nearly 19% of others who breathe compressed air are affected by changes in bone structure and density, mostly near the hip, knee and shoulder joints, which may reach a disabling degree. The mechanism of formation of the the bubbles of helium or nitrogen which cause the 'bends', and whose restriction of blood flow is believed to cause the bone deterioration, is uncertain. It is suggested here that the energy required to initiate bubble formation, of the order of several MeV, may come from the spontaneous fission of uranium traces in the body. It is significant that the distribution of uranium in the body is similar to that of the bone deterioration.

2281 EXPOSURE OF THE HANDS TO RADIATION IN HANDLING ^{99}Mo --/SUP ^{99}mTc GENERATORS AND /SUP ^{99}mTc SOLUTIONS.

Husak, V.; Lidova, L.;

Trousil, J.; Kukaska, R. *Med. Radiol.*; 21: No. 11, 33-36(1976). (In Russian).

The article contains the results of monitoring the hand and the finger exposure during the work with ^{99}Mo and $^{99\text{m}}\text{Tc}$ generators and $^{99\text{m}}\text{Tc}$ solutions. For this purpose the film dosimeters as well as thermoluminescent dosimeters LiF having the diameter of 13 mm and thickness of 0.4 mm were used. The approximate formula for the exposure rate on the surface of glass syringes containing radioactive substance is given. A table containing the results obtained allows one to estimate easily the finger exposure of workers of other departments of nuclear medicine. The hand exposure does not exceed the maximum permissible value 75 rem/year. Though the hand exposure is relatively small, still it is necessary to use regularly the protective means.

- 2282 ESTIMATED RISK FROM ^{239}Pu TO HUMAN BONE, LIVER AND LUNG. Mays, C.W. (Utah Univ., Salt Lake City (USA). Radiobiology Div.). pp 373-380 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The cumulative risks to humans, in terms of average organ doses from ^{239}Pu , are tentatively estimated as follows: bone sarcoma risk = 200 bone sarcomas/ 10^6 person.rad; liver cancer risk = 100 liver cancers/ 10^6 person.rad; and lung cancer risk = 200 lung cancers/ 10^6 person.rad. The considerations on which risk estimates are based are discussed for bone, liver and lung. An effort has been made to derive risk estimates that are realistic, rather than too low or too high. However, each of these estimated risks must be regarded as provisional and open to subsequent revision. The proposed risk for lung cancer is especially uncertain, although in rodents the incidence per rad from Pu-induced lung cancers seems somewhat similar to that for Pu-induced bone sarcomas. An inherent complication in each of these estimated risks is to what extent the true dose-responses deviate from the assumed linear relationships. These risk estimates should not be used for organ doses considerably above 1000 rads.

- 2283 EVALUATION OF RADIATION-INDUCED PULMONARY LESIONS BY SPIT AUTORADIOGRAPHY. Paun, C. (Clinical Hospital Fundeni, Bucharest (Romania)); Nicolae, M. (Institutul de Fizica Atomica, Bucharest (Romania)). pp 229-234 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Internal irradiation caused by radionuclides incorporated in pulmonary tissue is guilty of producing two kinds of biological effect: pulmonary fibrosis and carcinogenesis. The role of irradiation in the etheopathogenesis of carcinogenesis should be argued first by proving the presence of contamination radionuclides in pulmon, which is revealed by spit eliminations. To prove the presence of contaminating radionuclides inhaled in pulmon, spit autoradiography was used, representing the only way of showing the presence in pulmon of α - and β -emitting elements. Active elements contained in spit samples were identified by drawing the histograms of the path length of

particles. Contamination was considered significant when the difference between average density of α traces determined on sample and average density of traces on control exceeded two to three times the average fluctuation. In the case of contamination with β -emitting elements, specific autoradiographic images were noticed for accumulations of β activity at cellular level. Spit autoradiography was applied during complex periodic medical examinations of miners working in radioactive ore mines. By means of exhaustive clinical and laboratory examinations, correlations were established between autoradiographic findings and pulmonary radiopathological aspects. At present, methodological improvements are being dealt with to standardize spit smear collecting and processing methods and especially to obtain exact quantitative determinations of pulmonary contamination. In this way it is hoped to establish a dose-effect relation that would be an objective element in considering pulmonary lesions caused by internal irradiation.

- 2284 INFERENCES ON RADIATION CARCINOGENESIS REVEALED BY SELECTED STUDIES IN ANIMALS. Bustad, L.K.; Goldman, M.; Rosenblatt, L. (Washington State Univ., Pullman). pp 13-29 of Biology of radiation carcinogenesis. Yuhas, J.M. (ed.). New York; Raven Press (1976).

From Conference on the biology of radiation carcinogenesis; Gatlinburg, TN, USA (7 Apr 1975).

See CONF-750443--.

Studies of heterogeneous populations of animals with long lives and humans, exposed to various radionuclides and particularly those related to the nuclear energy fuel cycle, are instructive for deriving inferences relative to the cinogenic risk of energy-related radiation. Dose-response curves for various radionuclides [with varying half-lives, qualities of radiation (LET), and metabolic characteristics] provide similarities regardless of the species studied or the tissues at risk. (CH)

- 2285 GROSS DISTRIBUTION OF ^{241}Am IN A MAN SEVEN YEARS AFTER INHALATION. Toohey, R.E.; Essling, M.A. (Argonne National Lab., Ill. (USA)). pp 153-160 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The gross distribution of ^{241}Am remaining in a man seven years after exposure to airborne americium particles has been determined by several techniques. Measurements were made of the radiation with NaI(Tl) crystals, one above and one below the supine subject at seven equally spaced points along the long axis. The patterns obtained indicated skeletal deposition in addition to material in the thorax. More detail was obtained from a longitudinal profile scan made at 10-cm intervals with a slit-collimated detector. A general labelling of the skeleton consistent with bone surface deposition was observed, together with a pronounced increased concentration in the thorax. A transverse profile scan was made at the point which had yielded the highest counting rate in the longitudinal scan. Unequivocal evidence for a lung burden was observed in the asymmetry of this scan. The presence of the long-term lung burden was further confirmed by measurements made over the chest with a gas-filled proportional counter. The ratio of primary quanta in the 60-keV peak to those which had been forward scattered

indicated that the radiation had passed through approximately 5 cm of soft-tissue equivalent absorber. Since estimates of the subject's chest wall thickness were only about 2.5 cm, the major part of the radiation was coming from deeper in the chest, below the level of the rib cage. Therefore the material in the chest was primarily in the lungs and not in the bones of the thoracic cage. The proportional counter also showed that there was little contamination in the liver and spleen. This was expected since the subject had undergone extensive chelation therapy with DTPA at another centre. The whole-body content of ^{241}Am was estimated to be $1.00 \pm 0.03 \mu\text{Ci}$, with about 25% of this amount in the lungs. Thus a sizable fraction of the material retained is still in the lungs after seven years.

- 2286 (ORNL-tr--4247) PROBLEM OF HOT PARTICLES. Jacobi, W. Translated by S.D. Blalock Jr. from *Atomkernenergie*; 28: No. 1, 29-37(1976). 20p. (CONF-7505122--1). Dep. NTIS \$3.50.

From Conference of the medical and biological problems of radiation exposure; Borstel, F.R. Germany (30 May 1975).

Proceeding from an analysis of the dose distribution and the expected cytological effects in the surrounding of hot Pu-particles in the lung, the results of relevant animal experiments and the observations among overexposed Pu-workers are summarized. From these empirical findings no unusual high effectiveness of hot particles for the generation of late effects in the lung can be concluded. On the contrary they indicate that the late effect risk from hot, α -active particles is probably smaller compared with an uniform irradiation of the lung with the same mean dose. Accordingly there is no biological justification of the Tamplin--Cochran-proposal to revise in the case of hot α -active particles the concept of the mean lung dose, as it is currently used in radiation protection.

- 2287 LOW-LEVEL CHRONIC EXPOSURE TO TRITIUM: AN IMPROVED BASIS FOR HAZARD EVALUATION. Dobson, R.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 57-62 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The possibility that significant biological effects may result from chronic low-level exposure to ^3HOH is the main health and environmental concern regarding tritium from nuclear energy operations. Direct data for such exposure are, however, largely still unavailable. Information on chronic irradiation at low levels derives mostly from γ -ray studies, so extrapolations are necessary for tritium. But controversy exists on tritium's relative biological effectiveness (RBE) compared to γ radiation and on the related quality factor (Q) used for radiation protection (recently adjusted downward from 1.7 to 1). A firmer basis for extrapolation is needed. The author has obtained quantitative data for low-level ^3HOH and ^{60}Co γ -ray exposures in the intact mammal. Developing mice were exposed to various doses over 33 days; surviving oocytes were then counted in ovaries and compared with controls, providing dose-response curves for both radiations. By comparing these curves, RBE values were determined. The RBE was found to vary inversely with dose, in accord with the theory of dual

radiation action. At γ -ray doses of 50 rads, the RBE was 1.6. It increased at lower doses, reaching a value of approximately 3. With short exposures, the RBE was lower, due possibly to differences in microdistribution of ^3H . These results demonstrate that conclusions from both high-dose and short-term experiments are likely to underestimate the effects of low-level chronic exposure to ^3HOH . Measurement of the systematic variation of tritium's RBE with dose and recognition of the effect of exposure duration provide a more secure basis for hazard evaluation.

- 2288 BIOLOGY AND TOXIC ACTION OF PLUTONIUM AND TRANSPLUTONIUM ELEMENTS. Nenot, J.C.; Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). *Radioprotection*; 11: No. 3, 165-181(1976). (In French).

From Meeting on toxicity and ecology of plutonium and transplutonium elements; Chatenay-Malabry, France (11 Mar 1976).

A detailed analysis of plutonium and transplutonium elements is made both in the case of inhalation and contaminated wounds, and the various therapeutic procedures are given. The present state of knowledge on the toxicity of plutonium is discussed as well as the specific problems of hot spots and the mechanism of the effect of low level doses. Finally, the approach to the setting of safety standards and the methods of workers surveillance are presented.

- 2289 (ERDA-tr--222, pp 115-119) QUESTION OF EXTRAPOLATION TO MAN OF BEHAVIOR PATTERNS OF STRONTIUM-90 IN THE ANIMAL ORGANISM. Sarapul'tsev, I.A.; Rasin, I.M.; Panchenko, I.Ya. 1976. Translated from *Radiobiologiya*; 16: No. 3, 417-420(1976).

Radiobiology. A comparison was made of patterns of metabolism of radiostrontium obtained in dogs to analogous data in man. It was established that they are identical, and this permits direct extrapolation of radiation loads of radiostrontium from dogs to man.

- 2290 THYROID CANCER. CLINICAL ASPECTS OF TRH/TSH/T₃ INTERACTIONS. Piers, D.A. Groningen, Netherlands; Rijksuniversiteit, Netherlands (1976). 121p. (In Dutch). INIS.

Available from Library KNAW, Kloveniersburgwal 29, Amsterdam, Netherlands; 447 refs., 29 figs., 30 tables; with summary in English; Thesis.

The role of ionizing radiation in the introduction of thyroid carcinoma is discussed. In the treatment of thyroid cancer, radioiodine administration is of value as an ablation procedure, completing the thyroidectomy and as a method to irradiate selectively functioning thyroid carcinoma tissue that cannot be removed surgically. Results of the clinical management of 155 patients with malignant thyroid tumours are presented. The ablation dose of iodine-131 can be decreased to 40 millicuries thus effectively reducing the patients whole body radiation dose.

- 2291 NUCLEAR POWER. *Radiol. Technol.*; 48: No. 2, 176-178(1976).

It is assumed that nuclear capacity in the United States will increase from 6,000 megawatts in 1970 to 800,000 megawatts in 2000. There is a postulated 25-fold increase in uranium mining and milling and a 15-fold increase in fuel fabrication facilities. The primary problem in uranium mines is radon-222

and its short-lived daughters. Radium-226 and its decay products constitute the hazard from uranium mills and fabrication plants. The location of uranium mills in sparsely populated areas and the appropriate control of tailings and liquid wastes can prevent population exposures from this source. The important stack discharges from reactors are radionuclides of noble gases in the elemental form, tritium as water vapor, and iodine in a variety of forms. Sources of contamination from liquid metal fast breeder reactors are isotopes of Pu and Na. Estimated dose rates from power reactor effluents are discussed and hazards from reactor accidents are considered. (HLW)

- 2292 EXAMPLES OF MICRODOSIMETRIC PROBLEMS IN RADIATION PROTECTION: TRITIUM AND PLUTONIUM. Metalli, P. Radiat. Alta Energ.; 182-203(1976). (In Italian).

A short review is presented on the biological bases of the theory of microdosimetry, pointing out both the advantages of this modern approach for the understanding of radiation action, and its limitations with regard to practical applications. Two examples of extreme non-uniformity of energy deposition in living tissue are then briefly discussed, which are of some interest for radiation protection: the internal contamination by tritium and by plutonium deposition at the bone surfaces.

- 2293 MULTIPLE EXTERNAL-INTERNAL RESORPTIONS AS LATE EFFECTS OF THORIUM X (^{22}Ra).

Reichart, P.; Eckhardt, W.; Reznik, G. (Medizinische Hochschule Hannover (Germany, F.R.)). J. Oral Pathol.; 5: 52-59(1976).

Multiple external-internal resorptions are infrequent and are related to a variety of etiological factors. Thorium X (^{22}Ra) is believed to cause the dental resorptive changes observed in two patients who had received a series of injections each containing 8 to 70 μCi of ^{22}Ra 25 years previously.

- 2294 LEGAL ADMISSIBILITY OF EXPERIMENTS WITH RADIOACTIVE DRUGS, INCLUDING RADIOACTIVELY LABELLED DRUGS. Pabel, H. (Bundesministerium fuer Jugend, Familie und Gesundheit, Bonn-Bad Godesberg (Germany, F.R.)). pp 196-199 of Risk of hazards due to radiation exposure in medicine. Radiation protection in aeronautics and astronautics. Gremmel, H. Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

Short communication only.

GERMAN FEDERAL REPUBLIC;LEGAL ASPECTS; RADIOPHARMACEUTICALS;TESTING

- 2295 ALLOWED HEALTH RISK FOR PLUTONIUM AND AMERICIUM STANDARDS AS COMPARED WITH STANDARDS FOR PENETRATING RADIATION. Ellett, W.H.; Nelson, N.S.; Mills, W.A. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). pp 587-600 of Transuranium nuclides in the environment. Vienna; IAEA (1976).

From Symposium on transuranium nuclides in the environment; San Francisco, Calif., USA (17 Nov 1975).

Estimates of excess cancer mortality, based on the linear non-threshold hypothesis and calculated by means of the absolute risk estimates in the NAS-BEIR Report, are given for a number of current occupational limits. These include continuous whole-body exposure to adults, age 20 to 65 at 5rad/a from external

low LET radiation and skeletal body burdens for 45 years at the critical organ limits given by ICRP Committee II for ^{226}Ra and ^{239}Pu . The estimated cancer mortality for these three situations differs by a factor of 8. Additional mortality estimates are made for americium and curium isotopes and for the case of continuous ingestion. These estimates include the cancer risk to liver as estimated from the excess mortality observed in persons containing large thorotrast burdens and newer estimates of the relative damage factor for radionuclides deposited on bone surfaces. For all the transuranics studied the estimated excess mortality due to liver cancer is a major risk and often the largest.

- 2296 (AED-Conf--76-430-005) REPORTS ON THE NEUHERBERG LONG-TERM EXPERIMENTS WITH SHORT-LIVED α -EMITTERS. I. THE DEPENDENCE OF LATE EFFECTS IN MICE ON THE TEMPORAL DISTRIBUTION OF SKELETAL α -DOSES FROM ^{22}Ra AND ^{227}Th . Erfle, V.; Goessner, W.; Hug, G.; Marquart, K.H.; Mueller, W.A.; Luz, A. (Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Eggenstein-Leopoldshafen (Germany, F.R.)). 1976. 3p. (CONF-760992--4). NTIS (US Sales Only).

From 2. international symposium on biological effects of Ra-224; Neuherberg/Muenchen, F.R. Germany (20 Sep 1976).

Short communication only.

CARCINOGENESIS;DELAYED RADIATION EFFECTS; DOSIMETRY;INJECTION;MICE;OSTEOSARCOMAS; RADIATION DOSE DISTRIBUTIONS;RADIUM 224; SKELETON;THORIUM 227;TIME DEPENDENCE

- 2297 (AED-Conf--76-430-007) REPORTS ON THE NEUHERBERG LONG-TERM EXPERIMENTS WITH SHORT-LIVED α -EMITTERS. III. THE EXPRESSION OF RNA TUMOR VIRUSES IN ^{22}Ra -INDUCED OSTEOSARCOMAS. Erfle, V.; Goessner, W.; Hug, G.; Luz, A.; Marquart, K.H.; Mueller, W.A. (Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Eggenstein-Leopoldshafen (Germany, F.R.)). 1976. 2p. (CONF-760992--6). NTIS (US Sales Only).

From 2. international symposium on biological effects of Ra-224; Neuherberg/Muenchen, F.R. Germany (20 Sep 1976).

Short communication only.

CARCINOGENESIS;ELECTRON MICROSCOPY;MICE; ONCOGENIC VIRUSES;OSTEOSARCOMAS;RADIUM 224; RADIOINDUCTION

- 2298 (AED-Conf--76-430-012) LATE EFFECTS AND RISKS OF SHORT-LIVED ALPHA-EMITTING BONE SEEKERS. ANIMAL EXPERIMENTS. Kofranek, V.; Dvorak, V.; Klener, V.; Malatova, I.; Sedlak, A.; Thomas, J.; Bubenikova, D.; Svoboda, V.; Onyskova, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni). 1976. 1p. (CONF-760992--7). NTIS (US Sales Only).

From 2. international symposium on biological effects of Ra-224; Neuherberg/Muenchen, F.R. Germany (20 Sep 1976).

Short communication only.

BIOLOGICAL LOCALIZATION;BONE SEEKERS; CARCINOGENESIS;DELAYED RADIATION EFFECTS; INJECTION;MICE;OSTEOSARCOMAS;RADIATION DOSE DISTRIBUTIONS;RADIATION HAZARDS;RADIUM 224; RADIUM 226;SKELETON;TOXICITY

- 2299 (AED-Conf--76-430-014) BONE SARCOMA RISKS TO MAN FROM ^{22}Ra , ^{226}Ra , AND ^{239}Pu . Mays, C.W.; Spiess, H. (Utah Univ., Salt Lake City (USA). Radiobiology Div.). 1976. 2p. (CONF-760992--8). NTIS (US Sales Only).

From 2. international symposium on

biological effects of Ra-224; Neuherberg/
Muenchen, F.R. Germany (20 Sep 1976).

Short communication only.

BEAGLES; CARCINOGENESIS; DELAYED RADIATION
EFFECTS; FRACTIONATED IRRADIATION; INTERNAL
IRRADIATION; MAN; OSTEOSARCOMAS; PLUTONIUM 239;
RADIATION DOSES; RADIATION HAZARDS; RADIOTHERAPY;
RADIUM 224; RADIUM 226; RADIOINDUCTION; SKELETON

- 2300 (ANL--76-88(Pt.2), pp 12-16) ELECTRON
MICROSCOPE STUDIES OF VIRUSES IN TUMORS INDUCED
BY ^{239}Pu IN MICE. Lloyd, E.L.; Loutit, J.F.
1976.

Radiological and Environmental Research
Division annual report, July 1975--June 1976.

Tumors induced by the intraperitoneal
injection of 100 nCi, 30 nCi, and 10 nCi of
 ^{239}Pu -citrate into male and female CBA mice
were examined with the electron microscope for
the presence of viruses. The tumors examined
included 14 osteosarcomas, 2 lymphomas, 1
carcinoma, 1 haemangiosarcoma, and 1 reticulum-
cell sarcoma. C-type viruses were positively
identified in all the tumors examined with the
exception of 3. In one of the exceptions, a
lymphoma in a lymph node, suspicious virus-like
particles were observed; in the other two, an
osteosarcoma and a carcinoma of the lung from
the same animal, there was no evidence of viral
particles. In addition, no viruses could be
detected in three samples of normal tissue.
Despite the presence of virus in tumor and not
in normal tissue, evidence from ongoing
research is presented to suggest that the virus
is merely a passenger.

- 2301 (COO--2506-2) BIOLOGICAL EFFECTS OF
IMPLANTED NUCLEAR ENERGY SOURCES FOR ARTIFICIAL
HEART DEVICES. PROGRESS REPORT, SEPTEMBER 1,
1975--AUGUST 31, 1976. Kallfelz, F.A.;
Wentworth, R.A.; Cady, K.B. (New York State
Coll. of Veterinary Medicine, Ithaca (USA).
Dept. of Physical Biology). 1976. Contract
E(11-1)-2506. 62p. Dep. NTIS \$4.50.

A total of sixty dogs were implanted with
radioisotope-powered artificial heart systems
producing radiation fluxes similar to that of
plutonium-238, but having no associated heat,
at levels of from one to seventy times the
radiation flux expected from a 30-watt
plutonium-238 source. Results from studies
lasting up to 6 years after implantation
indicate that these animals, and by inference
human beings, may be able to tolerate the
radiation flux from 30-watt ^{238}Pu power
sources. Results of heat dissipation studies in
calves indicate that it may be possible to
induce a vascularized connective tissue capsule
sufficient to dissipate 30 watts of additional
heat from a surface area of approximately 500
cm sq., allowing a heat flux of 0.06 watts per
cm sq.

- 2302 (INIS-mf--3305, pp 65-67) COMPARISON
OF THE CARCINOGENICITY OF ^{131}I AND ^{125}I IN THE
THYROID GLAND OF THE RAT. de Ruiter, J.;
Hollander, C.F.; Boorman, G.A.; Hennemann, G.;
Docter, R.; van Putten, L.M. 1976.

Published in summary form only; 3 refs., 1
fig..

REP annual report 1975.

CARCINOGENESIS; COMPARATIVE EVALUATIONS;
HYPERTHYROIDISM; IODINE 125; IODINE 131; NEOPLASMS;
QUANTITY RATIO; RADIATION DOSES; RATS; THYROID;
BIOLOGICAL RADIATION EFFECTS

- 2303 (INIS-mf--3315, pp 41) MOUSE COCYTE
RESPONSE TO INTERNAL PHOSPHORUS-32: A
HISTOLOGIC STUDY. Kusheva, R.; Baev, I.
(Nauchno-Izslodovatel'ski Inst. po Radiologiya i

Radiatsionna, Khigiena, Sofia (Bulgaria)).
1976. (In Bulgarian).

From 2. national conference on medical
biology and genetics with international
participation and symposium on population
genetics and demography of hereditary diseases;
Varna, Bulgaria (2 Oct 1976).

Second national conference on medical
biology and genetics with international
participation and symposium on population
genetics and demography of hereditary diseases.
Abstracts.

Histologic changes in oocytes following
intraperitoneal injection of 0, 10, 25, or 50
 μCi phosphorus 32 per mouse were studied. Time
course of the response was followed by scoring
the number of primordial follicles present on
days 30, 60, and 90 postadministration. The
amounts of primordial follicles definitely
diminished with increase in phosphorus 32
activity (increase in ovarian dose) and with
length of time after administration. Complete
destruction of oocytes was observed two months
after injection of 50 μCi of phosphorus 32.

- 2304 (INIS-mf--3515, pp 29) DOMINANT
LETHALS FOLLOWING ADMINISTRATION OF TRITIUM
(THO) TO RAT MALES. Yagova, A.; Baev, I.;
Bairakova, A. (Nauchno-Izslodovatel'ski Inst. po
Radiologiya i Radiatsionna Khigiena, Sofia
(Bulgaria)). 1976. (In Bulgarian).

From 2. national conference on medical
biology and genetics with international
participation and symposium on population
genetics and demography of hereditary diseases;
Varna, Bulgaria (2 Oct 1976).

Second national conference on medical
biology and genetics with international
participation and symposium on population
genetics and demography of hereditary diseases.
Abstracts.

Adult rat males were given a single
intraperitoneal tritium (THO) injection at 0.01
or 0.001 mCi/g body weight (1/100 or 1/1000 of
LD₅₀(50/30), respectively). Twelve days after
treatment each male was mated to 3 to 5 intact
females, and the latter were replaced by fresh
ones every 12 following days over a 120-day
period. Mated females were killed to score
conceptions, corpora lutea, and live and dead
embryos. Estimations were made of F₁ prenatal
death rate (according to Bateman, 1958) and the
frequency of induction of dominant lethal
mutations (according to Roehrborn, 1970). The
results observed indicated paternal exposure to
tritium (THO) to produce dominant lethals both
in pre- and post-meiotic germ cells in the rat.
The extent of the genetic damage studied was
found to depend on the amount of activity
administered as well as on the time interval
between treatment and conception.

- 2305 (ORO--1643-126) STUDIES IN IODINE
METABOLISM. PROGRESS REPORT, APRIL 1975--
MARCH 1976. Van Middlesworth, L. (Tennessee
Univ., Memphis (USA). Dept. of Physiology and
Biophysics). 1976. Contract AT(40-1)-1643.
38p. Dep. NTIS \$4.00.

Investigations during the past twelve months
have included the following subjects: factors
which influence release of radioiodine from
thyroid glands; contamination of commercially
available low-iodine diets; effects of hypoxia
on release of iodine from thyroid glands of
rats and mice; development of practical tests
for available iodine in low-iodine diets;
reproduction and abnormal thyroglobulin of rats
maintained on low-iodine diets; observations on
radioactivity in animal thyroids; collaboration
with other laboratories regarding radium in
bovine thyroids.

- 2306 (UCD--472-123, pp 85-86) IMMUNE COMPETENCE OF ^{226}Ra -INJECTED DOGS AND AGE-MATCHED CONTROLS AS MEASURED BY THE MICRO-LYMPHOCYTE STIMULATION TEST. Shifrine, M.; Taylor, N.J.; DeRock, E.W.; Worthington, B.M. 1976.

Annual report, fiscal year 1976.

The micro-lymphocyte stimulation test was used to evaluate the immune competence of ^{226}Ra -injected dogs and normal age-matched controls. Ability of lymphocytes to divide was significantly reduced in tumor-bearing ^{226}Ra -injected dogs, and possibly reduced in the oldest ^{226}Ra -injected dogs. The test showed large variability in the oldest normal dogs tested (12.4 to 12.7 yrs old).

- 2307 (UCD--472-123, pp 90-93) CLINICAL CASE LOAD FOR RADIONUCLIDE-TREATED BEAGLES, CALENDAR YEAR 1975. Holbrook, C.H.; MacMillan, K.L.; Maslowski, S.F.; Muggli, F.M. 1976.

Annual report, fiscal year 1976.

Medical and surgical cases among the approximately 500 surviving beagles of the $^{226}\text{Ra}/^{90}\text{Sr}$ internal irradiation study are categorized on the basis of body system involved. The substantial increase in case load that occurred during calendar year 1975 (while mortality rates remained stable) is attributed primarily to an increase in spontaneous, rather than radiation-induced, disease conditions in the aging (8 to 15 years old) beagles.

- 2308 (UCD--472-123, pp 94-103) CUMULATIVE MORTALITY IN RADIONUCLIDE TREATED BEAGLES. Crisp, C.E.; Pool, R.R.; Spangler, W.; Goldman, M.; Rosenblatt, L.; Wolf, H.G. 1976.

Annual report, fiscal year 1976.

The first osteosarcoma in the ^{90}Sr injected dose was seen and late occurring myeloproliferative diseases were also seen. Non-radiation induced malignant tumors are assuming increased importance as the colony ages.

- 2309 (UCD--472-123, pp 116-117) METABOLISM OF ^{129}I IN YOUNG BEAGLES. Book, S.A.; McNeill, D.A. 1976.

Annual report, fiscal year 1976.

Iodine-129 was administered orally to young beagles. As the dosage increased, ^{129}I thyroid uptake and whole-body retention decreased, thereby limiting the radiologic risk associated with assimilation of this long-lived radionuclide.

- 2310 INFLUENCE OF AGE AND PHYSICOCHEMICAL FORM ON THE EFFECTS OF ^{239}Pu ON THE SKELETON OF THE RAT. Sikov, M.R.; Mahlum, D.D. (Battelle Pacific Northwest Labs., Richland, WA). pp 33-47 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The distribution, retention, and acute toxicity of the monomeric and polymeric forms of ^{239}Pu were earlier shown to be different in adult, weanling, and newborn rats. The femurs of rats from this series, which had been injected intravenously with doses of monomeric or polymeric ^{239}Pu over the range of 6-90 $\mu\text{Ci/kg}$, were studied at intervals through nine months postexposure to investigate the response of the skeleton relative to age. The dose rates to the femur were initially similar in the three age groups, but there was increasing divergence with time. Study of autoradiographs

suggested that periosteal deposition of activity was greater in the weanlings than in adults and newborns. Gross lesions of the skeleton, including pathologic fracture and abnormal healing, were observed in the rats exposed as weanlings. Bone strength was inversely related to radiation dose in the adults and weanlings although chemical composition was altered only at the highest doses. Histologic changes of bone, including exostosis, necrosis, and epiphyseal abnormalities, were most marked in the weanlings injected with monomer, less in the adults, and least in the newborns. (auth)

- 2311 INFLUENCE OF TEMPORAL DISTRIBUTION OF ALPHA DOSE IN BONE TUMOR INDUCTION. Mahlum, D.D. (Energy Research and Development Administration, Washington, DC); Sikov, M.R.; Hungate, F.P. pp 49-56 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Studies in which adult and weanling rats were intravenously injected with ^{239}Pu or ^{253}Es resulted in overlapping ranges of radiation doses to the skeleton. Comparison of the results has provided some insight into the carcinogenicity of that fraction of an alpha dose delivered at low dose rates during long periods after exposure relative to that delivered at higher rates at early times. Approximately 60 percent of the radiation dose to the adult from ^{253}Es , but only 5 percent of the dose from ^{239}Pu , was delivered within 30 days post-injection. The weanlings incurred a substantially greater fraction of the radiation dose from ^{239}Pu during the first month after injection (about $1/3$); the time distribution of dose from ^{253}Es was similar to the adults. The incidence of bone tumors among the rats that received the two higher doses of ^{239}Pu as adults was elevated and was higher than the incidence in adults that received equivalent cumulative radiation doses from ^{253}Es . The incidences of bone tumors among the weanlings that received ^{239}Pu were also greater than in those receiving comparable radiation doses from ^{253}Es . Direct comparisons of these results are complicated by differences in the microscopic distribution of dose. They nevertheless suggest that the initial radiation dose is less important in the induction of bone tumors than the dose delivered at a lower rate over a longer period of time. (auth)

- 2312 INDUCTION OF OSTEOGENIC SARCOMA BY POLYMERIC PLUTONIUM ($^{239}\text{Pu(IV)}$) IN BEAGLES. Stevens, W. (Univ. of Utah, Salt Lake City); Atherton, D.R.; Jee, W.S.S.; Buster, D.S.; Grube, B.J.; Bruenger, F.W.; Lindenbaum, A. pp 81-95 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Previous studies have demonstrated that a single I.V. injection of $^{239}\text{Pu(IV)}$ in monomeric form (Pu-Cit) will induce osteogenic sarcomas in beagles. The latent period for tumor induction decreased as the injected dose increased from 0.016 to 0.9 $\mu\text{Ci/kg}$ $^{239}\text{Pu(IV)}$. The effect of the chemical form of the injected ^{239}Pu on its distribution within the dogs was studied. Two dogs were injected with 0.9 $\mu\text{Ci/kg}$ of polymeric ^{239}Pu (Pu-P) for lifespan studies. Both of those dogs developed osteogenic

sarcomas with latent periods somewhat less than those observed in animals which received 0.9 $\mu\text{Ci } ^{239}\text{Pu/kg}$ of monomeric plutonium. The fraction of the injected polymeric plutonium retained in the skeleton increased from 2.2 percent at 14 days post injection to 24.4 percent at death (1166 days average). Plutonium retention in organs with a high percentage of mononuclear phagocytes showed a significant loss of Pu-P from these organs during this period. Dose calculations indicate that the slow release of Pu, primarily from the liver, and the subsequent protracted and continuous deposition of the nuclide on the skeletal surfaces was much more efficient in producing osteogenic sarcoma than the deposition resulting from a single injection of monomeric Pu. (auth)

- 2313 IRRADIATION OF THE LUNG WITH STATIC PLUTONIUM MICROEMBOLI. Holland, L.M.; Prine, J.R.; Smith, D.M.; Anderson, E.C. (Los Alamos Scientific Lab., NM). pp 127-138 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Syrian hamsters were exposed to selected lung burdens of ^{238}Pu or ^{239}Pu contained in 10 μm diameter microspheres of ZrO_2 ceramic. After injection into the jugular vein, the microspheres lodge in the lung capillaries and remain immobile throughout the lifetime of the animal. The specific activity of the microspheres varied from 0.22 to 59 pCi/sphere, and the lung burdens achieved varied from 0.44 to 354 nCi. The distribution in the lung was essentially random except in the groups receiving high numbers of spheres. Since entrapment in the lung approached 100 percent, there was essentially none of the involvement of other organs seen with inhalation methods. Hamsters were also exposed intratracheally to ^{210}Po to compare the results from an experiment in which other organs are involved and in which a high tumor yield may be anticipated. Tumor production in the microemboli experiment was quite low, and the overall damage to the lung was minimal in comparison to the intratracheal experiments with ^{210}Po or with published data from aerosol experiments. (auth)

- 2314 EARLY PATTERNS OF PULMONARY CELLULAR RESPONSE IN SYRIAN HAMSTERS FOLLOWING PLUTONIUM INHALATION. Slauson, D.O.; Hobbs, C.H.; Mewhinney, J.A.; Miglio, J.J.; McClellan, R.O. (Inhalation Toxicology Research Inst., Albuquerque, NM). pp 139-159 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Syrian hamsters were exposed as young adults (84 days of age) to aerosols of $^{239}\text{PuO}_2$ to obtain graded initial lung burdens (ILB) which ranged from levels calculated to result in early deaths from radiation pneumonitis and pulmonary fibrosis down to a level equivalent on a body weight basis to the currently accepted maximum permissible lung burden for man. The activity median aerodynamic diameter of the aerosol was 2.0 μm with a geometric standard deviation of 1.5. Early patterns of pulmonary cellular response are reported for 37 hamsters in the group that had the highest lung burdens (380 nCi, geometric mean) and survived

for 66 to 279 days with a mean survival of 95 days. All of these animals exhibited marked pulmonary inflammatory changes at death. (auth)

- 2315 PULMONARY LESIONS INDUCED BY INHALED PLUTONIUM IN BEAGLES. Dagle, G.E.; Lund, J.E.; Park, J.F. (Battelle Pacific Northwest Labs., Richland, WA). pp 161-167 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The histopathologic features of pulmonary fibrosis and bronchiolo-alveolar carcinoma in beagles exposed to aerosols of ^{238}Pu or ^{239}Pu oxide are reviewed. A hypothesis of the pathogenesis of radiation pneumonitis induced by inhalation of plutonium oxide is presented; this hypothesis included phagocytosis of Pu particles, fibrosis responding to the necrosis, and alveolar cell hyperplasia compensating for alveolar cells killed by alpha radiation. Histopathologic features of the epithelial changes suggest a progression from hyperplasia to metaplasia and, finally, to bronchiolo-alveolar carcinoma. The possibility of concurrent radiation-induced lymphopenia contributing to the development of bronchiolo-alveolar carcinoma through a loss of immunologic surveillance is discussed. (auth)

- 2316 RADIATION INDUCED SKELETAL CHANGES IN BEAGLE: DOSE RATES, DOSE, AND AGE EFFECT ANALYSIS FROM ^{226}Ra . Momeni, M.H. (Univ. of California, Davis); Williams, J.R.; Rosenblatt, L.S. pp 389-408 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Radiation-induced skeletal injury (E) and the rate of skeletal injury were studied as a function of time and dose in beagles administered $^{226}\text{Ra Cl}_2$ in eight semimonthly iv injections starting at 2, 4, or 14 months of age. Skeletal changes were evaluated with a radiographic x-ray scoring system in 20 skeletal regions; each region was scored on a 0 to 6 scale. Bone changes in six regions of humeri were qualitatively analyzed for comparison with total skeletal changes. Skeletal changes were classified by endosteal or periosteal cortical sclerosis and thickening, fractures, osteolytic lesions, and trabecular coarsening. (auth)

- 2317 PATHOLOGY OF TUMORS INDUCED IN HARWELL MICE BY ^{239}Pu AND ^{226}Ra . Loutit, J.F.; Sansom, J.; Carr, T.E.F. (Medical Research Council, Harwell, Eng.). pp 505-521 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Single intraperitoneal doses of ^{226}Ra and ^{239}Pu solutions given to Harwell-strain mice, produced mainly osteosarcoma. C3H mice were sensitive and CBA mice more resistant to ^{226}Ra . Plutonium-239 caused additionally lymphoma in CBA and possibly an increase in miscellaneous malignancies. The histology suggests that Ra and Pu produce osteosarcoma in areas of accentuated bone turnover in cortical bone. (auth)

2318 ACTINIDE CARCINOGENESIS: A DIRECT OR AN INDIRECT RADIATION EFFECT. Taylor, D.M. (Inst. of Cancer Research, Surrey, Eng.). pp 681-690 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The passage of an alpha-particle through a cell nucleus is likely to produce such intense ionization that the resultant damage to the genetic structure of the cell will be lethal. Thus direct nuclear irradiation by alpha particles appears unlikely to be the primary event in the initiation of a malignant neoplasm. Plutonium-239, and the actinide elements in general, deposit in lysosomal structures within cells and in liver and testes cells the deposition of ^{239}Pu has been shown to cause release of lysosomal enzymes into the cytosol. It is suggested that the release of lysosomal enzymes, including acid deoxyribonuclease, into the cytosol can produce chromosomal damage and may be key events in the initiation and development of tumours by ^{239}Pu and other alpha-particle emitting radionuclides. (auth)

2319 DOMINANT LETHAL TESTS OF MALE MICE GIVEN ^{239}Pu SALT INJECTIONS. Luening, K.G.; Froelen, H.; Nilsson, A. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). pp 39-48 of Biological and environmental effects of low-level radiation. Vol 1. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

To study the possible genetic effects of ^{239}Pu manifesting in dominant lethals, five test series (E1-E5) were performed. Males from an inbred CBA strain were given ^{239}Pu salt injections intravenously and mated weekly to 3 CBA females each for 12 to 24 weeks. Some interruptions in the mating scheme were made. For the first two test series (E1, E2) ^{239}Pu nitrate solution and ^{239}Pu citrate, used in E3-E5, were prepared. The solution was millipore filtered just prior to injection. Among a total of 10255 implants sired by males given Pu-nitrate in E1 and E2 no significant excess of intra-uterine death relative to 7216 control implants occurred. Test series E3-E5 with 60 males each, used three groups of 20, with one control group. In E3, 0.5 μCi and 0.1 μCi were given per male/group, respectively; in E4 and E5, 0.25 μCi and 0.05 μCi , respectively. The males given 0.5 μCi in E3 became successively sterile from the 7th week. The results in E3-E5 point in the same direction with significant excess of intra-uterine death in E3 and E5. In E4 the females from matings from the 9th, 14th and 16th week, and in E5 females from the 9th week, were allowed to litter to give F_1 offspring. Dominant lethal tests of F_1 males gave concordant results in all four samples, showing significantly excessive death in offspring to F_1 males whose fathers had received Pu. The excessive death was evenly distributed and did not indicate the presence of semisterile F_1 males. In tests of Pu-injected males and of F_1 males a remarkable excess of death in late stages of foetal development was observed. Such effects had never before been observed in this CBA strain in tests of extrinsic and intrinsic exposure to ionizing irradiation.

2320 PATHOLOGICAL ANATOMY, ETIOLOGY AND PATHOGENESIS OF DELAYED AFTEREFFECTS OF EXPOSURE TO RADIOACTIVE DUST. Likhachev, Yu.P. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Gigieny Truda i Professional'nykh Zabollevaniy). Arkh. Patol.; 38: No. 4, 18-26(1976). (In Russian).

Thorium (Th) is one of the widely spread radioactive substances in nature, and together with other aerosols it can penetrate into the organism. The article considers relationships between various histological forms of neoplasms induced by a radioactive dust agent containing Th and the rate of this etiological factor (total body dose and its rate). In experiments with 3000 white rats a 150 rad dose accumulated in the lungs during 15-21 months has lead to an increase in the number of cases of reticulosarcoma, a 300 rad dose produces no such effects. Doses as high as 1000 to 2700 rad brings about multicentric adenomas and glandular cancerous tumours against the background of pneumocirrhosis. But no reticulosarcomas of the lung have been noticed. Adenocarcinomas and squamous-cell carcinomas are distributed most often in the neighbourhood of accumulated radioactive dusts. The question is raised about the need of taking into account the microdistribution of energy in the lung tissue in exposure to α -active aerosols with subsequent microdosimetry; due account also should be made of detailed registration of forms of tumours and degree of their malignancy, which is not also observed by researchers in radiobiological investigations.

2321 GENETIC AND HAEMATOPOIETIC EFFECTS OF LONG-TERM TRITIATED WATER INGESTION IN MICE. Carsten, A.L.; Cronkite, E.P. (Brookhaven National Lab., Upton, N.Y. (USA)). pp 51-55 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The effect of large amounts of tritiated water (HTO) from reactors on the environment is evaluated. Randomly bred mice of the Hale-Stoner-Brookhaven strain have been maintained on HTO (3 $\mu\text{Ci}/\text{ml}$ itre) for extended periods. First-generation animals on HTO from four weeks of age have been evaluated for changes in growth pattern, and second-generation animals (also on HTO) for breeding efficiency, dominant lethal mutation rate and bone-marrow integrity. A total of 18831 embryos were examined. Statistical analysis of these results using either Student's 't' test or Kruskal and Wallis rank test indicates that there was a significant ($p < 0.01$) reduction in viable embryos and an increase in early deaths in matings involving animals drinking HTO. Beginning at eight weeks of age and monthly thereafter, the haematopoietic stem cell content of the bone marrow was determined using the exogenous spleen colony technique. Although the total cellularity of the bone marrow remains comparable in the control and treated groups, the total number of stem cells (CFU) was reduced beginning after approximately 12-20 weeks on the tritium regime. These findings indicate a reduction in the total number of pluripotent stem cells in the marrow together with the ability of this reduced number of cells to maintain normal levels of total cellularity in the bone marrow. Thus, continuous ingestion of HTO at a concentration of 3 $\mu\text{Ci}/\text{ml}$ itre by mice results in: (1) Reduction in number of viable embryos present in the female at late pregnancy from matings when either the female or both parents have

been on HTO; (2) Increase in number of early post-implantation deaths when both parents are on HTO; (3) Reduction in bone-marrow stem cell content after 12 weeks or longer on HTO; (4) No apparent effect on breeding efficiency (percentage of females pregnant) or body weight. These results are discussed in relation to the accumulated radiation dose.

OF CARRIER. Skupinski, W.; Masse, R.; Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 35-44 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976). (In French)

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Studies were undertaken to compare the toxic action of inhaled β - and α -emitters. About a hundred rats were contaminated by inhalation of acidic ^{144}Ce chloride. The initial activities ranged from 0.5 μCi to 10 μCi , so that the rats were subjected to doses of 500-5000 rads. It was observed that, depending on the dose, the life span of the animals was shortened and some ten lung cancers appeared in the animals which had received the highest doses. In another experiment, the activation product ^{141}Ce is inhaled in oxide or chloride form, the doses ranging from 50 rads to 2000 rads. Other animals inhaled stable cerium oxide. Lung cancers have already been observed in the animals which inhaled ^{141}Ce . The locations and histological types of the cancers induced by the three β -emitters are comparable with those observed after the inhalation of α -emitters.

- 2322 LUNG CANCER INDUCED IN RATS BY RADON AND ITS DAUGHTER NUCLIDES AT DIFFERENT CONCENTRATIONS. Chameaud, J.; Perraud, R. (CEA, Service medical, Direction des productions, Razes, France); Masse, R.; Nenot, J.C.; Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 223-228 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976). (In French)

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

In previous experiments on rats, nearly all the animals inhaling radon and its daughter nuclides in high concentrations developed bronchopulmonary cancers. In the experiments described here, the dose-effect relationship was studied as a function of several parameters: influence of total inhaled doses which were lower than in the previous experiments; influence of the concentration of the gas and its state of equilibrium with its daughter nuclides; influence of the duration of daily and total exposure. There was a definite increase in the frequency of cancers as a function of cumulative exposure. The respective effects of active deposition and daily dose are shown quite clearly. In view of the considerable importance of the dose-effect relationship in the radiation protection of uranium miners, it seemed worth while to compare these different experimental findings with the results of epidemiological studies made in this category of workers.

- 2325 BIOLOGICAL EFFECTIVENESS OF ^{239}Pu , ^{144}Ce AND ^{90}Sr CITRATE IN PRODUCING CHROMOSOME DAMAGE, BONE-RELATED TUMOURS, LIVER TUMOURS AND LIFE SHORTENING IN THE CHINESE HAMSTER. Benjamin, S.A.; Brooks, A.L.; McClellan, R.O. (Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, New Mexico, USA). pp 143-151 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Determination of the biological effectiveness for internally deposited α - and β -emitting radioactive materials using a number of endpoints is needed to make meaningful risk estimates for man. Late-occurring biological effects were studied in Chinese hamsters injected with ^{239}Pu , ^{144}Ce or ^{90}Sr citrate. Pu-239 is an α emitter which localizes in liver and bone, whereas ^{144}Ce and ^{90}Sr are β emitters which localize in liver and bone, and in bone, respectively. Biological alterations on the cellular, organ and organism level can be used in determining the relative effectiveness of α and β radiation in producing these endpoints. Significant life shortening was induced by all three radionuclides and was considered in evaluating time-related incidence of bone and liver neoplasms. Osteosarcomas were seen in animals injected with 1.0 μCi ^{90}Sr citrate and 0.002 μCi ^{239}Pu citrate/g body weight, while liver tumours including hemangiosarcomas, fibrosarcomas and hepatocellular neoplasms, were seen after injection of 0.25 μCi ^{144}Ce citrate and 0.002 μCi ^{239}Pu citrate/g body weight. Comparisons of bone and liver tumour incidences with cumulative radiation dose were made to derive quality factors for tumour production. In both cases, the derived factors (3.6 for bone tumours and 7.4 for liver tumours) were lower than the figure of 10 generally accepted for comparing α and β radiation. The factor derived from comparison of chromosome damage in liver cells was higher (15), indicating that other factors are involved between damage at the cellular level and final tumour production, and that direct correlations of genetic damage and tumorigenicity are hazardous.

- 2323 INDUCTION OF CANCERS IN THE RAT AFTER INHALATION OF ALPHA-EMITTING RADIONUCLIDES. Morin, M.; Nenot, J.C.; Masse, R.; Nolibe, D.; Metivier, H.; Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 109-119 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976). (In French)

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Experiments have been conducted for several years on the toxic action of inhaled alpha-emitters on laboratory rats. The inhaled radionuclides were ^{239}Pu , ^{238}Pu and ^{241}Am in oxide and nitrate form. The initial alveolar activities varied to give total activities ranging from 1 to 200 thousand million alpha-particles per gram of lung. Variations, depending on the physico-chemical form of the nuclides, in the space and time distributions of the dose are observed. The influence of the two parameters on life span reduction, latency time and frequency of cancer occurrence, initial location of tumours and their histological types were studied. A theoretical model relating the cancerous effect to the dose is compared with experimental data.

- 2324 EXPERIMENTAL STUDY OF ACTION OF INHALED CERIUM-144 AND CERIUM-141. LIFE SPAN REDUCTION AND CANCER INDUCTION - ROLE OF DOSE - INFLUENCE

2326 EFFECT OF SIZE AND ALPHA FLUX OF $^{239}\text{PuO}_2$ PARTICLES ON PRODUCTION OF CHROMOSOME ABERRATIONS IN LIVER OF CHINESE HAMSTER. Brooks, A.L.; McClellan, R.O.; Peters, R.F.; Mead, D.K. (Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, New Mexico, USA). pp 131-141 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Two important variables in determining the biological effect of α -emitting radioactive particles, "hot particles", are the flux of α emissions per particle and the fraction of the cell population exposed. To generate a spectrum of these conditions, Chinese hamsters were injected intravenously with $^{239}\text{PuO}_2$ or $^{238}\text{PuO}_2$ particles or with ^{239}Pu or ^{238}Pu citrate. The plutonium was retained with a long effective half-life in the liver for both the citrate and oxide forms. The particles of $^{239}\text{PuO}_2$ tended to aggregate as a function of time after injection. The level and distribution of chromosome damage in liver cells were determined as a function of the dose, fraction of liver exposed and α flux per particle. Aberration frequency following injection of ^{239}Pu and ^{238}Pu citrate increased with slopes of 4.8×10^{-3} and 3.8×10^{-3} aberrations/cell/rad, respectively. This rate was about three times higher than observed for $^{239}\text{PuO}_2$ particles and ten times as high as observed following injection with the smallest $^{238}\text{PuO}_2$ particles. When aberration frequency was related to average dose there was little effect of change in α flux until it reached a value of 860 disintegrations/particle/day. Above this level, there was a marked decrease in the aberration frequency per rad dose. Evidence of cell killing and extreme amounts of chromosome damage was found in liver cells after injection of $^{238}\text{PuO}_2$ and $^{239}\text{PuO}_2$. Increasing the percentage of the liver irradiated increased the amount of chromosome damage produced. More cells are at risk for cellular damage with uniformly distributed plutonium, and those cells in close proximity to plutonium particles may be lethally irradiated and would not be at risk for tumour production.

2327 BIOLOGICAL ASSESSMENT OF CONTINUOUS EXPOSURE TO TRITIUM AND LEAD IN THE RAT. Cahill, D.F.; Reiter, L.W.; Santolucito, J.A.; Rehnberg, G.I.; Ash, M.E.; Favor, M.J.; Bursian, S.J.; Wriht, J.F.; Laskey, J.W. (Environmental Protection Agency, Research Triangle Park, N.C. (USA)). pp 65-76 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

A broad investigation of the effects of simultaneous exposure to two potentially synergistic environmental pollutants, tritiated water (HTO) and lead, was conducted. Sprague-Dawley rats were continuously exposed to HTO and/or Pb in drinking water from conception of the F_1 through adulthood of the F_2 generation. A 12-cell exposure matrix was used employing HTO activities calculated to provide approximately 3-300 mrad/d whole-body irradiation and Pb levels of 5 or 50 ppm in drinking water. Observations were made on the reproductive capacity of the F_1 generation and

the effects of lifetime parental exposure to HTO and/or lead on the F_2 neonates. The effects of single and combined exposures on the development and function of the central nervous system, some brain catecholamine levels and electroencephalogram patterns were also examined in both generations. The results indicate that, in both generations, continuous HTO exposures as low as 3 mrad/d delayed development of righting reflexes in young rats; 30 mrad/d additionally depressed the spontaneous activity of adult male rats. Continuous exposure to 5 ppm lead produced similar effects on righting reflex development and adult spontaneous activity. The relative brain weight of F_2 neonates was decreased after lifetime parental exposure to 300 mrad/d or 5 and 50 ppm lead. Chronic lead exposure also appears to induce superovulation and increase preimplantation deaths in F_1 dams. Dose-effect responses to both HTO and lead were less than additive in their interactive effects on the parameters measured.

2328 DOSE, DOSE RATE AND AGE PARAMETERS IN ANALYSIS OF RISK FROM BONE-SEEKING RADIONUCLIDES: AN EXTRAPOLATION OF LOW LEVELS. Momeni, M.H.; Williams, J.R.; Rosenblatt, L.S. (California Univ., Davis (USA). Radiobiology Lab.). pp 197-209 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Radiation-induced primary bone sarcomas (PBS) and life-span shortening (Δ) were studied as a function of dose, dose rate and time in beagles fed from midgestation to 1.5 years of age diets containing $^{90}\text{Sr Cl}_2$ in equilibrium with ^{90}Y , or administered $^{226}\text{Ra Cl}_2$ in eight semimonthly intravenous injections starting at 2, 4 or 14 months of age. PBS and Δ from $^{90}\text{Sr}+^{90}\text{Y}$ and ^{226}Ra were dependent on interaction of dose rate, dose, age and time after the administration of the radioactivities, and mode of administration with a dynamic non-linear organ system, the skeleton. Incidence of PBS from $^{90}\text{Sr}+^{90}\text{Y}$ and ^{226}Ra was calculated from life-tables. Probability of greater than 1% PBS incidence was normally distributed with respect to dose and age. Delay period between exposure and tumour incidence was suggested to be proportional to time to 1% incidence of PBS (t_0). For $^{90}\text{Sr}+^{90}\text{Y}$ dogs, estimated t_0 were 9.4 years, 5.1 years, and 1.5 years for an average daily ingestion of 4.12 and 36 μCi $^{90}\text{Sr}+^{90}\text{Y}$ starting from birth, respectively. For ^{226}Ra , estimated t_0 were 3.8, 3.3, 1.7 and 1.3 years for cumulative injections of 3.14, 9.4, 28.1, and 83.6 μCi , respectively. Radiation-induced life-span shortening was estimated from "practical survival age", age at 8% population survival. At a maximum dose rate $D_{\text{sub(max)}}$ of 2.5 rad/d, $^{90}\text{Sr}+^{90}\text{Y}$ and ^{226}Ra were equally effective in reducing life-span, but for $D_{\text{sub(max)}} > 2.5$ rad/d, $^{90}\text{Sr}+^{90}\text{Y}$ was more effective than ^{226}Ra . A dose of 100 rads for radium and 1700 rads for strontium integrated to $T_{\text{sub(max)}} = 16.5$ years did not induce a detectable life-span shortening.

2329 GRAFTS OF PULMONARY TISSUE OF RATS CONTAMINATED WITH PLUTONIUM OXIDE IN ATHYMIC MICE. Nolibé, D.; Masse, R.; Fritsch, P.; Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 95-107 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976). (In French)

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Pulmonary fragments from control rats (Wistar) of varying age and contaminated with PuO_2 were grafted in an immunodeficient medium onto mice or histocompatible rats. In both cases the authors observed lesions presenting the histological characteristics of pulmonary cancer in rats; proliferation, however, remained discrete. After grafting on the athymic mice, the lungs of the control animals exhibited a percentage of tumoral-type differentiations which increased with age. In the contaminated rats, for an initial pulmonary burden of 10 nCi and cumulative doses of between 6×10^8 and $38 \times 10^9 \text{ } \alpha/\text{g}$ of lung, the grafts showed a clear-cut increase in lesions of this type. Their frequency increased with the total dose delivered. Conversely, if the dose delivered during a three-month period varied from 2×10^8 to $50 \times 10^9 \text{ } \alpha/\text{g}$ of lung, the maximum proliferation was observed at the lowest doses. Furthermore, the histological nature of the proliferations varied with the dose delivered. This transplantation technique would appear to show the existence of lesions which are not yet overt and which are a consequence either of ageing or of α -irradiation. The authors discuss the meaning of these lesions and the immunological component of the phenomenon.

- 2330 EFFECT OF ^{241}Am ON BONE STRUCTURE ACCORDING TO ITS MICRODISTRIBUTION. Polig, E. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Strahlenbiologie). pp 161-170 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Female rats, eight weeks old, were injected intravenously with monomeric $^{241}\text{Am}(\text{III})$ -citrate ($30 \text{ } \mu\text{Ci}/\text{kg}$) and sacrificed after 7, 28 and 56 days. Half of the animals received once weekly an intraperitoneal injection of Ca-DTPA ($30 \text{ } \mu\text{mol}/\text{kg}$), the first dose being administered 1.5 h after ^{241}Am . From the distal end of the femurs, $20\text{-}\mu\text{m}$ -thick longitudinal and sagittal sections were prepared. Both dose-rate distributions and morphometric parameters were determined by an electronic image analyser by scanning cellulose nitrate α detectors or microradiographs. Initially after injection, ^{241}Am is heavily deposited on the epiphyseal and metaphyseal sides of the cartilage plate as well as near the articular cartilage, whereas the labelling of the periosteal and endosteal surfaces in cortical bone and of all trabecular surfaces is less pronounced. Seven days after injection the maximum dose rate in the metaphyseal band amounts to approximately $120 \text{ rad}/\text{d}$ and increases to $170 \text{ rad}/\text{d}$ at 56 days. Deformations of the trabecular structure are presented quantitatively as deviations in the frequency function of chord lengths over trabeculae or marrow spaces. The endosteal surface area is lower in ^{241}Am animals than in controls and the complexity of the bone structure is reduced. In control animals the surface/volume ratio varies between 36 mm^{-1} and 64 mm^{-1} . The mean trabecular width ranges between $40 \text{ } \mu\text{m}$ and $100 \text{ } \mu\text{m}$ and the mean width of the marrow spaces range between $90 \text{ } \mu\text{m}$ and $210 \text{ } \mu\text{m}$. As a result of the locally high activity, the mechanism of bone resorption is strongly impaired in the metaphysis, manifesting as abnormal trabeculation. There is no pronounced diminution of DTPA efficacy over the period of

observation. Ca-DTPA treatment lowers the dose rates in the metaphysis and as a consequence the inhibition of bone resorption seems to be partially suspended.

- 2331 COMPARISON OF CARCINOGENICITY OF ^{131}I AND ^{125}I IN THYROID GLAND OF THE RAT. Ruiter, J. de; Putten, L.M. van (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Instituut TNO); Hollander, C.F.; Boorman, G.A. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Instituut voor Experimentele Gerontologie); Hennemann, G.; Docter, R. (Erasmus Universiteit, Rotterdam (Netherlands)). pp 21-31 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

To determine whether there was a difference in the carcinogenicity of ^{131}I and ^{125}I for the thyroid gland, groups of 40 rats on a low-iodine diet were injected with various doses of one of the nuclides. The doses of ^{131}I injected were 125, 50, 20, 8 and $3.2 \text{ } \mu\text{Ci}$; doses of ^{125}I were four times higher. The surviving rats were killed two years after injection and autopsies with complete histopathological examinations were performed. The results of survival and thyroid function studies revealed that the dose ranges in μCi for the two nuclides could not be directly compared and that each dose of ^{125}I could best be compared with a 10- to 25-fold lower dose of ^{131}I . The morphological findings in the follicular epithelium of the thyroid gland showed that the peak of induction of hyperplasia, cysts and tumours by ^{125}I occurred in the group injected with $80 \text{ } \mu\text{Ci}$, whereas comparable changes after ^{131}I administration were observed in the group injected with the lowest dose ($3.2 \text{ } \mu\text{Ci}$). The peak of tumour induction by ^{125}I in the parafollicular epithelium was found in the group injected with $32 \text{ } \mu\text{Ci}$; the peak with ^{131}I was probably missed, since the comparable dose for this nuclide was below the range of doses injected. The highest incidence of tumours of these parafollicular cells was 2.5 times the spontaneous incidence in control rats. However, extrapolation of these results to man seems unreliable, since the spontaneous incidence of tumours of the parafollicular cells is much higher in rats than in man. It may be concluded that ^{125}I does not induce more tumours of the follicular cells than does ^{131}I as has been suggested by others.

- 2332 (ERDA-tr--227, pp 102-106) REACTION OF ENDOCRINE GLANDS TO CHRONIC INTAKE OF STRONTIUM-90. Goloshchapova, Zh.A. 1976. Translated from Radiobiologiya; 16: No. 4, 567-570 (1976). Radiobiology.

Experiments were conducted on rats to investigate the structure of the hypophysis, thyroid and adrenals as related to chronic intake of strontium-90 at the rate of 0.00005 to $5.0 \text{ } \mu\text{Ci}/\text{day}$ per animal. The studies demonstrated that these organs were structurally highly radioresistant. The minimum amount of isotope leading to development of structural changes in endocrine glands when ingested daily constituted $0.5 \text{ } \mu\text{Ci}$ per animal; the minimum accretion in a critical organ constituted 5 krad.

- 2333 (ERDA-tr--227, pp 184-187) ROLE OF AGE AND DOSAGE OF ADMINISTERED PLUTONIUM IN ONSET OF OSTEOSARCOMA IN RATS. Sinyakov, E.G. 1976. Translated from Radiobiologiya; 16: No. 4, 631-634 (1976). Radiobiology.

In view of the universal

possibility of exposure of young organisms to radioisotopes, we undertook a study of the dose effectiveness of plutonium-239, according to yield of osteosarcomas in young rats, and to compare it to the data obtained on adult animals. We observed signs of radiation lesion in month-old rats given 5 and 2.5 $\mu\text{Ci/kg}$ plutonium, 2-3 months after administration of this isotope: less mobility, ruffled fur and loss of hair, as well as retarded weight gain, as compared to controls. In older groups of rats given 2.5 $\mu\text{Ci/kg}$ and month-old ones given smaller doses of plutonium, we failed to observe external signs of a radiation lesion. With decreased irradiation, there was manifestation of a tendency toward relative increase in incidence of osteosarcoma, as noted in other studies; thus, in series V-VIII, the absorbed doses were 7-54 times smaller, while yield of osteosarcoma presented a 4.5-28-fold decrease. Thus, we established that 2.5 $\mu\text{Ci/kg}$ is the optimum sarcomagenic dosage of plutonium for month-old rats, like adult animals. The latency period of development of osteosarcoma and survival of the animals are inversely proportional to age and absorbed doses, while the absence of skeletal tumors in the group of animals given 0.02 $\mu\text{Ci/kg}$ enables us to set the threshold at the 1 percent level of tumors.

- 2334 STUDY OF THE BARRIER FUNCTION OF THE UPPER RESPIRATORY TRACT COVERING EPITHELIUM IN THE EVENT OF COMBINED RESPIRATORY TRACT INJURIES. Ivanov, Z.; Kolev, K.; Dermendzhiev, Kh.; Nikolova, M.; Kantardzhiev, V. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). *Rentgenol. Radiol.*; 15: No. 1, 31-34(1976). (In Bulgarian).

Functional and morphologic impairment of upper respiratory tract mucous membranes after chronic exposure to the three major occupational noxious agents in ore mining - radon-222, silica dust, and respirable dust - has been studied experimentally. Over a 6-month period, rats were given daily treatments, with the agents applied either individually or in combination. Radon-222 (at 1×10^{-10} Ci/l, corresponding to the maximum permissible concentration in uranium mine atmospheres) and respirable dust (dispersed silicogen at 100 mg/ m^3) were administered four hours daily in toxicological chambers. Monodisperse silica dust was given by tracheal tube, at 50 mg in 1 ml of saline per rat. At the end of the treatment period, the barrier function of the respiratory epithelium was tested, and found to have been affected, by measuring beta radioactivity in blood following introduction into the animal's nasopharynx of a ^{32}P -labelled staphylococcus culture. The most severe degree of impairment was found to result from simultaneous exposure to radon and respirable dust. Any of the agents given individually caused a similar degree of impairment. Intratracheal administration of silicic acid anhydride appeared to have no deleterious consequences. The evidence for functional impairment was supported by histologic findings, indicating development of ulcerous bronchitis, metaplasia of cylindrical epithelium, etc., after both individual and combined radon exposure.

- 2335 EXPERIMENTAL LUNG CANCERS. INCIDENCE OF DOSE DISTRIBUTION. Lafuma, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). pp 141-151 of *Les concepts de faible dose de rayonnements ionisants en radiobiologie et en radioprotection*. 2. Cayet-Pennaneac'h, O. (ed.). Montrouge; Societe Francaise de

radioprotection (1976). (In French)

From 2. Seminar on radiobiology; Fontenay-aux-Roses, France (29 Apr 1975).

The experiments conducted at the CEA on the induction of lung cancers by alpha-emitters are presented, especially, the effects of temporal and spatial dose distributions, the processes of cancer induction, life-span shortening and the development of a biological model in order to have an insight on low dose effects.

- 2336 (KFK-tr--483) TOXICOLOGY OF RADIOACTIVE IODINE. Burykina, L.N. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Internationales Buero/Uebersetzergruppe). 1976. Translation of *K toksikologii radioaktivnogo ioda*. 18p. (In German). TIC.

Available from ZAED.

Assessing the biological effects of radioactive iodine isotopes is still an urgent problem due to its application in nuclear medicine diagnostics as well as to the iodine emissions from nuclear power stations. The paper therefore gives a survey of the information on the biological effects of ^{131}I acquired in animal experiments; radiolesions in general and carcinogenesis are gone into. The article states that ^{131}I accumulation in the thyroid and radiolesions of the thyroid are a function of age. Apart from this, studies on the gonadotropic action of ^{131}I supplied over a longer period of time are also reported on. Many studies also deal with the combined effects of ^{131}I and external irradiation. Preliminary studies on the transport of ^{131}I to embryos and fetuses have been carried out. It is found that further studies on teratogenesis will be necessary.

- 2337 ESTIMATION OF TUMOUR RISK AT LOW DOSE FROM EXPERIMENTAL RESULTS AFTER INCORPORATION OF SHORT-LIVED BONE-SEEKING ALPHA EMITTERS ^{224}Ra AND ^{227}Th IN MICE. Luz, A.; Mueller, W.A.; Goessner, W.; Hug, O. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.). Inst. fuer Biologie). pp 171-181 of *Biological and environmental effects of low-level radiation*. II. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

As a revision of older and recent data of experimental bone-tumour induction in mice after single and repeated incorporation of short-lived ^{224}Ra and ^{227}Th , the following indications for estimation of tumour risk at low dose can be given. (1) Dose rate has considerable influence on tumour risk following internal irradiation, but the relative increase of risk with decreasing dose rate is dose dependent. (2) At a tumour risk of about 10% the range of incidence in repeated experiments is high. It therefore seems difficult to find the exact dose-effect relationships in low-risk experiments. (3) On the other hand, the lower incidence at lower dose level seems to be, rather, a risk of the second half of lifespan. In addition, the high range of the rate of spontaneously occurring neoplasms at greater age does not permit exact statements about the whole lifespan. (4) However, one can tentatively assume that it should be possible to find dose limits for the tumour risk during the first half of the lifespan. (5) Besides radiation dose, other cofactors may interfere at the low-dose and low-risk level. There is no significant decrease in osteosarcoma risk if the incorporation period starts after stunting of growth. The greater risk in female mice than

in males indicates hormones as an example of cofactors for the pathogenesis of osteosarcoma.

- 2338 RESPONSE OF MOUSE FOETUS TO RADIATION FROM NA SUP(99m)TCO₄. Lathrop, K.A.; Gloria, I.V.; Harper, P.V. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). pp 211-220 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Technetium has assumed ecological importance as a source of low-level radiation, with the use of sup(99m)Tc in nuclear medicine and production of sup(99m)Tc in power generation reactions. Technetium introduced as pertechnetate into the bloodstream of pregnant females is transported across the placental barrier to the foetus, where a portion appears to be incorporated into biomolecules. When combined as biomolecules, radionuclides that decay by electron capture or isomeric transition show a lethality greater than that predicted in cell cultures and radiation therapy. The decay of sup(99m)Tc by isomeric transition, together with the above considerations, places a high priority on the investigation of its radiation effects due to clinical doses of up to 25 mCi. Female mice were given daily intravenous injections of 0, 5, 50 and 500 µCi of sup(99m)Tc as pertechnetate in isotonic saline throughout gestation, gestation and lactation, or lactation. At two months of age, the progeny were mated with randomly selected litter mates to produce a second generation; the process was repeated for production of the third generation. Only the first generation was irradiated. An injection of 5 µCi/mouse and 10 mCi/human both approximately equal 0.2 µCi/g of body weight; however, the mouse foetus receives an estimated radiation dose of 0.05 rad, and the human 1 rad. Throughout the gestation period, a mouse at the 5 µCi level receives about 100 µCi of sup(99m)Tc, resulting in approximately 1 rad to the foetus. Significant reduction of body weight was noted in all experimental groups. The greatest effects were seen in the progeny of mothers treated during gestation only. These preliminary results reinforce the existing concern about use of sup(99m)Tc-pertechnetate in pregnant or potentially pregnant subjects.

- 2339 CURRENT STATUS OF UTAH LONG-TERM ²³⁹PU STUDIES. Jee, W.S.S.; Atherton, D.R.; Bruenger, F.; Dougherty, J.H.; Lloyd, R.D.; Mays, C.W.; Nabors, C.J. Jr.; Stevens, W.; Stover, B.J.; Taylor, G.N. (Utah Univ., Salt Lake City (USA). Coll. of Medicine). pp v.2 p.79-93 of Biological and environmental effects of low-level radiation. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

Osteosarcomas have been the chief cause of death in the Utah young adult beagles injected intravenously with ²³⁹Pu citrate solution. There was nearly a 100% incidence of bone sarcomas above the 0.015 µCi/kg dose levels. At the 0.015 µCi/kg dose level there was a 29% (4 of 14) incidence. The latent period lengthened with decreasing injected dose. The only other pathology was liver regenerative foci occurring at doses as low as 0.0018 µCi/kg and an incidence of 12% (3 of 25) bile duct carcinomas at the 0.048 and 0.015 µCi/kg dose levels. Studies using older (5-year) and growing (3-

months) beagles, young adult St. Bernards and young adult beagles injected with polymeric ²³⁹Pu showed variation in sensitivity for bone tumour induction. The polymeric model represents a continuous cycling of ²³⁹Pu from the liver to a mature skeleton and the St. Bernard model typifies the relationship between high spontaneous and radiation-induced tumour sensitivity. No results are available for the older adult, but one bone tumour in a growing beagle injected with 0.3 µCi/kg suggests decreased sensitivity. There is increased sensitivity in St. Bernards and polymeric injected dogs for bone tumour induction.

- 2340 (ERDA-tr--241, pp 118-121) HEMODYNAMICS OF DOGS FOLLOWING INHALATION OF POLYMERIC PLUTONIUM-239. Kalmykova, Z.I. 1976. Translated from Radiobiologiya; 16: No. 5, 740-743(1976).

Radiobiology, Vol. 16, No. 5, 1976.

Changes were observed in arterial and venous pressure, slower blood flow, increased mass of circulating blood and an increase in amount of extracellular fluid in mongrel dogs following inhalation of polymeric plutonium-239 in doses that induce acute, subacute and chronic lesions. The time of appearance, severity and direction of the above changes are related to the magnitude of accretion of plutonium-239 in the organism and postinhalation time.

- 2341 INFLUENCE OF VARIATIONS IN DOSE AND DOSE RATES ON BIOLOGICAL EFFECTS OF INHALED BETA-EMITTING RADIONUCLIDES. McClellan, R.O.; Benjamin, S.A.; Boecker, B.B.; Hahn, F.F.; Hobbs, C.H.; Jones, R.K.; Lundgren, D.L. (Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Albuquerque, New Mexico, USA). pp 3-18 of Biological and environmental effects of low-level radiation. II. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The biological effects of inhaled β-emitting radionuclides, ⁹⁰Y, ⁹¹Y, ¹⁴⁴Ce and ⁹⁰Sr, are being investigated in beagle dogs that received single acute exposures at 12 to 14 months of age. The aerosols studied have included ⁹¹YCl₃, ¹⁴⁴CeCl₃, ⁹⁰SrCl₂, and ⁹⁰Y, ⁹¹Y, ¹⁴⁴Ce or ⁹⁰Sr in aluminosilicate particles. Thus, ⁹¹YCl₃, ¹⁴⁴CeCl₃ and the aluminosilicate containing radionuclide particles all resulted in significant exposures to lung; ⁹¹YCl₃, ¹⁴⁴CeCl₃ and ⁹⁰SrCl₂ resulted in significant exposures to bone; ⁹¹YCl₃ and ¹⁴⁴CeCl₃ resulted in significant exposures to liver. The higher initial dose-rate exposures have been more effective than low dose-rate exposures on a per-rad basis in producing early effects. To date (<5 years postinhalation exposure) only a limited number of neoplasms have been observed in these animals. In animals with protracted lower dose-rate exposure to bone, liver and lung, late-occurring neoplasms have frequently been observed at relatively high total doses. In other studies on the toxic effects of a single inhalation exposure of mice to ¹⁴⁴CeO₂, it was observed that, on a µCi initial lung burden per kilogram body weight basis, mice did not develop pulmonary tumours whereas beagle dogs did. To find out the reason for this observation mice have been repeatedly exposed by inhalation to ¹⁴⁴CeO₂ to maintain lung burdens of ¹⁴⁴Ce that resulted in radiation dose rates similar to that observed in beagle dogs. Several of the repeatedly exposed mice developed malignant pulmonary tumours. Thus, with similar dose rates and cumulative doses to

the lung, mice and dogs responded in a similar manner to chronic β radiation.

- 2342 BONE TUMORS INDUCED BY INHALATION OF $^{239}\text{PuO}_2$ IN DOGS. Park, J.F.; Lund, J.E.; Ragan, H.A.; Hackett, P.L.; Frazier, M.E. Recent Results Cancer Res.; No. 54, 17-35(1976).

Plutonium-238, an alpha-emitting radionuclide, is used as a heat source in thermoelectric power generators such as have been employed on lunar expeditions of communications satellites and in cardiac pacemakers. It has an 86.4 year half-life and emits 5.5 MeV alpha particles. Beagle dogs were given single 10 to 30 minute exposures to $^{239}\text{PuO}_2$ aerosols to study the long-term translocation of plutonium and biological effects. Dogs with a terminal body burden ranging from 7 to 260 μCi were euthanized due to respiratory insufficiency related to plutonium-induced pneumonitis during the first 3 years after exposure. Nine of the 11 dogs euthanized during the 4 to 6 year postexposure period had osteosarcomas. The terminal plutonium body burden in the tumor-bearing dogs ranged from 0.5 to 2.6 μCi with 30 to 55 percent of the plutonium in the skeleton. Experiments are in progress to further define the dose-effect relationship of inhaled $^{239}\text{PuO}_2$ and investigate the mechanisms of plutonium-induced neoplasia.

- 2343 EXPERIMENTAL INDUCTION OF BONE TUMORS BY SHORT-LIVED BONE-SEEKING RADIONUCLIDES. Goessner, W.; Hug, O.; Luz, A.; Mueller, W.A. Recent Results Cancer Res.; No. 54, 36-49(1976).

Single and repeated applications of ^{224}Ra and single applications of ^{227}Th to more than 600 female NMRI mice 3 to 4 weeks old, and to male NMRI mice have led to a high rate of osteosarcomas. Tumor incidence is dose-related. ^{227}Th is more carcinogenic than ^{224}Ra which induced the highest tumor incidence of 60 percent after a single injection of 5 μCi per Kg body weight or more. Repeated injections of ^{224}Ra to female mice yielded a tumor incidence of up to 92 percent. Most of these osteosarcomas consist of well-differentiated bone-forming osteoplastic tissue. Half of the tumors occurred in the spine, particularly in the lumbar region. In protraction experiments, multifocal osteosarcomas have been observed. Less than 10 percent of the mice with osteosarcoma had developed metastases in lung, spleen, liver, and kidney. The possible mechanisms of the protraction effect are discussed.

- 2344 RADIATION DOSE TO MOUSE TESTES FROM ^{239}Pu . Green, D.; Howells, G.R.; Humphreys, E.R.; Vennart, J.; Thorne, M.C. (Medical Research Council, Harwell, Eng.). pp 21-31 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Twelve week old male CBA mice were injected intravenously with an ultrafiltered solution of ^{239}Pu in 1 percent trisodium citrate and were killed four or 12 weeks later. The plutonium in the testes was measured radiochemically and autoradiographically. Most of the plutonium was found in the intertubular spaces but about 40 percent of the α -activity was shown to irradiate the spermatogonial cells lying at the periphery of the seminiferous tubules. At both

times dose-rate to the inter-tubular tissue and to the 10 μm shell of tissue containing the spermatogonial stem-cells surrounding each tubule was found to be greater than that averaged throughout the testis. The consequences of this inhomogeneous distribution are discussed. (auth)

- 2345 (ANL--76-88(Pt.2), pp 54-61) UNUSUAL CASE OF INTERNAL CONTAMINATION WITH ^{241}Am . Rundo, J.; Essling, M.; Huff, D.R.; Fairman, W.D. 1976.

Radiological and Environmental Research Division annual report, July 1975--June 1976.

A woman accidentally swallowed two sources of ^{241}Am of the type used in domestic smoke detectors; the nominal activity of each source was 2.5 μCi , and they were not voided until the 16th and 24th days after intake. A little less than 1% of the total activity of the two sources was found in the fecal material after removal of the sources and ^{241}Am was detected in the urine until the second source had been voided.

- 2346 (BNL--20909) KINETICS OF TOTAL BODY RETENTION AND CLEARANCE OF XENON AND KRYPTON AFTER INHALATION. Susskind, H.; Atkins, H.L.; Cohn, S.H.; Ellis, K.J.; Richards, P. (Brookhaven National Lab., Upton, N.Y. (USA)). 1976. 4p. (CONF-760802--1). Dep. NTIS \$3.50.

From 11. international conference on medical and biological engineering; Ottawa, Canada (2 Aug 1976).

The total body retention of Xe-127 and Kr-79 and their clearance rates following inhalation were measured in vivo. These data are useful for refined Xe-127 dosimetry calculations, to determine the potential radiation hazard of fission product Kr-85, and more generally to study the behavior of anesthetic gases. While data are available on the solubilities and partition coefficients of Xe and Kr in fat, blood, and other individual body constituents, few measurements of their retention and clearance from the entire body have been reported.

- 2347 (MLM--2339(OP)) CALIBRATION FOR PLUTONIUM-238 LUNG COUNTING AT MOUND LABORATORY. Tomlinson, F.K. (Mound Lab., Miamisburg, Ohio (USA)). 1976. Contract E-33-1-GEN-53. 13p. (CONF-760634--2). Dep. NTIS \$3.50.

From Pacific regional symposium; Seattle, WA, USA (24 Jun 1976).

The lung counting facility at Mound Laboratory was calibrated for making plutonium-238 lung deposition assessments in the fall of 1969. Phoswich detectors have been used since that time; however, the technique of calibration has improved considerably. The current technique of calibrating the lung counter is described as well as the method of error analysis and determination of the minimum detectable activity. A Remab hybrid phantom is used along with an attenuation curve which is derived from plutonium loaded lungs and ground beef absorber measurements. The errors that are included in an analysis as well as those that are excluded are described. The method of calculating the minimum detectable activity is also included. (auth)

- 2348 (STI/PUB--411) DIAGNOSIS AND TREATMENT OF INCORPORATED RADIONUCLIDES. PROCEEDINGS SERIES. PROCEEDINGS OF AN INTERNATIONAL SEMINAR, VIENNA, AUSTRIA, DECEMBER 8--12, 1975. (International Atomic Energy Agency, Vienna

(Austria)). 1976. 638p. (CONF-751205--). IAEA \$39.00.

From IAEA international seminar on diagnosis and treatment of incorporated radionuclides; Vienna, Austria (8 Dec 1975).

Some 50 papers discuss methods of treatment of incorporated radionuclides in personnel and report the results of related studies in laboratory animals. Emphasis is placed on methods for the assessment of the body burden of ^{239}Pu , ^{241}Am , and other transuranic elements following accidental inhalation or uptake through puncture wounds. The effectiveness of DTPA and other chelating compounds for decorporation is discussed. (CH)

2349 CHEMICAL FORM OF PLUTONIUM IN URINE. Popplewell, D.S.; Stradling, G.N.; Ham, G.J. (National Radiological Protection Board, Harwell, Eng.). pp 245-248 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Evidence from in vivo and in vitro experiments points to citrate as the plutonium-binding agent in human urine. (auth)

2350 LOS ALAMOS SCIENTIFIC LABORATORY'S HUMAN AUTOPSY TISSUE ANALYSIS STUDY. McInroy, J.F. (Los Alamos Scientific Lab., NM). pp 249-270 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Since 1959, the Health Division, Los Alamos Scientific Laboratory has analyzed the tissues from 81 former employees of the Laboratory for plutonium. Additionally, approximately 700 autopsy cases from the general population have also been analyzed for Pu resulting from fallout. The variation in the distribution of Pu in the bodies of the occupationally exposed individuals suggest that each exposure incident is unique and must be evaluated on the basis of the chemical form, solubility, particle size, mode of entry, and duration of exposure. Particle size distribution of Pu in a lymph node of a long-term chronic exposure case was estimated to have a mass median diameter of 0.32 μm with a geometric standard deviation of 1.5. The baseline concentrations of environmental Pu have been estimated for the general population and the tissue distributions compared with the occupationally exposed cases. (auth)

2351 HEALTH OF HANFORD PLUTONIUM (PU) WORKERS. I. Norwood, W.D. (Hanford Environmental Health Foundation, Richland, WA); Newton, C.E.; Kirklín, C.W.; Heid, K.R.; Breitenstein, B.D. pp 271-296 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Health, mortality and cause of death in 452 Hanford known Pu deposition cases was analyzed for the period 1944 to 1975. Malignant disease as a cause of morbidity and mortality was carefully examined because of its occurrence in laboratory animals subjected to very large doses of Pu. Other serious diseases were also

considered. The average years at risk in these individuals with depositions was 23 (range 2 to 31) years. The average years following deposition in those estimated to have more than 4 nCi was 16.7 (range 6 to 30) years. Using clinical judgment in evaluating severity of malignancy, and other disease, there does not appear to be any meaningful difference between the health and mortality of the employees with low deposition of Pu (less than or equal to 2 nCi) and that of employees with higher systematic depositions (2 nCi to 400 nCi). (auth)

2352 MACRO-DISTRIBUTION OF PLUTONIUM IN SELECTED BONES FROM AN ABNORMAL SKELETON. Larsen, R.P.; Toohey, R.E.; Ilcewicz, F.H. (Argonne National Lab., IL). pp 315-320 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The distribution of plutonium in the skeleton of a female patient who received about 0.3 μCi by injection in 1945 is being determined. At the time of the injection she was terminally ill; she died 17 months later. From the analysis of a selected number of bones, it has been possible to establish a preliminary view of the trabecular vs cortical distribution pattern and to provide a concentration profile of the tibia. The presence of ^{241}Am in the skeleton was observed; the decay of ^{241}Pu which was shown to have been present in the injected Pu was demonstrated to be its source. (auth)

2353 MICROSCOPIC DISTRIBUTION OF ^{239}Pu DEPOSITED IN BONE FROM A HUMAN INJECTION CASE. Schlenker, R.A.; Oltman, B.G.; Cummins, H.T. (Argonne National Lab., IL). pp 321-328 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The distribution of ^{239}Pu was studied in bone from a female patient who received an intravenous injection of 0.3 μCi ^{239}Pu in 1945 at age 18 and who died 17 months later with Cushing's Syndrome. The average depth at which ^{239}Pu was deposited by appositional bone growth in trabeculae ranged from 40 to 60 μm in seven bones. The average for all sites of deposition studied was 52 μm . Surface and volume concentrations in bone which covered surfaces in trabeculae ranged between 0.26 and 0.63 pCi/cm² and 56 and 160 pCi/cm³ respectively in seven bones. The mean values of the data for the seven bones were 0.39 pCi/cm³ and 94 pCi/cm³. The volume concentration contributes only about 4 percent of the total terminal dose rate in a layer of cells 10 μm thick lining the endosteal surfaces of trabeculae in the 6th thoracic vertebra. In other bones the contribution from bone volume would be even less. Concentrations on the periosteal, endosteal and Haversian canal surfaces in the shafts of six long bones ranged between 0.18 and 0.64 pCi/cm², 0.14 and 0.31 pCi/cm², and 0.13 and 0.59 pCi/cm² respectively. These concentrations are considerably less than those observed on overgrown surfaces at the same sites. (auth)

2354 GROSS DISTRIBUTION OF ^{226}Ra IN MAN FROM

EXTERNAL COUNTING. Rundo, J.; Essling, M.A.; Huff, D.R. (Argonne National Lab., IL). pp 409-420 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

When the first γ -ray measurements of ^{226}Ra retention in patients indicate a content in excess of about 20 nCi of RaC (^{214}Bi), a whole-body is made. Measurements are made with two detectors, above and below the supine subject, at seven equally spaced positions along the length. The spacing is set at 15 percent of the subject's height. Such scans have been made for 40 different patients and although the detectors are uncollimated, a surprising amount of information on the distribution is revealed. The following points are demonstrated graphically: the gross distribution is extremely variable, and the variability is unrelated to the mode of intake; there is no correlation between regions of high levels of radium and sites of malignancies, and the general pattern of distribution is stable over periods of some years. (auth)

2355 MACRODISTRIBUTION OF ^{226}Ra IN THE SKELETON OF A RADIUM DIAL PAINTER. Holtzman, R.B. (Argonne National Lab., IL); Simmons, D.J. pp 421-436 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

The concentrations of ^{226}Ra were determined in 190 samples of bone and in four teeth from a woman who had worked for two years as a radium dial painter 52 years prior to her death. The terminal body content of ^{226}Ra was 200 nCi. The weighted mean concentration of activity in bone was 146 ± 11 pCi/g ash. The concentrations of the ^{226}Ra in long bones were fairly constant along the shafts and increased greatly towards the ends. The concentration patterns were generally symmetrical with respect to right and left sides. The patterns in bone from the lower limbs (femur, tibia, and fibula) were similar to each other but differed from those in the upper limbs (humerus and radius). (auth)

2356 MICROSCOPIC DISTRIBUTION OF ^{226}Ra IN THE BONES OF RADIUM CASES: A COMPARISON BETWEEN DIFFUSE AND AVERAGE ^{226}Ra CONCENTRATIONS. Schlenker, R.A.; Farnham, J.E. (Argonne National Lab., IL). pp 437-449 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Diffuse concentration measurements were made at various sites in the skeletons of ten patients administered ^{226}Ra using alpha track autoradiography. The ratio of the highest to lowest concentration observed within a skeleton was found to be 2.8 ± 1.4 . Measurements were made at five pairs of contralateral sites in one case and bilateral asymmetry was found. Diffuse and average concentrations showed similar distribution patterns along the lengths of femora from three cases. Ratios of diffuse to uniform concentration, when analyzed using the ICRP model of alkaline earth metabolism indicated that the most representative compact bone remodeling rate for these skeletons was in

the range 0 to 0.4 percent/year. (auth)

2357 COMPARISON OF THE LATE EXCRETION OF ^{226}Ra AND ^{239}Pu BY MAN. Rundo, J.; Holtzman, R.B. (Argonne National Lab., IL). pp 497-504 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City; Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Excretion rates of ^{226}Ra (12 cases) and ^{239}Pu (2 cases) at roughly 10^3 and 10^4 days after intake are reviewed and compared with each other and with the predictions of various models. There are more differences than similarities between the behavior of Ra and that of Pu, but the excretion rates at 10^3 days are similar when expressed as percent of initial dose, as are the coefficients of elimination at 10^4 days. At the late times, about 1.5 percent of the body's content of either element is excreted annually. Between individuals there is enormous variability in the late excretion of Ra, which may also be present in Pu cases. The role (if any) of osteoporosis needs to be clarified. (auth)

2358 NATURE OF THE PROCESSES THAT TAKE PLACE DURING THE UPTAKE OF STRONTIUM RADIOISOTOPES BY FORMED BONE CRYSTALS. SORPTION. Golutvina, M.M. (Inst. of Biophysics, Moscow). Nauchn. Dokl. Vyssh. Shk., Biol. Nauki; No. 3, 35-39(1976). (In Russian).

In vitro experiments performed under physiological conditions (pH 7.3, ionic strength 0.16, temperature 37°C) with apatite isolated from human and rat bone and with a synthetic substitute for bone mineral showed that ion exchange is dominant in the initial phase of contact between radiostrontium and apatite. Strontium disappears from the solution while calcium in equimolar amounts enters it. The process is largely reversible even if the crystals are exposed to the isotope for as long as 2 weeks. Thereafter a slow process takes place in which strontium is irreversibly incorporated into the crystal lattice of the mineral. The kinetic parameters are similar in animals. Within 5 minutes of intravenous injection of rats with strontium 85, the isotope was found to be concentrated in bone. The amount of isotope in the skeleton increased with increasing time between its injection and sacrifice of the animal.

2359 TO THE PROBLEM OF HOT PARTICLES. Jacobi, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Strahlenschutz). Atomkernenergie; 28: No. 1, 29-37(1976). (In German).

From Symposium on medical and biological problems of radiation exposure; Borstel, F.R. Germany (30 May 1975).

6 figs.; 1 tab.; with refs..

Proceeding from an analysis of the dose distribution and the expected cytological effects in the surrounding of hot Pu-particles in the lung, the results of relevant animal experiments and the observations among overexposed Pu-workers are summarized. From these empirical findings no unusual high effectiveness of hot particles for the generation of late effects in the lung can be concluded. On the contrary they indicate that the late effect risk from hot, α -active particles is probably smaller compared with an uniform irradiation of the lung with the same mean dose. Accordingly there is no biological

justification of the Tamplin-Cochran-proposal to revise in the case of hot α -active particles the concept of the mean lung dose, as is it currently used in radiation protection.

- 2360 RADIATION EXPOSURE STUDY OF THE OTTAWA COUNTY, OKLAHOMA POPULATION FROM DIETARY INTAKE OF RADIUM-226. Keefer, D.H. Dallas; Univ. of Texas (1976). 210p. University Microfilms Order No. 76,23,152.

Thesis (Ph. D.).

Communities in Ottawa County and vicinity derive their water from the Roubidoux Formation in the Canadian Series of the Cambro-Ordovician Period. It was demonstrated in this study that wells on the eastern side of the county have radium-226 concentrations less than 1 pCi/l, reflecting the level of radium-226 existing along the hydrologic gradient of the aquifer. Water supplies in southwestern Ottawa County contain radium-226 concentrations as high as 11.2 pCi/l. This elevated radium-226 value is accompanied by 1.2 pCi/l of radium-228; together they exceed by a factor of 2.5 the maximum permissible contaminant level to be allowed by the Safe Drinking Water Act of 1974.

- 2361 DISTRIBUTION AND DOSIMETRY OF ^{52}Fe AND ^{59}Fe IN BONE MARROW AND OTHER ORGANS. Lillicrap, S.C.; Steere, H.; Clink, H.M. pp 79-90 of Radioaktive Isotope in Klinik und Forschung. Bd. 12. Hoefer, R. (ed.). Wien; H. Egermann (1976).

From International symposium on radioactive isotope in clinical medicine and research; Bad Gastein, Austria (12 Jan 1976).

13 refs..

^{59}Fe and ^{52}Fe have been used for haematological studies. The distribution and dosimetry of both ^{59}Fe and ^{52}Fe in patients with normal marrow function and distribution, and patients with poor or zero marrow function is described. The results were obtained using a quantitative dual-headed total body scanner situated in a low background environment. Differences in the distribution of the radionuclides are observed and the role of the sup(^{52}m)Mn daughter product of ^{52}Fe and of the different chemical forms of the radionuclides have been examined as possible reasons for these differences. An estimation of the distribution of the erythropoietic marrow in patients with normal marrow function has been made from the quantitative marrow scans. These results are compared with the estimates obtained from autopsy studies.

- 2362 TECHNICAL FAILURE IN A CONTAINER SEAL IN THE NUCLEAR RESEARCH CENTRE KARLSRUHE. At. Inf.; No. 8, . 9-10(1976). (In German).

Article identical with abstract.

On the morning of the 10th of August 1976, there was a technical failure on the seal of a container for highly active waste solution in the Hot Cells of the Nuclear Research Centre Karlsruhe. Thus, at the beginning of an experiment, about one liter of waste solution escaped into the operating room. The latter and adjoining rooms were thus radioactively contaminated. No activity was released to the outside. Some of the rooms concerned have already been decontaminated. Several people were contaminated in this incident. The evaluation of the personnel dosimeters showed a dose well below the permissible value for all persons involved.

- 2363 BIOLOGICAL BEHAVIOUR OF PLUTONIUM 239. Lafuma, J. (Commissariat a l'Energie Atomique, Brussels (Belgium)). Ann. Biol. Anim.

Biochim., Biophys.; 1: No. 1, 43-53(1976). (In French).

Plutonium is scarcely incorporated from the environment into the food chain because of its inability to penetrate biological membranes. Workers can be contaminated through inhalation or deposition in wounds. Pu present in the pulmonary alveoles or incorporated in wounds is redistributed in the organism either through cellular transport resulting in an important accumulation in the lymphatic ganglia either by blood transport as dissolved Pu bound to proteins. This mechanism results in a progressive accumulation of the radioelement in liver and bone. It is estimated that about 40% of the Pu present in the blood is deposited in the liver from which one half is eliminated every ten years. 50% is deposited in bone from which the elimination takes much longer and 10% is eliminated with the urines. Intravenous injection of DTPA is very useful for Pu elimination immediately after contamination. For elimination of pulmonary Pu the technique of 'pulmonary washing' is suggested. This method reduces the pulmonary contamination in laboratory animals by a factor 10.

- 2364 STATISTICAL EVALUATION OF THE RADIOTOXICITY OF INHALED PLUTONIUM IN INSOLUBLE FORM. Cave, L. (Pollution Prevention (Consultants) Ltd., Crawley (UK)); Freedman, L. (Medical Research Council, London (UK)). pp 547-565 of Transuranium nuclides in the environment. Vienna; International Atomic Energy Agency (1976).

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, CA, USA (17 Nov 1975).

See CONF-751105--.

The purpose of the paper is to analyse statistically the available human data relating to plutonium toxicity to see whether two outstanding uncertainties can be resolved: (1) whether there is a marked increase in toxicity with size of particle, due to a 'hot particle' effect; (2) whether the commonly used value of 0.016 μCi for the maximum permissible lung burden for occupational workers is an adequate interpretation of the ICRP recommendation that the dose to the lung should not exceed 15rem/a. Of the human data available, only that for the group of 25 LASL workers who acquired substantial lung burdens during 1944/45 can, at present, make a substantial contribution to the statistical analysis. Data relating to particle size distribution in plutonium handling facilities is reviewed. This review shows that it is reasonable to assume that the distributions to which these workers were exposed was reasonably representative of those that might be encountered in the normal operation of such facilities, and in accident conditions at such plants or at such nuclear power stations. The statistical methods employed provide estimates of 'risk factors' in terms of unit activity burden or per particle. They are able to take account of substantial random errors in the basic data and to give an appropriate weight to various hypotheses as to the extent, if any, of a 'hot particle' effect. The results of the analysis give little support to the view that there is a substantial 'hot particle' effect. Some published estimates of 'risk per particle' appear to be too large by factors of at least 1000. The total exposure represented by the available human data is not yet large enough to substantiate fully, on a statistical basis, the value of 0.016 μCi for the maximum permissible lung burden. However, regarded as a 'best estimate' this value should not be too high by a factor of more than 15 or, by a factor of more than 40 at the 95% upper confidence level.

2365 CALCULATED DOSES FROM INHALED TRANSURANIAN RADIONUCLIDES AND POTENTIAL RISK EQUIVALENCE TO WHOLE-BODY RADIATION. Strom, P.O. (US Nuclear Regulatory Commission, Rockville, Maryland, USA); Watson, E.C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). pp 603-625 of Transuranium nuclides in the environment. Vienna: International Atomic Energy Agency (1976).

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, CA, USA (17 Nov 1975).

See CONF-751105--.

The report examines the distribution of radiation dose commitments within the body that can result from the lung deposition of a number of transuranic radionuclides. The variables that influence these organ dose commitments include the mobility of the particle or its dissolution products within the body, the radiation characteristics of the inhaled radionuclides and their progeny, and the size of the particles inhaled. The calculated dose commitments form a part of the bases of a more speculative section of the report. Estimates of the risk of excess deaths from cancer due to whole-body radiation doses are included in the calculations to provide an estimate of cancer death risks associated with the inhalation of transuranic compounds. These results are then equated to those from whole-body radiation doses. The uncertainties associated with such calculations are recognized, and, in particular, the implicit assumptions of internally and externally generated dose equivalence and dose-effect linearity are acknowledged.

2366 (BNWL-SA--5896(Rev.)) LIFE HISTORY OF PLUTONIUM DIOXIDE IN THE LUNG: FROM MACROPHAGE TO CARCINOMA. Sanders, C.L.; Ade, R.R.; Rhoads, K.; Madison, R.M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1976. Contract E(45-1)-1830. 33p. (CONF-760927--2). Dep. NTIS \$4.00.

From 16. annual Hanford biology symposium on pulmonary macrophage and epithelial cells; Richland, WA, USA (27 Sep 1976).

The pulmonary macrophage exerts a large influence upon the distribution of alpha energy from inhaled $^{239}\text{PuO}_2$, while the pulmonary epithelium serves as the prime 'target' cell for neoplastic transformation. In the rat, of the total radiation energy absorbed in the lung, about 80 percent is delivered to the alveolar septae, 19 percent to the vascular tissues and less than 1 percent to the bronchial epithelium. Of the radiation energy delivered to the alveolar septae, about 10 percent is absorbed by alveolar epithelium, 10 percent by macrophage, 10 percent by endothelium and 70 percent by other cellular and noncellular elements. Both the type II alveolar epithelium and the bronchiolar epithelium serve as the probable cells of origin for induced adenocarcinoma.

2367 PLUTONIUM INCORPORATION THROUGH INGESTION BY YOUNG ANIMALS. Finkel, M.P.; Kisleleski, W.E. (Argonne National Lab., IL). pp 57-69 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City: Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Studies to determine whether animals nursed by dams with a ^{239}Pu burden would themselves acquire plutonium showed that rats incorporated

about 0.019 percent of the amount injected into the dam, mice incorporated about 0.11 percent, and cats about 0.28 percent. Plutonium obtained in this fashion was avidly retained by bone and resulted in the appearance of two osteogenic sarcomas in a seven and one-half-year-old cat with an estimated terminal body burden of 0.23 to 0.27 μCi . In comparing the incorporation of ingested Pu-milk and Pu-citrate by rats of different ages, it was found that nurslings incorporated more than weanlings and weanlings more than adults. Also, 1.6 to 3 times as much plutonium was incorporated from ingested Pu-milk as from ingested Pu-citrate. (auth)

2368 CORRELATIONS BETWEEN THE METABOLIC BEHAVIOR OF INHALED AND INTRAVENOUSLY INJECTED PLUTONIUM IN BEAGLE DOGS. Cuddihy, R.C.; McClellan, R.O.; Mewhinney, J.A.; Muggenburg, B.A. (Inhalation Toxicology Research Inst., Albuquerque, NM). pp 169-182 of Health effects of plutonium and radium. Webster, S.S. (ed.). Salt Lake City: Univ. of Utah (1976).

From Workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, ID, USA (6 Oct 1975).

See CONF-751043--.

Long-term studies of radiation dose distribution patterns in Beagle dogs after inhalation of ^{239}Pu oxide aerosols have been conducted at the Battelle Northwest Laboratories. Parallel studies with ^{239}Pu citrate injected into Beagles have been conducted at the University of Utah. In the present study, a mathematical model for describing internal organ retention patterns for ^{239}Pu was used to compare results obtained from these previous studies. The model was also used to assess new data being developed at the Lovelace Inhalation Toxicology Research Institute, ITRI, where dogs inhaled ^{239}Pu aerosols of varied solubility. In studies with inhaled ^{239}Pu oxide, most of the ^{239}Pu which deposited in the lower respiratory tract was retained in lung with a four year half-time. The ^{239}Pu slowly absorbed from lung accumulated about 75 percent in liver and 21 percent in the skeleton. After injection of ^{239}Pu citrate the early deposition favored skeleton over liver, however, only 21 percent of the injected dose was retained in the skeleton at times greater than two years. Early time (56 day) distribution of ^{239}Pu after inhalation reported from studies at ITRI were similar to the ^{239}Pu citrate injection studies in relative skeleton and liver deposition. Analyses with the ^{239}Pu deposition and retention model suggested that an early deposition pattern favoring skeletal deposition of ^{239}Pu may have been present but not readily apparent in the Battelle studies due to very slow movement of ^{239}Pu to internal organs. (auth)

2369 INVESTIGATIONS OF IODINE-131 RELEASE IN RATS. Correns, H.J.; Vogler, H.; Fink, V.; Hollenbach, K. pp 687-694 of Radioaktive Isotope in Klinik und Forschung. Bd. 12. Teil 26. Hoefer, R. (ed.). Wien; H. Egermann (1976). (In German)

From International symposium on radioactive isotope in clinical medicine and research; Bad Gastein, Austria (12 Jan 1976).

19 refs..

The effects of potassium iodide, sodium perchlorate and Methimazole in combination with TSH on iodine release following ^{131}I intake has been studied in rats 6 and 12 hours after the administration of ^{131}I . Combination of Methimazole with TSH six hours after therapy could reduce radiation dose to the thyroid by 51.8% and 12 hours later by 42.3%. Addition of

perchlorate during the first day had a synergetic effect.

- 2370 (ERDA-tr--266, pp 98-102) DISTRIBUTION AND BIOLOGICAL EFFECTS OF INTRATRACHEAL ADMINISTRATION OF CALIFORNIUM-252. Moskalev, Yu.I.; Stepanov, S.V.; Zalikin, G.A.; Kalistratova, V.S. 1976. Translated from Radiobiologiya; 16: No. 6, 882-885(1976).

Radiobiology. A study was made of distribution and biological effects of californium-252 nitrate (pH 3.0) on rats. It was shown that the skeleton, liver and kidneys are the principal organs of secondary deposition, which constituted 29.2 percent, 4.5 percent and 1.4 percent, respectively, of the given dose. An evaluation was made of the effect of Cf on mean life expectancy, composition of peripheral blood, weight, blood cholinesterase and alkaline phosphatase activity.

- 2371 INFLUENCE OF EXTERNAL IRRADIATION ON THE BIOLOGICAL HALF-LIFE OF TRITIUM IN RATS. Bilkiewicz, J.; Radwan, I.; Jaworowski, Z. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)). Postępy Fiz. Med.; 11: No. 2, 97-102(1976).

Wistar inbred rats were irradiated with 350 rads of X-rays and given subcutaneously 2.5 μ Ci of tritiated water per gram of body weight. Samples of the liver, lung, kidney, skin, muscle, small and large intestine and growing hair were collected at 1, 3 and 5 days intervals within 21 days of the experiment. Incorporation rate of tritium in particular tissues were determined. The biological half-life of tritium was calculated from regression equations obtained by means of the least square technique. In irradiated animals the biological half-life of free water tritium was similar in various tissues and ranged from 4.3 $\pm$ 0.2 days to 4.9 $\pm$ 0.4 days. These values were slightly higher than those found in nonirradiated rats, however, the differences were not statistically significant. The retention of tissue bound tritium was more variable in both groups of animals. The biological half-life tissue bound tritium varied in irradiated rats from 7.3 $\pm$ 0.8 days in the small intestine to 26.9 $\pm$ 9.3 days in the muscle and was significantly higher than in non-irradiated rats. The increase in tritium incorporation in the growing hair after irradiation has also been observed.

- 2372 (UCD--472-123) ANNUAL REPORT, FISCAL YEAR 1976. Goldman, M. (California Univ., Davis (USA). Radiobiology Lab.). 1976. Contract EY-76-C-03-0472. 179p. Dep. NTIS, PC A08/MF A01.

Separate abstracts were prepared for 22 sections of this report. A list is included of 60 publications during the period covered and tabulated data covers the health status of aging beagles administered ^{90}Sr or ^{22}Ra . (CH)

- 2373 (CONF-751022-- , pp 37-41) PRINCIPLES OF STANDARDS SETTING: THE RADIATION EXPERIENCE. Parker, H.M. (HMP Associates, Inc., Richland, WA). 1976.

From 3. life sciences symposium; Los Alamos, NM, USA (15 Oct 1975).

Impact of energy production on human health: an evaluation of means for assessment.

The basis and use of standards generally are repeated from material used in the Joint Committee on Atomic Energy Hearings on Radiation Protection Standards. A brief history of radiation protection standards is related to this base. The recent history emphasizes the

delayed production of leukemia and other cancers as a principal risk. A linear relationship between such effects and dose is accepted as a prudent policy. What really happens at low dose and low dose rate is unknown and may remain so. Whether linear or not, it is likely (but also unproven) that the deleterious effects are nonthreshold. Standards setting then becomes a public responsibility not soluble on purely technical grounds. It is implied that hazards of numerous environmental pollutants from alternative energy sources operate in the same way. To apply equal diligence to all pollutants as is now given to radiation would cost astronomical sums. Steps are outlined to reduce some of the excesses that have troubled the radiation case. The most useful step is probably to avoid the "Father knows best" approach that has encouraged some lack of credibility.

- 2374 (CONF-751022-- , pp 75-84) MUTAGENESIS AND TERATOGENESIS AS END POINTS IN HEALTH IMPACT ASSESSMENT. Bender, M.A. (Brookhaven National Lab., Upton, NY). 1976.

From 3. life sciences symposium; Los Alamos, NM, USA (15 Oct 1975).

Impact of energy production on human health: an evaluation of means for assessment.

The genetic and teratogenic effects of agents released to the environment as a consequence of energy production are exceedingly difficult to evaluate. Nevertheless, these effects on human health may be very costly in the context of cost-benefit analysis. In fact, the procedures required to limit mutagenic or teratogenic agents to the levels considered acceptable by regulatory bodies may constitute a major fraction of the cost of energy, especially where prudence dictates that a lack of empirical data requires extremely conservative regulations. Experience with ionizing radiation and with regulation of nuclear power installations illustrates the difficulty of genetic and teratogenic health impact assessment and the great uncertainties involved, as well as the influence of these impacts on the regulatory process and the consequent increased cost of power from this source. Data on genetic and teratogenic impacts on human health from chemical agents released to the environment by other energy technologies are much less complete, and, because of the large number of potentially active agents involved, it is evident that generic solutions to health impact assessment will be required to evaluate these energy alternatives.

- 2375 (CONF-760301--3) STATE AND FEDERAL REGULATORY MEASUREMENT RESPONSIBILITIES AROUND MEDICAL FACILITIES. Lanzl, L.H. (Chicago Univ., Ill. (USA). Dept. of Radiology). 1976. Contract E(11-1)-69. 14p. Dep. NTIS \$3.50.

From NBS symposium on measurements for the safe use of radiation; Gaithersburg, MD, USA (1 Mar 1976).

Radiation exposure to man is due chiefly to diagnostic x-ray procedures, in which radiation is intentionally directed toward a patient. Radiation therapy presents a lesser problem because a smaller percentage of the population is subjected to such treatment. Recently, some innovative steps were taken in the State of Illinois to reduce patient exposure in four diagnostic procedures without reducing the benefits derived therefrom. However, if these procedures are to be carried out properly, it is necessary to increase the precision and accuracy of radiation exposure measurements to the order of ± 2 percent. The usual accuracy and precision of radiation protection measurements are of the order of ± 20 percent.

Thus, should the Illinois radiation protection rules become widely adopted, the national dosimetry network will need to upgrade exposure measurement techniques. (auth)

- 2376 PRIMARY COSMIC RADIATION OUTSIDE AND WITHIN THE ATMOSPHERE. Bagge, E. (Kiel Univ. (Germany, F.R.). Inst. fuer Reine und Angewandte Kernphysik). pp 1-20 of Risiko der Gefaehrung durch die Strahlenexposition in der Medizin. Strahlenschutz bei der Luft- und Raumfahrt. Gremmel, H. (Kiel Univ. (Germany, F.R.). Radiologische Klinik); Ladner, H.A. (Freiburg Univ. (Germany, F.R.). Strahlenabteilung); Messerschmidt, O. (Laboratorium fuer Experimentelle Radiologie, Neuherberg/Muenchen (Germany, F.R.)); Moehrl, G. (Badenwerk A.G., Karlsruhe (Germany, F.R.)); Stieve, F.E. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Strahlenhygiene); Zimmer, R. (Bayerisches Landesinstitut fuer Arbeitsmedizin, Muenchen (Germany, F.R.)). Stuttgart, Germany, F.R.; Thieme (1976). (In German)

From 16. annual meeting of the Vereinigung Deutscher Strahlenschutzärzte e.V.; Kiel, Germany, F.R. (21 Jun 1975).

Solar and galactic radiation, nuclear collisions of primary particles and their secondary processes, and solar eruptions and their effects having been dealt with briefly, maps of the radiation exposure of the FRG's population are presented.

- 2377 (INIS-mf--3312) ANNUAL REPORT OF THE DEPARTMENT OF ATOMIC ENERGY 1975--76. (Department of Atomic Energy, Bombay (India)). 1976. 119p. NTIS (US Sales Only).
The activities of the various constituent units of the Department of Atomic Energy such as the Bhabha Atomic Research Centre, Reactor Research Centre, Variable Energy Cyclotron, the power stations and a few others during the year 1975--76 are reported. The progress achieved in the field of atomic minerals, nuclear medicine, nuclear power, development of radioisotopes, etc., is presented in detail. The responsibilities and achievements of the public sector undertakings under the Department of Atomic Energy, such as Indian Rare Earth Ltd., Electronics Corporation of India Ltd., Uranium Corporation of India Ltd., are highlighted. Other activities, such as planning and execution, economic and personnel health aspects, international relations, etc. are also mentioned.

- 2378 (NP--21778) ANNUAL REPORT, 1976. (Ankara Nuclear Research and Training Center (Turkey)). 1976. 20p. Dep. NTIS (US Sales Only), PC A02/MF A01.
The Ankara Nuclear Research and Training Center carries out applied research and development work, most of which is directly related to Turkish industry. The Center consists of the following eight departments: nuclear physics, nuclear chemistry, electronics, radioisotope applications in industry, health physics, agricultural and biological radioisotope applications, technical information, and technical services. Very brief, nontechnical summaries of work done are presented. (RWR)

- 2379 ESTIMATION OF RADIATION HAZARD IN MAN'S HABITATIONAL MICROENVIRONMENT IN POLAND. Pensko, J. (Institute of Nuclear Research, Warsaw (Poland)). Postepy Fiz. Med.; 11: No. 2, 73-86(1976). (In Polish).
Previous research proved that the population

of Poland received absorbed doses of natural background radiation for the whole body of approx. 100 mrad/a outdoors, 75-100 mrad/a in wooden houses, 100-150 mrad/a ceramic brick houses and 120-300 mrad/a in prefabricated ones. The doses for cells of bronchi epithelium due to alpha radiation of radon and its daughters were found to be between 1.3 and 500 mrad/a outdoors and 2-2550 mrad/a indoors. From these data the expected biological effects were evaluated applying a linear dose - effect approach with no threshold relationship. The existing and future housing development as well as demographic forecast of the population and alive birthrate for the decades of 1950-2009 have been adopted. It has been proved that the critical hazards in form of malignancies of bronchi epithelium may be expected. Some conclusions and recommendations are given.

- 2380 (AED-Conf--76-134-063) PATIENT DOSE WITH WHOLE-BODY COMPUTER TOMOGRAPHY. Krauss, O.; Schuhmacher, H. (Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Inst. fuer Nuklearmedizin). 1976. 11p. (In German). (CONF-760592--10). NTIS (US Sales Only).

From 7. scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Heidelberg, F.R. Germany (5 May 1976). 5 figs..

The radiation doses in the whole-body computer tomography for brain, lungs, liver and kidney investigations were measured by means of LiF-TLD in the Alderson phantom. With a single-layer image of the trunk (filtration 6 mm aluminium) dose values of 1.2 rad were found for the skin on the entering side and of 90 mrad on the exiting side. Using a close-to-reality investigating technique of, e.g., 5 layers next to each other in the upper stomach, one gets maximum tissue doses at the entering side of 1.8 rad, in the body axis of 700 mrad and at the exiting side of 230 mrad. The gonadal doses are smaller than 2-4 mrad when the body cross-section last investigated is at a distance of more than 15 cm from the gonads.

- 2381 TRANSITION FROM THE ATOMIC BOMB CASUALTY COMMISSION TO THE RADIATION EFFECTS RESEARCH FOUNDATION. Bond, V.P. (Brookhaven National Lab., Upton, N.Y. (USA)). pp 419-420 of Biological and environmental effects of low-level radiation. Vol. 2. Vienna; IAEA (1976).

From Symposium on biological effects of low-level radiation pertinent to protection of man and his environment; Chicago, Ill., USA (3 Nov 1975).

The events resulting in the establishment of the new foundation (RERF) to replace the Atomic Bomb Casualty Commission (ABCC) are briefly described.

- 2382 (AD-A--019804) NUCLEAR EMULSION MEASUREMENTS OF THE ASTRONAUTS' RADIATION EXPOSURES ON SKYLAB MISSIONS 2, 3 AND 4. Schaefer, H.J.; Sullivan, J.J. (Naval Aerospace Medical Inst., Pensacola, Fla. (USA)). 10 Dec 1975. 19p. (NAMRL--1220). NTIS \$3.50.

On the Skylab missions, Ilford G.5 and K.2 emulsions were flown as part of passive dosimeter packs carried by the astronauts on their wrists. Due to the long mission times, latent image fading and track crowding imposed limitations on a quantitative track and grain count analysis. For Skylab 2, the complete proton energy spectrum was determined within reasonable error limits. A combined mission dose equivalent of 2,490 millirems from

protons, tissue stars and neutrons was measured on Skylab 2. A stationary emulsion stack, kept in a film vault drawer on the same mission, displayed a highly structured directional distribution of the fluence of low-energy protons (enders) reflecting the local shield distribution. On the 59- and 84-day missions 3 and 4, G.5 emulsions had to be cut on the microtome to 5 to 7 microns for microscopic examination. Even so, the short track segments in such thin layers precluded a statistically reliable grain count analysis. However, the K.2 emulsions still allowed accurate proton ender counts without special provisions. (GRA)

- 2383 (N--76-16746) NUCLEAR EMULSION MEASUREMENTS OF THE ASTRONAUTS' RADIATION EXPOSURES ON SKYLAB MISSIONS 2, 3, AND 4. Schaefer, H.J.; Sullivan, J.J. (Naval Aerospace Medical Research Lab., Pensacola, Fla. (USA)). 10 Dec 1975. 17p. (NASA-CR--147436; NAMRL--1220). NTIS \$3.50.

On the Skylab missions, Ilford G.5 and K.2 emulsions were flown as part of passive dosimeter packs carried by the astronauts on their wrists. Due to the long mission times, latent image fading and track crowding imposed limitations on a quantitative track and grain count analysis. For Skylab 2, the complete proton energy spectrum was determined within reasonable error limits. A combined mission dose equivalent of 2,490 millirems from protons, tissue stars and neutrons was measured on Skylab 2. A stationary emulsion stack, kept in a film vault drawer on the same mission, displayed a highly structured directional distribution of the fluence of low-energy protons (enders) reflecting the local shield distribution. On the 59 and 84-day mission 3 and 4, G.5 emulsions had to be cut on the microtome to 5-7 microns for microscopic examination. Even so, the short track segments in such thin layers precluded a statistically reliable grain count analysis. However, the K.2 emulsions still allowed accurate proton ender counts without special provisions. (GRA)

- 2384 CHANGES IN RADIOIODINE UPTAKE IN NEW ZEALAND. Ross, I.T.H. (Wellington Hospital, N.Z.). N.Z. Med. J.; 82: No. 553, 380-381(10 Dec 1975).

The radioiodine uptakes of 965 patients presenting at Dunedin, over the period January 1959 to January 1970 have been examined. A small change toward lower values of uptake was noted, however, the change was much less than the changes reported in the USA.

- 2385 (COO--2539-32) IMMUNOLOGICAL AND VIRAL ASPECTS OF RADIATION-INDUCED TUMORS. ELEVENTH ANNUAL REPORT, FEBRUARY 1, 1975--FEBRUARY 29, 1976. Reif, A.E. (Boston City Hospital, Mass. (USA)). 5 Dec 1975. Contract AT(11-1)-2539. 7p. Dep. NTIS \$3.50.

Preliminary data are presented for studies on the immunological and viral aspects of radioinduced neoplasms in mice. The biological activity of oncogenic viruses is discussed. (CH)

- 2386 IN-WIRE MEASUREMENT OF THE NEUTRON DOSE RATE ON PATIENTS WITH ^{238}Pu PACEMAKERS IMPLANTED. Piesch, E.; Burgkhardt, B.; Kollmeier, W. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Strahlenschutz und Sicherheit). Nucl. Instrum. Methods; 131: No. 1, 191-196(1 Dec 1975).

In-vivo measurements of the neutron dose on Medtronic pacemakers have been performed by using a proportional counter and a

scintillation counter. The paper discusses the technique of free air and phantom calibration and the method of in-vivo measurement of the neutron fluence and the estimation of the dose equivalent. The neutron dose equivalent rate measured on seven patients with ^{238}Pu pacemakers implanted were found to be (5.6+-0.1) mRem/h at the surface of the pacemaker in 1.25 cm distance from the center of the source corresponding to a neutron emission rate of 940 ns⁻¹. The results are in good agreement with results of other methods reported by different authors.

- 2387 ENVIRONMENTAL IMPACT DUE TO NUCLEAR POWER PLANTS. AN ATTEMPT TO DETERMINE THE RISK FACTOR. Kellermann, O. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F.R. Germany)); Balfanz, H.P. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F.R. Germany). Abt. Auslegung). Tech. Ueberwach.; 16: No. 12, 364-368(Dec 1975). (In German).

1 fig.; 6 tabs.; 8 refs..

The environmental impact due to nuclear power plants is smaller than that due to fossil-fired power plants. The risks of the nuclear power plant operation are determined by the quantity and the probability of the release of radioactive materials. According to the value, the risks of normal operation can be compared to the accident risks. An attempt should be made to effectively reduce the remaining risk at unfavourable sites with the emphasis on accidents with larger effects than design basis accidents.

- 2388 (GEAP--14034-5) RADIOLOGICAL ASSESSMENT MODELS FIFTH QUARTERLY REPORT, SEPTEMBER--NOVEMBER 1975. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Dec 1975. Contract E(04-3)-893. vp. AT.

The objectives of the program are to develop models for analyzing and evaluating postulated radiological sources, aerosol dynamics, sodium fires, and radiological dosages arising from hypothetical core disruptive accidents in liquid metal fast breeder reactors.

- 2389 (WaBoLu--30/75) TRITIUM IN THE ENVIRONMENT DUE TO THE PEACEFUL USE OF NUCLEAR ENERGY. Mattern, F.C.M.; de Regt, H.J.B.; Aurand, K.; Ruehle, H. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene). Dec 1975. 9p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

With values of several prem/a and more, the present tritium exposure due to nuclear power stations and nuclear research centres in the FRG and the Netherlands is still very low. A theoretical estimation of the radiation exposure due to 100 hypothetical nuclear power stations along the Rhine - each with a power of 1,000 MWe - would give an additional radiation exposure of only about 0.15 mrem if the surface water were used as drinking water. Estimations of the tritium emission for the year 2000 show that the global environmental pollution is also low, having a mean value of about 0.1 mrem/a. The highest future environmental pollution due to tritium is expected from reprocessing plants. To keep tritium emissions with the waste water from reprocessing plants as low as possible, it should be found out whether waste water may, e.g. be pumped into deeper strata of the earth or into the deep sea.

- 2390 ISOLATION OF CHLAMYDIA IN IRRADIATED AND NON-IRRADIATED MCCOY CELLS. Johnson, L.; Harper, I.A. (New Cross Hospital, Wolverhampton (UK). Public Health Lab.). J. Clin. Pathol.; 28: No. 12, 1003-1004(Dec 1975).

Specimens from eye and genital tract were cultured in parallel in irradiated and non-irradiated McCoy cells and the frequency of isolation of chlamydia using these culture methods was compared. There was a significant difference between the frequencies of isolation; irradiated McCoy cells produced a greater number of positive results.

- 2391 POTENTIATION BY CAFFEINE OF ULTRAVIOLET-LIGHT DAMAGE IN CULTURED HUMAN CELLS. Schroy, C.B.; Todd, P. (Pennsylvania State Univ., University Park (USA). Dept. of Biophysics). Mutat. Res.; 33: No. 2/3, 347-355(Dec 1975).

Five cultured human cell lines (T-1 kidney, Chang liver, H.Ep. No. 2, HeLa-S3 and HeLa-O) were irradiated with ultraviolet light and immediately exposed to 1.0 and 3.0 mM caffeine for 44h thereafter. This caffeine treatment reduced the surviving fraction (assayed by colony formation) of the irradiated population, but did not significantly reduce the colony-forming ability of unirradiated control cells. These findings suggest that many cultured human cell lines exhibit post-UV potentiation of potentially lethal damage by caffeine.

- 2392 REPAIR MECHANISMS OF RADIATION DAMAGE. RECENT FINDINGS IN RADIOBIOLOGY. Pellerin, P. (Ministere de la Sante, 78 - Le Vesinet (France). Service Central de Protection contre les Rayonnements Ionisants). Atomwirtsch., Atomtech.; 20: No. 12, 617-620(Dec 1975). (In German).

Recent findings in radiobiology seem to indicate with a probability bordering on certainty that there is a threshold level of radiation damage to the organism. This fact, which has long been postulated by radiobiologists and geneticists, does not contradict the fact that cell nuclei may be damaged by radiation effects. For, it is seen from the natural repair mechanism of the cell structure that there is a quality assurance system without which any living organism would have to degenerate immediately in view of the large number of defects in the molecular structure, so that life would not be possible. In the human organism, for instance, several millions of cells must be renewed every second. The findings outlined above clearly show that the repair capability is constantly needed to balance out a certain measure of structural defects, also without any radiation impact, which is far above the damaging capability of low radiation doses.

- 2393 (AD-A--019797) PREDICTING SAFE DISTANCES TO PREVENT RETINAL BURNS FROM NUCLEAR DETONATIONS. INTERIM REPORT, DEC1972--DEC 1974. Richey, E.O.; Lof, N.E. (School of Aerospace Medicine, Brooks AFB, Tex. (USA)). Dec 1975. 71p. (SAM-TR--75-30). NTIS \$4.50.

The visual effects of chorioretinal burns are discussed, and a mathematical model is described for predicting the retinal burns threshold distance or safe distance from a low-altitude nuclear detonation. Mathematical equations for the model are derived, and a Fortran computer program to solve these equations is described. Retinal burn threshold distances are predicted and compared to experimental data for several nuclear detonations. This program is recommended for Air Force use to predict retinal burn safe-

separation distances for planning purposes. (GRA)

- 2394 (AD-A--021270) USE OF A THERMOLUMINESCENT DOSIMETRY SYSTEM IN MEASURING DOSE TO PATIENTS UNDERGOING XEROMAMMOGRAPHY. Guice, D.L. (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio (USA). School of Engineering). Dec 1975. 160p. (GNE/PH--75-17). NTIS \$6.75.

Thesis.

The response of lithium fluoride (TLD-100) thermoluminescent dosimeters (TLDs) was calibrated against known exposures to x-ray beams having most probable energies of 11.6, 19, 24.9, and 42 keV. Separate impressions were made of the right breast of a female volunteer positioned for two x-ray views used in xeromammography with a General Electric MMX-2 Mammography Unit. The impressions were used to cast Mix-D breast phantoms for an Alderson-RANDO man phantom. The TLDs were used to measure the exposure distributions on and within the breast phantoms that result from xeromammography. Exposure distributions were measured at x-ray generating potentials of 30 to 38 kVp for the craniocaudal view and 32 to 40 kVp for the mediolateral view. A technique of 300 mAs and 1.5 mm Al_{eq} filtration was used for all exposures. Maximum skin doses, calculated from the measured exposure, ranged from 730 to 1620 mrad for the craniocaudal view and 1030 to 2150 mrad for the mediolateral view as the generating potential was increased. (GRA)

- 2395 RADIATION EXPOSURES ABOARD COMMERCIAL AIRCRAFT. Uselman, J.; McKlveen, J.W. (Arizona State Univ., Tempe). Health Phys.; 29: No. 6, 881-883(Dec 1975).

Recently there has been concern, discussion and legislation restricting the type and amount of radioactivity shipped in cargo holds of passenger aircraft. Whereas abnormal packaging or breakage may result in significant exposure to personnel, the primary source of chronic radiation is undoubtedly cosmic rays. The study reported herein used highly sensitive thermoluminescent dosimetry (TLD) to discriminate and quantify both types of radiation. Results indicated that airline employees and passengers who accrue considerable amounts of flying time may receive yearly exposures which are twice that received by the general public. (auth)

- 2396 RADIOGRAPHIC TECHNIC, SAFETY, AND INTERPRETATION IN THE NEWBORN NURSERY. Holbert, C.L.; Frey, G.D.; Levkoff, A.H.; Travis, E.L. (Univ. of South Carolina, Charleston). Shonika Rinsho; 87: No. 6, 968-972(Dec 1975).

The technic and safety aspects of the radiographic evaluation of neonates with RDS are discussed. A study of radiographs taken in an intensive care nursery revealed that densitometric measurements are helpful in distinguishing changes in lung aeration from changes in radiographic quality. The radiation exposure to neonates was 5.1 (SD 2.3) mR per film and 44.9 (SD 39.7) mR per neonate. Limited chromosomal studies revealed no detectable abnormalities. The radiation exposure to the staff was minimal. The low-radiation exposure to the staff and neonates is the result of careful attention to radiation hygiene.

- 2397 GONADAL DOSE TO THE POPULATION OF THE CZECH SOCIALIST REPUBLIC FROM NATURAL EXTERNAL IRRADIATION. Spurny, Z.; Kovar, Z.

(Ceskoslovenska Akademie Ved, Prague. Laborator Radiologicke Dozimetrie). Jad. Energ.; 21: No. 12, 451-454(Dec 1975). (In Czech).

The gonadal population dose in the Czech Socialist Republic resulting from the effects of Earth crust gamma radiation and of cosmic radiation is discussed. The mean annual gonadal dose due to external natural radiation background was calculated to be $910 \mu\text{J.kg}^{-1}$ (91 mrad/s).

- 2398 RADIATION DOSAGE TO THE BREAST IN WELL-WOMEN SCREENING SURVEYS. Asbury, D.L.; Barker, P.G. (University Hospital of South Manchester (UK)). Br. J. Radiol.; 48: No. 576, 963-967(Dec 1975).

The D.H.S.S. is supporting research in several centres to determine the feasibility of establishing a nationwide Breast Cancer Screening Programme. This paper answers the questions 'What is the radiation dose produced by mammography, and is it safe'. In the context of well-women screening surveys a maximum skin dose of 2 R has been recommended. The variation of dose across the breast surface is recorded and the reasons for this enumerated. The lowest mean dose recorded with industrial quality film was 4.9 R, so that such fine-grain film cannot be used for this purpose. Doses within the recommended safety limit are achieved by the use of vacuum-packed film-screen combinations. The new rare-earth phosphor screens produced the lowest dose (0.2 R). There was no significant gonad dose. It is concluded that mammographic examination of well-women can be performed at safe radiation levels.

- 2399 SOMATIC AND GENETIC RISKS FOR POPULATION DUE TO THE NATURAL RADIATION AND TYPE OF THE BUILDING DEVELOPMENT IN POLAND. Pensko, J. (Institute of Nuclear Research, Swierk (Poland). Zaklad Ochrony przed Promieniowaniem). Kerntechnik; 17: No. 12, 533-536(Dec 1975).

7 figs.; 1 tab.; 15 refs..

Previous research proved that the population of Poland could receive the absorbed doses of natural background radiation for the whole body of approx. 100 mrad/a outdoors, 75 ... 100 mrad/a in wooden houses, 100 ... 150 mrad/a in ceramic brick houses and 120 ... 300 mrad/a in prefabricated ones. The doses for cells of bronchi epithelium due to alpha radiation of radon and its daughters could be within 1.3 ... 500 mrad/a outdoors and 2 ... 2,550 mrad/a indoors. Basing on these data the expected biological effects were evaluated applying a linear dose-effect approach with no threshold relationship. The existing and expected housing development as well as demographic forecast of the population and alive birth-rate for the decades of 1950-2009 were adopted. It was proved that critical hazards in form of malignancies of bronchi epithelium may be expected. Some conclusions and recommendations were given.

- 2400 ASSAY OF BIOLOGICAL DOSIMETRY FROM THE CHANGED NUMBER OF LYMPHOCYTES AND HYPERSEGMENTED NEUTROPHILES. Zak, M.; Rezny, Z.; Dienstbier, Z.; Uhlirova, A. (Karlova Universita, Prague (Czechoslovakia). Biofyzikalni Ustav). Strahlentherapie; 6: No. 150, 579-584(Dec 1975).

3 figs.; 3 tabs.; 5 refs..

The paper presented deals with the statistical utilization of changes in lymphocyte and hypersegmented neutrophils counts in peripheral blood after irradiation for the biological detection of ionizing radiation. Both parameters are in a good

correlation during simultaneous evaluation of their changes, and they fail during evaluation in various time intervals after irradiation. The changes of the two hematological parameters after irradiation, lymphopenia and hypersegmentation of cellular nuclei of granulocytes were therefore utilized. The changes under examination were elaborated in the computer and evaluated by a method of regression classification and by discriminatory analysis. This analytical way enables a new conception in the evaluation of individual hematological post-irradiation changes. This study is being continued along several lines. On the one hand, further statistical methods of making the results more precise will be used; on the other hand, other laboratory animals will be tested as well. Last but not least, the best statistical method will be used in an attempt to biologically detect the changes after therapeutical irradiation in man.

- 2401 PATH TO SPATIAL IRRADIATION PLANNING. PT. 2. VECTORIAL DESCRIPTION OF THE SPATIAL DOSE DISTRIBUTION WITHIN A SINGLE RAY BEAM; FIRST CONSEQUENCES FOR PRACTICAL APPLICATION. Sonntag, A. (Ulm Univ. (F.R. Germany). Dept. Radiologie). Strahlentherapie; 6: No. 150, 569-578(Dec 1975). (In German).

4 figs..

Spatial irradiation planning among other things demands spatial consideration of the dose distribution within the single useful ray beam. From this point of view, the vectorial dose quantities introduced in part I of this paper are reviewed, their correlations are examined as well as their dependences on different influencing quantities e.g. on the rotational position of the wedge filter with the central ray as an axis of rotation. The vectorial description of dose distribution used in this paper, additionally offers information on the total effect upon the inclination of isodose surfaces or curves respectively, caused either simultaneously by different influences (simultaneous effect) or in temporal succession by separate influences (succession effect). The correlations observed can be verified diagrammatically or dosimetrically using simple practical examples. Thus, it is possible for instance to obtain a continuous defined variation of the isodose inclination by varying the weights of the partial doses with successive irradiation with or without a wedge filter.

- 2402 ORAL CARE OF THE PATIENT HAVING HEAD AND NECK IRRADIATION. Trowbridge, J.E.; Carl, W. (Roswell Park Memorial Inst., Buffalo). Am. J. Nursing; 75: No. 12, 2146-2149(Dec 1975).

Saliva is an effective oral cleanser and lubricant. But salivary glands are sensitive to radiation therapy and their diminished function poses acute and painful problems for the patient.

- 2403 CRITERIA FOR RADIATION PROTECTION. Nooteboom-Beekman, Z.M. (Reactor Centrum Nederland, Netherlands). Atoomenerg. Haar Toepass.; 17: No. 12, 253-255(Dec 1975). (In Dutch).

The Third European Congress of the International Radiation Protection Association organised by the Netherlands Association for Health Physics was held 13-16 May 1975 in Amsterdam. Much new information was contributed about the doses from different natural and non-natural sources of radiation, the measurement and calculation of these doses, and methods of limiting them. In particular new data were presented on the natural occurrence of

hereditary effects, the natural frequency of mutations and the occurrence of chromosome abnormalities.

- 2404 HEREDITARY INFLUENCES OF ATOM-BOMB RADIATION. Awa, A. (Radiation Effect Research Foundation, Hiroshima (Japan)). Idem; 29: No. 12, 33-38(Dec 1975). (In Japanese).

Genetical investigation of an early time (including the time immediately after the atom-bomb exposure), epidemiological studies of mortality and cellular-hereditary investigations were conducted to the children of atom-bomb survivors, and the results were summarized. There was no statistically significant difference in any hereditary influences.

- 2405 EFFECTS FROM PLACENTAL EXPOSURE. Kawamoto, S. (Radiation Effect Research Foundation, Hiroshima (Japan)). Idem; 29: No. 12, 28-32(Dec 1975). (In Japanese).

Investigations of the effects on the people who had received placental exposure at either Hiroshima or Nagasaki were discussed. All of the subjects were children who had been born at either Hiroshima or Nagasaki between noon of 31, May, 1946 and the atomic-bomb detonation. Deaths of embryos and neonates were determined by the radiation dosage and the growth phase of embryos. Bifid uvula and a slight decrease of number of lumbar vertebra were observed in 14 males and 3 females at Nagasaki. Mental deficiency occurred in 25% of the children whose mothers had received radiation at Nagasaki, and in 8% at Hiroshima. The occurrence of microcephaly was high at both places in the children who had received placental exposure of more than 150 rad. A significant retardation of growth was observed in those who had had a high radiation dosage. Congenitally abnormal persistence of pupillary membrane was very frequently observed in the group which had received a high dosage of radiation. Concerning progeria, mortality of infants under one year of age was increased in the group which had received a high dosage of radiation, but mortality statistics should continue to be observed.

- 2406 SEARCH FOR THE LOWEST IRRADIATION DOSE FROM LITERATURES ON RADIATION-INDUCED BREAST CANCER. Yoshizawa, Y.; Kusama, T. (Tokyo Univ. (Japan). Faculty of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 35: No. 12, 1125-1130(Dec 1975). (In Japanese).

A survey of past case reports concerning radiation-induced breast cancer was carried out in order to find the lowest irradiation dose. The search of literature published since 1951 revealed 10 cases of radiation-induced breast cancer. Only 5 cases had precise descriptions of the irradiation dose. The lowest irradiation dose was estimated at 1470 rads in the case of external X-ray irradiation for tuberculous angioma. All of cases of radiation-induced breast cancer had received radiation for the treatment of nonmalignant tumors, such as pulmonary tuberculosis, mastitis, and tuberculous angioma. There also were three statistical studies. The first concerned atomic bomb survivors, the second, pulmonary tuberculous patients subjected to frequent fluoroscopies, and the third, patients of acute post partum mastitis. These statistical studies had revealed a significant increase in the incidence of breast cancer in the irradiated group, but there was little information about the lowest irradiation dose. It was noticed that radiation-induced breast cancer was more numerous in the upper inner quadrant of the

breast. Most histopathological findings of radiation-induced breast cancer involved duct cell carcinoma. The latent period was about 15 years.

- 2407 EXPOSURE DOSES TO ATOMIC BOMB IN HIROSHIMA AND NAGASAKI. Hashizume, T. (National Inst. of Radiological Sciences, Chiba (Japan)). Idem; 29: No. 12, 5-10(Dec 1975). (In Japanese).

In determining estimates of exposure doses in victims of an atomic air raid, the following things should be taken into consideration: the presence and type of interceptors, such as buildings around the site of the bombing; the distance of the victims who are immediately exposed to radioactivity from the site of the bombing; and the time at which they were exposed. When estimates of exposure doses of each organ are determined, approximately a 20% error should be taken into consideration.

- 2408 EVALUATION OF INTERNAL ABSORBED DOSE OF PUBLIC RESULTING FROM RADIOACTIVE PATIENT AND INDEX OF RADIOACTIVE LEVELS FOR DISCHARGE. Nishizawa, K.; Ohara, K.; Maekoshi, H.; Orito, T. (Nagoya Univ. (Japan). Faculty of Medicine); Koga, S. Kaku Igaku; 12: No. 6, 631-636(Dec 1975). (In Japanese).

The amount of radiation internally absorbed by the public contaminated by inhalation of air or excretion (sputa, urine, sweat and so on) of the radioactive patient was calculated. This dose determined the permissible radiation level in a room occupied by a patient injected or prescribed radioisotopes. The permissible dose level of radiation absorbed internally by the public must not exceed 0.5 rem/year. The allowable radiation level in the regular room of a radioactive patient should not exceed more than 10 mrem/week of radiation absorbed by another patient in the same room. The absorbed dose by the family in the home of the radioactive patient must not exceed 0.5/3 rem per investigation. The radioactive levels are obtained by calculation for the eight radionuclides ^{51}Cr , ^{59}Fe , ^{75}Se , $\text{sup}(99\text{m})\text{Tc}$, ^{131}I , ^{125}I , ^{198}Au and ^{203}Hg in both cases.

- 2409 CAFFEINE INHIBITION OF THE REPAIR OF ULTRAVIOLET-IRRADIATED ADENOVIRUS IN HUMAN CELLS. Day, R.S. III (National Institutes of Health, Bethesda, Md. (USA)). Mutat. Res.; 33: No. 2;3, 321-325(Dec 1975).

Caffeine is shown to block repair of ultraviolet-irradiated adenovirus 2 when the irradiated virus infects normal human fibroblasts from a xeroderma pigmentosum (XP) variant. Such blockage is not observed when the irradiated virus infects XP fibroblasts belonging to XP complementation group A. Thus normal and XP variant cells have a caffeine-sensitive repair process. This may be either excision or an excision dependent repair process because fibroblasts belonging to XP complementation group A are believed to lack the excision repair process.

- 2410 TWENTY-YEAR-CLINICAL HISTORY OF VICTIMS OF RADIOACTIVE FALLOUT IN BIKINI. Kumatori, T. (National Inst. of Radiological Sciences, Chiba (Japan)). Idem; 29: No. 12, 39-43(Dec 1975). (In Japanese).

A study was made on clinical course over a 20 years period in a former crew of the 5th Fukuryumaru who had been exposed to radioactive fallout in Bikini in 1954. The estimate of exposure dosage and general clinical findings, such as skin damage, blood dyscrasia, abnormal chromosome, the physical improvement and so

forth were described.

11 CANCER DEVELOPING AMONG ATOM-BOMB SURVIVORS. Yamamoto, T. (Radiation Effect Research Foundation, Hiroshima (Japan)). *Iden*; 29: No. 12, 17-22(Dec 1975). (In Japanese).

Cancer (with the exception of leukemia) which had often been observed among atom bomb survivors was discussed. Prevalence of thyroid carcinoma was high in the people who had been exposed to more than 50 rad of the atomic radiation. A great difference in prevalence of cancer was seen between irradiated people whose age had been under 20 years at the time of exposure and non-irradiated. More women than men had papillary adenocarcinoma. The highest prevalence was seen 16 to 20 years after exposure to atomic radiation, but there was no difference in prevalence between those from Hiroshima and from Nagasaki. Lung cancer comprised 89% of all cancers of the people whose age was 50 years and over. Most of them had been exposed to atomic radiation of more than 300 rad. The type was cellular retrograde cancer. The prevalence of gastric carcinoma was low, and breast cancer occurred at an early age before menopause. The occurrence of cancer in juvenile survivors was several times higher in the patients who had been exposed to atomic radiation of more than 100 rad than in non-irradiated. These values indicate that cancer occurs more frequently than leukemia does in such survivors.

2412 RELATIONSHIP BETWEEN RADIOACTIVITY FROM ATOMIC BOMB AND LEUKEMIA. Ishimaru, Toranosuke (Radiation Effect Research Foundation, Hiroshima (Japan)). *Iden*; 29: No. 12, 11-16(Dec 1975). (In Japanese).

A study was made on the atomic bomb survivors in whom leukemia subsequently occurred in Hiroshima and Nagasaki. The incidence of leukemia averaged 30 per one million people 5--26 years after they had been exposed to less than one rad. Among the atomic bomb survivors who had been exposed to 1--99 rads, leukemia occurred within 5--10 years, which showed a slightly higher incidence than that among those who had been exposed to one rad. Among survivors exposed to more than 100 rads, leukemia occurred within 5--10 years on an average of 900 per one million, which was more than 30 times as high as that among those with one rad. Among those aged 15--29 years at the time of bombing, it was high 10--15 years afterward, but was low among those aged 30--44 years at the time of bombing. Among people over 45 years, it became high within 10--15 years, and was still high 15--26 years after bombing. It was suspected that it took 2--3 years after the bombing to develop. From 1950 to 1961, among survivors with exposure to more than 50 rads in Hiroshima, there was a higher incidence of leukemia than there was in Nagasaki. This suggests that neutron-rays have a stronger effect on the incidence of leukemia than have γ -rays. Survivors who had been exposed to neutron-rays in Hiroshima, often had acute or chronic leukemia. On the other hand, some of the survivors with exposure to γ -rays in Nagasaki had only acute leukemia.

2413 STUDIES ON THE LIFE SPANS OF ATOM-BOMB SURVIVORS. Kato, H. (Radiation Effect Research Foundation, Hiroshima (Japan)). *Iden*; 29: No. 12, 23-27(Dec 1975). (In Japanese).

A shortening of whole life as late injuries of atom-bomb survivors was discussed from the aspects of aging and the studies on the causes of leukemia and cancers. Twenty-one thousands four hundreds and forty-seven of 109000

subjects died during the period between 1950 and 1970. Mortality by exposure doses presented a high value with exposure doses. Mortality of subjects which had received exposure doses of more than 200 rads rose to a level which was 1.27 times in all causes of deaths of the control which had received exposure doses of 0 to 9 rads, and it showed 1.32 times in all deaths of sickness, 18.3 times in leukemia, and 1.48 times in death from cancer. Mortality due to leukemia decreases after 1950-1954, but in the group which had received exposure doses over 100 rads, the mortality was significantly higher than that in all districts in Japan. The shape of dose-reaction curve in Hiroshima was different from that in Nagasaki. In the same dose, mortality due to leukemia in Hiroshima was higher than that in Nagasaki. The younger the age at exposure was, the higher the risk rate of occurring cancer was. Especially, the risk rate of cancer was high in the patients who were exposed to atomic bomb during the age of 0 to 9 years old. Mortality due to cancer increased with the dose. Cancers which statistically showed higher mortality than that in the control group are lung cancer, cancer of the breast (100-199 rad), carcinoma of the esophagus, cancer of the urinary organ (200-299 rad) and gastric cancer (over 300 rads). There are not so clear difference in the mortality due to cancer between Hiroshima and Nagasaki, comparing with the mortality due to leukemia.

2414 FIRST ASIAN REGIONAL CONGRESS ON RADIATION PROTECTION. Kumar, S.K. (Bhabha Atomic Research Centre, Bombay (India). Library and Technical Information Section). *J. Sci. Ind. Res.*; 34: No. 12, 658-662(Dec 1975).

Due to the rapid progress in the development of nuclear energy and its applications in medicine, agriculture and industry, the potential danger to large groups of population due to radiation hazards has increased. Thus, radiation protection has become an important aspects of industrial and public hygiene. The article reviews the deliberations of the First Asian Regional Congress on Radiation Protection which was held during 15-20 December 1974 at the Bhabha Atomic Research Centre. 190 papers were presented on the following broad subjects: (1) organization of radiation protection services on a countrywide scale and significant problems and experiences; (2) research and cooperation, mutual assistance, education and training; (3) personnel monitoring; (4) nuclear industry risks and benefits; (5) radiation protection legislation and (6) panel discussions and regional international cooperation in the field of radiation protection.

2415 COMPARISON STUDY OF THE ORGAN ABSORBED DOSES PER UNIT EXPOSURE IN EXTERNAL IRRADIATION. Kaminaga, H.; Kumazawa, S.; Furuta, T.; Tatsuta, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). *Hoken Butsuri*; 10: No. 4, 193-201(Dec 1975). (In Japanese).

The dose absorbed in an organ due to external radiation depends on the photon energy and incident direction to the body. The results of organ absorbed dose measured by C. Zeow et al. were revised into the absorbed dose in the organ per unit exposure (rad/R); these values are tabulated for each organ, photon energy and incident direction to the body. The gonadal doses are compared with those reported by other workers in energy dependence at a typical incident direction, and problems in conversion factor (rad/R) to the organ dose are described. The results for the tests agree with those by other workers for anterior and horizontal

rotational irradiations. There is disagreement, however, for posterior and left-side irradiations. This may be due to the differences in shape of the phantom and position of the organ. On the other hand, the ovary dose for all the incident directions is in good agreement with that by other workers.

- 2416 BACKGROUND GAMMA RADIATION: CONTRIBUTION TO THE EXPOSURE OF THE POPULATION IN ITALY. Cardinale, A. (Agip Nucleare, Milan); Cortellessa, G.C.; Gera, F.; Ilari, O.; Lembo, G. Com. Naz. Energ. Nucl., Nct.; 21: No. 12, 107-118(Dec 1975). (In Italian).

The distribution of the individual absorbed doses to the Italian population due to the natural background radiation was measured all over the country by means of a portable high-pressure ionization chamber. The collective dose, in man rads, was also estimated for the population of each region and of all the country. From these measurements, it resulted that the values of the average dose to the individuals of the population in the different Regions of Italy range from 38 mrad/year for the Molise Region to about 140 mrad/year for the Campania Region. The natural means is about 68 mrad/year. All these values do not include contribution due to cosmic rays.

- 2417 TRISOMY AND TRIPLOIDY INDUCED BY X IRRADIATION OF MOUSE SPERMATOCYTES. Szemere, G.; Chandley, A.C. (Western General Hospital, Edinburgh (UK)). Mutat. Res.; 33: No. 2/3, 229-237(Dec 1975).

Analysis of second meiotic metaphase divisions in control and irradiated male mice shows that while the spontaneous rates of autosomal and sex chromosomal anaphase I non-disjunction are extremely low, they can be enhanced by x ray treatment of prophase spermatocytes. Irradiation at pre-leptotene results in a higher rate of anaphase I non-disjunction than does irradiation at pachytene. Early spermatogonia are relatively insensitive. Experiments to detect trisomic progeny among the F₁ fetal offspring of male mice mated during weeks 5 and 6 following irradiation (sampling of irradiated early spermatocytes and late spermatogonia) showed that none were present. Possible explanations for this are considered. Two triploid fetuses were however found.

- 2418 EFFECTS OF SINGLE OR MULTIFRACTIONATED IRRADIATION WITH 2 MEV FAST NEUTRONS ON C₃H MOUSE MAMMARY CARCINOMA. Tsunemoto, H.; Kutsutani, Y.; Koike, Y.; Ando, K.; Furukawa, S. (National Inst. of Radiological Sciences, Chiba (Japan)). Nippon Igaku Hoshasen Gakkai Zasshi; 35: No. 12, 1116-1124(Dec 1975). (In Japanese).

Experimental assay method were used to estimate the growth delay time of irradiated tumors. Average growth delay times were plotted on a semilogarithmic graph as a function of dose, and the relative biological effectiveness (RBE) was estimated. The RBE after a single dose irradiation increased with increasing dose, when the tumors were irradiated under aerobic conditions. The RBE needed to produce a growth delay of 20 or 50 days was 2.6 or 3.1, respectively. On the other hand, if the irradiation was given under hypoxic conditions, the RBE needed to produce 10 or 20 days' delay was 3.5 or 3.1, respectively. For the fractionated dose irradiations, a treatment regime of 3 times a week was used, i.e., six equal doses were given in two weeks. The growth delay time after a single 600 rads of fast neutrons was 21.8 days, while it was prolonged

to 24.6 days if the same total dose was given in 6 fractions. A similar result was observed after a larger neutron dose. On the other hand, fractionated X-ray doses were less effective than a single dose. The growth delay time was 60.1 or 40.6 days for tumors irradiated with a single dose or six doses of 4800 rads. These results might indicate that some of the features of high LET radiations are that tumor cells irradiated with fast neutrons were capable of repairing sublethal damage less extensively than those irradiated with X-rays and that chronically hypoxic tumor cells might be sterilized more effectively by fast neutrons than by X-rays. The latter phenomenon might lead to extensive reoxygenation after neutron dose and that of fractionated neutron doses are effective.

- 2419 EFFECT OF X-IRRADIATION ON THE METABOLISM OF RAT ERYTHROCYTES. Prokes, J.; Sromova, S.; Vulterin, K.; Stavovcikova, O. (Karlova Universita, Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi); Proksova, M. (Vojensky Veterinarni Vyzkumny Ustav, Prague (Czechoslovakia)). Vet. Med. (Prague); 20: No. 12, 705-713(Dec 1975). (In Czech).

Rats and rabbits were whole-body irradiated with x rays at a dose of 100 to 750 R. At daily intervals samples of blood were taken and kept in heparin. After addition of ³²P phosphate they were incubated for 35 minutes at 37 degC in vitro. The incorporation in the erythrocytes decreased significantly for doses of 250 to 500 R. The maximum response was obtained between the 6th and 14th day. The method may be applied for the examination of the state of the organism irradiated with a dose of x radiation higher than 250 R. The specificity of the method is discussed.

- 2420 IRRADIATION AND RADIATION EXPOSURE. Rennert, O.M. Clin. Obstet. Gynecol.; 18: No. 4, 177-183(Dec 1975).

The induction of chemical damage in DNA following irradiation exposure is clear, and it is well established that the radiation sensitivity of mammalian cells with regard to the induction of mutation, malignant transformation, or cell death is a function of the cell cycle with respect to the time of exposure to radiation. The radiosensitivity of mammalian cells is related to their proliferative capacity. Evidence at the present time clearly indicates that damage to the heterocyclic bases in DNA is a major lesion resulting from irradiation. In the future biologic science must direct itself to elucidation of the excision and repair processes within a cell, development of methodologies for determination of strand breaks in DNA of molecular weight greater than 5 x 10⁶ daltons, and elucidation of the relation of strand breakage to the biologic effects of ionizing radiation on mammalian cells.

- 2421 SPECIFIC LOCUS MUTATION RATES AFTER REPEATED SMALL RADIATION DOSES TO MOUSE OOCYTES. Lyon, M.F.; Phillips, R.J.S. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). Mutat. Res.; 30: No. 3, 375-381(Dec 1975).

When female mice were given a dose of 20 x 10 rad x-rays, the specific locus mutation rate among offspring conceived up to 7 weeks after the end of treatment was 1/39887 or 0.18 x 10⁻⁷/rad/locus, whereas when the same total dose of 200 rad was given in a single exposure, the mutation rate was 9/34813 or 1.85 x 10⁻⁷/rad/locus. The lower mutation rate after the 20 x

10 rad dose was obtained whether the total of 200 rad was given over a period of 5 days or 4 weeks, and if only young conceived in the first 20 days, rather than 7 weeks, were considered. It is suggested that each 10 rad fraction had the same small effect, and hence that these results confirm and extend Russell's previous finding that the dose-response relationship for specific locus mutations in females is curved.

- 2422 CYTOLOGICAL INVESTIGATIONS ON THE EFFECTS OF ^{131}I IN MALE MICE. Subramanyam, S.; Murthy, D.K.; Reddi, O.S. (Osmania Univ., Hyderabad (India). Dept. of Genetics). Indian J. Med. Res.; 63: No. 12, 1680-1687 (Dec 1975). 30 refs..

Cytological investigations on the effects of the intraperitoneal administration of ^{131}I into male mice belonging to the CBA strain at doses of 0.01, 0.05, 0.07 and 0.1 μCi , revealed the induction of translocations and polyploid cells. There was a significant increase in such aberrations over the controls. The experimental/control response shows a gradual fall in the frequency of translocations during the period of observation, namely, from the first to the seventh day. No dosage effect was observed. Cytological studies confirmed that translocations had been induced.

- 2423 OBSERVATION OF TRITIUM BIOLOGICAL HALF-LIFE AND ESTIMATION OF INTERNAL RADIATION DOSE. Fu, Y.K.; Chen, L.H. (Inst. of Nuclear Energy Research, Lung-Tan, Taiwan). Nucl. Sci. J. (Taiwan); 12: No. 4, 219-231 (Dec 1975).

The tritium urinalysis by using azetropic distillation was developed at Institute of Nuclear Energy Research. It was compared with the method by adding the raw urine directly to the scintillation liquid, and with the method by distilling the sample and counting a portion of the distillate for tritium beta. Personnel exposed to tritium in Taiwan Research Reactor submitted 16h urine sample following exposure. The excretion data were fitted by computer program LLSFTE. Biological half-life values of 7, 8, 9.5, and 12 days were obtained. These were within the range of values between 4.1 and 13 days recommended by ICRP. The dose commitment estimations were calculated based on a permissible RBE dose rate to the critical organ, on the time integral of radioactivity in critical organ, and also on Butler's method.

- 2424 COMPARATIVE MEASUREMENTS OF THE PLANE-DOSE PRODUCT, THE SURFACE DOSE AND ORGAN EXPOSURE IN RADIODIAGNOSTIC ROUTINE EXAMINATIONS. Fiebach, O.; Even, K. (Essen Univ. (Gesamthochschule) (F.R. Germany). Radiologisches Zentrum; Gewerbeaufsicht des Landes Nordrhein-Westfalen, Duesseldorf (F.R. Germany). Zentralstelle fuer Sicherheitstechnik, Strahlenschutz und Kerntechnik). Roentgen Bl.; 28: No. 12, 609-612 (Dec 1975). (In German).

From 56. meeting of the Deutsche Roentgengesellschaft, Gesellschaft fuer Medizinische Radiologie, Strahlenbiologie und Nuklearmedizin e.V.; Berlin, F.R. Germany (1 May 1975).

2 figs.; 1 tab.; 1 ref..

Measurements have been carried out using an Alderson-Rando phantom. Their purpose was a comparison between the surface and organ doses of radiobiologic interest and the plane dose product, important for the documentation according to the Roentgen rules.

- 2425 METHOD OF PROTECTING HUMAN SKIN FROM ACTINIC RADIATION. Fusaro, R.M. (to Univ.

of Minnesota). US Patent 3,920,808. 18 Nov 1975. Filed date 8 May 1973. 8p.

Enhanced protection from sunlight is achieved by applying to human skin beforehand separate, time-spaced applications of (1) a carbonyl compound which is reactive with amino groups in human skin, for example dihydroxyacetone, and (2) a benzo- or naphtho-quinone such as lawsone. Preferably several sequential applications of each active component in a separate carrier are made the evening before the first exposure, and protection is thereafter maintained by applying each component separately each evening.

- 2426 METHOD FOR THE DIFFRACTION OF TERRESTRIAL RADIATION, GAMMA RADIATION, ETC. Busenbach, P. German (FRG) Patent 2,364,935/A/ 13 Nov 1975. 11p. (In German). 3 figs..

The patent claim concerns shielding against so-called earth radiation. These rays originate from water veins etc., cannot be defined any closer, and are supposed to cause injury to health. The author claims that shielding is possible with the aid of welding electrodes which have cores of nickel.

- 2427 (HRP--0006878) PERSONNEL RADIATION EXPOSURES IN A FUEL REPROCESSING FACILITY. Resnikoff, M. (Rachel Carson Coll., Amherst, N.Y. (USA)). Nov 1975. 15p. NTIS PC A02/MF A01.

This paper was presented at the 1975 Annual Meeting of the American Public Health Association..

Nuclear Fuel Services (NFS) was the first and only commercial nuclear fuel reprocessing facility which has operated in the United States, and as such, presents an experimental base with which to compare claims by nuclear proponents and opponents. This paper presents a review of the personnel radiation exposure record at NFS. The average whole body exposures to full-time NFS personnel rose steadily during the operating history of the plant, from 2.74 rems in 1968 to 7.15 rems in 1971; the plant ceased operation in January 1972. In addition to these 165 full-time personnel, the plant hired approximately 1,000 short term employees in an average year. After a brief presentation of the basic fuel reprocessing operation, the paper discusses the reasons for, and the plans of the company to reduce, these high exposure levels. Methods are suggested to reduce the projected levels still further for the modified NFS plan. (APHA)

- 2428 (PB--250729) INDIVIDUAL AND POPULATION DOSES FOR 1972 DISCHARGES FROM THE GINNA NUCLEAR POWER PLANT, UNIT NUMBER ONE.

Cochran, J.A.; Horton, T.R. (Environmental Protection Agency, Las Vegas, Nev. (USA). Office of Radiation Programs). Nov 1975. 39p. (ORP/LV--75-6). NTIS \$4.00.

The report presents the results of a study to determine the dose to the population in the vicinity of the Ginna Nuclear Power Plant (located in New York State) based upon 1972 discharge data. Doses calculated from release data are compared with current standards. This report fulfills the need to document the actual environmental impact of operating nuclear power reactors in contrast to Final Environmental Statement (FES) projections.

- 2429 (Juel-Conf--17, pp 39-49) NUCLEAR ENERGY AND RADIATION HAZARDS. Feldmann, A. Nov 1975. (In German). 4 figs.; 5 tabs.; 13 refs..

Profits and risks of nuclear energy. Lectures held at a seminar organized by the 'Arbeitsgruppe Kernenergie-Information' of the Kernforschungsanlage Juelich GmbH.

A survey is given of the present proportion between the population exposure to natural and to artificial radioactivity as well as of the radiobiological effects ionizing radiation has and radiation damage. Factor dependence of somatic and genetic damage is very clearly described and illustrated by data and figures. Genetic radiation risks, taking the population as a whole, is dealt with.

- 2430 DIP AND DIP + 2 AS GLUTATHIONE OXIDANTS AND RADIATION SENSITIZERS IN CULTURED CHINESE HAMSTER CELLS. Harris, J.W.; Power, J.A. (California Univ., San Francisco (USA). Lab. of Radiobiology); Kosower, N.S.; Kosower, E.M. Int. J. Radiat. Biol.; 28: No. 5, 439-445 (Nov 1975).

Two diamide analogues, diazene dicarboxylic acid bis (N'-methyl-piperazide) or DIP, and its bis-N'-methyl iodide salt, or DIP + 2, were tested for their ability to penetrate cultured Chinese hamster cells and oxidize intracellular glutathione. DIP penetrated the cells at a reasonable rate at 18°C, 160 nmoles being required to oxidize the endogenous glutathione of 2×10^6 cells, but it penetrated very slowly at 0°C. DIP + 2 did not effectively oxidize glutathione in Chinese hamster cells, possibly because it did not enter the cells. DIP became toxic after about 10 min of exposure, but its toxicity could be moderated by using anoxic conditions. DIP, but not DIP + 2, sensitized anoxic Chinese hamster cells to x radiation by a factor of 1.5, an effect that was due entirely to removal of the shoulder from the survival curve.

- 2431 OXYGEN-ENHANCEMENT RATIO FOR REPRODUCTIVE DEATH INDUCED BY ^3H OR ^{125}I DAMAGE IN MAMMALIAN CELLS. Koch, C.J. (California Univ., San Francisco (USA). Lab. of Radiobiology); Burki, H.J. Int. J. Radiat. Biol.; 28: No. 5, 417-425 (Nov 1975).

The oxygen-enhancement ratio (o.e.r.) for ^3H - and ^{125}I -induced cell death at 40°C was determined in cultured Chinese hamster cells. The o.e.r. for cell death induced by ^3H -thymidine was 3.2, essentially the same value as that previously reported for X-ray induced cell death. For cell death induced by ^{125}I -iododeoxyuridine ($^{125}\text{IdUrd}$), the o.e.r. was less than 1.4. The lower o.e.r. for ^{125}I -induced death was not due to the presence of the base analogue, since cells that had incorporated unlabelled IdUrd and were X-irradiated had an o.e.r. of 2.8 and cells that were inactivated by ^3H -IdUrd damage at 40°C had an o.e.r. even greater than 3. These results suggest that ^{125}I -decay damage, like high-linear-energy-transfer radiation damage, is only slightly increased by the presence of oxygen.

- 2432 (AECL--5309) PROGRESS REPORT, BIOLOGY AND HEALTH PHYSICS DIVISION, JULY 1 TO SEPTEMBER 30, 1975. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Nov 1975. 73p. (PR-B--107). INIS.

Interim results are reported for research in health physics, i.e. dosimetry, detectors, and monitoring; environmental research (limnology, radionuclide migration and kinetics; population research (radiation carcinogenesis, radiation effects in human populations); and biology (radiobiology).

- 2433 (KFK-EXT--20/75-2) ACCIDENT REPORT 1974. Windbuehl, E. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). Nov 1975. 54p. (In German). INIS.

11 refs.; with figs. and tabs..

This report continues the series of annual evaluations of accidents which took place at Gesellschaft fuer Kernforschung. The statistics are supplemented by examples of accidents and of preventive actions. The following objectives are pursued by this compilation: (1) Providing a survey of the development of the number of accidents which occurred from 1960 until 1974 and comparison of figures indicated. (2) Classification of accidents under different aspects and, hence, indication of accidents most frequently occurring. (3) Report about accident prevention activities.

- 2434 (SSI--1975-034) RADIATION DOSES TO THE PERSONNEL AT INSERTION OF GYNAECOLOGICAL IMPLANTS AND CLEANING OF RADIOACTIVE APPLICATORS. Lax, I. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Nov 1975. 27p. (In Swedish). INIS.

The measurements of the radiation doses to the personnel consisted of dose measurements on the fingers and on the body. The radiation doses to the fingers and to different parts of the body at on one hand the insertion of gynecological implants and on the other the cleaning of them have been measured before at the wards of gynecological application at the department of oncology (Radiumhemmet), the Caroline Institute. Thermoluminescent dosimeters were used to measure the radiation doses to the finger tips. The dimensions of these dosimeters are nowadays so small that they are no hindrance to the work.

- 2435 (SSI--1975-035) RADIATION DOSES TO PATIENTS AT DENTAL RADIOGRAPHY. Paulusson-Odenhagen, M. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Nov 1975. 10p. (In Swedish). INIS.

An investigation about the technique and the equipment at x-ray investigations and the distribution of the radiation doses to the thyroid and the gonads has been made in the dental polyclinics belonging to the county council of the province of Stockholm. This investigation, which was suggested by the National Institute of Radiation Protection and the faculty of odontology in Stockholm, consisted of on one hand a distributed questionnaire and on the other visits. The questionnaire was distributed to all dentists (altogether 343) belonging to the dental polyclinics of the county council of the province of Stockholm. 22 dentists of these were visited.

- 2436 X-RAYS IN INDUSTRY. Natl. Saf. News; 112: No. 5, 98-103 (Nov 1975).

A description of the sources and uses of industrial x-ray equipment is followed by data on design, maximum permissible doses, radiation monitoring and medical examinations. General procedures for the protection of operating personnel are outlined.

- 2437 Verordnung ueber den Schutz vor Schaeden durch ionisierende Strahlen. Entwurf. (ORDINANCE ON THE PROTECTION AGAINST DAMAGE FROM IONIZING RADIATION. DRAFT). Bonn; Bundesministerium des Innern (Nov 1975). 87p. (In German).

With figs. and tabs..

Complete text, including definition of terms and appendix, of the latest draft which is very much under discussion.

a poignant phrase, Morgan has stated "Radiation doesn't have to be feared, but should be respected."

- 2438 STUDIES ON THE TECHNIQUES OF PITUITARY IRRADIATION USING 6 MEV LINAC X-RAY. Tanaka, Y. (Keio Univ., Tokyo (Japan). School of Medicine). Keio Igaku; 52: No. 6, 463-481(Nov 1975). (In Japanese).

Forty patients with pituitary adenomas were treated by 6 MeV Linac X-ray from April 1966 to March 1974. Before 1971, conventional irradiation techniques such as the bilateral opposed fields method, or moving beam therapy situated in the sectional plane of the skull, were used. Since 1971, 360° moving beam therapy, situated in the coronal plane, and excluding the eye balls from exposed area (Yamashita's method) has been applied. Comparative physical and clinical studies of these irradiation techniques were made. Clinical improvement occurred in 26 of 40 cases. It was concluded that Yamashita's method is the most appropriate therapy for patients with pituitary adenomas.

- 2439 THYROID IRRADIATION AND CARCINOGENESIS. REVIEW WITH ASSESSMENT OF CLINICAL IMPLICATIONS. Foster, R.S. Jr. (Univ. of Vermont, Burlington). Am. J. Surg.; 130: No. 5, 608-611(Nov 1975).

Clinicians experienced in the management of thyroid disease are well aware of an association between irradiation of the thyroid and the subsequent development of carcinoma of the thyroid. Less widely known is the nature of the dose response relationship between the amount of irradiation and the incidence of carcinoma. High doses of irradiation to the thyroid may actually protect against the development of carcinoma whereas inappropriate diagnostic doses may occasionally fall into a range that has a significant potential for irradiation induction of carcinoma. This review will examine data relative to carcinogenesis from thyroid irradiation and summarize the implications for clinical practice.

- 2440 RADIATION AS AGENTS OF SOMATIC AND GENETIC ALTERATIONS. de Eston, V.R. (Univ., Sao Paulo, Brazil). J. Am. Med. Women's Assoc.; 30: No. 11, 445-449(Nov 1975).

According to the report on "The Effects on Population of Exposure to Low Levels of Ionizing Radiation," whether we regard a risk as acceptable or not depends on how avoidable it is, and, if not avoidable, how it compares with the risks of alternative options and those usually accepted by society. Regarding the use of ionizing radiation: No exposure should be permitted without the expectation of a commensurable benefit. The public must be protected from radiation, but not to the extent that the degree of protection provided results in the substitution of a worse hazard than that of the radiation avoided. Medical radiation exposure can and should be reduced considerably by limiting its use to clinically indicated procedures, utilizing efficient exposure techniques and optimal operation of radiation equipment. Consideration should be given to the following: (a) Restriction of the use of radiation for public health purposes, unless there is reasonable probability of significant detection of disease. (b) Inspection and licensing of radiation and ancillary equipment. (c) Appropriate training and certification of involved personnel. (d) Gonad shielding, especially shielding of the testis, is strongly recommended as a simple and highly efficient way to reduce the genetic significant dose. In

- 2441 (COD--3489-8) RADIOCHEMICAL AND RADIOECOLOGICAL STUDIES ON BRAZILIAN AREAS OF HIGH NATURAL BACKGROUND. PROGRESS REPORT, OCTOBER 30, 1974--OCTOBER 30, 1975. Costa-Ribeiro, C.; Penna-Franca, E.; Rocha-Nogueira, A.; Christian-Pfeiffer, W. (Rio de Janeiro Univ. (Brazil). Instituto de Biofisica). Nov 1975. Contract E(11-1)-3489. 7p. Dep. NTIS \$3.50.

The absorption of ^{212}Pb and/or ^{212}Bi by erythrocytes was investigated in an attempt to explain the in vivo genesis of somatic chromosomal aberrations of the type detected in peripheral blood lymphocytes of workers professionally exposed to ^{220}Rn and its decay products, as well as in dwellers of Brazilian areas of high natural radioactivity. (auth)

- 2442 RETINAL CHANGES INDUCED BY HEAVY PARTICLES: A NEW THERAPY MODALITY. Hunter, D.M. Aeromed. Rev.; 6: 3-13(Nov 1975).

The nature of the lesions produced by the oxygen particles appears similar to the experimental and clinical radiation retinopathies which have been reported previously. These reports, as well as our own findings, indicate that the lesion is primarily a circulatory one, with other retinal changes being secondary. Retinal changes of the magnitude produced with the oxygen ions have been reported with the use of cobalt plaques sewn to the sclera in the treatment of intraocular tumors. Doses that led to such clinical changes, however, were 8 times that required with the accelerated particles and required months to develop rather than 1 day or 1 week. Thus, retinal lesions produced with accelerated oxygen particles exhibit a significant compression of time and dose over those reported in the clinical literature. This study demonstrated that the tissue effectiveness of the accelerated particle is far greater than that of any previously utilized irradiation source. The oxygen atom is only the beginning; with the introduction of the Bevalac at the Lawrence Radiation Laboratory, multiple ion sources of various atomic weights will be available in future years. The radiation levels reported in this paper represent an "overkill" in the amount of radiation required for destruction of ocular tissue. With the development of a suitable particle source, and a collimated beam, these particles could become a clinically important therapeutic modality. By using B-scan ultrasonography and taking advantage of the relative energy absorption in tissue following heavy ion irradiation, one may have an effective radiation tool for treatment of choroidal melanomas and retinal blastomas.

- 2443 OSTEOSARCOMOGENIC EFFECT OF PLUTONIUM-239 DEPENDENT ON THE AGE AND SEX OF ANIMALS. Sinyakov, E.G. Radiobiologiya; 15: No. 6, 937-940(Nov 1975). (In Russian).

For English translation see the journal Radiobiology.

Plutonium-239 (2.5μ curie-kg) was administered to male and female rats at the age of 1, 6 and 12 months. Besides, one-month-old rats were momentarily given 5μ curie-kg. It has been found that the highest sensitivity to osteosarcomogenic effect of plutonium is exhibited by six-month-old animals; a lesser one - by one-month-old, and the least one - by 12-month-old rats. Males of all age groups are almost twice more sensitive than females.

- 2444 (PB--250753) THE CLINICAL TESTING OF MALE GONAD SHIELDS. TECHNICAL REPORT. Church, W.W.; Burnett, B.M. (Bureau of Radiological Health, Rockville, Md. (USA)). Nov 1975. 33p. (DHEW/FDA--76-8025). NTIS \$4.00.

Two types of male gonad shields, designed for use with support garments, were tested in a number of hospitals and clinics throughout the United States. The clinical evaluation consisted of: (1) measuring dose reduction with thermoluminescent dosimeters; and (2) determining acceptability of the shields for routine use in x-ray facilities, through the use of survey forms completed by patients, technologists, and facilities. The shields proved to provide a basis for a very satisfactory male gonad shield program. (GRA)

- 2445 (BNWL--2067) REVIEW OF REPORTS BY J.W. GOFMAN ON INHALED PLUTONIUM. Bair, W.J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 10 Oct 1975. Contract E(45-1)-1830. 12p. Dep. NTIS \$4.50.

Two recent widely circulated reports on the subject of inhaled plutonium have provoked concern among the press and in Congress. These reports, The Cancer Hazard from Inhaled Plutonium, CNR Report 1975-1R, May 14, 1975, and Estimated Production of Human Lung Cancers by Plutonium from Worldwide Fallout, CNR Report 1975-2, July 10, 1975, were written by John W. Gofman and issued by the Committee for Nuclear Responsibility, P. O. Box 2329, Dublin, California 94566. Gofman's reports do not present an objective analysis of the hazard of inhaled plutonium; his arguments, in fact, contradict many conclusions drawn in the scientific literature and supported by experimental data. Because the reports are skillfully written, however, they could easily mislead readers who are not well versed in this area. The purpose of this review, therefore, is to examine Gofman's reports in the light of recent research studies and to identify errors of fact and logic in his arguments.

- 2446 SCIENTIFIC ADVISORY BOARD OF THE FEDERAL MEDICAL SOCIETY (BUNDESAERZTEKAMMER) ANNOUNCES: COMMENT ON THE SUBJECT 'ENDANGERMENT BY NUCLEAR POWER PLANTS'. Dtsch. Aerztebl.; No. 41, 2821-2824 (Oct 1975). (In German).

The committee 'Endangerment by nuclear power plants' of the working group 'Environmental Medicine' of the Federal Medical Society (Bundesärztekammer) expresses its opinion on the risk of nuclear power plants to the population in the memorandum. The committee confirms that by keeping to the safety specifications, established until now, one can reckon with a radiation exposure averaging on 1/100th of the natural radiation exposure. Regarding the question of the thermal load, this proves to be no special problem of nuclear engineering. In the case of accidents, it is shown that the safety precautions are such as to exclude the endangering of persons in the environment of nuclear power stations. The probability of so-called hypothetical accidents endangering the population is several orders of magnitude smaller than that of earthquakes or other natural catastrophes.

- 2447 (MD/PUB--251) COMPUTER PROGRAM FOR THE DRAWING OF ISODOSE LINES IN AN IDEALISED FALLOUT PATTERN. Horst, J.W. (Ministerie van Defensie, The Hague (Netherlands). Advies Bureau der Genie). Oct 1975. 56p. (In Dutch). INIS.

Available from Technisch Documentatie en Informatiecentrum voor de Krijgsmacht, afd. Rapportencentrale, Frederikkazerne, Van Alkemadelaan 774, The Hague (Netherlands).

The mathematical formulae (polynomials) and the computer calculations for the plotting of isodose or iso-intensity lines for radioactive fallout after a nuclear explosion are given as well as two computer programs in FORTRAN. Parameters are wind velocity, distance from and time after explosion, fallout fraction, exploded weight, height above the ground.

- 2448 (NIRS-M--10, pp 65-69) RADIOACTIVE CONTAMINATION OF MARINE ORGANISMS AND ITS CONTRIBUTION TO THE INTERNAL RADIATION DOSE. Suzuki, Y. (National Inst. of Radiological Sciences, Chiba (Japan)). Oct 1975. (In Japanese).

From 2. National Institute of Radiological Sciences seminar; Chiba, Japan (28 Feb 1975).

Fundamental aspects of marine radioecology. I.

The pathway and transfer of radioactivity from sea water to man through sea food was investigated on Cs-137 originated from fallout. The present study summarizes the results on the basis of the data obtained in field studies concerning marine fish and total diet. The accumulation of Cs-137 in marine fish from the environmental water was examined from three points of view: concentration factors (CF), observed ratios (OR) and specific activities (SA). Using ^{137}Cs -K observed ratio (OR human body-total diet) of 2.35 for Japanese adults, the cumulative internal radiation dose to the whole body due to Cs-137 was estimated to be 7.3 mrad during the period from 1963 to 1971, and the cumulative dose from fishes and shellfishes would be 0.7 mrad at the most. On the other hand, it was found that a group of fishermen and their families might receive an internal radiation dose of about 1 mrad/year from Cs-137 in marine fish, because of the local radioactive contamination of sea water from the operation of a nuclear fuel reprocessing plant in the coastal site of Ibaraki prefecture.

- 2449 CHEMICAL FORM AND THE BIOCONDENSATION OF RUTHENIUM-106. PROBLEMS AND ESTIMATION OF THE EXPOSURE DOSE OF RUTHENIUM-106. Ishikawa, M. (National Inst. of Radiological Sciences, Chiba (Japan)). Hoshasen Kagaku; 18: No. 10, 187-192 (Oct 1975). (In Japanese).

^{106}Ru , one of the liquid radioactive wastes which nuclear fuel reprocessing plants produce, was described. Problems and the changes of the chemical form of ^{106}Ru were explained regarding the coefficient of ^{106}Ru condensation. The body exposure dose, based on intake of marine products in which ^{106}Ru had accumulated, was estimated using the coefficient of condensation.

- 2450 MEDICAL USES OF NUCLEAR DATA. Tilbury, R.S.; Bigler, R.E.; Zeitz, L.; Laughlin, J.S. (Memorial Sloan-Kettering Cancer Center, New York). Natl. Bur. Stand. (U.S.), Spec. Publ.; No. 425, 520-526 (Oct 1975).

From Proceedings on nuclear cross section and technology; Washington, DC, USA (3 Mar 1975).

See NBS-SPEC.PUBL.--425 (Vol.2); CONF-750303 P2.

Nuclear data is used in modern medicine in a myriad of ways. Activation cross sections are used in the calculation of radioisotope production rates for both neutron and charged particle activation. The radioisotopes so produced are used in diagnostic nuclear

medicine for the early detection of disease and for therapy either by external radiation or by internal radiation. The calculation of radiation dose from internally administered radioisotopes involves a knowledge of the decay scheme, mode and energy of decay, internal conversion coefficients, x-ray fluorescent and Auger electron yields. The decay scheme of radioisotopes including parent-daughter equilibria is essential knowledge for their accurate assay and for the understanding of radioisotope generators. Range-energy relationships for neutrons of various energies, charged particles, gamma-rays and electrons are also necessary for therapy and dose considerations. Applications to in vivo neutron activation analysis and photon absorptiometry for bone mineral measurement are also considered. An attempt is made to briefly describe these applications and to point out where more basic nuclear data measurements would be helpful. (auth)

- 2451 BASIC STUDIES ON TUMOR-SCINTIGRAM WITH USE OF ^{67}Ga -CITRATE. RELATION BETWEEN UPTAKE OF ^{67}Ga -CITRATE AND BLOOD FLOW /SUP 99m/Tc-ALBUMIN IN IRRADIATED TUMOR. Kwangok, B. (Nippon Dental Coll., Tokyo). Shigaku; 63: No. 4, 373-379 (Oct 1975). (In Japanese).

^{67}Ga -citrate scintigram, become frequently negative in tumors in the irradiation field after radiotherapy. In order to investigate the degree of decrease of the ^{67}Ga -citrate uptake in tumors in the early stage after irradiation and its causes, the relationship between the uptake and blood flow was examined using Ehrlich tumors. The following results were obtained. As the dose of irradiation increased, the uptake of ^{67}Ga -citrate in tumors decreased. The decrease was remarkable even by the irradiation of a fairly small dose, 500 rad. In the measurements of the blood flow including blood infiltration into tumors by using sup(99m)Tc-albumin, no significant relationship was observed between the blood flow and the ^{67}Ga -citrate uptake. A fair relation was observed between the angiographic findings by the Indian ink method and the ^{67}Ga -citrate uptake. It was suggested that the decrease in the ^{67}Ga -citrate uptake in tumors was much due to the effect of irradiation on the tumors themselves, and was due also to the effect of the vasculature.

- 2452 "PROTECTIVE" EFFECT OF CELLS GAMMA-IRRADIATION AT THE METAPHASE OF MITOSIS AFTER UV-IRRADIATION AT THE S-PERIOD. Lebedeva, L.I.; Chubykin, V.L. (AN SSSR, Novosibirsk. Inst. Tsitologii i Genetiki). Genetika; 11: No. 10, 24-29 (Oct 1975). (In Russian).

For English translation see the journal Sov. Genet..

As a result of the ultraviolet irradiation in vitro of the embryo fibroblasts of BALB mice in the S-stage with an incident dose of 40 erg/mm², 20.1% cells showed chromosome aberrations. Additional gamma irradiation of cells in the metaphase of the first mitosis with a dose of 5 krad leads with a high degree of certainty to a decrease to 11.7% in the frequency of aberrant cells observed in the same mitotic stage. The frequency of spontaneous aberrations does not change during the first few minutes after the gamma irradiation of intact cells. The "protective" effect of gamma rays cannot be attributed to non-uniform changes in the duration of the mitotic stages for aberrant and normal cells, to the adhesion of chromosome fragments or to the breaking of bridges in the anaphase. The destruction of cells during irradiation is also an unlikely explanation of the observed effect. It is assumed that the

decrease in the frequency of aberrations is a result of the previously predicted modification of the processes involved, when potential chromosome damage becomes visible aberrations during metaphase.

- 2453 (INIS-mf--3243, pp 323) "RISK VERSUS BENEFIT" FOR DIAGNOSTIC X-RAYS AND RADIONUCLIDES. Uzunov, I. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

In the fifties, when a radiation protection program in medicine was initiated in the country, permissible population exposure standards were based solely on genetic risk, and medical irradiations were excluded from these standards. It is currently thought, however, that somatic-stochastic consequences of the carcinogenic effect of ionizing radiations are commensurable with genetic lesions. Since carcinogenic risk is determined by organ dose, it is much higher than the genetic risk in most X-ray and radionuclide examinations. Furthermore, the majority of authors feel that medical radiation should be included in total maximum permissible population dose (5 rem up to 30 years of age). Taking into consideration that over 95% of population exposure in the following decades is expected to result from medical radiation, and that the risk of induction of malignancies cannot be taken to be "negligible" even at an exposure level of the order of natural background, it is evident that in any specific case where radiation is to be applied, "risk vs. benefit" should be appraised with adequate precision. This will necessitate a thorough revision of problems involving patient protection, particularly so since shortcomings in this respect have lately been brought to light (for instance, cardiac catheterization or roentgenoscopic examination for expertise purposes), unmotivated mass screening tests, etc.), such cases occurring mostly because of unsatisfactory regulatory activities, especially as regards use of X-rays by non-radiologists. The paper discusses carcinogenic risk for a number of specific procedure types and stresses the need for a symposium on radiation protection in medical practice, with participation of physicians employed in areas of medicine relevant to X-ray and radionuclide diagnostics, in order to arrive at reasonable decisions enabling the achievement of a drastic reduction in population exposure.

- 2454 (INIS-mf--3243, pp 319) EFFICIENCY OF RADIATION SAFEGUARDS TO PROTECT PATIENTS RECEIVING DIAGNOSTIC OR PROPHYLACTIC X-RAYS. Pechenikova, Z. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

Evidence from world statistics indicates that about 75% of excess radiation exposure to the population over that due to natural background results from diagnostic and prophylactic X-ray examinations. Current assessment of population exposure implies assessment of the genetically significant dose. Studies on a global scale have shown bulk figures for genetically significant dose

delivered to the population with medical X-rays to vary from 20 mrem per annum in Japan to 170 mrem per annum in New York. Rise or fall in these doses is closely related to measures taken in a country for patient protection. Apart from being highly dependent on professional skill of clinicists and radiologists, protection of patients involves a complex of physico-technical and organizational safeguards. From these considerations, specifically designed studies have been undertaken at 20 health establishments: polyclinics, hospitals, TB dispensaries, and others, i.e., where large numbers of people are exposed to be X-rayed. End-points investigated were: number of X-ray examinations, clinical motivation, proportion of negative X-ray findings, technical state of the facilities used, measures taken to protect patients, etc. From the general features found to characterize the state of patient protection in diagnostic and prophylactic X-ray examinations, conclusions were drawn and suggestions given for its improvement.

- 2455 (INIS-mf--3243, pp 326) PATIENT AND POPULATION PROTECTION IN X-RAY EXAMINATIONS: A GENERAL ROENTGENOLOGICAL AND HEALTH PROBLEM. Khadzhibekov, G.; Dermendzhiev, Kh. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

Population exposure in excess of that due to natural radiation background is known to result primarily (to 70-90%) from medical X-rays given in mass screening. Protection of the population is a problem of great concern in present-day radiology and is approached by balancing benefits of diagnostic X-rays against risks presented by the probability of overexposing the patient. An evaluation on such a basis necessitates detailed and accurate information on patient radiation exposure and takes into account factors leading to a population hazard by making assessments in terms of so-called genetically significant doses. Gonad doses have to be carefully analysed, implying a need for studies of various types of X-ray procedures, precautionary measures taken, etc. An important issue in the choice and adoption of an appropriate method for large-scale gonad dose assessments in routine practice. To obtain an estimate of radiation hazard from medical roentgenology in terms of genetically significant doses and identify measures necessary to limit exposure risks, collaborative efforts are needed involving participation of roentgenologists and hygienists, and use of dosimetric, organizational-methodological, and statistical techniques. These efforts should lead to an abrupt reduction in radiation burden to the population from diagnostic X-rays.

- 2456 (INIS-mf--3243, pp 312) SOME RADIATION EXPOSURE PROBLEMS IN HYSTEROSALPINGOGRAPHY PROCEDURES. Dakov, L.; Vasilev, D. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

While stressing the diagnostic usefulness of hysterosalpingography in gynecological

practice, the authors point out that generally much unjustified radiation exposure occurs during the procedure, affecting both the subjects investigated - usually women of reproductive age - and the attending personnel. Common faults in this respect are: disregard to preliminaries (team-work coordination, information on patient's condition), inadequate adaptation, roentgenoscopic examinations small in number but of long duration, a tendency to follow on the screen some aspects of the filling of genital tract sections that are of no particular relevance to diagnostic, quite unsatisfactory limitation of diaphragm aperture resulting in a 4 to 5 and even more times larger field than necessitated by the object of the investigation, either in roentgenoscopy or roentgenography, etc. The authors have measured the times of individual hysterosalpingography phases and present an analysis of a number of end-points: mean duration of the procedure, relative roentgenoscopic time, number of roentgenoscopic examinations, scopy-to-film ratio, failure to use maximum diaphragm-aperture constriction, etc. To achieve higher reliability, data were collected from 100 patient examinations involving one radiologist and three gynecologists. Finally, recommendations are given for a reasonable hysterosalpingography procedure aimed at reducing radiation exposure to female patients of reproductive age as well as medical personnel and providing permanent records by means of a larger number of films obtained under routine conditions instead of resorting to roentgenoscopic examinations of long duration associated with appreciable amounts of excessive exposure.

- 2457 (INIS-mf--3243, pp 313) ASSESSMENT OF HEALTH ASPECTS IN SOME X-RAY EXAMINATION TYPES FROM GONAD DOSE MEASUREMENTS ON PHANTOMS WITH OR WITHOUT SHIELDING. Dermendzhiev, Kh.; Velikov, V.; Katerinov, E. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

X-ray mass screening examinations have been found to lead, particularly in countries with a welldeveloped medical service, to substantial population exposure, namely in the range of 20 to 150 mrad per year versus 100 mrad per year from natural radiation background. A substantial share of this exposure stems from gonad doses delivered to patients in the course of various types of diagnostic X-ray procedures. The magnitude of doses absorbed by the gonads depends to a large extent on shielding devices used to protect the patient during the examination, on the nature of the examination - whether gonads lie directly under the beam - and a number of other factors. For the present study, four phantoms corresponding to a selection of ages (2, 7, 14, and 25 years of age) were prepared. Dosimetric measurements were performed on a "Hoffmann SR 700 D" X-ray apparatus, with simulation of various types of diagnostic procedures: roentgenoscopic examinations or films, with or without shielding, with or without use of image converters. The data obtained indicated that the X-ray procedure types investigated may be grouped, in descending order of associated radiation exposures, as follows: roentgenoscopy of GI tract in children or women, roentgenography of lumbar vertebrae, pelvic organs, kidneys, thighs. There are cases where shielding is unfeasible (roentgenoscopy of GI

tract in children or women, pelvic organ and kidney examination in women). In other cases, gonad shielding is of low efficiency: roentgenoscopy of lumbar vertebrae, skull or chest films in men. With use of image converters, a gonad-dose reduction by a factor of 2 to 9 is achieved. In terms of gonad dose level to the patient, X-ray procedure types may be distributed into three main groups: (1) low level (skull or chest films, etc.); (2) intermediate level (lung roentgenoscopy, thigh film, etc.); (3) high level, with gonads lying in the primary-beam field (GI tract roentgenoscopy, pelvic film, etc.).

- 2458 (INIS-mf--3243, pp 308) IRRADIATION OF THE SKIN FROM EXTERNAL CONTAMINATIONS OCCURRING IN MEDICAL APPLICATION OF RADIOACTIVE MATERIALS. Vasilev, G.; Mikhajlov, M. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

Radioactive skin contamination of medical personnel engaged in use of unsealed radioactive sources for radiation therapy and radioisotope diagnostics was studied. Data analysis concerned contamination of hand and face areas in handling radioactive compounds of iodine, gold, phosphorus, and some other isotopes. From measurements of the degree of radioactive contamination and from experimentally determined pattern of in-depth radioactivity distribution, estimates were made of radiation doses to the basal layer considered to be critical for skin. In a number of cases, dose rates to basal layer cells were found to attain excessive levels - up to tens and even hundreds of rad/hr - clearly indicating that problems involved in protection from radioactive contamination should be given full attention.

- 2459 (INIS-mf--3243, pp 309) INTERNAL EXPOSURE OF MEDICAL PERSONNEL HANDLING UNSEALED RADIOACTIVE MATERIALS. Vasilev, G.; Filev, G. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

Working with unsealed radioactive substances used for radiation therapy and radioisotope diagnostics, medical personnel may experience external as well as internal exposure. In the latter case, potential routes of intake are ingestion, inhalation, and percutaneous absorption. This paper presents the results of a survey of radioisotope body burdens in medical personnel handling unsealed radioactive substances. Subjects investigated were measured in the whole-body counter of the Institute of Roentgenology and Radiobiology (Sofia). Deposition of radioactivity in the body and resulting radiation doses to clinical organs were estimated. Based on findings from examinations of a medical staff sample and relevant dosimetric measurements, the authors conclude that personnel radiation exposures from medical applications of unsealed radioactive substances are primarily contributed through external irradiation.

- 2460 (INIS-mf--3243, pp 309) RADIATION EXPOSURE TO MEDICAL PERSONNEL DURING ROUTINE DIAGNOSTIC OR THERAPEUTIC X-RAY PROCEDURES. Vasilev, G.; Karadzhov, A.; Khristova, M. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (28 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

The paper presents a statistical analysis of 19 thousand individual measurements of monthly radiation exposures to medical personnel engaged in work with X-ray apparatuses used for routine diagnostic purposes as well as radiotherapy. These measurements used film dosimeters worn over the breast and changed monthly. Exposure distribution patterns were studied and respective typical distributions identified. From these data, mean radiation doses to selected critical organs were estimated. The radiation burden sustained by personnel was assessed by comparing dose estimates obtained with currently accepted maximum permissible dose levels.

- 2461 (NIRS-M--10, pp 70-74) CURRENT METHODS OF INTERNAL DOSE ESTIMATION. Yabe, A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Oct 1975. (In Japanese).

From 2. National Institute of Radiological Sciences seminar; Chiba, Japan (28 Feb 1975).

Fundamental aspects of marine radioecology. I.

Three different methods of estimating internal radiation doses to organs of human body are briefly described and reviewed. These are the method recommended for calculation of dose equivalent by Committee 4 of the International Commission on Radiological Protection, the method developed for absorbed dose calculation by the Medical Internal Dose Committee of the Society of Nuclear Medicine (USA), and the method used in computing MPC values in sea waters and introduced as a specific activity approach by the National Academy of Science and the National Research Council (USA).

- 2462 (NRPB-R--40) STUDY OF THE NRPB FAST NEUTRON PERSONAL MONITORING SERVICE. Bartlett, D.T.; Knight, A.; Marshall, T.O. (National Radiological Protection Board, Harwell (UK)). Oct 1975. 31p. NTIS (US Sales Only).

Available from H.M. Stationery Office, price Pound0.50.

The NRPB Fast Neutron Personal Monitoring Service has been reviewed and modifications have been, or are being, introduced to improve the accuracy and reliability of the nuclear emulsion dosimeter employed by the Service. This report presents the conclusions of the study. Experimental results of the investigations undertaken in the course of this study, together with full details of the dosimeter and Service, are appended.

- 2463 (PB--254273) A REVIEW OF BIOLOGICAL EFFECTS AND POTENTIAL RISKS ASSOCIATED WITH ULTRAVIOLET RADIATION AS USED IN DENTISTRY. TECHNICAL REPORT. Mills, L.F.; Lytle, C.D.; Andersen, F.A.; Hellman, K.B.; Bockstahler, L.E. (Bureau of Radiological Health, Rockville, Md. (USA)). Oct 1975. 41p. (FDA/BRH--76/40; DHEW/PUBL/FDA--76/8021). NTIS \$4.00.

Several dental procedures, recently developed and currently in use by the dental profession, involve the use of near or far ultraviolet (UV) radiation in the oral cavity. Recent studies on the biological effects of near and far UV radiation suggest potential risks to individuals from excessive UV exposure. In this paper the dental procedures are briefly described, the bases for UV safety standards are reviewed, effects of UV exposure to the skin and eyes and how these effects may relate to oral mucosa exposure are considered, potential modes of action by UV radiation on oral tissues as suggested by cell culture studies are summarized, and potential risks from UV exposure of individuals which might result from the dental procedures are discussed. (GRA)

- 2464 (SSI--1975-029) RADIATION DOSES FROM DENTAL RADIOGRAPHY AT PRIVATE PRACTITIONERS. Hylthen, J.A. (Statens Strålskyddsinstitut, Stockholm (Sweden)). Oct 1975. 49p. (In Swedish). INIS.

This investigation was made in January 1975 together with a seminar group from the faculty of odontology in Stockholm. Every four private practising dentists in Stockholm and its environs were selected by haphazard to get an enquiry equipment etc. Every forty private practising dentists were then selected by haphazard to get a visit. 32 x-ray plants were investigated. The radiation doses showed a great spreading. The mean value of the radiation doses to the irradiated organs had been reduced about 5 times compared to a similar investigation, which was made in 1960. The use of long metal tubes and high-speed film gave the lowest dose values, while a short cone of bakelite and a low-speed film gave the highest dose values. Fluctuations in the dose values seemed also to depend on the technique. The reasons for this may be variations in the settings of the instruments and in the dark room technique.

- 2465 BIOLOGICAL EFFECTS OF LOW DOSES OF IONIZING RADIATION. Polikarpov, G.G. (Scientific Council on Problems of Radiobiology, Kiev). Visn. Akad. Nauk Ukr. RSR; No. 10, 101 (Oct 1975).

A Plenary Session of the Scientific Council on Problems of Radiobiology, of the Academy of Sciences Ukrainian SSR, was held at the Institute of Biology of the Southern Seas of the Academy of Sciences Ukrainian SSR in Sevastopol, from 15 to 17 April. It was devoted to the achievements of the last year and to new tasks planned for the next year, as well as to biological effects of low doses of ionizing radiation.

- 2466 EFFECTS OF IONIZING RADIATION ON MAN. Watson, G.M. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). At. Energy Aust.; 18: No. 4, 1-11 (Oct 1975).

This paper describes the major effects of ionizing radiation on man and the relationship between such effects and radiation dose, with the conclusion that standards of radiological safety must be based on the carcinogenic and mutagenic properties of ionizing radiation. Man is exposed to radiation from natural sources and from man-made sources. Exposure from the latter should be regulated but, since there is little observational or experimental evidence for predicting the effects of the very small doses likely to be required for adequate standards of safety, it is necessary to infer them from what is seen at high doses. Because

the formal relationship between dose and effect is not fully understood, simplifying assumptions are necessary to estimate the effects of low doses. Two such assumptions are conventionally used; that there is a linear relationship between dose and effect at all levels of dose, and that the rate at which a dose of radiation is given does not alter the magnitude of the effect. These assumptions are thought to be conservative, that is they will not lead to an underestimation of the effects of small radiation doses although they may give an overestimate.

- 2467 MEDICAL USE OF FAST NEUTRONS IN RADIOTHERAPY AND RADIOGRAPHY. Bewley, D.K. (Hammersmith Hospital, London). Natl. Bur. Stand. (U.S.), Spec. Publ.; No. 425, 527-532 (Oct 1975).

From Proceedings on nuclear cross section and technology; Washington, DC, USA (3 Mar 1975).

See NBS-SPEC.PUBL.--425 (Vol.2); CONF-750303--P2.

Over 400 patients have been treated with fast neutrons from a cyclotron at Hammersmith Hospital, London, using 16 MeV deuterons on beryllium. A large variety of malignant disease is included in this trial. A randomized trial of fast neutron therapy for cancer of the mouth and throat is in progress and preliminary results will be given. Fast neutron radiographs are often taken to check the positions of the fields used on the patients. These show no contrast from bone, but demonstrate only the presence of gas-filled cavities. As a diagnostic method, fast neutron radiography suffers from a number of disadvantages, the main ones being lack of sensitivity of the image-forming system and the hazard to the patient due to a large Quality Factor. Estimation of the absorbed dose given to different types of tissue is an important factor in the medical use of fast neutrons. More data are needed on the processes whereby fast neutrons impart energy to matter, particularly for neutrons above 15 MeV. (auth)

- 2468 ALTERATION OF T CELL FUNCTION IN HEALTHY PERSONS WITH A HISTORY OF THYMIC X IRRADIATION. Rieger, C.H.L.; Kraft, S.C.; Rothberg, R.M. (Univ. of Chicago). J. Allergy Clin. Immunol.; 56: No. 4, 273-281 (Oct 1975).

The possible late effects of x irradiation to the infantile thymus were investigated by studying immune functions in 12 healthy persons with a history of thymic x irradiation and healthy control subjects. No differences were found in serum immunoglobulin values, humoral antibody levels, lymphocyte counts, and lymphocyte reactivity to phytohemagglutinin, vaccinia virus, purified protein derivative (PPD), and allogeneic cells. The irradiation group exhibited cellular hyperresponsiveness to streptokinase-streptodornase (SK-SD). In contrast, mean skin and in vitro lymphocyte responses to *Candida albicans* were depressed in the patients with thymic irradiation. A dissociation of these two *Candida* responses was found in only 1 of 14 healthy control subjects but in 7 of 12 irradiated individuals. While thymic irradiation did not result in impaired immunologic defenses leading to clinical disease, it caused alterations in T cell responses similar to those reported in patients with chronic mucocutaneous candidiasis.

- 2469 SKIN REACTIONS AFTER DIFFERENT FRACTIONATION SCHEDULES GIVING THE SAME CUMULATIVE RADIATION EFFECT. Turesson, I.; Notter, G. (Sahlgrenska Sjukhuset, Goeteborg

(Sweden)). Acta Radiol., Ther., Phys., Biol.; 14: No. 5, 475-484(Oct 1975).

The CRE formula was used for calculation of biologically equivalent radiation doses with different fractionation schedules. The early radiation effects, skin erythema and pigmentation were measured with a reflectance spectrophotometer at wavelengths 578 and 660 nm. The course and maximum for both erythema and pigmentation agreed well with the two types of fractionation. The results seem to justify further use of this simple formula.

- 2470 HEALTH PHYSICS IN THE UNIVERSITY. van Elegem, P.; Bette, L.; Lejeune, S. (Brussels Univ. (Belgium)). Rayonem. Ionis. Tech. Mes. Prot.; No. 4, 179-181(Oct 1975). (In French).

From 3. European congress of the International Radiation Protection Association: criteria for radiation protection; Amsterdam, Netherlands (13 May 1975).

A health physics experiment carried out in 120 services, occupying about 2000 people directly exposed, is reported. The policy of followed-up systematic help gives extremely satisfactory results.

- 2471 IRRADIATION RISKS FOR HOSPITAL STAFF WORKING WITH RADIOTECHNETIUM. Heaton, B.; Brown, L.D. (Aberdeen Univ. (UK)). Rayonem. Ionis. Tech. Mes. Prot.; No. 4, 173-178(Oct 1975). (In French).

From 3. European congress of the International Radiation Protection Association: criteria for radiation protection; Amsterdam, Netherlands (13 May 1975).

The handling of technetium-99m can lead to the irradiation of personnel during the five main stages of its use. Experience shows that the nurses and radiopharmacists are subjected to an exposure difficult to reduce below a certain threshold, but with adequate precautions and job rotation the dose received by the personnel is nevertheless very slight. The practitioners themselves, who have been the centre of attention over the last few years, undergo a negligible irradiation.

- 2472 PROSPECTIVE SURVEY ON THE INCIDENCE OF CHEST MALIGNANCIES AFTER REPEATED FLUOROSCOPY DURING ARTIFICIAL PNEUMOTHORAX THERAPY FOR PULMONARY TUBERCULOSIS. Kitabatake, T.; Kurokawa, S.; Yamasaki, M.; Sato, T.; Kurokawa, H. (Niigata Univ. (Japan). School of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 35: No. 10, 895-899(Oct 1975). (In Japanese).

Patients with pulmonary tuberculosis treated in 4 sanatoria in Niigata Prefecture between 1941 and 1961 were followed up by a mail questionnaire. Of 2756 patients, 1193 responded and sent back effective information, letters to 1224 were returned because of uncertain or unknown new address, 326 did not respond, and 13 were excluded because of incomplete answers. Out of the 1193 effective responders, 568 had been treated by artificial pneumothorax (the pneumothorax group), and 552 had not been treated by pneumothorax (the control group). There were 65 deaths in the pneumothorax group, but none of them were from chest malignancies; and 40 deaths in the control group with 4 from chest malignancies. In this survey, there was no evidence of an increased number of chest malignancies (including leukemia) after pneumothorax fluoroscopy.

- 2473 CARCINOMA OF THE THYROID AFTER RADIATION TO THE NECK. Crile, G. Jr. Surg. Gynecol. Obstet.; 141: No. 4, 602-603(Oct 1975).
The incidence of thyroid cancer following

irradiation of the neck is discussed. It is determined to be a dose related phenomenon following a bell shaped curve. (ERB)

- 2474 RADIATION AND THYROID CANCER. Debra, D.W. Jr. J. Med. Assoc., Ga.; 64: No. 10, 395-396(Oct 1975).

It should be the policy in all institutions and practices which administered head and neck irradiation to identify from its records those individuals so treated and to seek them out and advise them to have a thyroid evaluation. Physicians engaged in the general care of adults should incorporate questioning about head and neck irradiation into their history-taking. Further, they should direct the patient to inquire of his parents or guardian if a negative history is obtained. Records regarding the type of radiation given and dosimetry should be sought. Irradiated patients should have a thorough examination, including careful palpation of the thyroid and adjacent node-bearing areas. A chest film should be made and a thyroid scan performed. Surgery should be recommended to all who have the findings mentioned in the text above. For those who do not, it is recommended that they be placed on a suppressive dose of thyroid hormone (sodium L-thyroxine 0.15 to 0.25 mg/day) and that serum TSH levels be measured to ascertain suppression. The patient probably should have a careful examination of his thyroid gland performed annually throughout his life. The occurrence of any nodules should be grounds for surgery, unless a satisfactory and certain alternative explanation can be found.

- 2475 SEARCH FOR THE LOWEST IRRADIATION DOSE FROM LITERATURES ON RADIATION-INDUCED CANCER IN UTERUS. Yoshizawa, Y.; Kusama, T. (Tokyo Univ. (Japan). Faculty of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 35: No. 10, 900-907(Oct 1975). (In Japanese).

A survey of past case reports on radiation-induced cancer of the uterus was carried out with the main object of finding the lowest irradiation dose. Search of literature published since 1912 revealed 548 cases of radiation-induced cancer of the uterus. All of these cases of radiation-induced cancer had received radiation for the treatment of non-malignant disease. The primary gynecological conditions which were the object of radiation therapy were functional bleeding, endometrial hyperplasia, myoma, endometritis, and polyps. The lowest irradiation dose was estimated at 1000-1450 rad in the case of external X-ray irradiation, and 100 mg.hr for intrauterine radium therapy, which corresponds to 100-1000 rad. It was noted that there were more cases of corpus cancer than cervical cancer. Histopathological findings of radiation-induced uterine cancer were carcinoma, sarcoma, and mixed mesodermal tumors. The latent period was distributed in the range of 1 to 40 years, with the average of 10.1 years.

- 2476 THYROID CANCER: DELAYED EFFECTS OF HEAD AND NECK IRRADIATION IN CHILDREN. Earle, J. (Stanford Univ., CA). West. J. Med.; 123: No. 4, 340(Oct 1975).

Thyroid abnormalities were found in 21% of patients surveyed who had previous head or neck irradiation 18 to 35 years ago for benign conditions. Technetium 99 scintiscanning was a part of the survey procedure. (ERB)

- 2477 EXPERIMENTAL INVESTIGATIONS OF THE DOSIMETRIC FEATURES OF X-RAY RADIATION USED IN X-RAY DIAGNOSIS. Prostyakova, M.A. Gig.

Sanit.; No. 10, 40-45(Oct 1975). (In Russian).

For English translation see the journal Hyg. Sanit..

For radiation hygiene estimates of the extent of the irradiation of various organs and tissues in roentgenological investigations, the quality and quantity of the primary radiation beam and its behaviour in the irradiated medium are assessed. It is shown that the effective energy of x-rays generated at 50-100 kV and with different radiation field dimensions at different depths in a tissue-equivalent irradiated medium is more or less constant, varying within the range 25 to 32 keV. The constancy of effective x-ray energies in a tissue-equivalent medium enables one to use, for different x-ray tube regimes, constant values of the roentgen-rad conversion factor for soft tissue and bone tissue. The investigations confirm the desirability of using high voltages across the x-ray tube in practical x-ray work.

- 2478 POSSIBLE OBSTETRIC FACTORS EFFECTING LEUKEMIA IN TWINS. Keith, L.; Brown, E.R.; Ames, B.; Stotsky, M. (Northwestern Univ., Chicago). Bibl. Haematol.; No. 43, 221-223(Oct 1975).

Each of the following, acting alone or in conjunction, may be contributory in the etiopathogenesis of leukemia in twins: exposure to ionizing radiation; cojoined intrauterine circulation; direct metastasis of maternal tumors to the fetus, and chromosomal abnormalities. The question we must ask ourselves is whether or not the literature has presented an artificial picture, represented by underreporting of "uninteresting" or discordant pairs. Further study among leukemic twins and careful analyses of both members of the twin pair as presented by national Twin Registers is needed to clarify the uncertainty presently recognized.

- 2479 HEALTH AND SAFETY ASPECTS OF INDUSTRIAL RADIOGRAPHY. Boggs, R.; Moore, R. Indian J. Occup. Health; 18: No. 10, 211-216(Oct 1975).

The risk of potential exposure to ionizing radiation to personnel due to increased application of industrial radiography for extensive nondestructive testing procedures in recent years, has been explained. The growing demands on those concerned with industrial hygiene and radiation safety to: (1) obtain a basic understanding of the potential hazards associated with the operation of all kinds of radiographic and fluoroscopic equipment (including the increasingly popular particle accelerators); (2) know the health and safety standards and radiation exposure criteria that have been developed; and (3) be alert in recognizing potentially hazardous conditions, etc. are reviewed in relation to the use of X-ray equipment and radioisotopes for industrial radiography.

- 2480 HYGIENIC FEATURES OF WORKING CONDITIONS PREVAILING IN X-RAY CABINETS. Usolt'sev, V.I.; Serebryanyi, V.A. (Leningradskij Inst. Usovershenstvovaniya Vrachej (USSR)). Gig. Sanit.; No. 10, 38-40(Oct 1975). (In Russian).

The results of an investigation of 352 x-ray cabinets showed that their personnel is subjected to simultaneous action of a number of factors: discomfortable microclimate, small concentrations of ozone and nitrogen oxides (within 0.1 of the maximum permissible concentration). The hands of the personnel, especially those of the x-ray laboratory

assistants are contaminated with lead (2.38mg in the hands washings). Therefore the assessment of labour conditions prevailing in an x-ray cabinet and the accomplishment of measures of their improvement should be carried out with due regards to all the complex of the above mentioned factors besides the ionizing radiation.

- 2481 (INIS-mf--3243, pp 318) ASSESSMENT OF THE RELATIVE BIOLOGICAL EFFECTIVENESS OF MIXED NEUTRON-GAMMA RADIATION BY CONFORMATION SHIFT EFFECTS IN BLOOD PLASMA PROTEIN FRACTIONS. Paskalev, Z. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

To determine the relative biological effectiveness (RBE) of mixed neutron-gamma fields, nuclear reactor radiations have commonly been used. In such studies, however, there is a wide variation in gamma - to - neutron ratios and, hence, the mixed radiation is not readily characterized. On the other hand, RBE values for mixed neutron-gamma radiations have been estimated using total doses in the range of 200 to 600 rad. No information is available for lower total doses (in the range of 5 - 20 rad). This paper concerns the assessment of RBE of mixed neutron-gamma radiation at various proportions of its constituents (neutron components of 10, 25, 50, or 75%) on mice given total doses of 5, 10, or 20 rad, in terms of conformation-shift effects in blood-plasma protein fractions, as determined from measurements of blood-plasma electroconductivity and dielectric constant. RBE values were found to vary from 1.25 to 3.70 at neutron-component proportions of 10 to 75% in mice exposed to 4.1 MeV neutrons (plutonium-beryllium source) and gamma rays (radium source).

- 2482 (INIS-mf--3243, pp 317) STUDY ON THE CHANGES IN BLOOD PLASMA ELECTROCONDUCTIVITY AND DIELECTRIC CONSTANT IN IRRADIATED MAMMALS. Paskalev, Z.; Bancheva, E. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

Blood plasma electroconductivity and dielectric constant were measured in C57BL mice exposed to an uncontaminated gamma or neutron field or a mixed gamma-neutron field at a total dose of 5, 10, 15, 20, or 25 rad. Measurements were also made with blood plasma from Wistar rats given 200, 400, or 600 R X-rays. The results obtained revealed a characteristic pattern of radiation-induced changes in electroconductivity and dielectric constant, these end-points being indicative, respectively, or shifts in saline concentrations and in conformation of protein fractions of blood plasma. Analysis of the data showed that within a few days after exposure there were changes occurring in cellular and tissue water-salt metabolism, followed by enhancement or recovery to norm, depending on the dose. A possibility is thus rendered to use the blood plasma parameters studied as a test for detecting early shifts in cellular water-salt metabolism and in conformation of protein fractions at a time when no characteristic

changes are yet to be observed in amounts of individual types of protein fractions from blood plasma of irradiated organisms.

- 2483 (INIS-mf--3243, pp 321) STUDY ON PROLIFERATIVE ACTIVITY OF FEMALE GENITAL TRACT CELLS DURING POSTNATAL DEVELOPMENT AFTER BEING AFFECTED BY 500-RAD EXPOSURE. Tileva, M. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

Female albino rats were given, at the age of 8 or 19 days, a single whole-body exposure to 500 rad on a "Rocus-M" apparatus. Mitotic activity of epithelium cells from uterus, cervix, and vagina were examined at 2, 6, 12, 26, 50, and 74 hr postradiation. At 8 days of age (period of active growth), uterine, cervical, and vaginal epithelia had high mitotic indices (28.4%, 21.2%, and 23.0%, respectively). At 2 hr postradiation, mitotic index was found to drop to 3.0%; at 6 hr it began to rise, to attain a maximum at 12 hr (39.8%, 37.0%, 42.9%). A second maximum, of virtually similar extent, was noted at 74 hr postradiation. Over the period from 26 hr to 50 hr, mitotic activity was below maximum. At 19 days of age (period of prefunctional differentiation), mitotic indices of epithelium cells from uterus, cervix, and vagina were 2.9%, 7.1%, and 14.4%, respectively. The radiation induced suppression of mitotic activity in epithelia from the organs studied, as observed at 2 hr postradiation, was succeeded by a gradual rise with a maximum level between 12 hr and 50 hr; this peak rate exceeded control figures by a factor of 5 for uterus and a factor of 2.5 for cervix and vagina. At 74 hr postradiation, cervical and vaginal epithelia had recovered a normal mitotic rate, while uterine epithelium had a mitotic rate still twice the initial figure. The results of the study indicate that recovery of mitotic activity is more rapid and of a higher level for uterine epithelium from animals irradiated at 19 days of age. This is likely to be accounted for by a longer mitotic cycle - 203.4 hr - in uterine epithelium cells, with relatively more extended radiation sensitive phases of the cycle.

- 2484 GENETIC EFFECTS OF ACUTE AND CHRONIC IRRADIATION WITH 14 MEV NEUTRONS. 1. GENETIC ASPECTS. 2. TECHNIQUE OF NEUTRON IRRADIATION. Luening, K.G.; Roennbaeck, C.; Sheridan, W.; Holmberg, M. (Kungliga Karolinska Mediko-Kirurgiska Institutet, Stockholm (Sweden); Foersvarets Forskningsanstalt, Stockholm (Sweden)). Acta Radiol., Ther., Phys., Biol.; 14: No. 5, 401-416 (Oct 1975).

Male CBA mice were exposed to 14.5 MeV neutron, either in an acute (150 or 250 rad) or a chronic dose (250 rad) and the genetic effects of the irradiations were compared. No detectable difference in the rate of mutations existed between acute and chronic exposure, with these neutrons.

- 2485 EFFECT OF CONTINUOUS IRRADIATION UPON SOME BIOLOGICAL PROPERTIES OF MURINE LYMPHOSARCOMA LS/BL. Juraskova, V.; Drasil, V. (Ceskoslovenska Akademie Ved, Brno. Biofyzikalni Ustav). Folia Biol. (Prague); 21: No. 5, 340-348 (Oct 1975).

Mouse lymphosarcoma LS/BL cells passaged in syngeneic hosts were continuously irradiated

with ^{60}Co gamma rays at an exposure rate of 1 R/hour. Long-term irradiation did not substantially alter the proliferative rate of leukaemic cells. Radiation exposure in the duration of 60 and 70 weeks led to an increase in the mean survival time of the hosts and in the generation time of the cells. When compared with the changes observed in the hosts of unirradiated leukaemic cells, the decrease in erythrocyte counts was greater during the first few days after inoculation of irradiated tumour cells, whereas the increase in leucocyte counts was slower.

- 2486 MITOTIC INDEX IN THE MOUSE FETUS LIVER AS A BIOLOGICAL INDICATOR OF RADIATION EFFECTS. Kusama, T.; Yoshizawa, Y. (Tokyo Univ. (Japan). Faculty of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 35: No. 10, 908-912 (Oct 1975). (In Japanese).

This study was carried out in order to determine whether the mitotic index in mouse fetus liver tissue can be used practically for a biological indicator of radiation effects. Pregnant mice (ddY strain) which were in the 14th and 16th day of gestation were given 5, 10, 25, 50 or 100R of whole body γ -ray irradiation. At 30, 60 and 90 minutes after exposure, the pregnant mice were sacrificed to remove the fetuses. Smears were prepared from minced fetus liver. The mitotic index and the frequency of prophase cells in the liver were determined by observing 10000 cells from every fetus. The change of mitotic index and the frequency of prophase cells with fetus age between the 14th and 16th days were observed. The change of mitotic index and frequency of prophase cells with time after γ -irradiation was observed. There was a decrease at 30 minutes and an increase at 90 minutes after irradiation. It was found that the threshold dose in regard to the decrease of mitotic index and frequency of prophase cells in mouse fetus liver was between 5R and 10R.

- 2487 CHEMICAL AND RADIATION-INDUCED MUTAGENESIS OF THE RAT LIVER CHROMOSOMES. Mutovin, G.R.; Akif'ev, A.P.; Nikonov, V.P. (Vtoroj Moskovskij Gosudarstvennyj Meditsinskij Inst. (USSR); AN SSSR, Moscow. Inst. Obshchej Genetiki). Genetika; 11: No. 10, 170-172 (Oct 1975). (In Russian).

It was shown that radiation and chemical mutagenesis in rat liver cells is determined chiefly by long-lived premutational potential changes. The intensification of intrachromosomal processes under the action of an inducer of gene activity - phenobarbital - does not modify the yield of chromosome aberrations, both under the action of radiation and under the action of an alkylating agent - dipin. The facts obtained support the hypothesis that the chemical nature of the premutational changes differs from the primary molecular damages to DNA.

- 2488 (INIS-mf--3243, pp 314) ASSESSMENT OF LUNG CANCER RISKS FOR SOME CATEGORIES OF UNDERGROUND WORKERS. Dimitrov, M. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

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Fourth national congress of radiology and nuclear medicine.

In radioactive mines as well as in hardrock mines, tunnels under construction, and other underground workings, increased atmospheric levels of radioactive-gas daughter products are

associated with a potential hazard of inhalation overexposure to workers. Absorbed dose from the alpha-activity component of deposition occurring in the process of breathing manifests a maximum in the area of secondary to quarternary bronchi. In this critical tissue, radiation exposure, along with other deleterious factors, produces conditions favourable to initiation of lung cancer, with a frequency of the latter proportional to cumulative dose. An assessment was made of absolute radiation risk to workers inhaling a radon-daughter contaminated atmosphere, on the basis of an estimated cumulative dose and a dose-response relation arrived at from epidemiological studies by other authors. For a range with a lower limit representing the product of maximum permissible concentration and half of the underground experience assigned to first category labor, and an upper limit determined by the product of maximum 'hidden' alpha-decay energy measured and a full underground experience (180 months), cumulative exposures were found to vary from 90 to 8100 WLM. Rough estimates of corresponding lung cancer incidence ranged from 2 to 150 cases per year per 10,000 workers, versus 2-5 cases per year per 10,000 members of the general male population of the country. Results, obtained from a reconnaissance statistical study on a sample of 230 underground workers, with suitable working experiences and personal cumulative exposures, indicated a predicted frequency of lung cancer development of 0.43 cases per year, leading to an estimate of 19 cases per year per 10,000 workers. Such a magnitude of risk clearly shows an urgent need for introducing effective measures to improve radiological conditions in the occupational environment for a large proportion of the underground workers.

- 2489 RADIATION DOSE TO THE PATIENT AFTER ADMINISTRATION OF RADIOACTIVE LABELLED COLLOIDS. Wolf, R.; Hahn, K. (Mainz Univ. (F.R. Germany). Inst. fuer Klinische Strahlenkunde). Fortschr. Geb. Roentgenstr. Nuklearmed.; 123: No. 4, 324-330 (Oct 1975). (In German).

1 fig.; 4 tabs.; 23 refs..

The radiation dose to the patient after injection of radioactive colloids is calculated for three substances: colloidal radiogold, sup(99m)Tc sulfur colloid and sup(113m)In colloid. For the calculation normal and pathological conditions were assumed.

- 2490 (INIS-mf--3243, pp 311) CHROMOSOME ANOMALIES FROM INTERNAL CESIUM 131 APPLICATION IN RAT BONE-MARROW CELLS. Grigorov, L.; Karag'ozova, T.; Vylkova, G.; Lyutakova, E. Oct 1975. (In Bulgarian).

From 4. national congress of radiology and nuclear medicine; Varna, Bulgaria (27 Oct 1975).

Published in summary form only. English abstract available.

Fourth national congress of radiology and nuclear medicine.

Analysis of chromosome anomalies was performed on a total of 6160 bone-marrow cells from rats injected intraperitoneally with cesium-131 activities equivalent to diagnostic doses (6 μ Ci) or exceeding such doses by a factor of 5 or 10, respectively. Cytological observations were made at 1, 3, 7, and 14 days post-administration. At day 1 after injection of 6 μ Ci cesium-131, chromosome anomalies were found in 2.3% of bone-marrow cells blocked at metaphase. At day 3 (2%), day 7 (1.5%), and day 14 (1.3%), there was a tendency for aberrant cell yields to fall without, however, returning

to control level (0.6%). After administration of 30 μ Ci, aberrant cell yields were significantly increased over 6- μ Ci yields, the increase being particularly marked at day 1 and day 3 post-administration. As for 60- μ Ci doses of Cesium-131, the amounts of aberrant cells produced were superior to 6- μ Ci yields, but showed no trend toward a further increase over 30- μ Ci yields. Structural chromosome aberrations encountered were mostly of one-hit types (chromatid or chromosome fragments), with an insignificant proportion of two-hit types (polycentrics, rings, interstitial deletions) which were limited almost exclusively to day 1 post-administration.

- 2491 EFFECT OF RADIOPHOSPHORUS ON HEMATOLOGY OF MICE DURING POSTNATAL DEVELOPMENT. Malhotra, N.; Srivastava, P.N. (Jawaharlal Nehru Univ., New Delhi (India). School of Life Sciences). Strahlentherapie; 150: No. 4, 411-426 (Oct 1975).

5 figs.; 5 tabs.; 13 refs..

Swiss albino mice at different stages of their postnatal development (one day, one week, two weeks, three weeks, four weeks age groups) were injected intraperitoneally with radioactive phosphorus (P-32) at the dose of 1.0 μ Ci/g body weight and studied for their hematological response at weekly intervals up to six weeks of age when they attain sexual maturity. In all the treated groups in both males and females, the radiation injury was evident after injection of radioactive phosphorus. Animals showed reduction in blood cell number and fall in hemoglobin and hematocrit levels after injection. Reparation was also evident in the animals after some lapse of time following P-32 administration. Morphological changes in different white blood cells were not observed. No radiation sickness symptoms were observed in any of the treated groups during the study. There was no radiation mortality. The radiation damage to blood forming organs was moderate. It was observed that the females showed a greater hematological damage than the males.

- 2492 INFLUENCE OF OESTROGEN ON THE EXCRETION OF STRONTIUM-90 AND -85 IN MICE. Roennbaeck, C.; Nilsson, A. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Acta Radiol., Ther., Phys., Biol.; 14: No. 5, 485-496 (Oct 1975).

Groups of male CBA-mice were treated with oestrogenic hormones alone or in combination with ^{85}Sr and ^{90}Sr . The strontium retention was measured in special skeleton parts and also by means of whole body counting. After a period of increasing bone weight in mice treated with oestrogen and ^{90}Sr , there were signs of a serious breakdown of that newly formed 'oestrogenic' bone tissue. The strontium retention was in no case found higher in animals treated with both the hormones and ^{90}Sr when compared to those treated with ^{90}Sr alone. The life span was shortened in mice given the combined treatment. The results support the theories that at the same time irradiated and stimulated cell populations are exposed to a larger risk for induction of tumours and that the irradiation injury cannot be referred entirely to the irradiation dose in a physical sense.

- 2493 (AD-A--017507) LASER EXPOSURES IN THE MACULAS OF HUMAN VOLUNTEERS. FINAL REPORT. Wolbarsht, M.L.; Landers, M.B. III. (Duke Univ., Durham, N.C. (USA). Dept. of Ophthalmology). 30 Sep 1975. Contract N00014-67-A-0251-0011. 45p. NTIS \$4.00.

Patients whose eyes require enucleation for

medical reasons were exposed to focused argon laser beams in a regular pattern of locations in the eye, especially in the macula, including the fovea. The power levels were suprathreshold to just produce instantaneous lesions. The ophthalmoscopic appearance of the resultant lesions was correlated with loss of function and with subsequent histological examination. An argon laser lesion in the macula may have greater functional impairment than a comparable ruby laser lesion. In lesions outside the macula the damage is confined to the retinal pigment epithelium and adjacent structures. In markedly suprathreshold lesions the outer segments of the rods were less disturbed than the inner nuclear and plexiform layers. Within the macula there are usually two damage locations separated by unchanged layers of the retina. In the pigment epithelium in which the damage was the same or less than in lesions outside the macula, there was a larger area of damage in the outer plexiform layer. Foveal lesions had greater damage to the fiber layer of Henle (outer plexiform layer) than in adjacent areas of the macula at comparable power levels. (GRA)

- 2494 (ORNL-tr--4302) PRODUCTION, DISPOSAL, AND RELATIVE TOXICITY OF LONG-LIVED FISSION PRODUCTS AND ACTINIDES IN THE RADIOACTIVE WASTES FROM NUCLEAR FUEL CYCLES. Haug, H.O. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Heisse Chemie). 26 Sep 1975. Translation by E.G. Silver of KFK--2022. 190p. Dep. NTIS, PC A09/MF A01.

Chapters are devoted to the following topics: predicted future development of nuclear energy in the German Federal Republic and in Western Europe, fuel cycle variations and production of fission products and actinides in the radioactive waste from reprocessed nuclear fuels, long-lived fission products and actinides in the waste streams from the reprocessing of nuclear fuels, relative toxicity index, presently preferred waste management concepts, and alternative concepts for the elimination of high-level wastes. (LK)

- 2495 (INIS-mf--3148, pp 83-91) GENETIC EFFECTS, APP. 3. Sankaranarayanan, K. 3 Sep 1975.

Published in summary form only.

Nuclear power plants and public health, an advice by the Health Council.

Effects of energy production by nuclear power plants on the human genetic material are discussed. CHROMOSOMAL ABERRATIONS; GENE MUTATIONS; GENETIC RADIATION EFFECTS; GENETICALLY SIGNIFICANT DOSE; MAN; MICE; NUCLEAR POWER PLANTS; NETHERLANDS; RADIATION HAZARDS; RADIOACTIVE EFFLUENTS

- 2496 (INIS-mf--3148, pp 97-105) DATA ON THE RADIATION DOSE TO MAN CAUSED BY RADIONUCLIDES IN LIQUID WASTES OF NUCLEAR REACTORS, APP. 5. van Weers, A.W. 3 Sep 1975. (In Dutch).

Published in summary form only.

Nuclear power plants and public health, an advice by the Health Council. Influence of nuclear power plants with a total capacity of 3500 megawatts on environment and on public health in the Netherlands.

BARIUM 140; CESIUM 134; CESIUM 137; COBALT 58; COBALT 60; COOLANTS; CRITICAL ORGANS; CRUSTACEANS; DRINKING WATER; FISHES; INGESTION; IODINE 131; MAN; MANGANESE 54; NETHERLANDS; RADIATION DOSES; RADIOACTIVE EFFLUENTS; RADIOECOLOGICAL CONCENTRATION; STRONTIUM 89; STRONTIUM 90; TRITIUM

EXTRAPOLATION TO LOW DOSES AND LOW DOSE RATES OF DATA ON RADIATION INDUCED CANCER, APP. 2. Barendsen, G.W. 3 Sep 1975. (In Dutch).

Published in summary form only.

Nuclear power plants and public health, an advice by the Health Council.

CARCINOGENESIS; DELAYED RADIATION EFFECTS; DOSE RATES; DOSE-RESPONSE RELATIONSHIPS; LOW DOSE IRRADIATION; MAN; RADIATION HAZARDS

- 2498 DOSE COMMITMENTS OF PERSONNEL AT NUCLEAR FACILITIES. Herrmann, H.J. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F.R. Germany)). IRS Mitt.; No. 3, 17-21 (Sep 1975). (In German).

1 tab..

In connection with the increasing number of nuclear plants in the FRG, the compilation of data on the radiation exposure of monitored personnel has begun. This inventory is to serve the recognition of critical aspects and as a basis for expert activity in the field of radiation work protection. In the radiation exposure considerations, one differentiates between normal operation and the revision phase of the nuclear plant. Also a breakdown of the total dose of all monitored persons according to exposed persons for own and foreign personnel is carried out. The high exposure values in the revision and operational phases exceeding authorized basic allowance, whose increase with operational time of a plant is approximately squared, makes one realize the necessity of paying more attention to 'radiation work protection'.

- 2499 ATTITUDE TO NUCLEAR POWER QUESTIONS. PROF. STERNGLASS ON ALLEGED EFFECTS OF RADIOACTIVE FALLOUTS. Merton, A.; Butz, H.P. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F.R. Germany)). IRS Mitt.; No. 3, 27-31 (Sep 1975). (In German).

1 fig..

The main arguments of Sternglass connected with radioactive fallout of nuclear weapon explosions are the increase in the death rate of children in the USA and the occurrence of leukemia in children in the Troy-Albany region. Professor Sternglass' claims do not stand up to a precise check. His hypotheses have instead brought forth a flood of criticism on the selection of data and their processing. The criticism can be summarized in the following points: The selection of some data does not support his hypotheses as he has neglected much more extensive data. It has been proved that false assumptions have been used. Other investigations to support his thesis are falsely interpreted. Indispensable mathematical evidence has been omitted in the evaluation of the data material.

- 2500 FACTORS AFFECTING THE QUANTITATION OF DOSE-RESPONSE CURVES FOR MUTATION INDUCTION IN V79 CHINESE HAMSTER CELLS AFTER EXPOSURE TO CHEMICAL AND PHYSICAL MUTAGENS. Fox, M. (Christie Hospital and Holt Radium Inst., Manchester (UK). Paterson Labs.). Mutat. Res.; 29: No. 3, 449-466 (Sep 1975).

Using four common mutagens, ethyl methanesulphonate, methyl methanesulphonate, UV, and X-irradiation, the relationship between dose of mutagen, cellular lethality and frequency of 8-azaguanine resistant colonies in V₇₉ Chinese hamster cells has been examined. Several factors affecting the recovery of mutants including inter and intra-clone metabolic co-operation have been quantitated and their influence on survival response curves examined.

- 2497 (INIS-mf--3148, pp 77-82)

- 2501 (EPA--520/1-75-001) MANUAL OF PROTECTIVE ACTION GUIDES AND PROTECTIVE ACTIONS FOR NUCLEAR INCIDENTS. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). Sep 1975. 99p. Environmental Protection Agency, Office of Radiation Programs, Washington, DC.

This manual was prepared to provide practical guidance to State, local, and other officials on criteria to use in planning protective actions for radiological emergencies that could present a hazard to the public. The guidance presented here is not intended as a substitute for, or an addendum to, a State radiological emergency response plan. It is intended only to provide information for use in the development of such a plan.

- 2502 (RD/B/N--3496) USERS GUIDE TO THE POPDOS PROGRAM FOR EVALUATING COLLECTIVE DOSES. Henning, M.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Sep 1975. 25p. Dep. NTIS (US Sales Only) \$3.50.

A complete description is given of the input data needed to use the computer program POPDOS for estimating collective doses to the population of England and Wales following atmospheric releases of radioactivity. Details are given of the Job Control Language used for normal execution of the program. A complete test case is included to facilitate program transfer to other computers. POPDOS is written in Fortran IV (level H) and is compiled under OPT-2, using ASP3 on the IBM 370/168 computer. A list of subroutines and their functions is given together with a tabulation of the major dimensioned variables. Finally there is a description of the procedure by which a collective dose surface can be generated using the CALCOMP plotting facilities. (auth)

- 2503 CRITERIA FOR AN OPTIMAL ISOTOPE TO BE USED IN GYNECOLOGIC RADIATION THERAPY. Walstam, R. (Radiofysiska Institutionen, Stockholm (Sweden)). Strahlentherapie; 150: No. 3, 258-260(Sep 1975). (In German). 1 fig.; 2 tabs.; 4 refs. Lecture from the Symposium on Afterloading Techniques, Wuerzburg 1974.

With regard to the evident disadvantages of radium, nowadays an artificial radiation source always should be considered, since it may be much more favorable for any intracavitary application. The most usual ones are Cs-137, Co-60 and Ir-192. Each of these isotopes has its advantages and disadvantages; therefore the choice of the isotope must take into account the criteria and requirements for each intracavitary radiation technique.

- 2504 ON THE NEW DRAFT RADIATION PROTECTION ORDINANCE. Stucken, G. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F.R. Germany)). Atomwirtsch., Atomtech.; 20: No. 9, 440(Sep 1975). (In German).

From 4. atomic law symposium; Goettingen, F.R. Germany (26 May 1975).

Short communication only.

GERMAN FEDERAL REPUBLIC;LEGAL ASPECTS; MEETINGS;RADIATION PROTECTION;REGULATIONS; REVIEWS

- 2505 LEUKEMIA IN CHILDREN WITH WILMS TUMOR. Schwartz, A.D.; Lee, H.; Baum, E.S. (Northwestern Univ., Chicago). Shonika Rinsho; 87: No. 3, 374-376(Sep 1975).

Recently there have been numerous reports of second neoplastic diseases developing in individuals years after completion of therapy for their primary, apparently unrelated, malignancy. The authors have observed two children who developed leukemia following therapeutic control and apparent cure of Wilms tumor. These children and the discovery by a mail survey of three similar cases form the basis for this report. To our knowledge this is the first documentation of leukemia occurring in children who have been treated for Wilms tumor or any other common nonlymphomatous childhood neoplasm.

- 2506 BONE MARROW TRANSPLANTATION - A FIELD IN CONTINUOUS DEVELOPMENT. Pfeffer, P.F. (Forsvarets Forskningsinstitut, Kjeller (Norway)). Sanit. Nytt; 21: No. 2, 154-167(Sep 1975). (In Norwegian). 27 references.

The symptoms of the radiation syndrome are described briefly and the Vinca accident in 1958 is used as an illustration of the application of bone marrow transplantation as a treatment in radiation accidents. Thereafter the immunological problems arising when a permanent substitution of donor marrow is required are discussed. Greatest experience in bone marrow transplantation has been had in the treatment of aplastic anemia and acute leukemia. In these cases the recipient's bone marrow cells must be killed by whole body irradiation or by cyclophosphamide to preclude graft-host reaction. The removal of marrow from the donor and transplanting in the recipient are described, as is the progress of the patient in a typical case. The graft-host reaction is then discussed, as is the danger of secondary infections. In conclusion the long term results are evaluated and the future developments of the treatment discussed.

- 2507 CATARACTS IN URANIUM MINERS. France, A. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)). Cesk. Oftalmol.; 31: No. 5, 340-344(Sep 1975). (In Czech).

The question was studied of whether or not uranium miners with a long history of work underground develop alterations of the eye lens as a result of a long-term chronic exposure to gamma radiation. Investigated were the area of opacities and the occurrence of alterations of the lens posterior pole in a group of 800 uranium miners (i.e., 1,600 eyes) with work underground longer than 10 years. As against controls, no statistical differences were found in the lens transparency. Significant differences were also not found in the extent of cataracts and the occurrence of posterior pole alterations, nor in the rate of an increased occurrence of cataracts due to age.

- 2508 LEGAL AND TECHNICAL REGULATIONS IN RADIATION PROTECTION AND THEIR EFFECTS ON RADIOTHERAPY. Betz, B. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Strahlenschutz). Roentgen Ber.; 4: No. 3, 198-211(Sep 1975). (In German). 5 refs..

During the last few years, new regulations and guidelines in the field of radiation protection have been issued which affect radiotherapy, too. On September 1st, 1973 the X-ray Ordinance became effective; a few weeks later, new guidelines for radiation protections when using radioactive substances in the field of medicine were published. Of particular topical interest is the appendix of these new

guidelines, in which the principles of technical competence in radiation protection when handling radioactive substances in the field of medicine are laid down uniformly for the FRG. Amongst these more recent regulations, there is also the direction by the Minister of the Interior to put the operation of accelerators in the field of medicine according to section 19 of the Atomic Energy Act under the supervision of the state and to employ newly issued administrative guidelines. After a short survey on the radiation protection laws in force, a selection of important stipulations within the new legal regulations and guidelines is discussed with a view to their effects on radiotherapy.

- 2509 CLINICAL STATISTICS IN A FOUR-YEAR PERIOD (1971-1974) AND INCIDENCE OF MALIGNANT TUMOR IN GENERAL PATIENTS AND A-BOMB EXPOSED PATIENTS IN THE JAPAN RED CROSS NAGASAKI ATOMIC BOMB HOSPITAL. Noutomi, H.; Kanetake, H.; Ihara, K.; Takano, M.; Kakimoto, S. (Nagasaki Atomic Bomb Hospital (Japan)). Nagasaki Igakkai Zasshi; 50: No. 3, 193-202(Sep 1975). (In Japanese).

Clinical cases of the Japan Red Cross Nagasaki Atomic Bomb Hospital during the four-year period from 1971 to 1974 were analyzed statistically according to inpatient or outpatient, age, sex, disease and method of operation. Malignant tumor cases were divided into general patients and A-bomb exposed patients and in order to see if there was any significant difference in incidence of malignant tumor between these two groups, a total of 101 cases of malignant tumor during the 11-year period from 1964 to 1974 were studied statistically. A-bomb exposed patients consisted of 2547 outpatients and 370 inpatients. The male-female ratio was 1:1.04 in outpatients and 1:0.37 in inpatients. The rate of hospitalization was 17.0%. Aged patients over 70 years of age occupied 47.4% of the inpatients. During the 11 years from 1964 to 1974, there occurred 101 cases of malignant tumors and these cases were studied statistically to see the difference in incidence between the general patients group and the A-bomb exposed group. Prostatic cancer showed a significant difference between these two groups in outpatients with higher incidence for the A-bomb exposed group but no significant difference in inpatients. Other malignant tumors showed no significant difference.

- 2510 A COMPARISON OF CHROMOSOMAL RADIOSENSITIVITIES OF SOMATIC CELLS OF MOUSE AND MAN. Sasaki, M. (Tokyo Medical and Dental Univ. (Japan). Medical Research Inst.). Mutat. Res.; 29: No. 3, 433-447(Sep 1975).

A cell culture technique for quantitative analysis of radiation-induced chromosome aberrations in somatic cells has been developed and used for the comparison of chromosomal sensitivity of skin cells of mouse and man to ⁶⁰Co-γ-rays. This includes culture of irradiated tissues or cells in culture in arginine and isoleucine deficient medium and subsequent refeeding with complete medium. With this technique, radiation-induced chromosome aberrations can be analyzed selectively in the cells exposed in G₁ phase and recovered at their first post-irradiation mitosis. When tested on the human embryonic cells, the dicentric yield was essentially the same whether they were skin cells irradiated in situ or cultured cells at various in vitro passages irradiated in vitro. In contrast, when studied in the skin cells irradiated in situ, mouse embryos and newborns were insensitive to the induction of dicentricies. In young mice on day

11 however, the sensitivity was at a level comparable to that in human embryonic cells and it was intermediate on day 4. Such embryonic insensitivity of the mouse cells was rapidly lost during serial transfer in vitro, and when tested at 4th or later subculture generations, mouse and human cells were equally sensitive to the induction of dicentricies. These results suggest that the chromosomal radiosensitivity is essentially the same for mouse and human cells but can be modified by some biological factors, possibly DNA repair mechanisms, which differ between species as well as among the states of differentiation of particular cell types. Special attention was paid to the parallelism between the age-dependent changes in the chromosomal, mutational and carcinogenic radiosensitivities in the mouse. If this parallelism can be carried over to man, human pre-natal irradiation will not present any reduced genetic hazards.

- 2511 CHROMOSOME ABERRATIONS IN SOMATIC CELLS. Awa, A.A. (Radiation Effects Research Foundation, Hiroshima (Japan)). J. Radiat. Res.; 16: No. suppl., 122-131(Sep 1975).

Evidence concerning cytogenetic effects of A-bomb irradiations on the somatic cells of survivors of Hiroshima and Nagasaki is reviewed. It has been demonstrated that (1) radiation-induced chromosome aberrations have persisted in the circulating lymphocytes as well as in the bone marrow cells of survivors more than two decades after radiation exposure, and (2) that the chromosome-aberration frequency is in general proportional to the dose received. The relation, if any, between the occurrence of induced structural rearrangements of chromosomes and the health status of the survivors is as yet unknown, and the need for further and continued evaluation for possible associations between them is stressed.

- 2512 GROWTH AND DEVELOPMENT FOLLOWING PRENATAL AND CHILDHOOD EXPOSURE TO ATOMIC RADIATION. Blot, W.J. (National Cancer Inst., Bethesda, Md. (USA)). J. Radiat. Res.; 16: No. suppl., 82-88(Sep 1975).

Studies of growth and development of Hiroshima and Nagasaki children have shown significant long-range effects associated with exposure to the atomic bombs. Radiation to the fetus during early pregnancy, even at relatively low doses, may result in reduced growth, smaller head size, and mental retardation. Harmful effects of radiation later in pregnancy and in early childhood have not been as clearly demonstrated, however reduction in growth is also found among Hiroshima children.

- 2513 CATARACTS. Dodo, T. (Hiroshima Univ. (Japan). School of Medicine). J. Radiat. Res.; 16: No. suppl., 132-137(Sep 1975).

Several months to years after exposure to ionizing radiation of the atomic bombs (A-bombs), some survivors developed cataracts. The characteristic clinical finding was a localized lenticular opacity on the inner surface of the posterior polar capsule presenting a polychromatic sheen, and punctate opacities or aggregations thereof in the subcapsular cortical layer of the posterior polar region. In the majority of the affected survivors, the degree of opacification of these radiation cataracts was minimal to moderate and remained unchanged. These cases had no other subjective disturbances associated with this condition.

- 2514 AGING. Finch, S.C. (Yale Univ., New Haven, Conn. (USA). School of Medicine); Beebe, G.W. J. Radiat. Res.; 16: No. suppl., 108-121(Sep 1975).

The hypothesis that ionizing radiation accelerates natural aging has been under investigation at the Atomic Bomb Casualty Commission since 1959. Postmortem observations of morphologic and chemical changes, tests of functional capacity, physical tests and measurements, clinical laboratory tests, tissue changes, morbidity, and mortality have all been examined by ABCC investigators interested in this hypothesis. These studies have been beset with conceptual difficulties centered on the definition and measurement of aging. An empirical approach early led to the calculation of an index of physiologic age as a linear combination of age-related tests of various organ systems. Most studies have been negative but have not involved the large numbers that might be required to provide strong evidence for or against the hypothesis. Mortality, however, has been examined on the basis of a large sample and over the period 1950-1972 had provided no support for the hypothesis of radiation-accelerated aging. Ionizing radiation dose, of course shorten human life, but its life-shortening effect appears to be the result of specific radiation-induced disease, especially neoplasms. The hypothesis is now much less attractive than it was 10-20 years ago but still has some value in stimulating research on aging. The experience of the A-bomb survivors provides an unusual opportunity for a definitive test of the hypothesis.

- 2515 LEUKEMIA AND RELATED DISORDERS. Ichimaru, M. (Nagasaki Univ. (Japan). School of Medicine); Ishimaru, T. J. Radiat. Res.; 16: No. suppl., 89-96(Sep 1975).

The studies of radiation leukemogenesis in atomic bomb survivors is reviewed. Leukemia appeared early and was one of the most striking evident somatic effects of radiation in atomic bomb survivors. Leukemogenic effects of radiation vary by quality and quantity of radiation dose, age at the time of exposure, elapsed time after exposure and type of leukemia. Although the risk of leukemia in atomic bomb survivors is now greatly reduced with elapsed time after exposure, there is no evidence that the risk of leukemia has returned to control levels in those survivors who received a significant radiation dose even almost 30 years after the bombings. No significant clinical and pathologic manifestation of leukemia related to radiation dose was reported except the absence of chronic lymphocytic leukemia in those survivors who received a significant dose. A briefer review is also made of various studies concerning atomic bomb exposure and the incidence of related disorders such as malignant lymphoma, aplastic anemia and other hematologic disorders.

- 2516 GENETIC EFFECTS. EARLY GENETIC SURVEYS AND MORTALITY STUDY. Kato, H. (Radiation Effects Foundation, Hiroshima (Japan)). J. Radiat. Res.; 16: No. suppl., 67-74(Sep 1975).

In 1948-1953 a large scale field survey was conducted to investigate the possible genetic effects of A-bomb radiation on over 70,000 pregnancy terminations in the cities of Hiroshima and Nagasaki. The indices of possible genetic effect including sex ratio, birth weight, frequency of malformation, stillbirth, neonatal death, deaths within 9 months and anthropometric measurements at 9 months of age for these children were investigated in relation to their parent's exposure status to

the A-bomb. There were no detectable genetic effects in this sample, except for a slight change in sex ratio which was in the direction to be expected if exposure had induced sex-linked lethal mutations. However, continued study of the sex ratio, based upon birth certificates in Hiroshima and Nagasaki for 1954-1962, did not confirm the earlier trend. Mortality in these children of A-bomb survivors is being followed using a cohort of 54,000 subjects. No clearly significant effect of parental exposure on survival of the children has been demonstrated up to 1972 (age 17 on the average). On the basis of the regression data, the minimal genetic doubling dose of this type of radiation for mutations resulting in death is estimated at 46 rem for the father and 125 rem for the mother.

- 2517 ACUTE EFFECTS. Ohkita, T. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). J. Radiat. Res.; 16: No. suppl., 49-66(Sep 1975).

An outline of the acute effects of the Hiroshima and Nagasaki atomic bombs are summarized, based on documentary records. Acute injuries caused by the atomic bombs have been classified as thermal, mechanical, and radiation injuries. Combinations of these were most common. Many died from the immediate effects of blast and burns, but individuals often succumbed to trauma or burns before the radiation syndrome developed. Many more would have died from irradiation, had they been saved from the effects of trauma or burns. Nearly all who died within 10 weeks had signs suggestive of radiation injuries. Remarkable variation in sensitivity of body tissues to ionizing radiation was apparent. Radiation-induced bone marrow depletion was the most critical damage leading to death. In these instances, leukopenia and thrombocytopenia, and subsequent infections and hemorrhagic tendencies were the main causes of death. The clinical symptoms and signs of radiation injuries; the RBE of the atomic bomb neutrons for acute effects; and the effects of irradiation on spermatogenesis are also discussed.

- 2518 PHYSICAL DOSE ESTIMATES FOR A-BOMB SURVIVORS. STUDIES AT CHIBA, JAPAN. Hashizume, T.; Maruyama, T. (National Inst. of Radiological Sciences, Chiba (Japan)). J. Radiat. Res.; 16: No. suppl., 12-23(Sep 1975).

In-air tissue absorbed doses from the primary and scattered radiations of the Hiroshima and Nagasaki atomic bombs, without shielding, were estimated as function of distance from the hypocenters. Gamma-ray dose was determined from the thermoluminescence in bricks and tiles; neutron dose, from ^{60}Co activity induced in concrete-embedded iron of buildings. The ratio of the absorbed dose in critical organs to the in-air tissue absorbed dose was determined by phantom measurements using simulated radiation sources for the atomic bombs. The absorbed doses in the thyroid gland, the gonads, and the fetus in utero were thus estimated as a function of distance from the hypocenters.

- 2519 DOSE ESTIMATION FROM RESIDUAL AND FALLOUT RADIOACTIVITY. III. FALLOUT IN THE NAGASAKI, NISHIYAMA DISTRICT. Okajima, S. (Nagasaki Univ. (Japan). School of Medicine). J. Radiat. Res.; 16: No. suppl., 35-41(Sep 1975).

Fallout from the Nagasaki atomic bomb was mainly concentrated in the Nishiyama district of Nagasaki. Studies conducted in 1945 and 1946 indicated the average dose due to the external

irradiation from fallout in Nishiyama to be as high as 30 to 130 R. A significant leucocytosis occurred among Nishiyama residents two months following the explosion. In the present 1969-1972 investigation, Nishiyama residents and appropriate comparison residents elsewhere in Nagasaki underwent comprehensive clinical evaluations including thyroid function and chromosome studies, radiochemical urinalysis and whole body counting. No clinical abnormalities were found among the Nishiyama residents, but whole body counting demonstrated significantly elevated ^{137}Cs concentrations with parallel results by radiochemical urinalysis. Increased ^{137}Cs contents of soil and agricultural products of the Nishiyama area were apparently responsible for the relatively high body burdens. The annual internal doses from ^{137}Cs in the Nishiyama district were estimated to be 0.292 mrad per year for males and 0.187 mrad for females.

2520 DIAGNOSTIC AND THERAPEUTIC RADIATION EXPOSURE. Russell, W.J. (Radiation Effects Research Foundation, Hiroshima (Japan)). J. Radiat. Res.; 16: No. suppl., 42-48(Sep 1975).

Diagnostic and therapeutic radiology were studied as possible contaminants in the evaluations of A-bomb survivors in the ABCC-JNIH Adult Health Study for radiation effects. Hiroshima and Nagasaki subjects received X-ray examinations elsewhere within three months of their ABCC visits at rates of 23 and 12%, respectively. Medical X-ray examinations were more frequent among survivors than comparison subjects. Hiroshima and Nagasaki radiologic practice steadily increased since 1948, and differed markedly by city. From 1946-70 the Hiroshima and Nagasaki X-ray bone marrow doses were 2,300 and 1,000 g-rads, respectively. By 1970, cumulated medical X-ray doses approximated A-bomb doses at distances from the hypocenters of 2,000 m in Hiroshima and 2,800 m in Nagasaki. ABCC X-ray examination doses per subject are routinely updated for comparison with A-bomb doses. Each subject's reported fluoroscopy, photofluorography and radiation therapy exposure elsewhere are for future reference. Dental radiography, though increasing, was not currently an important contributor to survivors' overall exposure. Radiation therapy exposures of 137 subjects were confirmed, and doses estimated for most. Two-thirds the treatments were for malignancies; therapy differed markedly by city; and five cancers possibly arose from earlier radiation therapy. This underscores the importance of considering diagnostic and therapeutic radiology when attributing diseases to the atomic bombs.

2521 DOSE ESTIMATION FROM RESIDUAL AND FALLOUT RADIOACTIVITY. I. AREAL SURVEYS.

Takeshita, K. (Radiation Effects Research Foundation, Hiroshima (Japan)). J. Radiat. Res.; 16: No. suppl., 24-31(Sep 1975).

External dose rates and cumulative doses for early entrants from areal surveys and simulated experiments are reviewed. The average cumulative doses to infinity at the hypocenters were 101 rad in Hiroshima and 32 rad in Nagasaki, with a variation of about 60 percent. Radioactive fallout areas nearly matched the "black rain" areas in Nagasaki and in Hiroshima. Radioactivity in the fallout areas was affected by radioactive decay and by the leaching and dissipation by rains. Considering these factors, the cumulative dose to infinity in the fallout area of Hiroshima was estimated to be 13 rad, excluding internal radiation doses from inhaled and ingested radionuclides. Attempts to estimate radiation dose from

internally deposited radionuclides are also described.

2522 CANCERS OTHER THAN LEUKEMIA. Beebe, G.W.; Kato, H. (Radiation Effects Research Foundation, Hiroshima (Japan)). J. Radiat. Res.; 16: No. suppl., 97-107(Sep 1975).

Cancers which are unlikely to appear among atomic bomb survivors in excess of natural incidence include skin cancer and bone cancer, as these appear to require for their initiation doses that are incompatible with life if administered on a whole body basis. Although chronic lymphocytic leukemia continues to provide an important exception, and for many sites of cancer there is not yet evidence that radiation has increased incidence above normal levels, the data on A-bomb survivors are otherwise consistent with the hypothesis that the carcinogenic effect of ionizing radiation is general, involving all tissues. Studies of cancer among A-bomb survivors are notably limited with respect to the influence of variables other than dose, age, sex, and time. It seems highly desirable that other risk factors be studied in conjunction with radiation dose and demographic variables in an effort to detect interactions that might provide clues as to the etiology of cancer and as to the mechanisms by which ionizing radiation produces cancer. Provisional estimates suggest that the absolute risk of cancer, in terms of excess cases per 10^6 person-year rads (T65 dose) are about 1.6 for leukemia, 1.2 for thyroid, 2.1 for breast and 2.0 for lung, when estimation is based on age-ATB groups that have demonstrated these effects.

2523 FUTURE RESEARCH. Beebe, G.W.; Hamilton, H.B. (Radiation Effects Research Foundation, Hiroshima (Japan)). J. Radiat. Res.; 16: No. suppl., 149-164(Sep 1975).

Much remains to be learned from continued monitoring of the medical experience of the Hiroshima and Nagasaki A-bomb survivors. Many effects are so small, or have such long latent periods, that there is not even now a complete catalogue of effects visible in this large population. There is as yet no evidence of a mutagenic effect, but biochemical and cytogenetic approaches now offer powerful tools for a final effort to derive information that may set limits on the size of the doubling dose for mutations in man. The list of specific neoplasms induced by the whole-body exposure to the A-bomb radiation remains incomplete, and the quantitative dose-response aspects of established carcinogenic effects remains to be worked out in relation to time, host factors, linear energy transfer (LET) characteristics of radiation, and risk factors other than radiation. The dose-response estimates must be made, where possible, in terms of tissue dose. If there is to be any definitive test of the hypothesis of radiation accelerated aging in man, it will doubtless come from observations on the A-bomb survivors. The experience of the A-bomb survivors can make no direct contribution to knowledge of dose rate, and is much too small to provide direct information in the region of low dose. Nevertheless, as better knowledge of mechanisms of radiation damage and repair accumulates from laboratory experimental programs, this unique human experience will be of increasing value to radiation biology. Continued monitoring of the health and medical experience of the A-bomb survivors will depend on the voluntary cooperation of the subjects and their families, and on the interest of the physicians in the community. Present indications are that the research would gain

from a closer association with medical care and health maintenance programs.

- 2524 HEALTH SURVEILLANCE STUDIES. Hamilton, H.B.; Brody, J.A. (Radiation Effects Research Foundation, Hiroshima (Japan)). J. Radiat. Res.; 16: No. suppl., 138-148 (Sep 1975).

The majority of studies of the A-bomb survivors in Hiroshima and Nagasaki are concerned with monitoring the populations for long-term after-effects of exposure to ionizing radiation. Nonetheless, the health surveillance programs in the two cities must also be concerned with investigation of diseases which, though not directly related to radiation exposure, are of importance to the individual's overall health. This paper describes some examples of these investigations. Laboratory determination of levels of various serum components provide normal base line values in a healthy ambulatory population. Cytogenetic investigations yield data about normal chromosome variation, basic for future environmental pollution monitoring. Blood group gene antigen distributions, prevalences of inherited serum and red cell protein variants, and the cytogenetic information provide comparative data for a projected study of the children of the exposed generation. In the course of these population surveys, a number of extremely rare (genetic) traits unrelated to radiation exposure, such as the hereditary lack of a tissue enzyme, an unusual blood type, mutant hemoglobins, have been discovered. These traits appear to have little or no impact on the individual's health, but are of potential intrinsic interest to clinicians, geneticists, and molecular biologists.

- 2525 GENETIC EFFECTS, 2. CYTOGENETIC STUDY. Awa, A.A. (Radiation Effects Research Foundation, Hiroshima (Japan)). J. Radiat. Res.; 16: No. suppl., 75-81 (Sep 1975).

Chromosomes of the children of A-bomb survivors and appropriate control groups in Hiroshima and Nagasaki have been investigated to see if there are any genetic effects of A-bomb irradiation on the germ cell chromosomes of their parents. Data thus obtained have been compared with those derived from surveys on consecutive live-born infants undertaken by investigators in western countries, as well as those from induced abortuses in Japan, in terms of the frequency of individuals with both sex chromosome aneuploidy and autosomal balanced structural rearrangements. A preliminary statistical analysis shows no significant difference in frequency of chromosome anomalies in children born to the exposed compared with children of non-exposed parents, or with neonates or abortuses. The need for continuing this survey is clearly indicated.

- 2526 CLINICAL EXPERIENCE WITH SOLCOSERYL JELLY FOR ULCERATIVE SKIN DISEASES. FOR RADIATION INJURY OF SKIN, SCALDING ULCER, CRURAL ULCER, AND BEDSORE. Kamihata, S.; Tani, M. (Kobe Univ. (Japan). School of Medicine); Doi, A.; Nakamura, T.; Sakata, A. Kiso To Rinsho; 9: No. 10, 2480-2492 (Sep 1975). (In Japanese).

The clinical effect of solcoseryl jelly was examined on 20 cases of radiation injury of skin, 28 cases of scalding ulcer, 27 cases of crural ulcer, and 27 cases of bedsore, a total of 102 cases. In observation periods of less than 8 weeks, the drug was effective or remarkably effective for 16 cases, 23 cases, 21 cases, and 15 cases, respectively. No side effect was observed other than algogenic stimulation in 2 cases. Based on the above

results, solcoseryl jelly is thought to compare favorably with other topical drugs for the treatment of ulcers.

- 2527 PHYSICAL DOSE ESTIMATES FOR A-BOMB SURVIVORS. STUDIES AT OAK RIDGE, U.S.A. Auxier, J.A. (Oak Ridge National Lab., Tenn. (USA)). J. Radiat. Res.; 16: No. suppl., 1-11 (Sep 1975).

The radiation exposures for the survivors of the nuclear bombings of Hiroshima and Nagasaki have been determined in the course of studies conducted since the mid-1950's at the Oak Ridge National Laboratory. An extensive series of experiments in Japan, at weapons tests, and in the laboratory were supported by a comprehensive calculational effort to produce the "air dose" distributions and the shielding factors. The absorbed doses to tissues of the body have been calculated for the case of homogeneous tissue cylinders, and studies of dose distribution in heterogeneous, anthropomorphic configurations are under way. Because the device detonated over Hiroshima was never test fired before or after the bombing, the greatest difficulties were associated with the normalization of the radiation yield of this device. However, after several years of study, the "air dose" curves were obtained to an accuracy of $\pm 15\%$ for Hiroshima and $\pm 10\%$ for Nagasaki. Subsequently, the shielding factors for typical dwellings in both cities were determined to a comparable accuracy. Continuing work is focused on obtaining shielding factors for the heavily shielded survivors, the doses to survivors who are now located in the United States, and more comprehensive depth dose distributions.

- 2528 MECHANISM OF RELATIVELY LOW RADIATION DOSES EFFECTS ON THE COMPARTMENTALIZATION OF AMINO ACIDS IN THE CENTRAL NERVOUS SYSTEM. Dovgalevich, I.I. (Simferopol'skij Gosudarstvennyj Univ. (Ukrainian SSR); Belorusskij Gosudarstvennyj Univ., Minsk). Radiobiologiya; 15: No. 5, 750-754 (Sep 1975). (In Russian).

For English translation see the journal Radiobiology.

Action of relatively low (40 rad) radiation doses on the compartmentalization of amino acids in the exposed organism has been studied. It has been found that the compartmentalization of free, bound and of a total pool of amino acids in various parts of the central nervous system depends on the kind of the penetrating radiation and on the functional state of certain elements and integrating systems of the organism. The conclusion is drawn that the compartmentalization of amino acids in the irradiated organism is stipulated by both the specific and non-specific components.

- 2529 METABOLISM OF TISSUES OF THE INTESTINAL EPITHELIUM AS A POSSIBLE INDICATION OF RADIATION DAMAGE TO THE ORGANISM. Puchkova, S.M.; Goloshchapova, Zh.A. Radiobiologiya; 15: No. 5, 760-762 (Sep 1975). (In Russian).

For English translation see the journal Radiobiology.

The mitotic index (MI) and the ability of the small intestine mucosa to incorporate alanine- ^3H have been studied in mice exposed to acute doses of γ rays and treated with mercamine. Preventive treatment with mercamine helps to maintain the stable level of the mitotic index within first 24 min after the exposure and considerably increases it after 3 to 7 days. Variations in the time at which radiation damage to the protein synthesis manifests itself and changes in the MI of the

intestinal epithelium cells are discussed.

30 CHANGES IN THE QUANTITY OF THE COLONY-FORMING CELLS OF THE BONE MARROW IN MICE IN THE PROCESS OF IRRADIATION WITH DIFFERENT DOSE RATES. Shvets, V.N.; Gorlov, V.G. Radiobiologiya; 15: No. 5, 675-679(Sep 1975). (In Russian).

For English translation see the journal Radiobiology.

A protracted total-body irradiation of mice with a low dose rate (0.5 to 10 R/d) does not cause any considerable changes in the quantity of CFU and nucleus-containing cells of the bone marrow. A radiobiological effect at varying dose rates (300 R/min to 0.5 R/d) is a function of a cumulative dose and its dose rate. A graphical representation of this dependency has enabled us to determine, by means of extrapolation the value of the threshold dose rate for various cumulative radiation doses. A linear relationship has been found between the threshold dose rate and a cumulative dose of radiation.

2531 RADIOPROTECTION OF THE DIGESTIVE TRACT BY INTRAVENOUS INFUSION OF VASOPRESSIN. Juillard, G.J.F.; Peter, H.H.; Weisenburger, T.H.; Tesler, A.S.; Langdon, E.A.; Barenfus, M.; Lagasse, L.D.; Watring, W.E.; Smith, M.L. (Univ. of California, Los Angeles). Gynecol. Oncol.; 3: No. 3, 233-243(Sep 1975).

The effect of venous infusions of vasopressin during fractionated abdominal radiation exposures was evaluated in four pairs of dogs. In each pair, the control dog was given venous infusion of saline during irradiation. The results were analyzed from clinical observation, autopsy findings, and pathological examination. It appears that venous infusion of vasopressin has a definite and reproducible effect of radioprotection on the gastrointestinal tract, the dose modifying factor (DMF) being 1.5. Radiation therapy of the gynecologic malignancies would be one major application since the radiosensitivity of the intestinal tract is often a limiting factor in delivering high doses to the tumor, and further investigations are being done to study the effects of vasopressin on the radiosensitivity of malignant tumors.

2532 (ORP/CSD--75-4) PRELIMINARY FINDINGS RADON DAUGHTER LEVELS IN STRUCTURES CONSTRUCTED ON RECLAIMED FLORIDA PHOSPHATE LAND. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). Sep 1975. 38p. Environmental Protection Agency, Washington, DC.

Preliminary results are reported from a survey of the radon daughter levels in structures in Polk County, Florida, built on reclaimed phosphate tailings containing various amounts of ^{226}Ra . The structures surveyed consisted primarily of private dwellings although a few office buildings were also surveyed. Track-etch films and TLD air samplers were used to measure the levels of radon daughters within the structures and in structures built on non-phosphate land. Radiation levels were converted to WL units (the working level (WL) unit is defined as the potential α energy from the short-lived daughters of Rn which will produce 1.3×10^5 MeV in one liter of air). The highest observed level in any structure was 0.2 WL. Possible health hazards to long-time occupants are discussed. (CH)

IN HUMAN PLACENTA. Makarova, V.P.; Piskunov, L.I.; Treiger, S.I. Radiobiologiya; 15: No. 5, 778-780(Sep 1975). (In Russian).

For English translation see the journal Radiobiology.

Average concentration of Ca, ^{90}Sr and ^{137}Cs in human placenta was measured in one of the towns of the North Urals in 1971. It was 3.2 ± 0.1 mg/g, 5.6 ± 0.4 and 15 ± 1 pcurie/kg, respectively (normal birth). The possibility of using these data to estimate the uptake of ^{90}Sr and ^{137}Cs by the embryovia placenta is discussed.

2534 PROBABILITY DISTRIBUTION OF DOSE RATES IN THE BODY TISSUE AS A FUNCTION OF THE RHYTHM OF ^{90}Sr ADMINISTRATION AND THE AGE OF ANIMALS. Rasin, I.M.; Sarapul'tsev, I.A. Radiobiologiya; 15: No. 5, 691-694(Sep 1975). (In Russian).

For English translation see the journal Radiobiology.

The probability distribution of tissue radiation doses in the skeleton were studied in experiments on swines and dogs. When introducing Sr-90 into the organism from the day of birth till 90 days dose rate probability distribution is characterized by one, or, for adult animals, by two independent aggregates. Each of these aggregates correspond to the normal distribution law.

2535 DEVICE FOR PROTECTING THE GONADS IN X-RAY DIAGNOSTICS. Gaede, E.A. German(FRG) Patent 2,406,717/A/. 21 Aug 1975. 13p. (In German).

7 figs..

Device for protecting the gonads in X-ray diagnostics, for application in X-ray diagnostics instruments with a scattered-rays diaphragm which are equipped with a sight vane for recording the object field of the X-rays, with a shadow generator movably connected to a bearing device attachable to the scattered-rays diaphragm and consisting of a carrier of light- and X-ray-transparent material and of a disk of light- and X-ray-non-transparent substance.

2536 SEPARATION OF ^{85}Kr FROM THE OFF-GASES OF REPROCESSING PLANTS. IRS Kurz-Inf., Reihe C; 30: No. 15, 1(Aug 1975). (In German).

The aspect of keeping the radiation exposure to the population as small as possible, the following is recommended: 1) skin dose of maximum 10 mrem/a, global exposure maximum 10^6 Ci/a; 2) decontamination factor of ≥ 100 ; 3) storage of separated ^{85}Kr in pressure gas bottles, sinking in deep sea; 4) test-sinking in agreement with international panel.

2537 (KFK-EXT--20/75-1) MONITORING FOR ENVIRONMENTAL RADIOACTIVITY AT THE KARLSRUHE NUCLEAR RESEARCH CENTER IN 1974. Winter, M.; Tachlinski, W. (Kernforschungszentrum Karlsruhe (Germany, F.R.G.). Abt. Strahlenschutz und Sicherheit). Aug 1975. 50p. (In German). INIS.

With figs. and tabs..

Monitoring for environmental radioactivity at the Karlsruhe Nuclear Research Center is the responsibility of the Radiation Protection Department. A description is given of the routine environmental monitoring program as approved by the competent supervising authority of the state of Baden-Wuerttemberg. The letterpress of this report (extract from KFK Report No. 2155) is a summarizing representation of measured results obtained in 1974. Moreover, it includes a survey of special monitoring steps and of results of background

measurements performed for two nuclear power stations presently under construction. The comprehensive data section of the report contains a list of all individual measurement results of the routine measurement program. The measurement values prove that in 1974 the operation of the nuclear facilities of the Center caused at no time an inadmissible radiation burden on the population living in the vicinity.

- 2538 (DEU--76-1) NATURAL RADIONUCLIDES IN PHOSPHATE FERTILIZERS AND THEIR CONTRIBUTION TO THE EXTERNAL POPULATION EXPOSURE IN THE FRG. Pauly, H.; Pfister, H.; Philipp, G. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Radiologie). Aug 1975. 44p. (In German). INIS.

4 figs.; 8 tabs.; 35 refs. Available from ZAED.

The activity concentrations determined of ^{226}Ra , ^{232}Th and ^{40}K in nCi/kg P_2O_5 for the five most important kinds of fertilizer as well as their percent share in the economy year 1973/74 in the FRG are compiled in a table. From these values, the consumption of 0.917 million tons P_2O_5 and from an average annual fertilizer coverage of 68.3 kg/ha one can calculate a distribution of 32 Ci ^{226}Ra , 1Ci ^{232}Th and 543 Ci ^{40}K over the total agriculturally used area, in other words, a deposit of 2.4 μCi ^{226}Ra , 0.07 μCi ^{232}Th and 40.5 μCi ^{40}K per ha. Taking a pessimistic view, an external radiation exposure of 0.11 mrad/a was calculated for gonads and bone marrow. If the total accumulation of ^{226}Ra (38% of the radiation exposure) from phosphate fertilizers from the ground during the last 80 years is assumed, then there is a exposure of 1.7 mrad/a for individual members of the population and 2.0 mrad/a for those in occupied in agriculture.

- 2539 RADIATION EXPOSURE OF THE DENTIST. Regulla, D.F.; Wachsmann, F. (Institut fuer Strahlenschutz, Munich). Dtsch. Zahnarztzt. Z.; 30: No. 8, 552-554(Aug 1975). (In German).

The radiation doses per person undergoing dental treatment measured at the trunk is rather considerable, though not alarming. However, the number of people whose hands had been exposed to radiation as well as the individual extent of exposure were unexpectedly high. The radiation doses measured at the hands was about 100 times bigger than the radiation doses determined at the trunk for the whole body. Although these results may be very impressive, it should be borne in mind that the data on which the investigation was based date from 1967/68 and may no longer be fully applicable to the present situation. Whether and to what extent this assumption is justified ought to be found out by control studies regarding radiation doses per person and Roepak programs which are presently being started and whose results will be discussed in this journal.

- 2540 FREQUENCY OF MARRIAGE AND LIVE BIRTH AMONG SURVIVORS PRENATALLY EXPOSED TO THE ATOMIC BOMB. Biot, W.J. (National Cancer Inst., Bethesda, MD); Shimizu, Y.; Kato, H.; Miller, R.W. Am. J. Epidemiol.; 102: No. 2, 128-136(Aug 1975).

Frequency of marriage and birth as of January 1973 was determined for persons exposed in utero to the atomic bombs in 1945 and for controls. The marriage rate was lower in persons heavily exposed in utero than in the non-exposed or lightly exposed. This difference is attributed partly to the lesser

marriageability of persons with mental retardation who are significantly more numerous among the heavily exposed, and partly to unmeasured variables, possibly including social discrimination against survivors of the atomic bomb. No consistent relation was observed between radiation exposure and three reproductive indices: childless marriages, number of births, and interval between marriage and first birth.

- 2541 ESTIMATION OF THE PATIENT EXPOSURE IN TOMOGRAPHY. Maekoshi, H.; Orito, T.; Nishizawa, K. (Nagoya Univ. (Japan). Faculty of Medicine); Koga, S. Danso Satsueiho Kenkyukai Zasshi.; 3: No. 1, 48-50(Aug 1975). (In Japanese).

The author evaluated the estimation method of radiation dose according to surface and intracorporeal dose distribution in chest-tomography. In the study with phantom it was found that the maximum dose area of the skin surface became small and variation of dose in the surrounding area was sharp in proportion to the depth of the cross section. Therefore the author considers that the skin surface dose in tomography should be represented by the highest skin surface dose. In the intracorporeal distribution, the circular tomography undertaken at 10 cm deep from the surface indicated a larger equivalent dose area and higher yielding rate than those in curvilinear tomography. When the phantom filled with water and the one filled with lung equivalent material, cork, were compared; the radiation dose around the radiation field in the phantom with cork was 2-2.5 times the other in circular tomography. However, if the distance from the radiation field became as far as 40 cm, the cork of phantom made little difference. If the radiation dose on the cross section is estimated as 100% in drawing the intracorporeal dose distribution, the results change depending on lung equivalent material. Therefore the author considers that the highest skin dose will be more universal to be taken as the standard.

- 2542 RADIATION DOSE OF GONAD BY TOMOGRAPHY OF THE GALLBLADDER. Yamamoto, S.; Matsumoto, S.; Ishii, M.; Nakai, T. (Nissei Hospital, Osaka (Japan). Dept. of Radiology). Danso Satsueiho Kenkyukai Zasshi.; 3: No. 1, 44-47(Aug 1975). (In Japanese).

The author determined radiation dose of the gallbladder during hypocycloidal tomography. The skin surface dose at the center of the focus was determined in males and females totaling 14, and the gonad dose was also determined in 9 females. The skin surface dose at the center of the focus was in the range of 1150-2300 mR using 100 mA, and 600-1100 mR with 50 mA. The radiation dose increased as the voltage used for tomography increased, and the increasing rate was greater with 100 mA than with 50 mA. Female gonad dose decreased as the exposure voltage increased in prone position and also in VLAQ. The bilateral gonad doses calculated according to the theory of Hyuga were 0.5-9 mR and 0.4-6.5 mR in the prone position, and 3-16 mR and 1.5-30 mR in VLAQ.

- 2543 ESTIMATION OF RADIATION RISK IN OPERATIONS FOR REMOVAL OF LUMINOUS PAINTS. Dyachok, V.K.; Rymarchuk, A.A. Voenno-Med. Zh.; No. 8, 51-53(Aug 1975). (In Russian).

A sanitary-hygienic examination was made on several parts of the body during removal of luminous paint from equipment dials. The exposure dose rate to the facing surface of the body and the degree of irradiation of the foot,

leg, wrist, and forearm were determined. Gamma and beta radiation doses to different parts of the body were calculated. It was shown that removal of luminous paint may be classified as class III work with regard to radiation hazard. The controlling radiation is gamma radiation. It is suggested that constant hygienic supervision by experts and definite work conditions must be provided during removal of luminous paint.

- 2544 OBSERVATIONS ON A SET OF RADIATION-INDUCED DOMINANT T-LIKE MUTATIONS IN THE MOUSE. Bennett, D. (Cornell Univ., New York (USA). Medical Coll.); Dunn, L.C.; Spiegelman, M.; Artzt, K.; Cookingham, J.; Schermerhorn, E. Genet. Res.; 26: No. 1, 95-108 (Aug 1975).

Genetic analysis of seven dominant short tailed mutations independently induced by radiation of male mice showed that six were allelic to T (Brachyury) but not identical to it. Homozygotes for each mutant die at least 2 days earlier than T/T homozygotes; two that were studied histologically are indistinguishable from one another. The development of these abnormal embryos is arrested by seven days of gestation, when cells of embryonic ectoderm cease proliferation and become pycnotic. Endoderm and extra-embryonic ectoderm do not seem to be primarily affected, and survive and grow for at least 2 days more. Serological studies of one of these mutations suggest that it is a deletion. A review is presented of these and other T-like mutations that have been described; from this it appears that five different categories of T-like mutants are discernible.

- 2545 (ORP/CSD--75-3) RADIOACTIVITY DISTRIBUTION IN PHOSPHATE PRODUCTS, BY-PRODUCTS, EFFLUENTS, AND WASTES. Guimond, R.J.; Windham, S.T. (Environmental Protection Agency, Washington, D.C. (USA). Office of Radiation Programs). Aug 1975. 39p. Environmental Protection Agency, Washington, DC.

Phosphate rock throughout the world contains uranium in concentrations ranging from a few ppm to a few hundred ppm. In the United States, phosphate rock normally contains between 100 to 150 ppm uranium. Mining and processing of these ores redistributes much of the uranium daughters among the various products, by-products, and wastes. These materials are then widely dispersed throughout the environment. This redistribution may lead to increased exposure of the public to these naturally-occurring radionuclides. In determining the magnitude of the population exposure caused by this redistribution and in developing environmental standards and controls to prevent contamination of the biosphere from these naturally-occurring radionuclides it is necessary to determine the concentrations and total quantities of these radionuclides in the products, by-products, effluents and wastes of phosphate mining and manufacturing. Samples of phosphate ores, products, by-products, effluents, and wastes were obtained and analyzed for their radioactivity content. Quantities of radioactivity entering the environment through various products, by-products, effluents, and wastes were estimated.

- 2546 BIOLOGICAL EFFECTS OF TRITIUM. Akita, Y. (Ibaraki Univ., Mito (Japan)). Genshiryoku Kogyo; 21: No. 8, 14-17 (Aug 1975). (In Japanese).

The uptake of tritium (^3H) in an organism, especially man, was discussed. The distribution in the body, evacuation, biological half life,

dosage of ^3H in the body, and relative biological effectiveness were also discussed. The biological actions of ^3H , such as the cutting of DNA polynucleotide chains, the fatal effect on cells and the induction of mutation, were summarized. (Tsukamoto, Y.).

- 2547 (DOCKET-50213--480) HADDAM NECK PLANT. REPORTABLE OCCURRENCE REPORT: APPARENT EXPOSURE OF AN EMPLOYEE TO RADIATION IN EXCESS OF THE LIMIT. (Connecticut Yankee Atomic Power Co., Hartford (USA)). 15 Jul 1975. 2p.

Exposure of employee to radiation in excess of limit. CONNECTICUT YANKEE REACTOR; PERSONNEL; RADIATION DOSES

- 2548 NORMAL TISSUE RESPONSES TO RADIATION THERAPY. Bloomer, W.D.; Hellman, S. New Engl. J. Med.; 293: No. 2, 80-83 (10 Jul 1975).

Therapeutic strategy is discussed with regard to risk-benefit considerations and theoretical curves describing the probability of tumor control and the risk of developing major complications in relation to radiation dose are presented. Acute effects are discussed with regard to dose rate and time-dose fractionation characteristics; cellular radiation lethality; acute effects on bone marrow, skin, intestinal epithelium, respiratory epithelium, and bladder; and treatment of acute mucosal and epithelial reactions. Intermediate effects are discussed with regard to time-dose fractionation characteristics; radiation pneumonitis; radioinduced heart disease; and radioinduced paresthesia in extremities. Late effects are discussed in relation to the total effective dose received by the limiting normal tissue within a treatment portal. (HLW)

- 2549 (DOCKET-50293--592) PILGRIM NUCLEAR POWER STATION, UNIT 1. REPORTABLE OCCURRENCE REPORT: TWO INDIVIDUALS WERE EXPOSED TO RADIATION IN EXCESS OF SPECIFIED LIMITS. (Boston Edison Co., Mass. (USA)). 2 Jul 1975. 3p.

Two individuals were exposed to radiation in excess of specified limits. PILGRIM-1 REACTOR; PERSONNEL; RADIATION DOSES; RADIOACTIVE WASTE FACILITIES; CLEANING; RADIOACTIVE WASTE PROCESSING

- 2550 REPORT OF EXPERT COMMITTEE ON ACCIDENT COMPENSATION FOR THE WORKERS OF ATOMIC INDUSTRY. Genshiryoku Iinkai Geppo; 20: No. 7, 4-7 (Jul 1975). (In Japanese).

This report was prepared by the expert committee on this subject and was submitted to the chairman of the Japan Atomic Energy Commission. It is based on the previous report (1965) and discusses specific problems which require urgent solution. Present status, problems, and countermeasures are described for three fundamental areas of radiation accident compensation. The first area is the recognition of the cause and effect relation between accidents and diseases. Some recommendations are given for the role of the auxiliary organization for the recognition and approval of the relation. The second area is the problem of keeping the record of the radiation exposure dosage for individual workers. The necessity of establishing a national record-keeping system is recommended. The third area is the compensation system. The relation with the ordinary labor accident insurance is discussed.

- 2551 (HRP--0005527) ENVIRONMENTAL HEALTH

AND HEALTH PLANNING. (Western Massachusetts Health Planning Council, Inc., West Springfield (USA). Environmental Health Task Force). Jul 1975. 90p. NTIS \$5.00.

Areas of environmental concern are identified and recommendations for improving environmental health are proposed by the Environmental Health Task Force of the Western Massachusetts Health Planning Council. Environmental health concerns in Western Massachusetts are in the areas of: air pollution; dental health and the specific problem of water fluoridation; housing; injury control, including accidental death and disability; land use, and the specific problem of critical receptors; noise pollution; occupational hazards, specifically occupational accidents; pesticides; radiological exposure, particularly medical X-ray exposure and nuclear exposure; rural health care; sanitation; solid waste; and water quality including private and public water supplies, road salting, and rural sewerages. Each area of concern and specific problem are broken down into sections: background information; comments which incorporate recommendations for general problem-solving activities; and resources, including lists of key organization, individuals, laws and regulations, and publications relevant to the area of concern. Recommendations are presented based on long-term and short-term environmental goals. An inventory of environmental health organizations in Western Massachusetts is included. Appendices contain the charge to the Task Force, a definition of environmental health, sources of drinking water, the sanitation and sanitary codes, and housing and sanitation standards. Portions of this document are not fully legible. (GRA)

2552 EFFECT OF IRRADIATION ON THE PHOSPHORYLATION OF THE NUCLEAR PROTEINS OF THE LIVER AND THYMUS OF RATS. Umanski, S.R.; Zotova, R.N.; Tokarskaya, V.I. (AN SSSR, Pushchino-na-Oke. Inst. Biologicheskoy Fiziki). Radiobiologiya; 15: No. 4, 526-530(Jul 1975). (In Russian).

For English translation see the journal Radiobiology.

The exposure of the nuclei and chromatin of the rat liver and thymus in vitro to small doses (1 to 5 krad) stimulates, and to high doses (10 to 20 krad) inhibits the protein phosphorylation. Dephosphorylation is only inhibited when thymus nuclei are irradiated. Phosphorylation of the nuclear proteins of the liver and thymus is increased by 37% and 15%, respectively, 15 minutes after the exposure in vivo to a dose of 1 krad. Phosphorylation of histones is most- and of the nuclear sap proteins, least enhanced. A 10-per cent increase in the phosphorylation of the liver nuclei, and a 23-per cent decrease in that of the thymus nuclei, as compared to the controls, are observed two hours after the exposure. A possible relationship between radiation impairment of the nuclear protein phosphorylation and of the RNA synthesis is discussed.

2553 EFFECT OF STORAGE AND CULINARY TREATMENT OF IRRADIATED POTATO ON THE CYTOGENETIC ACTIVITY OF EXTRACTS OBTAINED THEREFROM. Osipova, I.N.; Shillinger, Yu.I.; Zaitsev, A.N. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Pitaniya). Vopr. Pitan.; No. 4, 54-57(Jul 1975). (In Russian).

Male-rats (25-27 g) were given perorally extracts separated from potato subjected to gamma-radiation in a dose of 10krad (test groups) and from non-irradiated tubers (controls). The extracts were introduced for a

period of one week, daily in an amount of 1 ml. The males from the test groups (each numbering 8-10 animals) received extracts of the raw potato stored for 4 months after irradiation and of the potato subjected to thermal treatment (cooking) after 1 day, 1 and 4 months of its storage. The frequency of chromosomal aberrations in the bone marrow cells was determined by the anaphase method. Altogether about 34000 cells (500-600 from each animal) were counted. The results testified to a significantly reduced frequency of chromosomal aberrations (bridges and fragments) occurring in the bone marrow cells of the mice which received extracts from the raw stored irradiated potato and from thermally treated freshly irradiated tubers, as compared to extracts obtained from the raw freshly irradiated potatoes. The extracts of irradiated potato cooked after 1 and 4 month of storage did not display any mutagenic properties.

2554 (PB--246642) PUBLIC HEALTH IMPLICATIONS OF RADIOLUMINOUS MATERIALS. Moghissi, A.A.; Carter, M.W. (Georgia Inst. of Tech., Atlanta (USA). Office of Interdisciplinary Programs). Jul 1975. Contract FDA-233-74-6091. 54p. NTIS \$4.50.

The safety, efficacy, and relative merits of radium, tritium, and promethium in radioluminous materials, particularly as used in the dial paint of timepieces and instruments, were evaluated. The reduced use of radium in recent years is reflected in estimates of the population dose for 1973--3600 person-rem from 24 million tritium watches versus 2500 person-rem from 8.4 million radium clocks. Had radium still been used in watches, the dose could have been significantly higher. No reliable data are available on the activity of promethium used for this purpose. Assuming a minimum dose of 6100 person-rem from all these radionuclides, an average of 0.03 mrem/year is estimated for the U.S. population. Because of the unavoidable radiation hazard, it is recommended that radium no longer be used in radioluminous materials. Furthermore, the 'frivolous' use of other radionuclides for this purpose should be discouraged. (GRA)

2555 (PB--246674) NASHVILLE DENTAL PROJECT: AN EDUCATIONAL APPROACH FOR VOLUNTARY IMPROVEMENT OF RADIOGRAPHIC PRACTICE. TECHNICAL REPORT. Crabtree, C.L.; Johnson, O.N.; Gibbs, S.J. Jul 1975. 65p. (DHEW/FDA--77-8011). NTIS \$4.50.

Survey data were collected on 110 x-ray units (72 dental offices) in Nashville, Tennessee in 1972. Dental consultants visited the offices two months later to present the survey findings and demonstrate needed improvements in radiographic practice. In 1973, a followup survey was conducted to determine the effectiveness of the consultation visits. Mean exposure per film was 542 mR in 1972 and 340 mR in 1973. Machines with large workloads generally had the lowest skin exposure per film. When weighted by workload, average exposures were 472 mR/film in 1972 and 311 mR/film in 1973. Thus, the study indicated the effectiveness of an educational approach to reducing unnecessary radiation. (GRA)

2556 (PB--246837) SUGGESTED OPTIMUM SURVEY PROCEDURES FOR DIAGNOSTIC X-RAY EQUIPMENT. (Nationwide Evaluation of X-Ray Trends Task Force (USA)). Jul 1975. 113p. NTIS \$5.50.

The manual contains survey procedures to test medical and dental x-ray machines for radiation safety in general and specifically for CSG regulations (Council of State

Governments). (GRA)

7 RADIATION BURDEN TO HANDS OF NUCLEAR MEDICINE PERSONNEL. Kukacka, R. (Krajska Hygienicka Stanice, Ostrava (Czechoslovakia)); Husak, V.; Charamza, O. (Palackeho Universita, Olomouc (Czechoslovakia). Fakulni Nemocnice); Trousil, J. (Ustav pro Vyzkum, Vyrobu a Využití Radioisotopu, Prague (Czechoslovakia)). *Cesk. Radiol.*; 29: No. 4, 260-265 (Jul 1975). (In Czech).

Radiation burden is discussed imposed to the hands of nuclear medicine personnel handling ^{99}Mo -sup($^{99\text{m}}\text{Tc}$) generators, imported from the GDR and Great Britain. The results are compared with available foreign data. Routine monitoring of the hands of nuclear medicine personnel is recommended. Suitable types of dosimeters for such measurements are briefly discussed. The need is stressed of better care paid in periodic preventive examinations to the finger skin of those personnel, whose hands come in contact with radiopharmaceuticals during production or application.

2558 IRRADIATION HAZARDS AND SAFETY STANDARDS FOR PATIENTS IN DENTAL RADIOGRAPHY. Williamson, B.D.P. *N.Z. Dent. J.*; 71: No. 325, 129-135 (Jul 1975).

The historical developments which have led to a reduction in the hazards or potential hazards to patients in dental radiography are reviewed. Based on a simple risk estimate, the safety of present-day techniques employed in routine dental radiography is assessed. Also included in the review is a description of techniques used and results obtained from the National Radiation Laboratory's (NRL) surveillance programme of patients' exposure to irradiation in dental radiography. The possibilities of and need for achieving further reductions of irradiation are discussed.

2559 STUDY OF SOME IMMUNOLOGICAL INDICATORS IN TIN-TUNGSTEN ORE MINERS ALSO EXPOSED TO RADON. Richter, J.; Landa, K.; Cizek, P. (Krajska Hygienicka Stanice, Usti Nad Labem (Czechoslovakia)). *Prac. Lek.*; 27: No. 6, 201-204 (Jul 1975). (In Czech).

The Ig G, Ig A, Ig M and Ig D immunoglobulin values and the lysozyme values were ascertained in 75 tin-tungsten ore miners who were also exposed to radon and in a control group of 32 coal miners. The mean values did not differ between the groups, but in the tin-tungsten ore miners the Ig G and Ig M values were 37.3% and 17.33% outside normal values. The lysozyme values were higher in the ore miners whereas in the control group the findings were within standard.

2560 SERVICE FACTOR CALCULATED FROM AN EXPERIMENTAL SIMULATION OF CHRONIC OCCUPATIONAL IRRADIATION. Berikashvili, V.S. *Radiobiologiya*; 15: No. 4, 577-582 (Jul 1975). (In Russian).

A correlation has been studied between the body weight, basal metabolism, lifespan, the period of water exchange, average life of erythrocytes and average rate of pulse-beat, and values $\text{LD}_{50/30-60}$, half-recovery period after irradiation and time of leucopenia occurrence in different species of laboratory animals and man. An authentic degree-interrelation of these indices has been revealed, and the dependency of radiobiological effects on the body weight of animals has been estimated. Similarity conditions of dose accumulation upon chronic irradiation of animals and man have been obtained on the basis

of Blair's and Davidson's equations for an effective dose of a single exposure. Service factor and coefficients of intensity and duration of irradiation of various animals have been calculated, simulating professional irradiation with 5 rad/a within 20 years.

2561 RADIOSENSITIZING EFFECT OF INTRALESIONAL ADMINISTRATIONS OF BUDR. Usui, S.; Todoroki, T. (Chiba Univ. (Japan). School of Medicine); Koike, S.; Ando, K.; Nesumi, N. *Nippon Igaku Hoshasen Gakkai Zasshi*; 35: No. 7, 580-582 (Jul 1975). (In Japanese).

The effect of intralesional injections of BUDR (5-Bromodeoxy-uridine) to enhance the response of tumor cells to ionizing radiation was studied. Experimental animal tumors were third generation isotransplants of a mammary carcinoma that had arisen spontaneously in a C3H female mouse. The TRT_{50} or 50% tumor regrowth time was determined for tumors that received X-ray alone and those treated with X-rays and BUDR. DMF (dose modifying factor) was 1.29 or 1.26 if the tumors were irradiated under air or hypoxic condition respectively. These results indicated that the agent was capable of sensitizing tumor cells which were acutely or chronically hypoxic.

2562 EFFECT OF PROLONGED IRRADIATION WITH LOW DOSES ON THE BRAIN OF RAT EMBRYOS. Semagin, V.N. (AN SSSR, Moscow. Inst. Vysshej Nervnoj Deyatel'nosti i Neirofizologii). *Radiobiologiya*; 15: No. 4, 583-588 (Jul 1975). (In Russian).

For English translation see the journal *Radiobiology*.

Pregnant rats (the last third of pregnancy) exposed to doses of 0.0008 to 10 R/d within 18 hours a day, showed a stimulated development of higher nervous system in the embryos.

2563 EFFECT OF INTERFERON ON THE UNSPECIFIC RADIORESISTANCE OF WHITE MICE TO X RAYS. Binyashevskii, E.V.; Ternovoi, N.K. (Kievskij Nauchno-Issledovatel'skij Inst. Ortopedii (Ukrainian SSR)). *Vrach. Delo*; No. 7, 138-141 (Jul 1975). (In Russian).

Intraperitoneal administration of the interferonogen, poly I:C, at 0.2 or 2.0 mg/kg to mice 2 hr or 1 day before exposure to x irradiation protected the animals as long as the dose of irradiation did not exceed 600 R. When poly I:C was also administered one every 4 days after irradiation, survival was increased to an even greater extent than when it was given only as a pretreatment.

2564 OCCURRENCE OF HEMANGIOSARCOMAS IN BEAGLES WITH INTERNALLY DEPOSITED RADIONUCLIDES. Benjamin, S.A.; Hahn, F.F.; Chiffelle, T.L.; Boecker, B.B.; Hobbs, C.H.; Jones, R.K.; McClellan, R.O.; Snipes, M.B. (Lovelace Foundation, Albuquerque, NM). *Cancer Res.*; 37: No. 7, 1745-1755 (Jul 1975).

In a series of related experiments to evaluate the relative toxicity of inhaled radionuclides, beagles were exposed to aerosols containing relatively soluble (chloride) or relatively insoluble (fused clay) forms of ^{144}Ce and ^{90}Sr . With the soluble $^{144}\text{CeCl}_3$, significant radiation doses were delivered in the lungs, liver, and skeleton whereas, after $^{90}\text{SrCl}_2$ exposure, the radiation dose was delivered predominantly to the skeleton. In dogs exposed to ^{144}Ce and ^{90}Sr in fused clay particles, radiation doses were delivered mostly to the lungs and tracheobronchial lymph nodes. In most dogs dying within 2 years after exposure, deaths were attributable to

nonneoplastic radiation-induced lesions in the target organ systems. At later times after exposure, neoplasms were the major cause of death, again occurring mostly in target organs or the adjacent tissues. Lung, liver, and bone-related neoplasms, including five hepatic hemangiosarcomas, developed after $^{144}\text{CeCl}_3$ exposure. Among the bone-related sarcomas seen in dogs exposed to $^{144}\text{CeCl}_3$ or $^{90}\text{SrCl}_2$, the incidence of hemangiosarcomas was over 40 percent. Among the 20 dogs dying with pulmonary neoplasms after exposure to ^{144}Ce or ^{90}Sr in fused clay particles, all had hemangiosarcomas and several also had other neoplasms. This high incidence of hemangiosarcomas has occurred within 7 years after exposure and differs from results in other laboratories where beagles have been exposed to both α - and β -emitting radionuclides. (auth)

- 2565 (SGAE--2475) DETERMINATIONS OF TRITIUM LEVELS IN URINE AND BLOOD SAMPLES, MEDICAL EXAMINATIONS OF PERSONS EMPLOYED AT RC SEIBERSDORF. Irlweck, K.; Teherani, D.K. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna). Jul 1975. 17p. (In German). (ST--47/75; BL--14575). INIS.

to be published in Health Physics.

Tritium determinations in urine and blood samples were performed with a liquid scintillation counter (Tri Carb No. 3375, PACKARD). In urine samples tritiated water (HTO) was measured after separation of organic substances by adsorption with activated charcoal and following distillation to dryness. In some urine and blood samples total Tritium content was determined by combustion in a sample Oxidizer (Mod. 306, PACKARD). Detection limits for HTO and total Tritium measurements were 2,5pCi/ml and 7 or 15pCi/ml respectively, taking 2sigma of statistical error of background values. Tritium concentrations in daily urine of occupational exposed persons, employed in RC Seibersdorf occurred up to 8pCi HTO/ml. An arithmetic mean was 3,85+-2,11pCi/ml from investigations on 16 persons. Tritium content in urine samples of occupational non exposed persons were about the same level up to 10pCi HTO/ml. An arithmetic mean was 3,70+-2,65pCi/ml from measurements on 20 persons. Statistical error of single values was sigmaequal to+-1,85pCi/ml. There was found no significantly higher concentration in urine of occupational exposed persons compared with a group of non exposed ones. Total Tritium content in urine samples seemed to be somewhat higher than HTO concentrations, also for occupational non exposed persons. Tritium levels in blood were notably higher than have to be expected assuming homogeneous distribution of HTO in body fluids. For occupational exposed persons in RC Seibersdorf Tritium concentrations between 26-58pCi/ml were found. An estimation about Tritium intake based on such results showed no more than 0,5% of maximum permissible intake for occupational exposed persons in the most unfavorable case.

- 2566 (N--75-25541) RADIATION SAFETY OF COSMONAUTS. Golovachev, V. 12 Jun 1975. Translated from Trud (USSR), 1 Feb 1975, p. 2. (NASA-TT-F--16323). 6p. NTIS \$3.25.
- Radiation monitoring in manned space flight is discussed with reference to the Salyut 4 and Soyuz 9 flights. Solar activity as the major source of dangerous radiation is explained and radiation dosages for the cosmonauts are reported. (GRA)

- 2567 WHAT PLANT ENGINEERS SHOULD KNOW ABOUT

RADIATION HAZARDS. Ulman, R. (VLN Corp, Cleveland, Ohio). Plant Eng. (Barrington, Ill.); 29: No. 12, 162-165(12 Jun 1975).

An introduction to radiation hazards and radiation monitoring devices alerts the plant engineer to the means and methods available for industrial radiation protection.

- 2568 (PB--253377) NUCLEAR MEDICINE ENVIRONMENTAL DISCHARGE MEASUREMENT. FINAL REPORT. Gesell, T.F.; Prichard, H.M.; Davis, E.M.; Pirtle, O.L.; DiPietro, W. (Texas Univ., Houston (USA). School of Public Health). Jun 1975. Contract EPA-1554-61-0407. 93p. NTIS \$5.00.

The discharge of most man-made radioactive materials to the environment is controlled by Federal, State or local regulatory agencies. Exceptions to this control include the radioactive wastes eliminated by individuals who have undergone diagnostic or therapeutic nuclear medicine procedures. The purpose of this study is to estimate the amount of radioactivity released to the environment via the nuclear medicine pathway for a single sewage drainage basin and to measure the amounts discharged to the environment. The report is organized into a review of previous studies, scope of work, facility data, environmental measurements and estimates of population exposure. (GRA)

- 2569 (INIS-mf--2010) NUCLEAR POWER: SHOULD WE HAVE DOUBTS: WHAT DO THE EXPERTS THINK. PROCEEDINGS OF LECTURES HELD AUTUMN 1974--SPRING 1975 IN OSLO, NORWAY. (Norsk Atomenergiforening, Oslo). Jun 1975. 332p. (In Norwegian). NTIS (US Sales Only).
- Separate entries were made for items of interest.

- 2570 (KFK--2262, pp 142-143) INVESTIGATION OF THE LONG-TERM RADIOLOGICAL ENVIRONMENTAL IMPACT CAUSED BY AN ACCUMULATION OF NUCLEAR FACILITIES. Bayer, A.; Kalckbrenner, R.; Schueckler, M. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Jun 1975. (In German). 1 fig.; 1 tab..

Semiannual report 1975/2.

After the incorporation of several additional atmospheric and hydrospheric transport effects the part of the computer program incorporating these effects is now nearly completed. The relevant input data like site characteristics, release rates, deposition velocities, etc. have been updated on the basis of recent reports and personal communications. Partial results of a few exposure pathways have already been obtained.

- 2571 (INIS-mf--2010, pp 1-25) ELECTRIC POWER - THE NUCLEAR OPTION. Rasmussen, N.C. Jun 1975.

Lectures, autumn 1974 - spring 1975.

Arguments are presented for regarding nuclear power as the safest, most economical and environmentally preferable source of electric power available today. The methodology of the safety evaluation performed in producing the 'Rasmussen Report' (WASH-1400) is explained. The risk of fatalities due to the operation of nuclear power plants is compared with those due to a number of other activities. The potential number of casualties is also stated not to be greater in the case of a reactor accident than for other kinds of catastrophe. The genetic and delayed radiation effects resulting from a major nuclear power plant accident would not be statistically

discernable. Although thyroid nodules would be a noticeable effect, these, provided medical care was available, would not be a serious problem. Experience has shown that nuclear plants can tolerate system failures. The questions of waste disposal and fissile materials diversion are also briefly discussed.

- 2572 MEASUREMENT OF CONTAMINATION BY RADIOISOTOPES FOR MEDICAL EXAMINATION AND TREATMENT IN MEDICAL ORGANIZATIONS. Hamada, M. (National Cancer Center, Tokyo (Japan)). Byoin; 34: No. 6, 84-87 (Jun 1975). (In Japanese).

For safety control of radioactive contamination by medical examination and treatment in medical organizations, establishment of a Health and Physics Department is desired. It is necessary to dispose of radiopharmaceuticals according to the classification of safety and to separate the use of non-sealed nuclides from the radiotherapy room. In relation to radioactive air pollution, attention should be paid to the sampling test of hood, management of ^{133}Xe using room, and air pollution in the disposal storage room and patient urine storage room. Concerning the disposal of liquid waste, it is most important to devise entirely different method of disposal according to the level differences in the amount of diagnostic use and the therapeutic dose. The method of use is most important also for the decision of the size of storage tank. For sampling and monitoring it is advisable to use up to the 10th rank nuclide for safety counting in consideration of physicochemical conditions.

- 2573 EFFECT OF RADIOIODINE ON SWINE SPERMATOGONIA. Krishna, M.; Ebenezer, D.N.; Reddy, P.P.; Reddi, O.S. (Osmania Univ., Hyderabad (India). Dept. of Genetics). J. Nucl. Agric. Biol.; 4: No. 2, 33-35 (Jun 1975). 22 refs..

Ten Yorkshire white boars were injected with a dose of 25 mCi of ^{131}I and were mated to normal females after ninety days to screen the effects on spermatogonia. The pregnant females were allowed to go to term and litter size, sex-ratio and body weights of F_1 offsprings were recorded. There was a significant reduction in the litter size at birth. Neo and postnatal mortalities of F_1 offsprings of treated male were also significantly high when compared to control. Hence further decrease in litter size at weaning was noted. The gonadal cell survival studies were also made in males injected with 25 mCi of ^{131}I . The cell counts of spermatogonia and resting primary spermatocytes were made on 3rd and 120th day after treatment. A high cell killing effect of radionuclide on germ cells on 3rd day was noted. Almost complete recovery was seen by 120th day. The results clearly indicate the genetic and cell killing effects on spermatogonia - the germ cells is of great importance from the point of view radiation hazards.

- 2574 (DHEW/FDA--75-8024 (Rev.)) GONAD SHIELDING IN DIAGNOSTIC RADIOLOGY. (California Univ., San Francisco (USA)). Jun 1975. Contract FDA 72-13. 24p. GPO.

The use of gonad shielding is an important radiation protection technique, intended to reduce unnecessary x-ray exposure of the gonads of patients from diagnostic x-ray procedures. This pamphlet will provide physicians and radiologic technologists with information which will aid their appropriate use of gonad shielding.

- 2575 (INIS-mf--2010, pp 40-46) NUCLEAR RADIATION AND ITS EFFECT ON MAN. Aamlid, H. Jun 1975. (In Norwegian).

From Nuclear power - should we have doubts - what do the experts think; Oslo, Norway (11 Feb 1975).

Lectures, autumn 1974 - spring 1975.

A brief presentation is made of the biological effects on man of nuclear radiation. The sources of such radiation, natural and artificial, are summarised. The philosophy on which the maximum permissible doses to various groups and to the population are based is briefly described. Tables are given illustrating the various aspects discussed.

- 2576 CURE OF CANCER AND RADIATION INJURY AS RESULTS OF RADIOTHERAPY. Umegaki, Yoichiro (National Inst. of Radiological Sciences, Chiba (Japan)). Gan No Rinsho; 21: No. 7, 576-584 (Jun 1975). (In Japanese).

Radiation injury is a limiting factor in radiation therapy for cancer. Results of radiotherapy in the National Cancer Center Hospital 1962-1968 were analyzed from this standpoint. The higher the survival rate was, the larger was the risk of radiation injuries, including late effects. In some places, however, in spite of a high survival rate a remarkable decrease in the incidence of injury was observed, as a result of improved treatment techniques. Injuries were classified into 4 types, acute, subacute, chronic and late. Fatal injuries were observed in all of the types, and the incident time showed a log normal distribution after treatment. Cure of cancer and incidence of radiation injury showed similar dose responses, suggesting that both are essentially the same phenomenon.

- 2577 THE FUNDAMENTALS OF RADIATION DAMAGE AND PROTECTION TO LIVING PROCESS. Mohindra, R.K. (Kurukshetra Univ. (India). Dept. of Physics). J. Phys. Educ.; 3: No. 1, 13-19 (Jun 1975).

A brief introduction to the sources and units of radiation handled or used by men in laboratories and reactors is given. The distribution of radionuclides which enter the human body due to various causes and their elimination is described. The mechanism of radiation damages such as: (i) immediate radiochemical effects (ii) biological effects (iii) the temporal stages of radiation action and (iv) genetic effects of radiation-mutation as well as the principle of radiation protection are explained. An account of the various meters used such as monitors, dosimeters, etc. is given. Important precautions to be taken while handling radioactive substances are enumerated.

- 2578 THYROID TUMOR RISK FROM RADIATION DURING CHILDHOOD. Silverman, C.; Hoffman, D.A. (Public Health Service, Rockville, MD). Prev. Med.; 4: No. 2, 100-105 (Jun 1975).

From Health Physics Society eighth midyear topical symposium; Knoxville, TN, USA (21 Oct 1974).

Estimated risks of thyroid tumor development following radiation during infancy and childhood are presented from seven followup studies. In most of the studies the thyroid absorbed doses are high but in two of them the doses associated with thyroid cancer and adenoma are of diagnostic interest. Estimates are presented of thyroid doses associated with several diagnostic procedures involving the head and neck region. The need for evaluation of radiopharmaceutical techniques in children to minimize radiation exposure necessary for

essential diagnostic information is suggested.
(auth)

- 2579 CASE REPORT OF RADIATION NECROSIS OF THE HIP. Gross, H.P.; DeClark, R.P. (Medical X-ray Center, Sioux Falls, SD). S. Dak. J. Med.; 28: No. 6, 5-6 (Jun 1975).

A 73-year-old lady with a pathologic fracture of the hip, secondary to radiation for melanoma 25 years after treatment is presented. This was treated with total hip replacement. A review of the symptoms, physical findings, x-ray changes, and pathology is presented. (auth)

- 2580 EVALUATION OF A PO-210 BIOASSAY AS AN INDEX OF THE EXPOSURE OF URANIUM MINE WORKERS IN JAPAN TO RADON DAUGHTERS. Okabayashi, H.; Suzuki, M.; Hongo, S. (National Inst. of Radiological Sciences, Chiba (Japan)); Watanabe, S. J. Radiat. Res.; 16: No. 2, 142-151 (Jun 1975).

As an indicator nuclide for inhalation exposure of mine workers to Rn daughters in a Japanese uranium mine, ^{210}Po urinalyses of the workers and surveys of some environmental factors were conducted. An estimation study of concentrations of Rn daughters in a mine, indicated that about 800-50 pCi of ^{210}Po could have been accumulated in each miner's body. However, according to the results of urinalyses performed several times in 5 years, a statistical difference in the quantity of ^{210}Po in urine among miners and non-mining workers there was not clearly identified. Investigations of ^{210}Po concentrations in the mine's air, water, foods (of about 30 kinds) and cigarettes, and investigations of feces-urine ^{210}Po ratios in humans revealed that these factors would greatly affect the metabolism and ^{210}Po excretion of the workers. In particular, some marine foods in Japan contained a great amount of ^{210}Po (several hundreds times that of other foods) and cigarettes showed 0.3-0.8 pCi of ^{210}Po per gramme. Smokers definitely excreted more ^{210}Po in urine than non-smokers. Feces-urine ratios ranged between 5.2-42.9 in one human subject. Therefore, it can be concluded that ^{210}Po would not be a good indicator for human exposure to Rn daughters, unless great care is taken regarding the eating and smoking habits of mine workers, as well as the exposure conditions in the uranium mine.

- 2581 RADIATION CANCER IN MAN, ESPECIALLY ON THE CASES DEVELOPED AFTER IRRADIATION FOR MALIGNANT CONDITIONS. Kikuchi, A. (Tohoku Univ., Sendai (Japan). School of Medicine). Gan No Rinsho; 21: No. 7, 464-469 (Jun 1975). (In Japanese).

Twelve cases in which radiation cancer was observed at the Tohoku University are reported. Half of them had been treated for tuberculous cervical lymphadenitis, one for lupus vulgaris and five for various malignant conditions. The average latent period was 27 years in 7 cases which were treated for benign conditions and 13 years in 5 cases treated for malignant conditions. In Japan, 12 cases of radiation cancer after irradiation for malignant conditions, excluding leukemia, have been reported. The clinical features of these 17 cases in addition to 5 cases are reviewed.

- 2582 CHROMOSOME ABERRATION FREQUENCY INDUCED BY FISSION RADIATION IN HUMAN PERIPHERAL BLOOD LYMPHOCYTES. BIOLOGICAL DOSIMETRY FOR A CRITICALITY ACCIDENT. Inoue, Y.; Bingo, K.; Fujita, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Hoken Butsuri; 10: No. 2, 73-77 (Jun 1975).

(In Japanese).

For the purpose of utilizing radiation-induced chromosome aberrations in human peripheral blood lymphocytes as a means of dose evaluation in a criticality accident, a study was made of the relationship between fission neutron + gamma dose and the chromosome aberrations. Human peripheral blood lymphocytes were exposed in vitro to fission neutrons + gamma rays at Japan Research Reactor No.4 for 5, 10, 20, 30, or 40 min at 200 kW. The cells were observed at their first mitotic division stage in culture. The frequency of the chromosome aberrations per cell, Y, was expressed as a power function of exposure time in minutes, t, as follows: $Y = 0.0018t^{1.12}$. On the assumption that there was no mutual interaction between chromosome aberrations induced by the neutrons and those aberrations induced by gamma rays and that there was a similarity in the effects of the gamma rays produced in fissions and those aberrations produced by Co-60 gamma rays, estimation was made of the contribution of gamma rays to the total yields. However, there was a contradiction: the contribution of gamma rays exceeded the total yield.

- 2583 MODIFIED INTRAORAL PROSTHESIS FOR DIRECTING A RADIATION BEAM. Parel, S.M.; Drane, J.B. (Univ. of Texas, Houston). J. Prosthet. Dent.; 33: No. 6, 666-671 (Jun 1975).

A method of modifying an intraoral radiation cone has been presented. A custom-fitted metal extension can be obtained either directly or indirectly using this technique. The final radiation stent allows consistent and stable direction of a radiation beam for treating intraoral lesions.

- 2584 CASE OF MESODERMIC MIXED TUMOR OF THE UTERUS DEVELOPING AFTER THE TREATMENT OF MYOMA WITH X-RAY IRRADIATION. Hiura, M.; Mano, A.; Egawa, K.; Katsube, Y.; Sasaki, T. (Hiroshima Univ. (Japan). School of Medicine). Sanfujinka No Jissai; 24: No. 6, 501-505 (Jun 1975). (In Japanese).

A case of mesodermic mixed tumor primarily developing in the endometrium was reported with some discussion. The anamnesis was interesting that the patient had been exposed to the secondary radioactivity of the atomic bomb in Hiroshima and to X-ray for the treatment of myoma. Histological examination revealed adenoma as the epithelial element and fibromyxoma-like tissues, cartilage tissues, vascular tissues, and endometrial interstitium-like tissues as the non-epithelial elements.

- 2585 PARA-AORTIC LYMPH NODE IRRADIATION FOR CARCINOMA OF THE UTERINE CERVIX USING SPLIT COURSE TECHNIQUE. Piver, M.S.; Vongtama, V.; Barlow, J.J. (Roswell Park Memorial Inst., Buffalo). Gynecol. Oncol.; 3: No. 2, 168-175 (Jun 1975).

Twenty women with previously untreated cervical cancer received radical irradiation to the para-aortic lymph nodes and pelvis. Ninety percent received 6000 rads to the para-aortic nodes and pelvis in 8 weeks using split course technique. The mortality from complications of therapy, without evidence of recurrence, was 25%. Forty percent of the women were dead from recurrent cervical cancer (4-23M), and even with this short follow-up only 35% were surviving NED (6-29M). Methods for improving future trials of irradiation to the para-aortic nodes are discussed.

- 2586 RADIATION THERAPY IN THE TREATMENT OF

INVASIVE CARCINOMA OF THE CERVIX UTERI AND THE MORBIDITY. Reddi, P.R. (West Virginia Univ. Medical Center, Morgantown). W. Va. Med. J.; 71: No. 6, 129-132 (Jun 1975).

The radiation therapy management consisted of external irradiation with Megavoltage using four pelvic ports, an anterior and posterior port and two lateral ports. All the dose calculations and planning of isodose plots were done individually for each patient with the aid of a computer. On the day following the completion of the course of radiation therapy, a singly radium insertion with a Fletcher-Suit apparatus was done. In case of para-aortic node involvement, the treatment was directed to this area in relation to the pelvis with the two parallel opposing ports. A gap ranging from 2.5 to 3.5 centimeters was given at the surface of the skin, depending upon the portal size, source skin distance, and anterior posterior thickness of the patient. Results are reported on a total of 71 patients with invasive carcinoma of the cervix uteri.

- 2587 (AD-A--015187) RADIOBIOLOGY OF LARGE ANIMALS. FINAL REPORT, AUG 1969--JUN 1975. Krebs, J.S.; Jones, D.C.L. (Stanford Research Inst., Menlo Park, Calif. (USA)). Jun 1975. Contract DAHC20-70-C-0219. 16p. NTIS \$6.25.

Topics discussed are lethality in sheep exposed to ^{60}Co gamma radiation using various exposure parameters; hematological findings in sheep exposed to lethal levels of ^{60}Co gamma rays at various dose rates and under various conditions of exposure; cellular changes in bone marrow of mice and sheep during and after exposure to ^{60}Co gamma rays; and biological and mathematical analysis of lethality in large animals exposed to ionizing radiation. (GRA)

- 2588 INFLUENCE OF LIVER RADIATION ON THE BONE MARROW. Kitahara, T.; Kiga, M. (Showa Univ., Tokyo (Japan). School of Medicine). Gan No Rinsho; 21: No. 7, 549-552 (Jun 1975). (In Japanese).

The purine requiring nature of bone marrow cells was responsible for a decrease in the DNA synthesis by liver irradiated rabbits. De novo purine, measured by glycine 2- ^{14}C incorporation, was also decreased in bone marrow. Administration of purine after liver irradiation improved the DNA synthesis rate in bone marrow. These results claimed the role of indirect effect and hepatic factor in radiation leukopenia. It is possible that indirect and slight damage to the liver may cancel the purine supply to the bone marrow.

- 2589 EFFECTS OF X-RAY IRRADIATION ON THE SUBSEQUENT GONADOTROPIN SECRETION IN NORMAL AND NEONATALLY ESTROGENIZED FEMALE RATS. Matsumoto, A. (Juntendo Univ., Tokyo (Japan). School of Medicine); Asai, T.; Wakabayashi, K. Endocrinol. Jpn.; 22: No. 3, 233-241 (Jun 1975).

Female rats were irradiated with 190 R of x rays at 10 days of age and sacrificed 4.7 or 12 months later. Their ovaries were histologically examined and serum levels and the pituitary contents of luteinizing hormone (LH) and follicle-stimulating hormone (FSH) were determined by radioimmunoassay. Both serum levels and pituitary contents of LH and FSH rose significantly 4 and 7 months after irradiation, although the ovaries were markedly reduced in weight. However, 12 months after irradiation, the ovaries increased in weight and consisted mostly of polyhedral, hyperplastic interstitial cell masses, and both LH and FSH in the serum and pituitary were

reduced to normal levels. These characteristic changes in the ovarian weight and the histological appearance could not be observed in similarly irradiated animals which were receiving daily injections of estrone for the first 30 days of postnatal life, i.e., daily injections of 54 μg for the first 10 days, 100 μg for the middle 10 days and 200 μg for the last 10 days. Serum LH levels in the estrogenized irradiated rats 7 or 12 months of age did not increase, although levels of FSH were significantly higher than the non-irradiated intact levels. From these results, a rise in the blood levels of LH and FSH may be attributed to the increase in weight and the histological changes in the ovaries of the irradiated female rats. The elevation of only FSH level may not result in an abnormal growth of the irradiated ovaries.

- 2590 (AAEC/E--346) ULTRASTRUCTURE CHANGES PRODUCED BY THE ACTION OF URANYL ACETATE ON THE HUMAN ERYTHROCYTE IN VITRO. Wyatt, J.H. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jun 1975. 22p. INIS.

21 figs..

Human erythrocytes exposed in vitro to low concentrations of uranyl ions are immediately changed in shape to stomatocytes. Electron microscope examination demonstrates that cellular damage is confined to the plasma membrane. Endocytosis of the cell membrane produces groups of inside out membrane-lined vesicles within the cell; lipid from the membrane enters the cell, giving rise to intracellular myelin figures, and breaks are seen in the cell membrane. It is proposed that the lipid fraction of the cell membrane is the primary target for damage by uranyl ions.

- 2591 THOROTRAST INJURY IN JAPAN. STATISTICAL STUDY ON AUTOPSY CASES AND FOLLOW-UP STUDY ON 147 CASES. Mori, T.; Maruyama, T. (Kanagawa Prefectural Junior Coll. of Nursing and Technol. (Japan)); Hatakeyama, S.; Miyaji, T.; Tsuya, A. Nippon Igaku Hoshasen Gakkai Zasshi; 35: No. 6, 439-452 (Jun 1975). (In Japanese).

Thorotrast injuries in Japan were discovered after 1945, and 94 autopsy cases were examined up to 1970. These autopsy cases included 60 cases of malignant tumor of the liver and 9 cases of blood disease. Examination of thorotrast-administered autopsy cases in Japan has revealed, among other things, that about one-half of all thorotrast-administered cases were war-wounded ex-servicemen and that the dates of injection in these cases were concentrated between 1932 and 1945. Based on this preliminary findings, a follow-up study was made on 147 thorotrast-administered war-wounded ex-servicemen after a lapse of 31 to 36 years from injection, and 6 cases of malignant tumor of the liver, 1 case of leukemia, 1 case of thrombocytopenic purpura, and 5 cases of liver cirrhosis were found among the samples. The incidence of these diseases in the samples was significantly higher than in the controls. The total number of thorotrast-administered persons living in Japan as of 1973 was roughly estimated at 5,000.

- 2592 (INIS-mf--2010, pp 73-119) PLUTONIUM - RADIOLOGICAL PROTECTION. Dolphin, G.W.; Dunster, H.J. Jun 1975.

The text of this lecture was based on report NRPB-R29 (Sep 1974) by G. Dolphin et al., reproduced here, 99 references.

Lectures, autumn 1974 - spring 1975.

For the protection of persons exposed to

plutonium isotopes and higher actinides there are five important requirements. First it is essential to evaluate all the appropriate data and develop basic dose standards for control of exposure of body organs, particularly bone, liver, and lung; these must be comparable to standards for exposure to external gamma and x radiation. Secondly, from these basic standards, values for maximum permissible concentrations in air and permissible annual intakes must be derived using metabolic models for plutonium in humans. As part of the biological monitoring of workers it is necessary to make assessments of the amount of plutonium in the body either by measurement of the excretion rate of plutonium in the urine or by external counting of gamma or x radiations over the chest or contaminated wound site. For the treatment of cases of high over-exposure therapeutic techniques should be available for accelerating the excretion or removal of the radioactivity from the body. Finally, plans must be made to cover the possibility of a large release of plutonium into the environment and these should include acceptable values for ground contamination levels.

- 2593 (PB--243898) ADVANCED TECHNIQUES FOR RADON GAS REMOVAL. RESEARCH REPORT, 22 MAY 1973--15 APR 1975. (Little (Arthur D.), Inc., Cambridge, Mass. (USA)). May 1975. Contract H0230022. 220p. (ADL--75946). NTIS \$7.25.

Results are summarized of engineering feasibility studies whose purpose was to assess the probable efficiency, reliability, safety and cost of a number of possible methods for removal of radon gas from the ambient air in underground mines particularly uranium mines. Fourteen candidate techniques were evaluated. Seven of these were based on specific individual principles, and seven were based on combinations of these principles. The individual principles were activated charcoal; organic fluids; semipermeable membranes; molecular sieves; cryogenics; chemical reaction; and, centrifuge. This study makes an initial assessment of basic techniques, and an examination of various possibilities for combining or modifying those techniques so as to improve their effectiveness and/or lower their cost. Any safe and practical technique that can result in the reduction of this insidious hazard to the health of underground miners, and that can substantially reduce the need for massive primary ventilation of the mines would be of considerable value to the industry and to the society. (GRA)

- 2594 (LURI--1975-04) MORPHOLOGICAL AND DYNAMIC STUDIES OF THE ACCUMULATION OF ^{123}I AND $^{99\text{m}}\text{Tc}$ IN THE THYROID. Cederquist, E.; Naversten, Y.; Persson, R.B.R.; Strand, S.E. (Lund Univ. (Sweden). Radiophysiska Institutionen). May 1975. 16p. (CONF-7505116--1). INIS.

From International symposium on nuclear medicine; Karlovy Vary, Czechoslovakia (20 May 1975).

This investigation was undertaken to compare the use of ^{131}I , ^{123}I and $^{99\text{m}}\text{Tc}$ for scintigraphic studies of the thyroid. ^{123}I has the most ideal physical and biological characteristics for this purpose. The detectability of ^{123}I with scintillation camera was found to be more than 200 times better than of ^{131}I in consideration of the absorbed dose to the patient. We have found that an activity of about $200\mu\text{Ci}$ ^{123}I is enough for thyroid scintigraphy. This activity will give about the same count rate with the scintillation camera as when 2mCi $^{99\text{m}}\text{Tc}$ -pertechnetate is used. Oblique scintillation camera views, which

have been found to be of value especially when cold areas were present in the thyroid, can be performed with both ^{123}I and $^{99\text{m}}\text{Tc}$. But when $^{99\text{m}}\text{Tc}$ is used, a greater fraction of circulating activity is registered. After i.v. administration of ^{123}I or $^{99\text{m}}\text{Tc}$ -pertechnetate sequential scintigrams were registered over the thyroid and the aortic region with a scintillation camera. The activity time curves were analyzed and uptake parameters were evaluated with a computer. The initial trapping curve could thus be studied in patients with different thyroid disorders.

- 2595 CHANGE IN THE QUANTITY OF CELLS IN SMALL INTESTINE OF MICE UNDER THE ACTION OF VARIOUS RADIATION DOSES. Semenov, L.F.; Altukhova, L.N. (Akademiya Meditsinskikh Nauk SSSR, Sukhumi. Inst. Eksperimental'noj Patologii i Terapii). Radiobiologiya; 15: No. 3, 447-449(May 1975). (In Russian).

For English translation see the journal Radiobiology.

Dose dependence of radiation injury to the intestinal tissue of mice exposed to 100-4000 r of γ -quanta has been studied by means of a new method of quantitative estimation of proliferation. It has been found that the initial radiation damage to cells of the intestine is independent of the radiation dose whereas the final result of the damage depends on the dose value.

- 2596 (SAAS--178) OCCUPATIONAL RADIATION EXPOSURE IN THE GDR IN 1971. Koenig, W.; Larssen, A.; Rothe, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). May 1975. 40p. (In German). NTIS (US Sales Only).

In 1971, 32, 843 occupationally exposed persons were monitored by the central film badge service of the National Centre for Radiation Protection. The monthly over-exposures (more than 0.4 rad) totaled to 685. In 40 cases the quarterly dose (3 rad) was exceeded during one month. 12 of these records could be assessed as real over-exposures. Most of the over-exposures could be attributed to an insufficient application of safety regulations. The results were analyzed according to type of institution, type and duration of employment as well as age of employees.

- 2597 (SSI--1975-019) INFORMATION FROM THE NATIONAL INSTITUTE OF RADIATION PROTECTION ABOUT RADIATION DOSES AND RADIATION RISKS AT X-RAY SCREENING. (Statens Straalskyddsinstitut, Stockholm (Sweden)). May 1975. 17p. (In Swedish). INIS.

This report gives a specification of data concerning radiation doses and risks at x-ray investigations of lungs. The dose estimations are principally based on measurements performed in 1974 by the National Institute of Radiation Protection. The radiation doses at x-ray screening are of that magnitude that the risk for acute radiation injuries is non-existent. At these low doses it has not either been able to prove that the radiation gives long-range effects as changes in the genes or cancer of late appearance. At considerable higher doses, more than tens of thousands of millirads, a risk of cancer appearance at a small part of all irradiated persons has been proved, based on the assumption that the cancer risk is proportional to the radiation dose. Cancer can thus occur at low radiation doses too. Because of the mass radiography in Sweden 1974 about twenty cases of cancer may appear in the future.

- 2598 EDUCATION CAMPAIGN FOCUSES ON EFFECTS OF IRRADIATION THERAPY. *Ill. Med. J.*; 147: No. 5, 430, 446(May 1975).

An educational campaign was recently launched to call attention to the increased risk of thyroid carcinoma resulting from radiotherapy administered to the head and neck during childhood or adolescence. Although irradiation therapy for benign conditions of the head and neck was discontinued 15 years ago, the late effects of this treatment are being reported with increasing frequency. Thyroid screening programs are being established in the Chicago area. (ERB)

- 2599 ELECTRON MICROSCOPIC STUDIES OF NEUROBLASTOMA. ESPECIALLY FINE STRUCTURAL COMPARISON IN UNTREATED NEUROBLASTOMA WITH IRRADIATED NEUROBLASTOMA. Nakayama, I.; Muta, H.; Tsuji, K.; Oyakawa, Y.; Matsuo, T. (*Nagasaki Univ. (Japan). School of Medicine*). *Nippon Rinsho Denshikenbikyō Gakkai Shi*; 8: No. 1-2, 21-31(May 1975). (In Japanese).

The fine structure of irradiated neuroblastoma has been compared with that of untreated neuroblastoma. After irradiation the tumor showed massive necrosis, however, remaining cells were markedly enlarged. The nucleus showed a deep nuclear indentation with decreased heterochromatin. The Golgi region occupied much of the cytoplasm. There appeared near the Golgi region an increased number of small granules having a dense core. The rough endoplasmic reticulum was considerably increased in amount. Various types of lysosomes or phagosomes were found in the cytoplasm. Cytoplasmic processes with the formation of neurites were increased in number. They contained significantly increased numbers of both cored and electron lucid granules compared with those of untreated neuroblastoma.

- 2600 EDUCATION CAMPAIGN FOCUSES ON EFFECTS OF IRRADIATION THERAPY. *Ill. Med. J.*; 147: No. 5, 430, 446(May 1975).

Patients having radiation therapy for benign conditions of the head and neck during 1930 to 1960 should submit to screening for possible thyroid carcinoma. A campaign is under way in the Chicago area to advise physicians and hospitals of the problem and to encourage former patients to submit to the screening procedure. (ERB)

- 2601 COMPLEMENTARY IRRADIATION IN LYMPHOGRANULOMA. 1. TECHNIQUE AND DOSIMETRY. Konecny, M.; Pecina, J. (*Onkologický Ústav, Brno (Czechoslovakia). Betatronové Pracoviště*). *Cesk. Radiol.*; 29: No. 3, 147-153(May 1975). (In Czech).

In radiotherapy of lymphogranuloma, complementary irradiation has substantial advantages as compared with local irradiation or irradiation using an extended field. Difficulties arising from the necessity of protecting the more sensitive tissues or of irradiating homogeneously all larger lymphatic groups of the given half of the body may at least partly be eliminated by an individually fitted shielding block placed at a distance of approximately 50 cm above the patient. This distance, the shielding of block edges in the radiation beam direction and the shielding equivalent of approximately 5 half-layers gives satisfactory protection to the tissue and provides a small half-shade. The measurements performed confirmed a homogeneous dose distribution, specified the dependence of the depth dose on the shielding value and permitted a more accurate adjustment of the shielding

block.

- 2602 PRINCIPLES OF BIOLOGICAL DOSIMETRY IN ACUTE RADIATION SICKNESS. Vorob'ev, A.I.; Brilliant, M.D.; Baranov, A.E.; Selidovkin, G.D.; Pyatkin, E.K.; Pokrovskaya, V.N. *Klin. Med. (Moscow)*; 53: No. 5, 69-74(May 1975). (In Russian).

On the basis of their own observations and data from the literature, the authors analyze a number of biological indicators to determine their usefulness for biological dosimetry and in particular the degree of dose correspondence (or rather dose range) they give. The leucocyte count 7, 8 and 9 days after exposure, the time of onset of agranulocytosis and the lymphocyte level 48 to 72 hours following irradiation were found to be useful biological dosimeters. A clear relationship was found between the number of brain cells with damaged chromosomes and the radiation dose received by the brain. The importance of the time at which vomiting begins is emphasized as a means of gauging the seriousness of radiation damage in general. On the basis of information derived from the literature, the authors provide data on the radiation doses to individual organs and tissues which cause the first clinical signs of radiation injury, i.e. threshold doses. A number of indices are given which make it possible to gauge threshold doses for the skin and small intestine.

- 2603 STUDY IN THE RADIOPROTECTIVE ACTION OF BETA-MERCAPTOPYLAMINE AGAINST A PROLONGED IRRADIATION. Tikhomirova, M.V.; Davydova, S.A.; Vodyakova, L.M. *Radiobiologiya*; 15: No. 3, 379-383(May 1975). (In Russian).

For English translation see the journal *Radiobiology*.

In experiments on mice it was shown that the radioprotective action of β -mercaptopylamine (MPA) is weakened when the rate of gamma-irradiation is reduced from 400.9 to 10.70 and 3.76 R/min. In dogs irradiated at a dose rate of 1 R/min administering MPA prophylactically did not increase the effectiveness of the treatment applied after irradiation.

- 2604 CYTOGENETIC EXAMINATION OF THE DOGS IRRADIATED WITHIN SIX YEARS. Tsessarskaya, T.P. *Radiobiologiya*; 15: No. 3, 434-437(May 1975). (In Russian).

For English translation see the journal *Radiobiology*.

Cytogenetic effects were studied as a function of the rate and dose of continuous gamma irradiation (dose rates 21, 63, 125 rad/year and total doses 125, 375, 750 rad). The structural damage to chromosomes seen in the metaphase of the mitosis of bone-marrow cells was investigated. A sharp increase in the frequency of aberrations was caused only by the highest of the dose rates used in the experiment, namely 125 rad/year, while at 21 and 63 rad/year the radiation effect was detected only in some periods. A characteristic feature was the absence of a single-valued dependence between the magnitudes of the effect and the irradiation dose.

- 2605 DEPENDENCE OF THE AVERAGE LIFE SPAN, MORTALITY AND OSTEOSARCOMA OCCURRENCE IN RATS ON THE RADIATION DOSE ABSORBED (SR 90). Shvedov, V.L.; Pantelev, L.I. *Radiobiologiya*; 15: No. 3, 402-406(May 1975). (In Russian).

For English translation see the journal *Radiobiology*.

The dose dependence of mortality and osteosarcoma development frequency is studied

in white rats which have received 0.00005-5.0 μ Ci/day of strontium-90 throughout their lives. It is shown that total mortality in the dose range 0-10 krad is a more sensitive test than osteosarcoma frequency, osteosarcomatosis hardly reducing the mean life span of the irradiated rats.

- 2606 LIVER INSULINASE AND INSULIN-LIKE ACTIVITY OF THE BLOOD PLASMA IN IRRADIATED RATS. Zhikhareva, A.I.; Dokshina, G.A. (Tomskij Gosudarstvennyj Univ. (USSR)). Radiobiologiya; 15: No. 3, 454-456 (May 1975). (In Russian).

For English translation see the journal Radiobiology.

Comparative quantitative analysis of the functional effect of radiation on the activity of liver insulinase of irradiated rats has shown that the insulinase activity of the blood plasma decreases (21-45%) one to three days after the exposure at betatron. Insulinase activity of the liver extracts is also inhibited (16-22%) as compared to intact liver extracts. Twelve days after the exposure and later, insulin-like activity of the plasma and the enzyme activity increase up to 37 per cent.

- 2607 INACTIVATION OF HEMOPOIETIC STEM CELLS BY LYMPHOCYTES AS RELATED TO GENOTYPE OF INTERACTING CELLS. Petrov, R.V.; Soslavina, L.S.; Panteleev, E.I.; Egorova, O.S. Tsitologiya; 17: No. 5, 560-564 (May 1975). (In Russian).

Inoculation of a mixture of bone marrow cells with allogeneic lymphocytes into irradiated mice of inbred strains or into F_1 hybrids results in the depression of bone marrow cell proliferation in the spleen of the recipient: the effect of inactivation of nonsyngeneic stem cells. The inactivation of stem cells by allogeneic lymphocytes can be detected in all tested combinations of mice strains - donors of lymphocytes and bone marrow cells and mice - recipients but the degree of inactivation differs and depends on the genotype of cell donors rather than on the genotype of the recipient. Lymphocytes of some mice strains (haplotypes H-2sup(k) and H-2sup(a)) are more active killers of bone marrow cells as compared with lymphocytes of other strains (haplotypes H-2sup(b) and H-2sup(d)). Probably, the degree of stem cells inactivation by lymphocytes depends on the differences of their histocompatibility in H-2 system.

- 2608 ESTIMATION OF WHOLE BODY ABSORBED DOSE OF THE PATIENT ADMINISTERED ^{57}Co -BLEOMYCIN FOR TUMOR DIAGNOSIS. Anzai, I. (Tokyo Univ. (Japan). Faculty of Medicine); Kanno, M.; Higashi, T.; Kato, H.; Nakamura, K. Radioisotopes (Tokyo); 24: No. 5, 327-331 (May 1975).

The whole body absorbed dose of the patient administered ^{57}Co -Bleomycin for tumor diagnosis was estimated in accordance with the MIRD Committee method. The whole body retention function was well described by the two component exponential model. The effective half-lives were several hours in the initial rapidly decreasing phase and 2 to 3 months in the successive slow phase. The accumulated whole body absorbed dose following intravenous administration of 1mCi of ^{57}Co -Bleomycin was calculated to be approximately 3 rads, more than 90% of which was delivered in the first one year following injection. It was also revealed that no less than 99% of the dose was brought by the slow phase component, which indicated the importance of obtaining slow phase excretion data for dose estimation

concerning the newly applied radiosubstances, irrespective of necessity or unnecessity for the diagnosis itself. Relatively high level of deposition was observed in the liver of a male patient of 82 years old who died of lung cancer 15 days after intravenous injection of ^{57}Co -Bleomycin.

- 2609 TOXICITY OF PLUTONIUM. Takagi, J. Kagaku (Tokyo); 45: No. 5, 309-316 (May 1975). (In Japanese).

Tamplin and Cochran evaluated the rate of carcinogenetic action of nonuniform exposure with PuO_2 particles deposited in the lungs and suggested to reduce the present standard of plutonium to 1/115,000. The author examined the management of nonuniform exposure based on various views and appraised the risk. The number of "permissible" particles for occupational exposures with the risk of 1/1,000 in a year was found to be 2s^{-2} or 25d^{-6} for personal and 0.2s^{-2} or 2.5d^{-6} for the general public against a particle with radioactivity of 5 pCi and diameter of μ . This result essentially supported the suggestion of Tamplin and Cochran.

- 2610 ACTION OF STRONTIUM-90 CHRONICALLY ADMINISTERED TO RATS ON CERTAIN PARTS OF THEIR DIGESTIVE TRACT. Boystova, V.P.; Goloshchapov, P.V.; Soroka, L.P. Radiobiologiya; 15: No. 3, 389-393 (May 1975). (In Russian).

For English translation see the journal Radiobiology.

The protracted uptake of ^{90}Sr has been found to cause structural disorders in all the layers of the intestinal wall, their degree being proportional to the dose absorbed by the osseous tissue. An increase in the intestinal autoflora, and a retrograde separation and modification of its species composition take place aggravating the toxemia, which is supported by the data of the histological and biochemical analyses of the liver.

- 2611 A STUDY OF QUANTITATIVE SCALE DISPLAY OF THE ORGAN UPTAKE WITH GAMMA-CAMERA. Ishigami, K.; Matsumoto, M. (Kumamoto Univ. (Japan) School of Medicine). Radioisotopes (Tokyo); 24: No. 5, 322-326 (May 1975). (In Japanese).

The fundamental study of quantitative scale display of the organ uptake with γ -camera was performed in special respect of the thyroid gland and the pancreas. As one of the measurements on certain dimension of the organ, an optical progression outside the digital image was expressed, and was subjected to the quantitative scale with the use of the threshold level. And a rather satisfactory correlation was clinically obtained between the scale display and the thyroidal ^{131}I uptake. For the purpose of revising the above scale display, the organ depth was measured with RI by the aid of the phantom. Then the pancreas depth determined by the count rate ratio curve of 140 and 270 keV peak of ^{75}Se energies. However, the body background and the radioactive rays from the neighboring organs interfered with this curve.

- 2612 EVALUATING ERROR DISTRIBUTION IN THE UPTAKE OF RADIOISOTOPES IN THE RESPIRATORY SYSTEM. Lekhtmakher, S.O.; Ruzer, L.S. Izmer. Tekh.; 18: No. 5, 75-76 (May 1975). (In Russian).

The errors in determining the uptake of radioactive isotopes in the respiratory organs are estimated. For the evaluation of the measurements of physical characteristics and

with increasing errors a Gaussian distribution for the errors is no longer applicable. A logarithmic-normal distribution law for the errors is proposed. The uptake of isotopes in the organism is discussed and an expression for its activity is given according to the new standards of radioactive protection (NRP-69). A large difference between the real and the calculated values of isotope activity in respiratory organs is found and discussed. For this large spread of results the expression for the logarithmic-normal distribution, for the real value and for the geometric mean are given.

- 2613 INVESTIGATION OF THE ROLE OF CERTAIN LIVER COMPONENTS IN FIXATION OF Pu^{239} . Popov, D.K.; Rushonik, S.I.; Shvydko, N.S. (Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR)). Gig. Sanit.; No. 5, 112-113 (May 1975). (In Russian).

For English translation see the journal Hyg. Sanit..

CITRATES; DISTRIBUTION; LIVER; PLUTONIUM 239; RADIATION DOSES; RADIONUCLIDE KINETICS; RATS; UPTAKE

- 2614 (AD-A--023777) THE NEW NUCLEAR RADIATION CASUALTY CRITERIA. Warshawsky, A.S. (Army Nuclear Agency, Fort Bliss, Tex. (USA)). May 1975. 9p. NTIS \$3.50.

Information paper on topics associated with nuclear weapons.

Many years of detailed analysis and experimentation have produced an improved understanding of nuclear weapons technology and phenomena, and of human and animal response to nuclear radiation. The information and data used to develop new radiation casualty criteria are briefly described, and it is shown how these criteria can be used by the battlefield commander and staff in planning nuclear strikes to inflict enemy casualties. The radiation criteria discussed apply only to initial radiation doses resulting from a single nuclear detonation; they do not apply to doses resulting from exposure to radioactive fallout. Moreover, the criteria do not consider synergistic effects due to the air blast and/or thermal energies that accompany initial radiation.

- 2615 DECREE NO. 75-306 OF 28 APRIL 1975 RESPECTING THE PROTECTION OF WORKERS AGAINST THE HAZARDS OF IONIZING RADIATION IN BASIC NUCLEAR PLANTS. J. Off. Repub. Fr.; 107: No. 101, 4428-4432 (30 Apr 1975). (In French).

Scope; administrative provisions concerning the project, construction and operational stages of nuclear facilities, plant safety organisation, modifications to existing structures, etc.; marking out of off-limits areas; protection of personnel required to enter these areas against external radiation and radioactive contamination; warning notices indicating off-limit areas; inspection, monitoring of protective equipment; monitoring of environment; individual monitoring for exposure to radiation and contamination; action to be taken in the case of over-exposure; safety engineering methods in off-limits areas (shielding, remote handling, glove boxes, etc.); medical rules; emergency organisation and fire prevention. A series of definitions is appended.

- 2616 METHOD AND APPARATUS FOR DOSE CONTROL IN THE IRRADIATION OF PERSONS. Vogel, T.M. (to Varian Associates, Palo Alto, Calif. (USA)). German (FRG) Patent 2447959/A/. 17 Apr 1975.

43p. (In German).

4 figs..

A method to control the aimed irradiation of a subject, e.g., part of the body, by a radiation source which is movable along a path relative to the irradiation subject is described. The method enables the detection of non-uniformities of the radiation and their compensation limiting the emitted quantity of radiation, to a previously determined maximum. The moving path of the source is thus subdivided into steps and the quantity of radiation of each step is measured and controlled. Several closures are designed to de-energize the system if various faults occur. Furthermore, devices are designed to control the mobility rate of the source or the dose rate of the source. The system is explained and illustrated in detail.

- 2617 CHROMOSOMAL ABERRATIONS IN PERIPHERAL BLOOD LYMPHOCYTES OF MONKEYS SUBJECTED TO LONG-TERM DAILY IRRADIATION. Kosichenko, L.P. (Inst. of Experimental Pathology and Therapy, Moscow). Genetika; No. 3, 134-140 (14 Apr 1975). (In Russian).

Following a prolonged period of daily exposure to low doses of gamma radiation for a total dose in the range of 826 to 3677 R, cytogenetic studies were commenced on the chromosomes of peripheral lymphocytes of eight male and three female rhesus monkeys 4.5 to 11 years after the last exposure. With rare exceptions, chromosomal aberrations consisted of symmetrical chromosomal exchanges; the incidence of aberrations in the 1st, 14th and the 20th chromosome pair was 1.67%, 2.2% and 3.0%, respectively, for the irradiated monkeys against an incidence of 0.6% for control monkeys. The total exposure dose or the time between the last exposure and the study did not influence the incidence of chromosomal aberrations.

- 2618 UNDETECTED LATROGENIC HYPOTHYROIDISM: A LATE COMPLICATION OF RADIO-IODINE THERAPY. Smidt, K.P. (Univ. of Otago Medical School, Dunedin, New Zealand). N.Z. Med. J.; 81: No. 537, 325-328 (9 Apr 1975).

The thyroid status of 317 patients treated with radioactive iodine between 1951 and December 1971 was investigated. Information was obtained on 236 patients and hypothyroidism, either treated or untreated, was present in 48 percent of women and 37 percent of men at mean follow-up intervals of 5.5 and 4.4 years respectively. Ninety-four of the 241 patients still alive were assessed personally by clinical examination and serum thyroxine assay, and 10 were found to have previously undiagnosed hypothyroidism. Seven of these patients had symptoms and in five these symptoms were the cause of significant distress. The importance of undertaking a long term review program following radioactive iodine therapy is emphasized. (auth)

- 2619 (LURI--1975-03) LONG-LIVED RADIONUCLIDE-IMPURITIES IN ELUATES FROM MOLYBDENUM-TECHNETIUM GENERATORS AND THE ASSOCIATED ABSORBED DOSE TO THE PATIENT. Finck, R.; Mattsson, S. (Lund Univ. (Sweden). Radiofysiska Institutionen). Apr 1975. 23p. INIS.

The activity-concentrations of several long-lived gamma-emitting radionuclides present in technetium generators and in eluates from these generators have been determined by means of Ge(Li) gamma-spectrometry. The principal contaminants of the eluates were: ^{192}Ir (T/sub 1/2/ = 74.3 d), ^{134}Cs (2.05 a), ^{131}I (8.05 d), /

sup 110m/Ag (255 d), ¹⁰³Ru (39.5 d), ⁹⁹Mo (66.7 h) and ⁶⁰Co (5.26 a). The impurity-concentrations were found to vary considerably from generator to generator. Changes in the impurity-concentrations in eluates from the same generator have also been recorded during an elution-period of one week. In accord with their ability to be eluted from the generators, the long-lived radionuclide-impurities may be arranged in the following sequence ¹³⁴Cs > ¹⁰³Ru greater than or equal to /sup 110m/Ag > ¹⁹²Ir > ⁶⁰Co.

- 2620 (PB--242983) RADIOACTIVITY IN CONSTRUCTION MATERIALS A LITERATURE REVIEW AND BIBLIOGRAPHY. TECHNICAL NOTE (FINAL). Eadie, G.G. (Environmental Protection Agency, Las Vegas, Nev. (USA). Office of Radiation Programs). Apr 1975. 50p. (ORP/LV--75-1). NTIS \$3.75.

Surveys to determine the radioactive content of specific building materials used in the United States have not been reported in the literature. The external dose to the U.S. population from exposure to natural radioactive materials (exclusive of uranium mill tailings) contained in U.S. building materials has not been evaluated, and the possibly significant external exposure from the use of by-product gypsum and fly-ash materials should be evaluated. The effects of various construction materials on the attenuation of cosmic and terrestrial radiations have been evaluated in a limited number of surveys in the urban areas of Boston, New York, and Livermore, California. The measurement of radon and radon daughter product concentrations has only been reported for a few dwellings and several multi-story office buildings in Boston and in several State-owned buildings in North Carolina. This literature search has found a lack of meaningful data for use in evaluating the U.S. population exposure from building materials. (GRA)

- 2621 (DHEW/FDA--75-8007) STANDARD TECHNIQUE FOR ESTIMATING PATIENT EXPOSURE FROM PHOTOFLUOROGRAPHIC X-RAY MACHINES. Gaeta, N.A.; Burnett, B.M. (Bureau of Radiological Health, Rockville, Md. (USA)). Apr 1975. 19p. GPO.

Many different techniques have been used to measure exposures from photofluorographic x-ray machines. To evaluate patient radiation exposures and enable comparison of data from different machines, a standard technique for estimating patient exposure is recommended. Human chest exposures were evaluated using a copper sheet as the attenuating medium. Relationships are developed between patient and copper sheet exposures; details of the survey method are presented; x-ray machine problems and recommendations for correction are discussed. The method is applicable to 14 x 17 wall chest and other phototimed units.

- 2622 CELL PROLIFERATION KINETICS IN HUMAN TUMOR CELLS. Brown, J.K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Environment and Public Health Div.). Aust. N.Z. J. Med.; 5: No. 2, 182(Apr 1975).

From Annual scientific meeting of the Australian and New Zealand society of nuclear medicine; Sydney, Australia (22 May 1974).

Abstract only.

Fundamental studies of the mechanism by which radiation acts on mammalian cell systems have to date not contributed one well-documented example of a significant improvement in the cure rate of human cancer. In part, this failure is due to ethical and technical

difficulties of conducting experiments on tumors in situ and, in part, to the fact that the results of in vitro studies are obtained under conditions hardly relevant to tumor cell populations. Present knowledge of the kinetics of tumor cells will be described by reference to in vivo and in vitro experiments employing labelled (tritium, carbon-14, iodine-125) precursors of DNA. Such experiments have revealed that the doubling times of solid human tumors may be several orders of magnitude less than expected due to cell loss (75 to 90%) and the large proportion of cells not in the proliferative phase (25 to 40%). By means of a new tissue culture technique, a human malignant cell line has been grown in suspension culture in the form of multicellular 'spheroids' comprised of up to 10⁴ cells. The spheroids morphologically and radiobiologically resemble the nodular structure of many human and animal neoplasms, consisting of a peripheral zone of actively metabolising cells relatively sensitive to radiation, and an inner core of hypoxic cells resistant to radiation.

- 2623 (NRPB-R--35) STUDY OF CHROMOSOME ABERRATION YIELD IN HUMAN LYMPHOCYTES AS AN INDICATOR OF RADIATION DOSE. 5. A REVIEW OF CASES INVESTIGATED: 1974. Purrott, R.J.; Lloyd, D.C.; Prosser, J.S.; Dolphin, G.W.; Tipper, P.A.; Reeder, E.J.; White, C.M.; Cooper, S.J.; Stephenson, B.D. (National Radiological Protection Board, Harwell (UK)). Apr 1975. 15p. NTIS (US Sales Only).

Available from H.M. Stationery Office, price Pound0.50.

Results from cytogenetic investigations into 28 cases of suspected overexposure to radiation are reviewed. This report is a sequel to NRPB-R5, R10 and R23 which contained data on 141 studies. Results from all 169 investigations have been pooled for general analysis. Brief accounts are given in an appendix of the circumstances behind the past year's 28 investigations and where possible physical estimates of dose have been included for comparison. Dose response studies have been completed for 250 kV X-rays delivered at 100 rads/min and for two dose rates of cobalt-60 γ radiation at 50 rads/min and 18 rads/hr. The data have been fitted to a quadratic function of the form $Y = \alpha D + \beta S^2$ and values for the coefficients α and β are given for the three curves. The lower limits of detection with cytogenetic dosimetry are equivalent whole body doses of 4 rads for X-rays and 10 rads γ radiation. Several weeks may elapse between exposure and blood sampling without detriment to the dose estimate.

- 2624 (NRPB-R--36) ASSESSMENT OF THE HAZARD TO THE PUBLIC FROM ANTI-STATIC BRUSHES CONTAINING POLONIUM-210 IN THE FORM OF CERAMIC MICROSPHERES. Webb, G.A.M.; Wilkins, B.T.; Wrixon, A.D. (National Radiological Protection Board, Harwell (UK)). Apr 1975. 21p. NTIS (US Sales Only).

Available from H.M. Stationery Office, price Pound0.50.

Anti-static brushes containing polonium-210 in the form of ceramic microspheres have been tested and evaluated with regard to their availability to the general public. After summarising existing test information, results are given of routine leakage tests and special tests intended to simulate severe but credible abuse and accidents with these devices. It is found that the low levels of removable contamination and the possible loss of complete microspheres, although in principle undesirable, do not present a significant hazard. The containment integrity of ceramic

microspheres under severe conditions (impact and fire) has been found unsatisfactory and it is considered possible that ICRP dose limits could be approached or even exceeded under these severe but credible abuse, accident or disposal conditions. The results of comparative tests with nonradioactive methods for static elimination did not demonstrate any adequate justification for the use of a radioactive material. The potential exposure from Staticmaster Brushes is therefore considered an unnecessary hazard to members of the public.

- 2625 (SSI--1975-016) TOPICAL STANDARDIZATION OF DOSIMETRY. TRAVEL REPORT FROM A MEETING AT BIPM IN PARIS IN APRIL 1976. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Apr 1975. 7p. (In Swedish). INIS.

The international concordance, concerning the measuring of exposure dose (unit: Roentgen), has now become about 0.5 percent to as well low energy x-radiation (10 - 50 kV) as to conventional x-radiation (50 - 250 kV) and Co 60-radiation. The statement from the laboratory of BIPM in Paris will valid as an international guide value. Bearing in mind the needs within the field of medical radiation treatment, international comparisons will be made during the next few years in order to determine absorbed dose (unit: rad) in graphite during irradiation with Co 60-radiation in a graphite phantom under defined irradiation conditions. Work will also be done about absorbed dose in water in a water phantom with a view to the possibility of calibration of an ionisation chamber for absorbed dose from Co 60-radiation.

- 2626 (TU-Inf--05-12-75) COMPARISON OF VARIOUS MODELS FOR THE ASSESSMENT OF RADIATION DOSES TO THE GASTROINTESTINAL TRACT. Schillinger, K.; Schuricht, V. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Apr 1975. 14p. (In German). NTIS (US Sales Only).

Various models for the assessment of internal radiation doses to the gastrointestinal tract are shortly described and compared. It is concluded that the existing models are satisfying from the viewpoint of radiation protection.

- 2627 MEDICAL SUPERVISION OF RADIATION WORKERS IN THE GERMAN DEMOCRATIC REPUBLIC.

Schuettmann, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 2. Gesamte Hyg. Ihre Grenzgeb.; 21: No. 4, 289-295 (Apr 1975). (In German).

AERIAL MONITORING; GERMAN DEMOCRATIC REPUBLIC; INSPECTION; LICENSING; MEDICAL SURVEILLANCE; ORGANIZING; PERSONNEL; PERSONNEL DOSIMETRY; RADIATION PROTECTION

- 2628 DETERMINATION OF RADIATION REDUCTION TO THE LENS DURING POLYTOMOGRAPHY OF THE PETROUS PYRAMID. Ellwood, R.A.; Morrison, J.L.; Pfeil, C.E. (Madigan Army Medical Center, Tacoma, WA). Mil. Med.; 140: No. 4, 276-277 (Apr 1975).

The preclusion of unwarranted radiation to critical organs is a basic principle of radiation safety to the patient. The lens of the eye is a critical organ in that ionizing radiation may induce cataract formation. In order to obviate this complication, a study was undertaken to determine the dosage to the ocular lens during petrous hypocyloidal tomography with and without ocular lead

shields. (auth)

- 2629 HAZARDS OF LARYNGEAL CANCER IN URANIUM MINERS. Placek, V. (Ustav Hygieny Prace Uranoveho Prumyslu, Kamenna (Czechoslovakia)); Sevc, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). Ustav Hygieny Zarení. Prac. Lek.; 27: No. 4, 113-115 (Apr 1975). (In Czech).

From Seminar of the Institute of Hygiene and Epidemiology, Centre of Radiation Hygiene; Prague, Czechoslovakia (2 May 1974).

The results are presented of an epidemiological study showing that no significant differences exist between the estimated and the observed incidence of cancer of the larynx in a group of uranium miners. The comparison of results of the epidemiological study, of the total number of larynx cancer in uranium miners ascertained so far, and of literature data shows that the low incidence of larynx cancer in uranium miners does not differ from the incidence of this disease among the male population in Czechoslovakia.

- 2630 MICROWAVE LENS EFFECTS IN HUMANS. Appleton, B.; Hirsch, S.; Kinton, R.O.; Soles, M.; McCrossan, G.C.; Neidlinger, R.M. Arch. Ophthalmol. (Chicago); 93: No. 5, 257-258 (Apr 1975).

Continuation of earlier studies (CIS 74-1296) extended to cover a total of 2343 microwave workers and 801 controls over 5 years. Comparison of lens abnormalities found (opacities, vacuoles, or posterior subcapsular iridescence) showed the 2 groups to be essentially the same, and did not support the hypothesis that microwave exposure causes lens damage in humans. The results suggest that the existing safety level of 10 mW/cm² is adequate.

- 2631 RADIATION HYGIENE IN PHOTOFLUOROGRAPHY. Welde, F. (The state institute of radiation hygiene, Montebello, Oslo (Norway)). Acta Radiol., Ther., Phys., Biol.; 14: No. 2, 187-194 (Apr 1975).

This paper comprises measurements and experiences from the surveillance of 36 photofluorographic units in Norway. Measured patient doses are given. Practical means for reducing the doses are emphasized. The radiation hygiene for the personnel in mass chest surveys is discussed.

- 2632 SIGNIFICANCE OF LENTICULAR OPACITY FROM THE VIEW POINT OF THE EXPOSURE DOSE OF A-BOMB RADIATION. Sugimoto, S. (Sugimoto Hospital, Hiroshima (Japan)). Hiroaki Igaku; 28: No. 4, 443-446 (Apr 1975). (In Japanese).

Two cases of lenticular opacity were discussed from the view point of exposure dose of A-bomb radiation. Case 1: female, 22 year and 5 months old when she was exposed to A-bomb radiation. The presumed exposure dose was 482.0 rad. Cataract due to A-bomb radiation. Case 2: female, 21 years and 6 months old when she was exposed to A-bomb radiation. The presumed exposure dose was more than 1,000 rad. Cataract due to A-bomb radiation and incipient cataract senilis. It was reported here that there was a marked difference in opacity findings of cataract due to A-bomb radiation in accordance with difference in exposure dose of radiation. It was also presumed from the findings of incipient cataract senilis that with increasing exposure dose, the aging phenomenon was promoted.

- 2633 EPIDEMIOLOGICAL STUDY ON PATIENT

EXPOSURE TO MEDICAL RADIATION. Kitabatake, T. (Niigata Univ. (Japan). School of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 35: No. 4, 228-242 (Apr 1975). (In Japanese).

Several aspects of radiation risk were studied: 1) epidemiology, 2) X-ray mass surveys, 3) factors related to patients dose, 4) clinical judgment and the indications for X-ray examination, 5) abdominal X-rays of women of child bearing age, 6) irradiation of the fetus, and 7) radiotherapy for benign disease. The survey results showed that 1) frequent fluoroscopic examinations may be related to late induction of leukemia, 2) radiation risk in X-ray mass surveys can be reduced by solving some technical problems and general problems of mass screening, 3) patients with high benefit health insurance tend to receive more X-rays than patients with low benefit insurance, 4) of 2000 patients on whom gastrointestinal tract X-ray examinations were requested, no necessity for the examination was recognized in 10% of the cases, 5) only about half of the female patients of child bearing age were checked for menstrual cycle at the time of an X-ray study, 6) radiodiagnostic histories of 1485 pregnant women showed that 22% were X-rayed at any time during the gestation period, with an over age dose of 61 mrad (a dose which would correspond to introduction of 19.5 excess leukemias in children under the age of 10 years), and 7) about 10% of the patients in radiotherapy departments are being treated for benign diseases. (Evans, J.).

2634 COMMON PROBLEMS IN THE SCIENTIFIC, INDUSTRIAL APPLICATIONS AND IN THE MEDICAL APPLICATIONS. FROM STUDY MEETING ON THE APPLICATION OF ^{252}Cf . Matsuoaka, O. (National Inst. of Radiological Sciences, Chiba (Japan)); Ueno, K.; Kawashima, K.; Enomoto, S.; Kobayashi, M. Radioisotopes (Tokyo); 24: No. 4, 262-272 (Apr 1975). (In Japanese).

Latent danger of ^{252}Cf was mentioned in problems on ^{252}Cf metabolism and injuries. Characteristics of ^{252}Cf radiation toxicity were considered from three points of character of emission radiation, chemical nature and metabolism within living body. Acute biological effect, delayed effect, nucleic nature and chemical nature of ^{252}Cf were also discussed. On radiation source engineering, raw materials of ^{252}Cf , manufacture of radiation source for medical and industrial use, safety estimation of radiation source were discussed.

2635 MEDICAL APPLICATIONS OF ^{252}Cf . FROM STUDY MEETING ON THE APPLICATIONS OF ^{252}Cf . Tsunemoto, H.; Umegaki, Y. (National Inst. of Radiological Sciences, Chiba (Japan)); Onai, Y.; Tsuya, A. Radioisotopes (Tokyo); 24: No. 4, 249-261 (Apr 1975). (In Japanese).

Problems to be considered when ^{252}Cf is used as radiation source of small radiation source therapy were mentioned as follows: a) decision of adaptation range for therapy, b) necessity of clinical discussion in normal tissue injuries, and c) necessity of discussion on biological effect of irradiation in tissues with low dose. Therapy with ^{252}Cf must be made by the "after lounding technique", and occupational exposure must be avoided. Problems on ^{252}Cf dosimetry and radiation protection were also described. The structure of small radiation source for medical applications and its clinical applications were also mentioned.

2636 LEVELS OF IRRADIATION OF THE INHABITANTS OF VYBORG DUE TO NATURAL γ -BACKGROUND OF THE TERRITORY AND THE BUILDINGS. Kataev, V.G. (Leningradskij Inst. Radiatsionnoj Gigieny

(USSR)). Gig. Sanit.; No. 4, 48-53 (Apr 1975). (In Russian).

The author classed the population according to the levels of γ -background and estimated the absorbed doses of external irradiation of the population and the gonad doses. The data obtained allow the radiation hygiene specialists to differentiate the means of investigating the connection of vitally important health indices of the population with small radiation doses.

2637 RADON IN TREATMENT OF INFILTRATING CARCINOMA OF URINARY BLADDER. Hendricks, E.D.; Massey, B.D.; Nation, E.F.; Gallup, C.A.; Massey, B.D. Jr.; Edwards, J.W. Urology (Ridgewood, N.J.); 5: No. 4, 465-469 (Apr 1975).

Shown here are the results from the use of radon in the treatment of 146 patients with infiltrating carcinoma of the bladder. Ninety-four percent of the tumors had invaded the muscle of the bladder; 54 percent were Stage B₂ or worse. Ninety percent of the radon implantations were done cystoscopically. Twenty-one percent of the patients survived five years or longer, free of recurrence. An additional 8 percent were cured by follow-up treatment of recurrences. Complications and morbidity are minimal. Survival results compare favorably with more dangerous and debilitating methods of treatment.

2638 (AD-A--013250) BIOLOGICAL MEASUREMENTS IN RODENTS EXPOSED CONTINUOUSLY THROUGHOUT THEIR ADULT LIFE TO PULSED ELECTROMAGNETIC RADIATION. SCIENTIFIC REPORT. Baum, S.J.; Ekstrom, M.E.; Skidmore, W.D.; Wyant, D.E.; Atkinson, J.L. (Armed Forces Radiobiology Research Inst., Bethesda, Md. (USA)). Apr 1975. 22p. (AFRRI-SR--75-11). NTIS \$3.25.

Rodents were exposed continuously for 94 weeks of their adult life to a total of 2.5×10 to the 8th power pulses from the AFRRI electromagnetic pulse (EMP) simulator which provides five pulses per second with a peak electric field intensity of 447 kV/m, a 5-nsec rise time and 550-nsec 1/e fall time. The following biological parameters were measured: blood chemistry, blood and bone marrow cellular concentration, chromosomal aberrations, erythrocyte production, effects on fertility and reproductive capability and appearance of tumors and other late effects. At no time before and particularly as the rodents approached the end of their life-span did any of the biological measurements indicate an effect of the EMP radiation. While it is extremely difficult to prove the absence of any injury, it can be unequivocally stated that EMP exposure presented no biological hazard to the rodents of the present study. (GRA)

2639 (NIOSH--75-171) SOCIOLOGICAL ANALYSIS OF THE REDUCTION OF HAZARDOUS RADIATION IN URANIUM MINES. Pearson, J.S. (Denver Univ., Colo. (USA)). Apr 1975. 137p. Public Health Service, Salt Lake City, UT.

The report describes the responses of companies, unions, and government enforcement agencies to the problem of excessive radiation in uranium mines resulting in respiratory cancer in Colorado chiefly between the years 1950 and 1969. It focuses on the organizational actions which ultimately solved the hazard as well as the non-technological factors that prevented an earlier solution of the problem.

2640 SUBCLINICAL NEUROPATHY AT SAFE LEVELS OF LEAD EXPOSURE. Seppalainen, A.M.; Tola, S.;

Hernberg, S.; Kock, B. (University Central Hospital, Helsinki). Arch. Environ. Health; 30: No. 4, 180-183 (Apr 1975).

Electrophysiological methods revealed subclinical neuropathy in 26 workers, exposed from 1 to 17 years to lead and whose blood lead (PbB) values had never exceeded 70 µg/100 ml, as ascertained by checking the monitor reports of the factory and by careful exposure history. The PbB determinations had been tested repeatedly and had been found valid. The main findings were slowing of the maximal motor conduction velocities of the median and ulnar nerves and particularly the conduction velocity of the slower fibers of the ulnar nerve. Electromyographical abnormalities comprised fibrillations, diminution of the number of motor units on maximal contraction, and an abnormally long duration of the units. Earlier similar measurements from heavily exposed workers had been even more abnormal. Thus, a dose-response relationship exists on a group basis. Since the regular monitoring of PbBs in most workers during their entire period of exposure excludes the possibility of a body burden out of proportion to the PbB slight neurological damage is produced at exposures hitherto regarded as quite safe.

2641 (COO--119-250, pp 128-137) INDUCTION OF OSTEOGENIC SARCOMA BY $^{239}\text{PuIV}$ (POLYMERIC) IN BEAGLES. Stevens, W. (Argonne National Lab., IL); Atherton, D.R.; Buster, D.S.; Grube, B.J.; Bruenger, F.W.; Lindenbaum, A. 31 Mar 1975.

Research in radiobiology. Annual report of work in progress in the internal irradiation program.

Previous studies in this laboratory have demonstrated the ability of monomeric $^{239}\text{PuIV}$ to induce osteogenic sarcomas in beagles when administered as a single injection in a wide range of doses. The latent period for induction decreased as the injected dose increased from 0.016 up to 0.9 µCi/kg ^{239}Pu . The effect of the chemical form of the injected ^{239}Pu on its distribution within the dog has been studied (1). At the time of these experiments, two additional dogs were injected with 0.9 µCi/kg of polymeric ^{239}Pu for lifespan studies. Both of those dogs have developed osteogenic sarcomas with latent periods similar to those in animals which received 0.9 µCi ^{239}Pu /kg of monomeric plutonium. Dose response calculations disclose that slow release of plutonium from the liver and subsequent protracted and apparently continuous deposition of the nuclide in the skeleton was much more effective in producing osteogenic sarcoma than deposition resulting from a single injection of monomeric plutonium.

2642 (COO--119-250, pp 182-187) CURRENT STATUS OF, AND OCCURRENCE BY SITE OF OSTEOSARCOMA IN BEAGLES INJECTED WITH RADIUM-226. Kimmel, D.B.; Taylor, G.N.; Dell, R.B.; Johnson, F.; Jee, W.S.S. 31 Mar 1975.

Research in radiobiology. Annual report of work in progress in the internal irradiation program.

A total of 76 osteosarcomas occurred in 58 beagles injected with radium-226. There were 15 sites examined for incidence with no obvious trends noted. The sites of the R2 (0.35 µCi ^{226}Ra /kg injected) osteosarcomas were distal femur, proximal femur, ischium, hard palate, and proximal humerus. The R1.7 (0.16 µCi ^{226}Ra /kg) osteosarcoma site was the cribriform plate. The osteosarcoma latent period became longer as the dosage of Ra-226 was decreased.

2643 (COO--119-250, pp 197-209) MAMMARY NEOPLASIA IN A CLOSED BEAGLE COLONY. Taylor, G.N.; Shabestari, L.; Williams, J.; Mays, C.W.; Angus, W.; McFarland, S. 31 Mar 1975.

Research in radiobiology. Annual report of work in progress in the internal irradiation program.

The incidence rate of mammary neoplasia in a large colony of beagles and its relationship to internal skeletal and/or liver radiation, age, relatively late ovariectomy (4 years and older), endometritis, parity status, and adrenal weight was examined. Of these various factors, age was the only condition that was clearly correlated with changes in the mammary tumor incidence. The rate became significant at approximately eight years of age and increased progressively throughout the successively older age classes. Within the female dogs, the incidence of mammary cancer was higher than that of any other form of spontaneous malignancy.

2644 (COO--119-250, pp 231-237) FISSION FRAGMENT INDUCTION OF BONE SARCOMAS. Mays, C.W.; Taylor, G.N.; McFarland, S.S.; Pollard, T.A.; Brammer, D.; Brammer, T.; Taysum, D.H. 31 Mar 1975.

Research in radiobiology. Annual report of work in progress in the internal irradiation program.

Fission fragments, emitted by the spontaneous fission of ^{252}Cf , were much less effective per unit energy than were α -particles in the induction of bone sarcomas in C57Bl mice. This agrees with a similar finding by A. L. Brooks et al. on the ineffectiveness of fission fragments from ^{252}Cf in producing chromosome aberrations in the livers of Chinese hamsters. The reduced effectiveness of fission fragments is attributed to their extremely high LET (about 4000 keV/µm of tissue) which results in fewer cellular traversals, and probably more overkill per cell traversed than occurs with the same dose of α -particles, for which the LET is about 135 keV/µm. The indicated RBE of fission fragments relative to α -particles in the induction of bone sarcomas was between the 95 percent confidence limits of (--) 0.85 and (+) 0.35. Our best estimate of the RBE is about 0.03, based on theoretical considerations.

2645 IONIZING RADIATIONS AND THEIR EFFECT ON THE SWISS POPULATION. Pretre, M.S. Rev. Polytech.; No. 3, 265, 271 (25 Mar 1975). (In French).

The radiation load of all the Swiss population is considered, including those occupationally especially exposed to radiation. The figures are expressed in man.rems/yr and then multiplied by the population at risk. It is thus shown that whereas radiation induced death from natural radiation might account for some 36 deaths/yr, hypothetical deaths from diagnostic radiography could be as high as 216/yr (although it appears to be assumed that every member of the population is so exposed each year), and thus the greatest immediate benefit could be obtained by reducing diagnostic dosages of x-rays.

2646 (LURI--1975-02) PATIENT DOSIMETRY AT MAMMOGRAPHY. Gustafsson, M. (Lund Univ. (Sweden). Radiofysiska Institutionen). Mar 1975. 22p. (In Swedish). INIS.

As mammography has become a frequently used diagnostic technique, it is important to estimate the radiation doses. Experiments with thermoluminescent dosimeters are described. The dosimeters were calibrated against an ionization chamber (Victoreen). The sensitivity

of the dosimeters was determined directly after the compression tube and behind 27 mm polystyrene. Dose measurements on patients are described and mean absorbed dose in the mammary gland is calculated. Finally use of more sensitive films to reduce patient doses is discussed.

- 2647 (N--76-19801) GONAD DOSAGE IN MALES RESULTING FROM X-RAY DIAGNOSTICS. Koen, J.A.; Huyskens, C.J. (Interuniversitair Reactor Instituut, Delft (Netherlands)). Mar 1975. 73p. (IRI--190-75-05). NTIS \$4.50.

The genetically significant dosage (GSD) resulting from x-ray diagnostics in Dutch hospitals was investigated. The frequency distribution of the dosage per patient was determined for eight x-ray diagnostic types which together produce about 90 % of the GSD. Some 6600 tests were carried out, and an estimate of 20 mrad was obtained for GSD in males. No correlation could be made between measured gonad dosage and the technical parameters of x-ray diagnostics. Some recommendations are made for possible further studies, which should result in suggestions for dosage-limiting measures. (GRA)

- 2648 RADIATION SAFETY IN FLIGHTS OF HIGH ALTITUDE AIRCRAFT. Kovalev, E.E.; Petrov, V.M. Kosm. Biol. Med.; 9: No. 2, 54-59(Mar 1975). (In Russian).

For English translation see the journal Environ. Space Sci..

AIRCRAFT;COSMIC RADIATION;DOSE RATES;IRRADIATION;MAN;RADIATION PROTECTION;SOLAR RADIATION;STRATOSPHERE;SUPERSONIC TRANSPORT

- 2649 THE OCCUPATIONAL EXPOSURE OF RADIATION WORKERS, I. Kawasaki, S.; Yamada, N.; Sakurai, K. (Yamaguchi Univ., Ube (Japan). School of Medicine). Yamaguchi Igaku; 24: No. 1, 33-38(Mar 1975). (In Japanese).

Because the medical use of x-rays and radioisotopes is gradually increasing for diagnosis and therapy, radiation workers, special doctors, nurses and radiological technicians have occupational exposure. Procedures for monitoring external exposure of personnel include the wearing of a film badge or a pocket chamber. The results of film badge monitoring in Yamaguchi University Hospital for the last 10 years were described. In 1964, the total number of film badges that radiation workers used during a 2 week period of radiological examination and therapy was 610. This has been increasing yearly, and in 1972 it was 1999. Radiological technicians generally had low occupational exposure, and about 90 per cent of their film badges were exposed to less than 10 mR. Approximately 65 per cent of the film badges that nurses used were less than 10 mR, but some nurses who worked in radium therapy at the isotope ward suffered large doses. Some nurses had occasionally exposure higher than 100 mR in radiological examination. Some doctors sustained an occupational exposure of more than 150 mR. From these data, some problems on radiation monitoring using a film badge were discussed.

- 2650 REPORT ON CYCLOTRON ACCIDENTS. Hoshasen Kagaku; 18: No. 3, 49-54(Mar 1975). (In Japanese).

Exposure accident in relation to a cyclotron is reported. The cyclotron was set up for cancer treatment, diagnosis of various diseases, and the production of short life isotopes, using neutrons. The aim of jobs and the arrangement of personnel at the time of the

accident are explained. Occurrence of injury of fingers was found, and the experiment for investigating the causes, and exposure dose estimation experiment were attempted. The course of the injured and the action taken after the accident are briefly reported. Accident prevention measures are proposed against further injury. (Yamamoto, Y.).

- 2651 MEASUREMENTS OF EXPOSURE IN CHEST X-RAY EXAMINATIONS CONDUCTED IN YAMAGUCHI PREFECTURE. Otsuka, A. (Yamaguchi Univ., Ube (Japan). School of Medicine); Oda, T.; Ito, Y. Nippon Hoshasen Gijutsu Gakkai Zasshi; 30: No. 6, 559-563(Mar 1975). (In Japanese).

In recent years, people have become increasingly concerned about radiations, especially those use in the medical field. In this situation, many radiological technicians are required to know about X-ray irradiation doses given to patients. It also is considered important for us to learn practical irradiation doses in X-ray examinations conducted in each hospital and clinic. Therefore, by taking an example of the chest X-ray examination which is one of the most popular diagnostic procedures, we measured the exposure in air just at the back of a 20 cm-thick thorax model made of foaming polystyrol at 30 different institutions in Yamaguchi Prefecture. In these measurements, pocket chambers and film badges were employed. As a result, the average exposure in air was found to be 23.5 mR $\pm$ 8.5 (SD).

- 2652 NOTES ON A PERIODICAL INSPECTION OF THE SKIN FOR RADIOLOGICAL HEALTH. Yoshizawa, Y.; Kusama, T. (Tokyo Univ. (Japan). Faculty of Medicine); Hoshino, M.; Ono, M. Hoken Butsuri; 10: No. 1, 13-16(Mar 1975). (In Japanese).

Published in summary form only.

INDUSTRIAL MEDICINE;INSPECTION;PREVENTIVE MEDICINE;RADIATION PROTECTION;RADIODERMATITIS;RADIOLOGICAL PERSONNEL;SAFETY;SKIN

- 2653 ISSUES OF THE MEETING OF THE MAIN COMMITTEE OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION (ICRP) IN BRIGHTON (ENGLAND, APRIL, 1973). Moskalev, Yu.I. Gig. Sanit.; No. 3, 93-95(Mar 1975). (In Russian).

For English translation see the journal Hyd. Sanit..

An information on dose limits of irradiation, reports of 4 committees of the commission, and ICRP committee members' communications on concepts and basic problems of radiation protection and measurements were presented at the meeting. It was decided to create several new working groups to develop basic standards of radiation protection based on existing radiobiologic information on effects of protracted radiation exposure and LET contribution to genetic and somatic effects of radiation. The first committee discussed the radiation dose limit problem, radiation protection and maximum tolerable levels for eye lens and skin exposure being of particular interest. Data on the genetic load from radiotherapy of young patients of reproductive age, and the relative significance of radiation-induced carcinogenesis and mutagenesis as tolerable dose limiting factors are analyzed. The second committee reported on the manual in preparation on dosimetry of incorporated radionuclides, with basic principles of calculation and reported actual figures of tolerable levels of radioisotope and radioactivity concentrations in air under conditions of professional irradiation (40-hr working week). The third committee was concerned with protection from external

radiation sources. A special group on patient protection in radiotherapeutic use of ionizing radiation has been formed. The joint working group of the third and fourth committees has continued its work on revision of the 5th ICRP publication on treatment and storage of radioactive material in hospitals and scientific institutions. The fourth committee reported on results for the 1972-73 period, concerning recommendations related to accidental irradiation, and radiation protection in uranium mines, also relevant to labor conditions elsewhere.

- 2654 CLINICAL TRIALS WITH NEW RADIATION MODALITIES. Bush, R.S. (Ontario Cancer Inst., Inc., Toronto). J. Can. Assoc. Radiol.; 26: No. 1, 54-63(Mar 1975).

It is suggested that the investigation of a new clinical modality involves a major commitment by the whole clinical group of the department involved and not just by the people chosen to be the primary investigators. As a base for comparison, it requires a detailed knowledge of the results and sites of failures and complications of the therapy used by that department. To make adequate relative biologic effect studies for the new modality, suitable comparative, quantitative tissue and tumor assays have to be done with photons and these could be done and established before the new modality came on line. For the Phase III trial, which is usually considered a randomized comparative trial, it can be argued (and a method is proposed) for the use of a non-randomized study to make the maximum use of patients coming to the center.

- 2655 ANIMAL EXPERIMENTS IN RADIOTHERAPY. I. SMALL ANIMALS. Kallman, R.F. (Stanford Univ. School of Medicine, CA). J. Can. Assoc. Radiol.; 26: No. 1, 15-24(Mar 1975).

From Annual meeting of the Canadian Association of Radiologists; Vancouver (22 Apr 1974).

This is a brief review of the contribution that the small laboratory animal, in particular the mouse, has made to experimental radiotherapy. Despite the great differences between mouse and man (e.g. size and life span), there are similarities of tissue cell kinetics and radiation response which greatly aid in the mouse-to-man extrapolation. The crucial advantage of being able to perform experiments with spontaneous tumors transplanted into syngeneic hosts is discussed. Examples are given of work using the tumor control dose (TCD₅₀) endpoint, the endpoint dilution assay, two different clone-counting assays, and the tumor regrowth system. The sophistication that can be achieved with an animal as small as a mouse is illustrated by two studies: one of prolonged intra-arterial catheterization, the other of blood flow measurements in an irradiated limb.

- 2656 DOSE AND EFFECT RELATIONSHIP OF RADIATION INDUCED CANCER AND ITS INFLUENCING FACTORS IN EXPERIMENTAL ANIMALS. I. Sasaki, S.; Sato, F.; Eto, H. (National Inst. of Radiological Sciences, Chiba (Japan)). Hoshasen Kagaku; 18: No. 3, 42-48(Mar 1975). (In Japanese).

The data of risk evaluation of external irradiation were integrated with animal experiments from the aspects of qualitative generalizations of characteristics of radiation induced tumors. Studies covered competition of cause of death, figure of dose-to-effect relationship, characteristics of low dose rate of irradiation, relative biological

effectiveness (RBE) of high LET radiation, effects of fractionated irradiation, complex actions with chemical substances, effects of protectional medium, differences of radiosensitivity by species and strains, and age dependency of sensitivities. Competition of cause of death by time length of latent period and degree of malignancy of the disease. Discussion on competition of death suggested the following idea: 1) incidence of tumor induction in the individual level did not correspond to transformation in the cellular level, and 2) relative incidence of tumor induction after a certain dose of whole body irradiation did not indicate the relative sensitivity of each tissue, for the relationship between tumor incidence and exposure dose was not a linear relationship. The dose-to-effect relationship of tumor induction was decided by the following factors: i) sensitivity on transformation of cells, ii) sensitivity on the death of potential tumor cells, and iii) competition of the cause of death. Tumor induction by low dose rate irradiation was also studied by comparing qualitative and quantitative differences between high dose rate single irradiation and a series of low dose rate irradiation.

- 2657 GENETIC EFFECTS OF ³²P IN SWINE. Reedy, P.P.; Ebenezer, D.N.; Krishna, M.; Reddi, O.S. (Osmania Univ., Hyderabad (India). Dept. of Genetics). J. Nucl. Agric. Biol.; 4: No. 1, 11-15(Mar 1975).

26 refs..

Genetic effects of ³²P administration in single dose and chronic doses has been studied in both male and female swine. Parameters measured were litter size at birth and weaning, sex ratio, neonatal and postnatal mortality, body weight and congenital abnormalities. Observations show that ³²P, in particular if administered in chronic doses causes chromosome breaks in male and female germ cells and therefore any indiscriminate use of ³²P in human medicine is fraught with genetic hazard.

- 2658 EFFECTS OF LOW DOSE X-RAY ON THE GENESIS AND DIFFERENTIATION OF THE CEREBROCORTEX. III. EARLY CHANGES OF UNDIFFERENTIATED CELLS OF THE NERVOUS SYSTEM OF THE CEREBRUM OF MOUSE EMBRYOS EXPOSED ON THE 10TH EMBRYONIC DAY. Hayashi, Y.; Hoshino, K.; Kameyama, Y. (Nagoya Univ. (Japan). Research Inst. of Environmental Medicine). Nago. Daigaku Kankyo Igaku Kenkyusho Nempo; 26: 152-154(Mar 1975). (In Japanese).

One systemic irradiation of 25 R and of 100 R (for comparison) of X-ray was performed on the 10th pregnant day of CF 1 mice, and the brain mantle of the embryos exposed in the placenta was observed under electron microscope 30 minutes, 1 hour, 2 hours, 3 hours, and 5 hours, after irradiation. In both 25 R and 100 R groups, there were observed two types of dense body 30 minutes after irradiation; one contacting the nucleus with an obscure border and the other being present apart from the nucleus and not being covered with the membrane. No prominent change was observed in the nucleus or membrane of cells possessing a dense body in the cytoplasm. Three hours after irradiation, there were numerous cells possessing a dense body covered with the membrane as well as nuclear concentration.

- 2659 EFFECTS OF LOW DOSE X-RAY ON THE GENESIS AND DIFFERENTIATION OF THE CEREBROCORTEX. II. OBSERVATIONS ON THE CELL CYCLE AND PYKNOSIS OF THE MATRIX CELLS OF THE END-BRAIN OF MOUSE EMBRYOS EXPOSED ON THE 13TH EMBRYONIC DAY.

Hoshino, K.; Hayashi, Y.; Kameyama, Y. (Nagoya Univ. (Japan). Research Inst. of Environmental Medicine). Nagoya Daigaku Kankyo Igaku Kenkyusho Nempo; 26: 150-151(Mar 1975). (In Japanese).

CF 1 mice were irradiated to 25 R or 100 R of X-ray on the 13th pregnant day. Immediately after irradiation ^3H -thymidine was injected, and litters were collected at intervals of 1-2 hours for the preparation of autoradiograms of the end-brains of the litters. The cell cycle and each stage of matrix cells of the end-brain were obtained by measuring the graph on which the rate of labeled mitotic cells in the matrix was plotted with the lapse of time. For the incidence of pyknosis more than 1000 Cells of the nervous system of the mantle of the end-brain were observed. The fluctuations of the cell cycle of end-brain matrix cells were more prominent in both the 25 R and 100 R groups than in the exposure on the 10th embryonic day, showing shortening of Stage S in proportion to dose, which was not observed in the exposure on the 10th embryonic day, as well as prolongation of Stage G₂. In addition, shortening of Stage G₁ was observed in the 100 R group. The incidence of pyknosis was higher in both the 25 R and 100 R groups than in the exposure on the 10th embryonic day. The 25 R group showed a peak of 8% 5 hours exposure, and the 100 R group showed two peaks, 35% 4 hours later and 45% 8 hours later.

- 2660 EXPERIMENTAL CEREBRAL DYSPLASIA PRODUCED BY X-RAY. CEREBROCORTICAL DYSPLASIA OF MICE DUE TO EXPOSURE TO 50 R OR 100 R IN THE EMBRYONIC STAGE. III. Kameyama, Y.; Hayashi, Y.; Hoshino, K.; Ito, Y. (Nagoya Univ. (Japan). Research Inst. of Environmental Medicine). Nagoya Daigaku Kankyo Igaku Kenkyusho Nempo; 26: 147-149(Mar 1975). (In Japanese).

CF 1 mice were irradiated to 50 R or 100 R of X-ray on the 17th embryonic day, and observations were made on the weight of brain, the thickness of cerebrocortex, the density of cortical cells, and the growth condition of the dendrite of nerve cells of exposed litters 6-52 weeks after birth. Similar observations to those in the previous report were made on the brain of litters exposed on the 10th, 13th, or 15th embryonic day, 52 weeks after birth. The group exposed on the 17th embryonic day showed no change in the weight of brain, the thickness of cortex, or the density of cortical cells, but a slight dysplasia of the dendrite of pyramidal cells was observed as was in litters exposed on the 15th embryonic day. Shortage of the cortical cell count in the 52nd week was observed only in litters exposed to 100 R on the 13th embryonic day.

- 2661 AUTOPSY CASE WITH MALIGNANT LIVER TUMOR CAUSED BY THOROTRAST. Sugiura, T.; Katayama, K.; Shinta, K. (Matsue City Hospital, Shimane (Japan)); Yamazaki, I. Shimane Igaku; 5: No. 3, 310-315(Mar 1975). (In Japanese).

This paper reported the roentgenographic, laparoscopic and autopsy findings of a patient with thorotrast liver complicated with malignant liver tumor, which was considered to develop 35 years after the infusion of thorotrast. Laboratory findings of a 67-year-old man, who got a war wound before 35 years and received angiography by using thorotrast at that time, indicated marked symptoms of liver parenchymal disturbance, biliary occlusion and malignant liver tumor. X-ray examination revealed arborescent and reticular abnormal shadow in the liver and the spleen and spotted shadow at the liver hilus. Laparoscopic findings revealed reticulate grayish-yellow particles adhered to the recessus of the

nodules in the surface of the liver. Liver biopsy showed deposition of thorotrast granules and necrosis and scar formation of the hepatic cells. Microautoradiography revealed α -track from the region where thorotrast was deposited. Postmortem findings revealed thorotrast liver cirrhosis, primary liver tumor (reticulo-endothelial sarcoma), circular calcium deposit in the hepatic duct, the bile duct and the portal vein, and cholangitis, demonstrating delayed disturbance by thorotrast.

- 2662 PRENATAL EFFECTS OF IODINE-131 IN MICE. Ebenezer, D.N.; Krishna, M.; Reddy, P.P.; Reddi, D.S. (Osmania Univ., Hyderabad (India). Dept. of Botany). J. Nucl. Agric. Biol.; 4: No. 1, 26-28(Mar 1975).

23 refs..

Pregnant mice of C₃H/He strain were injected intraperitoneally with 10 μCi of radioiodine on 3.5 day of gestation and allowed to go to term. There was no effect of isotope on the mortality and fertility of treated mice although the data showed an apparent reduction in respective parameters. The litter size recorded at birth was significantly ($P < 0.05$) lower than in control indicating the marked effect of radioiodine on the embryos dying at pre- and post-implantation levels. Further, reduction in litter size recorded at weaning was due to neo- and post-natal mortalities. The data on sex-ratio and body weights in experimental group did not differ significantly ($P < 0.05$) from those obtained in the control group.

- 2663 DETERMINING OF THE GENERAL ACTIVITY OF TRITIUM IN AN ALIVE BODY. Bogdanov, K.M.; Kalinina, E.V.; Kossova, G.V.; Romanovskaya, L.D. (Moskovskij Gosudarstvennyj Univ. (USSR). Biologo-Pochvennyj Fakul'tet; Akademiya Meditsinskikh Nauk SSSR, Obninsk. Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii). Gig. Sanit.; No. 3, 88-90(Mar 1975). (In Russian).

For English translation see the journal Hyg. Sanit..

The proposed technique includes sampling of 1 to 3 ml of venous blood which is subjected to chemical analysis and further calculation of general activity of the aqueous phase of host and that of tritium involved in metabolism of biochemical structures. The total isotope concentration in the host is obtained by summarizing these data. The in vivo measurements of the general tritium activity well provide an effective means of controlling the health of people dealing with radioactive hydrogen, and a direct diagnostic method of detecting hydrogen metabolism fluctuations and, therefore, to follow protein and fat metabolism in human biochemical structures in normal conditions and in case of pathology.

- 2664 INVOLVEMENT OF T- AND B-LYMPHOCYTES IN THE IMMUNE RESPONSE TO THE PROTEIN EXOTOXIN AND THE LIPOPOLYSACCHARIDE ANTIGENS OF VIBRIO CHOLERAE. Kateley, J.R.; Patel, C.B. Friedman, H. (Albert Einstein Medical Center, Philadelphia). Ann. N.Y. Acad. Sci.; 249: 404-412(28 Feb 1975).

The immune response at the level of individual immunocytes to the somatic lipopolysaccharide antigen derived from whole *Vibrio cholerae* and to the purified protein exotoxin from this organism were studied in terms of the role of T- and B-lymphocytes. By adoptive cell transfer studies with irradiated recipient mice, it was shown that normal spleen cells from normal syngeneic mice could readily transfer the capability of responding to both types of cholera antigens. However, when the

spleen cells were depleted of T-cells with anti-theta serum and complement, antibody responsiveness to the LPS antigen, but not the exotoxin, could be achieved in recipients. Furthermore, by appropriate transfer of either bone marrow, thymus, or thymus-marrow cell mixtures to irradiated mice, it was shown that the response to the cholera somatic antigen was relatively independent of thymus cells, whereas the response to exotoxin required "helper" T-cells.

- 2665 URINARY EXCRETION OF ^{87}Rb IN UNEXPOSED INDIVIDUALS. Holgye, Z. (Ustav Hygieny Prace v Uranovem Prumyslu, Pribram (Czechoslovakia)). Cas. Lek. Cesk.; 114: No. 6, 175-177 (Feb 1975). (In Czech).

The amount of ^{87}Rb in the urine of 25 non-exposed male adults was investigated. It was found that the mean daily amount excreted by these individuals was 32.9 pCi ^{87}Rb /day corresponding to 1.73 mg Rb/day, the specific activity of ^{87}Rb being equal to 1.9×10^{-8} Ci/1 g Rb.

- 2666 RESULTS OF CLINICAL AND HYGIENIC OBSERVATIONS OF LABOUR CONDITIONS AND THE STATE OF HEALTH OF PERSONNEL AT RESEARCH REACTOR FACILITIES. Moiseitsev, P.I.; Denisova, E.A.; Korlyakova, E.A.; Sizikova, N.V. At. Energ. (USSR); 38: No. 2, 90-93 (Feb 1975). (In Russian).

For English translation see the journal Sov. J. At. Energy.

Complex studies of operating conditions and health status of the personnel employed in research reactors or in critical assembly have been undertaken in order to define more precisely the regulations, requirements, and norms of radiation safety to be applied during the designing and operation of various facilities. The main potential sources of external radiation, dose rates for gamma radiation, neutron fluxes, and maximum annual doses received by personnel under normal reactor operation have been determined. Clinical physiological studies have shown that the health of the personnel employed at nuclear reactors is satisfactory.

- 2667 (AD--A029400) COMPARISON OF ENVIRONMENTAL IMPACTS OF COAL AND NUCLEAR SYSTEMS FOR MILITARY UTILITY APPLICATION AND CONSEQUENCES OF REACTOR ACCIDENTS. FINAL REPORT. Doyle, M.R.; Golay, M.W.; Rasmussen, N.C. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Feb 1975. Contract DAAK02-74-C-0308. 126p. NTIS (US Sales Only) \$6.00.

This study compares the environmental impacts of a coal district heating station and a high temperature gas cooled reactor total energy system. In addition, the consequences of nuclear accidents are predicted. Radioactive, chemical and thermal emissions from the two plants are determined and methods of control are discussed. The costs of control systems are estimated from a variety of sources including current prices provided by manufacturers. The consequences of nuclear accidents are predicted by use of the computer model developed for the Wash 1400 Reactor Safety Study of the Atomic Energy Commission. This model predicts the number of acute deaths, illnesses, cancers, and genetic diseases and the monetary cost which would be expected from the worst possible accident at the nuclear plant. (Author) (GRA)

- 2668 METHODS FOR REDUCING EXPOSURE TO PERSONNEL LEAK-TESTING SEALED RADIUM SOURCES.

Pasternak, T.J.; Bohning, D.E.; Vacirca, S.J. Health Phys.; 28: No. 2, 111-121 (Feb 1975).

A proposed method of leak-testing a drawer containing sealed radium source is described: if the result of an initial wet wipe of the upper surface of the drawer is positive, the sources are tested individually, starting with the one having the least activity and ending as soon as a contaminated source is found, with the exception that the last (highest activity) source is never tested since it is inferred to be the leaker if no preceding source has been found to be contaminated. Detailed evaluation of this procedure is given. Consideration is also given to storage arrangements: using the recommended leak-testing procedure, exposure is minimum when the distribution of sources among drawers is as alike as possible with respect to the number, arrangement and activity of sources per drawer.

- 2669 BENEFIT VS RISK IN THE PRACTICE OF NUCLEAR MEDICINE. Loken, M.K.; Payne, J.T. (Univ. of Minnesota, Minneapolis). Minn. Med.; 58: No. 2, 173-186 (Feb 1975).

Uses of radioisotopes in the practice of medicine have increased several fold during the past two decades leading to the establishment in 1972 of certification in the specialty of Nuclear Medicine by the National Board of Medical Examiners. An overview of radiation exposures to patients undergoing Nuclear Medicine procedures has been presented along with considerations of benefits that patients might derive from having had these procedures performed. Specific reference has been made to representative procedures in which specific radiopharmaceuticals are administered to patients. The radiation dose to patients is shown to be quite low for most procedures, almost always less than that delivered during comparable radiologic procedures. The risk from low doses of radiation has been conservatively estimated by extrapolating to zero dose from data on radiation effects observed at high dose levels. Thus, this conservative estimate represents the maximum risk, with the actual risk likely to be considerably below this value. This fact has been substantiated in many experiments in radiation biology in which a radiation dose has been delivered using several fractionated smaller doses, allowing for repair and recovery between each dose and thus reducing the radiation effect from that which would have occurred had the radiation been delivered acutely.

- 2670 (DHEW/FDA--75-8020) AUTOMATION OF SCHEDULING AND FILE ROOM FUNCTIONS OF A DIAGNOSTIC RADIOLOGY DEPARTMENT. VOLUME I. Lazarus, C.B.; Poitras, J.W.; Mitchell, W.P.; Knowlton, R.H.; Kaley, M.E.; Ianello, J.M.; Arenson, R.L.; Taveras, J.M.; Barnett, G.O. (Massachusetts General Hospital, Boston (USA)). Feb 1975. Contract FDA 72-71. 163p. GPO \$2.35.

The automation of patient scheduling and file room functions of a diagnostic radiology department has been successfully accomplished at the Massachusetts General Hospital. Carried out under contract from the Bureau of Radiological Health, the pilot system includes scheduling, file room, and registration modules. The system has resulted in a reduction in delays in obtaining examinations and reports, and reduction in unnecessary radiation by allowing for the detection of possible duplicate, similar, or conflicting examinations. Film tracking ensures knowledge of the location of a master folder at all times.

2671 (IAEA-R--1365-F) COMPUTERIZATION OF THE ISODOSE DISTRIBUTION OF HIGH-ENERGY ELECTRONS IN HUMAN TISSUES. FINAL REPORT FOR THE PERIOD 15 MAY 1973 - 14 MAY 1974. Poretti, C. (International Atomic Energy Agency, Vienna (Austria)). Feb 1975. vp. NTIS (US Sales Only).

High energy electron beams are used very often for the treatment of cancer and the representation of the isodose distributions in case of radiation therapy with electrons is an absolutely necessary step for the improvement of the therapeutical results. Only a computer calculated plan can give the physicians the possibility to choose the right treatment plan between different proposals. Within the terms of this contract, a semi-automatic device for the digitalization of the electron isodose curves and contours is designed and constructed. It transfers the graphic information into a 13 bit BCD digital signal and can be stored on a paper tape with ASCII code. The paper tape can be converted in EBCDIC code by MDS2400 and be taped on a magnetic tape. A set of different computer subprograms enables the transfer of the data from the magnetic tape into the main program for the subsequent calculation of the isodose distributions in the body. The trial calculations with a IBM/370 computer has been successfully completed and some examples have been presented.

2672 (SSI--1975-009) GENERAL GUIDE-LINES FOR PERMISSIBLE RADIATION DOSES TO REVISION PERSONNEL OR THE LIKE AT NUCLEAR POWER PLANTS. Snihs, J.O. (Statens Stralskyddsinstitut, Stockholm (Sweden)). Feb 1975. 3p. (In Swedish). INIS.

It is both possible and reasonable, according to experiences so far, to keep the collective professional radiation dose to production and service personnel at a nuclear power plant below 0.2 manrem per year and MWe. Almost half the total professional irradiation may arise in connection with the revisions. For a nuclear power plant of the size 1000 MWe the revision work would imply 100 manrem per year. The mean value of the radiation dose to personnel professionally exposed is below 0.5 rem per year. If this mean value is applied to revision personnel 100 manrem per year would imply a staff of 200 persons working with radioactivity.

2673 NATURAL BACKGROUND RADIATION EFFECTS ON HUMAN BODIES. Eto, H.; Muramatsu, S. (National Inst. of Radiological Sciences, Chiba (Japan)). Hoshasen Kagaku; 18: No. 2, 21-26 (Feb 1975). (In Japanese).

The relationship between long-term exposure of low level natural background radiation and possible hazards were discussed referring to literature of various foreign countries. The frequencies of osteosarcoma, leukemia, cancer, and congenital malformation, and neonatal death rate, were compared between probable presence area and unlikely presence area. There were no significant differences between two types of areas because background radiation contributed slightly and other factors also corresponded. Researches in India and Brazil where background radiation was high were described.

674 CASE REPORT OF NECROSIS OF THE FEMORAL HEAD DUE TO RADIATION THERAPY IN INFANCY. Sekiguchi, K.; Kimura, H.; Kojima, T.; Takagi, H.; Miura, Y. (Tokyo Medical Coll. (Japan)). Kanto Seikei Geka Saigai Geka Kai Zasshi; 6: No. 1, 16-22 (Feb 1975). (In Japanese).

A case of necrosis of the femoral head due to radiation therapy of the hip joint in early infancy is presented. The patient (a seven-year-old female) who had been diagnosed as malignant melanoma four months after birth, received radiation therapy of 6500 R by a betatron. She also received radiation therapy of 8100 R after the radical operation. When she was two years old, a diagnosis of necrosis of the femoral head was made. When she was four, she had extreme lameness of the right leg. Subtrochanteric osteotomy was performed at the diseased site of the right hip joint, and a patho-histological study was made of a biopsy. The authors also report the microangiographical and patho-histological studies of fifty young rabbits which had received 300 rads and 6000 rads of Linac X-ray.

2675 BIOLOGICAL PROBLEMS OF PLUTONIUM. Matsuo, O. (National Inst. of Radiological Sciences, Chiba (Japan)). Genshiryoku Kogyo; 21: No. 2, 13-19 (Feb 1975). (In Japanese).

Toxicity of ^{239}Pu in vivo was discussed from the aspects of its physical, chemical, and in vivo metabolic characteristics. Biological actions of ^{239}Pu in vivo shown in literature, i.e., acute and late toxicities, and hazards of human bodies, were summarized. The proposition made by Tamplin, and arguments against it controverted by Bair et al. were discussed, and the significant problems of the controversy were as follows: 1) significance of the methodology of assessing the biological hazards, 2) shortage of radiobiological data concerning internal exposure by hot particles, 3) difficulty of extrapolating the data from experimental animals to those of human being, and 4) specificity of α -ray hazards. The maximum permissible dose would be restricted much more strictly.

2676 (DPST--74-551 (Rev.)) GAMMA EXPOSURE RATES IN THE STEEL CREEK AND LITTLE HELL LANDING AREAS. Marter, W.L. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA)). Savannah River Lab.). 20 Jan 1975. 23p. Dep. NTIS \$3.50.

Aeroradiographic and ground transect γ surveys in the summer of 1974 were conducted to determine the degree of offsite radioactive contamination in an area immediately below the Savannah River plant boundary. Since it is recognized that mechanisms in the biosphere tend to cause nonhomogenous distribution and redistribution of radionuclides released to the environment, a plan was developed to continually evaluate the radioactivity of the offsite area. As part of this plan, a 1300-foot-long section of offsite swamp (42.9 acres) adjacent to the SRP boundary was surveyed in the latter half of October 1974 on a 10-foot grid pattern. The results of this survey show that 6.6 of the 42.9 acres surveyed in detail has γ exposure rates exceeding 57 $\mu\text{R/hr}$ (approximately 500 mR/yr). The maximum exposure rate found at a single grid point was 120 $\mu\text{R/hr}$. Approximately 5.8 Ci of ^{137}Cs was deposited in the 42.9-acre 10-foot grid survey area. It was calculated a hypothetical person residing continuously in the location of highest exposure rate when the swamp is not flooded (77 percent of the time each year) could receive an annual dose of about 809 mR. Previous surveys of this area indicated a maximum external annual dose of 357 mR under the same residency conditions. Even with the higher exposure rates detected in the 10-foot grid survey, the more probable incremental radiation dose (above background) to hunters and fishermen who spend a few hours to a few hundred hours in this section of swamp would range from less than 1

mR to a few tens of mR per year. (auth)

- 577 SPONTANEOUS MOTILITY EEG, AND SLEEP-WAKEFULNESS CYCLE DISTURBANCES IN RATS SUFFERED FROM FETAL X IRRADIATION. Kiyono, S.; Seo, M.; Takasu, K.; Shoji, R.; Takeuchi, I.; Murakami, U. (Inst. for Developmental Research, Aichi, Prefectural Colony, Kasugai, Japan). J. Phys. Soc. Jpn.; 37: No. 1, 4-6(1 Jan 1975).

In accordance with the recent development of behavioral studies in prenatally x-irradiated animals, several works have revealed functional changes in the maze learning and avoidance conditioning in those subjects. Since no reports, however, have examined the effects upon the sleep-wakefulness cycle except that of the acute lethal influence, preliminary results were presented in this paper.

- 2678 DETERMINATION OF THE ^{210}Po CONTENT IN THE URINE OF FILIPINO SMOKERS AND NON-SMOKERS. Juan, N.B.; Cruz, W.; Ballelos, E.; Bartolome, Z.M. (Philippine Atomic Energy Commission, Quezon City). Philipp. Nucl. J.; 3: No. 1, 243-246(Jan 1975).

The polonium content in the urine of Filipino smokers was compared with that of nonsmokers. The polonium was recovered from urine by centrifugation and deposition into silver discs. Quantitative results were obtained by counting the silver discs using a silicon surface-barrier detector. The average value obtained for smokers which was 0.5003 ± 0.2988 pCi/24 h sample was significantly higher than the value obtained for non-smokers which was 0.2313 ± 0.1664 pCi/24 h sample.

- 2679 APPLICATION OF THERMOLUMINESCENT DOSIMETRY IN X-RAY DIAGNOSTICS. Doubravsky, J.; Lidova, L.; Kamenicek, O. (Palackeho Universita, Olomouc (Czechoslovakia). Lekarska Fakulta). Cesk. Radiol.; 29: No. 1, 1-6(Jan 1975). (In Czech).

The radiodiagnostic application is discussed of thermoluminescent dosimetry using lithium fluoride (LiF). The use of thermoluminescent dosimetry in skiagraphic examinations is dealt with taking into consideration radiation load of gonads in hysterosalpingography. The advantages of thermoluminescent dosimetry are shown.

- 2680 OXYGEN-DEPENDENT EFFECT OF DOSE RATE IN γ -IRRADIATED PROTEINS. Kharchenko, L.I.; Pavlovskaya, T.E. (AN SSSR, Sverdlovsk. Inst. Khimii). Radiobiologiya; 15: No. 1, 21-26(Jan 1975). (In Russian).

For English translation see the journal Radiobiology.

The number of oxygen atoms bound per molecule of human serum albumin, gamma-irradiated in 10% solution at the maximum dose used (1000 kR), is 2.24, 2.62, 3.15 and 3.90 for dose rates 400, 200, 100 and 50 R/sec, respectively. The observed decrease in efficiency of irradiation at higher dose rates is explained by a rapid uptake of oxygen by radiation-chemical reactions which creates a hypoxic state in the object studied. It is supposed that the oxygen-dependent effect of dose rate can be found in all objects, provided the appropriate choice of intensity and total dose of irradiation is made.

- 2681 (AD-A--022183) ON THE STRINGENCY OF DOSAGE CRITERIA FOR BATTLEFIELD NUCLEAR OPERATIONS. Cohen, S.T. (RAND Corp., Santa Monica, Calif. (USA)). Jan 1975. 24p. (P--5332). NTIS \$3.50.

The major emphasis has been placed on dosage criteria for the production of a specified reduction in combat effectiveness, for relevant military tasks, within a given period after exposure. This has taken the form of determining a single dosage to describe the radiobiological effectiveness of a tactical nuclear weapon. The requirement for this dosage is that it produces a severe performance degradation within a short time after exposure and that the effect represents a specific human response -- i.e., permanent combat ineffectiveness. Such factors as transient incapacitation; delayed casualties and fatalities; less than severe performance degradation; and performance degradation resulting from synergistic relationships between weapon effects have not been given serious or adequate attention. (GRA)

- 2682 (NIRS-M--7, pp 77-79) OUTDOOR AND INDOOR DOSES. Fujimoto, K.; Abe, S. Jan 1975. (In Japanese).

From 1. NIRS seminar; Chiba, Japan (15 Feb 1974).

Methods and techniques for measurement of environmental radiation.

Human beings begin to be exposed to direct and indirect artificial radiation with the recent use of radioisotopes, artificial radiation sources and nuclear reactors, besides natural radiation. Even though these doses are very small in amount, their values as considered for the whole people in the country must be grasped always for future reference. The problems to be considered in case of obtaining the relation between indoor and outdoor doses and indoor dose rate were investigated. Here, population dose means gonad dose or bone marrow dose. The examination using multiple sampling is difficult to realize. So it is required to determine the population dose based on the surveys of lifeactivity and movement of population by determining typical dose in various environmental stages, as the second best plan. The proposal to estimate the present average dose in Japan is shown. Estimated values for natural radiation contribution are 36 mrad/y for earth origin, 26 mrad/y for cosmic ray contribution; total 62 mrad/y.

- 2683 (NIRS-M--7, pp 80-84) POPULATION DOSE ESTIMATION. Kato, Y. Jan 1975. (In Japanese).

From 1. NIRS seminar; Chiba, Japan (15 Feb 1974).

Methods and techniques for measurement of environmental radiation.

Critical organs in the individual or group injury due to radiation exposure are gonad and bone marrow. Estimation of the injury is performed with gonad dose and bone marrow dose, respectively. It is performed with genetically significant dose and leukaemia significant dose for groups. Estimation of the dose absorbed into the critical organs and population dose (significant) is described, but in limited case of photons. Tissue equivalent phantom must be utilized to determine the absorbed dose of critical organs. Absorbed dose distribution in human body is more complex because environmental radiation is not parallel beam, but impinges from 4 π directions, and its flux is directional. Simple explanation on both gonad dose and bone marrow dose is conducted. In estimating population dose, it is necessary to multiply the weight based on individual condition. The dose determined in accordance with the above concept is significant dose. Genetically significant and leukaemia significant doses are defined. Though the

United Nations Scientific Committee employs average bone marrow dose per year per man instead of the leukaemia significant dose, the Committee will transfer to use the significant dose corrected with weighting factor in future.

2684 STUDIES OF RADIATION HAZARDS.

Kumatori, T. (National Inst. of Radiological Sciences, Chiba (Japan)). Karada No Kagaku; No. 9, 61-66 (Jan 1975). (In Japanese).

The author reviews studies about radiation hazards in Japan, particularly the exposure to radiation in Nagasaki, Hiroshima and Bikini. The report by Dr. Masao Tsuzuki on the effect of radiation is summarized in the item concerning radiation hazards attributed to atomic bombs. It describes research studies of delayed radiation induced hazards, such as intrauterine exposure, cataract and malignancy from the reports of investigations conducted by ABCC (Atomic Bomb Casualty Commission) and from other reports. In addition, exposure dose and residual radioactivity are discussed, as well as the outline and process of hazards relative to the exposure at Bikini.

2685 SAFETY AND PROBLEMS IN USING RADIOACTIVE DRUGS IN HOSPITALS. Arimizu, N. (National Inst. of Radiological Sciences, Chiba (Japan)). Genshiryoku Kogyo; 21: No. 1, 17-20 (Jan 1975). (In Japanese).

The safety and the control problem of non-closed RI (radiopharmaceuticals) of which use has rapidly been increased, were studied. At present, the hospitals with an independent clinic for the nuclear medicine are very limited and many doctors, nurses and safety controllers who are working in the clinic belong to other clinics. As for the diagnosis using RI examination, the dangers of the persons who are working with radioimmunoassay, especially using Au-antigen kit were studied. Furthermore, the problems concerning the reduction of exposure dose by the use of a short half-life RI, such as ^{99m}Tc and the dangers of external exposure on the persons who use the isotope were studied. In addition, the control of RI ward for RI therapy was discussed. The author considered the specialization and fixation of doctors, nurses and technicians are becoming of necessity with the advancement of RI therapy. In addition, the necessity of training nurses for the nuclear medicine was insisted on.

2686 REDUCTION OF PATIENT EXPOSURE IN ROUTINE X-RAY DIAGNOSIS. Koga, S.; Naito, Y.; Sawada, T. (Fujita-Gakuen Univ., Aichi (Japan). School of Medicine). Rinsho Hoshasen; 20: No. 1, 67-70 (Jan 1975). (In Japanese).

Exposure in X-ray diagnosis was critical in spite of the fact that exposure dose of each examination was little, because the exposed population was large. In our study, exposure dose by routine diagnostic roentgenography could successfully reduce to 20 per cent of that under the standard condition. Reduction of exposure dose was achieved by using intensifying screen, such as MS, LT-II, and MSS for examination of infant pelvis, and obstetrical abdomen, and film as Sakura QS or Fuji Rx-s. X-ray quality was hardened by adding filter of 2mm Al, and total filtration was made up to 4 mm Al equivalent. Tube voltage was elevated to obtain favorable picture within short exposure time. Victoreen r-meter and Kyokko TLD1200 Type, elemental device included in Mg_2SiO_4 glass capsule, and water phantom were used for dosimetry. Area exposure dose in fluoroscopy was measured in the digestive tract exam. using Hitachi dose monitor. Above

mentioned exposure factors were combined, and under each conditions, exposure dose of the skin in various regions of the body. Chest roentgenography using LT-II screen showed 25 m of exposure dose obtaining 63 per cent reduction from standard roentgenography without screen. Furthermore, use of QS film decreased the exposure dose to 17 mR (43 per cent), and added 0.5 mm Al filter reduced it to 13 mR (33 per cent). Finally, filter of 0.3 mm Cu and 0.5 mm Al reduced it to 8 mR (20 per cent of standard exposure dose).

2687 RADIATION PROTECTION IN UNIVERSITIES.

Morikawa, N. (Tokyo Univ. (Japan)). Genshiryoku Kogyo; 21: No. 1, 21-23 (Jan 1975). (In Japanese).

Characteristics of the RI usage in universities are examined, and the problems of safety management are pointed out. Considering these factors, countermeasures are suggested for facilities, management organization and education and training. The facilities should be divided into two radiation levels, low and high. In the University of Tokyo "Radiation operator notebook" is utilized, and "Inspection system for radiation safety management" is examined.

2688 BIOLOGICAL ASPECT ON RADIUM THERAPY, AND APPROACH TO NEW RADIOTHERAPY BY SEVERAL SESSIONS A DAY. Mochizuki, S. (Jikei Univ., Tokyo (Japan). School of Medicine). Gan No Rinsho; 22: No. 2, 111-115 (Jan 1975). (In Japanese).

Through radiobiological study of treatment with radium, it was revealed that radium therapy has two such important features as (1) short overall treatment time and (2) low-dose rate irradiation and that it showed a higher therapeutic ratio than that of conventional high-dose rate fractionated irradiation. After searching for a high-dose rate irradiation method with these advantages of radium treatment, results were obtained which suggested the possibility of new radio-therapy with several sessions a day. In the new method, a small dose was applied several times a day. Then, the time-dose relationship of the new therapy was investigated, and an attempt was made to calculate the dose fractionation that seemed practical. The results obtained were in good agreement with those of Svoboda's recent clinical experience. However, since these results were based on many biological hypotheses, clinical application of them at present is risky. Prior to clinical application, it will be necessary to conduct a number of animal experiments.

2689 SOME ASPECTS OF BREEDING ECOLOGY OF WILD RODENTS IN CONNECTION WITH LIFE IN BIOGEOCENOSSES POLLUTED WITH ^{90}Sr . Isaev, S.I. (AN SSSR, Moscow. Inst. Morfologii Zhivotnykh). Ekologiya; No. 1, 45-51 (Jan 1975). (In Russian).

For English translation see the journal Ecology.

BIOLOGICAL RADIATION EFFECTS; CHRONIC IRRADIATION; CONTAMINATION; ECOSYSTEMS; EMBRYOS; FERTILITY; MORTALITY; POPULATION DYNAMICS; REPRODUCTION; RODENTS; SOILS; STRONTIUM 90

2690 ACTION OF IONIZING RADIATION ON CATALASE SYNTHESIS IN THE RAT LIVER. Komov, V.P.; Streikova, M.A. (Leningradskij Khimiko-Farmatsevticheskij Inst. (USSR)). Radiobiologiya; 15: No. 1, 111-113 (Jan 1975). (In Russian).

For English translation see the journal

Radiobiology.

3-amino-1,2,4-triazole was used to study the effect of total-body X-ray irradiation on the rates of catalase synthesis and breakdown in rat liver. It was found that in the interval between hour 22 and hour 144 of radiation sickness, the average rate of catalase synthesis in the liver was 2.6 times lower in rats that received a dose of 800 rads than in control rats.

- 2691 COMPARATIVE EVALUATION OF RADIATION DAMAGE TO THE INTESTINE IN LABORATORY ANIMALS DIFFERING IN RADIOSENSITIVITY. Fedotova, M.I.; Belousova, O.I. Radiobiologiya; 15: No. 1, 151-154 (Jan 1975). (In Russian).

For English translation see the journal Radiobiology.

The total number of cells in the duodenum of animals differing by radiosensitivity (Wistar rats, guinea pigs and rabbits) was determined at the time of the maximum fall in the quantity of such cells after irradiation with doses from 100 to 5000 R. The dynamics of cell number after 900, 1200 and 5000 R irradiation was also studied. The fall in the cell number was dose-dependent in the dose range of 1200 to 1500 R and the extent of devastation for a single dose varied with the species. A two-fold decrease in the cell number (CD_{50}) was observed at 500, 650 and 750 R for rats, rabbits and guinea pigs, respectively. Increasing the dose from 1500 to 5000 R did not result in any further fall of duodenum cell number in rats and guinea pigs (1200 R was the absolutely lethal dose for rabbits). The devastation process was the most rapid and pronounced in rats; in rabbits, and especially in guinea pigs, it developed slower and to a lesser extent.

- 2692 CHEMICAL PROTECTION OF MICE AGAINST REPEATED NEUTRON-IRRADIATION. Kavukchyan, T.V.; Sverdlov, A.G. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). Radiobiologiya; 15: No. 1, 74-78 (Jan 1975). (In Russian).

For English translation see the journal Radiobiology.

Radioprotective effects of chemicals have been studied using repeated neutron irradiation of mice at a dose of 3×100 rad and 2- and 4-day intervals between the treatments. Higher survival and efficiency of chemical radioprotection (Cystaphos-44.8%, cystamine-32%, mexamine-21%) have been observed for such mode of irradiation as compared to the single treatment with the same dose. This effect is attributed to the recovery processes taking place in the critical organs - the intestine and bone marrow.

- 2693 ACTION OF POLYVINYLSULPHATE ON METABOLISM OF NUCLEIC ACIDS AFFECTED BY RADIATION. Kharitanovich, N.P.; Dokshina, G.A.; Pegel, V.A.; Yartsev, E.I.; Yashunskii, V.G. (Institut Biofiziki, Moscow (USSR); Tomskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Biologii i Biofiziki). Radiobiologiya; 15: No. 1, 104-107 (Jan 1975). (In Russian).

For English translation see the journal Radiobiology.

Polyvinyl sulphate (PVS) as a nuclease inhibitor was used to protect endogenic nucleic acids from irradiation-activated nucleases. The survival of 700 rad irradiated rats was 33% and 60% in the control and PVS-treated (25 mg/kg) groups, respectively. PVS intravenously injected to 1000 R irradiated animals at 50 mg/kg inhibited DNase I in the liver and spleen and stimulated DNase 2 in the liver. A partial restoration of DNA level in the liver was

observed simultaneously with the inhibitory effect on alkaline nucleases (no restoration effect had been found in the spleen).

- 2694 ACTION OF THRICE- AND FIVE-TIMES REPEATED EXPOSURES OF RATS TO A LOW DOSE OF X-RAYS ON THE CARBOHYDRATE-ENERGY METABOLISM OF THE BRAIN. Mironova, T.M.; Cherkasova, L.S.; Fomichenko, V.G. (AN Belorusskoj SSR, Minsk. Inst. Fiziologii). Radiobiologiya; 15: No. 1, 42-45 (Jan 1975). (In Russian).

For English translation see the journal Radiobiology.

Rats have been subjected to whole-body X-irradiation either 3 times with 2- and 3-day intervals and the total dose of 40 R or 5 times with 3-day intervals and the total dose of 50 R. One day after the end of the 3 times irradiation course the following concentrational changes have been observed in brain hemispheres: increase in the biologically active glycogen-protein complex and creatine phosphate, and decrease in glucose-1-phosphate; after the 5 times irradiation course the changes have not been significant, though an elevated corticosterone level in blood has been noted in both cases. 9 to 15 days after the quintuple irradiation a discoordination of glycogenolysis processes against the background of lowered corticosterone level has been observed. The trend towards restitution of metabolism becomes apparent at the normal hormone level. The glycogenlipid complex has probably an adaptive function.

- 2695 MECHANISM OF RADIATION INDUCED CHANGES IN THE HETEROGENEOUS SYSTEM OF HAEMOGLOBIN. Starodub, N.F. (AN Ukrainskoj SSR, Kiev. Sektor Molekulyarnoj Biologii i Genetiki). Radiobiologiya; 15: No. 1, 27-31 (Jan 1975). (In Russian).

For English translation see the journal Radiobiology.

Alterations in fractional composition of rat hemoglobin resulting from in vitro and in vivo irradiation have been studied. Essential differences as well as similarities of the damage caused by the two modes of treatment to the heterogeneous system of this hemoprotein have been observed. The changes are, however, non-specific since similar alterations have been noted on exposure of hemoglobin to factors other than irradiation. The reasons of quantitative changes in the hemoglobin heterogeneous system of peripheral erythrocytes of irradiated animals are discussed.

- 2696 KINETICS OF THE IMMUNE RESPONSE OF UNEVENLY IRRADIATED (A PART OF THE BONE MARROW AND THYMUS SHIELDED) MICE OF VARIOUS LINES. Batyrbekov, A.A. Radiobiologiya; 15: No. 2, 309-310 (Jan 1975). (In Russian).

For English translation see the journal Radiobiology.

An attempt was made to amplify the immune response of non-uniformly irradiated mice by screening the bone marrow (B-lymphocyte source) by means of simultaneous protection of the thymus gland (T-lymphocyte source). Genetically determined differences between CBA mice (with high responses to sheep erythrocytes) and C57BL/6 mice (with high responses to sheep erythrocytes) were found to be associated with dissimilarly pronounced cooperative interactions between T- and B-cells. These interactions may have been due to dissimilar intensities of migrations of B- or T-lymphocytes from the bone marrow or thymus gland, respectively.

- 2697 DYNAMICS OF THE PHOSPHOLIPID METABOLISM IN THE RAT LUNGS AFTER INHALATION OF NITRATE SOLUTION OF POLYMERIC PLUTONIUM. Surina, A.G. Radiobiologiya; 15: No. 1, 145-147 (Jan 1975). (In Russian).

For English translation see the journal Radiobiology.

The content and synthesis of certain phospholipids was studied in the lungs of rats after single inhalation of polymeric plutonium nitrate solution (0.26 μ Ci per 1 g of lung tissue). The changes in phospholipid metabolism in plutonium-treated lungs were represented by an increased content and inhibition of synthesis of these substances. All phospholipid fractions, and to the most extent phosphatidyl choline, accounted for the increase in total phospholipids observed from 2 weeks to 2 months after the treatment.

- 2698 HEMATOLOGICAL EFFECTS OF TRITIUM-LABELLED COMPOUNDS AND PHOSPHOROUS-32 ON FIELD RATS (R. R. MINDANENSIS). de la Cruz, B.; Soriano, E.A.; Padrelanan, E.M.; Paradero, R.R.; Gregorio, J.S.; Yumul, B.V.; Medina, F.I.S. (Philippine Atomic Energy Commission, Manila). Philipp. Nucl. J.; 3: No. 1, 268-273 (Jan 1975).

The range of normal values for red blood cells, hemoglobin, blood platelets, total white blood cells and differential count for the adult male and female field rats (*Rattus rattus*) was determined. The mean values for the eosinophils, neutrophils, and lymphocytes which were 2.3%, 25.69% and 69.05% for the male rats were higher than the corresponding mean values of 1.2%, 20.48% and 64.44% in the female. The hemoglobin values of 14.61 gms/100 ml in the female rats were found to be higher than 12.8 gm/100 ml in the male rats. During the whole period of the hematological investigation, bone marrow studies were not available. Although occasional binucleate, lymphocytes and a typical granulocytes were seen in the peripheral blood, no manifestations in the different peripheral blood elements were detected to indicate the presence of a leukaemic process in the irradiated animals. Regarding the somatic effects of internal radiation which will shorten the life span of the experimental animals, only one male rat which was exposed to 50 μ Ci tritiated thymidine developed a tumor in the right kidney. In general, no shortening of life span was observed and the treated parent rats could still reproduce and give birth to certain progenies with heritable defects.

- 2699 (PB--266490) FILMS AND FILMSTRIPS ON OCCUPATIONAL SAFETY AND HEALTH. (National Inst. for Occupational Safety and Health, Cincinnati, Ohio (USA)). Jan 1975. 55p. (DHEW/PUB/NIOSH--75/128; NIOSH--75/128). NTIS PC A04/MF A01.

Films and filmstrips on occupational safety and health are listed by general topics, and by title, indicating whether the item is a motion picture or filmstrip, whether it has sound, is in color, the time length, the date of production, its loan-free source (including address) and its contents briefly. Also included is a list of organizations that offer rental and sale of films and filmstrips. Topics include safety with chemicals, construction and plant safety, electricity, equipment, eyes and vision, falls, slips, and backs, fire and explosion, general safety, hospitals and nursing, industrial hygiene, industrial medicine, laboratory safety, lead poisoning, mental health, chronic mercurialism, mining, noise, pesticides, power tools, protective devices, radiation, skin, supervision and

welding.

- 2700 GONAD DOSE IN THE GASTRIC FLUOROSCOPY. Higashida, Y.; Otsuka, A. (Yamaguchi Univ., Ube (Japan). School of Medicine). Nippon Hoshasen Gijutsu Gakkai Zasshi; 30: No. 5, 475-482 (Jan 1975). (In Japanese).

In recent years, with the increasing use of the medical X-ray examinations in Japan, the frequency of the irradiated persons has also increased year by year. In Japan, X-ray examinations of the gastrointestinal tract occupy almost half of the genetically significant dose. The gonad dose of female in the gastric fluoroscopy has been estimated. This study particularly concerns the difference of fluoroscopic time between the radiologists and nonradiologists and also between the patients.

- 2701 THOSE DANGEROUS ROENTGEN BACKGROUND, REVIEW OF BASIC RADIATION ACTION, AND THE FEDERAL GOVERNMENT'S ROLE IN POPULATION PROTECTION. Fleming, R.D. S. C. Dent. J.; 33: No. 1, 60-63 (Win 1975).

This first article briefly states the historical background of the general field of Radiology with specific direction to Dental Radiology. Also, information is presented concerning the Government's interest in the safety of the population of the United States as a result of the alarming rise in radiation exposure to the population for medical and dental purposes. Radiation damage at a cellular level as well as at the whole individual level is briefly outlined.

- 2702 HAZARDS ASSOCIATED WITH STAGE ONE-MINING. pp 11-15 of Uranium. Metal of menace. Melbourne, Australia; ACF (1975). Radiation hazards in uranium mining arise from the presence of radon-222, a gas which can escape from exposed rock surfaces into the air. Radon daughter products have been associated with an increased incidence of respiratory lung cancer. Other hazards include the tailings which arise from the extraction of uranium ores. The tailings still contain most of the original radium and emit gamma rays and radon gas. The hazards associated with uranium enrichment and fuel manufacture are also discussed.

- 2703 (RT/PROT--75-20) RADIATION PROTECTION PLANNING FOR A LIQUID RADIOACTIVE WASTES TREATMENT SYSTEM. Brofferio, C.; DeAngelis, F.; Papa, C.; Paribelli, S. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1975. 42p. (In Italian). INIS.

The main principles of radiation protection are discussed, in view of a sound design of liquid waste processing systems. Critical pathways, doses to workers and people at large are also discussed.

- 2704 PROBLEMS OF RADIATION SAFETY IN RADIOACTIVE REFUSES TREATMENT. Dermendzhiev, K.; Velikov, V.; Konstantinov, P. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Letopisi Khig. Epidemiol. Inst.; 9: No. 1, 110 (1975). (In Bulgarian).

After a brief characteristic of radioactive refuses, the methods of their treatment are outlined. A more detailed description is given of the hazards, arising in the different stages of their treatment. The necessity of dosimetric control when working with radioactive refuses

is stressed. The radioactivity of different natural objects such as rivers, seas, foodstuffs, etc. should be measured as they are subject to contamination in the process of throwing out or rendering innocuous radioactive waste matter. It is pointed out that the process of collection, keeping and treatment of radioactive wastes is an occupational entailing work with radioactive substances, and therefore all radiation safety requirements should be observed.

- 2705 (AED-Conf--75-769-043) ENVIRONMENTAL IMPACTS OF THE NUCLEAR FUEL CYCLE. Hamard, J. (International Atomic Energy Agency, Vienna (Austria)). 1975. 29p. (CONF-7509129--118). NTIS (US Sales Only).

From Meeting on nuclear power plant project planning and implementation; Karlsruhe, F.R. Germany (17 Sep 1975).

1 fig.; 3 tab..

A survey about the environmental pollution and the population exposure caused by the nuclear fuel cycle is set up. Proceeding from the environmental changes caused by the construction of plants, the author shows the hazards of the operation of the plants. The fuel cycle beginning with the mining of nuclear fuels and reaching to their reprocessing, the environmental pollution by radionuclides and the population exposure resulting from this are outlined. After indicating the advantages of the concentration of nuclear plants, the author shows comparatively the hazards caused by conventional energy sources.

- 2706 (DHEW/FDA--76-8026, pp 26-59) PERSPECTIVES ON RADIOACTIVE RELEASES FROM THE NUCLEAR FUEL CYCLE. Turnage, J.C. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

The following topics are discussed: the nuclear fuel cycle; radioactive effluents during mining, milling, conversion to UF₆, enrichment, and fuel fabrication; radioactive releases from nuclear power plants; radioactive effluents during reprocessing of spent nuclear fuel; effect on public health of radioactive releases from the nuclear fuel cycle; the probability and consequences of nuclear accidents; and implications for energy policy. (HLW)

- 2707 RADIOACTIVE POLLUTION OF THE ENVIRONMENT BY NUCLEAR POWER STATIONS AND REPROCESSING PLANTS IN NORMAL OPERATION. Bonka, H. (Technische Hochschule Aachen (F.R. Germany). Lehrstuhl fuer Reaktortechnik). ISU Mitt.; 4: No. 1, 73-106(1975). (In German).

23 figs.; 7 tabs.; 42 refs..

The paper shows that except for the radiation load due to iodine, the additional population exposure to radionuclides emitted from nuclear installations is very small. The additional radiation load is by far smaller than the regional variation of the natural radiation load in the FRG. The emission rates of radioiodine in the off-air from nuclear power stations with LWR reactors, in particular with BWR reactors, should be lowered by concerted gland leak-off.

- 2708 (DHEW/FDA--76-8026, pp 117-119) KERR--MCGEE INCIDENT. McHard, D. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

A contamination incident at the Kerr-McGee Corporation in November 1974, was reported to the AEC and the Oklahoma State Department of Health. The health physics personnel discovered skin contamination in an employee; no source within the plant could be found. The contamination was alleged to be due to a glove leak, but no leak could be found. An investigation revealed the apartment of the employee to be extensively contaminated with moderate levels of plutonium. An investigation of the Kerr-McGee plutonium plant by the OCAW International Union resulted in three citations of violations of AEC requirements. The death of the employee a short time later in a car accident was reported as accidental and not related to radiation exposure. It is emphasized that the case was very complex and that oversimplification should be guarded against. (HLW)

- 2709 (DHEW/FDA--76-8026, pp 170-173) STATUS OF URANIUM FUEL CYCLE STANDARDS AND PLUTONIUM STANDARD DEVELOPMENT. Martin, J.E. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Uranium fuel cycle standards were reviewed by federal agencies and an appendix to the document by the Nuclear Regulatory Commission is discussed. The appendix pertains just to light-water cooled nuclear power plants. The EPA standard is proposed to limit doses to human populations and to limit the discharge of long-lived materials into the environment to prevent long-term buildup of significant radionuclides. The standard will limit the dose to man to 25 millirems per yr for the whole body and 75 millirems per yr to the thyroid. (HLW)

- 2710 POWER SUPPLY OF CARDIAC PACEMAKERS.

Kowalewsky, H. (Bundesanstalt fuer Materialpruefung, Berlin (Germany, F.R.)). Med. Pr.; 23: No. 10, 330-334(1975). (In German).

9 figs.; 2 tabs.; with refs..

The author examines power sources for the supply of cardiac pacemakers under discussion at the moment. According to different types of batteries, lifetimes ranging from 5 - 10 years result from the power consumption of the voltage circuit, from the circuit generating stimulating pulses, and from battery losses due to self-discharge and - on the other hand - result in the power accumulation of batteries. Apart from primary chemical elements and chargeable secondary elements (accumulators) radionuclide batteries are described. The heat of the batteries generated by radiation is utilized in order to obtain electric energy in thermoelements. The author goes into detail as far as safety aspects are concerned, considering particularly radionuclide batteries which also have to be implanted. The author comments on the further development and further chances of the various battery types.

- 2711 (AED-CONF--75-538-000, pp v) MAINTENANCE AND REPAIR IN NUCLEAR POWER PLANT OPERATION. Weckesser, A. 1975. (In German).

From IRS symposium on operational experience with nuclear power plants; Koeln, F.R. Germany (30 Oct 1975).

16 figs. With abstract in English and German.

IRS symposium 1975: operational experience with nuclear power plants. Full text of papers.

Maintenance and repair work represents an essential part of plant operation. When designing new plants, it is necessary to take into account the special requirements of a nuclear power plant. The intermittent demand for repairing staff during the planned annual outages has to be coordinated in detail to avoid availability problems due to the number of employees and radiation exposure limitations. (DE)

- 2712 ROUTINE OPERATION OF NUCLEAR POWER PLANTS. IS IT CORRECT THAT RADIATION DOSES FROM RELEASES TO THE ATMOSPHERE ARE SO LOW. Tveten, U.; Thomassen, D. (Institutt for Atomenergi, Kjeller (Norway)). Fra Fys. Verden; 37: No. 3, 58-66(1975). (In Norwegian).

The various sources of gaseous radioactive release during routine operation of a PWR are described and their significance and treatment discussed. Atmospheric dilution is also briefly treated. The simplified calculation of the annual dose to a person downwind from the stack, with reference to the prevailing wind direction, at the same height above ground as the release point, and at a distance of 1 km, is presented. Both whole-body and skin doses are calculated. The results are compared with the ICRP recommendations, with measured releases from a number of PWR plants in the USA and with the doses from natural background radiation.

- 2713 (DOCKET-50219--818) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. SEMIANNUAL REPORT NO. 13, JULY--DECEMBER 1975. (Jersey Central Power and Light Co., Morristown, N.J. (USA)). 1975. 89p. Dep. NTIS \$5.00. Net electrical power generated was 1,600,885 MWh(e) with the reactor on line 3,682.2 hrs. Information is presented concerning operations, power generation, shutdowns, corrective maintenance, chemistry and radiochemistry, facility changes, occupational radiation exposure, tests, experiments, release of radioactive materials, and environmental monitoring of atmospheric radiation, fallout, domestic water, surface waters, and marine life. (FS)

- 2714 (AED-Conf--75-571-001) PREDICTION OF THE POPULATION EXPOSURE DURING HYPOTHETICAL ACCIDENTS. Huebschmann, W.G. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. Strahlenschutz und Sicherheit). 1975. 10p. (In German). (CONF-751191--4). INIS.

From Annual meeting of the project nuclear safety; Karlsruhe, F.R. Germany (11 Nov 1975).

3 figs.; 2 tabs.; 8 refs..

In the prognosis of the population exposure in hypothetical accidents, the emission prognosis presents the considerably more difficult problem, whereas the diffusion prognosis presents no particular problems with availability of a meteorological information system, at least with short emission times (about 1 h). Thus a radiation measuring team can be dispatched directly and at short notice in order to measure the activity concentration (in the air or on the ground) in the area of the concentration maximum. Such measurements are necessary to draw conclusions about the source strength. The equipping of the fixed measuring-point ring around the nuclear power plant is not further dealt with here. With

longer emission periods to be expected (greater than 3 h), a specific diffusion prognosis has proved to be purposeful which is related to the time of day and the stability class at the beginning of the emission and gives the area in which the maximum concentrations should be expected with greatest possibility. These data present an extension of the immediate information from the short-term prognosis and can be made available to the reactor personnel in simple diagrams.

- 2715 (EUR--5176) ORGANISATION AND OPERATION OF RADIOACTIVITY SURVEILLANCE AND CONTROL IN THE VICINITY OF NUCLEAR PLANTS. A PRACTICAL GUIDE. (Commission of the European Communities, Luxembourg). 1975. 35p. NTIS (US Sales Only).

Guidance is presented for the development of environmental monitoring programs and procedures relevant to the operation of nuclear plants. The essential aim of an environmental monitoring program is to ensure that the exposure of the general public does not exceed certain set limits. A certain uniformity of criteria in the organization of monitoring networks around nuclear installations may prove to be very useful. These criteria are set out in detail. Progress is reported on the following studies: monitoring of radioactive contamination of atmosphere, water, soils and foodstuffs; monitoring of external radiation.

- 2716 (AED-Conf--75-631-001) ENVIRONMENTAL IMPACT OF NUCLEAR POWER STATIONS. ATTEMPT AT A RISK ASSESSMENT. Kellermann, G.; Balfanz, H.P. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (Germany, F.R.)). 1975. 23p. (In German). (CONF-751244--1). INIS.

From Lecture meeting: nuclear energy--the energy of today and tomorrow; Dusseldorf, F.R. Germany (4 Dec 1975).

1 fig.; 6 tabs.; 8 refs..

Following a comparative consideration of the present and future environmental impact by coal, oil, and nuclear power plants, the special risks connected with the use of the latter are dealt with. A distinction is made in considering the risk between public exposure in the environment of a plant due to operational leakage and radiation exposure in the plant under normal operation and in the case of an accident. The accident risk consideration is the basis of the Rasmussen study where the different containment construction of german plants as well as the higher population density for sites in the FRG are considered. Evaluation parameters are given to quantify the risks, and using this, the risks of various cases of impact of nuclear power plants are compared. The comparison shows that the risks of nuclear power plant operation according to the value in normal operation are comparable to those in the case of an accident.

- 2717 CRITERIA FOR NUCLEAR CRITICALITY SAFETY CONTROLS IN OPERATIONS WHERE SHIELDING PROTECTS PERSONNEL. Hinsdale, IL; American Nuclear Society (1975). 5p.

This Standard is applicable to operations outside of nuclear reactors with ^{235}U , ^{233}U , ^{239}Pu , and other fissile and fissionable materials in which shielding and containment are provided for protection of personnel, except the assembly of these materials under controlled conditions, such as in critical experiments. Criteria are provided that may be used for criticality control under shielded conditions. The Standard does not include the details of administrative procedures for

control, which are considered to be management prerogatives, nor details regarding the design of processes and equipment or descriptions of instrumentation for process control.

2718 (DHEW/FDA--76-8026, pp 60-69)

SKEPTICAL VIEWPOINT OF NUCLEAR POWER.

MacKenzie, J. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: hazards of large releases of ^{85}K and tritium; continued building of light-water reactors in relation to the energy crisis; opposition to nuclear power plants; problems of waste storage; effectiveness of the emergency core cooling system; lethal effects of strontium and plutonium; public health problems of plutonium; and the use of coal, solar energy, and wind power as alternatives to nuclear power. (HLW)

2719 SKYSHINE: A PAPER TIGER. Rindi, A.; Thomas, R.H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Part. Accel.; 7: No. 1, 23-39(1975).

The study of large-distance transport of high-energy accelerator radiation is of fundamental interest and is important in the calculation of the exposure of the population living near the accelerator. The most significant experimental data accumulated since the construction of the early particle accelerators and their theoretical interpretation are reviewed.

2720 EXPOSURE TO EXAMINER AND PATIENTS IN X-RAY DIAGNOSTICS. Schmitt, G.; Ewen, K. pp 159-176 of Fundamentals of practical radiation protection in medical X-ray installations. Ewen, K. (Gewerbeaufsicht des Landes Nordrhein-Westfalen, Duesseldorf (F.R. Germany). Zentralstelle fuer Sicherheitstechnik, Strahlenschutz und Kerntechnik); Schmitt, G. (Essen Univ. (Gesamthochschule) (F.R. Germany). Radiologisches Zentrum). Stuttgart; Enke (1975). (In German)

11 figs.; 5 tabs.; 11 refs..

Following explanations on the radiation exposure to patients, which are supplemented by data in tables, the sensitivity of the patient exposure to technical as well as organisational parameters is gone into. Single points such as the influence of the tube voltage, the distance, field size, filtration, object thickness, intensification foils as well as examiner experience and training are briefly explained. The radiation exposure to the examiner as well as patient dosimetry are dealt with.

2721 (CONF-750671--) INTERNATIONAL SYMPOSIUM ON AREAS OF HIGH NATURAL RADIOACTIVITY. Cullen, T.L.; Penna Franca, E. (eds.). (Pontificia Universidade Catolica do Rio de Janeiro (Brazil)). 1975. Contract EY-76-C-02-2592. 191p. Dep. NTIS, PC A09/MF A01.

From International symposium on areas of high natural radioactivity; Pocos de Caldas, Brazil (16 Jun 1975).

Twelve papers and abstracts of nine papers are included that were presented at a conference to review what is known about the world's natural radioactive anomalies and their biological implications was held in Pocos de Caldas, Minas Gerais, Brazil, June 16 to 20, 1975. Pocos de Caldas was selected as the site

of the symposium because of its proximity to Morro do Ferro, a hill on which the external radiation level is as much as 300 times normal. The natural thorium in the rocks and soils give a remarkable exposure to the native flora and fauna due to the absorption of nuclides. Other reported radioactive anomalies are the monazite sand areas of Brazil and India, and a number of places throughout the world in which the radioactivity of drinking water and certain foods are known to be elevated above normal to a significant degree. The objectives of the symposium were: to inventory those places in the world where such anomalies are known to exist; to review the status of investigations being conducted; and to assess the extent to which research in such places can add much needed information on the effects of low level exposure to ionizing radiation. For the purpose of this symposium, an anomalous radioactive environment was defined as one that is characterized by one or more of the following: the exposure rate from external terrestrial sources, over extended areas, is greater than 200 mR/yr; the long lived alpha activity, ingested with the local diet and water, is greater than 50 pCi/day; the radon-222 concentration of potable water is greater than 5000 pCi/l; and the radon 220 and 222 concentration of the atmosphere is greater than 1 pCi/l. Abstracts of two of the papers appeared previously in ERA.

2722 RADIOLOGICAL ASPECTS OF NUCLEAR WARFARE. Edvarson, K. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Ambio; 4: No. 5-6, 209-210R(1975).

The radioactive fallout from nuclear explosions is one of the major effects of nuclear warfare. Those levels causing acute radiation sickness are to be expected only within the close-in or intermediate areas downwind from surface bursts. Global fallout from high yield explosions will be fairly evenly distributed in the hemisphere where the explosions occurred and cause irradiation from ground deposit, inhaled material and contaminated food. The collective doses and the order of magnitude of late casualties from this global contamination are estimated for a given total explosion yield.

2723 Izotopy radona i produkty ikh raspada v prirode. (ISOTOPES OF RADON AND ITS DECAY PRODUCTS IN NATURE). Serdyukova, A.S.; Kapitanov, Yu.T. Moscow; Atomizdat (1975). 296p.

In the book are described the formation, chemical and physical properties, processes of extension and carrying over of isotopes of radon and products of their decomposition. Data concerning the content of isotopes of radon and products of their decomposition in different environments are given. The causes and ways of appearance of indicated isotopes in organism of man, their biological action and average annual permissible concentration are examined. Methods of determination of concentration of isotopes of radon and products of their decomposition, coefficients of diffusion, emanation, and exhalation are described. Isotopes of radon and methods of dosimetric check of impurity of air by isotopes of radon and by products of their composition are described. Information concerning utilization of isotopes of radon and products of their decomposition, concerning the complexity of engineering-technical measures according to the supporting of concentration of isotopes of radon and products of their decomposition on a permissible level is given.

2724 (ERDA--92(Vol.2), pp 622-637)
MIGRATION OF TRITIUM FROM A NUCLEAR WASTE
BURIAL SITE. Hawkins, R.H. (E.I. du Pont de
Nemours and Co., Aiken, SC). 1975.

From 3. ERDA environmental protection
conference; Chicago, IL, USA (23 Sep 1975).

Proceedings of the third environmental
protection conference.

The Savannah River Plant (SRP) has routinely
and continuously monitored the local
environment since 1951. A three-part study was
made to assess the tritium migration from an
onsite burial ground for solid nuclear wastes
and the resulting dose-to-man. A major source
of tritium is buried, massive, Li-Al, melt,
residues from the thermal extraction step in
the SRP tritium production process. A melt with
its extraction crucible and lid were immersed
in water to measure the amounts of tritium
released as HTO and HT to the water and to air.
The result was a rapid release of 23 curies, of
which approximately 99 percent was HTO that
remained in the immersion water, and 1 percent
was HT that passed into the air. Three
crucibles and lids were buried in a soil-
filled, open-top lysimeter. Results showed that
177 curies were released as HTO to the
percolate water during the first 93 weeks of
the test. Approximately one curie of tritium
was released as HT to the air. Tritium
concentrations were measured monthly for a year
in 41 groundwater monitoring wells at the
burial ground and in 6 adjacent wells for a
shorter time. Average concentrations were used
to estimate that some 50 kilocuries of tritium
are in the groundwater underlying the 77-acre
burial site. The travel time of tritium in the
groundwater from the burial ground to a
tributary stream 3000 feet away is about 60
years. Radioactive decay and dilution in the
Savannah River will limit the dose-to-man to
the down-river population to approximately 0.02
man-rem yearly. (auth)

2725 (INIS-mf--2098) 1974 ANNUAL REPORT OF
STATE INSTITUTE FOR PROTECTION AGAINST
RADIATION. Lindell, B.; Snihs, J.O.;
Swedjemark, G.A.; Bengtsson, G. (Statens
Straalskyddsinstitut, Stockholm (Sweden)).
1975. 15p. (In Swedish). NTIS (US Sales
Only).

This report submitted to the Swedish Council
for Atomic Research deals with research work in
nuclear physics, special laboratories, and the
dosimetric laboratory, in particular with
exposure of miners to radioactive substances
(causing lung cancer), natural radioactive
constituents of building materials and in
drinking water, deposits of uranium in human
lungs, radioactive substances in foods and in
human bodies.

2726 EFFECT OF SEDIMENT DISPLACEMENT ON THE
DISPERSAL OF RADIONUCLIDES. Schaeffer, R.
(Electricite de France, 75 - Paris). pp 263-
274 of Impacts of nuclear releases into the
aquatic environment. Proceedings of an
international symposium on radiological impacts
of releases from nuclear facilities into
aquatic environments held by the IAEA at
Otanemi, Finland, 30 June to 4 July 1975.
Vienna; International Atomic Energy Agency
(1975). (In French)

From International symposium on radiological
impacts of releases from nuclear facilities
into aquatic environments; Otanemi, Finland
(30 Jun 1975).

The bulk of discharged radionuclides are
adsorbed by the sediments in water courses. It
follows from this that the volumetric activity
of the water decreases with distance from the
disposal point in an approximately exponential

manner. However, the activity accumulated by
the sediments deposited on the river bed does
not follow this law: the bottom transport to
which these sediments are subjected reverses
the direction of the variation for them so that
their activity increases progressively in the
downstream direction, reaching a maximum which
may be situated a great distance away after a
long period of disposal. In the long term,
therefore, the sediments could constitute the
main source of irradiation of populations
living on river banks fairly far from a
disposal point. In view of this variation of
sediment activity in time and in space, the
paper draws attention to the fact that a very
limited number of measurements repeated at a
single point is not representative.

2727 (DHEW/FDA--76-8026) 7TH ANNUAL
NATIONAL CONFERENCE ON RADIATION CONTROL:
ASSURING RADIATION PROTECTION, APRIL 27--MAY
2, 1975, HYANNIS, MASS. (Food and Drug
Administration, Rockville, Md. (USA)). 1975.
317p. (CONF-7504107--). GPO \$4.40.

From 7. annual national conference on
radiation control; Hyannis, MA, USA (27 Apr
1975).

Separate abstracts were prepared for 40
papers presented at the conference. (HLW)

2728 (DHEW/FDA--76-8026, pp 7-10) ASSURING
RADIATION PROTECTION FOR THE PUBLIC. Hardin,
C.M. 1975.

From 7. annual national conference on
radiation control; Hyannis, MA, USA (27 Apr
1975).

7th annual national conference on radiation
control.

Some topics discussed are: accomplishments
and activities of the Conference Task Forces;
incorporation of the Conference in the state of
Arkansas; state regulations for the control of
radiation; role of U. S. Department of Labor in
development of uniform radiation regulations;
and meetings of the Executive Committee with
Commissions of the NRC. (HLW)

2729 (DHEW/FDA--76-8026, pp 250-251) REPORT
OF THE TASK FORCE ON THE MEASURE OF PROGRAM
EFFECTIVENESS AS RELATED TO RADIOACTIVE
MATERIALS. Watkins, G.; Morris, J.; Russo, J.
1975.

From 7. annual national conference on
radiation control; Hyannis, MA, USA (27 Apr
1975).

7th annual national conference on radiation
control.

It was recommended that a task force be
established: to contact the 50 states,
territories, and federal agencies to accumulate
information on the existing indices for
radioactive material program effectiveness
evaluation; to consider the quantifiable
indices of radioactive materials program, the
size of the population at risk in the various
medical and nonmedical groups, and those
indices that can be applied to all forms and
uses of radioactive material; and to consider
possible indices for such items as emergency
response capability, laboratory capability and
reliability. It was also recommended that the
federal and state agencies support studies on
how to measure radioactive material program
effectiveness. (HLW)

2730 EFFECT OF AGE ON CELL-MEDIATED IMMUNITY
IN LONG-LIVED MICE. Goodman, S.A. (Univ. of
Tennessee, Oak Ridge); Makinodan, T. Clin.
Exp. Immunol.; 19: 533-542(1975).

The cytolytic ability of sensitized spleen

cells to kill allogeneic target cell in vitro, a correlate of cell-mediated immune activity, was assessed in aging long-lived hybrid mice. There was a 3-4 fold decline with age, of which about half could be accounted for by the decrease in relative numbers of immunocompetent precursor cell units. The terminally differentiated progeny cells of antigen-stimulated precursor cells of old mice were as efficient in killing targets cells as were those of precursor cells of young mice. Thus, it would appear that a decrease in the proliferative and transforming capacities of antigen-stimulated precursor cells of old mice can account for the other half decline with age in the cytolytic activity. Cytolytic activity may not be the limiting function in resistance to tumor formation. This was indicated by the observation that resistance to allogeneic tumor cell challenge declines with age by as much as 500-fold in mice, showing only a 4-fold decline in their cytolytic activity.

- 2731 Leitfaden der medizinischen Röntgentechnik. Diagnostik - Dosimetrie - Strahlenschutz - Strahlentherapie. (GUIDE FOR MEDICAL X-RAY TECHNOLOGY. DIAGNOSTICS - DOSIMETRY - RADIATION PROTECTION - RADIOTHERAPY). Laubenberger, T. (Universitaet des Saarlandes, Homburg/Saar (F.R. Germany). Radiologische Klinik; Stadtkrankenhaus Hanau (F.R. Germany). Strahlenklinik). Koeln, F.R. Germany; Deutscher Aerzte-Verl. (1975). 386p. (In German).

With figs. and tabs..

This book turns to the medical X-ray assistants. The guide comprises in brief the most important details of X-ray diagnostics and radiotherapy. Modern methods and new trends in the techniques of medical radiology are presented. In order to make the technical steps more easily understood, physical model concepts are submitted.

- 2732 INVESTIGATION OF ^{125}I AS AN ISOTOPIC SOURCE FOR MAMMOGRAPHY. Fairchild, R.; Atkins, H.L.; Lebowitz, E.; Greenberg, D. (Brookhaven National Lab., Upton, NY). Invest. Radiol.; 10: No. 5, 511-518(1975).

An isotopic radiation source ^{125}I was investigated for use in soft tissue radiography, with particular attention to possible use in mammography for mass screening. Film sensitivities, exposure rates, absorbed doses, contrast and resolution were determined, and compared to conventional x-ray units. It was found that contrast and resolution were comparable to 30 kVp x-rays (W anode) but that surface absorbed dose was reduced by a factor of two with ^{125}I . These results experimentally verified the advantage to be obtained from monoenergetic radiations, which had been predicted from theoretical considerations by others. Duration of exposure was estimated to be between 4 and 12 sec with a 40 Ci source. The 60-day half life of ^{125}I may necessitate its use in conjunction with an image intensification system or electron radiographic techniques, in order to preclude source replacement at inconveniently short intervals. (auth)

- 2733 (EUR--5484) PROGRAMME BIOLOGY - HEALTH PROTECTION. ANNUAL REPORT 1975. (Commission of the European Communities, Brussels (Belgium)). 1975. v.1 p.1-618, v.2 p.619-953p. NTIS (US Sales Only).

French and German version also available.

The scientific results for 1975, of the five-year Biology-Health Protection programme adopted in 1971, are presented in two volumes.

In volume one, Research in Radiation Protection are developed exclusively, including the following topics: measurement and interpretation of radiation (dosimetry); transfer of radioactive nuclides in the constituents of the environment; hereditary effects of radiation; short-term effects (acute irradiation syndrome and its treatment); long-term effects and toxicology of radioactive elements. In volume, two Research on applications in Agriculture and Medicine are developed. It includes: mutagenesis; soil-plant relations; radiation analysis; food conservation; cell culture; radioentomology. Research on applications in Medicine include: Nuclear Medicine and Neutron Dosimetry.

- 2734 MATHEMATICAL MODEL OF ABSORBED DOSE IN A LIVING ORGANISM DURING NEUTRON IRRADIATION AS A FUNCTION OF SIZE OF THE OBJECT. Paskalev, Z. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: No. 1, 9-12(1975). (In Bulgarian).

The purpose of this study is by the use of a Monte Carlo method to develop a model of the absorbed dose from neutron irradiation which takes into account the linear dimensions of the irradiated object. In studying the distribution of absorbed neutron dose it is found that the maximum dose is found mainly at the surface of the biological object under irradiation. It is shown that the part of the body opposite to the side from the neutron flux only receives 30 percent of the dose given to the directly exposed side in the case of the rat, while the corresponding figure is approximately 70 percent for mice. 4 refs.

- 2735 (ERDA-tr--110, pp 124-127) INVESTIGATION OF THE REPAIR OF SINGLE-STRANDED BREAKS IN DNA OF THE REGENERATING LIVER OF γ -IRRADIATED RATS BY THE METHOD OF SEDIMENTATION. Zakrzhevskaya, D.T.; Gaziev, A.I. (Inst. of Biological Physics, Pushchino, USSR). 1975. Translated from Radiobiologiya; 15: No. 4, 593-596(1975).

Radiobiology. The formation and repair of single-stranded breaks in DNA of the regenerating liver of γ -irradiated rats were studied using the method of sedimentation. The data obtained permit the conclusion that in the regenerating rat liver, just as in a culture of mammalian cells, during the first hour after irradiation with γ rays the process of DNA repair begins to function. (ERB)

- 2736 BIOLOGICAL EFFECT OF IONIZING RADIATIONS AND THE PRIMARY STRUCTURE OF DNA. Kritskij, G.A.; Lakhtin, V.M.; Aleksandrov, S.V.; Kopylov, V.A. (AN SSSR, Moscow. Inst. Biokhimi; AN SSSR, Pushchino-na-Oke. Inst. Biologicheskij Fiziki). Stud. Biophys.; 53: 9-12(1975).

From 3. International symposium on primary and initial mechanisms of the effect of ionizing radiation on the cell; Erevan, USSR (26 May 1975).

Pyrimidine oligonucleotides were determined in diphenylamine/formic acid hydrolysates of DNA. It was shown that DNA regions with a predominant content of oligonucleotides of the polythymine (or AT) type are damaged by irradiation in vivo to a greater extent as compared with those with a predominant content of oligonucleotides of the polycytidyl (or GC) type.

- 2737 (AED-Conf--75-780-000, pp 269-282) RECOVERY OF IRRADIATED L-CELLS: CHANGES OF THE MEMBRANE POTENTIAL. Baisch, H.; Linden, W.A.; Bluhm, H. 1975. (In German).

From Meeting of the Schutzkommission beim Bundesministerium des Innern; Erlangen, F.R. Germany (May 1975).

10 figs.; 13 refs. Available from ZAED.

Meeting of the Schutzkommission beim Bundesministerium des Innern.

The cell membranes and their structures play an essential role in radiation damage. Membrane-bound enzymes and their damaging by radiation are further important factors in the question of recovery from radiation damage. The present investigation deals with these problems. L 929 cells, which grow as a monolayer, from a mouse cell strain were irradiated, and the corresponding survival curves with marked shoulder were characterized and discussed for the repair of radiation damage. The results are not particularly clear from the radiation protection aspect, as it is not yet explained to what extent the measured damage of the membrane affects the survival of the cells. On the other hand, the measured effects occurred at doses which are only just lethal, i.e. lying in the region of the survival curve and not only at overkill doses. Furthermore, the time-recovery slope is discussed.

- 2738 (COO--3286-11) STUDY OF THE RADIATION EFFECTS ON NUCLEIC ACIDS AND RELATED COMPOUNDS. ANNUAL PROGRESS REPORT, AUGUST 15, 1974--AUGUST 14, 1975. Wang, S.Y. (Johns Hopkins Univ., Baltimore, Md. (USA)). 1975. Contract E(11-1)-3286. 21p. Dep. NTIS \$3.50.

Interest is being centered on the chemical and physical nature of radiation-induced lesions to nucleic acids and their components. These investigations have revealed the enormous complexity of chemical events in these systems and the possible degradation of nucleic acids by strand breakage. Therefore, work in the ionizing radiation of DNA and its components has proceeded along a dual course. For chemical studies, our prime concern is the stepwise isolation and identification of the radiation products of derivatives of pyrimidines and the study of the actual mechanisms of their formation. For biological studies, H. influenzae cells, the Chinese hamster V79B-1 cell line, and the Dunn osteosarcoma lung colony system were used. During the last year, the method of synthesis of 5-hydroperoxymethyluracil ($T^{\alpha}OOH$) was greatly improved. Large-scale preparation of 5-hydroxy-6-hydroperoxy-5,6-dihydrothymine ($T^{\alpha}OOH$) were carried out in order to study the action of $T^{\alpha}OOH$ on neighboring bases, glycosidic bond-breakage, cell mutagenesis, chromosomal aberrations, and possible synergistic effects on x radiation. These results allow one to relate radiobiological effects with radiation chemical changes in DNA.

- 2739 (INIS-mf--2078, pp 89-91) RADIOBIOLOGICAL STUDIES OF HUMAN CELLS IN CULTURE, DERIVED FROM AN EARLY STAGE OF CARCINOMA OF THE UTERINE CERVIX. 1975.
In summary form only. Several references.
Tenth report from Norsk Hydro's Institute for Cancer Research for 1973 and 1974.
ANIMAL CELLS; ANOXIA; BIOLOGICAL RADIATION EFFECTS; FRACTIONATED IRRADIATION; IN VITRO; MAN; RADIATION DOSES; RADIOSENSITIVITY; RADIOSENSITIZERS; SURVIVAL CURVES; TUMOR CELLS

- 2740 (INIS-mf--2078, pp 36-37) SURVIVAL AFTER X IRRADIATION OF EXTREMELY HYPOXIC HUMAN CELLS OF THE LINE NHK 3025, CULTIVATED IN VITRO. Pettersen, E.O.; Oftebro, R.; Brustad, T. 1975.

In summary form only.

Tenth report from Norsk Hydro's Institute

for Cancer Research for 1973 and 1974.

ANIMAL CELLS; ANOXIA; BIOLOGICAL RADIATION EFFECTS; IN VITRO; IRRADIATION PROCEDURES; MAN; RADIATION DOSES; RADIOSENSITIVITY; SURVIVAL CURVES; TUMOR CELLS; X RADIATION

- 2741 (INIS-mf--2078, pp 37-38) INFLUENCE OF CERTAIN TECHNICAL PARAMETERS ON THE SHAPE OF DOSE RESPONSE CURVES IN STUDIES OF X-RAY-INDUCED EFFECTS ON HUMAN CELLS OF THE LINE NHK 3025, CULTIVATED IN VITRO. Pettersen, E.O.; Oftebro, R.; Brustad, T. 1975.
In summary form only.
Tenth report from Norsk Hydro's Institute for Cancer Research for 1973 and 1974.
ANIMAL CELLS; BIOLOGICAL RADIATION EFFECTS; DOSE-RESPONSE RELATIONSHIPS; IN VITRO; IRRADIATION PROCEDURES; MAN; TUMOR CELLS; X RADIATION

- 2742 IN VITRO TRANSFORMATION: INTERACTION OF CHEMICALS, VIRUSES, AND IRRADIATION. Casto, B.C. (Biolabs, Inc., Northbrook, IL); DiPaolo, J.A. Bibl. Haematol.; 40: 197-199(1975).

The data obtained from the viral enhancement studies suggest that induction of lesions in host cell DNA by irradiation or chemical carcinogens increases the sensitivity of cells to viral transformation. The enhancement may be the result of creation of additional sites for incorporation of viral genetic material into cell DNA during repair synthesis or to gaps in cell DNA arising during scheduled DNA synthesis in areas opposite unrepaired damage. Persistence of enhancement following treatment with MMS and DMBA could be correlated with the rate at which DNA repair synthesis proceeded. All of the agents thus far tested, that have the capacity to induce host cell DNA single-strand breaks and/or DNA repair synthesis, will enhance adenovirus transformation, but such damage is not a prerequisite for enhancement to occur. Enhancement of chemical transformations by MMS and x irradiation does not appear to be related in the same way to cell DNA repair synthesis, since maximal enhancement was obtained 48 hr after treatment. Alteration of scheduled DNA synthesis did not seem to be involved since treated cells were indistinguishable from control cells in their synthesis of DNA at 24 and 48 hr following MMS treatment. (auth)

- 2743 (ERDA-tr--99, pp 20-24) RECOVERY OF RADIORESISTANCE AND HEMATOGENIC STEM CELLS. Butomo, N.V.; Pegov, A.A. (Military-Medical Academy, Leningrad). 1975. Translated from Radiobiologiya; 15: No. 3, 345-347(1975).
Radiobiology. A comparison of the recovery of radioresistance was conducted on mice irradiated at a dose of 400 R, according to the value of LD_{50} of repeated irradiation and the dynamics of the content of colony-forming units in the bone marrow. No parallelism was detected in the changes in these indices. (tr-auth)

- 2744 (ERDA-tr--99, pp 114-117) ROLE OF ATP IN THE REPAIR OF DN OF GAMMA-IRRADIATED CHINESE HAMSTER CELLS. Fomenko, L.A.; Gaziev, A.I.; Mantseygin, Yu.A.; Kublik, L.N. (Inst. of Biological Physics, Pushchino, USSR). 1975. Translated from Radiobiologiya; 15: No. 3, 420-423(1975).

Radiobiology. The role of ATP in the regeneration of DNA of mammalian cells after γ irradiation was studied using monolayer cultures of fibroblast-like cells of the Chinese hamster. The results obtained permit

the conclusion that ATP plays an important role in the repair of DNA of mammalian cells. Irradiated cells have a sufficient amount of ATP available for the maintenance of DNA repair. (ERB)

- 2745 DOSE-RESPONSE RELATIONSHIP FOR ULTRAVIOLET-LIGHT-INDUCED MUTATIONS AT THE HYPOXANTHINE-GUANINE PHOSPHORIBOSYLTRANSFERASE LOCUS IN CHINESE HAMSTER OVARY CELLS. Hsie, A.W. (Oak Ridge National Lab., TN); Brimer, P.A.; Mitchell, T.J.; Gosslee, D.G. Somatic Cell Genet.; 1: No. 4, 383-389(1975).

Exposure of Chinese hamster ovary (CHO) cells clone K₁BH₄ to ultraviolet (uv) light at doses up to 86 ergs/mm² did not significantly reduce cell survival, but uv doses of 86-648 ergs/mm² produced an exponential cell killing. Observed mutation frequency to 6-thioguanine resistance induced by uv increases approximately in proportion to increasing doses up to 260 ergs/mm² in a range of 5-648 ergs/mm² examined. The pooled data of mutation frequency $f(X)$ as a function of dose X from 0-260 ergs/mm² is adequately described by $f(X) = 10^{-6} (13.6 + 2.04 X)$. That the uv-induced mutations to 6-thioguanine resistance affects the hypoxanthine-guanine phosphoribosyltransferase (HGPRT) locus is supported by the observation that all randomly isolated drug-resistant colonies contained highly reduced or undetectable HGPRT activity.

- 2746 INVESTIGATION OF THE EFFECTS OF FAST NEUTRONS ON DNA BY SEDIMENTATION ANALYSIS. Schroeder, E.; Magdon, E. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung). pp 87-92 of Grundlagen der Neutronentherapie. Graffi, A. (ed.). Berlin; Akademie-Verlag (1975). (In German)
From Symposium on neutron therapy; Rossendorf, Dresden, German Democratic Republic (26 Apr 1973).

Sedimentation analyses were used to demonstrate the difference between ⁶⁰Co gamma irradiation and neutron irradiation of HeLa cells. Though the rate of DNA strand breaks was nearly the same for gamma radiation and fast neutrons there was a significant difference with regard to the repair. Whereas the DNA breaks induced by gamma radiation were completely repaired after an incubation time of 30 minutes, breaks caused by neutrons showed practically no repair even after a recovery of 8 hours.

- 2747 (ERDA-tr--146, pp 48-53) ROLE OF DIRECT PROTECTION OF CELLS OF THE HEMATOGENIC SYSTEM IN THE RADIOPROTECTIVE ACTION OF CERTAIN BIOGENIC AMINES ON THE ANIMAL ORGANISM. Smirnova, I.B.; Dontsova, G.V.; Yanushevskaya, M.I.; Graevskii, E.Ya. (Inst. of Developmental Biology, Moscow). 1975. Translated from Radiobiologiya; 15: No. 5, 680-683(1975).

Radiobiology. It was established by the method of spleen exocolonies on mice that serotonin, adrenaline, and noradrenaline possess the ability to protect both isolated bone marrow cells and cells in situ; a significant fraction in the radioprotective action of the investigated amines on the animal organism consists of the direct protective action on their cells; in the case of serotonin and adrenaline, the cell protection in the organism is supplemented by the radioprotective action of tissue hypoxia induced by these amines.

- 2748 RECOVERY DURING RADIATION AND CHEMICAL

MUTAGENESIS. Deen, D.F. Lawrence, KS; Univ. of Kansas (1975). 213p. University Microfilms Order No. 76-16,714.

Thesis (Ph. D.).

These investigations were directed toward the study of recovery in radiation and chemical mutagenesis in cultured mammalian cells. A mutagenesis system was established in which mutation of V79-17b Chinese hamster cells to 8-azaguanine resistance was tested. The effects of split dose and postirradiation treatments upon both x-ray and EMS induced mutagenesis were determined. Increasing the cell inoculum by a factor of 5 (from 10⁵ to 5 x 10⁵) decreased both the spontaneous and x-ray induced mutation frequencies by two orders of magnitude. The x-ray induced mutation frequency was found to be higher for those cells allowed to attach for 5 hours before irradiation, in comparison to those allowed to attach for 2 hours. The uv spectrum of 8-azaguanine changes as a function of storage time at low temperature, but not when diluted to either 10 µg/ml or 30 µg/ml and maintained at 37°C. The optimal expression time required after irradiation is dose dependent and can be determined from the relationship: E.T. = 1.93(10⁻²)D + 15.5. (E.T. = hours; D = rads). The duration of the optimal expression time can be estimated by summing the cell cycle time and the radiation induced lag time.

- 2749 ALTERATIONS IN RNA TURNOVER FOLLOWING X-IRRADIATION. Hetzel, F.W.; Kolodny, G.M. (Massachusetts General Hospital, Boston). Radiat. Res.; 62: 585(1975).

Mouse embryonic fibroblasts, 3T3, were irradiated in growing and confluent states with 280KV x-rays to a dose of 3750 rads. All cells were prelabeled while growing with ¹⁴C thymidine for 24 hours and for 24 hours with ³H uridine in either the growing or confluent state. The turnover of prelabeled cellular RNA was then studied. While RNA turnover normally occurs in confluent cells and does not occur in subconfluent cells the results of this study suggested the existence of RNA turnover in both cell populations following radiation. The rate of RNA turnover in irradiated confluent cells was less than that seen in normal confluent cells while for irradiated growing cells the rate of turnover was higher than in controls. The two rates were approximately equal in both irradiated populations. In each case the amount of prelabeled DNA lost from the acid insoluble fraction was approximately 50 percent after 10 days. The possible significance of these results in relation to radiation induced giant cell formation and alterations in RNA minor bases will be discussed.

- 2750 DNA DAMAGE AND ITS REPAIR IN HYPERTHERMIC MAMMALIAN CELLS: RELATION TO ENHANCED CELL KILLING. Ben-Hur, E.; Elkind, M.M. (Hebrew Univ., Jerusalem). pp 703-717 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

Recently, it was reported that cultured mammalian cells are killed more readily under hyperthermia compared to normal conditions. In this presentation we summarize observations relative to the sensitizing effects of hyperthermia and several agents that are known to induce DNA damage. Correlations between cell killing and DNA damage and repair are noted, and the possible use of this approach in cancer therapy is discussed.

- 2751 CHEMICAL RADIOSENSITIZATION STUDIES WITH MAMMALIAN CELLS GROWING IN VITRO. Chapman, J.D.; Dugle, D.L.; Reuvers, A.P.; Gillespie, C.J.; Borsa, J. (Whiteshell Nuclear Research Establishment, Pinawa, Manitoba). pp 752-760 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

The study of chemicals which can sensitize cells to the lethal action of ionizing radiation has proved useful in the elucidation of cellular radiation mechanisms. Those which selectively radiosensitize hypoxic cells could have a role, in combination with radiotherapy, in an improved treatment of some solid tumors. The scope of this paper is restricted to those compounds which appear to mimic the radiosensitizing action of molecular oxygen in mammalian cells and have come to be known as electron-affinic (EA) sensitizers.

- 2752 THE INITIAL SLOPE OF THE GAMMA-RAY SURVIVAL CURVE IN THE THEORY OF RBE. Katz, R.; Sharma, S.C. (Nebraska Univ., Lincoln (USA)). pp 78-85 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Inferences about the initial slope of the survival curves of cells exposed to gamma rays may be drawn from the variations of RBE with dose and with radiation quality. As perceived by a biological cell capable of accumulating sublethal damage, the essential difference between a primary photon and a primary heavy particle lies in the probability that a single particle can eject sufficient delta rays to inactivate the cell through which it passes. Various examples of RBE-LET relationships are discussed. A calculation is presented of the survival of several population mixtures of cells having radiosensitivity parameters appropriate to hamster cells in (A) early S, (B) G₁, and (C) G₂ phases. RBE-dose relations have been calculated for neutrons of various energies for different mammalian cells. It is stated that, in summary, the RBE-dose relations may be taken to support the view of the theory of RBE that gamma-ray survival curves have an initial shoulder (rather than an initial negative slope) where the RBE exceeds 1 at any LET.

- 2753 STATISTICAL AND BIOPHYSICAL ASPECTS OF THE SURVIVAL CURVE. Kellerer, A.M. (Columbia Univ., New York (USA). Coll. of Physicians and Surgeons). pp 69-77 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Statistical fluctuations in a series of repeated x-ray survival curves of non-synchronized V79 hamster cells are considered. Within each experiment the fluctuations are close to those theoretically expected on the basis of Poisson statistics. Between successive

experiments however sensitivity fluctuations of the order of 10% occur. The mean and the variance of the survival curves in nine repeated experiments are analysed and are compared to the conventional parameters n and q . A normalization utilizing the observed mean values for each experiment leads to an idealized x-ray survival curve. This curve corresponds only in its lower dose range to a mathematical expression in which the logarithm of the survival curve is proportional to a linear and a square term in absorbed dose. For V79 cells in late S-phase however one obtains full agreement with such an equation. Microdosimetric considerations are used to derive the distances over which radiation products or sublesions must interact to cause a nonlinear component in absorbed dose. It is found that for interaction distances of the order of 10 to 100 nm the linear component must always be predominant up to doses of 1000 rad or more. A higher-order term in absorbed dose which is comparable to the linear term at doses of a few hundred rad implies interaction distances close to a micrometre.

- 2754 GENETIC DAMAGE AND MAMMALIAN CELL SURVIVAL CURVES. Burki, H.J. (California Univ., Berkeley (USA)). pp 209-216 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Recent studies have shown that both the extent of shoulder of the Chinese hamster cell survival curve and the final slope are influenced by the ploidy of the cells. These results suggest that chromatin and chromosomal damage may be the major cause of reproductive death in these cells. After low doses most likely deletions predominate in causing death while after large doses two-hit aberrations predominate. Both the shoulder and the slope of the mammalian cell survival curve are changed by changing the quality of the lesion in the chromatin using tritiated thymidine or ¹²⁵I Udr incorporated into the DNA. The survival curve found after ¹²⁵I damage is almost exponential with a final D₀ of 50 rad while the survival curve after tritiated thymidine incorporation has a D_{sub}(q) of 750 rad and a final D₀ of 450 rad. This change is analogous to the change found when the effects of radiation of normal and high LET are compared. Although the number of strand breaks per unit dose to the nucleus is similar when cells are exposed to tritium or ¹²⁵I decays in the DNA or cells are exposed to x-rays, when compared on a dose to the nucleus basis the repairability of the single-strand breaks produced is quite different. A large percentage of the single-strand breaks induced by ¹²⁵I disintegrations are not rejoined. This lack of rejoining suggests that the efficiency of radiation in activating cells is related to the production of non-repaired DNA damage as has been observed in micro-organisms.

- 2755 RADIOPROTECTORS, RADIOSENSITIZERS AND THE SHAPE OF THE MAMMALIAN CELL SURVIVAL CURVE. Chapman, J.D.; Gillespie, C.J.; Reuvers, A.P.; Dugle, D.L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). pp 135-140 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley

(1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Chemical radioprotectors and radiosensitizers have been used as tools in the study of mechanisms of mammalian cell inactivation by ionizing radiations. A correspondence between the rate of inactivation of cellular proliferative capacity and the rate of induction of strand breaks in cellular DNA has been found. The Chadwick-Leenhouts model, which relates unrepaired DNA double-strand breaks to cell inactivation, accurately describes the inactivation kinetics of Chinese hamster cells irradiated in the presence of various chemical modifiers. Hydroxyl radicals, the species responsible for the bulk of indirect effect in mammalian cells, have been found to contribute to cell inactivation resulting from single (α) as well as from double (β) events. Free radical repair, by hydrogen donation from sulphhydryls, can protect cells against both α and β inactivating events. Molecular oxygen and other radical-oxidizing chemicals potentiate cell inactivation predominantly by enhancing single-strand breakage (β events). At doses of 500 rad and less, cell inactivation results predominantly from single events. A model for cell inactivation based on these observations has provided a framework whereby experimental data from studies in microdosimetry, radiation chemistry, radiation molecular biology, and radiotherapy can be inter-related.

- 2756 X-RAY SURVIVAL CURVES OF CULTURED HUMAN DIPLOID FIBROBLASTS. Cox, R.; Masson, W.K. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). pp 217-222 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Primary foetal lung cells had shouldered x-ray survival curves. The shoulder was lost after only two in vitro population doublings, but had returned in three late passage cultures tested. Changes in the cloning efficiency, population doubling times and distribution of karyotypes were observed during the in vitro life-span of the cells but the nature of the changes in radiosensitivity observed remains uncertain.

- 2757 INTERCELLULAR CONTACT: ITS INFLUENCE ON THE $D_{SUB}(Q)$ OF MAMMALIAN CELL SURVIVAL CURVES. Durand, R.E. (Wisconsin Univ., Madison (USA). Dept. of Radiology); Sutherland, R.M. pp 237-247 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Cell survival in tissues exposed to a given dose of ionizing radiation is usually greater than that of similar cells grown individually in vitro, despite the fact that the radiosensitivities (D_0) are virtually identical under the two conditions. An analogous increase in cell survival is observed when Chinese hamster V79-171 cells are grown in suspension culture and irradiated as multicell spheroids. Unfortunately, the information gained from the survival curves so obtained is limited by the inhomogeneity of the cell population with

respect to both degree of contact and cell cycle position. The latter can be studied using synchronized small spheroids. The ratio of $D_{SUB}(Q)$ of spheroid cells to $D_{SUB}(Q)$ of single cells increased as the cells progressed through the cell cycle, from a minimum of 1.3 for G_1 phase cells to a maximum of 2.2 for late S-phase cells. The enhanced survival, or 'contact effect', developed slowly as the spheroids grew, after an initial latent period of about one generation cycle of the cells. A second effect of intercellular contact on mammalian cell survival has also been observed. When cells are assayed under conditions in which intercellular contact is maintained, the net cellular survival is increased further. This effect is different from the usual repair of potentially lethal damage, in that it occurs much more slowly and results in modification of the survival-curve shoulder. Not all cell types tested have shown enhanced survival when grown as spheroids. Several MNNG-induced mutants of the Chinese hamster V79-171 line have been isolated and sublines which do and do not show the contact effect are now available. These may permit study of the mechanism(s) of contact effects.

- 2758 SURVIVAL OF X-IRRADIATED HAMSTER CELLS. ANALYSIS IN TERMS OF THE CHADWICK-LEENHOUTS MODEL. Gillespie, C.J.; Chapman, J.D.; Reuvers, A.P.; Dugle, D.L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). pp 25-31 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Survival measurements, with well synchronized cells, are compared with the equation derived from the Chadwick-Leenhouts model. Corrections for DNA replication are shown to be required. Corrected data are accurately fitted by the equation at all stages of the cell cycle. Synthesized data for asynchronous cells are shown to conform fortuitously to the same equation, as found experimentally. Evidence from DNA strand breakage and repair studies supports the direct relationship with survival proposed in the model. Use of the equation to establish the initial shape of survival curves appears to be well justified. On this basis, the initial shape is always a finite slope, except for predominantly late interphase or mitotic cells, for which zero slope may be approximated.

- 2759 EFFECTS OF PROTRACTED GAMMA IRRADIATION ON CELLS FROM A RAT RHABDOMYOSARCOMA TREATED IN VITRO AND IN VIVO. Kal, H.B. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Instituut TNO). pp 259-267 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Experiments designed to obtain insight into factors which influence reproductive death of R-1 tumour cells during and after protracted irradiation with ^{137}Cs gamma rays are discussed. Cells were derived from a transplantable rat rhabdomyosarcoma which can also be cultured in vitro. Results of experiments with in vitro cultured cells show

that repair of sublethal damage takes place during protracted gamma irradiation. Nevertheless an acute single dose given at the end of a protracted irradiation of many hours is more effective with respect to cell inactivation than a single acute dose applied without pretreatment. This increased radiosensitivity at the end of a low dose rate treatment can be explained by the observation that cells were redistributed over the cell cycle phases with relatively more cells in the G_2 phase. For R-1 cells in the tumour irradiated in situ and assayed in vitro, repair of sublethal damage and redistribution was observed as well. In addition, it was found that reoxygenation of hypoxic cells took place. The effectiveness of protracted irradiation on R-1 cells cultured in vitro as compared to acute irradiation depends on the dose rate. The dose-rate modification factor for R-1 calls irradiated in the tumour in situ, however, does not vary with the dose rate in the range 75 to 150 rad h^{-1} . The D_0 of the slope of a low dose rate survival curve is not an accurate measure of the D_0 of the initial slope of a high dose rate survival curve. Results are compared with data obtained with protracted irradiation on a normal tissue, the rat skin.

- 2760 RELATION OF INTRACELLULAR CYCLIC AMP TO THE SHAPE OF MAMMALIAN CELL SURVIVAL CURVES. Lehnert, S. (McGill Univ., Montreal, Quebec (Canada)). pp 226-235 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Results of experiments with V79 cells growing in tissue culture indicate that the reproductive survival of cells following irradiation is influenced by the level of intracellular 3', 5'-cyclic adenosine monophosphate (cyclic AMP) at the time of irradiation. Cells containing high levels of cyclic AMP induced by treatments with drugs show a characteristic survival curve in which the extent of the shoulder is increased so that the survival after low doses is enhanced. The exponential slope or D_0 , however, is decreased so that at high doses the survival of cells containing high levels of cyclic AMP may be less than that of controls. Naturally occurring changes in radiosensitivity such as those observed as cells pass through the division cycle, may also be related to parallel changes in cyclic AMP concentration occurring during the cycle. Injection of mice with compounds producing elevated cyclic AMP prior to whole-body irradiation increases survival at seven days post-irradiation. The shape of the survival curve for intestinal stem cells in these mice differs from that of the control in having an increased extrapolation number; no change in D_0 is observed in this in vivo situation.

- 2761 THE EFFECT OF REPEATED SMALL DOSES OF RADIATION ON RECOVERY FROM SUBLETHAL DAMAGE BY CHINESE HAMSTER CELLS IRRADIATED IN OXIC OR HYPOXIC CONDITIONS IN THE PLATEAU PHASE OF GROWTH. McNally, N.J. (Mount Vernon Hospital, Northwood (UK)). pp 119-125 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16

Sep 1974).

Unfed plateau phase Chinese hamster cells have been irradiated with either single doses or up to ten fractions of x-rays six hours apart. These cells remained in an extended G_1 -like phase throughout the irradiation period. The single-dose log survival curve had an extrapolation number of about 9 and the oxygen enhancement ratio was three. Cells were exposed either to 200 rad per fraction in air and 600 rad per fraction in hypoxia (during irradiation only), or 150 rad per fraction in air and 450 rad per fraction in hypoxia. The resulting fractionated log survival curves did not fit a multitarget model of cell survival, being much steeper than that would predict. The addition of a single-hit component to the lethal effect of the radiation gave reasonable agreement for the first five fractions although the curves tended to bend downwards with increasing number of fractions. The log survival curve for cells irradiated with five fractions of 200 rad (or 600 rad in hypoxia) six hours apart and graded doses six hours after the fifth fraction had an extrapolation number much less than that following single doses, implying a decreased ability to absorb radiation damage as sublethal. The ratio of the initial slopes of the fractionated log survival curves for irradiation in air and hypoxia was less than three, implying that the oxygen enhancement ratio on the shoulder may be less than that in the exponential region of survival.

- 2762 RESPONSE OF HELA AND CHINESE HAMSTER CELLS TO LOW DOSES OF PHOTONS AND NEUTRONS. Nias, A.H.W.; Gilbert, C.W. (Christie Hospital and Holt Radium Inst., Manchester (UK)). Paterson Labs.). pp 93-99 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Survival of colony-forming ability has been estimated for HeLa and Chinese hamster (ovary) cells irradiated in vitro with 300 kV x-rays at 100 rad min^{-1} , with ^{60}Co gamma rays over protracted periods of time, with 14 MeV DT neutrons at 10 to 30 rad min^{-1} and with protracted ^{252}Cf neutron irradiation. A computer program has been used to analyse the experimental data to determine the best fit to a Puck-type survival curve. Comparison of the survival curves of HeLa cells show that oxygen was a simple DMF when cells were only hypoxic but not when they were completely anoxic. The same contrast applied to a change in LET from 300 kV x-rays to 14 MeV neutrons; with CHO cells a simple DMF was found but with HeLa cells it was not. With protracted cobalt gamma-irradiation, oxygen was a simple DMF; with californium it was not. The comparison between cobalt and californium is therefore complicated. In two series of experiments the dose-response of both HeLa and CHO cells was measured over the shoulder as well as the straight-line portions of the Puck curves for both 300 kV x-rays and 14 MeV neutrons. The initial slopes of the survival curves could therefore be computed. These observations lead to the conclusion that for x-rays the initial slope of the survival curve for CHO cells is only just significantly different from zero. For HeLa cells the x-ray curve has a well defined initial slope.

- 2763 EFFECT OF CYSTEAMINE ON THE YIELD OF CHROMOSOMAL ABERRATIONS IN LYMPHOCYTES OF HUMAN

BLOOD IRRADIATED WITH GAMMA RAYS. Mileva, M. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: No. 1, 36-40(1975). (In Bulgarian).

Whole blood is irradiated with ^{60}Co gamma rays at doses of 93, 188, 372 and 558 rads with and without the addition of cysteamine at a dose of 200 gammas per 1 mm of blood. A lymphocyte culture is fixed 52 hours after stimulation with phytohemagglutinin, and various chromosomal aberrations were determined. The protective effect of cysteamine is manifested on all types of aberrations. A protective factor P was calculated from the relation: $P = (100 - O/K) 100$. Here O is the number of aberrations with protection, and K is the number of aberrations without protection by cysteamine. The protective effect is 18.4 percent at 93 rad, 53.3 percent at 188 rad, 69.7 percent at 372 rad, and 75.7 percent at 558 rads. It is concluded that cysteamine protects the somatic cells of man from radiation damage by gamma rays. 17 refs.

- 2764 EXPERIMENT TO DETERMINE THE RELATIVE GENETIC EFFICIENCY OF FAST NEUTRONS IN INDUCING RECIPROCAL TRANSLOCATIONS IN SPERMATOGONIA OF MICE. Khadzhiyeva, T. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: No. 1, 87-91(1975). (In Bulgarian).

A neutron dose of 25 R from a plutonium-beryllium source was given to male mice of the C57 BI line over a period of 10, 70 and 720 hours and corresponding dose rates of 0.0410, 0.006 and 0.0006 rads per minute. A gamma dose of 200 R was administered over a period of 10, 70 and 720 hours and at corresponding dose rates of 0.33, 0.048 and 0.0048 rads per minute. Cytological analysis of primary spermatocytes in diakinesis of metaphase I was carried out to determine reciprocal translocations occurring in spermatogonia. A total of 1.2, 2.6 and 2.8 cells with translocations were measured in the neutron series. At neutron dose rates of 0.0410, 0.006 and 0.0006 rads per minute the corresponding translocation rates were 0.6×10^{-3} , 1.0×10^{-3} and 1.1×10^{-3} translocations per rad per cell respectively. In the gamma irradiations the translocation rates were 0.06, 0.06 and 0.08 translocations per rad per cell respectively. These results indicate a high genetic risk to man from radiation with a high linear input of energy. 11 refs.

- 2765 GENETIC CONSEQUENCES OF RADIOACTIVE ISOTOPES. VI. EMBRYONIC LETHALITY IN THE FIRST GENERATION OF MALE MICE TREATED WITH PHOSPHOROUS-32 IN THE PREMEIOTIC STAGE. Baev, I.; Bairakova, A.; Manchev, V. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: No. 1, 97-100(1975). (In Bulgarian).

Male mice of the BALB/C line were given intraperitoneally ^{32}P doses of 0, 25, 50, 75 and 135 microcuries of ^{32}P per mouse. Nineteen days after injection these male mice were housed with five intact females of the C₅₇ BI line. On the 18th day after fertilization the females were dissected, and a count was made of the living and dead embryos and of the yellow bodies. The dominant lethals (DL) were calculated from the formula: $DL = 1 - (\text{ratio of embryos per yellow body on irradiation} / \text{ratio of embryos per yellow body in the controls})$. The dominant lethals were found to increase in the order 0, 2, 10, 28 and 23 percent in the above cases. The embryonic mortality was 13.4, 14.9, 21.8, 37.5 and 33.3 percent respectively in the above cases. 10 refs.

- 2766 GENETIC CONSEQUENCES OF RADIOACTIVE

ISOTOPES. II. CHROMOSOMAL ANOMALIES (TRANSLOCATIONS) FROM IODINE-131 AND STRONTIUM-89 IN MALE SEX CELLS OF RATS. Baev, I.; Bairakova, A.; Benova, D. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: No. 1, 101-104(1975). (In Bulgarian).

Male Wistar rats were divided into three groups. The first group was given 3.5 microcuries of ^{129}I per rat; the second group, 10 microcuries of ^{89}Sr per rat, and the third group was injected intraperitoneally with water to serve as controls. The translocation frequency in rat spermatocytes were found to be 1.5 percent, 3.8 percent and zero respectively in the above three groups. 6 refs.

- 2767 CYTOGENETIC STUDIES IN RATS FED IRRADIATED WHEAT. Vijayalaxmi. (National Inst. of Nutrition, Hyderabad, India). Int. J. Radiat. Biol.; 27: No. 3, 283-285(1975).

The results of a study in which irradiated wheat was stored for 12 weeks before being fed to rats and the time-course of the appearance of polyploid cells with increasing duration of feeding freshly-irradiated wheat are presented. The data presented suggest that when irradiation is used as a method for sterilization and preservation, it is necessary to recommend that irradiated wheat be stored for periods extending beyond three months before it can be considered wholesome for consumption. (ERB)

- 2768 (AED-Conf--75-244-013) PROBLEMS IN THE TRANSPORT OF RADIONUCLIDES BY AIR. Pabst, H.W.; Hoer, G.; Kriegel, H. (Technische Univ. Muenchen (Germany, F.R.). Nuklearmedizinische Klinik und Poliklinik). 1975. 8p. (In German). (CONF-750689--10). INIS.

From 16. annual meeting of the Association of German Radiation Protection Physicians; Kiel, F.R. Germany (20 Jun 1975).

7 refs..

On July 1st, 1974, TWA have announced an embargo on the transport of dangerous materials (including radiopharmaceuticals such as Tc generators) on passenger planes which has since then led to modifications of the IATA regulations. They were forced to this step by the assertion that the transport of radiation sources would mean an unreasonably high radiation load to the flight personnel. It had also been claimed that the incidence of spontaneous abortions is considerably higher for stewardesses in these flights than for others. These claims are invalidated by dose rate measurements of flight personnel in the USA and of Lufthansa flight personnel as well as by the radiological findings of animal experiments. Restrictions on the transport of radiopharmaceuticals by air may also endanger the supply to patients in large hospitals.

- 2769 (AED-CONF--75-696-000, pp 3434-3438) MONTE CARLO SIMULATION OF ASTRONAUT LIGHT FLASH OBSERVATIONS ON APOLLO AND SKYLAB MISSIONS*11014TH INTERNATIONAL COSMIC RAY CONFERENCE. CONFERENCE PAPERS. VOL. 9. T SESSION. Osborne, W.Z.; Pinsky, L.S. (Houston Univ., Tex. (USA). Dept. of Physics). 1975.

From 14. international cosmic ray conference; Munich, F.R. Germany (15 Aug 1975).

3 tabs.; 6 refs..

14th international cosmic ray conference. Conference papers. Vol. 9. T session.

We have carried out detailed Monte Carlo calculations in order to understand better the relation between cosmic ray nuclei and visual flashes observed by astronauts in space. A satisfactory overall fit to all available data (excluding the Skylab observations in the South

Atlantic Anomaly (SAA)) has been achieved by varying three visual system parameters.

- 2770 (AED-Conf--75-769-008) RADIATION PROTECTION STANDARDS AND THEIR APPLICATION. Beninson, D. (United Nations Scientific Committee on the Effects of Atomic Radiation). 1975. 18p. (CONF-7509129--44). NTIS (US Sales Only).

From Meeting on nuclear power plant project planning and implementation; Karlsruhe, F.R. Germany (17 Sep 1975).

Brief discussion of ICRP concepts and recommendations.

- 2771 (AED-Conf--75-769-054) BIOLOGICAL EFFECTS OF NUCLEAR RADIATION. Hotz, G. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Strahlenbiologie). 1975. 9p. (CONF-7509129--139). NTIS (US Sales Only).

From Meeting on nuclear power plant project planning and implementation; Karlsruhe, F.R. Germany (17 Sep 1975).

With tabs..

After a brief survey about the main radiobiological effects caused by ionizing radiation, human symptoms after irradiation and incorporation are shown. The special radiotoxic effect of radionuclides which are chemically associated with metabolism-specific elements such as calcium and potassium is shown and methods of treatment are indicated.

- 2772 (AED-Conf--75-769-063) RADIATION PROTECTION. Koelzer, W. (Kernforschungszentrum Karlsruhe (Germany, F.R.)). 1975. 17p. (CONF-7509129--30). NTIS (US Sales Only).

From Meeting on nuclear power plant project planning and implementation; Karlsruhe, F.R. Germany (17 Sep 1975).

3 figs.; 4 tabs.; 14 refs..

Physical and radiological terms, quantities, and units are presented. Basic principles of radiation protection (ICRP, IAEA, EURATOM, FRG) are discussed. Biological effects of ionizing radiation and objectives of practical radiation protection are also discussed.

- 2773 (BMVg-FBWT--75-1) GAMMA RADIATION AND GAMMA RAY PROTECTION FACTORS OF SHIPS IN VARIOUS SITUATIONS OF RADIOACTIVE FALL-OUT. Brehm, E.H.; Holst, T. (Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Abt. Wehrtechnik). 1975. 66p. (In German). TIC.

4 refs.; with figs. and tabs. Available from ZAED.

In this report the development of methods of evaluating gamma ray protection factors (GSF) of ships for various situations of radioactive fall-out is described. The joining calculations of gamma ray protection factors are performed by the newly developed computer procedure GASUFA. These protection factors determine - in connection with a measured gamma radiation dose at a given detector point - the gamma radiation in different compartments of the ships. The computer program GASUFA is able to perform calculations considering the dependence of energy, place and time for the following situations: - the ship is under a radioactive cloud without fall-out; - the ship is under a radioactive cloud with fall-out; - the ship is contaminated by radioactive fall-out; - the clean or decontaminated ship is going through a zone, which is contaminated by radioactive fall-out; - the ship and the surrounding water surface are contaminated by radioactive fall-

out.

- 2774 (CEA-CONF--3461) STUDY OF A ²⁵²Cf SOURCE PROJECTOR FOR PLESIOCURIETHERAPY. Blanche, J.; Brault, G.; Barthelemy, P.; Boucher, R.; Berger, R.; Chemtob, M.; Parmentier, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1975. 9p. INIS.

From 4. International transplutonium element symposium; Baden-Baden, F.R. Germany (13 Sep 1975).

The source projector described is roughly a sphere 1.10m in diameter with an octagonal steel body and weighs about a metric ton. This device is designed for the purposes: to provide a biological shielding for the storage of 16 source-holders containing a total amount of 25µg of californium-252 and to insure the simultaneous ejection of up to 6 source-holders through the applicators. The availability of the californium-252 source-projector by the end of this year will provide major assistance in the clinical evaluation program of neutron plesiocurietherapy by facilitating the implantation of source-assemblies and reducing the radiation dose to hospital staff.

- 2775 (DHEW/FDA--75-8027) RADIOLOGICAL HEALTH TRAINING RESOURCES, 1975. (Bureau of Radiological Health, Rockville, Md. (USA). Div. of Training and Medical Applications). 1975. 30p. GPO.

The Division of Training and Medical Applications is the component of the Bureau of Radiological Health which has the responsibility for providing training assistance to the Nation's radiological health agencies. Recognizing that these agencies are establishing their own user and personnel training programs, the Division offers through the Training Resources Center a variety of educational materials which may be utilized for specific training purposes. This bulletin contains a list of educational materials, including publications, booklets, slides and transparencies, movies, video tapes, training guides, and training seminars for the education of x-ray technicians in radiation protection. (CH)

- 2776 (DHEW/FDA--76-8026, pp 11-14) OVERVIEW OF FEDERAL AGENCY RADIATION PROTECTION ACTIVITIES. I. Augustine, R.J. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: uranium fuel cycle standards; development of plutonium and transuranium standards; water standards; natural radioactivity; the phosphate industry; radon in natural gas; environmental effects of high-voltage electrical transmission; medical x-rays; occupational radiation exposure; and EPA policy statements. (HLW)

- 2777 (DHEW/FDA--76-8026, pp 15-19) OVERVIEW OF FEDERAL AGENCY RADIATION PROTECTION ACTIVITIES. II. Schwartz, S.A. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: responsibilities of ERDA and other federal agencies; nuclear facility licensing; guiding principles of the

Nuclear Regulatory Commission; radiation doses to personnel; design of facilities and equipment that contain, store, or transport radioactive material; radiation protection training programs; transportation surveillance program; and effluent and environmental monitoring contract program. (HLW)

2778 (DHEW/FDA--76-8026, pp 21-25) OVERVIEW OF FEDERAL AGENCY RADIATION PROTECTION ACTIVITIES. II. Villforth, J.C. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: procedural regulations of the FDA; scientific basis for regulatory programs; standards for lasers and diagnostic x-ray equipment; genetically significant dose from medical x-ray exposure; development of bone marrow and other organ dose models; and evaluation of thyroid and bone marrow doses. (HLW)

2779 (DHEW/FDA--76-8026, pp 70-76) RADIOLOGIST'S VIEW OF THE EFFICIENT USE OF DIAGNOSTIC RADIATION. McClenahan, J.L. (F.A.C.R., I.A.C.P., Philadelphia). 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Emphasis is placed on the excessive and unnecessary use of x rays for diagnostic examinations. In many cases the only benefit to the patient is psychological reassurance and radiologists sometimes subject the patient to unnecessary x radiation to obtain illustrations for research papers. The moral obligation of the radiologist to refuse to make an x-ray diagnosis is discussed. (HLW)

2780 (DHEW/FDA--76-8026, pp 77-84) HOW PATIENTS VIEW THE EFFICIENT USE OF DIAGNOSTIC RADIATION. Laws, P. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: lack of communication between doctors and patients; requirements of hospitals and employers for x rays without justification for these requirements; effects on patient of long time delays and numerous retakes; activities of the FDA Bureau of Radiological Health; and recognition of the patient as an integrative factor in the diagnostic radiation system. (HLW)

2781 (DHEW/FDA--76-8026, pp 85-95) RADIATION EXPOSURE CONSIDERATIONS IN THE DESIGN OF ELECTRONIC PRODUCTS FOR CONSUMER USE. McConnell, D.R. (Amana Refrigeration, Inc., Amana, IA). 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

A review is given of the design, manufacture, quality control, and testing of microwave ovens to ensure that they comply with federal regulations. Some aspects of the review are common to all electronic products regulated under the radiation control for Health and Safety Act of 1968. The majority of microwave

ovens deliver about 600 to 675 watts to the oven cavity, utilizing a fixed frequency magnetron tube which is driven at about 4000 volts. Factors influencing personal exposure are time the oven operates per day and location of people in relation to the oven. Various types of door seals and an interlock for shutting the oven off when the door is opened are described and illustrated. Before an oven design is introduced into commerce an extensive testing program is carried out. (HLW)

2782 (DHEW/FDA--76-8026, pp 96-105) CONSUMER PROTECTION: HOW MUCH AND WHO DECIDES. Cowgill, C.A. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: safety characteristics of electronic products such as color television sets and microwave ovens; impossibility of lay consumer determining frequency, severity, and probability of injury from radiation emissions; leakage of x radiation from color television sets; costs of safety standards to consumer; user habits and attitudes such as ignoring directions in instruction booklets; and consumer participation such as Consumers Union petition to amend the federal microwave standard and meetings of the technical electronic products radiation safety standards committee. (HLW)

2783 (DHEW/FDA--76-8026, pp 128-135) FIELD SURVEILLANCE OF CERTIFIED X-RAY EQUIPMENT. Britain, R.G.; Hazle, A.J.; McHard, D. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: enforcement program for diagnostic x-ray; evaluation of manufacturer's reports; product testing in FDA laboratories; inspection of completed assembly of the x-ray machine; state contracting plans for x ray inspections; national diagnostic compliance; and activities of the Colorado Department of Health. (HLW)

2784 (DHEW/FDA--76-8026, pp 136-143) SURVEY OF MAMMOGRAPHIC EXPOSURE LEVELS AND TECHNIQUES USED IN EASTERN PENNSYLVANIA. Bicehouse, H.J. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Radiation exposures from routine mammographic techniques utilized by 70 facilities in eastern Pennsylvania for a cranio-caudal mammograph on a medium-density, medium-sized breast ranged from 0.25 to 47 R. Five facilities apparently overexposed and underdeveloped their films resulting in the highest exposures observed. Approximately one-third of the facilities did not follow the film supplier's recommendations for image-receptor development. Approximately two-thirds of the x-ray units surveyed had measured half-value layers consistent with total filtrations of from 1.0 to 2.5 mm of aluminum. Apparently, three-fifths of the surveyed facilities had not optimized their mammographic procedures for x-ray energies and image-receptor development. This lack of optimization led to a blurring of techniques and exposures making various techniques statistically indistinguishable in

the lower ranges of exposures; e.g., less than 5 R. The overall range of exposures is consistent with an empirical factor due to the radiologist's choice of desired density. The desired density differences for the same image receptor system cause exposure differences of up to a factor of ten.

2785 (DHEW/FDA--76-8026, pp 144-146) POST-TREATMENT RADIOLOGY FOR QUALITY ASSURANCE IN DENTISTRY. Gerusky, T.M. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

It is emphasized that to justify the use of radiation the patient must derive a benefit. Guidelines are presented in an attempt to define conditions in which the probability of the patient receiving a benefit is sufficiently great to justify the additional post-treatment radiation exposure. In general, post-treatment radiographs are a benefit to the patient only when they indicate that radiographically detectable lesions have not been treated and the dental treatment performed is inappropriate for the individual patient's oral environment. (HLW)

2786 (DHEW/FDA--76-8026, pp 148-153) PENNSYLVANIA'S EXPERIENCE IN MASS SCREENING. Gerusky, T.M. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

A policy statement issued in 1972 by the Assistant Secretary for Health and Scientific Affairs of the Department of Health, Education, and Welfare recommended that community chest x-ray surveys should not be used as a screening procedure for the detection of cardiopulmonary disorders and that when chest x-ray screening programs are justified for selected population groups, the full size photograph, rather than the miniature film, is preferred. A survey conducted in 1974-75 revealed that chest x-rays were required for prisoners, prison employees, school employees, food handlers, and students who wished to participate in sports. Meetings were held with medical associations in the hope of stopping the local mass-screening operations. Of 27 groups in Pennsylvania involved in tuberculosis screening, 12 groups refused or were unwilling to phase out their photofluorographic procedures. The problem will be resolved by regulation. (HLW)

2787 (DHEW/FDA--76-8026, pp 154-156) OVERVIEW OF QUALITY ASSURANCE IN DIAGNOSTIC MEDICAL X-RAY EXAMINATIONS. Benson, J.S. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Quality assurance is defined as reduction of patient exposure and improvement in film quality. The history of quality assurance programs is briefly reviewed. The Dental Exposure Normalization Technique for improving dental practices and dental equipment is discussed. Data on exposure of patients to medical radiation show wide variations. Some causes of poor film quality are inconsistent machine output, poor beam alignment, timer inaccuracy, improper film-screen combination, and poor film-screen contact. (HLW)

2788 (DHEW/FDA--76-8026, pp 157-159) TASK FORCE'S VIEWPOINT OF THE CURRENT BRH PROGRAM. GONAD SHIELD, PART F. Dolezal, A. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

A previous report on radiation protection during diagnostic exposure is reviewed. Some topics discussed are: Task Force regulations for the model by which routine use of patient shielding or gonad shielding would be required; shielding in relation to collimation, scatter radiation, and enforcement of regulations; and proposed regulations for reduction of unnecessary radiation. (HLW)

2789 (DHEW/FDA--76-8026, pp 160-165) BRH GONAD SHIELDING PROGRAM: WHERE IT HAS LED. Arcarese, J.S. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: Bureau of Radiological Health guidelines; types of gonad shields; specific area shielding; gonad shielding guidelines; and publication of pamphlet on types of shields and circumstances under which they should be used. (HLW)

2790 (DHEW/FDA--76-8026, pp 180-183) PROPOSED REGULATIONS ON DOSIMETRY CERTIFICATION. Weiss, B.H. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: development of testing laboratory concept; need for establishing a film dosimetry calibration laboratory; federal agency to direct a continuing performance testing program; need for regulatory device to compel personnel dosimetry suppliers to submit to testing; and criteria for testing of personnel dosimetry suppliers. (HLW)

2791 (DHEW/FDA--76-8026, pp 206-212) LATEST DEVELOPMENTS IN EMERGENCY PREPAREDNESS PLANNING. Collins, H.E. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Emergency preparedness is discussed under the following headings: federal administrative actions concerning emergency preparedness; technical guidance; training; review of state radiological emergency response plans; field assistance effort; and federal response programs under development. (HLW)

2792 (DHEW/FDA--76-8026, pp 213-217) USE AND MISUSE OF THE BEIR REPORT AND NCRP REPORT NO. 43. Hilberg, A.W. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

The BEIR report on the effects on populations of exposure to low levels of ionizing radiation is being used as a radiation

protection guide and to establish radiation standards. This was not the intent of the document. Several statements most often used in the misinterpretation of the BEIR report are quoted and discussed. Report 43 of the NCRP substantiates the value of the BEIR report and brings to attention the necessary understanding of the warnings and restrictions of the use of the BEIR report. (HLW)

- 2793 (DHEW/FDA--76-8026, pp 218-232) RADIATION PROTECTION PHILOSOPHY AND RISK ESTIMATES. NCRP REPORT 43 (1975), NAS-BEIR COMMITTEE REPORT (1972, UNSCEAR REPORT (1972). Casarett, G.W. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

The purpose of the NCRP report no. 43 was to determine what influence the epidemiological and experimental radiobiological reports of the past several years should have on current NCRP radiation exposure standards. The position of the NCRP is that the lowest practicable radiation level below the recommended dose limits is the fundamental basis for establishing radiation protection standards, and on the assumption that the most important health hazards do not have a dose threshold. The BEIR report states that societal needs can be met with far lower average exposures and risks than permitted by the current Radiation Protection Guide of 170 millirems per yr, and that the current Guide is unnecessarily high. A review is given of the recent history of radiation protection standards and a discussion is given of similarities and differences between the BEIR and UNSCEAR reports. (HLW)

- 2794 (DHEW/FDA--76-8026, pp 233-234) REPORT OF THE TASK FORCE ON NATIONWIDE EVALUATION OF X-RAY TRENDS. Ward, J.O. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Objectives of the NEXT program are to identify optimum components of a survey, provide for uniform data collection, provide a system for assigning program priorities, and provide a system for measuring program effectiveness. Studies on new methods of organ dose estimation are discussed and the problem of credibility of NEXT data is considered. (HLW)

- 2795 (DHEW/FDA--76-8026, pp 238-242) REPORT OF THE TASK FORCE ON PERSONNEL DOSIMETRY. Lloyd, L.L. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Recommendations of the workshop on personnel dosimetry are presented and conditions under which reliability testing is to be performed are listed. A baseline study of commercial personnel dosimeter services was conducted to evaluate the state-of-the-art of personnel dosimeters and to test current and proposed standards that apply to evaluation and testing of dosimeters. The Task Force recommended that: the conference support the NRC in the development of regulations requiring licensees to utilize tested personnel dosimetry services; the conference support continued efforts by the Task Force and the various federal agencies in

evaluation of existing standards pertaining to personnel dosimeters and to the development of new criteria and standards which can be applied to the testing laboratory and to suppliers of personnel dosimeters; the Task Force continue in a monitoring status. (HLW)

- 2796 (DHEW/FDA--76-8026, pp 243-246) SUMMARY OF RTC ACTIVITIES. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

A summary of Regional Training Committee activities is presented with regard to assessment of training needs and implementation of training, mechanisms of communication, formal training courses in basic radiological health and radiation emergency planning, and other training services. A summary of available training resources is presented. Recommendations of the National Training Coordination Committee are as follows: continue the RTC concept; broaden the role of the NTCC; the individual should assess its regional resources; increase financial support of RTC; and conference members should support federal efforts in training. (HLW)

- 2797 (DHEW/FDA--76-8026, pp 275-278) WORKSHOP SUMMARY REPORTS. Parrott, M. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Summaries are presented of the activities of the following workshops: develop criteria for an adequate state radiological health program for radiation sources not covered under the atomic energy act; develop user assistance programs at the state level to improve diagnostic x-ray quality; define the role and functions of states in the implementation of current and proposed transportation standards, regulations, and guidelines; explore and define the role of paid radiation consultants in assuring use compliance with state regulations; develop guidance to state radiation health programs in the control and regulation of multiphasic screening mobile laboratories; evaluate federal efforts in assisting states in emergency response planning; develop criteria for the evaluation and distribution of radioactive sources and devices manufactured in nonagreement states; and evaluate the radiation protection practices in nuclear medicine. (HLW)

- 2798 (DHEW/FDA--76-8026, pp 249) REPORT OF THE TASK FORCE ON RADIOPHARMACEUTICALS.

Lacker, D.K.; Porter, B.J.; Watkins, G. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

The procedures for evaluation of IND and NDA applications were reviewed by FDA and the state members of the Task Force believe that there is significant progress being made toward expeditious handling of these items. Progress toward publication of the final rule on radiopharmaceuticals has reduced the need for state regulatory activity in investigational aspects of radiopharmaceutical research to the point that the original concept for the training is no longer valid. (HLW)

- 2799 (DOC-LFEN--163-b) RADIATION PROTECTION

IN PORTUGAL: HEALTH, SAFETY AND LEGAL ASPECTS. Galvao, J.P.; Carreiro, J.V.; Bettencourt, A.O.; Vaz, A.N.; Severo, A. (Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares). 1975. 16p. (In French). Dep. NTIS (US Sales Only), PC A02/MF A01.

5 figs..

The paper describes the basic legal and technical principles governing radiation protection in Portugal. The methods used in the medical surveillance of occupationally exposed persons (especially in the assessment of biological effects) are described, and the results of recent studies carried out with a view to improving biological dosimetry techniques are reported. An account is also given of dosimetry at nuclear centres in mines, at research establishments, in industry and in hospitals and private clinics, the accumulated doses being examined in the light of international recommendations relating to radiation protection. Statistical data on the granting of licences to different kinds of establishment are considered from the radiation safety point of view by the authors, who also describe the methods used for controlling waste from nuclear facilities and the measures taken in such special situations as the visit of a nuclear-powered ship to a Portuguese port or the disposal of radioactive waste into the Atlantic Ocean. A brief account is given of recent efforts to check on radioactive pollution (especially the contamination of milk by ^{90}Sr). Lastly, the criteria followed in licensing and controlling Portuguese establishments which work with radioactive substances or other radiation sources are reviewed and, on the basis of experience, a critical appraisal is made of the application of the fundamental technical and legal principles, which presupposes the necessary co-operation between license-issuing authority, facility operator and staff.

2800 (ERDA--77-29) EIGHTH ANNUAL REPORT OF RADIATION EXPOSURES FOR ERDA AND ERDA CONTRACTOR EMPLOYEES. (Environmental Research and Technology, Inc., Concord, Mass. (USA)). 1975. 49p. Dep. NTIS, PC A03/MF A01.

In 1968, the U.S. Atomic Energy Commission (AEC) established a program for reporting certain occupational radiation exposure information to a central radiation records repository maintained at the Union Carbide Computing Technology Center, Oak Ridge, Tennessee. Annual summaries (WASH-1350-R1 through WASH-1350-R6) were reported for the years 1968 to 1973 and included data on AEC contractor employees as well as employees of companies in the private sector licensed by the AEC. The 1974 data for what is presently ERDA and ERDA contractor employees are published in the ERDA 76/119 report. In January 1975, two new agencies, the Energy Research and Development Administration (ERDA) and the U.S. Nuclear Regulatory Commission (NRC) were formed and now share the responsibilities previously held by the AEC. Previous AEC licensees now report to NRC while the contractors report to ERDA. This report contains 1975 radiation exposure data for ERDA and ERDA contractor employees.

2801 (FRNC-TH--624) CONTRIBUTION TO RESEARCH ON RADIATION PROTECTION OF THE EYES. Soussan, R.E. (Paris-6 Univ., 75 (France)). 1975. 67p. (In French). NTIS (US Sales Only), PC A04/MF A01.

Copies available from Service de Documentation, CEN Saclay, B.P.N2, 91190 Gif-sur-Yvette (France). Thesis.

The problem of the harmful effects of different radiations to which workers are more or less seriously exposed was studied as a whole. It is shown that any ray without exception can cause damage to the ocular apparatus since even natural light, when suffered too intensely or for too long, can cause sight disorders and lesions, and this applied even more to so-called invisible rays: infrared, ultraviolet, laser. Powerful short-range radar waves and X, gamma and cosmic rays are also mentioned. This work covers both a physical study of the above radiations and a clinical anatomical study on the pathogenesis of the eye lesions they cause (more or less serious and more or less irreversible damage to the retina, cornea, crystalline lens, conjunctive tissue). General and individual protective measures are reported, and finally the work laws are discussed in terms of their application to radiation-induced eye troubles.

2802 (INIS-mf--1906) ROLE OF CERENKOV RADIATION IN THE EYE-FLASHES OBSERVED BY APOLLO ASTRONAUTS. McNulty, P.J.; Pease, V.P.; Bond, V.P. (Clarkson Coll. of Tech., Potsdam, N.Y. (USA)). 1975. 40p. INIS.

From 18. COSPAR plenary meeting. Radiation biology; Varna, Bulgaria (29 May 1975).

The variety of visual phenomena experienced by dark-adapted human observers when a pulse of extremely relativistic particles passes through the eyeball have been studied in experiments at the Alternating Gradient Synchrotron at Brookhaven National Laboratory. Experiments with muons and pions involving three subjects were carried out in such a manner that Cherenkov radiation was the physical mechanism initiating the visual sensation. Standard psychophysical techniques were used to determine threshold. Considerable success was obtained in using collimated beam pulses to simulate the types of visual phenomena described by Apollo astronauts. (auth)

2803 (INIS-mf--2078, pp 56-57) THE EFFECT OF PSORALEN AND ULTRAVIOLET LIGHT UPON HUMAN CHROMOSOMES. Waksvik, H.; Broegger, A. 1975.

In summary form only.

Tenth report from Norsk Hydro's Institute for Cancer Research for 1973 and 1974.

ALKYLATING AGENTS;CAFFEINE;CHROMOSOMAL ABERRATIONS;CHROMOSOMES;LYMPHOCYTES;MAN; MUTATIONS;PSORALEN;SYNERGISM;ULTRAVIOLET RADIATION;RADIOINDUCTION;RADIOSENSITIVITY EFFECTS

2804 (INIS-mf--3133, pp III 4-III 7) EVALUATION OF DOSES GIVEN TO FOETUS IN DIAGNOSTIC RADIOLOGY IN ISRAEL. Schlesinger, T.; Donagi, A.; Karpinovitz, A. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Lichter, A.; Hai, J.; Amir, Y.; Naveh, M. (Ministry of Health, Tel Aviv (Israel)). 1975.

From Joint annual meeting of the Israel Nuclear Society and the Israel Health Physics Society (IRPA); Haifa, Israel (30 Nov 1975).

Transactions of the Israel Nuclear Society and the Israel Health Physics Society (IRPA), of the joint annual meeting 1975. Vol. 3.

Among the various groups exposed to diagnostic radiation, pregnant women, during the first months of pregnancy, require special attention, because of the high sensitivity of the developing foetus to ionizing radiation. In light of this sensitivity, special limitations were adopted in different countries, concerning female X-ray technicians in the reproductive age. However, it frequently happens that a

pregnant woman is irradiated during the first months of pregnancy, due to the fact that neither she nor the attending physician is aware that she is pregnant. Many times, after this fact is realized, physicists are asked to "reconstruct" the radiographs in order to evaluate the foetus dose. The purpose of this "reconstruction" is to determine whether an abortion is to be performed. The present work constitutes the first stage of a research designed to provide the radiologist with typical Israeli data, which he could use for evaluating the order of magnitude of the foetus dose. The purpose of this "preliminary evaluation" carried out by the radiologist is to determine whether the foetus dose is of such a magnitude justifying the performance of a specific "reconstruction test" or not.

- 2805 (INIS-mf--3141, pp 129-136) UNACCEPTABLE UNCERTAINTY IN RISK ANALYSIS RELATED TO THE MEDICAL CONSEQUENCES OF NUCLEAR FISSION. Keestra, P.C. 1975. (In Dutch).

From Symposium on key questions about the fast breeder reactor; Delft, Netherlands (27 Nov 1975).

10 refs..

Symposium on key questions about the fast breeder reactor.

The biological radiation effects, as a consequence of the increasing application of nuclear fission and the accompanying migration of radioactive materials like krypton 84, tritium and carbon 14, are usually heavily underestimated. Two reasons are given: 1. the increased sensitivity for ionizing radiation of cells in the process of mitosis and 2. the effects of mutations as a consequence of autoradiolysis of DNA by the decay of tritium and carbon 14. It is argued that those and other effects should be re-examined in detail.

- 2806 (INIS-mf--3141, pp 157-169) IS THE MAXIMUM PERMISSIBLE RADIATION BURDEN FOR THE POPULATION INDEED PERMISSIBLE. Renesse, R.L. van. 1975. (In Dutch).

From Symposium on key questions about the fast breeder reactor; Delft, Netherlands (27 Nov 1975).

29 p..

Symposium on key questions about the fast breeder reactor.

It is argued that legislation based on the ICRP doses will, under economical influences, lead to a situation where the population is exposed to radiation doses near the maximum permissible dose. Due to cumulative radiation effects, this will introduce unacceptable health risks. Therefore, it will be necessary to lower the legal dose limit of 170 millirem per year per person by a factor 10 to 20.

- 2807 (INIS-mf--3141, pp 99-101) SOMATIC AND GENETIC RADIATION EFFECTS AND RISK ESTIMATES IN RELATION TO NUCLEAR ENERGY. Barendsen, G.W. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Instituut TNO). 1975. (In Dutch).

From Symposium on key questions about the fast breeder reactor; Delft, Netherlands (27 Nov 1975).

Published in summary form only; 3 refs..

Symposium on key questions about the fast breeder reactor.

BIOLOGICAL RADIATION EFFECTS; GENETIC RADIATION EFFECTS; NEOPLASMS; NUCLEAR ENERGY; PROBABILITY; RADIATION HAZARDS

- 2808 (INIS-mf--3141, pp 103-114) FUTURE RADIATION EFFECTS. Beentjes, L.B.; Glas, J.A.

(Katholieke Universiteit Nijmegen (Netherlands)). 1975. (In Dutch).

From Symposium on key questions about the fast breeder reactor; Delft, Netherlands (27 Nov 1975).

5 refs..

Symposium on key questions about the fast breeder reactor.

A review is given of the units used in radiation protection. The radiation hazards incurred by human populations can be divided into early and late somatic radiation effects and genetic radiation effects. Examples and motivations of risk analysis estimates are given. For genetic radiation effects, the significance dose and the doubling dose are defined. The minimum permissible dose for different human populations are compared with the doses received from natural radioactivity with medical applications. The risk caused by nuclear reactors and fall-out and its consequences are given for the year 1972 and estimated for the year 2000.

- 2809 (INIS-mf--3179) DICTIONARY OF TERMS AND DEFINITIONS USED IN RADIATION PROTECTION TECHNOLOGY. (Sovet Ekonomicheskoy Vneshnepromyshlennoy Komissiiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh). 1975. 86p. (In Russian). NTIS (US Sales Only).

The dictionary contains terms and definitions used in radiation protection technology. This document is developed by the Section of CMEA Secretariat on peaceful atomic energy application on the basis of materials provided by member states. The dictionary contains versions of terms and definitions in the languages of member states. Total number of terms is 94.

- 2810 (INIS-mf--3257, pp 114) DETERMINATION OF THE DOSE AND LINEAR ENERGY TRANSFER OF MIXED N, γ -RADIATION. Kol'chitskaya, S.L. (Belorusskiy Gosudarstvennyy Univ., Minsk). 1975. (In Russian).

From 1. republican conference of young scientists-chemists; Tallin, USSR (20 May 1975).

1. republican conference of young scientists-chemists, Tallin, May 20-22, 1975.

Radiolysis in alcohol systems. ALCOHOLS; DOSE RATES; DOSIMETRY; GAMMA RADIATION; IONIZING RADIATIONS; LET; QUANTITY RATIO; RADIATION DOSES; RADIOLYSIS; REACTORS; NEUTRONS

- 2811 (INIS-mf--3590, pp 23-31) BIOCHEMICAL EFFECTS OF TRACE AMOUNTS OF URANYL SALTS. Nosek, J. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia). Laboratorni Oddeleni). 1975. (In Czech).

From 9. seminar on the methods of determination and on significance of trace elements in biological materials; Prague, Czechoslovakia (15 Apr 1975).

Trace elements '75.

The biochemical effects were studied of uranyl salt trace amounts on metabolism. In vitro experiments show that microamounts of uranyl salt (from 0.4 to 4 $\mu\text{g U/ml}$) reduce the dehydrogenase activity of D-glyceraldehyde-3-phosphate while increasing its phosphatase activity. The concentration of 10^{-2} $\mu\text{g U/ml}$ increases the activity of glucosyl-6-phosphate dehydrogenase while amounts 10 to 100-times greater significantly inhibit the activity. The process was also studied of the oxidation of nicotinamide coenzymes by gaseous oxygen and by uranium miners' erythrocyte stromata.

2812 (IPNO--75-11) ACTIVITY REPORT OF THE MEDICAL SECTION OF RADIOPROTECTION, 1974-1975. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1975. 16p. (In French). INIS.

This report supersedes the activities of the medical section of the Radioprotection Department of the Orsay Institute of Nuclear Physics: industrial medicine, monitoring of ionizing radiation effects.

2813 (N--76-16913) GAMMA RADIATION AND GAMMA PROTECTION FACTORS ON BOARD SHIPS DURING RADIOACTIVE FALLOUT. Brehm, E.H.; Holst, T. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.)). 1975. 70p. (BMVG-FBWT--75-1). NTIS \$4.50.

Sponsored by Bundesmin. Der Verteidigung. Methods of evaluating Gamma Ray Protection Factors (GRPF) for ships in various situations of radioactive fallout are discussed. These factors determine, in connection with a measured gamma radiation dose at a given detector point, the gamma radiation in different compartments of the ship. A computer program GASUFA was developed to calculate the GRPF. GASUFA performs calculations, considering energy, place, and time dependence, for the following situations: the ship under a radioactive cloud, with or without fallout; the ship contaminated by fallout; the clean or decontaminated ship going to a contaminated zone; and the ship and the surrounding water surface contaminated by fallout. (GRA)

2814 STUDY OF CERTAIN ASPECTS AFFECTING PATIENT DOSE AND DIAGNOSTIC ACCURACY. Ambiger, T.Y.; Ayappan, P.; Hatimbhai; Viswanathan, P.S.; Iyer, P.S. (Bhabha Atomic Research Centre, Trombay, India). pp 529-537 of Biomedical dosimetry. Vienna; International Atomic Energy Agency (1975). From International symposium on advances in biomedical dosimetry; Vienna, Austria (10 Mar 1975).

See STI/PUB--401; CONF-750331--.

With a view to investigating the extent of the implementation of the latest recommendations of the International Commission on Radiological Protection in connection with the protection of patients undergoing diagnostic x ray examinations, certain studies have been carried out in India. These include the study of the sensitometric properties of the high-speed medical x ray films most commonly used in India, the dark-room techniques practised in different x ray departments in the country and the consequent effect on the patient dose, and the equipment parameters of the fluoroscopy units currently being used in the country. The results of these investigations are presented and discussed. The results indicate that the sensitometric properties of the indigenous film-screen combinations are satisfactory. The dark-room techniques lead to undesirable underdevelopment of the films resulting in the overexposure of the patient and loss of contrast. About 45 percent of the fluoroscopy units have table-top exposure rates higher than the ICRP-recommended value resulting in excessive patient exposure. Further, although the target-to-table top distances of the fluoroscopy units examined satisfy the ICRP recommendations, a major drawback of most of the units is the inadequacy of the tube filtration. (auth)

2815 IMAGE QUALITY AND PATIENT EXPOSURE IN MAMMOGRAPHY, TOMOGRAPHY, ANGIOGRAPHY, AND BONE RADIOGRAPHY. Haus, A.G.; Rossmann, K.; Doi, K.; Chiles, J.T. (Univ. of Chicago). pp 539-

555 of Biomedical dosimetry. Vienna; International Atomic Energy Agency (1975).

From International symposium on advances in biomedical dosimetry; Vienna, Austria (10 Mar 1975).

See STI/PUB--401; CONF-750331--.

In diagnostic radiology, the physical factors affecting image quality and patient exposure are complex and must be studied for each individual procedure. They are a function of recording system unsharpness, geometric unsharpness, image noise, and of the shape, size, and absorption properties of the anatomic part radiographed and the lesion to be detected. The choice of recording system has a significant effect on image quality, and the speed of the recording system is directly related to patient exposure for each procedure. This paper discusses the complexities involved in the selection of recording systems for four radiologic procedures. The authors describe in detail their most recent work on mammography with the Lo-Dose system, whereby a significant reduction in exposure may not reduce, but may even increase, the diagnostic accuracy by reducing geometric unsharpness. We also describe several examples: in tomography, image resolution is not decreased and diagnostic certainty is affected by a change from a medium-speed screen to a high-speed screen recording system; in fine-detail skeletal radiography, the diagnostic information is increased significantly by a change from a conventional screen-film technique to a non-screen technique with fine-grain film and optical magnification, but at the cost of increased patient exposure; and in cerebral angiography, diagnostic information can be increased by use of a screen-film recording system of higher resolution, but lower speed for imaging of small blood vessels. Modulation transfer functions and clinical examples are used to illustrate each procedure. (auth)

2816 ASSESSMENT OF POPULATION DOSE IN X-RAY DIAGNOSIS IN BRAZIL. Alves, R.N.; Araujo, A.M.; Nette, P.H.; Peixoto, J.E.; Reis, V.R.; Tostes, H.C.; Vasconcellos, J.M. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro). pp 557-560 of Biomedical dosimetry. Vienna; International Atomic Energy Agency (1975).

From International symposium on advances in biomedical dosimetry; Vienna, Austria (10 Mar 1975).

See STI/PUB--401; CONF-750331--.

Measurements of gonadal and thyroidal doses were made in Brazil to estimate the contribution of mass chest and dental radiography to the population dose during diagnostic radiography. A survey of the conditions under which the x-ray machines were used and of the film processing procedures in a representative sample of institutes indicated easy measures that could be taken to reduce the population dose. (auth)

2817 HAZARDS ASSOCIATED WITH STAGE ONE: MINING. pp 11-15 of Uranium: metal of menace. East Melbourne, Australia; Australian Conservation Foundation (1975).

Radiation hazards in uranium mining arise from the presence of ^{222}Rn , a gas which can escape from exposed rock surfaces into the air. Radon daughter products have been associated with an increased incidence of respiratory lung cancer. Other hazards include the tailings which arise from the extraction of uranium ores. The tailings still contain most of the original radium and emit gamma rays and radon gas. The hazards associated with uranium enrichment and fuel manufacture are also discussed. (AT)

- 2818 BIOLOGICAL EFFECTS OF RADIATION. pp 36-40 of Uranium: metal of menace. East Melbourne, Australia; Australian Conservation Foundation (1975).

The controversy of the biological effects of radiation is discussed. The arguments for the acceptance of the radiation risks associated with nuclear power are criticized. (RL)

- 2819 POLYCYTHEMIA VERA TREATED WITH ^{32}P AND MYLERAN: DEVELOPMENT OF CHRONIC GRANULOCYTIC LEUKEMIA WITH CHROMOSOMAL ABNORMALITIES IN ONE PATIENT. Stavem, P.; Sandnes, K. (Rikshospitalet, Oslo (Norway)); Hagen, C.B. van der (Oslo Univ. (Norway)); Vogt, E. (Statens Institutt for Folkehelse, Oslo, Norway). Clin. Genet.; 7: 227-231(1975).

Chronic granulocytic leukemia developed in a 59-year-old woman who had previously received a total of 21 mCi ^{32}P for polycythemia vera. She was treated with Myleran (busulphan) for her chronic granulocytic leukemia. Cytogenetic studies revealed deletion of chromosomes No. 8 and 12, and translocation between 1 and 8. The patient also developed a severe autoimmune hemolytic anemia, for which she received prednisone treatment. She died with a perforated stomach ulcer. (INIS)

- 2820 RADIOCARDIOGRAPHIC DATA ON HEMODYNAMICS IN INDIVIDUALS OCCUPATIONALLY EXPOSED TO SOURCES OF IONIZING RADIATION. Denisova, E.A.; Smirnova, M.I. (Scientific Research Inst. of Labor Hygiene and Occupational Diseases, Moscow). Radiobiologiya; No. 8, 106-110(1975). (In Russian).

Radiocardiography was employed to obtain hemodynamic data for 51 middle aged subjects occupationally exposed to gamma- or x-rays (total exposure amounting to 30-50 rem in the majority of cases) and 41 control subjects without such exposure. The resultant data showed that the control values were as follows: 124.5 $\pm$ 5.1 mm Hg maximum arterial pressure, 73.2 $\pm$ 3.0 mm Hg minimum arterial pressure, 72.7 $\pm$ 3.3 beats/min pulse frequency, 66.2 $\pm$ 2.0 ml circulating volume, 4.4 $\pm$ 0.12 liters/min/m² minute index, 65.2 $\pm$ 2.9 ml/m² stroke index, 16.4 $\pm$ 0.8 sec systemic blood flow, 5.1 $\pm$ 0.12 sec pulmonary blood flow, and 1.72 $\pm$ 0.05 for circulatory efficiency coefficient. The corresponding values for the exposed subjects were, respectively, 119.7 $\pm$ 4.8 mm Hg 72.8 $\pm$ 3.2 mm Hg, 70.6 $\pm$ 5.6 beats/min, 73.98 $\pm$ 3.6 ml, 4.9 $\pm$ 0.1 liters/min/m², 72.8 $\pm$ 3.5 ml/m², 17.2 $\pm$ 1.2 sec, 6.7 $\pm$ 0.36 sec and 1.76 $\pm$ 0.1. The hemodynamic changes were most pronounced in subjects with a 6-10 year work history, and less remarkable in those with shorter or longer employment. Hemodynamic changes were also more pronounced and encountered more frequently among individuals with functional disorders of the nervous system, such as neurocirculatory dystonia. That the hemodynamic differences are dependent on the duration of work suggests that these changes are adaptive in nature.

- 2821 REVIEW OF BIOLOGICAL EFFECTS AND POTENTIAL RISKS ASSOCIATED WITH ULTRAVIOLET RADIATION AS USED IN DENTISTRY. Mills, L.F.; Lytle, C.D.; Andersen, F.A.; Hellman, K.B.; Bockstahler, L.E. Rockville, MD; Department of Health, Education, and Welfare (1975). 33p. GPO \$0.85.

Several dental procedures, recently developed and currently in use by the dental profession, involve the use of near or far ultraviolet (uv) radiation in the oral cavity.

Recent studies on the biological effects of near and far uv radiation suggest potential risks to individuals from excessive uv exposure. In this paper the dental procedures are briefly described, the bases for uv safety standards are reviewed, effects of uv exposure to the skin and eyes and how these effects may relate to oral mucosa exposure are considered, potential modes of action by uv radiation on oral tissues as suggested by cell culture studies are summarized, and potential risks from uv exposure of individuals which might result from the dental procedures are discussed.

- 2822 (ERDA-tr--110, pp 105-111) CALCULATION OF THE CONDITIONS OF IRRADIATION IN EXPERIMENTAL MODEL STUDIES OF CHRONIC OCCUPATIONAL IRRADIATIONS. Berikashvili, V.Sh. 1975. Translated from Radiobiologiya; 15: No. 4, 577-582(1975).

Radiobiology. The correlation of the body weight and other physiological indices with the values of LD_{50/30-60} and the half-recovery period after irradiation in man and in laboratory animals of various species was investigated. A significant exponential interrelationship of these indices was detected, and the parameters of the dependence of the radiobiological indices on the body weight of the animals were found. Mathematical conditions of similarity of the accumulation of doses in chronic irradiation of man and animals were obtained on the basis of the equations of Blair and Davidson for the effective dose after a single irradiation. The conversion factors, as well as the intensities and durations of irradiation of various animals simulating occupational irradiation of 5 rad/year for 20 years, were calculated. (tr-auth)

- 2823 CLINICO-MORPHOLOGIC STUDY OF LEUKOPLAKIA OF THE VULVA PRIOR TO AND AFTER PHOSPHORUS 32 TREATMENT BY USE OF APPLICATORS. Tileva, M.D.; Iliev, E. (Meditsinski Fakultet, Plovdiv (Bulgaria). Radioizotopen Tsentyr s Radiologichna Klinika). Rentgenol. Radiol.; 14: No. 2, 134-141(1975). (In Bulgarian).

EARLY RADIATION EFFECTS; EPITHELIUM; FEMALE GENITALS; HEALING; LOCAL RADIATION EFFECTS; MUCOUS MEMBRANES; PATHOLOGICAL CHANGES; PATIENTS; PHOSPHORUS 32; RADIOTHERAPY; UROGENITAL SYSTEM DISEASES; SIDE EFFECTS

- 2824 TOTAL-BODY IRRADIATION AND HUMAN CHROMOSOMES. V. ADDITIONAL EVIDENCE OF A TRANSFERABLE SUBSTANCE IN THE PLASMA OF IRRADIATED PERSONS TO INDUCE CHROMOSOMAL BREAKAGES. Goh, K. (Oak Ridge Associated Universities, TN). J. Med. (Westbury, N.Y.); 6: No. 1, 51-60(1975).

A substance (or substances) produced or activated by total-body irradiation in man and capable of affecting the chromosomes for an extended time has been postulated. Leukocytes from normal persons were cultured with autologous plasma, homologous plasma or serum from patients irradiated 10.5 years previously. Thirty (5.5 percent) chromosomal breaks were found in the 550 metaphases from the control cultures, 152 (13 percent) in the 1175 metaphases from the irradiated plasma cultures and 130 (12 percent) in the 1100 metaphases from the irradiated serum cultures. This finding confirms and extends our previous observation that plasma from total-body irradiated persons is capable of inducing chromosomal breakage in normal leukocytes even 10.5 years after the irradiation. (auth)

- 2825 DOSES OF HUMAN SKIN IRRADIATION DUE TO POLLUTION WITH LIQUID RADIOACTIVE SUBSTANCES. Vasilev, G.; Mikhajlov, M.G.; Sharov, P. (Nauchno-Izslédovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 14: No. 1, 42-43(1975). (In Bulgarian).
BETA PARTICLES; CESIUM 137; CHLORIDES; EPIDERMIS; GOLD 198; IODINE 131; LIQUID WASTES; MAN; RADIATION DOSES; RADIONUCLIDE KINETICS; SKIN; STRONTIUM 85; STRONTIUM 89; STRONTIUM 90
- 2826 MANUAL ON RADIATION PROTECTION IN HOSPITALS AND GENERAL PRACTICE. VOLUME 2. UNSEALED SOURCES. Frost, D.; Jammet, H. Geneva; World Health Organization (1975). 113p. SF.24.00.
Published under the auspices of the International Labour Organization, the International Atomic Energy Agency and the World Health Organization, this volume, the second of a series of 5, reviews the radiation protection requirements in hospitals using unsealed radioactive sources and discusses the problems associated with the administration, handling, and transportation of these sources: characteristics of unsealed sources and radiation hazards; diagnostic and therapeutic applications of radionuclides; organization and staffing; planning of facilities and general layout of a department for the use of unsealed sources, with examples; safe handling of unsealed sources; waste treatment and disposal; monitoring; special problems relating to tritium and carbon-14; decontamination; protection of patients; handling of cadavers with incorporated radionuclides; protection of personnel and members of the public; measures for dealing with accidents. Characteristics of some commonly used radionuclides and doses used in diagnostic examination are appended.
- 2827 THE BIOLOGICAL EFFECTS OF RADIATION. pp 36-40 of Uranium. Metal of menace. Melbourne, Australia; ACF (1975).
The controversy of the biological effects of radiation is discussed. The arguments for the acceptance of the radiation risks associated with nuclear power are criticised.
- 2828 ADVANCE IN RADIATION HYGIENE. Klenner, V. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zarení). Rev. Czech. Med.; 21: No. 4, 216-224(1975).
The development is reviewed of radiation hygiene in Czechoslovakia during the past twenty years since the formation of the branch as an independent discipline. The responsibilities of individual radiation hygiene research institutes in the country are indicated and the main tasks that have been solved so far are briefly outlined, including the research into the incidence of pulmonary cancer in uranium miners in which Czechoslovak radiation hygiene ranks first in the world.
- 2829 CONTROLLED EARLY REHABILITATION FOR CONSERVATION OF FITNESS OF AGING PERSONS WITH REGARD TO OCCUPATIONAL EXPOSURE TO IONIZING RADIATION. Schuettmann, W.; Arndt, D. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Wiss. Z. Humboldt-Univ. Berlin, Math.-Naturwiss. Reihe; 24: No. 2, 228-230(1975). (In German).
In order to conserve the fitness of occupationally exposed personnel, particularly highly specialized personnel, a programme for early rehabilitation was established by the National Board of Nuclear Safety and Radiation Protection of the GDR. The programme aimed at detecting and intensively treating relevant pathological processes is described emphasizing chronic diseases of the respiratory and circulatory organs, kidneys, liver, skin and the hematopoietic system.
- 2830 RADIATION PROTECTION: PURPOSES AND ECONOMICAL ANALYSIS. Lacourly, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Radioprotection; 10: No. 2, 103-119(1975). (In French).
There are three basic principles to radiation protection, viz the limitation of individual doses, justification of exposure and optimization of protection. The practical application of these principles requires the following investigations: an evaluation of the critical group exposure; a cost-benefit analysis showing the benefit versus specific hazards; a cost-effectiveness analysis demonstrating the optimal protection level. The first one is now a usual method, the other two belong to decision making methods and their application raises a number of difficulties in the ethical rather than in the technical field.
- 2831 RADIOPROTECTIVE SHIELD - AN ADEQUATE RADIOPROTECTIVE DEVICE FOR ROUTINE STOMATOLOGICAL RADIODIAGNOSIS. Wiltzschke, F. (Ernst-Moritz-Arndt-Univ., Greifswald (German Democratic Republic)); Taschner, P.; Koenig, W.; Menzel, B. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Stomatol. DDR; 25: No. 10, 701-705(1975). (In German).
Starting from the shortcomings of the radioprotective devices at present used in routine stomatological radiodiagnosis, the authors describe the advantages of a radioprotective shield which has been produced in the Greifswald University Stomatological Clinic. On the basis of dosimetric studies, the National Board for Nuclear Safety and Radiological Protection of the GDR (Staatliches Amt fuer Atomsicherheit und Strahlenschutz der DDR) could demonstrate the suitability of this shield as a radioprotective device for routine stomatological radiodiagnosis.
- 2832 THE EFFECT OF THE RADIATION DOSE ON THE HEALTH OF THE WORKING WOMEN. Correns, H.J. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Koenig, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Z. Gesamte Hyg. Ihre Grenzgeb.; 21: No. 11, 813-814(1975). (In German).
Short communication only.
DOSE LIMITS; IONIZING RADIATIONS; OCCUPATIONS; PERSONNEL; RADIATION DOSES; RADIATION HAZARDS; WOMEN
- 2833 FUNDAMENTALS OF RADIOLOGICAL PROTECTION. Tschirf, E. Sichere Arb.; 28: No. 2, 5-8(1975). (In German).
Definitions and units of measurement: radiation sources, activity, field, flux, energy, path of particulate radiation in human tissue, absorbed dose. Maximum permissible doses in Austria for occupational exposure to radiation, for the various parts of the body. A brief review of the commonest types of radiation employed in industry brings out the major role played by hard (electromagnetic and neutron) radiation. Consequently, radiological protection measures should be aimed primarily at external radiation (dose determination,

limited duration of exposure, remoteness from source, shields).

50m long, with a vertical wall, 2m high and a platform 8m wide. The dose rates were calculated close to the walls, taking account of the various γ and β radiation emitted either by the walls or by atmospheric radon or by the ore dust deposited on the skin. The calculated values were close to the measured values. The radiation contribution depends on the conditions of exposure; exposure is mainly due to γ radiation close to very thick wall whereas β radiation is prevailing in a contaminated atmosphere or in the case of skin contamination.

- 2834 HEALTH PROTECTION OF RADIATION WORKERS. Norwood, W.D. Springfield, IL; Charles C. Thomas (1975). 442p. \$27.50.

This textbook is addressed to all those concerned with the protection of radiation workers. It provides full coverage of the implications of radiation in exposed workers, and, after a chapter outlining, in simple terms, the basic facts about radiation, deals with measurement of ionising radiation; radiation dosimetry; effectiveness of absorbed dose; general biological effects of ionising radiation; somatic effects of radiation; the acute radiation syndrome; other somatic effects; hereditary effects; radiation protection standards and regulations; radiation protection; medical supervision of radiation workers; general methods of diagnosis and treatment; metabolism and health problems of some radioisotopes; plutonium and other transuranium elements; radiation accidents; emergency plans and medical care; atomic power plants; medico-legal problems.

- 2835 RADIOLOGICAL PROTECTION IN DENTAL PRACTICE. London; Dept. of Health and Social Security (1975). 18p.

Intended to be complementary to the more comprehensive document, "Code of Practice for the protection of persons against ionizing radiations arising from medical and dental use" (CIS 74-423), the purpose of this booklet is to give dentists some basic information on the safe use of X-rays. Contents: why protection from X-rays; responsibility for radiation protection; protection during a dental examination; ensuring a safe installation; sources of further information. Appendices: maximum permissible doses; useful addresses; summary of relevant recommendations from the Code of Practice; notes on film processing.

- 2836 IONISING RADIATION: HAZARDS AND PROTECTIVE MEASURES. Brats, G.; Cavigneaux, A. Paris; Institut National de Recherche et de Securite (1975). 2p. (In French).

Brief review of developments and technical background information on ionizing radiations and their use in industry. Biological effects. Safe working methods: protection against external radiation, internal contamination, radioactive waste, transport of radioactive material, monitoring of premises and personnel, detection of radiation. Preventive medicine and role of the plant physician: staff information; pre-employment medical examination and subsequent check-ups. Texts of the principal French legislation in force concerning radiological protection.

- 2837 A CALCULATION OF EXTERNAL EXPOSURE IN A URANIUM MINE. Fourcade-Cancelle, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Service Technique d'Etudes de Protection et de Pollution Atmospherique). Radioprotection; 10: No. 1, 11-28(1975). (In French).

The dose rate measured at the centre of a tunnel excavated in an ore at 1p. thousand of uranium was assessed to average 0.5mrad/h. This value was verified by calculations taking account of the source geometries and the main emitters of the uranium family. The dose rate from external exposure was calculated for two typical cases: in a cylindrical tunnel (length=50m, diameter=2m); in an open quarry

- 2838 A NEW DEVELOPMENT OF HEALTH PHYSICS MONITORING BOARDS. Joffre, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Protection contre les Rayonnements). Radioprotection; 10: No. 1, 45-48(1975). (In French).

From Scientific and technical one-day meeting on health physics monitoring boards; Saclay, France (25 Feb 1975).

A new generation of health physics monitoring boards has been developed through reliability improvements, miniaturized components, and use of computers with a view to a more efficient monitoring of workers.

- 2839 PRACTICAL LIMITATIONS OF CRITERIA FOR LIMITING RADIATION RISKS TO THE PUBLIC. MacDonald, H.F. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Ann. Nucl. Energy; 2: No. 9; 10, 625-635(1975).

The methods employed to relate basic dose limits recommended by the I.C.R.P. and the M.R.C. to measurable environmental parameters through Derived Working Limits (DWLs) and Emergency Reference Levels (ERLs) are outlined. The simplifying assumptions underlying these concepts and the practical limitations which they impose upon the use of DWLs and ERLs in the control of radiation exposure are described. It is shown that although derived parameters, such as DWLs and ERLs, will continue to be relevant in cases where a single radionuclide irradiates predominantly a single human body organ via a well defined pathway, the simplifications involved in their derivation impose limitations upon their usefulness in many practical situations. The implications of new dose estimation techniques in the design and operation of nuclear plant are discussed and, in the case of accidental discharge limits, a modification of the current ERL dose limits used within the U.K. is suggested to take account of the relative risks associated with single organ and whole body exposure.

- 2840 ENVIRONMENTAL PROTECTION DEMANDS RADIATION PROTECTION WHEN USING NUCLEAR ENERGY FOR CIVIL PURPOSES. Aurand, K. (Bundesgesundheitsamt, Berlin (F.R. Germany)). pp 283-296 of Kernenergie und internationale Politik. Zur friedlichen Nutzung der Kernenergie. Kaiser, K.; Lindemann, B. (eds.) (Deutsche Gesellschaft fuer Auswaertige Politik e.V., Bonn (F.R. Germany). Forschungsinstitut). Munich; Oldenbourg (1975). (In German) 12 refs..

A survey is given on international cooperation and tasks regarding radiation protection (HP/LN).

- 2841 RADIATION EXPOSURE OF MANKIND. Koelzer, W. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Strahlenschutz und Sicherheit). pp 11-17 of Aktuelle Themen zur Kernenergie. Mannheim, F.R. Germany; BBC (1975). (In German)

8 figs.; 9 tabs.; with refs..

This paper deals with population exposure to natural and man-made radiation sources. It is shown that the operation of nuclear power plants only accounts for a minimum (less than 1 %) of the population's whole body dose average.

- 2842 DO ONE-HIT CHROMOSOME EXCHANGES EXIST. DOSE-RESPONSE RELATION FOR IRRADIATED HUMAN LYMPHOCYTES. Luchnik, N.V. (Akademiya Meditsinskikh Nauk SSSR, Obninsk. Nauchno-Issledovatel'skij Inst. Meditsinskij Radiologii). Radiat. Environ. Biophys.; 12: No. 3, 197-204(1975).

2 figs.; 3 tabs.; 18 refs..

It is demonstrated that the expectation of a quadratic dose-response relation for two-hit aberrations is not correct. In fact the theoretical curve is changed from near-quadratic to near-linear when the dose increases and fits well the experimental data on production of exchanges in human lymphocytes by radiation. The commonly used relation $y = \alpha D + \beta D^2$ shows systematic deviations from the observed frequencies. Therefore, no reason exists to postulate some fraction of exchanges to be produced by a one-hit mechanism.

- 2843 LATE EFFECTS OF ACUTE EXTERNAL EXPOSURE TO IONIZING RADIATION IN MAN. Jablon, S. (National Research Council, Washington, DC). pp 132-145 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

The late effects of acute external exposure to ionizing radiation in man are discussed. Included among the late effects are non-neoplastic mortalities and mortalities due to cancer including leukemia. The hazards of prenatal irradiation are considered. (ERB)

- 2844 CHEMICAL AND RADIATION CARCINOGENESIS IN MAN AND EXPERIMENTAL ANIMALS. Miller, J.A.; Miller, E.C. (Univ. of Wisconsin, Madison). pp 158-168 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

It is now well established that some cancer in man results from exposures to certain chemicals and radiations, both ultraviolet and ionizing radiations. These chemical and physical agents are also carcinogenic in experimental animals and, where adequately tested, in mammalian cell cultures. However, only very limited data are available on the relative roles of and the interrelationships, if any, between these various environmental agents in the causation of the majority of the cancers in man. Nothing is known of the relationship between these agents and possible carcinogenic viral information in the etiology of cancer in man. Furthermore, little is known about the molecular mechanisms by which chemicals and radiations induce cancers in either man or experimental animals. The objective of this brief review is to present certain aspects of chemical and radiation carcinogenesis in man and experimental animals and some of the problems in the elucidation of their roles in carcinogenesis in the human.

- 2845 USE OF CHROMOSOME ABERRATIONS FOR PREDICTING GENETIC HAZARDS TO MAN. Brewen, J.G.; Preston, R.J. (Oak Ridge National Lab. TN). pp 926-936 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

The question of the use of chromosome aberrations for predicting genetic hazards to man is discussed under the following headings: interspecific comparisons of dicentric and deletion production in peripheral leukocytes; comparison of dicentric yields in leukocytes to reciprocal translocation yield in spermatogonia; recovery of spermatogonia induced translocations in the sons of irradiated males; cytologically and genetically detected deletions; and current gaps in our knowledge and problems of future interest.

- 2846 MUTATION AND THE AMOUNT OF HUMAN ILL HEALTH. Newcombe, H.B. (Atomic Energy of Canada Ltd., Chalk River, Ontario). pp 937-946 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

The genetic hazards to main interest in the proliferation of nuclear power plants is discussed. The following topics are included in the discussion: general principles; methods of estimating risks; dominant diseases; and the cost of preventing a genetic defect. It is concluded that we must draw the line somewhere between protection of the germ plasm and over protection resulting in unnecessary delay of the replacement of energy sources that are no longer readily available. (ERB)

- 2847 COMPARISON OF THE MUTAGENIC EFFECTS OF CHEMICALS AND IONIZING RADIATION (CHAIRMAN'S REMARKS). Sobels, F.H. (Univ., Leiden). pp 958-965 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

A comparison is made between the mutagenic effects of various chemicals (mutagens) and ionizing radiation. The following topics are included in the discussion; differences between the effects of chemicals and irradiation; relationship between mutations and chromosome aberrations; specificity; dose effect relationships; and the mutation spectrum. (ERB)

- 2848 CHANGES IN THE RATE OF PROLIFERATION IN NORMAL TISSUES AFTER IRRADIATION. Denekamp, J. (Mount Vernon Hospital, Northwood, Eng.). pp 810-825 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

In tissues where reproductive cell death is known to cause the functional tissue damage (e.g., intestine and skin), repopulation

becomes important only after the death of the radiation-damaged cells. Since these tissues have a fairly rapid turnover, this can occur within a short period of time and can assist in the healing of tissues during fractionated therapy. However, in tissues which express their damage late, such as the lung, it is very unlikely that repopulation will be stimulated before cell death is manifested and this does not occur during the period over which fractionated radiotherapy is administered. Although repopulation may be of no importance in these tissues, e.g., lungs and kidneys, there appears to be some other "repair" process which requires additional radiation dose to be administered to achieve the same endpoint if the overall time is increased.

- 2849 Strahlenschutzärztliche Aufgaben bei der Ueberwachung beruflich strahlenexponierter Personen. (TASKS OF THE RADIATION PROTECTION PHYSICIST IN MONITORING PERSONNEL EXPOSED TO RADIATION). Ohlenschlaeger, L. (Kernforschungszentrum Karlsruhe (F.R. Germany). Medizinische Abt.). Stuttgart; Gentner (1975). 46p. (In German). (KFK--2245).

10 figs.; 2 tabs.; 27 refs..

The monitoring of personnel exposed to radiation is the responsibility of the radiation protection physician according to article 46 of the 1st Radiation Protection Ordinance and article 42 of the X-Ray Ordinance. The findings in radiobiology and radiopathology are the foundation of radiation protection medicine. The activities consist of preventive examinations which are to protect the staff against the dangers of ionizing radiation. It is the physician's task to discover findings which speak against employment in controlled areas or against the handling of open radioactive materials. Specific duties include first-aid measures in cases of contamination, incorporations, contaminated injuries as well as outer and internal excessive radiation loads.

- 2850 LEGAL SPECIFICATIONS AND REGULATIONS IN THE FIELD OF X-RAY APPLICATION. Rosenbaum, O. pp 1-20 of Fundamentals of practical radiation protection in medical X-ray installations. Even, K. (Gewerbeaufsicht des Landes Nordrhein-Westfalen, Duesseldorf (F.R. Germany). Zentralstelle fuer Sicherheitstechnik, Strahlenschutz und Kerntechnik); Schmitt, G. (Essen Univ. (Gesamthochschule) (F.R. Germany). Radiologisches Zentrum). Stuttgart; Enke (1975). (In German)

1 fig.; 1 tab.; 7 refs..

Starting with the reasons for the issuing of the X-ray ordinance, the content of the single paragraphs of the ordinance are discussed. Besides the required preconditions for the operation of X-ray equipment such as notification procedures, experts' opinions, expert evidence as well as other duties to be fulfilled by the operator, the operation regulations themselves are gone into in detail. They are concerned with the persons performing certain activities or duties as well as the equipment and rooms and in particular with the type and manner of X-ray application in view of the health of the patients. Connected with this, the right of the inspecting authorities stated in paragraph 37 and 38 to order measures or tests to be carried out by experts and to punish offences against regulations of the ordinance, as stated in paragraph 52, is also dealt with.

- 2851 GENETIC RISKS FROM MEDICAL RADIATION.

Seelentag, W. (World Health Organization, Geneva). World Health Organ. Chron.; 29: No. 4, 117-122(1975).

After a brief discussion of the sources of radiation exposure of human populations (natural and man made), the genetically significant dose per person per year from medical examinations is presented and discussed. The data are taken from world-wide sources. The problems of radiation protection in hospitals is discussed briefly. (ERB)

- 2852 CONNECTION BETWEEN RELATIVE GENETIC EFFECTIVENESS AND LINEAR ENERGY TRANSFER IN ANALYSIS OF CHROMOSOME ABERRATIONS IN HUMAN LYMPHOCYTES. Todorov, S. (Meditsinska Akademiya, Sofia (Bulgaria). Tsentyr po Zarazni i Parazitni Bolesti). C. R. Acad. Bulg. Sci.; 28: No. 3, 415-417(1975).

The relative genetic effectiveness (RGE) of electromagnetic (roentgen and gamma rays) and corpuscular (protons and neutrons) radiations is determined on the basis of the quantitative characteristics of the chromosome aberrations yields, induced while irradiating entire human blood in vitro: 0,76 for ^{60}Co radiation, 0,80 for protons 50 MeV, 2,14 for fission neutrons and 1,00 for 180 kV X-rays. The linear energy transfer (LET) for the radiations applied has the following mean values: 0,28 Kev/ μm for ^{60}Co gamma radiation, 1,8 Kev/ μm for protons 50 MeV, 2,5 Kev/ μm for 180 kV X-ray radiation and 45-55 Kev/ μm for fission neutrons. The analysis shows certain dependence between the RGE and the LET. An optimal quantity of energy must be deposited in a fixed volume in order to evoke a primary chromosome aberration. The RGE is not related to the quality of different kinds of radiations but depends on the LET typical for a given kind of radiation.

- 2853 "DOUBLING DOSE" OBTAINED FROM THE ANALYSIS OF THE CHROMOSOME DISTURBANCES IN HUMAN LYMPHOCYTES. Todorov, S.L. C. R. Acad. Bulg. Sci.; 28: No. 12, 1705-1707(1975).

Proceeding from personal experimental material on the incidence of spontaneous and radiation-induced chromosomal aberrations in cultures from human peripheral blood lymphocytes, the author estimated the doubling dose for some types of radiations, i.e. the radiation dose which induces the same number of chromosomal aberrations as the spontaneously arising ones. The parameters aberrations per cell per rad and breaks per cell per rad were used. The doubling dose for quick neutrons has the lowest value - 0.35 to 0.48 rad. The doubling dose for 180 kV X-radiation is 0.80 to 1.15 rad, for protons 50 MeV - 0.98 to 1.23 rad and for gamma radiation from Cobalt-60 - 1.05 to 1.40 rad. The doubling dose for poorly ionizing radiations is therefore approximately 1.20 rad, whereas for strongly ionizing ones it is much lower.

- 2854 SPONTANEOUS FREQUENCY OF THE STRUCTURAL CHROMOSOME ABERRATIONS (ANOMALIES) IN LYMPHOCYTES FROM HUMAN BLOOD. Todorov, S. (Akademiya na Selskostopanskite Nauki, Sofia (Bulgaria). Veterinaren Institut za Infektsiozni i Parazitni Bolesti). C. R. Acad. Bulg. Sci.; 28: No. 10, 1427-1430(1975).

Chromosomal aberrations are observed both in irradiated cells and in cells which have not been irradiated but submitted to the action of the natural radioactive background. The reasons for these "spontaneous chromosomal aberrations" are both the natural radioactivity and a complex of physical, chemical and biological factors. A cytogenetic analysis of 6000 lymphocytes metaphases from

- the peripheral blood of 47 people indicates that the overall amount of the spontaneous aberrations is 2% with a ratio of chromosomal type aberrations to chromatide type aberrations of 1:5. Chromatide type aberrations are seen as the result of purely mechanical factors acting during slides preparation but yet another unknown moments cannot be excluded. They are more one hit type aberrations - chromatide and chromosomal fragments, whereas the two hit aberrations are very rare - one dicentric per 3000 cells. The chromosome type aberrations are proposed for comparison with radiation induced aberrations in human lymphocytes. They have a frequency of 0.0035 per cell or 0.0040 breakages per cell. Ionizing radiation does not induce qualitatively specific type of aberrations but increases many times the yield of anomalies, which are spontaneously observed.
- 2855 RADIOACTIVE RELEASES FROM NUCLEAR POWER PLANTS AND THE ENVIRONMENT. Martin, J.-J. (Electricite de France, 93 - Saint-Denis. Service de la Production Thermique). Radioprotection; 10: No. 4, 229-234(1975). (In French).
From Information meeting on nuclear environment; Paris, France (4 Feb 1975).
Gaseous and liquid radioactive effluents from operating or scheduled nuclear power plants are reviewed and a simple method of dose assessment for direct pathways of human exposure resulting from inhalation and tap water is given. The complete results of the assessment of all the direct or indirect exposure pathways show that the highest annual dose is to be a few millirems per year for a site such as Fessenheim. Environmental controls carried out both by the nuclear operator or Public Health Services should verify these assessments.
- 2856 HISTORY OF RADIATION HYGIENE AND MISSION OF THE STATE SANITARY CONTROL. Shamov, V.P. Rentgenol. Radiol.; 14: No. 4, 219-222(1975). (In Bulgarian).
Three main stages are outlined in the evolution of radiation hygiene as a science. The first of these is characterized by some underestimation of the radiation factor, particularly as regards potential long-term biological effects. The second stage (1940-1950) coincided historically with the atomic bomb explosions in Hiroshima and Nagasaki. With subsequent large-scale atomic weapons testing, the problem arose of radioactive contamination of the biosphere, and the need was recognized for quantifying potential radiation risks thereby incurred. A third stage developed in connection with scientific-technological revolution. Based on better understanding of radiation-related somatic and genetic effects, efforts were made to arrive at a reasonable assessment of hazards involved in peaceful uses of atomic energy. Two main lines of inquiry were followed, namely to (a) gain primary information on radiation exposure levels and (b) acquire better insight into biological effects so as to establish well-grounded regulations. There is a need for studies on natural background radiation in communities and environmental contamination in the vicinity of plants using radioactive materials, as well as for development of radiation control guides and optimization of environmental and occupational monitoring. Conditions are now more favourable for the solution of these problems since many countries, in particular socialist ones, are collaborating in efforts to limit radiation exposure.
- 2857 X-RAY EMISSIONS FROM COLOUR TELEVISION RECEIVERS IN NEW ZEALAND. Luketina, I.A. (National Radiation Lab., Christchurch, New Zealand). N.Z. Med. J.; 81: No. 534, 197-200(1975).
Color television receivers produced for the New Zealand market have been tested to ensure that any x-radiation emissions result in dose rates less than the 0.5 mrem/h (500 μ rem/h) limit allowed under the Radiation Protection Regulations, 1973. Five receivers representing the five different models available on the New Zealand market were surveyed and the maximum dose rate measured from any screen was 0.05 μ rem/h. The estimated maximum annual radiation dose to an average viewer from the receivers surveyed will be less than 5 μ rem or less than 5×10^{-3} percent of the dose from natural background radiation. This level of x radiation is well below that which could constitute a health hazard.
- 2858 CYTOGENETIC INVESTIGATION IN A BRAZILIAN POPULATION LIVING IN AN AREA OF HIGH NATURAL RADIOACTIVITY. Barcinski, M.A.; Abreu, M.C.A.; de Almeida, J.C.C.; Naya, J.M.; Fonseca, L.G.; Castro, L.E. (Inst. of Biophysics, Rio de Janeiro). Am. J. Hum. Genet.; 27: No. 6, 802-806(1975).
A cytogenetic survey is presented of the inhabitants from Guarapari, a small village on the coast of the state of Espirito Santo, Brazil, who live permanently exposed to high levels of radiation. The survey was performed in order to detect possible biological effects of chronic natural radiation exposure. An increase in the total number of chromosomal aberrations was found in the inhabitants of Guarapari, compared to a control group. (ERB)
- 2859 CARCINOGENESIS BY IONIZING RADIATION AND LESSONS FOR OTHER POLLUTANTS. Mole, R.H. (Medical Research Council, Harwell, Eng.). pp 860-868 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).
From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).
See CONF-740715--.
The subject of ionizing radiations and carcinogenesis is discussed under the following topics: the nature of cancer; ionizing radiation as a carcinogen; carcinogenesis by low levels of exposure; latent period; the variety of the carcinogenic transformation; dose-response relationships and cell sterilization; and carcinogenesis in vivo-age and sensitivity to radiation. The author concludes that for a number of reasons ionizing radiation is of quite basic importance in the search for a fuller understanding of the process of carcinogenesis. (ERB)
- 2860 ANALYTICAL PREDICTION OF THE ABSORBED DOSE FROM EXTERNAL IRRADIATION AND FROM INHALATION OF RADIOACTIVE PARTICLES AFTER STARTUP OF A NUCLEAR POWER PLANT. Khristova, M.; Paskalev, Z. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: 151-155(1975). (In Bulgarian).
Methods and formulas are presented for calculating the dose to a population living in the vicinity of a nuclear power plant. The total dose is found to consist of two components. The first component of the dose comes from radioactive gamma emitters deposited in the soil up to a depth of 5 to 6 cm. This dose component is a result of external irradiation of the population. The second dose

component originates from radioactive aerosol particles 5 microns in size or less. Formulas are given for calculating the lung dose for beta and gamma emitters. The activity and energies of the radioactive nuclides must be known to determine the lung dose. 8 refs. (SJR)

- 2861 IRRADIATION OF PEOPLE WORKING WITH OPEN RADIOACTIVE MATERIALS. CONSEQUENCES OF INHALATION. Vasiliev, G. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: 169-173(1975). (In Bulgarian).

In practice the most-widely utilized radioactive compounds contain the following radioactive elements: carbon-14, phosphorus-32, iron-59, strontium-89, iodine-131, cesium-137, and gold-198. In order to estimate the dose it is necessary to know the activity concentration in the air, working time during which the person is exposed, and the kinetics of the radioactive element in the body. The average, allowable, annual working concentrations in curies per liter are 3.5×10^{-9} for C-14, 7.2×10^{-11} for P-32, 5.2×10^{-11} for Fe-59, 2.8×10^{-11} for Sr-89, 8.4×10^{-12} for I-131, 1.4×10^{-11} for Cs-137 and 2.4×10^{-10} for Au-198. From an analysis of 578 radioactive aerosol samples it is shown that in the radioisotope laboratory of the author the main dose to the personnel comes from external irradiation and that irradiation as a result of inhalation of activity is insignificant. 4 refs. (SJR)

- 2862 TECHNICAL COMMITTEE III: RADIATION DOSE AND RADIATION EFFECT. Muth, H. pp 41-50 of 25 years of research in the protection of the civilian population and disaster control. Bad Honnef, F.R. Germany; Usang (1975). (In German)

Report on the activities of the technical committee III of the Ministry of the Interior's Commission for the Protection of Civilians whose task it is to investigate the biological effect of penetrating radiation on the human organism.

- 2863 TECHNICAL COMMITTEE II: RADIOACTIVE FALLOUT. Schumann, G. pp 33-40 of 25 years of research in the protection of the civilian population and disaster control. Bad Honnef, F.R. Germany; Usang (1975). (In German)

Report on the activities of the technical committee II of the Ministry of the Interior's Commission for the Protection of Civilians. Its main field of work is to investigate radioactive fallout and radioactive radiation as a result of nuclear weapons explosions.

- 2864 RADIATION EXPOSURE IN THE STANDARDIZED METHOD OF CHEST EXAMINATION. Angerstein, W.; Stier, M.; Wolf, M. (Forschungsinstitut fuer Tuberkulose und Lungenkrankheiten, Berlin (German Democratic Republic)); Koenig, W.; Menzel, B. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Radiol. Diagn.; 16: No. 6, 863-868(1975). (In German).

Following a discussion of the technical parameters which influence the radiation dose to the gonads the dose values determined by condenser chambers for the chest X-rays made according to standard recommendations (posteroanterior takings, lateral takings, simultaneous tomograms, posteroanterior fluorographs) are given. According to those the incident dose is about 78 mR, the exit dose is about 7.5 mR and the gonad dose is about 52 μ R for survey exposures with film-foil combinations.

- 2865 COMPARATIVE ANALYSIS OF CHROMOSOME ABERRATIONS IN HUMAN LYMPHOCYTES INDUCED 'IN VITRO' BY VARIOUS TYPES OF IONIZING RADIATION. Todorov, S. (Meditsinska Akademiya, Sofia (Bulgaria)). Tsentyr po Infektsiozni i Parazitni Bolesti. Acta Med. Bulg.; 3: No. 1, 31-37(1975).

A quantitative analysis on various types of chromosome aberrations in human peripheral blood lymphocytes after in vitro whole blood irradiation with 180 kV X-rays, gamma rays from cobalt 60, 50 MeV protons and scission neutrons is carried out. The following aberrations are scored: breaks, total number of aberrations, aberrant cells, chromosome fragments, dicentric and interstitial deletions. The experimental data obtained are statistically processed applying the method of the least squares and employing four mathematical models: $Y = cD^2$, $Y = cD$, $Y = a + bD$ and $Y = a + bD + cD^2$. Statistical analysis showed that after treatment with low LET (linear energy transfer) radiations the most suitable for the description of the kinetic of the two break aberrations, total number of aberrations and breaks in relation to dose is the polynomial second degree model, whereas for one break aberrations and aberrant cells - the linear model. The linear model is equally appropriate for one or two breaks aberrations when it is a matter of high LET radiations. Using the linear component of the polynomial second degree equation a comparative characteristic of the RBE (relative biological effectiveness) for the various radiations types is made. The following mean values for RBE are obtained: 0.86 ± 0.44 for gamma radiation from cobalt 60, 0.98 ± 0.06 for 50 MeV protons and 2.38 ± 0.11 for scission neutrons.

- 2866 RADIATION ACCIDENTS AT WORKING WITH IONIZING IRRADIATION SOURCES IN BULGARIA FOR THE PERIOD 1962-1972. Vasiliev, G. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Letopisi Khig. Epidemiol. Inst.; 9: No. 6, 94-100(1975). (In Bulgarian).

Registered radiation accidents in the People's Republic of Bulgaria for the period 1962-1972 which have occurred at working with ionizing irradiation sources are considered. As radiation accident should be assumed the case when the worker receives a dose exceeding 5 times the maximum permissible annual dose for the corresponding critical organs. For the period examined 64 accidents are registered with 144 people affected. 42 accidents are related to external irradiation with gamma radiation, neutrons or X-rays, and in 22 accidents radioactive substances have entered the worker's organisms. Statistic analysis shows that the irradiation dose of the whole Bulgarian population as a cause of accidental irradiation is of the order of the dose due to professional irradiation of the medical staff working with X-rays under normal conditions.

- 2867 EFFECTS OF IONIZING RADIATION ON SOME CYTOGENETIC AND METABOLIC CHANGES IN HUMAN SOMATIC CELLS. Ivanov, B.A. Sofia; Meditsinska Akademiya (1975). vp. (In Bulgarian). INIS.

Thesis.

Chromosome aberration yields in human peripheral lymphocytes following in vitro exposure to 125-150 R x-rays are studied. Equations of best fit for yields of polycentric, minutes, chromosome fragments, aberrant cell percentage, and total breakage per cell are a prerequisite for biological

dosimetry. Thus, based on cytogenetic findings in the case of a radium-226 incident, doses to two subjects are estimated at 48 and 15 rad, respectively, which corresponds to values from physical dosimetry. In four children receiving diagnostic radiation exposure (heart catheterization), there are some cytogenetic changes, but these are inappropriate to be used for biological dosimetry purposes. Storing of human whole blood in plexiglass bottles for 24, 48, 72, or 173 hours at 5 deg, 20 deg, or 37 deg C with subsequent exposure to 125-150 R X-rays will produce significantly more chromosome aberrations than are obtained with irradiation of fresh blood. Blood stored in neutral glass and subsequently irradiated showed no such sensitizing effect. The RBE for 50-MeV protons relative to X-rays (180 kV, 15 mA, 0.35 mm Cu) for doses ranging from 0 to 500 R is estimated to be 0.91 as based on dicentric yields, 0.89 on minute yields, and 0.75 on breakage per cell. In these experiments, time in culture is 72 hours. Comparative studies between Gsub(o)- and G₂-cell response of 50-MeV proton exposure (time in culture, 66 hours) indicate susceptibility to induction of chromosome abnormalities to be higher in G₂- vs. Gsub(o)-cells by a factor of 6-8 for one-hit aberrations, 4.5-5.5 for breakage per cell, and 2.5-3.5 for aberrant cell percentage. In studies with acute or fractionated X-ray doses (125, 250, or 125 + 125 R) given to various cell cycle stages, evidence was obtained for the occurrence of repair processes heritable structures, this being most marked within the first 6 hours of the presynthetic period. Later through the synthetic period, repair proceeded at a fluctuating rate.

- 2868 SOME PROBLEMS ON RADIATION LOADING DURING THE PERFORMANCE OF HISTEROSALPINGOGRAPHY. Dakov, L.; Vasilev, D. (Meditsinska Akademiya, Sofia (Bulgaria). Inst. po Akusherstvo i Ginekologiya). Akush. Ginekol. (Sofia); 14: No. 6, 484-491(1975). (In Bulgarian).

Stressing the significance of histerosalpingography in the gynecologic diagnosis the authors pay attention of the irradiation of the patient and the attending personnel during this diagnostic procedure. Among the most frequent omission made in this respect the authors indicate the following: a rather continuous scoping, a lack of preliminary preparation for the procedure (coordination of the team), insufficient adaptation, a desire to examine also insignificant from the point of the diagnosis moments in the filling under scopic control, unsatisfactory diaphragm, etc. The authors carry out timing of the separate moments of the performance of histerosalpingography and propose an analysis of the data on the mean duration of the procedure, a part of which is due to light increase, the number of light increase, the ratio between roentgenological examination and roentgenological graphs the possibilities for maximal diaphragm, etc. For better statistical significance the data were observed on 100 consecutive histerosalpingographies with the participation of a roentgenologist and three gynecologists. The author recommend to rationalize the method of performing histerosalpingography in view of reducing irradiation of the patient and the medical staff.

- 2869 UNSEALED RADIOACTIVE MATERIALS IN MEDICAL PRACTICE IN NEW ZEALAND. McEwan, A.C. (National Radiation Lab., Christchurch, New Zealand). N.Z. Med. J.; 82: No. 547, 163-168(1975).

Information has been collected on numbers and types of radionuclide procedures in medical practice in New Zealand over a three-month period in the latter half of 1973. For in vivo procedures data on the age and sex of patients and the activities of radioactive materials administered were also collected. The changes in numbers of such procedures carried out over a seven-year period are discussed. A genetic radiation dose to the population of 0.24 mrad per person is derived for the year 1973, about 0.20 mrad of this dose arising from diagnostic procedures and 64% being attributable to brain imaging. Whereas formerly genetic doses have been estimated from data on activities of ¹³¹I and ³²P used, this is no longer possible.

- 2870 SMALL HEAD SIZE AFTER ATOMIC IRRADIATION. Miller, R.W.; Mulvihill, J.J. (National Cancer Inst., Bethesda, MD). Teratology; 14: 355-358(1975).

A study of children exposed to nuclear explosions in Hiroshima and Nagasaki showed small head size and mental retardation when exposure occurred less than 18 weeks of gestational age. Increased frequency of small head size occurred when maternal exposure was 10 to 19 rad. Tables and graphs are presented to show relationships between dose, gestational age, and frequency of small head size. (HLW)

- 2871 SCISSION NEUTRONS INDUCED PRODUCTION OF DICENTRICS IN LYMPHOCYTES FROM HUMAN PERIPHERAL BLOOD. Todorov, S. (Meditsinska Akademiya, Sofia (Bulgaria)); Bulanova, M.; Mileva, M.; Ivanov, B. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Acta Med. Bulg.; 3: No. 2, 45-48(1975).

Dicentric chromosome aberration yields in lymphocytes were studied following exposure of human peripheral blood to fission neutrons. Irradiations were performed on the IRT-2000 Experimental Nuclear Reactor, Sofia, with doses of 25, 50, 100, or 200 rad from the following neutron spectra and fluences: 0.025 eV to 0.4 eV, 4.29×10^6 neutrons/cm².sec; 0.4 eV to 0.5 MeV, 4.28×10^5 neutrons/cm².sec; and 0.5 MeV to 2-3 MeV, 9.64×10^6 neutrons/cm².sec. Doses were essentially delivered by fission neutrons, with gamma contamination in the beam contributing 10% to dose. Lymphocyte cultures were fixed 52 hours after phytohemagglutinin stimulation. Cytogenetic analysis indicated that dicentrics-per-cell yields increased with dose. Statistical treatment by least squares techniques showed experimental findings to be best fitted by a linear relationship, $Y = -0.0275 + (2.66 \pm 0.25) \times 10^{-3}D$. Discrepancies in comparison with results obtained by other investigators may be accounted for by use of different energy spectra and non-standard lymphocyte cultivation techniques.

- 2872 AUSTRIAN RADIATION MAP. AVERAGE POPULATION DOSES IN THE OPEN AIR THROUGH TERRESTRIAL AND COSMIC RADIATION. Tschirf, E.; Baumann, W.; Niesner, R. (Atominstitut der Oesterreichischen Hochschulen, Vienna); Vychytil, P. (Bundesministerium fuer Gesundheit und Umweltschutz, Vienna (Austria)). Vienna; Bundesministerium fuer Gesundheit und Umweltschutz (1975). 42p. (In German). 11 tables, 4 maps.

Background radiation in the open air was measured on behalf of the Ministry of Health and Environmental Protection. The measurements were carried out from the Atominstitut (Technical University) Vienna in all Austrian communities with more than 3000 inhabitants with a modified Geiger-Mueller tube. The

results were presented in the form of a map.

postoperative radiotherapy to the scar.

- 2873 KEEPING DOSE COMMITMENTS ALAP. Morgan, K.Z. (Georgia Inst. of Tech., Atlanta). pp 71-77 of Nuclear safety, 1975. Hetrick, D.L. (ed.). Hinsdale, IL; American Nuclear Society (1975).

From ANS topical meeting on nuclear safety; Tucson, AZ, USA (5 Oct 1975).

See CONF-751044--.

The dose commitment principle should be applied both to the individual and collectively to members of the public and to special subgroups in the population in relation to age, sex, condition of health, etc. It should be applied to each critical body organ in relation to possible somatic injury as well as to the gonads in terms of the genetically significant dose or genetic mutations. The maximum permissible dose commitments cannot and need not be set essentially at zero but they must be carefully selected such that they do not exceed values that knowledgeable and representable members of the public consider to be as low as practicable (ALAP) and that are believed to be as low as reasonably attainable (ALARA) after giving due and realistic consideration to the various alternatives.

- 2874 RADIATION EXPOSURE TO ANGIOGRAPHER DURING CORONARY ARTERIOGRAPHY USING THE U ARM IMAGE AMPLIFIER. Begg, F.R.; Hans, L.F. (Allegheny General Hospital, Pittsburgh). Cathet. Cardiovasc. Diagn.; 1: No. 3, 261-265(1975).

Radiation exposure to the angiographer was measured using thermoluminescent dosimeters (TLD), commercial film badges, and appropriate ionization survey meters. Data were collected during 47 coronary artery examinations with the lead overleaf. During a single coronary examination, the angiographer receives 0.9 mR to the lens and 2.8 mR to the hand. The calculated yearly exposure to the angiographer performing 10 examinations per week is 450 mR to the lens, 9% of the maximum permissible dose (MPD), and 1400 mR to the hand, 2% of the MPD. Exposure rates for the left anterior oblique (LAO) and right anterior oblique (RAO) projections during cine and fluoroscopy were taken at the position occupied by the angiographer. Scatter radiation is 5-10 times greater in the LAO projection. The second trial was monitored during 18 coronary artery examinations minus the lead overleaf. A significant decrease in radiation exposure was accomplished through the use of the lead overleaf.

- 2875 EVALUATION OF EFFECTIVENESS OF IRRADIATION OF SCAR AFTER RADICAL MASTECTOMY IN PATIENTS WITH BREAST CANCER. Jordan, E.; Krajewska, B. (Akademia Medyczna, Gdansk (Poland)). Pol. Przegl. Radiol. Med. Nukl.; 39: No. 6, 709-713(1975). (In Polish).

The authors report the results of an analysis of recurrences in postoperative scar in patients with breast cancer for evaluation of the effectiveness of postoperative radiotherapy. In a group of 423 cases recurrences in scar were observed in 51 (12.1%). In the group of patients who had been given postoperative radiotherapy to the scar the frequency of recurrences was lower (8.1%) as compared with the group treated only surgically (16.5%), in the group treated by preoperative radiotherapy it was high (17.1%) and in the group with postoperative radiotherapy given only to regional lymph nodes it was even higher (18.0%). The results of analysis indicate the effectiveness of

- 2876 RADIOTHERAPY OF BASAL-CELL CARCINOMA OF THE SKIN AT THE PROVINCE ONCOLOGICAL HOSPITAL IN POZNAN IN THE YEARS 1953 TO 1959. Ramlau, C. (Wojewodzki Szpital Onkologiczny, Poznan (Poland)). Pol. Przegl. Radiol. Med. Nukl.; 39: No. 6, 715-722(1975). (In Polish).

The author described the results of radiotherapy applied in 713 patients with basal-cell carcinoma of the skin treated at the Province Oncological Hospital in Poznan in the period from Aug. 1 1953 to Dec. 31 1959. Radium therapy was given to 468 patients (65.6%) and in 245 (34.4%) x-ray therapy was applied. Clinical progression of the disease was evaluated on the 4 grade gradation system T1, T2, T3, T4. Radium was applied in tubes or needles in a total dose of 2 mcd/1 cm² i.e. about 6000 R. x-ray treatment was given using a Dermix (90 to 95 kV) apparatus with daily fractionation of doses of 200 to 400 r up to a total dose of 6000 R. Control investigations of patients were carried out during the first 3 years every 2 months, then every 6 months, and after 5 years follow-up examinations were carried out once yearly. The 5-year follow-up period was survived by 579 patients and the 10-year follow-up was survived by 265 patients. In the radium-treated patients followed-up over 5 years in 1.8% of cases the neoplasm failed to disappear and recurrences were observed in 5.6% of cases. After X-ray therapy the neoplasma failed to regress in 4.2% of cases and recurrences developed in 8.5% of cases. In none of 4 grades of basal-cell carcinoma progression to statistically significant differences were observed between radium treatment and X-ray treatment. Development of recurrences even after a long time after treatment, especially with radium, indicates the necessity of following-up the patients over 5 years.

- 2877 MODIFICATION OF GASTROINTESTINAL SYMPTOMS FOLLOWING IRRADIATION BY LOW DOSE RATE TECHNIQUE. Cassidy, J.R.; Order, S.; Camitta, B.; Marck, A. (Harvard Medical School, Boston). Int. J. Radiat. Oncol., Biol. Phys.; 1: No. 1-2, 15-20(1975).

Tolerance of patients receiving 1000 rad total body irradiation at the low dose rate of 5 rad/min prior to bone marrow transplantation is presented. The striking gastrointestinal tolerance is stressed and, as a result of this experience, results in five patients with ovarian carcinoma receiving total abdominal irradiation with similar low dose rate irradiation are presented. Possible explanations for these results are presented and other potential applications of this technique are suggested.

- 2878 (AED-Conf--75-244-011) THE RISK OF GENETIC HAZARDS IN MEDICAL APPLICATIONS. Stephan, G. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). 1975. 11p. (In German). (CONF-750689--9). INIS.

From 16. annual meeting of the Association of German Radiation Protection Physicians; Kiel, F.R. Germany (20 Jun 1975).

1 fig.; 4 tabs.; 20 refs. Available from ZAED.

The mutagenic action of ionizing radiation in humans is discussed, and a relationship is established between the absorbed dose and the genetic effects. The incidence of mutations is estimated on the basis of statistics. Results of animal experiments (mice) are referred to in order to estimate the ratio of absorbed dose to mutation frequency in humans. The rate of

mutations induced per dose unit is a function of the germinal state and of the acute or chronic radiation exposure. Chronic radiation exposure of humans is connected with increased frequency of miscarriages, stillbirths, and genetic damage of the descendants. Diagnostic use of ionizing radiation is a negligible risk to the individual.

- 2879 (AED-Conf--75-780-000, pp 151-160)
COMBINED INJURIES AND THEIR SIGNIFICANCE IN
CATASTROPHIC MEDICINE. Messerschmidt, O.
1975. (In German).

From Meeting of the Schutzkommission beim
Bundesministerium des Innern; Erlangen, F.R.
Germany (May 1975).

87 refs. Available from ZAED.

Meeting of the Schutzkommission beim
Bundesministerium des Innern.

The problems involved in combined injuries and their significance for catastrophe medicine are investigated in animal experiments. Rats and mice were irradiated under various conditions. In addition, they were subjected to further traumas such as wounds, application of chemotherapeutics, stress, amongst others, in order to test these combined injuries. Certain pathological parameters such as the influence of these combined injuries on hematopoiesis, erythropoiesis, metabolic behaviour, histological investigations on organs, mortality, recovery phase were tested. It was thus shown that the dose and time dependence are of decisive importance. The effects of pure radiation injuries - compared to those injuries brought about by other parameters - generally do not give a summation of the injuries within the combined injuries. Rather, we find a very different effect picture of the combined injuries compared to the so-called 'single injuries'. The varying behaviour of the species is also remarkable so that one cannot directly relate these results to humans. The results clearly show that yet several animal species must be investigated in order to be able to draw conclusions regarding combined injuries in humans.

- 2880 (AED-Conf--75-780-000, pp 253-260)
ANIMAL EXPERIMENTS WITH RATS AS A CONTRIBUTION
TO THE QUESTION OF WHOLE BODY IRRADIATION.
Schraub, A.; Doell, G.; Jonas, H.; Kindt, A.;
Sattler, E.L. 1975. (In German).

From Meeting of the Schutzkommission beim
Bundesministerium des Innern; Erlangen, F.R.
Germany (May 1975).

8 figs.; 5 refs. Available from ZAED.

Meeting of the Schutzkommission beim
Bundesministerium des Innern.

Recovery after sublethal radiation damage was studied in the white blood count which shows a fast reaction to attacks caused by radiation. The so-called 'fractionated-dose method' was used. This method determines to what extent the total dose must be raised for two partial doses given at different times to produce the same amount of damage as a single irradiation. The second dose was applied after 7. days. A dose reduction by protraction of the first dose over 2 days was only found after doses of 300 to 400 rad. Regarding the anorexia connected with the radiation syndrome, no differences were found at low doses between protracted and one-time irradiation. This suggests that there is no repair.

- 2881 (ANL--76-99, pp 43-70) NEUTRON AND
GAMMA-RAY TOXICITY STUDIES. Ainsworth, E.J.
1975.

Division of Biological and Medical Research
annual report, 1975.

The focus of the program is on late effects of neutron and gamma radiation and assessment of risk. Principal research activities are in two complementary areas: life-span experiments with large populations of laboratory mice to compare the effectiveness of single or protracted doses of neutron or gamma radiation for life shortening due to cancer and other debilitating noncancerous diseases; and basic research on cellular injury and recovery for the evaluation of potential contributions of latent injury in the mouse circulatory, immune, and hematopoietic systems to life shortening, and for the comparison of late radiation effects in proliferating tissues. The data are used to test existing models and to formulate new models for prediction of radiation hazards and the relative biological effectiveness (RBE) of fission neutrons, particularly at low radiation doses. The neutron dose-response curve is nonlinear, with the life shortening effect decreasing from 3-4 day/rad to 1 day/rad with increasing dose over the range of 20-240 rad. Clearly, linear extrapolations from high neutron doses to estimate life shortening at low doses would underestimate risk; the underestimation is even greater when the enhancement of life shortening produced by fractionated neutron exposure, described previously by us, is also considered. These results from single neutron doses deviate from predictions of total dose dependency based on the predictive model of Kellerer and Rossi. The shape of the gamma radiation dose-response curve is linear over the range of 90 to 788 rad; linear dose-response curves for gamma radiation have been described previously by others, but a quadratic function has been considered by some to be most applicable.

- 2882 (COO--3380-25) DOSE RESPONSE CURVE FOR
TUMOR INDUCTION WITH SINGLE AND SPLIT DOSES OF
10 MEV PROTONS. Burns, F.J.; Albert, R.E.;
Vanderlaan, M.; Strickland, P. (New York
Univ., N.Y. (USA). Inst. of Environmental
Medicine). 1975. Contract AT(11-1)-3380.
18p. (CONF-7506138--1). Dep. NTIS \$3.50.

From Annual Radiation Research Society
meeting; Miami, FL, USA (Jun 1975).

The response of rat skin to proton irradiation shows a rapid form of recovery of both sublethal and suboncogenic injury and RBE values between 2 and 3. The combination of RBE values greater than one, and recovery indicates that while protons induce injury more efficiently per unit absorbed dose than electrons, there is still a reversible component to the injury process. (auth)

- 2883 (GSF-B--642) MOTTLED NEUHERBERG (MO/
SUP N/), A NEW MALE-LETHAL COAT COLOUR MUTATION
OF THE HOUSE MOUSE (MUS MUSCULUS). Schroeder,
J.H. (Gesellschaft fuer Strahlen- und
Umweltforschung m.b.H., Neuherberg/Muenchen
(Germany, F.R.). Inst. fuer Biologie). 1975.
8p. INIS.

2 figs.; 9 tabs.; 16 refs. Also published in
Theor. Appl. Genet.; 46: 135-142(1975).
Available from ZAED.

A new semidominant X-chromosomal mutation, Mottled Neuherberg (Mo/sup N/), which causes coat colour variegation is described. Mo/sup N/ arose in the second postirradiation generation after 2 x 200 R of x-rays (24 hours apart) to oocytes of X/O mice. Heterozygous Mo/sup N/ females have irregular patches of fully and lightly coloured fur over the whole coat with curly vibrissae. Their viability is reduced, about 3% of the heterozygotes dying prenatally and 6 to 28% dying postnatally before weaning. Survivors are fertile without externally visible abnormalities. Hemizygous Mo/sup N/

males die in utero after implantation. The recombination frequency between Mo/sup N/ and tabby (Ta) was $3.65 \pm 3.16\%$ (with 95% - confidence limits). Therefore, it is suggested that Mo/sup N/ is a new allele of the mottled (Mo) locus of the house mouse. Mo/sup N/-bearing ova seem to have a lower chance of becoming fertilized by wild-type spermatozoa than by Ta-bearing spermatozoa.

- 2884 (GWI-R--12-75) EFFECTS OF SUBLETHAL DOSES OF GAMMA RADIATION ON THE DEVELOPING RAT BRAIN. Cerda, H.; Carlsson, J.; Larsson, B.; Saefwenberg, J.O. (Uppsala Univ. (Sweden). Gustaf Werner Institutet). 1975. 23p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Newborn rats were irradiated with ^{60}Co gamma rays. Doses of 0, 80 or 160 rads were given to the whole body. The whole body and brain weights, DNA and RNA contents of the brain and ^3H -thymidine or ^3H -uridine incorporated by the brain were measured at 5, 10 or 15 days after birth. A dose of 160 rads produced clear alterations in the brain but no clear effects could be detected when 80 rads were given.

- 2885 (INIS-mf--1942, pp 107) STUDIES ON THE SERUM GLOBULINS STIMULATING EFFECTS ON THE IMMUNE REACTIVITY OF IRRADIATED AND NON-IRRADIATED ANIMALS IN CONNECTION WITH THE PROBLEM OF NATURAL RADIORESISTANCE AUGMENTATION. Shal'nova, G.A.; Kuz'mina, T.D.; Ulanova, A.M. 1975. (In Russian).

From 8. symposium on cosmic biology and medicine; Varna, Bulgaria (19 May 1975).

Published in summary form only.

8. symposium on cosmic biology and medicine, Varna, Golden Sands, 19-25 May, 1975.

Abstracts.

ANTIBODIES;BLOOD SERUM;CFU;GLOBULINS; IMMUNITY;MICE;MICROORGANISMS;MORTALITY;MUCOUS MEMBRANES;RABBITS;RADIOSENSITIVITY;RESPONSE MODIFYING FACTORS;SKIN;IMMUNE REACTIONS; BIOLOGICAL RADIATION EFFECTS;RADIOSENSITIVITY EFFECTS

- 2886 EXPERIMENTAL DETERMINATION OF THE RELATIVE BIOLOGICAL EFFECT OF ^{252}Cf . Letov, V.N.; Abdullaev, V.N.; Koval, G.N. (Scientific-Research Roentgeno-Radiological Inst., Moscow). Med. Radiol.; No. 10, 69-71(1975). (In Russian).

One of the most important problems in the process of preparing neutron therapy, especially with use of ^{252}Cf sources, is the study of the relative biological effect of this isotope in critical tissues--the skin, mucous membranes of the mouth, intestines and urinary bladder. Available data, however, are fairly limited and inconclusive. The present study was aimed at the relative biological effect of mixed γ -neutron radiation from ^{252}Cf . As test animals, 46 Chinchilla rabbits were used ranging in weight from 1.5 to 3.5 kg. Urinary bladder and rectum were subjected to local radiation from ^{252}Cf and ^{60}Co sources. Effects on viable cells were estimated by the modified method of M.I. Fedotova and L.M. Rozhdestvenskiy. Tabular and graphic data of the effects observed are given, along with computation formulas. (JPRS)

- 2887 ELIMINATION OF GAMMA RAYS FROM A THERMAL NEUTRON FIELD FOR MEDICAL AND BIOLOGICAL IRRADIATION PURPOSES. Kanda, K. (Kyoto Univ.); Kobayashi, T.; Ono, K.; Sato, T.; Shibata, T.; Ueno, Y.; Mishima, Y.; Hatanaka, H.; Nishiwaki, Y. pp 205-223 of Biomedical dosimetry. Vienna; International Atomic Energy Agency (1975).

From International symposium on advances in biomedical dosimetry; Vienna, Austria (10 Mar 1975).

See STI/PUB--401; CONF-750331--.

When a research reactor is used as a neutron source, a considerable amount of contamination with gamma rays is unavoidable. In biological and medical uses of neutrons, the gamma rays from the reactor core become background against the thermal neutrons. The paper proposes the use of a bismuth scatterer as a gamma-ray eliminator by which a neutron field with very few gamma rays can be obtained. A lithium-fluoride tile, manufactured by the sintering method, was also found to be a good neutron collimator as it produces few gamma rays while absorbing neutrons. The boron accumulation effect in tissue was estimated for a tissue-equivalent liquid model. The importance of minimizing gamma-ray contamination in the thermal neutron field is emphasized for selective irradiation of the boron-containing tissue. The neutron field was applied to several experiments, such as biological experiments for the treatment of cancers. (auth)

- 2888 (ERDA-tr--110, pp 41-46) INFLUENCE OF PROLONGED IRRADIATION ON THE ENZYMES OF DNA SYNTHESIS IN RAT BONE MARROW. Elkina, N.I. 1975. Translated from Radiobiologiya; 15: No. 4, 521-525(1975).

Radiobiology. The activity of the enzymes of DNA synthesis in the bone marrow of rats at various periods after prolonged daily irradiation at a dose of 50 R was studied. During the first five days of irradiation (dose 50 R), the activity of the enzymes of phosphorylation of thymidine and TMP to TTP and DNA polymerase was 50 percent higher calculated per myelokaryocyte than the activity of these enzymes in the control animals. The high activity of kinases and DNA polymerase was detected before the animals received a dose of 2000 R. As a result of the increased activity of the enzymes per karyocyte of the irradiated rats, the activity of the kinases and DNA polymerase per mg protein and per gram of tissue remained at a level close to the control. The activity of dCMP deaminase did not change appreciably during the first irradiation and gradually decreased beginning with a dose of 500 R. (tr-auth)

- 2889 (ERDA-tr--110, pp 77-81) DYNAMICS OF THE IMMUNOLOGICAL REACTIONS IN THE CHRONIC INFLUENCE OF RADIONUCLIDES AND EXTERNAL IRRADIATION. Shubik, V.M.; Livshits, R.E. (Leningrad Scientific Research Inst. of Radiation Hygiene). 1975. Translated from Radiobiologiya; 15: No. 4, 552-555(1975).

Radiobiology. In experiments on rats a comparative study was made of the nonspecific factors of immunity and the formation of autoantibodies under the action of comparable doses of chronic external γ irradiation and chronic administration of ^{137}Cs , ^{90}Sr , and ^{131}I . The absence of any significant differences in the changes in the immunological responses in the case of chronic external and uniform internal γ irradiation was demonstrated. Some peculiarities in the nature of the changes in the immunological responses depending on the biophysical properties of the radionuclides used in the experiments were detected. (tr-auth)

- 2890 (ERDA-tr--110, pp 100-104) FUNCTIONAL ACTIVITY OF THE SYMPATHICOADRENAL SYSTEM IN THE CASE OF CHRONIC AND FRACTIONATED IRRADIATION OF RATS. Musagalieva, G.M. (Kazakh Inst. of

- Physical Culture, USSR). 1975. Translated from *Radiobiologiya*; 15: No. 4, 573-576(1975).
 Radiobiology. The chronic action of low doses of ionizing radiation has a number of peculiarities in comparison with a single influence, determined by the differential sensitivity of various tissues to the radiation influence, the different ability for summation of the effects and repair of radiation damages. Until recently there has not been sufficient information on the influence of low doses of chronic irradiation on the functional state of the sympathicoadrenal system, in particular, its specific metabolism--the catecholamine metabolism. Therefore, in this work we made an attempt to study the content of catecholamines and their precursors--dopamine and dopa in various links of the sympathicoadrenal system in the case of chronic and fractionated irradiation. (tr-auth)
- 2891 (ERDA-tr--110, pp 112-118) INFLUENCE OF PROLONGED IRRADIATION IN LOW DOSES ON THE RAT EMBRYO BRAIN. Semagin, V.N. 1975. Translated from *Radiobiologiya*; 15: No. 4, 583-588(1975).
 Radiobiology. Irradiation for 18 hrs a day in the last third of pregnancy of rats in doses of 0.0008 to 10 R/day leads to a stimulation of the development of the higher divisions of the central nervous system in the fetuses. (tr-auth)
- 2892 (ERDA-tr--110, pp 119-123) INFLUENCE OF CHRONIC IRRADIATION AT LOW DOSES ON THE AGE CHANGES IN THE RADIORESISTANCE OF WHITE MICE. Lisenkova, L.N. (Leningrad Scientific Research Inst. of Radiation Hygiene). 1975. Translated from *Radiobiologiya*; 15: No. 4, 589-592(1975).
 Radiobiology. The results of a study of chronic irradiation with the γ rays of ^{60}Co at doses of 6, 17, and 50 mR 6 to 7 hrs daily on the age changes in the radioresistance of white mice are cited. It was shown that under the influence of chronic irradiation at low doses, the degree of expression of the age peculiarities of the resistance of the animals to a supplementary test irradiation at a dose of 570 R is changed. (tr-auth)
- 2893 (ERDA-tr--110, pp 162-165) ASCORBIC ACID SUPPLY OF MONKEYS SUBJECTED TO PROLONGED IRRADIATION AT LOW DOSES. Solov'eva, G.A.; Dzhikidze, E.K. (Inst. of Experimental Pathology and Therapy, Sukhumi, USSR). 1975. Translated from *Radiobiologiya*; 15: No. 4, 624-627(1975).
 Radiobiology. Keeping in mind, on the one hand, the data on the influence of the vitamin C balance on the natural resistance of the organism to infections, and, on the other hand, the disturbance of the vitamin C metabolism under the influence of acute irradiation, we undertook to determine the state of supply of the indicated vitamin in the case of a repeated influence of relatively low doses of external irradiation of the organism of monkeys, which, like man, need an exogenous intake of vitamin C, and also to follow the dynamics of the restoration of the ascorbic acid content in monkeys that had been subjected to irradiation. The beginning of the decrease in the vitamin C content in monkeys according to these two tests was already noted when they were irradiated at a summary dose of 800 R; moreover, the level of the indices fluctuated within narrow limits throughout the entire period of irradiation, regardless of the value of the dose received. Despite the fact that after the cessation of irradiation, the vitamin C content in the whole blood was increased to the initial values, the low ascorbic acid content in the leukocytes was evidence that chronic irradiation so disturbs the ascorbic acid metabolism in the organism of irradiated monkeys that in our experiments, even after two years, its content cannot reach the norm. Evidently the restoration of the disturbed balance of vitamin C requires a longer time. (ERB)
- 2894 (ERDA-tr--110, pp 166-169) INFLUENCE OF VARIOUS DIETS ON THE RADIOSENSITIVITY OF GUINEA PIGS. Darenskaya, N.G.; Kuznetsova, S.S.; Lebengarts, Ya.Z.; Il'in, V.V. 1975. Translated from *Radiobiologiya*; 15: No. 4, 627-630(1975).
 Radiobiology. The influence of seven different diets on the radiosensitivity of guinea pigs was studied. The diets varied in protein content and cellulose content. Mortality following γ irradiation was the criterion used to determine radiosensitivity. No significant increase in the radiosensitivity of the guinea pigs was detected with any of the diets tested. (ERB)
- 2895 LATE EFFECTS OF SELECTED IMMUNOSUPPRESSANTS ON IMMUNOCOMPETENCE, DISEASE INCIDENCE, AND MEAN LIFE-SPAN. II. CELL-MEDIATED IMMUNE ACTIVITY. Peterson, W.J.; Perkins, E.H.; Goodman, S.A.; Hori, Y.; Halsall, M.K.; Makinodan, T. (Oak Ridge National Lab., TN). *Mech. Ageing Dev.*; 4: 241-249(1975).
 The late effects of various immunosuppressive insults on cell-mediated immunity in mice were studied in an attempt to assess the role of immune surveillance in the aging process. Results were obtained using susceptibility to allogeneic tumor cell challenge, graft-versus-host reaction (GVHR), blastogenic response to PHA, a thymus derived T cell-specific plant mitogen, and cytolytic activity against allogeneic tumor cells as measures of immunologic activity. In vivo studies late in life show that resistance to allogeneic tumor cells is significantly decreased in thymectomized mice, whereas those treated with cortisone, cyclophosphamide and sublethal x-ray remain unchanged. Spleen cells from only the thymectomized and the sublethally irradiated mice show reduced activity in the GVHR. No difference is seen in the activity of bone marrow cells. Results consistent with these findings were obtained in in vitro studies. Thus spleen cells from thymectomized or sublethally irradiated mice show decreased activity in response to PHA, whereas no change is seen in spleen cells from other treated groups. Hence, surgical and physical insults are more likely to induce long-lasting immunosuppression in those immunocompetent tissues whose activity normally diminishes with advancing age. Furthermore, the degree of immunosuppression seen in this study is not of the order of magnitude that one could reasonably predict a significant decrease in mean life-span.
- 2896 LATE EFFECTS OF SELECTED IMMUNOSUPPRESSANTS ON IMMUNOCOMPETENCE, DISEASE INCIDENCE, AND MEAN LIFE-SPAN. III. DISEASE INCIDENCE AND LIFE EXPECTANCY. Peter, C.P.; Perkins, E.H.; Peterson, W.J.; Walburg, H.E.; Makinodan, T. (Oak Ridge National Lab., TN). *Mech. Ageing Dev.*; 4: 251-261(1975).
 The effect of various immunosuppressive treatments on mean life-span and disease incidence have been studied. Significant life shortening was seen only in mice which received

X-irradiation early in life and can be ascribed primarily to an increased incidence of certain malignancies. Marginal life shortening was seen in cyclophosphamide-treated animals, however, survival patterns between those and control animals did not differ until 30 months of age and the magnitude of life-shortening never approached that seen in X-irradiated animals. Thymectomy, splenectomy or cortisone treatment did not alter survival. All immunosuppressive treatments enhanced mortality due to non-neoplastic diseases, however, only a small percentage of animals die with these disease entities. With the exception of cortisone all immunosuppressive treatments increased the incidence of neoplastic disease. However, their effects on various neoplastic processes were variable and unpredictable. Four primary patterns in terms of relative immune competence, disease incidence and life expectancy were seen. Thus, immunodepression may or may not correlate with increased disease incidence, which in turn may or may not have a life-shortening effect. These findings are discussed in terms of the marked reduction of both humoral and cell-mediated immunity normally seen in aged mice and the significance of postulated immune surveillance mechanisms to survival.

- 2897 COMPARATIVE ENVIRONMENTAL PHYSIOLOGY OF MAMMALIAN LONGEVITY: METABOLIC AND THERMOREGULATORY EFFECTS OF IONIZING RADIATION. Braham, H.W. Columbus, OH; Ohio State Univ. (1975). 152p. University Microfilms Order No. 76-9941.

Thesis (Ph. D.).

The comparative environmental physiologies of two species of wild rodents with different longevity were studied; the wild house mouse (*Mus musculus* Linnaeus) the short-lived species, and the white-footed mouse (*Peromyscus leucopus noveboracensis*) the long-lived species. The consequences of ionizing radiation and ambient temperature change were used to study differential effects of metabolic and thermoregulatory performance. *P. leucopus* expended less energy for thermoregulation and lost less heat to the environment than *M. musculus* during both active and inactive periods of the day. The amount of heat loss by *M. musculus* was 18.2 percent higher at 32°C, 9.3 percent higher at 27°C and 4.3 percent higher at 15°C than *P. leucopus*. Thermal conductance was shown to be a more effective mechanism to reduce heat loss in *P. leucopus* than *M. musculus*. At 27°C, *M. musculus* had a 13.3 percent higher metabolic rate than *P. leucopus* and at 32°C *M. musculus* had a 6.0 percent lower metabolic rate, suggesting that the optimal thermometabolic temperature in *P. leucopus* was lower than in *M. musculus*. The lower critical temperature in *P. leucopus* was determined to be about 1°C below that of *M. musculus*. The energetics of both species of mice have been shown to be significantly altered by sub-lethal acute gamma (⁶⁰Co) ionizing radiation. The predicted total metabolic output of nonirradiated *P. leucopus* and *M. musculus* fit Wunder's (1975) metabolic model to within 1 percent. Irradiated *M. musculus* had an 8 percent higher total metabolic rate than predicted, and irradiated *P. leucopus* a 20 percent higher metabolic rate than predicted. Irradiated mice lost 25 to 30 percent more heat to the environment than control mice. The difference in thermoregulatory capacity between irradiated and non-irradiated mice was expressed by higher metabolic rates, excess heat lost to the environment and 2 to 3°C lower deep body temperatures in the irradiated animals.

- 2898 (ERDA-tr--99, pp 103-107) EQUIVALENT CONDITIONS OF IRRADIATION OF MAMMALS. Tyazhelova, V.G.; Akoev, I.G. (Inst. of Biological Physics, Pushchino, USSR). 1975. Translated from Radiobiologiya; 15: No. 3, 411-414(1975).

Radiobiology. On the basis of a study of the change in the value of LD₅₀ with the dose rate in the series of mammals: mouse, rat, dog, man, and the previously derived results on the gradual involvement of the recovery systems of various biological levels of the organism in the repair process, methods were developed for the selection of equivalent conditions of irradiation of mammals of the indicated species. (tr-auth)

- 2899 (ERDA-tr--99, pp 132-135) CYTOGENETIC INVESTIGATIONS IN THE CASE OF SIX-YEAR IRRADIATION OF DOGS. Tsessarskaya, T.P. 1975. Translated from Radiobiologiya; 15: No. 3, 434-437(1975).

Radiobiology. The cytogenetic effect of continuous γ irradiation was studied in dogs as a function of the dose rate and dose. A distinct increase in the frequency of aberrations in the bone marrow cells was produced only by irradiation with the maximum rate of irradiation of the dose used in the experiment--125 rad/year, while at dose rates of 21 and 63 rad/year the radiation effect was detected only at certain periods. The absence of an unambiguous relationship between the value of the effect and the dose of irradiation is characteristic. (ERB)

- 2900 (ERDA-tr--99, pp 148-150) CHANGE IN THE NUMBER OF CELLS OF THE SMALL INTESTINE OF MICE UNDER THE INFLUENCE OF VARIOUS DOSES OF IRRADIATION. Semenov, L.F.; Altukhova, L.N. (Inst. of Experimental Pathology and Therapy, Sukhumi, USSR). 1975. Translated from Radiobiologiya; 15: No. 3, 447-449(1975).

Radiobiology. The dose dependence of radiation damage to the intestine was investigated in γ -irradiated mice. It was found that different forms of radiation damage to the intestine are based on a delay of the proliferation of the epithelium of varying duration, a dose-dependent phenomenon. (ERB)

- 2901 RADIATION-INDUCED CHROMOSOME ABERRATIONS IN MOUSE SPERMATOCYTES AND OOCYTES. Tsuchida, W.S.; Uchida, I.A. (McMaster Univ., Hamilton, Ont.). Cytogenet. Cell Genet.; 14: 1-8(1975).

ICR/Swiss males and females were exposed to 300 R whole-body γ irradiation. The frequency of aberrations in metaphase I chromosomes recovered from oocytes cultured in vitro was compared with those recovered from spermatocytes irradiated in pachytene and diplotene. The ability of oocytes collected 1 day postirradiation to mature in vitro was not affected, but significantly fewer oocytes cultured 5 days after irradiation matured. The frequency of aberrations in oocytes did not differ from spermatocytes irradiated during diplotene, but significantly more chromosome aberrations were found when pachytene spermatocytes were irradiated. Some variation in the relative frequencies of aberrations was also observed. (auth)

- 2902 STUDY ON CHANGED IN BLOOD PLASMA ELECTRIC CONDUCTIVITY AND DIELECTRIC CONSTANT IN X-IRRADIATED RATS. Bancheva, E. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)).

Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.1, 13-20(1975). (In Bulgarian).

The changes in plasma electric conductivity at different frequencies provide information on its electrolyte concentration; those of the dielectric constant reflect plasma protein pattern changes. Results are reported of measurements of plasma electric conductivity and dielectric constant in rats following single and fractional irradiation with 200, 400, and 600 R. Measurements were performed on the first, third and tenth day after irradiation at frequencies of 0.6 to 3.5 Hz. Statistically significant differences were recorded in plasma electric conductivity and dielectric constant on the third and tenth day for doses of 400 and 600 R, and on the tenth day for a 200 R dose.

- 2903 CHROMOSOMAL ABERRATIONS IN BONE MARROW OF CONTINUOUSLY IRRADIATED RATS. Chlebosky, O.; Praslicka, M.; Chlebovska, K. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Prirodovedecka Fakulta). Biologia (Bratislava); 30: No. 6, 427-433(1975).

Research on chromosomal aberrations of the bone marrow in continuously irradiated rats showed that chromosomal aberrations are a highly sensitive indicator of radiation injury. An increase in the chromosomal aberration frequency was already found on the 5th day at daily doses of 0.5 R, i.e. a 12% increase at a total dose of 25 R. In the steady-state stage at daily doses of 0.5; 1; 2.5 R, the number of chromosomal aberrations stabilized at values of about 20%; at daily doses of 5 and 10 R at values of 30%, at daily doses of 53 R at 45%, at a daily dose of 82.5 R, the number of chromosomal aberrations increased to 55%.

- 2904 MITOSIS DYNAMICS IN BONE MARROW OF CONTINUOUSLY IRRADIATED RATS. Chlebovsky, O.; Praslicka, M.; Chlebovska, K. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Prirodovedecka Fakulta). Biologia (Bratislava); 30: No. 6, 419-425(1975).

Values were investigated of the mitotic index (MI) and the metaphase/prophase ratio (M/P) in rats continuously irradiated with daily doses of 0.5 to 82.5 R. Changes resulting from the continuous irradiation were manifest in two stages, viz.: 1. adaptation stage up to the 30th day of irradiation - the values fluctuated considerably; 2. steady-state stage since the 30th day till the end of irradiation - the values stabilized at a certain level. During the adaptation stage, MI values decreased till the 25th day; then they increased and remained at a certain lower value till the end of the experiment. M/P values showed a considerable variability between the 5th and the 25th days and a significant increase in the steady-state stage, mainly at higher dose rates.

- 2905 AN ATTEMPT TO DETERMINE THE RELATIVE GENETIC EFFICIENCY OF FAST NEUTRONS BY THE INDUCED RECIPROCAL TRANSLOCATIONS IN MOUSE SPERMATOGONIA. Khadzheva, T. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.1, 87-91(1975). (In Bulgarian).

Sexually mature male mice of C57BL line are irradiated over a period of 10, 70 or 720 hours with 25 rad neutrons from plutonium-berilium source. Another series of mice is exposed to 200 rad gamma-rays from radium source, distributed over the same three lengths of time. The cytogenetic analysis of primordial spermatocytes in diakinesis metaphase I on the 60th post-irradiation day disclosed chromosomal

translocations resulting from injury to the hereditary structures of the spermatogonial cells. A dose power variation by one or two orders exerts no influence on the radiation effect. Under these conditions the relative genetic effectiveness of neutrons with an average energy of 41 MeV was 11 to 20 tending to be higher at decreasing the dose rate.

- 2906 STUDY OF CHANGES IN BLOOD PLASMA ELECTRIC CONDUCTIVITY AND DIELECTRIC CONSTANT IN MICE EXPOSED TO 4,1 MEV NEUTRONS. Paskalev, Z.; Khristova, M. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.1, 3-7(1975). (In Bulgarian).

The changes in the electric properties of blood plasma of mice, irradiated with 10, 15 or 20 rad of fast neutrons from plutonium-berilium source with an intensity of 5.6×10^6 neutrons/sec are investigated. Plasma high-frequency electric conduction and dielectric constant was measured with the aid of admittance measurer type SWM-2 at a frequency range between 0.1 and 17 MHz. The changes in the electric constant are attributed to conformation changes in the protein macromolecule; those of the high-frequency electric concentration - to changes in the amount of the basic electrolytes sodium, potassium and chlorides, as a manifestation of impaired electrolyte balance during the early post-irradiation period.

- 2907 CHROMOSOME ANOMALIES IN MOUSE OOCYTES AFTER IRRADIATION. Reichert, W.; Hansmann, I.; Roehrborn, G. (Heidelberg Univ. (F.R. Germany). Inst. fuer Anthropologie und Humangenetik). Humangenetik; 28: No. 1, 25-38(1975). 8 figs.; 4 tabs.; 20 refs..

We investigated the cytogenetic effects of X-rays on unfertilized mouse oocytes. NMRI females received an irradiation with 0, 22.2, 66.6, 200, and 600 R during the preovulatory phase 3 hrs after HCG (human chorionic gonadotrophin). This is a stage during oogenesis in which the oocytes pass from late dictyotene to diakinesis. Chromosome analysis was performed after ovulation at metaphase II. From these experiments we can draw the following conclusions: X-rays induced during the preovulatory phase a high number of chromosome anomalies. Among these, structural anomalies prevail. 7 out of 144 ovulated oocytes in matched controls carried such an abnormality, whereas after irradiation we observed with 22.2, 66.6, 200, and 600 R, 11 out of 72, 34 out of 108, 89 out of 102, and 122 out of 124, respectively. Irradiation seems also to affect the chromosome segregation during the 1. meiotic division, as we observed after 22.2, 66.6 and 200 R a total of 6 oocytes out of 204 with a supernummary chromosome. In controls, however, no hyperploidy was found in 143 ova. This increase, however, was not significant. Chromosome anomalies, e.g. breaks and deletions that go back to a one-break event increased linearly with increasing dose. Exchanges, however, going back to two-break events fitted best to the linear-quadratic dose-response model. The dose of 600 R seems to represent a kind of borderline in this experiment, because nearly all (122 out of 124) carried at least one structural chromosome anomaly. It is also this dose after which the highest frequency of reciprocal translocations was observed in a humpshaped slope in spermatocytes after irradiation of spermatogonia (Preston and Brewen, 1973). With an increasing dosage up to 1,200 R the frequency of translocations decrease again. The elimination of cells, crossing this borderline,

might be due to genetic or non-genetic effects.

- 2908 INITIAL CHANGES IN THE STATE OF DNP AND DNA OF GERM AND INCRETORY CELLS OF TESTIS UNDER THE ACTION OF IONIZING RADIATION. Kondratenko, V.G.; Stakanov, V.A. (AN SSSR, Pushchino-na-Oke. Inst. Biologicheskoy Fiziki). Stud. Biophys.; 53: 29-30(1975).

From 3. International symposium on primary and initial mechanisms of the effect of ionizing radiation on the cell; Erevan, USSR (26 May 1975).

Short communication only.

BIOLOGICAL RADIATION EFFECTS;CHEMICAL RADIATION EFFECTS;DNA;DOSE-RESPONSE RELATIONSHIPS;GERM CELLS;IONIZING RADIATIONS; MICE;NUCLEOTIDES;TESTES

- 2909 AGE DIFFERENCES IN GENETIC EFFECT OF RADIATION. Ohanjanian, E.E.; Sahakian, D.G.; Khachatryan, G.A.; Mkrtichian, S.A. (Sector of Radiobiology of the Ministry of Health of the Armenian SSR, Erevan (USSR)). Stud. Biophys.; 53: 77-78(1975).

From 3. International symposium on primary and initial mechanisms of the effect of ionizing radiation on the cell; Erevan, USSR (26 May 1975).

The age differences in the radiosensitivity of the genetic apparatus of spleen cells, lymphatic ganglion and the epithelium of the mucous uterus have been revealed. In mice not having reached puberty the chromosomes of the cells of the above-mentioned organs are more sensitive to a single radiation dose of 100 R than in mice having reached puberty.

- 2910 INITIAL MECHANISMS OF X RAY DAMAGE OF EUKARYOTIC TRANSCRIPTION PROCESSES. Paskevich, I.F.; Shantir, V.I.; Stolyarov, I.V.; Savenko, L.N.; Likhoded, V.S. (Khar'kovskij Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii (Ukrainian SSR)). Stud. Biophys.; 53: 35-36(1975).

From 3. International symposium on primary and initial mechanisms of the effect of ionizing radiation on the cell; Erevan, USSR (26 May 1975).

Short communication only.

BIOLOGICAL RADIATION EFFECTS;BIOSYNTHESIS; CHEMICAL RADIATION EFFECTS;LIVER;NUCLEOPROTEINS; POLYMERASES;RATS;RNA;SPLEEN;TIME DEPENDENCE;X RADIATION

- 2911 (ERDA-tr--151, pp 82-88) EFFECTS OF SMALL DOSES OF RADIATION OF SPERMATOGENESIS. Kondratenko, V.G.; Ganzenko, L.F. (Inst. of Biological Physics, Pushchino, USSR). 1975. Translated from Radiobiologiya; 15: No. 6, 861-865(1975).

Radiobiology. Cytological and cytochemical investigations were made of the testes of dogs subjected to the chronic action of irradiation at doses of 21, 62.5 and 124.5 rad per year for various periods from two to six years. Quantitative analysis showed that there is a dose and time dependence of the inhibition of the process of spermatogenesis, caused by a disruption of the state of the nuclear chromatin of the germ cells. It was shown that the observed decrease in the weight of the testes is due to a loss of spermatogenic cells. It was established that the process of spermatogenesis possesses an adaptation to the effect of low doses of radiation and can compensate for their action.

EMBRYOS WITH X-RAYS AND CHEMICAL MUTAGENS. Fahrigh, R. (Deutsche Forschungsgemeinschaft, Freiburg (F.R. Germany). Zentrallaboratorium fuer Mutagenitaetspruefung). Mol. Gen. Genet.; 138: No. 4, 309-314(1975).

1 fig.; 1 tab.; 9 refs..

Embryos heterozygous for five recessive coat-color genes from the cross C57 BL/6 J Han x T-stock were X-irradiated with 100 R or treated in utero with 50 mg/kg methyl methanesulfonate (MMS) and ethyl methanesulfonate (EMS), respectively. Controls consisted of irradiated embryos of C57 BL x C57 BL matings homozygous wild-type for the genes under study, and non-treated offspring of both types of mating. The colors of the spots observed in the adult fur were either due to expression of the recessive coat genes or were white. 1) Irradiated and mutagen-treated offspring of C57 BL x T-stock matings had almost exclusively nonwhite spots, distributed randomly over the mouse surface. 2) Irradiated offspring of C57 BL x C57 BL matings had only white spots which were always midventral. 3) In non-treated offspring of both types of mating no spot could be observed. It is discussed that the white midventral spots are preferentially the result of pigment cell killing, while the nonwhite spots are preferentially the result of gene mutations or recombinational processes like mitotic crossing over and mitotic gene conversion.

- 2913 USE OF THE MOUSE TO FILL GAPS IN OUR RISK ASSIGNMENTS. Searle, A.G. (Medical Research Council, Harwell, Eng.). pp 947-956 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

The use of data on mice to fill gaps in our risk assignments of genetic radiation hazards to man is discussed. The following topics are included in the discussion; dominant mutations; recessives and their heterozygous effects; threshold variants; somatic mutations; and losses and gains of chromosomes. (ERB)

- 2914 COMPARISON OF THE MUTAGENIC EFFECT OF CHEMICALS AND IONIZING RADIATION IN THE SPERMATOGENIC CELLS OF THE MOUSE. Cattanaach, B.M. (Medical Research Council, Harwell, Eng.). pp 984-992 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

The problems involved in chemical mutation work are both complex and varied. With ionizing radiation it is known that genetic effects are produced in all organisms, in all cells, and the assessment of genetic risk is thus one of ascertaining how much damage is being induced: It is a quantitative problem. By contrast, chemical mutagens may be highly mutagenic in one organism, or one cell type, but totally ineffective in another. In cases where mutagenic effects are produced, all those classes of mutation recovered following radiation may occur, or only a few. Where no mutagenic effects can be detected, this may be due to any one of a variety of different causes.

- 2912 MAMMALIAN SPOT TEST: INDUCTION OF GENETIC ALTERATIONS IN PIGMENT CELLS OR MOUSE

- 2915 BIOPHYSICAL IMPLICATIONS OF RADIATION QUALITY. Rossi, H.H. (Columbia Univ., New

York). pp 594-597 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

Almost as soon as the biological effects of ionizing radiation were discovered, attempts were made to explain some of their basic characteristics in terms of the physical process of energy absorption in the irradiated tissues. The classical target theory and a variety of other approaches, although occasionally useful in simple situations, have had little success when effects on higher organisms were under consideration. It seems apparent that such failures were due to the fact that many of the radiobiological experiments were designed from a phenomenological point of view; that the radiations employed were usually X or gamma rays which have complex inactivating mechanisms; and that the physical concepts employed in the analysis (such as absorbed dose and LET) were inadequate. The results of systematic experiments in which the effects of neutrons and electromagnetic radiations were compared coupled with the development of microdosimetry have in recent years resulted in advances which are the subject of this presentation.

- 2916 CHARACTERISTICS OF CELL SURVIVAL CURVES FOR DIFFERENT RADIATIONS IN RELATION TO ISO-EFFECT CURVES FOR FRACTIONATED TREATMENTS OF A RAT RHABDOMYOSARCOMA. Barendsen, G.W. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Instituut TNO). pp 270-277 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Shapes of survival curves for mammalian cells treated with low doses of x-rays are discussed, starting from the observation that with high-LET alpha particles survival curves were within experimental errors indistinguishable from exponential. An interpretation of this result can be given based on the assumption that reproductive death can be induced by the traversal of a single particle through part of a critical structure in the cell. Since x-rays, gamma rays and fast electrons deposit part of their energy through low energy secondary electron at LET values in excess of $20 \text{ keV } \mu\text{m}^{-1}$, it is expected that survival curves for these radiations which deposit energy through particles of low mean LET have an initial negative slope at low doses. This is supported by results of experiments with synchronized cultured cells. Insights obtained from the data on cultured mammalian cells have now been applied to the interpretation of dose-response relationships of an experimental R-1 rhabdomyosarcoma transplantable in an inbred strain of WAG/Rij rats. Cells from these tumours can be plated in vitro and grow quantitatively into colonies. With this technique fractions of clonogenic cells have been analysed after treatments of the tumours with single and fractionated doses of 300 kV x-rays and 15 MeV neutrons. Data have been obtained for fractionated treatments with daily doses of 300 kV x-rays, doses given for several weeks. These data are used to derive iso-effect curves, which can be interpreted on the basis of data for in vitro survival curves

measured for doses between 100 and 500 rad and by taking into account the repair of sublethal damage, reoxygenation and proliferation of cells.

- 2917 THE RESPONSE OF MOUSE SKIN TO MULTIPLE SMALL DOSES OF RADIATION. Denekamp, J.; Harris, S.R. (Mount Vernon Hospital, Northwood (UK)). pp 342-350 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

The response of mouse skin has been tested by irradiating the foot of albino mice and scoring erythema and desquamation during the following month. Multiple small doses of 150, 250 and 350 rad have been given 'daily', and the test dose necessary to achieve a given reaction has been determined one day after the last small fraction. This test dose has been compared with the single dose necessary to produce the same reaction level in previously untreated mice, in order to determine the ratio of the slopes of the dose-response curve at low and high doses: Slope ratio = (single dose - test dose)/total fractionated priming dose. In three separate experiments the slope ratio decreased as the dose per fraction was reduced from 350 to 150 rad. This conflicts with the data of Dutreix et al, who found a constant slope ratio over this dose range. The present data are compared with those obtained by Denekamp using 4, 9 and 14 fractions of 300 rad and by Douglas et al, using the same experimental technique, over the dose range 45 to 200 rad/fraction. In addition, the results from multifraction experiments in which equal dose increments were administered until the requisite skin reaction was achieved are also analysed in terms of their slope ratio (Fowler et al. Douglas et al). When all these results are plotted it is impossible to be sure whether the slope ratio is decreasing over the range 300 to 45 rad per fraction, although it seems likely. Most of the values at low doses lie in the range 0.15 to 0.25, indicating that at low doses the radiation is only 15 to 25% as effective per rad in causing cell death as at higher doses.

- 2918 THE EFFECT OF MULTIPLE SMALL FRACTIONS OF X-RAYS ON SKIN REACTIONS IN THE MOUSE. Douglas, B.G.; Fowler, J.F.; Denekamp, J.; Harris, S.R.; Ayres, S.E.; Fairman, S.; Hill, S.A.; Sheldon, P.W.; Stewart, F.A. (Mount Vernon Hospital, Northwood (UK)). pp 351-360 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Multiple fraction experiments have been carried out to determine the response to repeated small doses of 240 kV x-rays down to 107 rad per fraction, using mouse skin desquamation reactions. In one series of experiments the overall time was kept shorter than 8 days so that proliferation was negligible. Up to 64 fractions were given. It was found that the total dose required to produce a given reaction continued to rise with number of fractions up to 64 fractions, in contradiction to the conclusions of Dutreix and Wambersie. The plot of reciprocal total dose

against size of each fraction was linear. This finding led to an analysis in terms of a function $F_{sub}(e)$ which is proportional to the slope of the chord from the origin to the point corresponding to the dose per fraction on the derived cell survival curve. On the assumption that the effects depended on cell killing, the initial slope of the survival curve was calculated as 1/690 rad, and the slope at 2340 rad was 1/126 rad. Thus one rad at a dose approaching 0 rads has 18% of the effect of one rad at a dose of 2340 rad for 'tolerance' skin desquamation. The derived cell survival curve is well fitted by an equation of the form $s = \exp[-(\alpha D + \beta D^2)]$.

- 2919 DEDUCTIONS ABOUT SURVIVAL-CURVE PARAMETERS FROM ISO-EFFECT RADIATION REGIMES. OBSERVATIONS ON LETHALITY AFTER WHOLE-BODY IRRADIATION OF MICE. Mole, R.H. (Medical Research Council, Harwell (UK). Radiobiological Research Unit). pp 299-306 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth LH. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

Criteria which permit iso-effect radiation regimes to be regarded as equivalent in terms of cell depletion are briefly discussed. Observations on whole-body irradiation of mice by split and multiple exposures suggest that $D_{sub}(Q)$ for haematopoietic stem cells in the non-cycling state is approximately 100 rad but about zero when they are cycling. Corresponding changes in radiobiological properties of cells are to be expected during the course of fractionated and protracted exposures in vivo when the iso-effect of interest is relatively gross tissue damage. Responses to ionizing radiation in vivo are dependent on aspects of cellular organisation which are missing from in vitro experimentation.

- 2920 RESPONSES OF SOME NORMAL TISSUES TO LOW DOSES OF γ -RADIATION. Withers, H.R. (Anderson (M.D.) Hospital and Tumor Inst., Houston, Tex. (USA)). pp 369-375 of Cell survival after low doses of radiation: theoretical and clinical implications. Proceedings of the sixth L.H. Gray conference, held at Bedford College, London, 16-21 September 1974. Alper, T. (ed.). London; Institute of Physics and Wiley (1975).

From 6. L.H. Gray conference; London, UK (16 Sep 1974).

The response of four normal tissues to low doses of γ -radiation was measured in mice using three indirect methods. The survival curves for cells of the tissues studied (colon, jejunum, testis and haemoleucopoietic system) may be exponential over an uncertain dose range (from zero to between 100 to 230 rad), the slope being about one third of that in the high-dose region. Some of the uncertainties in the data probably reflect variations in age-density distribution.

- 2921 ERYTHROPOIESIS IN THE X-IRRADIATED, BLED RAT. Marchetti, D.L.; Glomski, C.A. (Buffalo Univ., N.Y. (USA)). Exp. Hematol.; 3: 375-382(1975).

Exposure to low levels of x irradiation (50R) followed by phlebotomy (50% blood volume) one month post-irradiation, resulted in identifiable alterations of the erythropoietic status of the rat. The red cell indices revealed a decrease in mean corpuscular volume and an increase in mean corpuscular hemoglobin

concentration. The half-life of ^{51}Cr -labelled erythrocytes was 16.7 days versus 14.4 days for the untreated controls. These subjects also demonstrated hyperplastic marrows with an approximate 60% mean increase in marrow cellularity. A reproducible mortality of 25% was seen at 17 weeks post-irradiation. The one group of animals followed for an extended period exhibited an 86% cumulative mortality at 23 weeks. The observations supported the concept that x-irradiated rats exposed to a relatively low dose of X-rays ($< 10\% \text{ LD}_{50}$) maintain a latent or residual injury of the bone marrow. These animals, when subsequently challenged by phlebotomy, are placed at greater risk with respect to their ability to survive.

- 2922 PATHWAYS IN THYMUS- AND BONE MARROW-DERIVED LYMPHATIC LEUKEMIA IN MICE. Haran-Ghera, N.; Ben-Yaakov, M.; Chazan, R.; Peled, A. (Weizmann Inst. of Science, Rehovot, Israel). Bibl. Haematol.; 40: 133-141(1975).

The radiation- and radiation leukemia virus-induced leukemias in C57BL/6 strain mice were found to be of the thymus-derived (T) lymphocyte origin. Experimental evidence indicated that the interaction of the radiation leukemia virus with thymus-derived lymphoid cells and specifically with the thymus subpopulation bearing high levels of H-2 alloantigens were prerequisites for the development of high leukemia incidence in these test systems. In radiation leukemogenesis in C57BL/6 mice it was shown that within several days following the radiation treatment a "released" leukemogenic agent was found in the irradiated bone marrow; whereas, several days following chemical carcinogen leukemogenesis in SJL/J mice, established preleukemic or leukemic cells could be detected in the bone marrow. The analysis concerned with the lymphoid origin of chemical carcinogen-induced lymphatic leukemias in SJL/J mice indicated clearly that the carcinogen could affect different lymphoid populations. The majority of the chemical-induced leukemias were of the bone marrow-derived (B) lymphocyte origin, although some leukemias were of T lymphocyte origin, and some tumors could not be classified as either T or B leukemias, perhaps representing stem cells which do not carry the characteristic surface antigens for mature T and B cells.

- 2923 Beitrage zur Frage der Erholung von Strahlenschaden. (CONTRIBUTIONS TO THE QUESTION OF RECOVERY FROM RADIATION INJURIES). Bad Honnef, F.R. Germany; Osang (1975). 107p. (In German).

With figs., tabs. and refs..

This book presents the results of research work of the committees III 'radiation dose and radiation effects' and IV 'radiation damage and diseases due to radiation' of the Schutzkommission beim Bundesminister des Innern (Safety commission at the Federal Ministry of the Interior) to the interested public. The reports and papers deal with the phenomenon of the recovery of mammals after exposure to ionizing radiation. During the last few years, these problems of recovery from radiation damage have become of focal interest. This is due, above all, to our increased knowledge in the fields of radiochemistry and radiobiology. As an example various repair mechanisms have been identified in irradiated mammal cells in the last few decades. Most of the investigations carried out afterwards, some of which were made by committees III and IV of the Schutzkommission, had practical purposes. There is a hope that the effective radiation damage after a certain radiation dose can be

considerably reduced by utilizing the natural ability of animal and human cells to recover, if necessary in combination with the application of chemical radioprotective substances.

- 2924 (ERDA-tr--36/7-12, pp 1-5) BIOLOGICAL ACTION OF IONIZING RADIATION ON GONADS. VIII. THE SURVIVAL OF OOCYTES IN MICE IRRADIATED DURING FETAL DEVELOPMENT. Rudnicki, T.; Trojczuk, D. 1975. Translated from Nukleonika; 20: (1975).

Nukleonika. The irradiation of the ovaries in mice on the 17th day of their fetal development results in a gradual decrease in the number of oocytes in the extrauterine life primarily at the expense of the primitive ones. In the course of sexual maturation the process becomes stabilized at a level of 40% of controls, and the relative number of growing oocytes increases. The number of matured and maturing oocytes remains unchanged. Reproductive capacity of mice appears to be essentially unaffected despite the decreased number of oocytes observed.

- 2925 (ERDA-tr--36/1-6, pp 40-46) BIOLOGICAL ACTION OF IONIZING RADIATION ON GONADS. V. EARLY AND LATE CHANGES IN THE SEMINIFEROUS EPITHELIUM OF MICE AFTER 100-RAD FRACTIONATED IRRADIATION. Rudnicki, T.; Kochmanska-Twardowska, A. 1975. Translated from Nukleonika; 20: (1975).

Nukleonika. Maturation of the seminiferous epithelium was studied in mice x-irradiated at 50 rads on the 17th day of intrauterine life. Up to the 14th day of life, the quantitative changes in the cell populations of the sexual cords and seminiferous tubules were relatively slight. Attention was attracted, however, by the distinct late effects, noticeable when the testicle was passing into the mature state. They could be seen even on the 60th day of life.

- 2926 (ERDA-tr--36/1-6, pp 47-50) BIOLOGICAL ACTION OF IONIZING RADIATION ON GONADS. VI. MATURATION OF THE SEMINIFEROUS EPITHELIUM OF MICE AFTER IRRADIATION OF THE FETAL GONAD. Rudnicki, T.; Trojczuk, D. 1975. Translated from Nukleonika; 20: (1975).

Nukleonika. The effectiveness of fractionating exposure to ionizing radiation was analyzed quantitatively in six populations of mice spermatogonia. The effects of deranged spermatogenesis on the maturation of spermatids was studied at the same time. The total dose of 100 rads was given in 2--9 split doses during 24--96 hr. The spermatogonia populations differed in their radiobiological response. Methods of evaluating the effectiveness of fractionation were shown to be relative in character. In general, the effects of single and fractionated irradiation were found to be the same, notwithstanding some differences in the dynamics of radiation damage.

- 2927 OCCURRENCE OF CONCEALED BLOOD IN MICE FAECES FOLLOWING ABDOMINAL IRRADIATION WITH IONIZING RADIATIONS, CHEMOTHERAPY AND RADIO-CHEMOTHERAPY. Hilmer, W. Giessen, Germany; Giessen University (1975). 57p. (In German).

Thesis.

In a model experiment using the Heglostix-Ames test shpe method, concealed blood could be detected in the feces of mice after an abdominal partial irradiation with differing penetrating doses of 100 R - 1,100 R or after

i.m. injections of 120 and 90 mg/kg Endoxan or 110 and 840 mg/kg Proresid. The beginning of positive reactions and their duration were proved to depend on the dose. Untreated controls always showed negative reactions, even if the experimental animals were not kept and fed without iron. Cumulative effects could be made up in simultaneous as well as alternating radio-chemotherapy. It would be useful to try the Heglostix method for the early diagnosis of radiogenic or chemogenic haemorrhagic enterocolitides in clinical practice.

- 2928 INVESTIGATIONS ON THE QUESTION OF RADIATION-INDUCED INTRACELLULAR ION TRANSLOCATIONS IN THE LIVER OF RATS. Wenning, J. Bonn; Bonn Univ. (1975). 93p. (In German). INIS.

Thesis.

Radiation-induced ion translocations in cellular and/or subcellular units can be detected in the course of the examination of whole organs. The present paper attempts to study this problem in the liver of rats. The size and ion composition of the extracellular space and its subunits (interstice, intravascular space, biliary discharge system) must therefore be known in order to obtain purely cellular electrolyte values. They can be determined with the aid of dilution methods and by applying Donnan's law. For measuring radiation-induced ion translocations in nuclei and mitochondria, they must be isolated in an aqueous phase. Processing in 0.25 mol l⁻¹ saccharose yields the best results with regard to ion losses, since the vitality of the membranes is largely preserved when using this method. During suspension, some of the nuclei and mitochondria obtained in saccharose solution show considerable ion translocations, depending on the composition of the medium. Irradiation up to 10 kR showed that relatively low doses (100 R) already cause further changes of the electrolyte concentrations of nuclei and mitochondria. In-vivo irradiation of the liver also caused definite potassium-sodium translocations in the nucleus and the mitochondria at doses as low as 100 R. These intracellular electrolyte translocations cannot be detected in examinations of the whole organ. All in all, it is shown that intracellular ion translocations can be found at relatively low radiation doses already. The present paper discusses the possible methods by which they can be detected.

- 2929 (AD-A--028273) PROBLEMS OF POSTRADIAL RECOVERY. Akoev, I.G. 1975. Translation of unidentified Russian language article, 368p, 1970. (USAMIIA-K--0424). 307p. NTIS \$9.75.

The monograph is devoted to the restoration of the organism following the effects of ionizing radiation. The fundamental quantitative laws have been determined for the restorative processes for various conditions of radiation effect. Relationships have been established for the first time determining the rate of restoration of dosages and power of radiation dosages, fractioning, and repetitiveness of radiation. The evolution of radiation damage by time, detected by the method of double irradiation and other methods, is reviewed as associated with clinical and pathophysiological aspects of the problem. Factors are reviewed which define the clinical 'manifestation' of radiation aftereffects. The effects of means of chemical prophylaxis and hormonal preparations are clarified. Elements of compatibility and divergence are described in the processes of damage development and restoration in various biological types. (GRA)

- 2930 EFFECTIVENESS OF ANCESTRAL IRRADIATION IN THE DIRECT AND CORRELATED RESPONSES TO SELECTION FOR BODY WEIGHT IN RATS. Gianola, D. Madison, WI; Univ. of Wisconsin (1975). 102p. University Microfilms Order No. 76-6865.

Thesis (Ph. D.).

The effects of ancestral irradiation of rat spermatogonia (a cumulative total of 4050 r of x-rays) were studied in a highly inbred line of rats to explore the feasibility of using irradiation to enhance the effectiveness of selection. Six generations after irradiation was terminated, a selection experiment for body weight at six weeks of age was started in both ancestrally irradiated and non-irradiated populations. There were two non-contemporaneous replicates in each of the populations. Within each of the ancestral treatment-replicate combinations one line was selected for high, one for low body weight at six weeks of age, and a third line was maintained by random selection. In each line, avoidance of mating of animals with grandparents in common was attempted. Data on the first ten progeny generations of selection were included in this study. Five types of covariances among relatives were used to estimate causal components of variance for five different genetic models within the "non-irradiated" and "irradiated" randomly selected models. The parameters in the genetic models were estimated by generalized least-squares. This analysis suggested that a genetic model including direct genetic and maternal genetic effects was adequate to describe the body weights at 3, 6 and 10 weeks of age and the weight gains between these ages. Ancestral irradiation seemed to have enhanced the maternal genetic variance and the covariance between the direct genetic and the maternal genetic effects. On the basis of the above analysis, it was deduced that mass selection should have been more effective in the descendants of irradiated males than in those of the non-irradiated males as a consequence of greater phenotypic variability in their progeny and an enhancement in the regression of the genetic value on the selection criterion.

- 2931 ULTRASTRUCTURE OF RAT CEREBRAL VESSELS 4 MONTHS AFTER GAMMA IRRADIATION. Iwanowski, L.; Ostenda, M. (Medical Research Centre, Warsaw). *Neuropatol. Pol.*; 13: No. 3/4, 527-530(1975).

The purpose of this paper was to check the current opinion that one of the late postirradiation changes is early senility (Maxwell, Kruger, 1964). The postirradiation changes of the brain parenchyma are well known from the literature; therefore our investigation is limited to brain capillaries and their closest vicinity. This paper constitutes a fragment of a larger work on the role of connective tissue in the aging brain. Six Wistar male rats of the same brood, about 3 months old, were irradiated over the whole body with gamma rays. Three rats were exposed to a dose of 400 R and three to 800 R. The chosen doses were the lowest and the highest, provoking brain edema but still not lethal. Four months after the exposure the rats were perfused with 4% glutaraldehyde intracardially and decapitated. Brain specimens were taken from frontoparietal cortex, lateral ventricle wall, from corpus callosum and griseum pontis. The samples were routinely handled for ultrastructural studies. Observations were performed under electron microscopes showed that the cerebral vessels of both groups of animals were similar.

- 2932 INTERACTION OF X-RADIATION, DIETARY FAT, AND α -TOCOPHEROL ON TISSUE LIPID PEROXIDATION IN RAT. Abu-Irmeileh, N.M. Madison, WI; Univ. of Wisconsin (1975). 249p. University Microfilms Order No. 76-8187.

Thesis (Ph. D.).

The influence of multiple sub-lethal doses of x-radiation, dietary fat, and α -tocopherol supplementation on lipid peroxidation in various rat tissues was investigated. Following x-radiation, both heart and lung tissues had elevated lipid peroxidation levels. A further increase was obtained when the rats were pre-fed diets high in polyunsaturated fats. In contrast, the level in hepatic tissue did not change dramatically. Administration of α -tocopherol decreased lipid peroxidation level in both the heart and the lung following their exposure to ionizing irradiation. It is significant that the level of lipid peroxidation in lungs of control animals maintained under standard U.W. Medical School Animal Care conditions was markedly reduced following α -tocopherol administration. In addition, the level of lipid peroxidation in the hearts of these animals was reduced but to a lesser degree.

- 2933 ULTRASTRUCTURAL CHANGES IN RABBITS LIVER AFTER IRRADIATION. Cieciura, L.; Bartel, H.; Orkisz, S. (Military Medical Academy, Lodz, Poland). *Ann. Med. Sect. Pol. Acad. Sci.*; 20: No. 2, 67-73(1975).

Ultrastructural changes in hepatocytes observed 1 to 30 days after irradiation are presented. The dose absorbed was 550 rad (LD 33/30). Electron microscopy studies showed that early and more distinct changes were observed in mitochondria within 24 hours. Disintegration of endoplasmic reticulum and vacuolization of cytoplasm were seen on the 3rd day after irradiation. From the 9th day, the ultrastructural picture of hepatocytes became normal. In the liver in this period the increase in number of large hypertrophic macrophages was noted.

- 2934 (ANL--76-99, pp 95-107) EXPERIMENTAL RADIATION PATHOLOGY AND ONCOLOGY. Finkel, M.P. 1975.

Division of Biological and Medical Research annual report, 1975.

The program goal is to provide basic data for evaluating the hazard to man from radioactive materials deposited within the body. The original objective, to obtain dose-response information and to provide data from several species for extrapolating animal data to man, is receiving less attention at present as effort is being put into determining how radiation causes bone cancer and whether viruses play a role. The program began with the very early radiotoxicologic investigations of materials important in the development of the atomic bomb and the necessity to establish maximum permissible levels of exposure to these materials. With the demonstration that bone cancer is the most sensitive indicator of damage from transuranic elements and some of the fission products, bone pathology became the focus of attention. When it became evident that questions of human hazard cannot be answered unequivocally on the basis of dose-response relationships, different approaches were considered, and one based on knowledge of mechanisms of cancer induction seemed most likely to be successful. The detection of viruses in both radiation-induced and spontaneous bone cancer of mice, and the present evidence for a similar virus in bone

cancer of man, support the hypothesis that radiation causes cancer by activating endogenous neoplastic information, which can also be expressed as oncornavirus. Present emphases therefore concern understanding the biological, biochemical, and physical attributes of the five murine oncornaviruses that have now been isolated in the course of the program; demonstrating the existence of a comparable human oncornavirus; and discovering how radiation and virus interact in the induction of bone cancer.

- 2935 (DHEW/FDA--76-8026, pp 110-113) SOIL DENSITY METER INCIDENT. Dolezal, A. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

As packages were being transferred from one plane to another at a metropolitan airport, an instrument fell from a package and was picked up by a cargo handler. The instrument was a soil density meter containing a $^{137}\text{Cs}/^{241}\text{Am}/\text{Be}$ source. Monitoring of the package and hands of the cargo handler revealed very little contamination. Photographs of the incident were taken by a television crew and a news report contained several inaccuracies and misinterpretations. (HLW)

- 2936 (DHEW/FDA--76-8026, pp 114-116) COBALT INCIDENT. Fisher, E. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

A hot cell operator entered a hot cell containing an exposed ^{60}Co source of 120,000 curies. The source had been irradiating 30-gallon drums of teflon for 12 hrs. The monitoring system of the facility is described in detail. The cell operator was using a 50,000 curie source in addition to the 120,000 curie source. As he entered cell No. 2 he saw either the primary source or certain physical barriers that normally are not seen. As he exited he saw that two alarms had been tripped. The exposure was estimated to be 40 R per second for 6 seconds. He was admitted to the hospital and the whole body dose was estimated to be 400 rad based on chromosomal aberration studies. Various aspects of the incident are discussed. (HLW)

- 2937 (DHEW/FDA--76-8026, pp 120-127) REGULATION OF RADIOACTIVE DRUGS. Halperin, J.A. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

The following topics are discussed with regard to activities of the Bureau of Drugs: the final order of the regulation on radioactive drugs and biologics; the nuclear pharmacy issue; the interrelationships between the Bureau of Drugs and the Bureau of Biologics on the control of radiobiologics; the January 1975 meeting between representatives of the Bureau and the Task Force on Radiopharmaceuticals of the Conference of Radiation Control Program Directors; activities with specific products; and a description of the Bureau's actions with regard to the NCRP report on thyroid blocking. (HLW)

- 2938 (DHEW/FDA--76-8026, pp 166-169) NATURAL RADIOACTIVITY IN THE ENVIRONMENT: THE FLORIDA PHOSPHATE STUDY. Clark, U. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: effects of phosphate mining on public health and the environment; concentrations of uranium and daughter products in phosphate ore; investigations of phosphate mining areas by the Florida Division of Health; development of an instrument for aerial survey of background radiation; evaluation of drinking water supplies; and use of waste products from mining operations for construction material. (HLW)

- 2939 (DHEW/FDA--76-8026, pp 174-179) RADIOACTIVITY STANDARDS FOR THE SAFE DRINKING WATER ACT OF 1974. Ellett, W.H. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

Some topics discussed are: maximum contaminant levels and monitoring requirements of the EPA; technical considerations on which proposed regulations are based; detection limits for ^3H , ^{89}Sr , ^{90}Sr , ^{131}I , ^{134}Cs , and gross beta; limitations of monitoring to systems distributing surface water to more than 100,000 persons and systems downstream from nuclear facilities; ratio of allowed limits for ^{226}Ra and ^{228}Ra in drinking water; Ra dose to bone surfaces based on chronic ingestion of ^{226}Ra and ^{228}Ra ; application of radiation risk estimates to the case of radium ingestion; and comparison of task force report and EPA estimates of estimated total risk from radium. (HLW)

- 2940 (INIS-mf--3141, pp 175-176) ESTIMATED PRODUCTION OF HUMAN LUNG CANCERS BY PLUTONIUM FROM WORLDWIDE FALLOUT. Gofman, J.W. (California Univ., Berkely (USA). Div. of Medical Physics). 1975.

From Symposium on key questions about the fast breeder reactor; Delft, Netherlands (27 Nov 1975).

Published in summary form only; published in full as CNR-1975-2.

Symposium on key questions about the fast breeder reactor.

CARCINOGENS; CARCINOMAS; GLOBAL FALLOUT; INHALATION; LUNGS; MORTALITY; NUCLEAR EXPLOSIONS; NUCLEAR INDUSTRY; PLUTONIUM 239; BIOLOGICAL RADIATION EFFECTS

- 2941 (INIS-mf--3141, pp 172-174) CANCER HAZARD FROM INHALED PLUTONIUM. Gofman, J.W. (California Univ., Berkely (USA). Div. of Medical Physics). 1975.

From Symposium on key questions about the fast breeder reactor; Delft, Netherlands (27 Nov 1975).

Published in summary form only; published in full as CNR-1975-1-R.

Symposium on key questions about the fast breeder reactor.

CARCINOGENS; CARCINOMAS; DUSTS; ICRP; INHALATION; LUNGS; PLUTONIUM 239; RADIOSENSITIZERS; TOBACCO SMOKE; BIOLOGICAL RADIATION EFFECTS

- 2942 (INIS-mf--3141, pp 115-127) RISKS OF PLUTONIUM INHALATION. Jelsma, J. (Rijksuniversiteit Groningen (Netherlands)). 1975. (In Dutch).

From Symposium on key questions about the fast breeder reactor; Delft, Netherlands (27 Nov 1975).

34 figs..

Symposium on key questions about the fast breeder reactor.

Risks for inhalation of plutonium aerosols are reviewed with criticizing the maximum permissible lung burden (MPLB) for plutonium. The existing risk model assumes a uniform dose distribution neglecting the possibility that aerosols will cause radiation injuries and lung cancer forming hot spots in the lung epithelium (hot particle hypothesis). The conclusion is that the MPLB has to be lowered by a factor of at least 2000 if this hypothesis is true and that the construction of plutonium based breeder reactors is premature and not advisable until more knowledge is gained in this matter. Finally, with the hot particle hypothesis as an example, an analysis is given of the irrational way these matters are sometimes discussed. A plea is given for a more relevant discussion.

- 2943 RADIATION ABSORBED DOSE FROM MEDICALLY ADMINISTERED RADIOPHARMACEUTICALS. Roedler, H.D.; Kaul, A. (Freie Univ., Berlin). pp 655-665 of Biomedical dosimetry. Vienna; International Atomic Energy Agency (1975).

From International symposium on advances in biomedical dosimetry; Vienna, Austria (10 Mar 1975).

See STI/PUB--401; CONF-750331--.

The increasing use of radiopharmaceuticals for medical examinations implies an increased genetic and somatic radiation exposure of the population in general. Determination of radiation exposure requires a knowledge of the radiation dose absorbed by each organ. Survey of the literature revealed widely different dose values for the same defined examination methods and radiopharmaceuticals. The authors recalculated some of the dose values published for radiopharmaceuticals used in patients by applying biokinetic data obtained from exponential models of usable metabolism data reported in the literature. The calculation of organ dose values was done according to the concept of absorbed fractions in its extended form. For all radiopharmaceuticals used in nuclear medicine the energy dose values for the most important organs (ovaries, testicles, liver, lungs, spleen, kidneys, skeleton, total body or residual body) were recalculated and tabulated for the gonads, skeleton and critical or examined organs respectively. (auth)

- 2944 DOSIMETRY AND RADIATION PROTECTION PROBLEMS OF USING RADIONUCLIDES FOR DIAGNOSTIC PURPOSES. Conte, L.; Mombelli, L. (Univ., Milan). pp 667-681 of Biomedical dosimetry. Vienna; International Atomic Energy Agency (1975). (In Italian)

From International symposium on advances in biomedical dosimetry; Vienna, Austria (10 Mar 1975).

See STI/PUB--401; CONF-750331--.

An evaluation of the overall risk to which the use of radionuclides in medical diagnosis exposes patients and the population as a whole is presented. The whole-body doses, the accumulating-organ doses, the mean bone marrow dose, and the genetically significant dose due to the use of radionuclides in medical examinations during 1972 in the province of Varese, Italy, were determined. Analysis of the results showed that the risk of cancer due to whole-body irradiation is virtually negligible. The genetic risk and the risk of leukemia associated with irradiation of the gonads and of the bone marrow are small relative to the risks associated with the use of x rays for

diagnostic purposes. On the other hand, the risk due to the irradiation of accumulating organs must be examined closely. In particular, the risk associated with irradiation of the thyroid does not appear to be negligible; an appreciable increase in the probability of thyroid cancer may result from such irradiation. On the basis of the authors' findings it is possible to give advice designed to reduce the risks mentioned and to avoid those which are avoidable at all. (auth)

- 2945 RADIATION DOSE PATTERNS FOR INHALED RADIONUCLIDES. Snipes, M.B.; Hulbert, A.J.; Runkle, G.E. (Inhalation Toxicology Research Inst., Albuquerque, NM). pp 683-694 of Biomedical dosimetry. Vienna; International Atomic Energy Agency (1975).

From International symposium on advances in biomedical dosimetry; Vienna, Austria (10 Mar 1975).

See STI/PUB--401; CONF-750331--.

This experimental work was designed to examine two major assumptions used in lung dosimetry for relatively insoluble lung burdens of energetic β - γ emitters. The first assumption is that inhaled radioactive particles are deposited uniformly in the lung and remain uniformly dispersed with time after exposure; the second is that the resulting absorbed radiation dose pattern is uniformly distributed throughout the lung mass. These assumptions have important implications in experimental animal studies and in the use of radioactive lung burdens in medical diagnosis of pulmonary disease or injury. For instance, it is of interest to know the degree of uniformity of the lung dose resulting from use of ^{131}I human serum albumin macroaggregates in nuclear medicine. Two experiments are concurrently in progress to examine these assumptions. In both experiments, Beagle dogs were exposed once by inhalation (nose-only) to achieve lung burdens of heat-treated aluminosilicate particles labelled with either ^{90}Sr - ^{90}Y or ^{147}Pm . The ^{90}Sr - ^{90}Y was chosen as representative of relatively energetic β - γ emitters, the ^{147}Pm was chosen for its slight penetrating ability. At prescribed times after exposure, the dogs were sacrificed and frozen, their thoraxes removed and encased in a block of polyurethane foam and sliced at approximately equal to 1 cm intervals. Photography, autoradiography, and computer techniques were combined to study the radiation dose to specific locations in the dog's thorax. Preliminary results from the ^{90}Sr - ^{90}Y experiment yielded a range of 3 to 4 for the ratio (observed absorbed dose)/(average thorax dose), indicating a wide range of absorbed dose levels throughout the Beagle thorax. Subsequent data analysis will yield retention patterns and absorbed dose patterns for individual lung lobes and other tissues of interest in the Beagle thorax as a function of time after exposure to these particulate lung burdens. (auth)

- 2946 (ERDA-tr--99, pp 76-81) STATE OF CERTAIN DIVISIONS OF THE DIGESTIVE TRACT OF RATS IN THE CASE OF CHRONIC INTAKE OF STRONTIUM-90. Boitsova, V.P.; Goloshchapov, P.V.; Soroka, L.P. 1975. Translated from Radiobiologiya; 15: No. 3, 389-393(1975).

Radiobiology. Chronic intake of strontium-90 into the rat organism with the feed causes distinct structural disorders in the wall of the small intestine. In this case the intestinal autoflora is sharply increased, there is a retrograde separation of it, and there is a change in the species composition. In the lower regions of the gastrointestinal tract, enterococci, *Bacillus pyocyaneus* and *B.*

perfringens predominated. Bacteriemia did not develop; symptoms indicating the presence of toxemia were present. (tr-auth)

- 2947 SAFE USE OF RADIOACTIVE TRACERS IN INDUSTRIAL PROCESSES. Vienna; International Atomic Energy Agency (1975). 54p. Sch. 48.00.

The principal objectives of this guide, sponsored jointly by the IAEA and WHO, are to identify the safety considerations in industrial radiotracing, to provide guidance to competent authorities in converting ICRP recommendations into appropriate policies and regulations applicable to radiotracing, to assist competent authorities in implementing an appropriate program for control of industrial radiotracing, and to provide users with guidance in the planning and safe implementation of radiotracer investigations. Contents: basic radiation safety considerations; determination of radiation dose; role of competent authority; planning and design; operational procedures. Examples of tracer applications are appended (measurement of flow rates of liquids, steam, gases; measurement of dispersion of industrial effluent in a river; measurement of mixing in a large tank; ventilation studies; continuous measurement of lining wear in a steel furnace; investigation of wood-chip transport in a continuous digester).

- 2948 TOXICITY OF PLUTONIUM. London; H.M. Stationery Office (1975). 38p. pounds0.45.

The following aspects of the report of the British Medical Research Council Committee on Protection against ionizing radiations on the present knowledge of the potential hazards to man of plutonium and its compounds are examined: radiological protection standards; recommendations relating specifically to plutonium; and acceptability of the basic radiation standards. It is concluded that the standards in general fulfil the intentions of the International Commission on Radiological Protection although small adjustments may be needed. The principal criticisms concern the current methods of estimating values for acceptable limits of exposure to plutonium-239. The technical considerations relating to the critical tissues and the dosimetry of plutonium are outlined in an appendix.

- 2949 EFFECTS OF TRITIUM ON THE HUMAN ORGANISM. Feinendegen, L.E.

(Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Medizin). J. Belge Radiol.; 58: No. 2, 147-155(1975).

The radiation and transmutation effects of tritium are studied on the basis of documents found in the literature. Only few examples can be cited indicating the effect of tritiated water and tritiated thymidine in mammals. Direct extrapolation from such data to the human being are not permissible. Radiation effects from incorporated tritiated water, are comparable to those caused by an equivalent dose from external X radiation. Conventional dosimetry is not applicable in the case of heterogeneous distribution of tritium within living organisms. Late effects and dose calculations are discussed based on the critical cell concept.

- 2950 PREDICTED RADIATION EXPOSURE OF THE POPULATION OF THE EUROPEAN COMMUNITY RESULTING FROM DISCHARGES OF KRYPTON-85, TRITIUM, CARBON-14, AND IODINE-129 FROM THE NUCLEAR POWER INDUSTRY TO THE YEAR 2000. Kelly, G.N.;

Jones, J.A.; Bryant, P.M.; Morley, F. Luxembourg; Commission of the European Communities (1975). 108p.

The exposure of the population of the European Community from the predicted discharges of krypton-85, tritium, carbon-14 and iodine-129 from the Community and world nuclear power programs up to the year 2000 is assessed. These nuclides, owing to their relatively long half-lives and their widespread dispersion, accumulate in the environment and represent long term sources of irradiation to essentially the whole of the world population. Consideration is given to the exposure of individuals and the Community population as a whole from each of the four nuclides; the relative significance of each nuclide in this context is evaluated. The levels of exposure are compared with ICRP recommended dose limits and with exposure from other sources such as natural background radiation. A comparison is also made between the natural inventories of these nuclides in the environment and those arising from discharges from the nuclear power programs. The assessment is based on the continued application, to the end of this century, of current waste management practices; the implications and likelihood of the implementation of improved practices prior to the year 2000 are also discussed.

- 2951 EFFECT OF ^{137}Cs ON IMMUNOLOGICAL REACTIVITY. Shubik, V.M. (Inst. of Radiation Hygiene, Leningrad). J. Hyg., Epidemiol., Microbiol., Immunol.; 19: No. 3, 271-278(1975).

An important role of ^{137}Cs as a new ecological factor was shown by analyzing the works of 31 authors. This radioisotope may at present be detected in the organisms of all the inhabitants of this planet. The migration of ^{137}Cs along the chain lichen-deer-man leads to its accumulation in the organism of human subjects living in the Extreme North and utilizing venison in their diet. Although the high sensitivity of immunological reactions to various unfavorable environmental factors is well known, the materials on the effect of incorporated ^{137}Cs on immunity are scanty. Experiments on animals have shown changes in factors of nonspecific immunity (phagocytic reaction of blood neutrophils, bactericidal activity, lysozyme and complement titres of blood serum) and specific immunity (formation of antiviral antibodies). The blood of animals injured by the isotope displays complete and incomplete autoantibodies. A dependence between the immunobiological changes and the dose absorbed by the organism was demonstrated. The entry of ^{137}Cs into the organism of the inhabitants of the Extreme North who use venison in their diet did not, with the absorbed dose equaling up to 50 Mrem per year, lead to changes in their immunological reactivity.

- 2952 RISK OF MALIGNANCY FROM INTERNALLY-DEPOSITED RADIOISOTOPES. Rowland, R.E. (Argonne National Lab., IL). pp 146-155 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

The somatic effects of the internal emitters is considered. The shape of the dose-response function is deduced from the data itself. It is concluded that the major long-term somatic effect of radiation on man is cancer. Much of the data used in the study is taken from radium

studies.

- 53 CASE OF AN ACCIDENTAL IRRADIATION WITH IRIDIUM-192. Krushkov, I.V.; Mikhailov, M.A.; Nacheva, V.; Ivanova, M.; Serafimov, A.; Kalchev, K.T. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: No. 1, 135-138(1975). (In Bulgarian).

It is estimated that a worker operating with a 15-curie, ^{192}Ir source obtained a surface skin dose of 2000 to 3000 rads, 1200 to 2000 rads at a depth of 7 mm, 21 to 26 rads at the wrist, and 1.5 to 2 rads at the humeral joint. The patient did not seek medical aid, until on the tenth day after irradiation a dull ache, numbness of surface sensitivity and lack of mobility was noted on the first three fingers of the right hand. Damaged parts of the skin were whitish-yellow in color. The blood chemistry was at the boundary of normal: erythrocytes - 4.2 million; hemoglobin - 80 percent; leucocytes - 7600. On the 20th day necrotic zones of size 16/16 mm were noted on the first finger, of size 17/17 mm on the second finger, and of size 7/7 mm on the third finger. Skin darkening and hardening of the epithelium were noted by the 30th day. Necrosis started to decrease in the third month. Chromosomal analysis showed 18 percent structural changes in the skin cells. 13 refs.

- 2954 (ERDA-tr--110, pp 87-91) MORPHOLOGICAL CHANGES IN THE CENTRAL NERVOUS SYSTEM OF DOGS CHRONICALLY IRRADIATED AT AN EARLY AGE WITH INCORPORATED RADIOPHOSPHORUS. Chervinskaya, A.F. (Rostov State Univ., USSR). 1975. Translated from Radiobiologiya; 15: No. 4, 560-565(1975).

Radiobiology. Dogs were given ^{32}P in doses of 5, 10, and 20 $\mu\text{Ci/kg}$ with their food twice a month for a year starting with five weeks of age. It was shown that the degree and nature of the histological changes in the nerve tissue depend on the clinical state and age of the irradiated animals. Possible mechanisms of this phenomenon are discussed. (tr-auth)

- 2955 (ERDA-tr--99, pp 92-97) DEPENDENCE OF THE AVERAGE LIFETIME, MORTALITY, AND FREQUENCY OF OSTEOSARCOMAS IN RATS ON THE ABSORBED DOSE DUE TO STRONTIUM-90. Shvedov, V.L.; Pantelev, L.I. 1975. Translated from Radiobiologiya; 15: No. 3, 402-406(1975).

Radiobiology. The dependence of the mortality and frequency of development of osteosarcomas on the dose was studied on white rats that had received 0.00005 to 5.0 $\mu\text{Ci/day}$ of ^{90}Sr daily throughout their lifetime. It was shown that the general mortality in the dose range 0 to 10 krad is a more sensitive test than the frequency of osteosarcomas; moreover, osteosarcomatosis practically does not shorten the average lifetime of the irradiated rats. (tr-auth)

- 2956 SOME EFFECTS OF THE COMBINED INHALATORY ACTION OF TOBACCO SMOKE AND RADON 222 ON THE ORGANISM (EXPERIMENTAL STUDY). Ivanov, Z.; Vasiliev, G.; Dermendzhiev, Kh.; Nikolova, M.; Khadzheva, T.; Dimitrov, T. (Nauchno-Izledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 14: No. 3, 188-192(1975). (In Bulgarian).

The effect of combining radon-222 inhalation exposure with two non-radiological factors, cigarette smoke and indifferent dust, is studied in terms of lung tissue dose and histomorphology. The experiments are carried out on rat males given a 6-month treatment, 4

hours per day, 6 days of the week, with: radon-222 at a concentration of 1×10^{-9} Ci/l (Group I), cigarette smoke (Group II), amorphous dust (Group III), radon plus cigarette smoke (Group IV) or radon-222 plus cigarette smoke plus amorphous dust (Group V). After cessation of exposures, lung tissue dose D from a single 4-hour inhalation of radon and its decay was determined from activity measurements to serve as an integral criterion for entry and retention of the radioactive aerosol in the respiratory tract. For groups I and II compared to controls receiving no pretreatment, D dose by a factor of 3.3 and 2.1, respectively. For exposure to radon-222 plus cigarette smoke (Group IV, more than two-fold increase is established in D; a similar effect is observed with exposure solely to amorphous dust (Group III). The peak value for D, 12.6 Mrad, is obtained with simultaneous exposure to the three factors tested (Group V). The D data are supported by observations of histomorphological changes. The experimental results are discussed from the standpoint of the hypothesis of the importance of non-radiological factors for lung carcinogenesis in uranium miners and, on the other hand, absence of excess lung cancer incidence in personnel employed at radon spa baths.

- 2957 GENETIC EFFECTS FROM RADIOACTIVE ISOTOPES. VI. EMBRYONAL LETHALITY IN FIRST PROGENY OF MALE MICE TREATED WITH PHOSPHORUS 32 IN THE PREMEIOTIC PHASE. Baev, I.; Bajrakova, A.; Manchev, V. (Nauchno-Izledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.1, 97-100(1975). (In Bulgarian).

Sexually mature male mice of BAL B/C line were given by single intraperitoneal injection different activities (25, 50, 75, and 135 μCi) of phosphorus-32 as aqueous Na_2HPO_4 solution. Ninety days after treatment each male was coupled for four weeks with five intact sexually mature females of C57BL line. Dissection of fecundated females was made, and the pre- and post-implantation mortality was estimated together with the overall loss in the first progeny and the incidence of induced dominant lethal mutations. Phosphorus-32 displayed mutagenic effectiveness for mouse spermatogonial cells. The degree of induced genetic injury differed depending on the incorporated activity; it was not demonstrable at 25 $\mu\text{Ci/mouse}$, reached a maximum at 75 $\mu\text{Ci/mouse}$ and tended to decrease at 135 $\mu\text{Ci/mouse}$.

- 2958 GENETIC EFFECTS FROM RADIOACTIVE ISOTOPES. II. CHROMOSOMAL ANOMALIES (TRANSLOCATIONS) INDUCED BY IODINE 131 AND STRONTIUM 89 IN RATS MALE GERM CELLS. Baev, I.; Bajrakova, A.; Benova, D. (Nauchno-Izledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.1, 101-104(1975). (In Bulgarian).

Male sexually mature rats are treated intraperitoneally with a single dose of 3.5 $\mu\text{Ci/g}$ bodyweight of iodine-131 or 1.0 $\mu\text{Ci/g}$ bodyweight of strontium-89 in the form of aqueous sodium iodine, resp. strontium bichloride solution without carrier. Cytogenetic analysis is performed after six months on primordial spermatocytes in diakinesis metaphase I. The chromosomal translocations - 3/230 and 16/420 demonstrable in the gonadal cells of iodine-131, resp. strontium-89 - treated rats are a manifestation of severe damage to hereditary structures in gonadal cells of premeiotic (spermatogonial) phase.

2959 PERSISTENT CHROMOSOMAL TRANSLOCATIONS IN MICE SPERMATOGENIA AFTER INCORPORATION OF DIFFERENT PHOSPHORUS-32 ACTIVITIES.

Bajrakova, A. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.1, 93-96(1975). (In Bulgarian).

Sexually mature male mice of BAL B/C line are given by single intraperitoneal injection different activities (25, 50, 75 and 135 μ Ci) of phosphorus-32 as Na_2HPO_4 . Cytogenetic analysis is made six months later on primordial spermatocytes in diakinesis-metaphase I. It is found that phosphorus-32 induces chromosomal translocations in spermatogonia of treated animals, manifested in primordial spermatocytes as multivalents in the form of rings or chains. The yield of chromosomal translocations depending on incorporated activity may best be described by the model $Y = a + bD + cD^2$, Y being the yield of translocations per cell $\cdot 10^2$, D - incorporated phosphorus-32 per mouse in μ Ci; the coefficients 'a', 'b' and 'c' have the following values: 0.04, 0.0375 and 0.0002 respectively.

2960 A STUDY OF THE ALKALINE AND ACID PHOSPHATASE ACTIVITIES IN ACUTE URANIUM INTOXICATION.

Bokova, N.; Pavlova, V.; Stancheva, Yu.; Khadzhirusev, S.; Kiradzhiev, G. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.1, 31-35(1975). (In Bulgarian).

Comparative study of the ability of the sodium salt of diethylbarbituric acid and acetazolamide to protect the kidneys is conducted under conditions of acute uranium intoxication in rats. The parameters studied are alkaline and acid phosphatase activities in the serum and urine and phosphatase activity in the kidneys (histochemically as described by Gomori) followed up until the 30th day after the total uranyl acetate dose was reached (2 or 7 mg per kg bodyweight). Either compound exerted only minor effect on serum alkaline phosphatase activity. Sodium diethylbarbiturate induced distinct fluctuations in urinary alkaline phosphatase activity throughout the entire study period, but the differences never reached statistical significance. Acetazolamide caused essential decrease in urinary alkaline phosphatase activity. In either case renal tissue protection from the action of the uranyl ion may be suggested. This assumption is supported by the histochemical analysis. The compounds appeared to have no effect on serum acid phosphatase activity which showed high variability both in control and in treated rats.

2961 (ERDA-tr--146, pp 62-66) PROBABILISTIC DISTRIBUTION OF DOSE RATES IN THE BONE AS A FUNCTION OF THE RHYTHM OF THE STRONTIUM-90 ADMINISTRATION AND AGE OF THE ANIMALS. Rasin, I.M.; Sarapul'tsev, I.A. 1975. Translated from Radiobiologiya; 15: No. 5, 691-694(1975).

Radiobiology. The probabilistic distribution of tissue doses in the skeleton was studied in experiment on pigs and dogs. It was established that in the case of oral administration of ^{90}Sr from birth up to 90 days, the probabilistic distribution of the dose rate is characterized by one set, and in adult animals by two independent sets, each of which corresponds to a normal law; in the case of prolonged excretion, both for growing and for adult animals, the probabilistic

distribution of tissue doses in the tubular bones is characterized by two sets, and in the ribs and vertebrae by one independent set, each of which also corresponds to a normal law.

2962 LATE EFFECTS OF INHALED PLUTONIUM IN DOGS.

Park, J.F. (Battelle Pacific Northwest Labs., Richland, WA). pp 1233-1247 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

An overview is presented summarizing the effects of inhaled $^{239}\text{PuO}_2$ and $^{238}\text{PuO}_2$ in dogs with emphasis on dose-response relationships at low exposure levels. With the dose levels studied to date, pulmonary neoplasia was the primary cause of death in beagles 5 to 10 years after inhalation of $^{239}\text{PuO}_2$. None of the dogs exposed to $^{239}\text{PuO}_2$ developed bone tumors. Bone neoplasia was the primary cause of death 5 to 6 years after inhalation of $^{238}\text{PuO}_2$; however, one of the dogs had pulmonary tumors in addition to bone tumors. The earliest indication of a biological effect after the inhalation of $^{239}\text{PuO}_2$ or $^{238}\text{PuO}_2$ was dose related lymphocytopenia. (ERB)

2963 STUDY ON ALKALINE AND ACID PHOSPHATASE ACTIVITY IN ACUTE URANIUM INTOXICATION.

Bokova, N.V.; Pavlova, V.B.; Stancheva, Yu.A.; Khadzhirusev, S.B.; Kiradzhiev, G.D. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 14: No. 4, 236-240(1975). (In Bulgarian).

The protective potential of diethyl barbituric acid sodium salt is studied, in comparison with that of acetazolamide, on kidneys under acute uranium intoxication. Experiments involved rats given intraperitoneal injections with uranyl acetate on 12 successive days up to a total dose of 0.5, 2.0 or 7.0 mg/kg. The resulting effects are measured by chemical assays of serum and urine for alkaline and acid phosphatase and histochemical assays for phosphatase activities in kidneys, kinetics being followed over a 30-day period after total dose administration. Protection of kidneys from toxic uranium effects was found to be of about the same degree with sodium diethyl barbiturate as with acetazolamide.

2964 TUMORS IN SOFT TISSUES AND INTERNAL ORGANS IN NEPTUNIUM-237 INDUCED LESION.

Levdik, T.I.; Buldakov, L.A. Vopr. Onkol.; 21: No. 1, 80-87(1975). (In Russian).

RATS; INTERNAL IRRADIATION; NEPTUNIUM 237; TISSUE DISTRIBUTION; NEOPLASMS; RADIOINDUCTION; RADIONUCLIDE KINETICS; BIOLOGICAL RADIATION EFFECTS

2965 (AED-Conf--75-780-000, pp 237-239) SUPPRESSION OF RADIOIODINE INCORPORATION IN MAN.

Gloebe, B. 1975. (In German).

From Meeting of the Schutzkommission beim Bundesministerium des Innern; Erlangen, F.R. Germany (May 1975).

1 tab. Available from ZAED.

Meeting of the Schutzkommission beim Bundesministerium des Innern.

The author discusses various possibilities of reducing the building-in of incorporated radioactive iodine into organic compounds, thus also reducing the resulting radiation load. Suitable methods should involve no harm to humans. In healthy test persons, 6 mg/d of D-

tetraiodothyronine (D-T₄) reduced the iodine incorporation into the thyroid by a factor 8 without any discomfort. A possible improvement of the results by combining L- and D-T₄ will be investigated.

- 2966 (SSI--1975-004) THE PROPORTION OF CESIUM-137 IN THE CONTROL GROUP OF THE NATIONAL INSTITUTE OF RADIATION PROTECTION, IN 1974. Schnell, P.O.; Eklund, G. (Statens Strålskyddsinstitut, Stockholm (Sweden)). 1975. 7p. (In Swedish). INIS.

Measurements of the proportion of cesium-137 in a control group, consisting of about 20 persons employed by the institute, have been made since 1959. Individual factors have been determined and used in the calculation of the mean value of the Cs 137-level, since the composition of the group has not been the same on every measuring occasion. Thereby this mean value can be used to study the time variation of the Cs 137-level of the group. Since the group is not selected haphazardly the Cs 137-level cannot be regarded as representative of the Stockholm area.

- 2967 ASSESSMENT OF HUMAN SKIN DECONTAMINATION FROM RADIOACTIVE CONTAMINATION. Mikhajlov, M.G.; Vasilev, G.; Sharov, P. (Nauchno-Izledovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.2, 189-191(1975). (In Bulgarian).

A suitable and practicable means for assessing skin decontamination and percutaneous adsorption of radioactive skin contaminants is developed by comparing the streams of beta-particles and gamma-quanta characterizing the penetration and distribution of radioactive skin contaminants. The principal requirements which a preparation for human skin decontaminants should meet are: effectiveness of the preparation, minimal percutaneous absorption, broad activity spectrum on compounds and radionuclides, preservation of integrity of the treated skin and a simple method of use of the decontaminant.

- 2968 POLONIUM-210 IN HUMAN HAIR, BONES AND TEETH. Novakova, E.; Kerteva, A.; Boyadzhiev, A. (Nauchno-Izledovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.2, 201-205(1975). (In Bulgarian).

Polonium-210 concentration in hair, bones and teeth of human individuals of different age groups (1 to 10 yrs, 10 to 20 yrs and older than 20 yrs) is studied. Samples were collected in 1972 and subjected to wet combustion. Radiochemical determination of polonium-210 is performed after a method based on its spontaneous deposition on a silver plate. It is found that the content of polonium-210 in bones varies from 0.7 to 4.0 pCi/100 g fresh tissue. In hair and teeth the concentrations vary within broader limits - from 2.3 to 11.9, resp. from 6.2 to 14.0 pCi/100 g fresh tissue. These values match the ones published in the literatures. Peak mean radionuclide concentrations - 9.7 pCi/100 g fresh tissue - were found in the teeth. In all three samples the content of polonium-210 was maximal in the youngest age group, probably due to the intensive mineral metabolism in the growing organism. On the basis of the polonium-210 content the intensity of the dose incorporated in different areas of the skeleton (Havers canals, osteocytes and canaliculi) is calculated. Radiation loading was most intensive in the youngest age group.

- 2969 BLOOD AND URINARY POLONIUM 210 LEVELS IN PERSONNEL EMPLOYED AT THE NARECHEN SPA. Novakova, E.; Kerteva, A.; Boyadzhiev, A. (Nauchno-Izledovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.2, 207-210(1975). (In Bulgarian).

In an effort to study the integral contamination with radon and its degradation products of individuals employed at the Narechen Spa, the authors determined their urinary and blood concentration of polonium-210. In the 10 persons admitted to the study the radionuclide values were essentially elevated - from 0.58 to 2.12 pCi in diurnal urine samples, against 0.2 - 0.4 pCi in radon-noncontaminated persons. The degree of contamination with radon and its degradation products did not correlate with the length of service. There was close correlation between blood and urinary polonium-210 concentrations in these individuals. A regression equation for a rectilinear dependency was formulated: $Y=0.2+5.2X$, Y being polonium-210 concentration in the blood (pCi/l) and X its urinary concentration (pCi/24 hours' urine). The errors in determining the coefficients are accordingly 0.02 and 1.0.

- 2970 INTERNAL CONTAMINATION WITH STRONTIUM 90 IN MAN. Boyadzhiev, A.; Mikhajlov, M.A.; Jotov, M.; Novakova, E.; Kerveta, A. (Nauchno-Izledovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Publ., Res. Inst. Radiol. Radiat. Hyg.; 5: No. pt.2, 179-183(1975). (In Bulgarian).

A case of accidental contamination with strontium-90 is reported. The person was working with a standard containing strontium-90 in the form of $Sr(NO_3)_2$ with activity of 400 μ Ci. The integrity of the standard had been broken and about half of its content was spilled on the work place. Contamination was recognized on the third day of the accident. Urinary radionuclide excretion was determined several times over a period of 184 days. Proceeding from the data obtained, the authors were able to find the "urinary strontium-90 excretion curve" and herefrom the "unloading function" which makes feasible the determination of strontium 90 content in the body at any moment selected at random. The analysis showed that urinary strontium 90 excretion proceeds in several stages with essentially different rate. The internal irradiation dose was calculated by the exponential "unloading function", by the mixed (exponential and degree) function recommended by the International Committee for Radiation Protection and by the exponential function obtained for this very case. The dose uptaken by the bones for 50 years will amount to 3.8, 5.3 and 0.3 ber accordingly.

- 2971 (ERDA-tr--146, pp 187-190) CONTENT OF CA, ⁹⁰SR, AND ¹³⁷CS IN THE HUMAN PLACENTA. Makarova, V.P.; Piskunov, L.I.; Treiger, S.I. (Sverdlovsk Regional Sanitary-Epidemiological Station, USSR). 1975. Translated from Radiobiologiya; 15: No. 5, 778-780(1975).

Radiobiology. The content of Ca, ⁹⁰Sr, and ¹³⁷Cs was determined in placental tissues of women from a city of the northern Urals. The data were used to estimate the migration of ⁹⁰Sr and ¹³⁷Cs through the placental barrier into the fetus. The kinetics of distribution of ⁹⁰Sr, ¹³⁷Cs, Ca, and K in the placenta and fetal tissues is discussed and it is concluded that the content of ⁹⁰Sr and ¹³⁷Cs in the placenta may be used as a method of indirect

dosimetry of neonates. (HLW)

- 2972 RADIOPROTECTION STANDARDS AND DERIVED LIMITS FOR TRITIUM. Dousset, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Service de Protection Sanitaire). J. Belge Radiol.; 58: No. 2, 167-171(1975). (In French).

After reminding the fundamental standards from which the actual derived limits about tritium were determined, the author considers in view of the various studies published in the last decade, how the values of these derived limits may evolve in the future.

- 2973 CURRENT STATUS OF INFORMATION OBTAINED FROM PLUTONIUM CONTAMINATED PEOPLE. Richmond, C.R. (Los Alamos Scientific Lab., NM). pp 1248-1265 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

Data on various personnel exposed to plutonium over the last three decades is summarized. No adverse biological effects are evident from the data obtained so far. Although this does not mean that we may not see adverse effects in future cases, it is reassuring in the sense that the radiation protection standards which have been followed for many years are very probably quite adequate and do not misrepresent the potential risk by many orders of magnitude, as has been suggested. (ERB)

- 2974 TRANSURANIUM ELEMENT TOXICITY: DOSE RESPONSE RELATIONSHIPS AT LOW EXPOSURE LEVELS. SUMMARY AND SPECULATIVE INTERPRETATION RELATIVE TO EXPOSURE LIMITS. Thompson, R.C. (Battelle Pacific Northwest Labs., Richland, WA). pp 1278-1284 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

Dose-response relationships at low exposure levels for transuranium elements (particularly plutonium) are discussed. The author concludes that because of the nonuniform nature of the dose distribution in organisms, it is very difficult to establish meaningful dose limits. Our present capabilities seem to be limited to the setting of upper limits, while we are ignorant of the actual dose-effect relationship at the levels of concern. (ERB)

- 2975 STUDY OF THE EFFECTIVENESS OF MUCOLYTIC AGENTS ON THE ELIMINATION OF ¹³¹I-HSA MACROAGGREGATE. Kutas, V.; Benko, G.; Kocsar, L.; Farkas, G. (Orszagos Frederic Joliot-Curie Sugorbiologiai es Sugaregeszsegugyi Kutato Intezet, Budapest (Hungary)). Radioprotection; 10: No. 4, 223-228(1975). (In French).

The elimination of ¹³¹I-labelled human serum albumin macroaggregate used for lung scanning by inhalation of mucolytic aerosols was studied in rats. Among the mucolytic aerosols studied, N-acetyl-L-cysteine (Mucosolvin) appreciably reduced radioactivity in the lungs and in the liver following inhalation for 40 min (diameter of the particles: 3µm). The alcoholic solution of dimethyl-polysiloxane (Sicol) proved to be less effective in reducing the radioactivity of

the lungs, however, it also accelerated the elimination of the macroaggregate. No results were obtained with Tacholiquin having a detergent as active principle. The inhalation of mucolytic aerosols after scanning is an important means of reducing radiation body burden.

- 2976 INTERNAL CONTAMINATION OF A MAN WITH STRONTIUM-90. Boyadzhiev, A.; Mikhailov, M.A.; Iotov, M.; Novakova, E.; Kerteva, A. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: 179-183(1975). (In Bulgarian).

It was established that the contaminated person was working with a Sr-90 standard containing about 400 microcuries of activity. About one-half of the activity in the source was dispersed at the working site, as determined on the third day of the incident. A urine analysis on the seventh day of the incident showed high activity. The Sr-90, urine elimination was determined over a period of 184 days. The data were fitted to a three-term, exponential function. A total of 10.5 nanocuries of Sr-90 was eliminated by way of the urine with a biological half-life of 2 days; 2.7 nanocuries were eliminated by the urine with a biological half-life of 7.5 days, and 9.2 nanocuries were eliminated with a biological half-life of 155 days. The total activity of Sr-90 eliminated via the urine was 22.4 nanocuries. It is concluded that the maximum amount of Sr-90 entering the bloodstream is about 0.1 microcuries, and the probable amount absorbed perorally is about 0.3 microcuries. The dose to the bone marrow over 50 years is calculated to be 5.3 ber. 5 refs. (SJR)

- 2977 DECONTAMINATION OF RADIOACTIVELY CONTAMINATED SKIN IN VIVO. Sharov, P.; Vasilev, G.; Mikhailov, M.G. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: 185-188(1975). (In Bulgarian).

A skin-decontaminating agent was made up by heating 50 grams of a thermoplastic gel ("LAV" from an East German firm) on a water bath to a thick solution. Then 3 grams of triethanolamine and one gram of EDTA in 8 to 10 ml of distilled water were added and mixed until homogenized. Experiments with this gel were run on volunteers whose hands were contaminated with a count of 50,000 beta particles/cm².min. On using the decontaminating agent the gel hardens and forms a film which can be peeled off. About 80% of the activity (¹³¹I, ¹³⁷Cs, and ⁸⁵Sr) is removed per pass compared to 60% for two other skin decontaminating agents used in the Soviet Union and Bulgaria. 7 refs. (SJR)

- 2978 ESTIMATING THE DECONTAMINATION OF HUMAN SKIN FROM RADIOACTIVE CONTAMINATION. Mikhailov, M.G.; Vasilev, G.; Sharov, P. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: 189-191(1975). (In Bulgarian).

Skin decontamination experiments were performed on the hands of volunteers contaminated with iodine-131, strontium-89, cesium-134 and cesium-137 with exposure times of 30 to 60 minutes. The decontaminating agents used to remove the activity were a Soviet preparation "11B", a Bulgarian paste "RV-2", and a new agent "TkhG" containing a thermoplastic gel with 6% triethanolamine and 2% EDTA. The decontamination coefficient (percentage of activity removed per pass) was found to vary from 50 to 80%. The variation was ascribed mainly to differences in percutaneous resorption of activity by the skin. 2 refs. (SJR)

- 2979 POLONIUM-210 CONTENT IN THE HAIR, BONE, AND TEETH OF MAN. Novakova, E.; Kerteva, A.; Boyadzhiev, A. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: 201-205(1975). (In Bulgarian).

Po-210 was determined on samples of hair, bone and teeth taken from three age groups of 1 to 10 years, 10 to 20 years, and over-20 years. Values of Po-210 from the bone are given in picocuries per 100 grams of bone as follows: 2.74 for 1 to 10 years, 1.93 to 10 to 20 years and 1.43 for over-20 years. Values of Po-210 found in hair samples in picocuries per 100 grams of hair were: 7.8 for the 1- to 10-years group, 4.6 for the 10- to 20-years group and 5.55 for over-20-years group. The Po-210 values for the teeth in picocuries per 100 grams of teeth were: 9.75 for 1 to 10 years, 8.58 for 10 to 20 years, and 9.0 for over-20 years. The dose to the osteocytes in ber/year was calculated to be 35.5 for the 1- to 10-years group, 24.9 for the 10- to 20-years group, and 18.52 ber/year for the over-20-years group. 6 refs. (SJR)

- 2980 POLONIUM-210 IN THE URINE AND BLOOD OF THOSE WORKING AT THE NARECHENSKI MINERAL BATHS. Novakova, E.; Kerteva, A.; Boyadzhiev, A. Nauchni Tr., Nauchnoizsled. Inst. Radiobiol. Radiats. Khig.; 5: 207-210(1975). (In Bulgarian).

Urine and blood samples were taken from 10 people working at the above mineral baths, and Po-210 was determined radiometrically. The following correlation was obtained between the concentrations of Po-210 in the blood and urine: $y = 0.2 = 5.2 \text{ chi}$. Here y is the concentration of Po-210 in the blood, and chi is the concentration of Po-210 in the urine. The urine values are in picocuries per 24 hours, and the blood values are in picocuries per liter. Thus, if the Po-210 content in the urine is known, the amount of Po-210 in the blood can be calculated readily. 5 refs. (SJR)

- 2981 STRONTIUM-90 AND CESIUM-137 CONTENT IN MAN'S TEETH AND HAIR. Byrborska, D. (Khigienno-Epidemiologichen Institut, Vratsa (Bulgaria)). Letopisi Khig. Epidemiol. Inst.; 9: No. 1, 115-118(1975). (In Bulgarian).

In 1972, samples from teeth and hair were collected from the following age groups: 1-10 years of age, 10-20 years of age, over 20 years of age. The data show highest concentration of strontium 90 in children's teeth, followed by the second group (10-20 years of age) and the lowest concentration in the age group over 20 years. No reliable age related differences in the hair concentrations of strontium 90 and cesium 137 are found. The data for strontium 90 and cesium 137 content in teeth and hair are in good agreement with the literature data for other European countries.

- 2982 BIOLOGICAL HALF-LIFE OF POTASSIUM IN MAN. Rahola, T. (Helsinki Univ. (Finland). Dept. of Radiochemistry); Suomela, M. (Institute of Radiation Physics, Helsinki (Finland)). Ann. Clin. Res.; 7: No. 2, 62-65(1975).

The highly sensitive whole-body counting technique makes quantitative determinations of nanocurie amounts of gamma-emitters within the body possible. So such counters are especially suitable for the long-term measurement of tracer retention and excretion rates. In the present study, the biological half-life of body potassium in ten male volunteers was determined using ^{42}K as tracer. The group was measured

using two different types of whole-body counters. A 43-cm standard chair technique was used with counter A and a multidetector linear scanning technique with counter B. The oral tracer dose of 12-15 μCi ^{42}K to volunteers made it possible to estimate the biological half-life of potassium, which varied from 10 to 28 days, the mean being 16 days. The total body potassium determinations were carried out with the ^{42}K - and ^{40}K -methods. The results of the parallel determinations performed with Counter A agreed well with those of Counter B. A good consistency was also found in the body potassium values of individual subjects, obtained using both the methods separately for each counter.

- 2983 (ERDA-tr--151, pp 197-201) OSTEOSARCOMOGENIC EFFECT OF PLUTONIUM-239 AS A FUNCTION OF THE AGE AND SEX OF THE ANIMAL. Sinyakov, E.G. 1975. Translated from Radiobiologiya; 15: No. 6, 937-940(1975).

Radiobiology. Experiments were conducted on 520 rats of both sexes and different ages. Plutonium-239 was injected intraperitoneally and the skeleton content of ^{239}Pu was determined at intervals up to 256 days. After 200 days the bones were examined for osteosarcomas by radiography. The largest number of osteosarcomas was detected in animals that received the isotope at six months of age and the frequency of bone tumors in males of all age groups was almost twice as high as that of females. (HLW)

- 2984 METABOLISM AND BIOLOGICAL EFFECTS IN RODENTS OF PLUTONIUM AND OTHER ACTINIDE ELEMENTS. Moskalev, Yu.I.; Ldevdik, T.I.; Lyubchanskii, E.R. (Inst. of Biophysics, Moscow). pp 1214-1232 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

The metabolism and late effects of inhaled actinides in rodents is discussed. Among the topics included in the discussion are: tissue distribution of inhaled actinides; local radiation dose in lung from inhaled plutonium; late effects of deposited actinides; assessment of the late effects arising from low doses of alpha-emitters; factors that influence development of late effects; consideration of time of observation and life span; and evaluation of safe levels of deposited actinides. (ERB)

- 2985 DOSE-RESPONSE RELATIONSHIPS FOR BEAGLES INJECTED WITH $^{239}\text{Pu}(\text{IV})$ OR $^{241}\text{Am}(\text{III})$. Stover, B.J. (Univ. of North Carolina, Chapel Hill). pp 1266-1277 of Radiation research. Biomedical, chemical, and physical perspectives. Nygaard, O.F. (ed.). New York; Academic Press, Inc. (1975).

From 5. international radiation research congress meeting; Seattle, WA, USA (14 Jul 1974).

See CONF-740715--.

An experiment on the dose-response relationship for beagles injected with $^{239}\text{Pu}(\text{IV})$ is completed. The author concludes that after 24 years of research the results are inadequate to determine a radiation dose-carcinogenic response relationship. A second study is in progress. A companion study on $^{241}\text{Am}(\text{III})$ is in progress. Results are beginning to come in, but definitive results at lower doses will require about ten more years.

(ERB)

- 2986 COMPARATIVE KINETICS OF ⁴⁵CA AND ⁸⁹SR IN CHRONIC UREMIC SYNDROME IN THE RAT. Remagen, W.; Heutz, Ph.; Weidmann, D.; Schuppler, J.; Ohnacker, O. (Basel Univ. (Switzerland). Inst. fuer Pathologie); Luethy, H. (Basel Univ. (Switzerland). Inst. fuer Roentgendiagnostik und Strahlentherapie); Del Pozo, E. (Sandoz A.G., Basel (Switzerland). Abt. Experimentelle Therapie). Res. Exp. Med.; 165: No. 3, 271-284(1975).

1 tabs; 23 ref..

In rats a chronic uremic syndrome was induced by 5/6 resection and subsequent X irradiation of the kidneys. After 5 weeks ⁴⁵Ca and ⁸⁹Sr were injected simultaneously, and the different metabolic handling of the two elements was determined applying an open two-compartment model of Calcium kinetics. The uremic animals were compared with two groups of rats which were pairfed, and fed ad libitum, respectively. Besides an elevenfold faster urinary excretion when calculated with Sr, and which was reduced to about one half in the uremic rats, a significant discrimination by bone in favour of Ca was found, with a rather stable factor of 1.2 in the three groups. This is considered to evidence that urinary excretion and bone uptake of Sr are independent processes.

- 2987 ACCUMULATION AND ELIMINATION OF STRONTIUM 85 IN RATS PREVIOUSLY TREATED WITH IODINE 131. Slavov, S.; Kiradzhiev, G.; Kharzhirusev, S.; Nikolov, I. (Nauchno-Izslodovatel'ski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Acta Med. Bulg.; 3: No. 2, 27-30(1975).

Strontium 85 deposition and retention rates up to day 25 posttreatment were studied in rats previously given ¹³¹I activities (2 µCi/g body weight) disruptive to the thyroid gland. Such antecedent administration of radioiodine was found to bear on ⁸⁵Sr kinetics. The extent of this effect depends on time interval between iodine and strontium treatments. Femur strontium concentrations were higher at a 15-day interval and lower at a 45-day interval, as compared to controls receiving strontium solely. Accordingly, doses delivered to the femur were higher by a factor of 1.6 and 1.3 for administrations 5 and 15 days apart, respectively, and lower by a factor of 0.95 for the 45-day interval. The shifts in ⁸⁵Sr kinetics observed under these treatment conditions are presumably related to thyroid lesion, as indicated by a functional test (Shivachenko-Modestov) of the gland, where initial increase in hormone secretion was eventually followed by failure of thyroid function. Possible involvement of parathyroid hyperfunction is discussed.

- 2988 EFFECT OF METHYL MERCURY ON GROWTH, REPRODUCTION AND METABOLISM OF GUINEA PIGS. Hugunin, A.G. Madison, WI; Univ. of Wisconsin (1975). 248p. University Microfilms Order No. 76-6089.

Thesis (Ph. D.).

Methyl mercury hydroxide was added to a commercial guinea pig ration to determine effects of daily consumption of methyl mercury and fed ad libitum to weanling male and female guinea pigs. After 28 to 36 days, guinea pigs fed a diet containing 20 ppm mercury displayed signs of neurotoxicity. Weight losses were recorded in guinea pigs after 17 days on the 20 ppm mercury diet. Alkaline phosphatase activity of serum was less than half that detected in guinea pigs without signs of neurotoxicity.

Guinea pigs fed diets containing <0.01, 0.05, 0.29 and 1.9 ppm mercury for 188 to 190 days did not display signs of neurotoxicity. The concentrations of mercury in hair samples, determined by neutron activation, were directly related to the mercury content of the diet and were stabilized after 110 days.

- 2989 (EUR--5360(Vol.1), pp 313-331) PREDICTIVE MODELS FOR ESTIMATING THE HEALTH IMPACT OF FUTURE ENERGY SOURCES. Carnow, B.W. 1975.

From International symposium of recent advances in the assessment of the health effects of environmental pollution; Paris, France (24 Jun 1974).

Recent advances in the assessment of the health effects of environmental pollution. Vol. I.

Models for quantitating health effects on varying populations and the predictive capacity for assessing these effects have been developed. Results of a study examining visits to the emergency rooms in eighteen major hospitals in the City of Chicago during twenty-four hours on the same day of the week that was carried out for a period of eighteen months will be presented. Documentation of all admissions to the emergency rooms for cardiac, respiratory, and other diseases was maintained and levels of various air pollutants at the hospital and in the area of the residence from which the patients came to the hospital were evaluated. The study examines these relationships and their effect on the cardiopulmonary system and how these results can be used in the predictive model being developed. The model is based on the concept of a continual dose-response relationship between air pollutants and health and requires definition of various categories in the population at high risk. By quantitative definition of differences in disease at low and high pollution levels in those at high risk and determination of the total numbers of these individuals in the population, the numbers that are affected at varying levels of pollution can be ascertained.

- 2990 (EUR--5360(Vol.1), pp 181-191) DESIGNING THE EXPOSURE/RESPONSE MATRIX IN ENVIRONMENTAL HEALTH STUDIES. Knelson, J.H. (National Environmental Research Center, Research Triangle Park, NC). 1975.

From International symposium of recent advances in the assessment of the health effects of environmental pollution; Paris, France (24 Jun 1974).

Recent advances in the assessment of the health effects of environmental pollution. Vol. I.

Assessing the influence of an environmental agent on public health is a difficult multifactorial problem. However, some unifying concepts in research design are now being used to provide a better data base for emission control strategies. The Exposure/Response Matrix is essentially a three-dimensional approach to determining the relationship between environmental stress or insult, and the resulting health effect. One dimension represents pollutant concentration gradient, the second is range of susceptibility within a population and the third is the spectrum of response within population subsets of different susceptibility. This method of approaching study design and interpreted results is applicable to classic toxicology, epidemiology and clinical research. The pollutant concentration gradient, ranging from background through levels actually occurring in varying geographic areas to those levels recognized as

producing overt toxicity must be measured unambiguously and accurately for population studies and reproduced in controlled environmental laboratories for toxicologic and clinical studies. The pollutant gradient or a body pollutant burden is usually treated as the independent variable.

- 2991 (WASH--1192(Rev.)) OPERATIONAL ACCIDENTS AND RADIATION EXPOSURE EXPERIENCE WITHIN THE UNITED STATES ATOMIC ENERGY COMMISSION, 1943--1975. (USAEC Division of Operational Safety, Washington, D.C.). 1975. 150p. Dep. NTIS \$6.75.

The occupational injury and fatality experience during 32 years of the development of the atomic energy industry under the direction of the Atomic Energy Commission (AEC) and its predecessor, the Manhattan Engineering District, is reviewed. Data are included on the cause of all accidents, including fires and transportation accidents, and the cost of AEC property damage. Fatalities of AEC and contractor personnel from all causes during the 32-year period totaled 321, of which 184 occurred in construction; 121 in AEC operations such as production, research, and services; and 16 in Government functions. There were 19,225 lost-time injuries attributable to all accidental causes, or a 32-year frequency rate of 2.75 based on the number of injuries per million man-hours. There were six deaths attributable to nuclear causes, three of which were due to blast and flying missiles and three caused by whole-body radiation exposure. Forty-one workers were involved in lost-time radiation accidents, of whom 26 showed clinical manifestations attributable to radiation, resulting in permanent partial-disability of three workers and the loss of a digit by four workers, while the others did not develop evidence of radiation injury. (CH)

- 2992 (INIS-mf--1905) PIONEER 10 JOVIAN ENCOUNTER: RADIATION DOSE AND IMPLICATION FOR BIOLOGICAL LETHALITY. Miller, M.W.; Kaufman, G.E.; Maillie, H.D. (Rochester Univ., N.Y. (USA). Dept. of Radiation Biology and Biophysics). 1975. 10p. INIS.

From 18. COSPAR plenary meeting. Radiation biology; Varna, Bulgaria (29 May 1975).

Pioneer 10 in its recent Jupiter flyby passed through a belt of intense particulate radiation. The radiation dose to the outer surface of the spacecraft was at least 4.9×10^5 rad from electrons plus 2.9×10^6 rad from protons, sufficient to cause significant microbial decontamination. The radiation dose inside Pioneer 10, approximately 2.8×10^5 to 4.9×10^5 rad, was less effective for microbial decontamination but would be lethal to man and to most multicellular biological organisms. (auth)

- 2993 SHIELDING FROM X-RADIATION. Ewen, K. pp 120-141 of Fundamentals of practical radiation protection in medical X-ray installations. Ewen, K. (Gewerbeaufsicht des Landes Nordrhein-Westfalen, Duesseldorf (F.R. Germany). Zentralstelle fuer Sicherheitstechnik, Strahlenschutz und Kerntechnik); Schmitt, G. (Essen Univ. (Gesamthochschule) (F.R. Germany). Radiologisches Zentrum). Stuttgart; Enke (1975). (In German)

18 figs.; 15 tabs.; 6 refs..

Following an explanation of the physical fundamentals of the shielding diagrams, examples for shielding materials as well as measurements of the connection times of X-ray equipment are given. Furthermore, important

terms such as load equivalent, penetration factor, residence factor, dose rate constants and highest permissible local dose are dealt with. By means of application cases frequently occurring in practice, the determination of shielding is illustrated with the help of tables. Finally, X-ray protective clothing and special shielding systems are described.

- 2994 (DHEW/FDA--76-8026, pp 247-248) REPORT OF THE TASK FORCE ON GENERALLY LICENSED DEVICES. Lacker, D.K.; FitzRandolph, L.A.; Neuwig, M.; Smith, D.A.; Kerr, G.W. 1975.

From 7. annual national conference on radiation control; Hyannis, MA, USA (27 Apr 1975).

7th annual national conference on radiation control.

The Task Force was established to resolve problems associated with the proposed rule change to 10 CFR and 32 in the following areas: preregistration requirements; transfer of G. L. devices from one general licensee to another general licensee; and performance of leak testing by mailable kits. Summaries of discussions of these areas are presented. (HLW)

- 2995 (INIS-mf--3135) OCCUPATIONAL RADIATION EXPOSURE IN WORK WITH RADIOACTIVE MATERIALS. Georgiev, G.V. (Meditsinska Akademiya, Sofia (Bulgaria); Nauchno-Izledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). 1975. vp. (In Bulgarian). NTIS (US Sales Only).

Copies available from Nauchno-Izledovatelski Institut po Radiobiologiya i Radiatsionna Khigiena, Sofia 56, Bulgaria.

Radiation exposure to personnel dealing with radioactive materials is studied on a national scale. The survey covers any type of radiation work except for mining and milling of radioactive ore, fuel production, and nuclear reactor operation. Assessments are based on a decade's collection of personnel monitoring data obtained by film dosimetry techniques, as well as on data from systematic operational site monitoring. Statistical analysis indicated exposures based on personal records to follow a normal distribution pattern and, hence, arithmetic averages to be representative. Airborne concentrations of radioactive materials and aerosols in working areas are shown to follow a logarithmic normal distribution pattern, so that geometric means are representative. Radiation exposures are generally found to be well below annual maximum permissible doses for radiation workers. However, their distribution among employee groups is nonuniform. Group A, comprising about 700 subjects, received mean annual gonad doses of more than 1000 mrem; group B, about 670 subjects, had doses ranging from 100 to 500 mrem per year; and group C, 1610 subjects, received less than 100 mrem per year. Most of the radiation dose is accounted for by external radiation, which contributed 0.327 mrem to the genetically significant population dose (0.227 from exposure to males, and 0.025 mrem from exposure to females). Analysis of accidental exposures occurring over the period 1963-1973 indicated that the contribution of this source is substantial as compared to routine work (1.0: 0.3). Based on the results obtained, a number of preventive measures are developed and introduced into practice to improve radiological safety in work with radioactive materials.

- 2996 RADIATION PROTECTION IN NEUTRON THERAPY. Rossbender, W. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German

Democratic Republic)). pp 105-112 of Grundlagen der Neutronentherapie. Graffi, A. (ed.). Berlin; Akademie-Verlag (1975). (In German)

From Symposium on neutron therapy; Rossendorf, Dresden, German Democratic Republic (26 Apr 1973).

Gamma and neutron doses were measured in a neutron therapy facility considering the design of the facility, the arrangement of shields and the positions mainly occupied by patients and personnel. The radiation dose to the patient outside the useful beam and the surface dose distribution in thorax irradiation was studied with the aid of a paraffin phantom.

- 2997 (ERDA-tr--267) COMPARISON OF THE RADIATION HAZARD OF FISSION AND FISSION REACTORS. Sivintsev, Yu.V. Translated from At. Energ. (USSR); 39: No. 3, 173-176(1975). 7p. Dep. NTIS, PC A02/MF A01.

An earlier paper (Hafelc, W. and C. Starr, J. Brit. Nucl. Energy Soc., Vol. 13, No. 2, 1974, p. 131) on the hazards of fission and fusion reactors examined only the exposure of the population during emergency situations and as a result of waste removal. This paper claims a more detailed analysis than the earlier paper. More radioisotopes are considered in this study. (MDW)

- 2998 Strahlenschutzpraxis. (RADIATION PROTECTION PRACTICE). Sitzlack, G. (ed.) (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Berlin; Verlag Tribuene (1975). 416p. (In German).

Proceeding from the physical fundamentals, this manual summarizes practical aspects of radiation protection including radiation doses to man, maximum permissible levels, responsibility, training, licensing, X-ray application, handling of sealed and unsealed sources, radiation monitoring, medical surveillance, and emergency measures. Small chapters are devoted to the transport of radioactive materials, to the management of radioactive wastes and to radiation protection problems associated with the construction and operation of nuclear power plants. The appendix contains a compilation of titles of current GDR regulations and standards in radiation protection.

- 2999 (TNO-RD-I--7501-155) PRELIMINARY INVESTIGATIONS ON THE LOCAL RADIATION DOSE IN PATIENTS UNDERGOING DENTAL X-RAY EXAMINATIONS. Julius, H.W.; Stutterheim, H.J. (Gezondheidsorganisatie TNO, Arnhem (Netherlands). Radiologische Dienst). Dec 1974. 19p. (In Dutch). NTIS (US Sales Only).

15 figs..

Preliminary data are presented on the local radiation dose delivered to patients during X-ray investigation of the teeth, performed with a Philips oralix-dental X-ray tube. Measurements were carried out in a phantom using thermoluminescent dosimeters.

- 3000 SUPPORTING IMPLEMENT OF THE PEDIATRIC RADIOGRAPHY. Sakakibara, T.; Takahashi, R.; Baba, K.; Takegoshi, R. (Nihon Univ., Tokyo. School of Medicine). Shoni Geka Naika; 6: No. 12, 1117-1121(Dec 1974). (In Japanese).

The exposure to radiation must be naturally taken into consideration. Especially, the x-ray diagnosis should be carefully done in infants, because the exposure dose must be decreased. In addition, it is to be desired that x-ray

examination in infants should be done by a group who are practiced in the equipment and exposure technique, and well know the protection. From the point of dealing and protection of x-rays, it is important to use the supporting implements for x-ray diagnosis, especially in infants.

- 3001 ANALYTIC METHODS FOR BIOCHEMICAL INDICATORS OF RADIATION INJURY. Gerberg, G.B.; Decock, J.P. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Acta Radiol., Ther., Phys., Biol.; 13: No. 6, 556-571(Dec 1974).

Since the development of biochemical indicators of radiation injury has been hampered often by the lack of simple and rapid methods of determination, techniques for the measurement of 30 urinary compounds are presented. These methods have been in part taken from the literature, in part they have been modified or developed by us. They represent a compromise between speed and simplicity of execution and specificity of assay.

- 3002 RADIATION PROTECTION OF PATIENTS IN X-RAY DIAGNOSIS. FROM A RESEARCH ON ACTUAL CONDITIONS OF X-RAY DIAGNOSIS IN IWATE PREFECTURE. Yanagisawa, T. (Iwate Medical Coll., Morioka (Japan). School of Medicine). Iwate Igaku Zasshi; 26: No. 6, 640-650(Dec 1974). (In Japanese).

The author mentioned the changes of radiation hazards and the outlook of X-ray diagnosis in Iwate prefecture, and made comments on the technical factors of diagnostic X-ray exposure. Although comparatively large equipment was used, there was a tendency toward low voltage exposure for a duration of several minutes. Concern for the patient's protection has reached a national level. The technical factors of high voltage radiography, irradiation field limits, and gonadal protection were explained on the basis of reports made by the ICRP and the Investigation Committee of the Japan Medical Association. Appropriate radiographical procedures for the each factor were introduced. The author emphasized that it is important for doctors to give an X-ray examination only after making a thorough physical examination, determining the necessity for X-ray examination(Why), deciding the purpose of the examination from the previous findings(What), and selecting the test which is the most useful and has the least exposure dose for the patient(How). Hasty, aimless radiography should be avoided. It should also be kept in mind that now is the time to reduce the exposure dose, and that the first radiography decided by the first line doctor will be a significant factor.

- 3003 DOSIMETRY OF INTERNAL IRRADIATION AT THE NUCLEAR CENTERS OF CSSR. Sivintsev, Yu.V. At. Tekh. Rubezhom; No. 12, 18-27(Dec 1974). (In Russian).

Short communication only; 32 refs..

CONTAMINATION;CZECHOSLOVAKIA;DOSE LIMITS; EMANOMETERS;ENVIRONMENT;FISSION FRAGMENTS; FISSION PRODUCTS;INTERNAL IRRADIATION;IONIZING RADIATIONS;LUNGS;MAXIMUM PERMISSIBLE DOSE; MORTALITY;NEOPLASMS;NUCLEAR INDUSTRY;PERSONNEL DOSIMETRY;PROGRAMMING;RADIUM 226;RADON; STRONTIUM 90;THORIUM OXIDES;TRITIUM;URANIUM; URANIUM COMPOUNDS

- 3004 CHRONIC RADIUM INTOXICATION: CLINICAL AND AUTOPSY FINDINGS IN LONG-TERM NEW JERSEY SURVIVORS. Sharpe, W.D. Environ. Res.; 8:

No. 3, 243-383(Dec 1974).

After briefly tracing the development of investigations into radium intoxication in the 1920s, the author presents detailed clinical and autopsy findings from each of the 42 people associated with the New Jersey radium industry during the second and third decades of this century who survived their initial occupational exposure to ^{226}Ra and ^{228}Ra for 25 years or longer. Preterminal ^{226}Ra burdens are known for 31 cases. 24 of the 42 had malignant tumors or blood dyscrasias. Female, but not male, life spans were shortened and fertility possibly reduced. These and a variety of additional findings are discussed and deductions suggested. It was not possible to identify dose-response patterns and the study neither confirms nor challenges the current lifetime maximum permissible human ^{226}Ra content of 0.1 μCi . Clinical and laboratory data are presented in 52 tables in an appendix.

- 3005 ENVIRONMENTAL RADIATION AND THE LUNG. Hamrick, P.E.; Walsh, P.J. (National Inst. of Environmental Health Sciences, Research Triangle Park, NC). Environ. Health Perspect.; 9: 33-52(Dec 1974).

Environmental sources of radioactive materials and their relation to lung doses and lung burdens are described. The approaches used and the problems encountered in estimating lung doses are illustrated. Exposure to radon daughter products is contrasted to exposure to plutonium as particular examples of the hazards associated with radioactive materials of different chemical and physical characteristics.

- 3006 RADIOACTIVE DECONTAMINATION. Wadachi, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Radioisotopes (Tokyo); 23: No. 12, 723-728(Dec 1974). (In Japanese).

It discusses radioactive decontamination from the practical point of view with aim of contributions to safety control of radioisotopes. As general knowledges, contamination forms are explained from physical states of solid materials' surfaces and classification of contaminative mechanism are conducted in each contamination form. Furthermore, the decontaminants selected for each classified contaminative mechanism are indicated from pH-effect and concentration effect. Decontamination on laboratory, using wet method generally as a decontamination technic includes irrigation method by decontaminant solution and scrubbing method. Decontamination of machinery and tools includes scrubbing method and the methods using ultrasonic decontamination equipment and semiautomatic decontamination equipment of which flow-diagram is illustrated. The methods of decontamination of clothing include its disposal or the use of tightly-closed full automatic washing machine. The general irrigation method are indicated as decontamination of skin. Furthermore, neutral cleaning material method for elimination of short-term elapsed contamination and Titanium oxide paste method for elimination of long-term elapsed contamination are explained.

- 007 (NIOSH--75-117) EVALUATION AND CONTROL OF RADON DAUGHTER HAZARDS IN URANIUM MINES. Holaday, D.A. (National Inst. for Occupational Safety and Health, Rockville, Md. (USA)). Nov 1974. 64p. GPO.

This monograph discusses primarily those health hazards to uranium miners which are produced by exposure to ionizing radiation.

Emphasis is placed on the areas of evaluation of exposures to the radioactive gas radon-222 and its short-lived transformation products, and methods of controlling such exposures. A limited discussion of the biological effects of radon and radon daughters is undertaken, and some procedures are given for evaluating hazards created by other common contaminants of mine atmospheres. A large amount of information exists on these topics, some of which is unpublished or is not readily available. While efforts were made to obtain data from all sources, undoubtedly some valuable work was overlooked. The monograph is an endeavor to assemble pertinent information and make it available to those who are concerned with producing uranium at minimal risks. Where they were available, a variety of procedures for evaluating hazards are given, and examples of systems for controlling hazards are included. 154 references.

- 3008 CYTOGENETIC ANALYSIS OF BONE MARROW PROTECTION WITH MEXAMINE DEPENDENT ON DIFFERENT IRRADIATION DOSES. Voitkevich, N.D.; Palyga, G.F.; Yarmonenko, S.P. (Akademiya Meditsinskikh Nauk SSSR, Obninsk. Nauchno-Issledovatel'skij Inst. Meditsinskoi Radiologii; Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Eksperimental'noj i Klinicheskoi Onkologii). Med. Radiol.; 19: No. 11, 12-17(Nov 1974). (In Russian).

The effect of mexamine of radiation-damaged chromosomes of bone marrow cells during metaphase was studied using 82 white non-linear male mice exposed to total-body radiation in single doses of 150, 300 or 450 rad from the "Gamma-Cell-220" facility. The antiradiation effect of mexamine depending on its concentration, the radiation dose and the time elapsed after irradiation was measured.

- 3009 DEVELOPMENT OF TUMOURS IN DOGS EXPOSED TO LOW DOSES OF GAMMA RADIATION FOR A LONG TIME. Yakovleva, V.I. Kosm. Biol. Med.; 8: No. 6, 20-25(Nov 1974). (In Russian).

For English translation see the journal Environ. Space Sci..

150 animals were exposed to chronic (doses 21, 63 and 125 rad/year, with dose rates of 0.06, 0.17 and 0.34 rad/day, respectively) or combined γ -irradiation (chronic irradiation at 63 rad/year and acute irradiation at 58 and 126 rad/year) for a total period of 6 years. Post-mortem examination of 74 irradiated animals revealed malignant neoplasms in 5 (flat-cell pulmonary carcinoma, hepatocellular liver carcinoma, skin basaloma, osteogenic costal sarcoma, and eye melanoma) and benign neoplasms also in 5 (3 leiomyomas, parenchymatous thyroid struma and angiofibroma of hypodermic tissue). Of the 19 dogs in the control group, 2 had mammary tumours (cystadenoma and adenofibroma that changed to adenocarcinoma). Most of the neoplasms were seen in animals exposed to chronic irradiation with the highest dose rates as well as in those which received the highest total doses used in chronic irradiation. Acute effects were noted twice as often as chronic ones.

- 3010 (CEA-R--4604) RADIOTOXICOLOGICAL MONITORING OF PERSONS EXPOSED TO TRITIATED WATER. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1974. 13p. (In French).

The purpose of this report is to serve as a basis for standardising the procedure, interpretation and minimum frequency of toxicological and radiotoxicological examinations; reviewing the treatment of

external and internal contamination; and harmonising methods of calculating the dose received. Brief review of the physical properties of tritium and of the metabolism of tritiated water. Radiological protection standards and maximum permissible concentrations in air ($2.20 \times 10^{-6} \text{Ci/m}^3$) and in water ($3.10 \times 10^{-2} \text{Ci/m}^3$). Principles of radiotoxicological supervision, the aim of which is to determine the dose equivalents delivered by tritiated water, both for routine screening and in the event of accidental contamination; routine examination (sampling of urine every 14 days in persons subject to regular exposure, weekly in high-risk situations) and procedure in the event of an accident.

- 3011 SURVEY ON TECHNICAL FACTORS IN MEDICAL EXPOSURE. Yoshimura, S.; Watanabe, T. (Niigata Univ. (Japan). School of Medicine); Miyaji, T. Nippon Hoshasen Gijutsu Gakkai Zasshi; 30: No. 4, 353-358 (Nov 1974). (In Japanese).

The present status of technical factors for radiation dose of the patients in X-ray examination was studied in hospitals and clinics in the Niigata prefecture. The following four points are mainly treated. 1) Exposure factors in the chest and digestive organ examinations. 2) Exposure factors in roentgenography of the organs or neighboring to the gonads. 3) Difference between light and X-ray field size in usual X-ray machines. 4) Excess of radiation field size in automatic beam limiting X-ray TV machines.

- 3012 ANTI-RECEPTOR ANTIBODY AND RESISTANCE TO GRAFT-VERSUS-HOST DISEASE. McKearn, T.J.; Hamada, Y.; Stuart, F.P.; Fitch, F.W. (Univ. of Chicago). Nature (London); 251: No. 5476, 648-650 (18 Oct 1974).

Investigations were conducted to discover whether the natural resistance of adult F_1 hybrid rats to graft-versus-host (GvH) disease is associated with the production of anti-receptor antibody (ARA). ARA was found in rats not developing the disease while those rendered susceptible to the disease by irradiation did not produce ARA.

- 3013 EQUIPMENT AND A METHOD FOR MEASURING THE ADMINISTRATION OF A RADIATION. Vogel, T.M. (to Varian Associates). French Patent 2,247,736/A/. 14 Oct 1974. Priority date 12 Oct 1973, United States of America (USA). 29p. (In French).

The equipment establishes a cumulative count of the amounts of radiation emitted by the source in the direction of the patient during each of the successive equal incremental movements of the source, moving around the patient. When each of said cumulative counts reaches a pre-determined value, the source stops radiating until the beginning of the next incremental movement. The cumulative count is re-started at the very moment the source stops radiating so as to ascribe any remanent radiation to the next incremental movement. The equipment is brought to rest by various safety interconnections, in various cases of faulty operations. Means for controlling the displacement speed of the source and/or the intensity of its radiation are also provided.

- 3014 (AD-A--017201) THERMAL MODEL OF LASER-INDUCED EYE DAMAGE. FINAL REPORT, OCT 1973--SEP 1974. Takata, A.N.; Goldfinch, L.; Hinds, J.K.; Kuan, L.P.; Thomopoulos, N. (IIT Research Inst., Chicago, Ill. (USA).

Engineering Mechanics Div.). 8 Oct 1974. Contract F41609-74-C-0005. 400p. (IITRI-J-TR--74-6324). NTIS \$10.75.

This report describes the development of computerized models for predicting the temperatures and thermal damage (protein denaturation) caused by the exposure of eyes to laser beams. The extent of thermal damage or the threshold level for thermal damage may be predicted either for the cornea, lens or retina of the eye -- wherever the energy deposition is greatest. Included is a description of the models and data for predicting the thermal damage to monkey and human eyes for known laser exposures. Model predictions were found to be in reasonably good agreement with experimental results for pulse durations ranging from about 10 to the minus 7th power sec to 1000. However, major discrepancies arise with pulses less than about 10 to the minus 7th power sec. With such short pulses, the predicted temperature rises are much too small to cause thermal damage. Therefore, some other damage mechanism at present unidentified, appears responsible for the damage caused by the very short pulse. (GRA)

- 3015 (SSI--1974-030) THE NATIONAL INSTITUTE OF RADIATION PROTECTION INFORMS ABOUT RADIATION IN BUILDINGS. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Oct 1974. 53p. (In Swedish). INIS.

There is a risk of radiation from the building material 'ytong' (concrete). The radiation consists of radon, oozing out of the walls, roof and floor and of a direct radiation from the concrete. The radiation is insignificant, though, as a high concentration of radon is not possible with a ventilation of about 0.7 changes of air per hour. This ventilation is normally obtained without any specific arrangement, such as fans, as normal vents and fissures are sufficient.

- 3016 ESTIMATION OF ABSORBED DOSE IN THYROIDS AND GONADS OF SURVIVORS IN HIROSHIMA AND NAGASAKI. Hashizume, T.; Maruyama, T.; Nishizawa, K.; Nishimura, A. (National Institute of Radiological Sciences, 91-1, 4-Chome, Anagawa, Chiba (Japan). Div. of Physics). Acta Radiol., Ther., Phys., Biol.; 13: No. 5, 411-424 (Oct 1974).

Ratios of the absorbed dose in the thyroid and gonads to in-air tissue absorbed dose were determined using simulated radiation sources for the initial gamma-rays and neutrons from the atomic bombs. The absorbed dose in these critical organs of the survivors exposed to gamma-rays and neutrons from the 1945 atomic bombs in Hiroshima and Nagasaki was estimated as a function of distance from the hypocenter.

- 3017 EFFECT OF GAMMA RAYS ON THE TOTAL PROTEIN CONTENT OF ALDOLASE, GLUTAMIC ACID TRANSAMINASE AND GLUTAMIC ACID-PYRUVIC ACID TRANSAMINASE IN THE RABBIT LENS. Zygulska-Mach, H.; Mach, Z. (Akademia Medyczna, Krakow (Poland). Clinic for Eye Diseases; Akademia Medyczna, Krakow (Poland). Inst. fuer Klinische Analytik). Klin. Monatsbl. Augenheilkd.; 165: No. 4, 633-638 (Oct 1974). (In German). 3 tabs.; 19 refs..

The author subjected rabbit eyes to gamma rays using the Stallard applicators which are also employed in the treatment of intraocular tumors in human eyes. In the radiated eyes there was a reduction of activity of aldolase and GOT in the lenses which was indirectly proportional to the applied dose of ionized rays. The lens of the fellow eye which was not directly subjected to radiation showed also a

lowering of enzyme activity which was however of only a low degree. In the material examined there were no changes in total protein content. There were however slight changes in the activity of GPT. In the discussion special attention is paid to radiation damage to the fellow eyes which were not subjected to direct radiation.

- 3018 (AD-A--028735) INVESTIGATIONS CONCERNING THE PATHOGENESIS AND THERAPY OF COMBINED INJURIES. Messerschmidt, O.; Henneberg, R.; Metzger, E.; Schick, P.; Sedlmeier, H. 6 Sep 1974. Translation of Armed Forces Medical Research Report. 8 (West Germany), Munich, Feb 1974, p. 1-71. (USAMIA-K--4997). 64p. NTIS, PC A04/MF A01.

In preliminary tests, the question was investigated in how far the radiation lethality of test animals (NMRI mice) was modified not solely by open wounds but also by closed wounds (aseptic muscle necrosis), by the effects of heat and low temperatures as well as by a physical state of severe exhaustion (having forced them to swim). Although the influence of the individual types of stress being different, a trend was ascertained with combined injuries, demonstrating that the radiation lethality increased either not at all or just a little or even decreased significantly in the presence of simultaneously or prior to irradiation inflicted traumata, whereas traumata inflicted after irradiation mostly resulted in a high degree increase in radiation lethality. In subsequent tests the question concerning the causes for these changes in lethality were investigated. (GRA)

- 3019 (PB--246225) USE OF ELECTRON LINEAR ACCELERATORS IN MEDICAL RADIATION THERAPY. OVERVIEW REPORT NO. 1. PHYSICAL CHARACTERISTICS. TECHNICAL REPORT. (Safety Sciences, San Diego, Calif. (USA)). Sep 1974. Contract PHS-223-74-6211. 159p. NTIS \$6.75.

See also report no. 2, PB--246226..

The report is the first of a series of four overview reports prepared during the course of study regarding the use of electron linear accelerators in radiation therapy. The purpose of the study was to provide a data base which will assist BRH to decide whether the development of a performance standard concerning the radiation safety of medical linear accelerators is necessary, and if so, the priority which should be assigned to such a standard. The purpose of this report is to present an overview of the physical characteristics of electron linear accelerators used in medical radiation therapy. Particular attention is given to those physical characteristics and performance parameters which are related to delivery of a useful properly controlled prescription dose of radiation to the patient and to delivery of a potentially harmful dose of radiation to the patient, machine operator or others in the vicinity of the accelerator. (GRA)

- 3020 PREGNANCY AND X-RAY. Katayama, H.; Kimoto, T. (Juntendo Univ., Tokyo (Japan). School of Medicine). Juntendo Igaku; 20: No. 3, 287-292(Sep 1974). (In Japanese).

Radiation effects in the gynecologic and obstetric fields were discussed. In mammals, radiation sensitivity was high in cells which had frequent cell division, and in undifferentiated cells. The prenatal growing phase was classified in three periods, i.e. the preimplantation period, the period of organogenesis, and the fetal period, according to the effects of radiation. Radiation exposure

of the genital gland during x-ray examination was classified in three volumes ranging from 100 to 1,000 mrad, and a genetically significant dose ranged from 10 to 60 mrad. In order to maintain the exposure dose at a minimum amount, concrete warnings of the x-ray examination should be observed in addition to the three rules for radiation hazard protection i.e. short time, long distance, and protection equipment. Although, physicians need to have a deep understanding about radiation hazards, they should make an effort to let patients relax from their anxiety.

- 3021 PLUTONIUM AND THE HOT PARTICLE PROBLEM. Eto, H. (National Inst. of Radiological Sciences, Chiba (Japan)). Hoshasen Kagaku; 17: No. 9, 161-165(Sep 1974). (In Japanese).

The hot particle problem was discussed from the standpoint of carcinogenic dose. The calculation of the maximum permissible lung burden from maximum permissible dose adopted by ICRP was summarized. A model for composition of deep respiratory tissue was attempted. An estimation of cell group reaction to various radiation levels was made. Animal experiments for study of tissue injuries by local irradiation were reviewed. The method for calculation of mean carcinogenic dose of hot particle, which was designed by Tamplin--Cochran, was described.

- 3022 HISTORY AND ACTUAL STATE OF STUDY ON THOROTRAST DELAYED INJURIES. Mori, Takesaburo (Kanagawa Prefectural Junior Coll. of Nursing and Medical Technology, Yokohama (Japan)). Hoshasen Kagaku; 17: No. 9, 173-175(Sep 1974). (In Japanese).

Disorders caused by thorotrast have been paid attention recently from the aspect of the relationship of radiation delayed injuries and it will be called into question in the future. It is regarded as important as one of the basic data of ultra-uranium element disorders which induced alpha disintegration. Reports from each country such as epidemiological study, clinical and pathohistological examinations presented at the third international meeting on the toxicity of thorotrast held in April of 1973 were given an outline. Being too late in the study of thorotrast injuries in Japan as compared with that in Europe and America each country was pointed out.

- 3023 EXPOSURE DOSE IN RECENT TREATMENT OF NUCLEAR MEDICINE AND COUNTERMEASURES. Iio, M. (Tokyo Metropolitan Geriatric Medical Center (Japan)). Proc. Jpn. Conf. Radioisot.; No. 11, 283(Aug 1974). (In Japanese).

From 11. Japan conference on radioisotopes; Tokyo, Japan (13 Nov 1973).

Radioactive pharmaceuticals widely used for the diagnosis in nuclear medicine utilize radiation as tracer for dynamic behavior measurement and locality diagnosis, and the exposure due to their use has very little chance to attain the maximum permissible dose of ICRP. The MIRD (Medical Internal Radiation Dose) method tends to be adopted for the measurement of internally absorbed dose due to radio-pharmaceuticals in future. The feature of the MIRD method is that the targeted object is not a critical organ but the region of interest, and the source organ and target organ are fully taken into consideration. Recently, the exposure of patients has been significantly lowered by applying sup(99m)Tc and the like. Though the contribution to national dose is small, it is required to perform immediate conversion from the older nuclear medicine typified with conventional ¹³¹I, ¹⁹⁸Au and

^{203}Hg to modern one centering around $^{99\text{m}}\text{Tc}$. The problems in calculating the absorbed dose due to nuclear medicine diagnosis are very low accuracy of biological data though the high accuracy of data in physics has been achieved, and the difficulty to obtain data for calculating patients' absorbed dose in routine inspection.

- 3024 PLENARY SESSION OF THE COMMISSION "SCIENTIFIC FUNDAMENTALS OF MEDICAL RADIOLOGY AND ROENTGENOLOGY". Palyga, G.F. Med. Radiol.; 19: No. 8, 72-73(Aug 1974). (In Russian).

An account of reports heard at the plenum and of the draft 5-year plan of subjects and problems for 1976-1980 is presented. It is pointed out that the research into the basic problems of biological effects of ionizing radiation on different organizational levels of organism will continue in this time period. A special consideration will be given to pathogenesis, development, treatment, diagnostics and prevention of chronic radiation injuries and to remote effects of exposure to radiation. It is stressed that a thorough investigation of problems concerned with selective control of radiosensitivity of normal and tumour tissues is necessary in developing new and refining conventional methods of radiotherapy of various organ and system diseases. It is also necessary to investigate the effectiveness of radiotherapy and to develop new methods of radiotherapeutic planning and control, based on the data of clinical dosimetry.

- 3025 RADIATION DOSE DISTRIBUTION DURING TOMOGRAPHIC EXAMINATION OF VARIOUS PARTS. Hinata, H.; Kitabatake, T.; Yoshimura, S.; Ito, T. (Niigata Univ. (Japan). School of Medicine). Danso Satsueiho Kenkyukai Zasshi.; 2: No. 1, 100-101(Aug 1974). (In Japanese).

In linear, elliptical, circular and hypocycloidal tomographies of the head, chest and abdomen, the author determined skin surface dose, gonad doses, and relative dose distribution on the surface of the phantom and relative dose distribution in the longitudinal and the transverse sections of the phantom. As regards the skin surface dose in the circular tomography, geometrical maximum radiation field roughly corresponded to the 10%-dose area. With an increase in the exposure angle the 80%-dose area was reduced. The author observed no marked difference between the relative dose distribution on the longitudinal section and that of the transverse one. Radiation doses in circular or elliptical tomography were greater than those in linear tomography. The female gonad dose in the radiation beam was 1/4-1/5 of the skin surface dose. This result accorded with that of the surface dose distribution previously determined.

- 3026 RADIATION DOSE OF GONAD AND EYE RECEIVED BY TOMOGRAPHY. Tarusawa, K.; Shinozaki, T.; Jin, K.; Ishida, A.; Sugawara, K. (Hiroasaki Univ., Aomori (Japan). School of Medicine). Danso Satsueiho Kenkyukai Zasshi.; 2: No. 1, 97-99(Aug 1974). (In Japanese).

The author measured radiation dose of the chest, eye and male gonad during chest tomography. In 86 cases which underwent tomography, radiation dose, voltage, and site of the measurement were recorded in each tomography. These results were compared with those of the phantoms. The radiation doses were 550-880 mR in the chest, 2-10 mR in the eye and 1-2 mR in the male gonad. The distance between the focus and the site of the measurement was

more responsible for the variation of radiation dose than the voltage. Thus a reduction in the distance had greater effect on the dose than an increase in the voltage. Especially in the eye the radiation dose increased up to more than 10 mR at the site within 10 cm from the radiation field, and further increases up to 20 mR at the site 3 cm apart from the radiation field. From the above results, the author considers that an appropriate choice of radiation field and a diaphragm in tomography can be of much help in reducing the radiation dose.

- 3027 EXTENDED MANTLE RADIOTHERAPY IN HODGKIN'S DISEASE AND MALIGNANT LYMPHOMA. Marks, J.E.; Moran, E.M.; Griem, M.L.; Ultmann, J.E. Am. J. Roentgenol., Radium Ther. Nucl. Med.; 121: No. 4, 772-788(Aug 1974).

From 55. Annual meeting of the American Radium Society; Colorado Springs, CO, USA (22 Apr 1973).

Results from 95 cases show that patients tolerate radiotherapy to an extended mantle field, and that treatment results are satisfactory with its use. Our experience with such a field is analyzed in terms of technique, relapse, survival, morbidity, hematologic tolerance, and mortality.

- 3028 THREE AUTOPSIZED CASES OF THOROTRAST. Takeichi, S.; Akagi, G. (Tokushima Univ. (Japan). School of Medicine). Nippon Rinsho; 32: No. 8, 2728-2735(Aug 1974). (In Japanese).

Three autopsized cases of serious hepatic pathology such as tumor, fibrosis, and atrophy involved by thorotrast which was used for angiography about 30 years ago were examined, and its influence of internal irradiation was discussed in the paper. Hepatic tumor occurred in two cases; a case of hepatocellular tumor in the liver and a case of malignant hamangioma. There were fibrosis of the liver in three cases, remarkable atrophy of the spleen in case 2, and atrophy of the lymph node caused by thorotrast deposition was seen in all the cases. Remarkable increase of plasmic cell was suggestive of hyperglobulinemia.

- 3029 EFFECTS OF IONIZING RADIATIONS ON PHYTOHEMAGGLUTININS OF LEGUMINOSAE. Mancini, J.F.; Lajolo, F.M.; Vizeu, D.M. (Sao Paulo Univ. (Brazil). Faculdade de Ciencias Farmaceuticas). Cienc. Cult. (Sao Paulo); 26: No. 7, 510(Jul 1974). (In Portuguese).

From 26. annual meeting of the Brazilian society for the advancement of science; Recife, Pernambuco, Brazil (Jul 1974).

Published in summary form only.

BEANS; BIOLOGICAL RADIATION EFFECTS; BLOOD CELLS; DOSE RATES; LEGUMINOSAE; RABBITS; X RADIATION; PHYTOHEMAGGLUTININ

- 3030 LOCALIZATION ERROR IN THE RADIOTHERAPY OF HODGKIN'S DISEASE AND MALIGNANT LYMPHOMA WITH EXTENDED MANTLE FIELDS. Marks, J.E.; Haus, A.G.; Sutton, H.G.; Griem, M.L. Cancer; 34: No. 1, 83-90(Jul 1974).

From 15. Annual meeting of the American Society of Therapeutic Radiologists; New Orleans, LA, USA (24 Oct 1973).

In a review of 902 treatment verification films for 99 lymphoma patients receiving radiation therapy with extended mantle fields, 330 localization errors were detected. We found that 50 percent of the localization errors occurred in the axillae and that the axillae were the sites of most frequent clustering and recurrence. These facts suggest that

localization errors caused sufficient reduction in dose to explain the recurrence of lymphoma in the axillae of several patients. Technical modifications of the blocks in relation to the axillae are discussed. Of 10 patients with local recurrence of Hodgkin's disease or malignant lymphoma, 2 had enough documented localization errors at the site of recurrence to account for a dose reduction sufficient to explain the recurrence. For the remaining 8 cases, we lacked sufficient films to determine the incidence of localization errors and thus to make estimates of reductions in dose. We observed a reduction of localization errors from 55 percent to 29 percent over the last 2 years of the study. This gratifying result is best explained by technical refinements and by the increased use of treatment verification films. On the basis of the data gathered in this study, we feel that treatment verification films are invaluable in the detection of localization errors in the treatment of lymphoma, and that they can lead to a reduction in localization errors if they are used regularly.

- 3031 (LURI--1974-02) GAMMA RADIATION AND CONTAMINATION OF PERSONS IN THE SURROUNDING OF A NUCLEAR POWER STATION: A RESEARCH PROGRAM. Liden, K. (Lund Univ. (Sweden). Radiofysiska Institutionen). Jun 1974. 11p. (In Swedish). (CONF-740671--2). INIS.

From Meeting of Nordic Society for radiation protection; Helsinki, Finland (5 Jun 1974).

A project for environment control in the surrounding of a nuclear power station is described. The project includes gammaspectrometric field studies of natural and artificial radionuclides in the ground and in the air, studies of contamination of people in the surroundings of nuclear power stations, and a few food chains. The Swedish nuclear power station Barsebaeck is chosen as an example. The apparatus for the gammaspectrometric field measurements is described. For the activity measurements a whole-body counter is used. It is concluded that environment control of this kind is important because it can be carried out independently of the administration of the nuclear power plant.

- 3032 RECENT INCIDENCE OF LEUKEMIA IN HIROSHIMA ATOMIC BOMB SURVIVORS. Takahashi, H.; Ohkita, T.; Enzan, H. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Hirosaki Igaku; 27: No. 6, 538-544 (Jun 1974). (In Japanese).

On the recent trend of leukemia in atomic bomb survivors in Hiroshima City, the onset of leukemia in the survivors was outlined and the epidemiological survey for the incidence was described, which showed a fall in recent years. However, in comparison with the non-exposed cases, the rate is still high, indicating that the survivors are not yet clear from the risk of the onset of leukemia due to exposure. The incidence of survivors exposed at high age continues to be high, and they have chromosome aberration. Those exposed in youth showed a marked fall recently but still require a long-term, deliberate observation.

- 3033 SENSITIVITY OF MITOCHONDRIA OF THE MOUSE LIVER CELLS TO RADIATION. Shima, A. (Tokyo Univ. (Japan). Faculty of Science). Hoshasen Seibutsu Kenkyu; 9: No. 2, 92-94 (Jun 1974). (In Japanese).

In order to study the sensitivity of mitochondria (Mt) of the liver cells to radiation, 0.4 mg of riboflavine (RF) was intraperitoneally injected into mice which had

been fed RF deficient food for 13 weeks. Three hours later 400 R of X-ray (190 KVP, 25 mA, 0.5 mmCu, 0.5 mmAl filter, FSD 61.5 cm, and HVL 0.80 mmCu) were irradiated to the whole body, and giant Mt of the liver cells were observed. When the liver cells were observed 24 hours after injection, neither giant Mt nor mitotic findings of Mt were found. All Mt observed were small (1.2μ), although mice received 400 R of X-ray.

- 3034 (IEA--346) MONTE CARLO ESTIMATION OF DOSE FROM INTERNAL SOURCES OF PHOTONS IN A ANTHROPOMORPHIC MODEL OF HUMAN BODY. Snyder, W.S. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Ciencia e Tecnologia de Materiais). Jun 1974. 22p. NTIS (US Sales Only).

To estimate the dose from a source of photons within the body, attempts are made to model the body and its principal organs approximately, taking into account their sizes, shapes, compositions and densities. Monte Carlo Method is used. Using this technique it is attempted to computer represent 'histories' of photons originating in the source. At each point of interaction, the type of interaction, the energy loss in the tissue and the new direction of the photon are determined using the well established laws of physics.

- 3035 ALL-UNION SYMPOSIUM ON THEORETICAL AND PRACTICAL ASPECTS OF LOW DOSE IONIZING RADIATION EFFECTS. Kondratenko, V. Usp. Sovrem. Biol.; 77: No. 3, 464-465 (May 1974). (In Russian).

ANIMALS; BIOLOGICAL RADIATION EFFECTS; BIOMEDICAL RADIOGRAPHY; BIOSPHERE; IONIZING RADIATIONS; LOW DOSE IRRADIATION; MAN; PLANTS; POPULATIONS; RADIONUCLIDE KINETICS; RADIONUCLIDE MIGRATION

- 3036 IMMUNOLOGICAL ASPECTS OF IONIZING RADIATIONS. Brizola, I.P.; Schunke, A.; Fiori, A.M.C.; Langeloh, A.; Finkelfarb, E.; Pagnoncelli, C.C.K.; Sieczkowski, F. Cienc. Cult. (Sao Paulo); 26: No. 5, 493-498 (May 1974). (In Portuguese).

Seven groups of rabbits have been whole-body irradiated with doses ranging from 100 to 1200 rad. Both, the irradiated groups and the control one were immunized against human albumin and studied regarding the hematological reactions, phagocyte response, and antibodies presence. Hematological results showed no repercussion on the series concerning the different groups. Lethal results appeared with 1200 rad doses and necropsy showed the occurrence of generalized hemorrhage. The results have made possible to determine some parameters regarding doses and responses of rabbits related to radiation and immunization.

- 3037 (NRPB-R--19) IDENTIFICATION OF AN HOMOGENOUS CRITICAL GROUP USING STATISTICAL EXTREME-VALUE THEORY: APPLICATION TO LAVERBREAD CONSUMERS AND THE WINDSCALE EFFLUENT DISCHARGES. Beach, S. (National Radiological Protection Board, Harwell (UK)). Apr 1974. 19p. TIC.

Available from H.M. Stationery Office, price Pound0.50.

The International Commission of Radiological Protection states that a critical group should be representative of those individuals in the population expected to receive the highest dose. The appropriate dose limit should then be applied to the mean dose of this group. The edible seaweed *Porphyra* (laverbread) has been identified as the link in the critical exposure

pathway limiting discharges of controlled low-level radioactive liquid waste from Windscale. The frequency distributions of the largest values of samples of 10, 20, 30, 40 and 50 male and female, child and adult consumers of liverbread are determined from the parent distributions by Monte Carlo sampling methods. From these results the extreme-value distribution of adult males of samples of 30 is taken to be a good estimate of the critical group, from which the median consumption rate of liverbread consumed per day is 55 g. The annual collective organ dose delivered to the lower large intestine of the total liverbread consumer group is estimated to be 266 man-rem.

- 3038 (NRPB-R--22) DETERMINATION OF THE RATES OF CLEARANCE OF INSOLUBLE COMPOUNDS OF PLUTONIUM FROM THE LUNG. Watts, L. (National Radiological Protection Board, Harwell (UK)). Apr 1974. 16p. NTIS (US Sales Only).

Available from H.M. Stationery Office, price Pound0.50.

There are indications that the process of clearance of inhaled insoluble plutonium compounds from the lung may be represented by a model consisting of three exponential phases. A survey of published data on 'in vivo' and bioassay measurements made after $^{239}\text{PuO}_2$ inhalation by men and dogs has been carried out, and the half times of the three exponential phases determined as approximately 1 day, 30 days and 500 days.

- 3039 RADIATION EXPOSURE BY RADIOPHARMACEUTICALS. DEVELOPMENT OF A MATHEMATICAL DOSE CONCEPT AND RESULTS OF RECALCULATIONS OF THE ENERGY DOSE. Roedler, H.D. Freie, Germany; Freie University (13 Mar 1974). 133p. INIS.(In German).

39 refs.; with figs. and tabs. Available from ZAED.

Thesis (Ph. D.).

New dose calculations for the most important radiopharmaceuticals used in nuclear medicine are performed in connection with the increasing application of radioactive materials in medicine, and the results are compared with the magnitude of the natural radiation effect and the remaining exposure to man-made radiation, especially due to X-ray diagnostics. Following a discussion of the physical and biokinetic fundamentals of the dose calculation of incorporated radioactive materials, the three available concepts, mathematically completely differing from one another, are arranged in a uniform formalism which is characterized by the term of the absorbed fraction. The most important parameters are discussed and criteria for approximation solutions are given. A FORTRAN programme was developed for the calculations. The results include dose values for whole and remaining body as well as the most important organs including the gonads.

- 3040 HAZARDS FROM THE INDUSTRIAL USE OF RADIOACTIVE STATIC ELIMINATORS. Robertson, M.K.; Randle, M.W. Health Phys.; 26: No. 3, 245-250(Mar 1974).

It was suspected that a commercial air-ionizing device for the elimination of static electricity, employing ^{210}Po incorporated in nickel-plated ceramic microspheres, might constitute a radiation hazard to persons working in its vicinity. Tests were carried out to determine possible hazards from the release of radioactive material under conditions of industrial use. It was found that a severe hazard could arise from the accidental crushing of a microsphere, thus releasing radioactive

particles which could be readily inhaled. The administrative measures taken by the authorities in New Zealand to control this hazard are described.

- 3041 INTERNATIONAL INQUIRY CENTRE OF WHO ON EXTERNAL RADIATION. Shalmon, E. (World Health Organization, Geneva (Switzerland)). Khron. VOZ.; 28: No. 3, 166-168(Mar 1974). (In Russian).

BIOSPHERE; INFORMATION SYSTEMS; RADIATION MONITORING; RADIATION PROTECTION; WHO

- 3042 EXPERIMENTAL CEREBRAL DYSPHASIA PRODUCED BY X-RAY. CEREBROCORTICAL DYSPHASIA OF MICE DUE TO EXPOSURE TO 50 R OR 100 R IN THE EMBRYONIC STAGE. II. Kameyama, Y.; Hayashi, Y.; Hoshino, K.; Ito, Y. (Nagoya Univ. (Japan). Research Inst. of Environmental Medicine). Nagoya Daigaku Kankyo Igaku Kenkyusho Nempo; 25: 193-195(Mar 1974). (In Japanese).

One irradiation of 50 R or 100 R of X-ray was given to mouse embryos on the 10th, 13th, and 15th embryonic days. By measuring the weight of brain, the thickness of cortex, and density of cortical cells of the exposed litters 6-24 weeks after birth, the relationship between the shortage of cortical cell count and the embryonic age of exposure was examined. In the 100 R exposure group the shortage of cortical cell count was relatively pronounced in litters exposed on the 13th embryonic day. In the 50 R exposure group also, the shortage was observed in 6 week and 12 week old litters which were exposed on the 13th embryonic day. The preceding paper on histologic observations reported that the shortage of cell count was remarkable in litters exposed on the 10th embryonic day. It is to be corrected to be in litters exposed on the 13th embryonic day.

- 3043 ESTIMATED USE OF ^{131}I AT DIAGNOSTIC AND TREATMENT IN NUCL. MED. IN GB (BRAZIL). Calegario, J.U.M. (Centro de Analises Clinicas e Medicina Nuclear); Alves, R.N. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). Radiol. Bras.; 7: No. 3, 129-137(Mar 1974). (In Portuguese).

From 5. Latim-American congress on Biology and Nuclear Medicine; La Paz, Bolivia (3 Nov 1974).

The ^{131}I -radioiodine use in Guanabara area, during 1972-1973 is studied. References are made to the radiation levels delivered to thyroid, bone marrow, and gonads in a population of 27000 peoples examined by tracer techniques, 190 submitted to hyperthyroidism treatment and 50 treated for thyroid data concerning radiation induced cancer (Leukaemia and thyroid cancer). By this, it was possible to estimate the probability of tumor occurrence in that population, assuming a linear relationship between dose and effect. The conclusions are the following: there are many duties in this field at the present; the Leukaemia incidence related to the ^{131}I - radioiodine use is negligible, either in diagnostic or therapeutic modalities; the possibility of thyroid tumors induced by radiation is real, specially in hyperthyroidism treatment; the use of tracer techniques that causes lower irradiation to the patient is advisable, because we can't exclude thyroid carcinogenesis at this level.

- 3044 (CONF-730907--P1) PROCEEDINGS OF THE THIRD INTERNATIONAL CONGRESS OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION, WASHINGTON, D.C., SEPTEMBER 9--14, 1973.

VOLUME 1. (USAEC Technical Information Center, Oak Ridge, Tenn.). Feb 1974. 832p. (In several languages). NTIS \$13.60.

From 3. international congress of the International Radiation Protection Association meeting; Washington, DC, USA (9 Sep 1973).

Complete texts of 123 communications to the Congress (in the original language; the majority in English, some in Russian, French), on the following topics; radiation perspective in the U.S., radiation and man, non-ionising radiation, radiation effects on animals, radiation quantities, radioecology, reactor experience, late radiation effects, dose calculations and radiation accidents.

- 3045 (LBL--2654) PRELIMINARY EXPERIMENTS WITH HELIUM ION RADIOGRAPHY AT THE 184-INCH CYCLOTRON. Budinger, T.F.; Crowe, K.; Kanstein, L.L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Feb 1974. Contract W-7405-ENG-48. 9p. Dep. NTIS, PC A02/MF A01.

In preliminary experiments with 840-MeV helium ions and x-ray film as a detector, we have been able to assess the range sensitivity and spatial resolution for eventual patient studies wherein the range is approximately 30 g/cm². These experiments show spatial resolution of less than 2 mm is obtainable, and a sensitivity in range or mass thickness of 0.045 percent can be achieved with a total flux of 3×10^7 ions/cm² through a range of 28 g/cm². Future experiments will include use of wire chambers and single-particle trajectory detection for a comparison of the advantages of helium ions over protons for radiography of human tissues.

- 3046 RADON-222 AND ITS DAUGHTERS: A REVIEW OF INSTRUMENTATION FOR OCCUPATIONAL AND ENVIRONMENTAL MONITORING. Budnitz, R.J. Health Phys.; 26: No. 2, 145-163 (Feb 1974).

A survey is made of the techniques developed for measuring ²²²Rn and its daughters in various media, in particular for monitoring and protection in occupational and environmental situations. Individual sections are devoted to: physical characteristics of ²²²Rn and its decay chain, radiation protection guides laid down in the USA for radiological protection of the lungs in the uranium mining industry, and sources of radon and its daughter products and typical concentrations encountered in the natural environment and in occupational exposures. Measurement techniques are described: measurements of radon (gas) concentrations, measurements of working level, measurements of individual radon-daughter concentrations, and working level dosimetry.

- 3047 ASSAY OF STRONTIUM-90 IN HUMAN PERMANENT TEETH IN THE UNITED KINGDOM 1966 TO 1971. Starkey, W.E. (Inst. of Naval Medicine, Gosport, Eng.); Brooks, W.L. J. R. Nav. Med. Serv. (London); 60: No. 3, 145-148 (Win 1974).

A survey of the accumulation of ⁹⁰Sr in human teeth has been carried out by the Royal Navy. It covers the 13 years 1959 to 71 in which fallout levels rose to a peak and declined again. Correlations have been established between the uptake of ⁹⁰Sr in developing tooth and bone, related to fluctuating ratios of ⁹⁰Sr/Ca in the diet. Since mineral ratios are permanently fixed in teeth by irreversible deposition they constitute an indelible record of the levels of bone-seeking elements (including contaminants) that existed when the teeth were being laid down. Thus it becomes possible to estimate former bone ratios persisting in the teeth, no

matter how much prevailing levels of contamination may have altered in the meantime. The present study provides general parameters whereby this may be done.

- 3048 (INIS-mf--3363, pp 51-55) HEAVY METAL RISKS IN URANIUM MINERS. Nosek, J. (Zavodni Ustav Narodniho Zdravi Trineckych Zelezaren (Czechoslovakia)). 1974. (In Czech).

From 8. seminar on the methodology of determination and on the significance of trace elements in biologic material; Prague, Czechoslovakia (7 May 1974).

Proceedings of the 8th seminar on the methodology of determination and on the significance of trace elements in biologic material.

Studies are briefly reported related to the retention by erythrocytes in uranium miners of uranium and lead and to health risks thereof for the miners' organisms. Uranium in the erythrocytes was studied by activation analysis, lead was determined by polarography. It was found that as compared to controls, significantly higher retention of both heavy metals was shown by the uranium miners' erythrocytes, directly proportional to the duration of their work in the mines. The findings justify the hypothesis that the blood is gradually contaminated by the heavy metals studied. It is believed that the miners' organisms are altered by the effect of heavy metals, thus being made susceptible to other harmful effects, such as that of ionizing radiation.

- 3049 (KURRI-TR--125, pp 1-5) FALLOUT BY NUCLEAR EXPLOSION EXPERIMENT AND THE RADIOACTIVE IODINE IN ANIMAL ORGANISM. Tanaka, G. (National Inst. of Radiological Sciences, Chiba (Japan)). 1974. (In Japanese).

From Symposium on radiiodine; Kumatori, Osaka, Japan (24 Oct 1973).

Symposium on radiiodine.

Radioactive iodine (mainly ¹³¹I, ¹³²I, ¹³³I, and ¹³⁵I) was measured with fallout, cow milk, human urine, and thyroid glands (human and cattle) after the first nuclear explosion experiment in China. Analysing method was determined by placing emphasis on rapidity and perfect separation from other nuclides. The detectable limit employing this method was about several pCi. The identification of radioactive iodine was performed with a simultaneous counting type β -ray spectrometer, and ¹³¹I, ¹³²I, and ¹³³I were identified by their half lives. ¹³¹I in cow milk increased from around the 4th day after the experiment, and it had been detected for a month continuously, the maximum amount being 437 pCi/l. In thyroid glands, ¹³¹I was detected for 100 days in a milch cow, the maximum being 88, 1pCi/g, while it was somewhat low in Japanese cows and pigs. ¹³¹I in the thyroid gland of a human infant (accidentally died after 12 days) was 1.29pCi/g. ¹³¹I in human urine was 6.3pCi/l on the 7th day.

- 3050 MEASUREMENTS OF IODINE-131 IN MILK SUPPLIES. Duggleby, J.C.; Kotler, L.H.; Wilks, M.J.; Wise, K.N. pp 23-25 of Fallout over Australia from nuclear weapons tested by France in Polynesia during July and August 1973. Canberra, Australia; Aust. Govt. Publ. Serv. (1974).

As with previous series of French nuclear tests in Polynesia, a program was instituted to monitor major milk supplies for iodine-131. This program extended from 25 July to 23

October 1973, and was terminated only after there was no further possibility of iodine-131 reaching the milk supplies. The program covered the nine major population centres and effectively monitored the milk consumed by 80 per cent of the entire Australian population. The method employed for iodine-131 assay of milk supplies is described, and the final results obtained are presented.

- 3051 NUCLEAR STANDARDS IN MEDICAL USE OF RADIOISOTOPES AND INSTRUMENTS. Failla, L. (CNEN, Rome). Ig. Sanita Publica; 30: No. 11/12, 378-394 (1974). (In Italian).

A catalogue of nuclear regulations is presented which includes three synoptic tables containing radiation protection standards. The fundamental structure of the regulations is examined. A summary of regulations in medical uses includes the following: field of application; communications and authorizations; radiation protection; and control. Under the heading communications and authorizations the following activities are given: detention; use; commerce; transport; and waste. The law indicates provisions of radiation protection that can be defined technologically for the health of people in the above activities. (HLW)

- 3052 FLUORESCENT IMAGING IN PEDIATRICS.

Hendrix, R.W.; Hoffer, P.B. pp 78-84 of Pediatric nuclear medicine. James, A.E. Jr.; Wagner, H.N. Jr.; Cooke, R.E. (eds.). Philadelphia; W. B. Saunders Co. (1974).

Since 1969 we have routinely used the fluorescent thyroid scanning technique for pediatric and adult patients. Our findings in the pediatric age group are similar to those recorded earlier in adults. Numerous advantages favor the fluorescent technique over radionuclide scanning in pediatric patients. The patient receives no total body or gonadal radiation, and the thyroid receives approximately 15 millirads, as compared with multirad doses for a radionuclide scan. Specific information about iodine content of the gland is available only with the fluorescent technique. This information makes it possible to distinguish primary from secondary hypothyroidism. The image quality of the fluorescent scan appears to be about the same as that of the nuclide scan whenever both are available.

- 3053 EXTERNAL EXPOSURE BY TERRESTRIAL RADIATION IN THE OPEN AIR. Franke, T.

(Westinghouse Electric Nuclear Energy Systems Europe (WENESE), Brussels (Belgium)); Schales, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Biologie); Keil, R. pp 62-69 of Die natuerliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlitz, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)

3 figs.; 2 tabs.; 12 refs..

Based on the present measured results in the Federal Republic of Germany, the energy dose rate for the population due to terrestrial radiation was determined to be 4.4 ± 0.8 J/kg a (44 ± 8 mrd/a).

- 3054 LESIONS AND LUNG CANCERS INDUCED IN RATS BY INHALED RADON 222 AT VARIOUS EQUILIBRIUMS WITH RADON DAUGHTERS. Chameaud, J. (CEA, Razes, France); Perraud, R.; LaFuma, J.; Masse, R.; Pradel, J. pp 411-421 of Experimental lung cancer: carcinogenesis and bioassays.

Karbe, E. (ed.). New York; Springer-Verlag New York Inc. (1974).

From Symposium on experimental respiratory carcinogenesis and bioassays; Seattle, WA, USA (23 Jun 1974).

See CONF-740648--.

To investigate the dose-effect relationships, rats were exposed to several dose levels of radon at different levels of equilibrium with radon decay products, after inhalation of stable cerium hydroxide, and in combination with uranium ore dust. Lung cancers were induced with exposures ranging from 500 Working Level Months (WLM) to 14,000 WLM. Exposures of 3,000 WLM to 9,000 WLM delivered over 300 to 500 hours during a 3- to 4-month period, produced the highest incidence of tumors (50 percent). The cancers appeared from the 12th to the 24th month after the beginning of exposure. Above 14,000 WLM, the animals died due to pulmonary fibrosis by the 12th month and the cancers may not have time to develop. At the lowest dose (500 WLM), the first cancers appeared in the 24th month. They appeared earlier as the dose was increased. The lesions appeared in the following chronological order: metaplasia, adenomatous lesions, adenomas, and cancers. Exposure to stable cerium hydroxide prior to radon exposure shortened the induction time of the tumors by 2 to 3 months. Uranium ore dust appeared to have little influence on the tumorigenic process. The incidence of lesions was related to total exposure time, expressed as cumulative WLM. The different equilibrium levels of radon and radon decay products had no specific effect.

- 3055 HISTOLOGIC OBSERVATIONS ON THE PATHOGENESIS OF LUNG CANCER IN HAMSTERS FOLLOWING ADMINISTRATION OF POLONIUM-210.

Lisco, H.; Kennedy, A.R.; Little, J.B. (Harvard Medical School, Boston). pp 468-474 of Experimental lung cancer: carcinogenesis and bioassays. Karbe, E. (ed.). New York; Springer-Verlag New York Inc. (1974).

From Symposium on experimental respiratory carcinogenesis and bioassays; Seattle, WA, USA (23 Jun 1974).

See CONF-740648--.

A serial sacrifice experiment was carried out to study the site of origin and the stages in development of lung cancer in hamsters induced by polonium-210 (^{210}Po). 1 or 2 animals were sacrificed weekly during and after a course of 7 intratracheal instillations of 0.1 μCi of ^{210}Po in saline. This exposure produced a transient radiation pneumonitis of moderate severity during, and for several weeks after, the instillation period. Subsequent pathological changes included hyperplasia of bronchiolar epithelium, and focal proliferation of epithelial cells in peribronchiolar and more remote alveoli, termed epithelialization of alveoli. Hyperplastic bronchiolar epithelium frequently showed numerous Clara cells which exhibited pleomorphism of cells and nuclei, multinucleated cells, and striking changes in staining characteristics of secretory granules. Epithelialization of alveoli showed steady progression from well-circumscribed small foci to larger confluent lesions which were composed of various cell types and resembled tumors. Malignant tumors occurred in many animals surviving more than 24 weeks after the last instillation of ^{210}Po .

- 3056 INTERACTIONS BETWEEN RADIATION AND BENZO(A)PYRENE IN AN IN VITRO MODEL FOR MALIGNANT TRANSFORMATION. Terzaghi, M.; Little, J.B. (Harvard School of Public Health, Boston). pp 496-506 of Experimental lung cancer: carcinogenesis and bioassays.

Karbe, E. (ed.). New York; Springer-Verlag New York Inc. (1974).

From Symposium on experimental respiratory carcinogenesis and bioassays; Seattle, WA, USA (23 Jun 1974).

See CONF-740648--.

Malignant transformation, confirmed by reinjection of transformed cells into syngeneic mice, has been induced by both BaP and X-irradiation in a C3H mouse embryo cell line (10T-1/2). A synergistic effect was found when both agents were given sequentially; maximum synergism occurred when 15 to 20 hours elapsed between treatments. Both survival and transformation frequency per surviving cell were enhanced by maintaining cells in conditions of growth inhibition for 4 hours after radiation, suggesting that repair processes may be involved in the transformation process. Such an in vitro transformation system, particularly involving plateau phase cultures, appears to be valuable adjunct to the study of interactions between chemical carcinogens and radiation that may occur in critical cell populations in the lung.

biological properties of californium-252, its health physics aspects are reviewed in detail. Its external and internal radiation hazards can be minimised through control of radiation and contamination and proper shield design. Use of various shielding materials is evaluated. The following aspects are also discussed: (1) radiation detectors for neutrons and gamma radiation (2) personnel monitoring techniques (3) bioassay and (4) storage and transportation.

- 3057 CELLULAR TRANSFORMATION IN VITRO INDUCED BY HERPES SIMPLEX VIRUS. NOTE II. TRANSFORMATION OF HAMSTER EMBRYO CELLS. Sahnazarov, N.; Mutiu, A.; Athanasias, P.; Gruia, M.; Cajal, N.; Gologan, R. (Inst. of Virology, Bucharest). Rev. Roum. Virol.; 25: No. 4, 355-360(1974).

Golden hamster cell cultures inoculated with two autochthonous uv-irradiated herpes simplex virus strains (type 1 and 2) showed growth capacity, morphologic and antigenic modifications characteristic of in vitro cell transformation. Re-infection with various herpes virus strains of 4 transformed cell lines made evident their partial susceptibility, in most of the cases persistent infections being obtained.

- 3058 (AED-Conf--74-736-000, pp 7-30) RADIATION INJURIES AND RECOVERY. Pauly, H. 1974. (In German).

From Meeting of the Schutzkommission beim Bundesministerium des Innern; Munich, F.R. Germany (May 1974).

8 figs.; 1 tab.; with refs..

Meeting of the Schutzkommission beim Bundesministerium des Innern. Lectures.

In memory of Prof. Dr. Langendorff, a survey and a cross-section are given of the development of radiobiology during the last 40 years. The importance of radiobiology is shown using several examples. The mechanisms and effects of radiation on man, animals and plants are discussed. Effects of radiation and radiolesions are explained down to the molecular field, and their importance is discussed quantitatively with stochastic considerations. Stress is laid upon recovering from radiolesions. It is tried to explain recovery quantitatively in all its several sorts. Using all these deliberations, the author also tries to give a wide spectrum for radiation protection. These fundamental deliberations and works of Prof. Dr. Langendorff are guidelines of great importance also for radiation protection in connection with the protection of the civil population.

- 3059 (BARC/I--336) HEALTH PHYSICS ASPECTS OF ²⁵²Cf. Bhagwat, A.M. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). 1974. 27p. NTIS (US Sales Only). 23 refs., 16 figures.

After briefly describing the methods of production, radioactive, chemical and

- 3060 (CONF-741219--(Absts.)) FIRST ASIAN REGIONAL CONGRESS ON RADIATION PROTECTION, BOMBAY, INDIA, DECEMBER 15--20, 1974. PROGRAMME AND ABSTRACTS. (Indian Association for Radiation Protection, Bombay). 1974. 111p. (In French). Indian Association for Radiation Protection, Bombay.

From 1. Asian regional congress on radiation protection; Bombay, India (15 Dec 1974).

Abstracts of some 200 papers presented at this Congress are included. Subjects discussed included radiation protection, biological effects of radiation, dosimetry, radiation sources, and various other aspects of health physics. (CH)

- 3061 (CS-INIS--12) APPLICABILITY OF CHROMOSOMAL ABERRATIONS IN PERIPHERAL BLOOD LYMPHOCYTES IN DETERMINATION OF RADIATION BURDEN IN MAN. Tuscany, R.; Globocnik, E.; Sedlak, A.; Ruzickova, V.; Kotaskova, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zarení). 1974. 83p. (In Czech). Dep. NTIS (US Sales Only), PC A05/MF A01.

Available from Institut Hygieny a Epidemiologie, Centrum Hygieny Zarení, Prague, Czechoslovakia.

Chromosomal aberrations in man as a result of radiation exposure are considered and the possibility is discussed of applying the knowledge of radiation-induced aberrations as a biological indicator in the radiation protection practice. Methods of karyological examinations were tested and an analysis was made of the application of stimulated peripheral blood lymphocytes as biological indicators of radiation dose. Experience is reported gained with the karyological examinations of hair follicles as a suitable method of radiation dose assessment.

- 3062 (ERDA--76/119) SEVENTH ANNUAL REPORT OF RADIATION EXPOSURES FOR AEC AND AEC CONTRACTOR EMPLOYEES. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Safety, Standards and Compliance). 1974. vp. Dep. NTIS \$4.00.

Data are presented on the radiation exposure for the last 11 years of the Atomic Energy Commission (AEC) and its contractor employees. As time progressed, the number of personnel receiving large dose equivalents was reduced, and fewer employees were being monitored each year. Monitoring is required where the potential exists for the individual to receive a dose or dose commitment in any calendar quarter in excess of 10 percent of the quarterly standards as prescribed in AEC Manual Chapter 0524 and most of the personnel receive an undetectable dose equivalent. Prior to 1974, contractors were asked only to report the number of personnel in the 0 to 1 rem range making a total man-rem dose equivalent estimate difficult. A breakdown of the 1974 whole-body dose equivalents according to facility type is presented. This was the first year that the contractors were asked to submit data of this kind and many were unable to adjust their

reporting systems in time to fully comply. They instead reported as a group under the General Research facility type. It was intended that the General Research facility type would include only those that received their radiation exposures from a variety of sources. It is expected that subsequent reports will more truly represent the source of the radiation exposure than does this 1974 report.

- 3063 (HRP--0010759) MANUAL ON RADIATION PROTECTION IN HOSPITAL AND GENERAL PRACTICE. VOLUME 1. BASIC PROTECTION REQUIREMENTS. Braestrup, C.B.; Vikterlof, K.J. (Lenox Hill Hospital, New York (USA)). 1974. 112p. Available from Q Corp., 49 Sheridan Ave., Albany, N.Y. 12210.

See also volumes 2 and 3, HRP-0010760 and HRP-0010761..

A general review of the radiation protection requirements common to all medical applications of ionizing radiation and radionuclides is presented in the first volume of a three-part series dealing with the radiation protection of patients, occupationally exposed persons, and the public. The series is directed to national authorities, hospital administrators, supervisors, hospital workers, teachers, and others who have responsibility in the area of radiation protection. A general knowledge of radiation and biology on the part of the reader is assumed. The first volume opens with a general discussion of X-rays, electrons, radiation from radionuclides, interaction of radiation with matter, basic dosimetry, the biological effects of ionizing radiation, and risk evaluation. Principal objectives of radiation protection are identified, and data on maximum permissible levels are presented. Subsequent chapters address the following topics: (1) radiation equipment and operating procedures (diagnostic X-ray installations, X-ray beam therapy, gamma-ray installations for teletherapy, brachytherapy, unsealed sources for therapeutic use, and diagnostic use of unsealed sources); (2) planning of radiation facilities, (levels of medical care, centralization and decentralization of radiation facilities, diagnostic X-ray facilities, therapy facilities, and nuclear medicine and therapy with unsealed sources); (3) shielding design (diagnostic radiology, radiotherapy, and nuclear medicine and therapy); and (4) the organization of radiation protection (assignment of responsibilities and general duties, legal responsibilities, safety checks, and refresher courses and symposiums). The implementation of radiation surveys before, during, and after the installation of radiation equipment is described, as are elements of personnel monitoring and health supervision. A list of commonly used radionuclides and illustrations of a design for protective shielding are appended. An index is provided.

- 3064 (INIS-mf--1840, pp 101) AN ATTEMPT TO USE CONFORMATION CHANGES OF PROTEIN BLOOD PLASMA FRACTIONS OF IRRADIATED ORGANISMS AS AN INDICATOR FOR THE ABSORBED RADIATION DOSE. Paskalev, Z. 1974. (In Bulgarian).

From National conference "Physics-Manufacture"; Kazanlyk, Bulgaria (14 Oct 1974).

Published in summary form only. Abstract available in English.

National conference "Physics-Manufacture", October 14-17, 1974, Kazanlyk. Abstracts of reports and communications.

Recently some reactions of biological systems were successfully applied as an indicator for the absorbed exposure dose. Dose-effect relationship between absorbed dose (rad)

and the level of conformation changes of blood plasma protein fraction is examined. Clearly expressed linear relationship between absorbed doses and the level of conformation protein fraction changes is established in the range 5 to 150 rad. The conformation changes in biomolecules begin at comparatively low radiation doses while at higher doses (above 150 to 200 rad) deeper structural changes are ensured. This peculiarity gives an opportunity to use the conformation changes of protein blood plasma fractions as an indicator for the absorbed dose in low dose range up to 150 rad. Determination of blood plasma protein conformation changes is based on measuring dielectric constant of blood plasma at high frequencies (0.4 MHz to 17 MHz) by means of defining the electrostatical components of free energy as well as some other methods. (auth)

- 3065 (INIS-mf--2013) LYMPHOCYTE AS A BIOLOGICAL DOSIMETER: A DIFFERENT APPROACH. Madhvanath, U. (Bhabha Atomic Research Centre, Bombay (India)). 1974. 7p. NTIS (US Sales Only).

From 1. Asian regional congress on radiation protection; Bombay, India (15 Dec 1974). 12 refs..

Chromosome aberration frequency as a measure of radiation exposure in human blood lymphocytes following a short term culture is well known and the technique is in use at several laboratories in the world to determine accidental exposures. Results of an entirely different approach to arrive at the exposure is presented. Time course of interphase death of human peripheral blood lymphocytes was followed for 6 days after exposure to cobalt-60 gamma radiation. Trypan blue dye exclusion method was used for scoring viable cells. Survival curves at 5 days post irradiation were exponential and had two components: an initial sensitive component representing a major sub-population of lymphocytes with a mean lethal dose (D₀) of 75 rads and the other an apparently more resistant population with a D₀ of about 300 rads. The initial part of the survival curve which spans to about 100 rads reaching a survival level of 15 percent, can be used to read off the extent of exposure in accident cases. Although 60 percent of the initial lymphocytes survive in the unexposed control cultures, the method is sensitive to exposures of the order of 20 rads and reproducible results have been obtained. The response is independent of dose-rate from 65 rads/min to 65 rads/hour. Other aspects of the dosimetry system such as the neutron response, in vitro and in vivo correlation are discussed.

- 3066 (N--75-24329) INFLUENCE OF IONIZING RADIATION ON THE IMMUNE RESPONSE. Brocadeszaalberg, O. (Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands). Medisch Biologisch Lab. TNO). 1974. 17p. (MBL--1974-28; TDCK--65585). NTIS \$3.25.

The effects of ionizing radiation on the immune response are reviewed. Following an introduction on the function of the immune apparatus, the effect of radiation in the different cell types of the immune system is described. The possible consequences of these effects on the prognosis of radiation victims are discussed. (GRA)

- 3067 (N--75-32733) STUDIES RELATIVE TO THE RADIOSENSITIVITY OF MAN: BASED ON RETROSPECTIVE EVALUATIONS OF THERAPEUTIC AND ACCIDENTAL TOTAL-BODY IRRADIATION. FINAL REPORT. Ricks, R.C.; Lushbaugh, C.C.

(comps.). (Oak Ridge Associated Universities, Inc., Tenn. (USA). Medical Div.). 1974. Contract E(40-1)-GEN-33. 229p. (NASA-CR--144439). Dep. NTIS \$8.00.

Data from human radiation accident victims, patients undergoing therapeutic whole-body irradiation, and astronauts during space flight are reviewed for radiation dose response relationships. The effects of whole-body irradiation at various doses and dose rates on the hematopoietic system, response to physiological stress, and gastrointestinal side effects were related to man's ability to repair radiation damage. Methods used for the evaluation of the physiological response to irradiation are discussed. Simultaneous studies of the hemic responses of mice and humans to the same low dose rate and daily doses showed a threefold greater radiation resistance of mice over man. (CH)

3068 (PB--244781) ADMINISTRATION OF THE RADIATION CONTROL FOR HEALTH AND SAFETY ACT OF 1968, PUBLIC LAW 90-602, APRIL 1, 1975. ANNUAL REPORT, JAN--DEC 1974. (Bureau of Radiological Health, Rockville, Md. (USA)). 1974. 100p. NTIS \$4.75.

The Secretary of Health, Education, and Welfare is required, Subpart 3, Section 2, Part F of Title III of the Public Health Service Act; 42 USC et seq. (Public Law 90-602), to submit an annual report to the President for transmittal to the Congress on or before April 1 on the administration of the Radiation Control for Health and Safety Act. The detailed information required to be included in the report is outlined in Section 360D of Public Law 90-602. The Food and Drug Administration, through its Bureau of Radiological Health, has been delegated the authority for the day-to-day administration of the Act. This report covers the detailed operation of the Agency in carrying out that responsibility for calendar year 1974. (GRA)

3069 ENVIRONMENTAL THREATS FROM NUCLEAR WEAPONS. Mann, L.R.B. (Auckland Univ. (New Zealand). Dept. of Biochemistry). N.Z. Sci. Rev.; 31: No. 4, 89-100(1974).

Somatic and genetic health hazards from ionizing radiation are outlined, with quantitative estimates of damage productivities based on recent authoritative reviews. The concept is stressed that, in a large population, fallout is predicted to harm millions of people while remaining statistically undetectable. The linear extrapolation to low doses (as adopted by all standard-setting bodies) is explained, in contrast to the threshold of "safe dose" assumption of some apologists for nuclear bombs. The "no public health hazard" policy with regard to fallout of the N.Z. Government National Radiation Laboratory and Institute of Nuclear Sciences is strongly criticized. There is no "permissible dose" of fallout, and the fact that the potential victims receive it without any choice or benefit sets it apart from occupational permissible doses where the irradiated person gets both a choice and some compensating benefit. The main objection to nuclear bomb tests is, however, not fallout but the nuclear arms race with its increasing risk of a catastrophic nuclear war. The U.S.A. has over 7,000 and the U.S.S.R. over 2,000 strategic nuclear warheads. New delivery systems, especially multiple independently-targetable re-entry vehicles (MIRV), and new strategies, notably counterforce targeting, seriously increase the risk of nuclear war. Links between nuclear weapons and the "peaceful atom" are outlined. Diversion of a

small fraction of the plutonium from civilian nuclear power programs may afford enough to make one or more bombs; and it is unfortunately easy to design and make a crude bomb or other weapon of mass destruction. Actions are proposed for New Zealand to take against the nuclear arms race. A substantial list of references is given. (auth)

3070 GONADAL RADIOPROTECTION IN MEN.

Penchev, V.; Pomakov, P.; Kolev, K. (Meditsinska Akademiya, Sofia (Bulgaria). Katedra po Rentgenologiya i Radiologiya). Rentgenol. Radiol.; 13: No. 4, 231-235(1974). (In Bulgarian).

In 60 patients, subjected to a contrast X-ray examination of the colon by enema using apparatus with and without an image converter, the testes were protected by a lead capsule for the scrotum. The capsule is a personal construction of the authors manufactured from lead sheet one mm thick. By use of condensor ionizing chambers of the integral dosimeter "Condiometer" scrotum exposure was measured with and without application of protective capsule. It was found that, unless measures are taken to limit the irradiated field so that the gonads remain out of it, even with the use of the image converters, scrotum exposure will be greater than the one without image converters, but with adequate limitation of the field. Observations have demonstrated essential decrease in testicular irradiation with the use of protective capsule for the scrotum. This is particularly important in roentgen diagnostic procedures in which the gonads come under or in close proximity to the direct ray beam. (auth)

3071 NUCLEAR POWER PLANTS AND THE ENVIRONMENT. Rossi, L.C. (CNEN, Rome). Ig. Sanita Pubblica; 30: No. 11/12, 371-377(1974). (In Italian).

The present energetic crisis has drawn the attention of the public opinion both to the Nuclear Power Plants and to the influence they may exert on the Environment and on man. The criteria followed in order to prevent radiation damages to populations and ecosystems are briefly summarized. A high degree of safety is being reached thanks to the technological progresses and by means of careful studies on the surroundings of a nuclear plant and strict controls for the sake of containing the radioactive discharges well below the limits allowed by the international norms. Another problem connected with the operation of Nuclear Power Plants is caused by the discharge of the cooling waters which have a higher temperature than that of the receiving water. This aspect also is carefully studied in order to propose the utilization of such waters for different domestic and industrial purposes.

3072 BIOLOGICAL HAZARD AND MEASUREMENT OF PLUTONIUM. Myers, D.S. (Univ. of California, Livermore). pp 117-141 of Radiological defense officer conference. Sacramento, CA; Office of Emergency Services (1974).

From Radiological defense officer's conference; Lake Tahoe, CA, USA (23 Oct 1974). See CONF-7410106--.

The basic characteristics of Pu, its physical and chemical properties, the uses and decay schemes of ^{238}Pu and ^{239}Pu , and techniques for monitoring Pu in the field using portable instruments are discussed. The hazards to personnel from a criticality accident involving Pu are considered and protection procedures are suggested. It is pointed out that the major biological hazard from Pu arises

- when it is deposited internally following inhalation, ingestion, injection or wound contamination, or skin absorption, with inhalation of ^{239}Pu oxides or nitrates being the greatest hazard. It is estimated that approximately 25 mg of inhaled ^{239}Pu deposited in the respiratory tract would result in a LD_{50} dose of a radiation and 500 mg of ingested ^{239}Pu would result in a LD_{50} dose to the GI tract. Based on animal studies, it is concluded that if a person inhales or ingests a quantity of ^{239}Pu which results in a body burden considerably more than the maximum permissible body burden but less than the quantity required to produce acute symptoms, his chances of developing cancer some 10 to 20 years later are greatly increased. Personnel with known body burdens of ^{239}Pu acquired 10 to 20 years ago are being carefully watched but so far no signs of cancer have been observed. (CH)
- 3073 Einführung in den Strahlenschutz. Lehrbuch fuer die Berufsbildung. (INTRODUCTION TO RADIATION PROTECTION. COMPENDIUM FOR VOCATIONAL TRAINING). Sitzlack, G. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Berlin; VEB Verlag Volk und Gesundheit (1974). 214p. (In German).
Following a historical outline of radiation protection and a review of radiation exposure of man, the present third revised edition deals with types and properties of ionizing radiation and its interaction with matter, dosimetry and dose units, radiation measurements, tasks and measures of radiation protection including legislation, licensing, responsibility, dosimetric and medical supervision of occupationally exposed personnel in the GDR, and safe handling of sealed and unsealed sources with special regard to X-ray application in medicine. In an appendix a compilation of titles of current GDR regulations and standards in radiation protection is given. (INIS)
- 3074 (SLAC-Trans--171) RADIOLOGICAL PROTECTION AND NUCLEAR POWER PLANTS. Delpla, M. 1974. Translated from the French. (CONF-740603--2). 17p. Dep. NTIS \$3.50.
From 2. international conference on radiation protection - philosophy and implementation; Aviemore, Scotland, UK (2 Jun 1974).
Dosimetric results obtained inside and outside nuclear power plants are examined with a review to proposing revision of the radiological protection standards. Dose limits are considered with regard to leukemia and genetic effects. Other topics discussed are: observed collective damage and mean risk; lethal exposure; healing and sign change of additional risk; and genetic effects of radiation on mice. (HLW)
- 3075 SHIELDING OF ORGANS LYING INSIDE THE TREATMENT VOLUME IN COBALT 60 RADIOTHERAPY. Tveraa, K. (Norske Radiumhospital, Oslo). pp 205-211B of Proceedings of the seventh Nordic meeting on clinical physics. Jähren, R. (ed.). Oslo; Dept. of Medical Physics, the Norwegian Radium Hospital (1974).
From 7. Nordic meeting on clinical physics; Tretten, Norway (14 Jun 1973).
In megavoltage therapy the shadow method of ocular protection is used in most cases. Measurements have been carried out to investigate the influence of the distance between the block and the patient on the surface doses and the dose levels at different depths, using a Mobaltron 80 ^{60}Co machine and a phantom. It is concluded that the shielding should be placed as near the patient as possible.
- 3076 RADIATION HYGIENE IN PHOTOFLUOROGRAPHY. Welde, F. (Statens Institutt for Strålehygiene, Oslo (Norway)). pp 41-56 of Proceedings of the seventh Nordic meeting on clinical physics. Jähren, R. (ed.). Oslo; Dept. of Medical Physics, the Norwegian Radium Hospital (1974).
From 7. Nordic meeting on clinical physics; Tretten, Norway (14 Jun 1973).
Photofluorography is used for mass chest X-ray examinations. There is, however, a trend towards more selective examinations. Doses to patients and staff are discussed and the use of a lead rubber apron for reduction of gonad doses to female patients shown to be ineffective. The radiation levels around a photofluorographic unit are shown in diagrams for various configurations.
- 3077 THE CYCLOTRON IN RADIATION THERAPY AND MEDICAL DIAGNOSIS. Bozoky, L. (Országos Onkológiai Intézet, Budapest (Hungary)). Fiz. Sz.; 24: No. 3, 65-69(1974). (In Hungarian). 4 figs.; 4 refs.; 1 tab..
A review is given on the present state of the use of cyclotrons in medicine. The differences in the biological effects of neutron and X-ray or gamma radiation make it possible to use fast neutron radiation to kill tumour cells without inflicting irreversible damage to the necessarily irradiated normal cells. Neutrons transfer their energy to the medium by colliding with protons and thus their linear energy transfer [LET] is high. The high LET radiations have similar effects on the cells with normal or low oxygen supply. In addition, the relative biological effectiveness [RBE] of neutron radiation is dependent on the doses used in the various fractions. The depth dose curves of fast neutron radiation generated by D-Be nuclear reaction with deuteron energies above 35 MeV is more advantageous than the depth dose curves of ^{60}Co . The cyclotrons can also be used to produce at the site of use the radioisotopes with very short half-life. These isotopes have several advantageous properties when used in medical diagnosis: the radiation load to the patient is much lower than with isotopes with longer half-life, the precision of the measurements can be increased without health hazard to the patients, the diagnostic procedures can be repeated after a short time, and isotopes emitting gamma radiation without the joint emission of beta radiation can be produced.
- 3078 RADIATION DOSIMETRY: ELECTRONS WITH INITIAL ENERGIES BETWEEN 1 AND 50 MEV. Washington, DC; International Commission on Radiation Units and Measurements (1974). 64p. \$4.00.
The purpose of the report is to examine how certain radiation quantities, particularly the absorbed dose, can be determined for electrons with initial energies between 1 and 50 MeV. This energy range was chosen to include those radiations produced by linear and circular accelerators in medical, radiochemical and radiobiological applications. The determination of basic parameters of electron beams, especially electron energy, energy spectrum, and electron fluence, is dealt with. Individual chapters cover different methods for determination of the absorbed dose (including solid state dosimetry with thermoluminescent materials), construction and use of monitor

systems, measurement and control of electron beam characteristics and practical problems in determination of the absorbed dose. (CIS Abstr., Vol. 2)

- 3079 RADIOPROTECTION OF HOSPITAL WORKERS IN CONTACT WITH RADIOACTIVE PATIENTS. Jean-Claude, D. (Univ., Liege). pp 303-305 of Recent advances in nuclear medicine. Tokyo; First World Congress of Nuclear Medicine (1974).

From 1. world congress of nuclear medicine and exhibition meeting; Tokyo, Japan (30 Sep 1974).

See CONF-740926--.

Some topics discussed are: patients as sources of external radiation and contamination; assessment of exposure of nursing personnel; maximum permissible dose for hospital staff; responsibility of hospital for administrative and physical control; and recommendations for reducing doses and organization of information of hospital staff to provide signaling system of radioactive patients and development of safety measures. (HLW)

- 3080 RADIATION PROTECTION PRINCIPLES IN RADIOIODINE THERAPY. Nemec, J. pp 156-161 of Radioiodine therapy of thyroid diseases. Prague; Avicenum, Zdravotnicke Nakladatelstvi (1974). (In Czech)

The principles are listed reducing the risks to medical personnel of external irradiation and internal contamination during radiiodine treatment.

- 3081 HIROSHIMA AND NAGASAKI: THE GENETIC CONSEQUENCES OF THE ATOM BOMBS. Frydenberg, O. Nat. Verden; No. 10, 305-328(1974). (In Danish).

A summary of results published in reports from the Atomic Bomb Casualty Commission concerning the genetic consequences of the use of atom bombs on Hiroshima and Nagasaki.

- 3082 POSSIBLE RISKS OF LOW-DOSE IRRADIATION. Hug, O. (Muenchen Univ. (F.R. Germany). Strahlenbiologisches Inst.; Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Biologie). pp 140-158 of Die natuerliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)

13 figs.; 38 refs..

The survey on more recent experimental and epidemiological data and newer concepts for a realistic estimation of the radiation risk leads to the conclusion that for radiation late damages and possibly also for genetic damages with a chronic radiation exposure in the order of magnitude of the natural radiation exposure and probably also in the order of magnitude of the maximum permissible radiation dose, the risk is very probably lower than is to be expected based on the findings after relatively high doses and dose rates. A few less direct comparative studies have detected a time factor of 3 to 5. Considering the analysis of the RBW demely ionizing radiation which at high doses is not greater than 3, increases with decreasing dose and according to biophysical considerations, can possibly reach a value of 30, an effectiveness reduced by a factor of 10 of small doses and dose rates of loosely ionizing radiation would be even to be expected. All radiobiological knowledge on the effect of ionizing radiation allows one to

expect that even smallest radiation doses can cause cellular damages due to the linear irreversable components of the radiation effect and probably that these damages can even be the starting point of a malignant tumour. Regarding this cancer-initiating effect however, the effectiveness of loosely ionizing radiation per rad in the region of natural radiation exposure lie considerably below that existing at high doses and dose rates. Whether however this initial carcinogenic effect of very small doses is at all noticeable during the average life duration in an increase of the spontaneous age-specific tumour rate is questionable if the assumption is confirmed that with decreasing dose, the time manifestation of the radiation induced tumours is delayed.

- 3083 SAFE HANDLING OF RADIATION SOURCES.

Oberhofer, M. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). Munich; Thieme (1974). 252p.

116 figs.; 9 tabs.; 65 refs..

This book does not present regulations and explanations, but offers guidance in the practical procedures of radiation protection. It describes how man, who cannot perceive the danger of radiation with his natural senses, should conduct himself in a radiation field - how we should work with sealed and unsealed radiation sources. The book describes the appropriate equipment and discusses typical incidents and accidents.

- 3084 CONSIDERATIONS ON THE ESTABLISHMENT OF MAXIMUM PERMISSIBLE EXPOSURE OF MAN. Jacobi, W. (Gesellschaft fuer Strahlen- und

Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Strahlenschutz). pp 170-186 of Die natuerliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)

7 figs.; 3 tabs.; 18 refs..

An attempt is made in the information lecture to give a quantitative analysis of the somatic radiation risk and to illustrate a concept to fix dose limiting values. Of primary importance is the limiting value of the radiation exposure to the whole population. By consequential application of the risk concept, the following points are considered: 1) Definition of the risk for radiation late damages (cancer, leukemia); 2) relationship between radiation dose and thus caused radiation risk; 3) radiation risk and the dose limiting values at the time; 4) criteria for the maximum acceptable radiation risk; 5) limiting value which can be expected at the time.

- 3085 EXTERNAL EXPOSURE BY TERRESTRIAL RADIATION IN BUILDINGS (BUILDING MATERIALS).

Keller, G. (Universitaet des Saarlandes, Homburg/Saar (F.R. Germany). Inst. fuer Biophysik); Schmier, H.; Seelentag, W. Jr. (Bundesgesundheitsamt, Berlin (F.R. Germany). Abt. fuer Strahlenhygiene). pp 70-79 of Die natuerliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)

7 tabs.; 7 refs..

The external exposure by terrestrial radiation from outside should be due to the greater exposure in buildings, on average about 10 to 20 mrem per annum higher than was assumed

sofar. According to the hitherto results of site dose rate measurements in flats, the extreme values should be about 40 to 200 mrem per annum for the total external exposure. Sofar no extremely high value has been found in the determination of the content of radioactive materials in building materials. Besides the content of radioactive materials, other criteria too, such as radiotoxicity and the dose rate constant, have to be considered in fixing a limiting value of radioactivity in the building materials which are allowed to be used.

- 3086 BALANCE OF EXTERNAL AND INTERNAL NATURAL RADIATION EXPOSURE. Muth, H. (Universitaet des Saarlandes, Homburg/Saar (F.R. Germany). Inst. fuer Biophysik). pp 129-139 of Die natuerliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)

5 tabs.; 20 refs..

Data from UNSCEAR 1972 and a few new data are the basis of the summarizing survey. The tables contain average values of the dose rates in the organs of particular interest through the single exposure components and a summing-up for the average total dose rate.

- 3087 SOCIAL LEGISLATION: ARTICLES 548, 551 RVG. Fischerhof, H. Soz.- Praeventivmed.; No. 6, 247-251(1974). (In German).
A physicist who had been concerned with the nuclear photoelectric effect of deuterons at a university became ill 2 years after completing the work and died a year later. The widow sued for a pension out of the official compensation fund. The case went through a lower instance to the Bundessozialgericht (BSG). This court passed the first judgement - as far as is known - on legal insurance against accidents with regard to the handling of radioactive materials (judgement of the 8th senate of the 'Bundessozialgericht' dated 29.1.74 - 8/7 RU 18/72): The principle of objective onus of the proof with regard to social jurisdiction (BSG 1957-10-24 10 RV 945/55 = BSGE 6, 70) is also valid in the case of a possible but not probable causal connection between occupational radiation effect and illness according to the taking of evidence. The exact wording of the reasons for the judgement is given. The author comments on the judgement and holds out hope that the case before the court induces the legislator to give a better protection to those employed in establishments concerned with radiation by a legal supposition of causality. - Personal remark by the abstractor: How will a plaintiff objectively prove causality - perhaps even after many years.

- 3088 RESULTS OF THE RADIATION TREATMENT OF PATIENTS WITH CANCER OF THE DISTAL SECTIONS OF THE COLON. Galstyan, A.M.; Grigoryan, G.T.; Sarkisyan, E.Kh.; Papazyan, Sh.A.; Galcyan, I.S.; Dadoyan, G.S. Zh. Eksp. Klin. Med.; 14: No. 4, 60-66(1974). (In Russian).

Results are presented on the telegammatherapy of 270 patients having cancer of the distal sections of the colon. Preoperational irradiation led to significant regression of the tumor so that it was possible to perform radical operations on 31.5 percent of the patients with locally propagated forms of the tumor. The effectiveness of fractionated and continuous techniques of irradiation therapy were almost the same, but the patients endured the fractionated therapy significantly

better. The most sensitive to radiation was glandular cancer, while the most resistant to radiation was colloidal cancer. The radiosensitivity of healthy and cancerous tissues is different. With radiation therapy (not less than 4500 rad) a decrease in parenchymal elements of the tumor sets in with the appearance of vacuoles and necrotic spots. Recidivists were resistant to irradiation. Thanks to preoperational gamma therapy the percent of recidivists in comparison with nonirradiated patients with 28.4 fell to 19.2. 15 refs. (SJR)

- 3089 ACTIVITY DYNAMICS OF LYSOSOMAL ENZYMES AND PROTEOGLYCAN-LIKE COMPOUNDS IN PATIENTS WITH PRIMARY DEFORMING OSTEOARTHRITIS UNDER THE EFFECT OF RADON BATHS HAVING RADON CONCENTRATIONS OF 100 (36.4 NANOCURIES/L) AND 300 (102.2 NANOCURIES/L) MACH UNITS. Aryppaeva, T.T. (Central Inst. of Health Resorts and Physioger., Moscow). Vopr. Kurortol., Fizioter. Lech. Fiz. Kul't.; 6: 509-512(1974). (In Russian).

Determination of the activity of acid phosphatase and of the acid proteinases in the blood serum is an additional criterion of the course of a pathological process during primary deforming osteoarthritis. Radon baths with a radon concentration of 100 Mach units cause a decided lowering in the activity of acid hydrolases and proteoglycan-like compounds in the blood serum. Radon baths with a radon concentration of 100 (36.4 nanocuries/liter) Mach units promote a favorable decrease in the destructive effects on the epiphyseal cartilage, and an increase in the nonspecific resistance of the organism. 6 references. (SJR)

- 3090 EFFECT OF RADON BATHS HAVING A RADON CONCENTRATION OF 100 MACH UNITS (36.4 NANOCURIES/LITER) ON PATIENTS HAVING A DEFORMING OSTEOARTHRITIS WITH MYOCARDIAL DAMAGE. Tsarfis, P.G.; Kostrova, V.D.; Gerasimenko, V.N.; Fifeiskaya, A.A. (Central Inst. of Health Resorts and Physioger., Moscow). Vopr. Kurortol., Fizioter. Lech. Fiz. Kul't.; 6: 506-509(1974). (In Russian).

The patients took the radon baths at a temperature of 36°C for a period of 15 minutes. The treatment consisted of 14 to 16 baths with a break of one day between baths. After completing the baths, pain in the limbs subsided significantly and disappeared in three-fourths of the patients. Locomotor function improved. Muscle tone increased. Improvement in physical function was noted in 75 out of 80 patients. 3 references. (SJR)

- 3091 EVALUATION AND CONTROL OF RADON DAUGHTER HAZARDS IN URANIUM MINES. Holaday, D.A. Cincinnati; National Institute for Occupational Safety and Health (1974). 64p.

Technical information report covering the following subjects: physical and chemical characteristics of radon and daughter products; biological effects; dosimetric considerations; evaluation of uranium mine atmospheres; control of exposure; evaluation of individual exposures; personal protection devices; glossary of terms.

- 3092 RADIATION LOADS OF PHYSICIANS-SURGEONS AND PARAMEDICAL PERSONNEL IN CATHETERIZATION OF THE CARDIAC CAVITIES AND VESSELS WITH THE USE OF ELECTRON-OPTIC AMPLIFIERS AND X RAY TV UNITS. Zolnikova, N.I.; Zaretskii, V.V.; Petrosyan, Yu.S. Grud. Khir.; 1: 41-47(1974). (In Russian).

The article presents the materials of radiative-dosimetric investigations of the

working conditions of physicians-surgeons, paramedical and auxiliary medical personnel, who use electron-optic amplifiers, roentgenotelevision and roentgenocinematographic units in the present-day roentgenodiagnosis of cardiovascular diseases.

- 3093 EFFICACY OF PROPHYLACTIC IRRADIATION IN ALTERING RENAL ALLOGRAFT SURVIVAL. Faber, R.; Johnson, H.K.; Braren, H.V.; Richie, R.E. (Vanderbilt Univ., Nashville). Proc. Clin. Dial. Transplant Forum; 4: 135-137(1974).

Renal allograft rejection is a complex phenomenon involving both cell-mediated and humoral antibody responses. Most transplant programs have used a combination of therapeutic modalities to combat the immune system in an attempt to prolong both allograft and patient survival. Corticosteroids (methylprednisolone (Solu-Medrol) and prednisone and azathioprine (Imuran) are widely accepted as immunosuppressive drugs; however, both are non-specific and have the disadvantage of compromising the recipients' defense mechanisms. Nevertheless, these drugs have proved to be essential to the success of renal transplantation and they are routinely used while the efficacy of other modalities continues to be evaluated. We could find no reports of a prospective study to evaluate the efficacy of prophylactic irradiation in the complex therapeutic situation of renal transplantation with the only variable being the administration of local graft irradiation. The purpose of this study was to evaluate prophylactic graft irradiation for its effectiveness in preventing graft rejection in conjunction with Imuran and corticosteroids.

- 3094 ALTERATIONS OF BLOOD AND BLOOD COAGULATION BY EXTRACORPOREAL IRRADIATION IN LEUKEMIA AND RADIOPHOSPHORUS THERAPY IN POLYCYTHEMIA. Huhn, D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Muenchen (Germany, F.R.). Inst. fuer Haematologie); Kaboth, W.; Theml, H.; Murr, H.; Schramm, W.; Leisner, B. pp 89-102 of Strahlen, Blutgerinnung und Haemostase. XVI. Hamburger Symposium ueber Blutgerinnung. Marx, R. (ed.) (Muenchen Univ. (Germany, F.R.). 1. Medizinische Klinik); Thies, H.A. (ed.) (Staedtische Krankenanstalten Heilbronn (Germany, F.R.). Chirurgische Klinik). Stuttgart, Germany, F.R.; Schattauer (1974). (In German)

Animal experiments prove a high radiation resistance of megakaryocytes and thrombocytes. Radiophosphorus is thought to influence mainly the megakaryocytes in their beginnings; an effect on the vessel system of the bone marrow is particularly to be discussed in the case of very early and quickly reversible drop in thrombocytes. In the very first week after radiophosphorus administration, a considerable drop in thrombocytes is already seen in some patients, the number of patients remaining the same during the following 3 weeks. After blood irradiation, the thrombocytes are for a certain period reduced due to the influence of the extracorporeal circulation, but in general their number increases again during the following months. A considerable disfunction of the thrombocytes or a disturbed coagulation is not found either after radiophosphorus treatment or after extracorporeal blood irradiation.

- 3095 TYPES AND EFFECTS OF RADIATION COMING FROM NUCLEAR WEAPONS. Messerschmidt, O. (Laboratorium fuer Experimentelle Radiologie, Neuherberg/Muenchen (Germany, F.R.)). pp 9-27

of Strahlen, Blutgerinnung und Haemostase. XVI. Hamburger Symposium ueber Blutgerinnung. Marx, R. (ed.) (Muenchen Univ. (Germany, F.R.). 1. Medizinische Klinik); Thies, H.A. (ed.) (Staedtische Krankenanstalten Heilbronn (Germany, F.R.). Chirurgische Klinik). Stuttgart, Germany, F.R.; Schattauer (1974). (In German)

The article shows which effects can be expected from an atomic explosion, such as neutron and gamma rays, pressure surge, thermal radiation and at which KT-values and at which distance from the centre influence the individual noxious substances is most pronounced. Combined effects and delayed effects are discussed. The results of the numerous studies on the effects of the A-bomb dropping on Hiroshima and Nagasaki are shown. Results of animal experiments are used for explanation. Furthermore, the effect of radioactive fallout is described. As an example, the author points out the Marshall islands on which radioactive fallout was noticed after a nuclear weapon test by the Americans.

- 3096 BLOOD AND BLOOD COAGULATION DISTURBANCES BY NUCLEAR WEAPONS. Uchino, H.; Kamada, N. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). pp 45-72 of Strahlen, Blutgerinnung und Haemostase. XVI. Hamburger Symposium ueber Blutgerinnung. Marx, R. (ed.) (Muenchen Univ. (Germany, F.R.). 1. Medizinische Klinik); Thies, H.A. (ed.) (Staedtische Krankenanstalten Heilbronn (Germany, F.R.). Chirurgische Klinik). Stuttgart, Germany, F.R.; Schattauer (1974).

The paper reviews the summarized results of investigations on the effect of atomic bomb on hematology which were obtained in inhabitants of Hiroshima and Nagasaki in the early stage after detonation and, furthermore, the results of studies on late effects which were investigated at the authors Institute. Emphasis is given on the fact that the effects of irradiation on bone marrow could continue for more than 25 years.

- 3097 CERTAIN PROBLEMS IN THE DETERMINATION OF ACCEPTABLE EXPOSURE TO RADIATION. Musialowicz, T. (Centralne Lab. Ochrony Radiologicznej, Warsaw (Poland)). Probl. Tech. Med.; 5: No. 2, 113-119(1974). (In Polish).

National regulations, according to international recommendations determine three categories of exposure of persons to ionizing radiation. These categories are limited by different maximal permissible doses. In practice there exist, at times, difficulties in the classification of persons into the different categories and the establishing of the acceptable risk for them. Such situations concern in general the risk, present in accidental situations. The paper presents suggestions to delineate the acceptable exposure for personnel, working with radiation sources and for other persons acting in diverse atypical, but met in practice, situations.

- 3098 ANATOMIC AND GEOMETRIC PRECISION IN RADIOTHERAPY. Marks, J.E.; Davis, M.K.; Haus, A.G. (Univ. of Chicago). Radiol. Clin. Biol.; 43: 1-20(1974).

Localization error or geometric miss as a cause of local failure in the radiotherapeutic management of cancer is generally known but inadequately studied. Using a film technique for treatment verification, a systematic study of localization error, its causes and incidence, was undertaken. Out of a total of

- 173 patients included in the study, a cumulative localization error of 27 percent could be ascribed to physicians, technicians and patients. No attempt was made to correlate localization error with local failure to control tumors but such a study is feasible with preservation of treatment verification films.
- 3099 (AED-Conf--74-736-000, pp 121-131) INVESTIGATIONS ABOUT THE EFFECT OF RADIOPROTECTIVE SUBSTANCES AFTER IRRADIATION OF MICE WITH FAST NEUTRONS. Langendorff, H.; Langendorff, M.; Moenig, H. 1974. (In German).
From Meeting of the Schutzkommission beim Bundesministerium des Innern; Munich, F.R. Germany (May 1974).
2 figs.; 3 tabs.; 19 refs..
Meeting of the Schutzkommission beim Bundesministerium des Innern. Lectures.
Several protective substances and their effects were tested within the frame of a radiobiological investigation with fast neutrons on mice. The following substances with an obviously resistance-raising effect in X-ray or γ -radiation were tested: p-aminopropionic phenon (PAPP), cystamine, 5-hydroxytryptamine (Serotomine), liposaccharide of E-coli (LPS), chlortrianisen, and 5-2/3 aminopropylaminoethylthiophosphate. The substances were all but one injected inhaperitroneally; chlortrianisen was given subcutaneously. The LDsub(50/30d) was chosen as a basis for the evaluation of the test results. The dose reduction factor (DRF) was used as quantitative measure for the protective effect of a substance. The results show that the radiation-resistance-raising effect of the substances mentioned above is clearly lower in neutron radiation of mice than in X-ray radiation. Some experiments showed no resistance-increasing effects at all. The corresponding mechanisms of the substances and their protective effect one discussed on various tissues. The results obtained might help to find substances inducing an increased radiation resistance in the future even if cells and tissues of mammals are exposed to radiation of high LET.
- 3100 CHANGES OF MAO ACTIVITY IN THE BRAIN FOLLOWING RADIATION EXPOSURE. Goksadse, G.K. pp 52-63 of Radiatsionnye issledovaniya. I. Nadareishvili, K.Sh. (ed.). Tbilisi, USSR; Metsniereba (1974). (In Russian)
The effect of whole-body x-irradiation on the monoaminooxidase activity in the cortex, thalamus, medulla, and cerebellum has been studied in rats. It has been established that after x-irradiation the activity of total monoaminooxidase in all the brain areas studied first increases, then decreases, and keeps at this level over several days. Monoaminooxidase, specific to serotonin, has also been found to be highly sensitive to x rays. (auth)
- 3101 CYTOPHOTOMETRY OF THE ADRENAL CORTEX IN THE X-IRRADIATED RABBITS. Gelashvili, N.A. pp 80-110 of Radiatsionnye issledovaniya. I. Nadareishvili, K.Sh. (ed.). Tbilisi, USSR; Metsniereba (1974). (In Russian)
According to the decrease in the total number of cells, structural changes in nuclei and cytoplasm, nuclear content of DNA, the cellular populations of various lamina in the adrenal cortex varied in radiosensitivity. The cells of the reticular and medullar areas appeared in this respect most sensitive, then those of fascicular and arched areas. At stimulation of the retina with blinking light during irradiation according to their radiosensitivity the adrenal lamina responded as follows: medullar, reticular, fascicular and arched areas. On the 15th day after the exposure hypertrophy and widening of the cortical and brain areas accounting for the increase of the volume of the adrenal cortex were observed. Stimulation of the retina with blinking light during irradiation enhances the effect of exposure in all the adrenal cells of the rabbit. (auth)
- 3102 EFFECT OF OVERCOOLING OF THE ORGANISM DURING X-IRRADIATION ON THE RADIORESISTANCE OF THE ANIMAL AND EMBRYO. Partskhaladze, N.N. pp 111-130 of Radiatsionnye issledovaniya. I. Nadareishvili, K.Sh. (ed.). Tbilisi, USSR; Metsniereba (1974). (In Russian)
Studies made on the overcooling effect in warmblooded animals (rats) have demonstrated that only deep hypothermia with a breath arrest during x-irradiation yields a vivid radioprotective effect; hypothermia itself with no decrease in oxygen consumption has no antiradiation effect; i.e. oxygen effect is a major factor in the defence mechanism; at absolute lethal doses of x-irradiation hypoxia without a considerable hypothermia has no radioprotective effect. Overcooling of the organism to the arrest of the heart beat was found to have no radioprotective effect in poikilothermal animals and embryos. (auth)
- 3103 DARK RETICULAR CELLS IN THE THYMUS OF MICE. Jaerplid, B. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Acta Radiol., Ther., Phys., Biol.; 13: No. 4, 319-328(1974).
The morphology and distribution of dark reticular cells in the thymus of normal mice, of irradiated mice, and of mice with thymic lymphoma are described. It is concluded that dark cells are epithelial reticular cells and the hypothesis is suggested that dark and light epithelial reticular cells may be different modes of expression of the same cell type. (auth)
- 3104 Radiobiologiya. Uchebnik za studenti po zhivotnovydstvo. (RADIOBIOLOGY. A TEXTBOOK FOR STUDENTS IN ANIMAL BREEDING). Dryanovski, P. Sofia; Zemizdat (1974). 192p. (In Bulgarian).
46 refs..
The book represents a textbook of radiobiology adapted to the needs of veterinary medical sciences and practice, where some of the examined questions concern interests of other agricultural specialists. Physical properties of ionizing radiation, its interaction with the substance and hypothesis explaining biological action of radiation are consistently looked into. Effects of radiation on cells and animal and plant organisms are described as well as factors involved in radiation effect. Furthermore, symptoms of acute radiation illness in man and some domestic animals are examined. Information is given concerning radioactivity in the biosphere: natural radioactive background and sources of artificial radioactive contamination as well as a more detailed information about radioactive contamination of man and animals and that of food products of animal origin. Peculiarities in biologic action of radioactive substances are shown. A special attention is drawn to the question of veterinary radiometric expert examination of the environment and food products and methods used in deactivation of fodder, food products and water as well as the question about applying radioactive isotopes in

diagnostic practice and therapy and its use in sterilization and conservation of food products and other materials. (INIS)

- 3105 ANTIRADIATION EFFECTIVENESS OF PHOSPHORUS-CONTAINING DERIVATIVES OF S-ALKYLSITHIURONIUM. Kozhevnikov, V.V.; Suetina, G.N.; Afonina, T.D.; Shinyaeva, V.N.; Mizrahh, L.I. *Izv. Estestvennonauchn. Inst. Permsk. Gos. Univ.*; 15: No. 2, 114-118(1974). (In Russian).

A study was made of 8 new substances from the series of phosphorus-containing derivatives of S-alkylisothiuronium, most of which fall in the betaine class. To make the evaluation, two tests were performed: 30 day survival of lethally irradiated animals [mice--hybrid F₁ (CBA x C₅₇Bl)] and the dynamics of change in total bone marrow cell count within 30 days after γ irradiation at low dose rates. The standard in the first case was S-ethylisothiuronium (ethirone), in the second case-- α -mercaptoethylamine (MEA). A slight protective effect (10-17 percent) was found for two substances in the survival test, while the other substances in the series showed no effect at all. These two substances had a clear normalizing influence on the bone marrow, equal to the effect of the mercamine standard.

- 3106 LOW-DOSE RADIATION EFFECTS ON THE DEVELOPING BRAIN OF THE MAMMALIAN FETUS. Kameyama, Y.; Hoshino, K. (Nagoya Univ., Japan). pp 1215-1217 of *Recent advances in nuclear medicine*. Tokyo: First World Conference of Nuclear Medicine (1974).

From 1. world congress of nuclear medicine and exhibition meeting; Tokyo, Japan (30 Sep 1974).

See CONF-740926--.

X radiation at a single dose of 25 R prolonged significantly the cell cycle time of matrix cells of telencephalon in 10-day CF 1 mouse embryos. The prolongation was due to lengthening of G₂ period. At the same time, pyknotic cells in the matrix layer increased more than five times of control level, indicating a threshold dose of x-ray for causing acute cell death in embryonic brain is lower than 25 R in mice.

- 3107 BIOLOGICAL IONIZING RADIATION EFFECTS ON GONADS. IV. THE EFFECT OF DOSE FRACTIONATION ON SURVIVING OF OOCYTES IN THE OVARY OF MICE. Rudnicki, T.; Sloninska, B. (Akademia Medyczna, Poznan (Poland)). *Nukleonika*; 19: No. 10, 941-947(1974). (In Polish).

The mice were irradiated with single and fractionated dose 100 rad, using 2-9 split doses in 24 or 96 hours. Qualitative estimation of surviving of oocytes was carried out in 1-90 days after irradiation. The number of degenerated oocytes does not depend upon the number of split doses or the time of protraction. The final effect of irradiation depends on accumulated dose only.

- 3108 EFFECT OF RADON INHALATIONS ON CERTAIN OXYDA-REDUCTIVE ENZYMES IN ADRENALS OF WHITE RATS. Robaczynski, J.; Kaplonska, J.; Lozinska, E. (Akademia Medyczna, Wroclaw (Poland)). *Pol. Tyg. Lek.*; 29: No. 50, 2173-2176(1974). (In Polish).

Histochemical investigations were carried out on adrenals of white rats after radon inhalations from inhalers in Swieradow-spa. Increased reactions of oxydo-reductive enzymes: NAD tetrazolium reductase, succinic dehydrogenase and glucose-6-phosphate dehydrogenase were observed in the adrenal

cortex, particularly in the zona reticularis which was hypertrophied. Raised activity of oxydo-reductive enzymes in the cells of adrenal cortex evidences increased metabolism in these cells which may reflect increased production of hormones. Finding of stimulation of adrenocortical cells after radon inhalations is of essential importance for explanation of the biological mechanism of action of radon used in balneotherapy.

- 3109 RADIATION EFFECTS ON PLATELET FUNCTION AND ON SOME SUBSTANCES IMPORTANT FOR THE PRIMARY HAEMOSTASIS. Marx, R. (Muenchen Univ. (Germany, F.R.)). 1. Medizinische Klinik; Bunde, E.; Murr, H.; Schramm, W. pp 109-115 of *Strahlen, Blutgerinnung und Haemostase*. XVI. Hamburger Symposium ueber Blutgerinnung. Marx, R. (ed.) (Muenchen Univ. (Germany, F.R.)). 1. Medizinische Klinik; Thies, H.A. (ed.) (Staedtische Krankenanstalten Heilbronn (Germany, F.R.)). Chirurgische Klinik. Stuttgart, Germany, F.R.; Schattauer (1974). (In German)

Human thrombocytes in citrated plasm are only little sensitive to x rays or γ rays extracorporally. Non-fibrillary collagen is rather sensitive to γ rays. Whole-body irradiation with higher doses in experimental animals can lead (in phases) to radiothrombopathy, the megakaryocytic or plasmatic genesis of which has not been examined yet. According to the results available, γ rays can lead to ambivalent haemostaseotropic effects depending on the dosage. The minus-radio-haemostaseopathy in the case of radiation syndrome is potentially due to complex causes, quantitative as well as potentially qualitative platelet alterations playing the main part, and vessel alterations (endotheliopathy, hyperpermeability etc.) being also of importance.

- 3110 STUDIES ON THE RADIOPROTECTIVE EFFECT OF DIANABOL AND TRASYLOL DURING FRACTIONATED IRRADIATION OF RATS. Kocmierska-Grodzka, D.; Daniluk, J.; Radwan, J.; Danysz, A. (Akademia Medyczna, Bialystok (Poland)). *Postepy Fiz. Med.*; 9: No. 4, 185-191(1974). (In Polish).

Studies were made on the radioprotective effect of Dianabol using two different modes of irradiation. It was found, that Dianabol did not have any effect on the dynamics of the survival of the rats irradiated daily with the dose of 75 and 150 R (up to the time of their death). By limited fractionated irradiation (5 x 150 R) Dianabol had a slight protective effect in the survival estimation. This was found to increase by using Trasylool.

- 3111 CASE OF EXTERNAL CESIUM-137 EXPOSURE OF RARE ANATOMICAL LOCALIZATION. Krushkov, I.; Daskalov, A.; Kusmanova, P.; Konstantinova, B.; Mikhailov, M.; Kodjeikova, A. (Inst. of Radiology, Sofia). pp 1404-1406 of *Recent advance in nuclear medicine*. Tokyo: First World Conference of Nuclear Medicine (1974).

From 1. world congress of nuclear medicine and exhibition meeting; Tokyo, Japan (30 Sep 1974).

See CONF-740926--.

A 30-yr old man placed a metallic capsule containing ¹³⁷Cs in his shirt pocket and handled the capsule with both hands. Four days later he noticed erythema and vesiculation of the skin of the chest and he noticed pain and numbness of the fingers 11 days after exposure. At 19 days gastrointestinal symptoms appeared and at 22 days he consulted a physician and was hospitalized. Changes in blood, bone marrow, chromosomes, and skin of the chest, neck, and

- hands are described up to 40 days post-exposure. Daily EKG observations revealed no pathologic changes in the heart. (HLW)
- 3112 CHARACTERIZATION OF RECIPIENT RADIATION DOSE FROM A PLUTONIUM-238 PULSE GENERATOR. Brackenbush, L.W.; Endres, G.W.R.; Griffin, B.I.; Nelson, I.C. (Battelle Pacific Northwest Labs., Richland, WA). pp 1410-1412 of Recent advance in nuclear medicine. Tokyo; First World Conference of Nuclear Medicine (1974).
From 1. world congress of nuclear medicine and exhibition meeting; Tokyo, Japan (30 Sep 1974).
See CONF-740926--.
Measurements were made of photon and neutron dose equivalents of a ^{238}Pu pulse generator used in nuclear heart pacemakers. Dose equivalents to various organs of a simulated recipient are presented. Doses to those associated with the recipient were estimated and it was concluded that an individual could be located within 25 cm of a pacemaker recipient for one year and receive a total dose including background radiation of only twice the background radiation dose. (HLW)
- 3113 FURTHER APPRAISAL OF DOSIMETRY RELATED TO URANIUM MINING HEALTH HAZARDS. Nelson, I.C.; Parker, H.M. Cincinnati; National Institute for Occupational Safety and Health (1974). 106p.
The contents include: introduction; characterization of mine atmosphere; lung model and breathing patterns; deposition of active material in the respiratory system; regional translocation and equilibrium activities; target tissue and dose; subjective basis of dose comparisons; conclusions and recommendations. Appendices are devoted to: radon (^{222}Rn) decay scheme; comparison of lung models; regional translocation and equilibrium activities; development of dose; dose equations and calculated results; subjective dose calculation, etc., much of this information being given in tabular form.
- 3114 INTERNAL RADIATION EXPOSURE BY URANIUM. Aurand, K.; Gans, I.; Ruehle, H. (Bundesgesundheitsamt, Berlin (F.R. Germany). Inst. fuer Wasser-, Boden- und Lufthygiene). pp 80-84 of Die naturliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)
6 tabs.; 11 refs..
The ubiquitous occurring natural uranium in the biosphere is contained in human tissue in concentrations of the magnitude of ng/g where the kidneys with 5.6 ng/g and the bones with 3.1 to 7 ng/g exhibit the highest concentrations. The annual equivalent dose resulting from the α -decay is between 0.1 and 8 mrem/a for individual organs. An enrichment of uranium in areas of greater uranium uptake in drinking water could sofar not be observed.
- 3115 INTERNAL RADIATION EXPOSURE BY ^{226}Ra . Gloebel, B.; Muth, H. (Universitaet des Saarlandes, Homburg/Saar (F.R. Germany). Inst. fuer Biophysik); Oberhausen, E. (Universitaet des Saarlandes, Homburg/Saar (F.R. Germany). Abt. fuer Nuklearmedizin und Medizinische Physik). pp 90-94 of Die naturliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)
1 fig.; 3 tabs.; 30 refs..
The natural internal radiation exposure of man by ^{226}Ra can be estimated from literature data for an average whole body content of 10^{-10}Ci ^{226}Ra to 0.08 mrad/a for soft tissue share and to about 1.7 mrad/a for bones.
- 3116 INTERNAL RADIATION EXPOSURE BY ^{222}Rn , ^{220}Rn AND THEIR SHORT-LIVED DAUGHTER PRODUCTS. Jacobi, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Strahlenschutz); Schraub, A. (Giessen Univ. (F.R. Germany). Inst. fuer Biophysik). pp 118-128 of Die naturliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)
3 figs.; 2 tabs.; 33 refs..
The lung dose due to ^{222}Rn and ^{220}Rn is negligible compared to the dose through inhalation of its short-lived decay products. In the average natural activity level of these nuclides in the air, the following average values of the average α -dose rate or equivalent dose in the respiratory tract for the reference human are obtained: 1) pulmonary region 6 mrad/a or 60 mrem/a; 2) tracheal bronchial region 12 mrad/a or 120 mrem/a, i.e. the ICRP recommendations of 1959 still valid today must be partly revised.
- 3117 INTERNAL RADIATION EXPOSURE BY ^{40}K . Kaul, A.; Roedler, H.D. (Freie Univ. Berlin (F.R. Germany). Klinikum Steglitz); Oberhausen, E. (Universitaet des Saarlandes, Homburg/Saar (F.R. Germany). Abt. fuer Nuklearmedizin und Medizinische Physik); Werner, E. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Biologie). pp 103-111 of Die naturliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)
2 figs.; 3 tabs.; with refs..
Single values and the sum of the energy dose rate in various human organs are calculated from the distribution of ^{40}K in the whole body, its variation and age dependence.
- 3118 INTERNAL RADIATION EXPOSURE BY LOW ATOMIC NUMBER RADIONUCLIDES ^3H , ^{14}C AND OTHERS EXCEPT ^{40}K . Scheuermann, W. (Bochum Univ. (F.R. Germany). Arbeitsgruppe Molekulare Pflanzenzytologie). pp 112-118 of Die naturliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlit, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)
2 tabs.; 23 refs..
The average dose rate for the whole body is calculated to be 1.02 mrad/a (^{14}C), 7.2-81.5 $\mu\text{rem/a}$ (T) and 0.6 mrad/a (^{87}Rb) from literature data.
- 3119 INTERNAL RADIATION EXPOSURE BY ^{210}Pb AND ^{210}Po . Stahlhofen, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Frankfurt am Main (F.R. Germany). Abt. fuer Biophysikalische Strahlenforschung); Sattler, E.L. (Giessen Univ. (F.R. Germany). Strahlenzentrum); Gloebel, B. (Universitaet des

Saarlandes, Homburg/Saar (F.R. Germany). Inst. fuer Biophysik). pp 94-102 of Die natuerliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, G.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlitz, W.; Stahlhofen, W. (eds.). Stuttgart; Thieme (1974). (In German)

2 tabs.; with refs..

For an average specific surface activity of about 13×10^{-4} pCi/cm², a dose rate region of about 2.6-13 mrad/a is calculated for the bronchial system obtained from own measurements and literature data of the α -activity and the distribution of ²¹⁰Pb/²¹⁰Po in the human body.

- 3120 CHANGES IN BLOOD COAGULATION AND BONE MARROW DUE TO THOROTRAST. Thies, H.A. (Staetdtische Krankenanstalten Heilbronn (Germany, F.R.). Chirurgische Klinik); Kuder, E. pp 273-279 of Strahlen, Blutgerinnung und Haemostase. XVI. Hamburger Symposium ueber Blutgerinnung. Marx, R. (ed.) (Muenchen Univ. (Germany, F.R.). 1. Medizinische Klinik); Thies, H.A. (ed.) (Staetdtische Krankenanstalten Heilbronn (Germany, F.R.). Chirurgische Klinik). Stuttgart Germany, F.R.; Schattauer (1974). (In German)

Delayed effects after application of thorotrast are reported on. Two thorotrast carriers are examined with regard to the plasma clotting factors to the thrombocytopcrosis of the bone marrow, and the capillary resistance. Both patients have a strongly reduced resistance of the capillary walls; the ascorbic acid test in the urine is negative. Thrombopenia is seen in one of the patients, plasmatic coagulation disturbance is not found. Thorotrast crystals are found in the sternal puncture fluid of both patients, once with reduced megakaryocytes as thrombocytes and once without any disturbance of haematopoiesis.

- 3121 STUDIES OF PULMONARY CARCINOGENESIS IN RODENTS FOLLOWING INHALATION OF TRANSURANIC COMPOUNDS. Sanders, C.L.; Dagle, G.E. (Pacific Northwest Labs., Richland, WA). pp 422-429 of Experimental lung cancer: carcinogenesis and bioassays. Karbe, E. (ed.). New York; Springer-Verlag New York Inc. (1974).

From Symposium on experimental respiratory carcinogenesis and bioassays; Seattle, WA, USA (23 Jun 1974).

See CONF-740648--.

The influence of radiation dose and its distribution on pulmonary carcinogenesis in rats was examined following inhalation of ²³⁸Pu from crushed ²³⁸PuO₂ microspheres, ²³⁸PuO₂, ²³⁹PuO₂, and ²⁴¹CmO₂. A more uneven dose-distribution (e.g., ²³⁸PuO₂ or ²³⁹PuO₂) favored squamous carcinoma induction at high doses, while adenocarcinoma induction was more frequent at lower doses or at all doses having a more even dose-distribution in the lung (e.g., ²⁴¹CmO₂). Squamous metaplasia and adenomatosis preceded the development of squamous carcinoma and adenocarcinoma, respectively. Pulmonary hemangiosarcomas were found only after high doses of inhaled ²³⁹PuO₂. These results suggest an influence of dose and dose-distribution on the type and incidence of pulmonary tumors from inhaled alpha emitters.

- 3122 LUNG IRRADIATION WITH STATIC PLUTONIUM MICROSPHERES. Anderson, E.C.; Holland, L.M.; Prine, J.R.; Richmond, C.R. (Univ. of California, Los Alamos, NM). pp 430-442 of Experimental lung cancer: carcinogenesis and bioassays. Karbe, E. (ed.). New York; Springer-Verlag New York Inc. (1974).

From Symposium on experimental respiratory

carcinogenesis and bioassays; Seattle, WA, USA (23 Jun 1974).

See CONF-740648--.

Hamsters are exposed to selected lung burdens of plutonium contained in 10 μ m diameter inert microspheres of ZrO₂ ceramic. Injected into the jugular vein, the microspheres lodge quantitatively in the lung capillaries and remain immobile for the life of the hamster. Distribution through the lung is essentially random but shows a systematic variation through a factor of about 2 from lobe to lobe. The specific activity of the microspheres is varied from 0.01 to 100 pCi per sphere, spanning the range of respirable particles of ²³⁸PuO₂ and ²³⁹PuO₂. The number of spheres per animal varies from 2,000 to 1,000,000 and the lung burden from 0.1 to 1000 nCi. The fraction of lung irradiated ranges from 0.01 to 0.98, and the calculated median dose rate to the tissue exposed is from 0.5 to 700 krad per year. The spheres are completely inert and provoke no foreign-body reactions. In contrast to most methods of exposure by inhalation or insufflation, the radiation is delivered essentially 100 percent to the lung. Because of the immobility and uniformity of the microspheres, the distribution of energy deposition can be calculated with precision on a microscale.

- 3123 REPIRATORY CARCINOGENESIS IN RATS AFTER INHALATION OF RADIOACTIVE AEROSOLS OF ACTINIDES AND LANTHANIDES IN VARIOUS PHYSICOCHEMICAL FORMS. LaFuma, J.; Nenot, J.C.; Morin, M.; Masse, R.; Metivier, H.; Nobile, D.; Skupinski, W. (EURATOM-CEA, Fontenay-aux-Roses, France). pp 443-453 of Experimental lung cancer: carcinogenesis and bioassays. Karbe, E. (ed.). New York; Springer-Verlag New York Inc. (1974).

From Symposium on experimental respiratory carcinogenesis and bioassays; Seattle, WA, USA (23 Jun 1974).

See CONF-740648--.

To study the role of the distribution of local tissue irradiation on the toxicity of alpha emitters, groups of 50 to 165 rats were exposed to aerosols of ²⁴¹Cm(NO₃)₃, ²⁴¹Am(NO₃)₃, ²³⁸Pu(NO₃)₄, ²³⁹PuO₂, and ²⁴¹AmO₂ and observed for effects. Curium-244 was most evenly distributed in the lung and most effective in reduction of survival time followed in descending order by ²³⁸Pu(NO₃)₄, ²⁴¹Am(NO₃)₃, ²⁴¹AmO₂, ²³⁹Pu(NO₃)₄, and ²³⁹PuO₂, which was more heterogeneously distributed in the lung as particulate. The toxicity had 2 results: shortening of life span and cancer induction (about 50 percent bronchogenic carcinoma and 40 percent bronchiolo-alveolar carcinomas). There appeared to be no correlation between survival time and cancer induction or localization of the element in the lung and the starting point of the tumors. This histologic type of cancer was independent of the nature of the element. Toxicity and cancer induction appeared to depend on the homogeneity of radiation dose with the more evenly distributed dose being most effective.

- 3124 PULMONARY CARCINOGENESIS AND CHRONIC BETA IRRADIATION OF LUNG. Jones, R.K.; Hahn, F.F.; Hobbs, C.H.; Benjamin, S.A.; Boecker, B.B.; McClellan, R.O.; Slauson, D.O. (Inhalation Toxicology Research Inst., Albuquerque, NM). pp 454-467 of Experimental lung cancer: carcinogenesis and bioassays. Karbe, E. (ed.). New York; Springer-Verlag New York Inc. (1974).

From Symposium on experimental respiratory carcinogenesis and bioassays; Seattle, WA, USA (23 Jun 1974).

See CONF-740648--.

Light water nuclear power reactor fuel cycles at various stages contain substantial quantities of β -emitting radionuclides. Thus, in the event of an accident, there is potential for inhalation exposure of man to various types and forms of β -emitting radionuclides. In order to study the biological effects of such potential exposures, a series of life span studies have been initiated in which beagle dogs have been exposed to inhalation to achieve graded lung burdens of a relatively insoluble fused clay form of β -emitting radionuclides. The specific radionuclides, ^{90}Y , ^{91}Y , ^{144}Ce , or ^{90}Sr , were selected on the basis of physical half-life to produce a variety of radiation-dose patterns to the lung. Early effects have been the development of radiation pneumonitis and progressive pulmonary fibrosis. In general, dogs which receive high- and rapidly-declining dose-rate exposure from ^{90}Y or ^{91}Y die earlier and at lower cumulative doses than dogs exposed to ^{144}Ce or ^{90}Sr . By contrast, the incidence of later-occurring malignant lung tumors and the degree of inflammatory response is greater in dogs which received protracted low dose-rate exposure associated with ^{144}Ce and ^{90}Sr . Of particular note is the nature of the lung tumors thus far observed.

- 3125 EXPERIMENTAL RESPIRATORY CARCINOGENESIS: INTERACTION BETWEEN ALPHA RADIATION AND BENZO(A)PYRENE IN THE HAMSTER. McGandy, R.B.; Kennedy, A.R.; Terzaghi, M.; Little, J.B. (Harvard School of Public Health, Boston). pp 485-491 of Experimental lung cancer: carcinogenesis and bioassays. Karbe, E. (ed.). New York; Springer-Verlag New York Inc. (1974).

From Symposium on experimental respiratory carcinogenesis and bioassays; Seattle, WA, USA (23 Jun 1974).

See CONF-740648--.

We have previously shown that a high incidence of lung cancer can be induced in hamsters by multiple intratracheal instillations of either benzo(a)pyrene (BaP) or polonium-210 (^{210}Po). The present experiments have used low doses of these 2 carcinogens, singly and together, in simultaneous and sequential designs. In terms of unequivocal lung tumors, 15 weekly instillations of ^{210}Po (total 0.05 μCi) and BaP (total 4.5 mg) given simultaneously on the same carrier particles induced twice the prevalence of lung tumors expected from the additive effect of either carcinogen alone. In a separate experiment, a single instillation of 0.04 μCi ^{210}Po led to only 1 tumor in 139 animals (0.7 percent) in contrast to 23 tumors among 135 animals (17 percent) when it was followed 18 weeks later by 7 weekly instillations of BaP (total 2.1 mg). These results suggest synergistic action between alpha radiation and BaP in the induction of lung cancer.

- 3126 (LF-tr--111) EXPERIMENTAL STUDY OF INHALED RADIOACTIVE POLLUTANTS. I. PRESENT DATA. II. INVENTORY OF LESIONS. III. VALIDITY OF THE ANIMAL MODEL DOSE-EFFECT RELATIONSHIPS. Lafuma, J.; Masse, R.; Metivier, H. 1974. Translation of French report. 22p. Dep. NTIS \$3.50.

Preliminary results are reported from studies on the survival and incidence of lethal lesions in dogs, rats, and monkeys in relation to the activity inhaled during exposure to radon or ^{239}Pu oxide, ^{241}Am , ^{239}Pu nitrate, and ^{244}Cm nitrate. The relative toxicity and biological half-life of the radionuclides were compared. (CH)

- 3127 EMBRYOTOXICITY OF ASTATINE-211. Borras, C. (Thomas Jefferson Univ., Philadelphia); Brent, R.L.; Gorson, R.O. pp 335-339 of Recent advances in nuclear medicine. Tokyo; First World Congress of Nuclear Medicine (1974).

From 1. world congress of nuclear medicine and exhibition meeting; Tokyo, Japan (30 Sep 1974).

See CONF-740926--.

Pregnant rats were anesthetized and the uterine horns were exteriorized and examined for number, condition, and position of the embryonic sites. The rats were then injected intravenously with ^{211}At . When the injected rats were compared with controls, the following effects were observed: an increase in embryo lethality; a decrease in fetal and placental mass; and an increase in incidence of malformations. (HLW)

- 3128 HISTOCHEMICAL STUDIES OF THE EFFECT OF RADIOPHOSPHORUS ON TESTIS IN SWISS ALBINO MICE DURING POSTNATAL DEVELOPMENT. Srivastava, P.N.; Kaul, R.A. (Univ. of Rajasthan, Jaipur, India). pp 1219-1221 of Recent advances in nuclear medicine. Tokyo; First World Conference of Nuclear Medicine (1974).

From 1. world congress of nuclear medicine and exhibition meeting; Tokyo, Japan (30 Sep 1974).

See CONF-740926--.

Phosphorus-32 was injected into mice aged 1 day to 4 weeks in a dose of 1 $\mu\text{Ci/g}$ body weight. No radiation sickness was observed during the experimental period. The animals were autopsied at weekly intervals for 6 weeks. Histochemical examinations of the testes were made for succinic dehydrogenase, esterase, alkaline phosphatase, lipids, nucleic acids, and carbohydrates. The significance of the results in relation to metabolism of the testes is discussed. (HLW)

- 3129 FUNCTIONAL STATE OF THE THYROID GLAND IN RATS WITH URANIC INTOXICATION. Malenchenko, A.F.; Kozyuk, G.V. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Energetiki). Eksp. Med. Morfol.; 13: No. 3, 148-153(1974). (In Bulgarian).

The influence of nitric acidic uranium on the functional state of the thyroid gland in rats by means of radioiodine tests and neutronic activatory method for determination of serum binding iodine 127 (SBI 127) was studied. The treatment with nitric acidic uranium (0.1, 0.5 or 2.0 mgr/100 g body weight once or 0.5 mgr/100 g body weight for 4 successive days) caused prominent reduction of the nonorganic and organic phase of iodine metabolism in the thyroid gland in correlation with the dose applied. The dynamics of the changes of SBI 131 and SBI 127 indicated that during the uranic intoxication the secretory phase prevailed over the phase of storage of the thyroid hormones. The morphologic changes in the thyroid gland during the uranic intoxication were the colloid evacuation of the follicles, focal proliferation and desquamation of the thyroid epithelium. (auth)

- 3130 (CS-INIS--5) RAPID IDENTIFICATION OF THE EXTENT OF SINGLE INTERNAL CONTAMINATION WITH RADIOACTIVE SUBSTANCES IN MAN BY EXCRETION ANALYSIS. Holgye, Z.; Popper, J. (Ustav Hygieny Prace Uranoveho Prumyslu, Kamenna (Czechoslovakia)). 1974. 105p. (In Czech). Dep. NTIS (US Sales Only), PC A06/MF A01.

Available from Nuclear Information Centre,

Praha-Zbraslav, Czechoslovakia.

The development is described of methods used for determining the contamination of urine without correction for ^{40}K content and with a correction for ^{40}K which is by one order more sensitive but more time-consuming. The statistical processing of the results of activity measurements made possible the determination of the contamination limits. In different control groups the dependence was observed of the sensitivity of the method on the amount of urine analyzed, on the length of measurement and on the parallel determination of the activity in one and the same urine sample. A method was elaborated for determining ^{35}S and ^{106}Ru in urine consisting of mineralization of the urine by nitric acid, further chemical processing, separation and final activity measurement by a low-background measuring set. 2000 pCi ^{35}S /l of urine and 15 pCi ^{106}Ru /l urine may reliably be determined. For these methods mineralization losses were studied for 27 chemical elements. Losses were found only for Ru, Os, Hg, S, P, I, Br, Cl and F. For Ru the losses are 13 to 26%, for S 7 to 8%.

3131 (IAEA-R--1260-F) INTERLABORATORY COMPARISON OF TECHNIQUES FOR MEASURING LUNG BURDENS OF LOW ENERGY X-RAY EMITTERS. PART OF A COORDINATED PROGRAM ON THE CALIBRATION OF BURDENS OF INHALED PLUTONIUM BY EXTERNAL COUNTING. FINAL REPORT FOR THE PERIOD 16 AUGUST 1972 - 14 AUGUST 1974. Newton, D. (International Atomic Energy Agency, Vienna (Austria)). 1974. 46p. NTIS (US Sales Only).

6 figs..

Three volunteers, representing subjects of small, intermediate and large physique, inhaled aerosols of polystyrene microspheres which incorporated the nuclides ^{103}Pd (17.0 days half-life) and ^{51}Cr (27.8 days). ^{103}Pd decays by electron capture, emitting x-rays of 20.2 keV, similar in energy to those of ^{239}Pu (13.6, 17.2 and 20.2 keV), while the ^{51}Cr , emitting γ -rays at 323 keV, serves as a marker; through established methods of body radioactivity measurement it can be used to calculate the retention of the particles at a particular time after intake and hence, given the radioactive composition of the inhaled aerosol, the x-ray emission from the ^{103}Pd . Fourteen laboratories assessed Pd-contents for the estimation of ^{239}Pu in the lungs. If a standard configuration of detectors for use on all subjects is required, offering the highest sensitivity in most individuals, the choice should be a pair of phoswich detectors viewing the left and right anterior surfaces of the upper thorax. Several methods of calculation have been devised in order to derive, from the detection efficiencies reported for ^{103}Pd , calibration data for ^{239}Pu .

3132 (INIS-mf--2015) A STUDY OF THE BEHAVIOR OF 0.5 μM AEROSOL PARTICLES IN THE HUMAN LUNG. Subba Ramu, M.C. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). 1974. 16p. NTIS (US Sales Only).

From 1. asian regional congress on radiation protection; Bombay, India (15 Dec 1974). 18 refs., 4 figures.

The evaluation of the tissue dose of inhaled aerosol particles (including radioactive particles) requires a study of the behavior of particles in the human lung. Half-micron particles (unit density spheres) of di-2-ethyl hexyl subacate have been used for carrying out the study since their deposition is mostly in the pulmonary region and they are good tracers of air flow in the lung. The deposition

measured is the lowest reported so far and is affected by physiological parameters like the tidal volume, the breathing frequency and the resting expiratory level. Steady-state and single-breath aerosol experiments show that the particles inhaled remain airborne in the lung during several breaths and support the view that mechanical mixing is completely absent in the alveolated airways of the lung. Studies of the effect of breath-holding on the deposition of 0.5 μm particles in the lung show that these particles may be used for the calculation of the diameter of the alveolar space in life.

3133 (KURRI-TR--125, pp 40-46) IODINE METABOLISM WITHIN THE HUMAN BODY. Mori, T. (Kyoto Univ. (Japan). Faculty of Medicine). 1974. (In Japanese).

From Symposium on radioiodine; Kumatori, Osaka, Japan (24 Oct 1973).

Symposium on radioiodine.

This paper summarized the iodine metabolism, particularly that of a large amount of iodine, in Japanese using radioiodine as a tracer. In the patients with hyperthyroidism, hourly variation of ^{131}I distribution within the body was examined when the iodine intake in meals was high and low respectively. The relationship between ^{131}I -thyroid uptake rate and the amount of iodine taken at meal was also studied. The ideas of organic and inorganic iodine tank in the thyroid gland and four compartments model were devised in order to analyse the iodine metabolism within the body. In addition, long-term observation of iodine metabolism within the body was carried out after the administration of ^{131}I , and the process of the metabolism including the form of its presence in the blood and the central government was outlined. Considering above results, countermeasures against human body contamination with ^{131}I were mentioned.

3134 (KURRI-TR--125, pp 47-52) THYROID FRACTIONAL DEPOSITION AND HALF LIFE OF RADIOIODINE. Fujita, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1974. (In Japanese).

From Symposium on radioiodine; Kumatori, Osaka, Japan (24 Oct 1973).

Symposium on radioiodine.

In order to measure the absorbed dose of radioiodine in the thyroid gland, which was incorporated by inhalation or ingestion, iodine intake (fa), ^{131}I thyroid uptake rate (fw), ^{131}I thyroid uptake rate compared to the rate in the whole body (f_2) and the half life of iodine in the thyroid gland (T_{eff}) were examined. Thyroid fractional deposition of ^{131}I was compared between Japanese and European. The rate of ^{131}I which moved from the blood into the thyroid gland in children (f_2') and the effect of the iodine in meals on ^{131}I thyroid uptake (fw) were also studied. In Japanese, f_2 was 0.28 and the mean T_{eff} was 6.9 $\pm$ 0.7 days in 11 Japanese adults. There was an individual difference in these biological parameter and the values in adults were different from those in children. A little difference in value between Japanese and European suggested to be caused by the greater amount of stable iodine in meals in Japanese.

3135 POTASSIUM IODIDE AND OTHER BLOCKING AGENTS CAN COUNTERACT THE EFFECTS OF RADIATION EXPOSURE. Grendon, A. (Univ. of California, Berkeley). pp 75-82 of Radiological defense officer conference. Sacramento, CA; Office of Emergency Services (1974).

From Radiological defense officer's conference; Lake Tahoe, CA, USA (23 Oct 1974).

See CONF-7410106--.

The effectiveness of the administration of potassium iodide for blocking the uptake of ^{131}I by the human thyroid is evaluated. The value of this treatment for the radiation protection of human populations in the event of the release of ^{131}I to the environment is discussed. (CH)

- 3136 MEASUREMENT OF RETENTION OF AN ORAL DOSE OF CA-47 BY WHOLE-BODY COUNTING. Baerenholdt, O.; Pors Nielsen, S.; Munck, O. (Glostrup Sygehus, Copenhagen (Denmark)). pp 221-224C of Proceedings of the seventh Nordic meeting on clinical physics. Jähren, R. (ed.). Oslo; Dept. of Medical Physics, the Norwegian Radium Hospital (1974).

From 7. Nordic meeting on clinical physics; Tretten, Norway (14 Jun 1973).

Twenty normal fasting subjects were given an oral dose of $3\mu\text{Ci}$ of Ca-47. Whole-body counting was performed after 5, 6, 7 and 8 days and immediately after the counting on day 8 an intravenous injection of Ca-47 was given. New counts were made on days 13, 14 and 15. It is assumed that geometry problems are negligible, and that the retention is not dependent on losses of calcium from the kidneys or intestine as the subject is used as his own standard. The method also supplies the slope of the whole-body curve indicating the calcium turnover of the subject.

- 3137 COMPARATIVE INVESTIGATIONS OF THE KINETIC BEHAVIOUR OF /SUP 99M/TC-PERTECHNETATE, /SUP 99M/TC-HUMAN ALBUMIN-MICROSOPHERES AND /SUP 99M/TC-SULFURCOLLOID IN THE LACRIMAL FLUID. Dressler, J.; Denffer, H. von; Pabst, H.W.; Hoer, G. (Technische Univ. Muenchen (F.R. Germany). Nuklearmedizinische Klinik und Poliklinik; Technische Univ. Muenchen (F.R. Germany). Augenklinik und Poliklinik). pp 822-826 of Nuklearmedizin. Fortschritte der Nuklearmedizin in klinischer und technologischer Sicht. Pabst, H.W.; Hoer, G.; Schmidt, H.A.E. (eds.). Stuttgart; Schattauer (1974). (In German)

From 12. international annual meeting of the Gesellschaft fuer Nuklearmedizin e.V.; Muenchen, F.R. Germany (11 Sep 1974).

2 figs.; 1 tab.; 3 refs..

Investigations on the regional kinetics of the transport of radioactive technetium in the individual sections of the lacrimal ducts are important as a basis for the clinical application of radionuclide dacryocystography. We were able to show that technetium, in spite of its low resorption during a 15-minute study, can be applied in functional tests of the lacrimal system. The varying size of the Tc-labelled particles leads to a delay in the transport through the lacrimal ducts, while free technetium in the form of pertechnetate is best for an assessment of the physiological and pathological drainage of tears.

- 3138 BIOKINETICS OF RADIOGALLIUM. Hayes, R.L.; Brown, D.H. (Oak Ridge Associated Universities, Inc., Tenn. (USA). Medical Div.). pp 837-848 of Nuklearmedizin. Fortschritte der Nuklearmedizin in klinischer und technologischer Sicht. Pabst, H.W.; Hoer, G.; Schmidt, H.A.E. (eds.). Stuttgart; Schattauer (1974).

From 12. international annual meeting of the Gesellschaft fuer Nuklearmedizin e.V.; Muenchen, F.R. Germany (11 Sep 1974).

4 figs.; 3 tabs.; 32 refs..

^{67}Ga would seem to be unique in many ways as a diagnostic agent, since it not only can be used as such for detection of cancer, but may

also be of potential use in a number of other fields as well. The overall processes involved in the in vivo distribution of ^{67}Ga appear to be similar in tumor and normal tissues. However, the higher rate of uptake by malignant tissues provides the basis for a valuable diagnostic procedure. Among the factors that may play a role in the greater uptake and binding of ^{67}Ga by certain tumors are the greater permeability of these cells and the presence of a higher level of a specific macromolecular gallium-binding component.

- 3139 INTERNAL RADIATION EXPOSURE BY ^{232}Th AND ^{228}Th . Kaul, A. (Freie Univ. Berlin (F.R. Germany). Klinikum Steglitz); Stahlhofen, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Frankfurt am Main (F.R. Germany). Abt. fuer Biophysikalische Strahlenforschung). pp 84-89 of Die natuerliche Strahlenexposition es Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K.; Buecker, H.; Hug, O.; Jacobi, W.; Kaul, A.; Muth, H.; Pohlitz, W.; Stahlhofen, W. (eds.). Stuttgart, F.R. Germany; Thieme (1974). (In German)

3 tabs.; with refs..

The energy and equivalent dose rates of both isotopes are calculated for bones, bone marrow and soft tissue.

- 3140 ATTITUDE PROFILE OF THE COSMIC RADIATION DOSE. Schaefer, H.J. (Naval Aerospace Medical Inst., Pensacola, Fla. (USA)). pp 1-9 of Die natuerliche Strahlenexposition des Menschen. Grundlage zur Beurteilung des Strahlenrisikos. Aurand, K. (ed.). Stuttgart; Thieme (1974). (In German)

10 figs.; 11 refs..

The complicated changes that the primary cosmic radiation undergoes on its path through the atmosphere are discussed, and the altitude profile of the total equivalent dose compiled from the individual components is shown in tables. The contribution of the civil air travel to the population dose is estimated from this.

- 3141 Grazhdanskaya oborona. (CIVIL DEFENSE). Titov, M.N.; Egorov, P.T.; Gaiko, G.A. Moscow; Vysshaya Shkola (1974). 215p.

The textbook is written for programs for training students of intermediate special education institutions and professional-technical students in civil defense. The role of civil defense in a system of general state defense measures, implemented in peace and war for the defense of the population and items of national economy from massive strike weapons; the civil defense objectives and organizations for items of national economy and in educational institutions are reported; the characteristics of massive strike weapons and of infection (contamination) sites are given; the purpose, layout, and operation of devices for radiation and chemical surveillance are examined. Some questions on the improvement of the operational reliability of national economy items in wartime are examined. The principles of the organization and management of surveillance, rescue and emergency recovery work in infection (contamination) centers, and some other special problems are discussed. The textbook is intended for students of all middle special educational institutions and professional-technical schools.

- 3142 MANHATTAN PROJECT PLUTONIUM WORKERS: A TWENTY-SEVEN YEAR FOLLOW-UP STUDY OF SELECTED CASES. Hempelmann, L.H.; Langham, W.H.;

Richmond, C.R.; Voelz, G.L. Health Phys.; 25: No. 5, 461-479 (Nov 1973).

Twenty-five males who were heavily exposed to plutonium while working under very crude conditions during World War II were followed up medically for 27 years. Examinations included physical inspection, laboratory studies, chest, pelvis, knee and teeth roentgenograms; chromosomes of lymphocytes cultured from the peripheral blood and cells exfoliated from the pulmonary tract were also studied. The findings are described in detail. Because of the small body burdens in these men so heavily exposed to plutonium compounds, it is concluded that the body has protective mechanisms which are effective in discriminating against these materials. This is probably explained by the insolubility of many plutonium compounds.

3143 CURRENT PROBLEMS OF THE MAN'S ENVIRONMENT. Khron. VOZ.; 27: No. 11-12, 565-569 (Nov 1973). (In Russian).

AIR; CHROMOSOMES; COBALT 60; COMPARATIVE EVALUATIONS; ENVIRONMENT; HUMAN POPULATIONS; IAEA; INTERNATIONAL COOPERATION; MAN; MILK; POLLUTION; QUALITATIVE CHEMICAL ANALYSIS; RADIATION DOSES; RADIATION MONITORING; SAFETY STANDARDS; SAMPLING; SKELETON; WHO

3144 (HRP--0003170) RADIOLOGICAL HEALTH IN THE GENESSEE REGION. (Genesee Region Health Planning Council, Rochester, N.Y. (USA). Radiologic Health Task Force). Oct 1973. 128p. NTIS, PC A07/MF A01.

Potentially harmful sources of ionizing and nonionizing radiations in the 10-county Genesee Region of New York State are identified in a task force report. All sources of radiation considered to be of importance to the general population were studied. Occupational radiation exposures were excluded. The radiation levels from major sources in the Genesee Region were found to be comparable to those for the nation as a whole. Current methods of protecting the public from radiation hazards were also examined, and recommendations were made concerning the enforcement of existing codes. Areas of ionizing radiation examined in the Genesee Region include natural sources, X-rays, nuclear medicine, nuclear power general, transportation of radioactive material, disposal of radioactive material, miscellaneous sources of radioactivity and radiation producing equipment. Civil defense programs and activities concerned with radioactivity are noted. Nonionizing radiation sources include the sun, sun lamps, lasers, microwave ovens, microwave communications and radar, and radio and television stations. A glossary, tabulation of the Genesee Region population density, a map of the surrounding area, and a list of references are appended.

3145 INVESTIGATION OF RADIATION DOSE RATES AROUND GAMMA RADIOGRAPHY EXPOSURE CONTAINERS DURING USE. Atherton, N.J. Br. J. Non-Destr. Test.; 15: No. 8, 143-145 (Sep 1973).

A report of experiments conducted as part of an investigation into the reasons for the higher doses of radiation received by site radiographers as compared with factory employed radiographers is given. Radiation dose rate measurements were made around 6 types of gamma radiography exposure container. The results, which are tabulated, indicate wide variations of dose rates around each container and between different containers. Shutter type exposure containers afford much better protection to operators than the manual extraction types.

3146 (DHEW/FDA--75-8017) APPLICATION OF AUTOMATIC DATA PROCESSING TECHNIQUES TO SELECTED DIAGNOSTIC RADIOLOGY OPERATIONS. Gitlin, J.N. (Bureau of Radiological Health, Rockville, Md. (USA)). Jun 1973. 151p. GPO.

Following a preliminary review of diagnostic radiology operations at the Johns Hopkins Hospital, in which several major activities were identified as amenable to automatic data processing (ADP) techniques, a pilot study of computer applications was undertaken with the cooperation and support of the National Center for Radiological Health. The pilot study was designed to test the feasibility of applying ADP techniques to the reporting of diagnostic radiology findings and to the control of x-ray film library transactions. The results of the pilot study demonstrated the feasibility of applying ADP techniques to the reporting of radiographic diagnoses with a significant reduction in the elapsed time associated with the x-ray consultation request-report cycle. The tests also provided a basis for evaluating the remote terminal configuration and the procedures developed to implement the systems design. In general, the findings were sufficiently encouraging to proceed with further development of the system, with the knowledge that specific modifications were required, particularly with regard to remote terminal devices, before the application of ADP techniques could be considered operational in diagnostic radiology.

3147 (NCRP--32) RADIATION PROTECTION IN EDUCATIONAL INSTITUTIONS. (National Council on Radiation Protection and Measurements, Washington, D.C. (USA)). 1 May 1973. 56p. National Council on Radiation Protection and Measurements, Washington, DC \$2.00.

The report provides information on the hazards involved in the use of radiation-producing equipment or radioactive material in science demonstrations and experiments, and recommendations on the means of protection. Following biological considerations, there are 3 chapters on radiation sources used in schools, basic principles of radiation protection, and the radiation protection programme. Appendices contain definitions of radiation units and terms as well as findings of a survey and a radiation safety check sheet. (CIS Abstr. Vol 2)

3148 (GSF-K--75) RADIATION PROTECTION IN ACCELERATORS IN MEDICAL USE. Betz, B.; Loester, W.; Niklas, K. (eds.). (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (Germany, F.R.)). Inst. fuer Strahlenschutz. May 1973. vp. (In German). INIS.

Separate abstracts were prepared for individual papers. (ERB)

3149 (GSF-K--75, pp vp.) BIOLOGICAL EFFECTS. Trott, K.R. May 1973. (In German).

15 figs.; 1 tab.; 14 refs..

Radiation protection in accelerators in medical use.

Following an introduction into the field of cellular radiation effect considering the most important experimental results, the biological significance of the colony formation ability is brought out. The inactivation concept of stem cells does not only prove to be good, according to the present results, in the interpretation of the pathogenesis of acute radiation effects on moult tissue, it also enables chronic radiation injuries to be interpreted through

changes in the fibrous part of the organs. Radiation therapy of tumors can also be explained to a large extent by the radiation effect on the unlimited reproductiveness of tumor cells. The more or less similar dose effect curves for healthy and tumor tissue in practice lead to intermittent irradiation. The dependence of the intermittent doses and intervals on factors such as Elkind recovery, synchronisation, redistribution, reoxygenation, repopulation and regeneration are reviewed.

- 3150 (GSF-K--75, pp vp.) STRUCTURAL RADIATION PROTECTION MEASURES FOR MEDICALLY USED ELECTRON ACCELERATORS. Frost, D. May 1973. (In German).

12 figs.; 2 refs..

Radiation protection in accelerators in medical use.

Recommendations are given for radiation protection measures when operating electron accelerators. They start from the DIN-regulations with the title 'Medical electron accelerating plants; radiation protection rules for the set-up' (standards proposal; draft from DIN 6847, sheet 2). According to the specifications for minimum radiation exposure to the personnel and that absolutely necessary to the patient, the radiation exposures which should be considered in the concept of the structural measures are dealt with. So besides the radiation due to neutron activation of materials and air, the higher power of modern accelerators at start-up time must be considered. Aside from useful structural measures, material problems for shielding are also discussed.

- 3151 (GSF-K--75, pp vp.) RADIATION PROTECTION. Hoefer, G. May 1973. (In German).

9 figs..

Radiation protection in accelerators in medical use.

The most important measurements required in practice on electron accelerators to protect the patient, personnel and other persons from undesirable, uncontrolled and non-permissible ionizing radiation is described using the example of the 42 MeV betatron. Starting with the radiation protection of the patients, the control of the exact beam aperture is given. The determination of the dose rate outside the field, measurement of neutrons which occur as a result of (γ, n) and ($\gamma, 2n$) effects, as well as the ensuing air activation is then given. The continuous control of the operational data of the accelerator is not to be neglected as failures lead to deviations from the fixed data in the irradiation plan and thus to damage to the patient. Furthermore, perfect visual and speaking contacts must be ensured. For the safety of the personnel, there are additional contamination controls such as personnel dosimetry, for other persons, the monitoring of adjacent rooms, control of the vent air and protection from activated patients as well as general measures.

- 3152 (GSF-K--75, pp vp.) PATIENT RADIATION PROTECTION IN MEGAVOLT THERAPY. Scherer, E. May 1973. (In German).

13 figs.; 53 refs..

Radiation protection in accelerators in medical use.

A survey is given on the practically important organs and organ systems whose radiation sensitivity and type of reaction are of significance regarding irradiation planning.

- 3153 (GSF-K--75, pp vp.) RADIATION PROTECTION IN MEGAVOLT THERAPY. Wiedersee, R. May 1973. (In German).

26 figs.; 2 tabs.; 35 refs..

Radiation protection in accelerators in medical use.

Following brief data on the radiation protection standards of today and the aspects which determined the requirements, short data on neutrons are given. The fast neutrons occurring with betatron radiation are particularly dealt with here. Data on the radiation protection of the patient then follow where the relative volume dose (i.e. the relative radiation exposure) as well as the radiation given off besides the signal field (secondary radiation) of the betatron are dealt with. The protective measures to be met in order to keep the secondary radiation within permissible limits are discussed, and finally data on plants equipped with 35 MeV betatrons and linear accelerators are given.

- 3154 (GSF-K--75, pp vp.) PHYSICAL IRRADIATION PLANNING. Leetz, H.K. May 1973. (In German).

7 figs.; 1 tab.; 6 refs..

Radiation protection in accelerators in medical use.

Following a definition of the physical irradiation plan, the methodics of the procedure are explained. Starting with the simplest case, irradiation where only the depth of the focus is known, the depth dose curves for single fields are calculated and extended to the overlapping of several single fields on the basis of a body cross-section. In addition to this calculation-graphical irradiation planning, the possibility of experimental determination of a dose distribution on the phantom is indicated. In addition, the possibilities resulting from the use of modern computers are shown in the individual calculation of dose distributions.

- 3155 (GSF-K--75, pp vp.) FUNDAMENTALS OF THE DOSIMETRY OF ENERGY-RICH RADIATION. Pohlitz, W. May 1973. (In German).

8 figs.; 3 tabs.; 11 refs..

Radiation protection in accelerators in medical use.

Following an illustration of the individual development phases in the dosimetry of ionizing radiation, the definitions of the physical parameters belonging to the unit X-ray are described. They are divided into 3 classes, namely into parameters of radiation sources, those of the radiation field as well as parameters in the interaction with matter and in connection with the measuring principle where various types of radiation and energy regions are considered. The conditions contained in the definitions for the measuring methods are shown in detail.

- 3156 (GSF-K--75, pp vp.) CLINICAL DOSIMETRY. Rassow, J. May 1973. (In German).

25 figs.; 33 tabs.; 19 refs..

Radiation protection in accelerators in medical use.

The main point of this paper on clinical dosimetry which is to be understood here as application of physical dosimetry on accelerators in medical practice, is based on dosimetric methodics. Following an explanation of the dose parameters and description of the dose distribution important for clinical practice as well as geometric irradiation parameters, the significance of a series of physical parameters such as accelerator energy,

surface energy of average stopping power etc. is dealt with in detail. Following a section on field homogenization with bremsstrahlung and electron radiation, details on dosimetry in clinical practice are given. Finally, a few problems of dosimeter or monitor calibration on accelerators are described. The explanations are supplemented by a series of diagrams and tables.

PROTECTION FOR ENERGIES UP TO 10 MEV: EQUIPMENT DESIGN AND USE. (National Council on Radiation Protection and Measurements, Washington, D.C. (USA)). 1 Mar 1973. 66p. National Council on Radiation Protection and Measurements, Washington, DC \$2.00.

The report contains a number of recommendations concerning the design and performance characteristics of medical radiation-producing equipment and the operating conditions. Following general guidelines on the clinical use of radiation, recommendations and guidelines are given for X-ray and gamma-beam therapy equipment. Further sections give guidance for calibration, radiation protection surveys and working conditions. Definitions of terms, tables with biological and technical radiation data, and an example of emergency procedure are appended. (CIS Abstr. Vol 2)

- 3157 ANIMAL EXPERIMENTS TO STUDY THE EFFECT OF IONIZING BEAMS ON THE BARRIER FUNCTION OF LYMPH NODES. THE INFLUENCE OF VARIOUS SURVIVAL TIMES. Aguilar, H. Hamburg; Hamburg University (11 Apr 1973). 57p. INIS.(In German).

1 fig.; 11 tabs.; 35 refs. Available from ZAED.

Thesis (Ph. D.).

The barrier function of a lymph node chain was examined on 48 female albino rats 20 weeks after applying a radiation dose of 2×100 R (telecobalt-gamma radiation). In addition, Cr^{51} labelled erythrocytes were intralymphatically injected at minimum pressure. The results obtained by ENGESET (1964), each only on one lymph node of dead rats, were confirmed, as a highly significant or significant influence on the barrier function of the investigated lymph node chain was observed compared to a non-irradiated collective of animals.

- 3158 STATISTICAL INVESTIGATION ON FREQUENCY, DURATION, NUMBER OF X-RAY INVESTIGATIONS AND RADIATION EXPOSURE TO THE PATIENTS OF A DISTRICT HOSPITAL ON THE OUTSKIRTS OF MUNICH. Nordmann, W. Muenchen, Germany; Muenchen University (10 Apr 1973). 110p. INIS.(In German).

16 figs.; 33 tabs.; 53 refs. Available from ZAED.

Thesis (Ph. D.).

Within the framework of a dissertation, X-ray examined patients were statistically surveyed during one month at the district hospital. The radiation exposure of the patients increased strongly particularly with men of the age of 21 to 30 and of 61 to 70. The causes are the multiply performed investigations after accidents as well as angiography at greater ages. The exposure is in the case of women particularly high between the ages of 66 and 70. In determining the gonadal exposure, the average values for the X-ray investigation at the time were referred to. The numbers give an approximate idea of to what extent single investigations with varying investigation or picture frequency can contribute to gonadal exposure.

- 3159 PERSONNEL EXPOSURES DUE TO INADEQUATE LEAK TEST METHODS FOR ^{125}I SOURCES. Murphy, P.C.; Burson, Z.G. Health Phys.; 24: No. 4, 443-444(Apr 1973).

A description is presented of a series of personnel exposures due to leakage from a sealed ^{125}I source which went undetected for a considerable time even though routine wipe tests were carried out on the source each time it was removed from storage for use. It was found that the ^{125}I was evolving in gaseous form and being released from the plastic bag in which the source was stored each time the bag was opened. The danger has now been controlled by monitoring the source storage cabinet with activated charcoal filters and by taking air samples in the immediate area when sealed sources of ^{125}I are used.

- 3161 (AAEC/E--290) ASSESSMENT OF RADIOACTIVE FALLOUT ARISING FROM TESTING OF NUCLEAR WEAPONS IN THE SOUTH PACIFIC AND THE PROBABLE EFFECTS ON THE AUSTRALIAN POPULATION. Fry, R.M.; Symonds, J.L.; Watson, G.M. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1973. 32p. NTIS (US Sales Only).

A discussion is given of the measurement of radiation and what dose units are appropriate for assessment of the significance of fallout exposure to man, and an outline is given of the background of natural and man-made radiation to which man is inevitably subject. The principal biological effects of radiation are then examined and the nature of the relationship between radiation dose and the incidence of effects is examined. The final section assesses the magnitude of fallout in Australia from the French and Chinese series of tests and expresses this in the form of dose commitments to man; the dose commitment for any radionuclide being the dose received to date plus the dose to be received in the future from residual long lived activity already incorporated in the body and remaining in the environment. From these dose commitments, using generally accepted risk coefficient estimates of the upper limits of the magnitude of the harmful effects, carcinogenesis and mutagenesis, which may be attributed to fallout from the respective series have been derived for the Australian population.

- 3162 (AAEC/E--291) ESTIMATES OF RADIATION DOSE TO THE AUSTRALIAN POPULATION AS A RESULT OF EXPOSURE TO FALLOUT FROM THE FRENCH AND THE CHINESE NUCLEAR BOMB TESTS OVER THE PERIOD 1964-1972 AND ASSESSMENTS OF THE ADVERSE EFFECTS ON PUBLIC HEALTH. Cook, J.E.; Combe, V. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1973. 26p. INIS.

Measurements of fallout levels in Australia up to 1971 are reviewed and used to estimate Australian average individual dose commitments. An alternative set of numbers is given based on the most recent figures for global average dose commitments provided by the United Nations Scientific Committee on the Effects of Atomic Radiation. The two sets of numbers show reasonable agreement; the larger are adopted for use in estimating adverse effects. The contribution of the French and Chinese weapons tests relative to that from all tests is derived by inspection and extrapolation where necessary of data on the injection of strontium-90 into the northern and southern hemispheres and its subsequent deposition as a function of time. The risk data reviewed and summarised in the 1972 UNSCEAR and BEIR reports are used to derive estimates of adverse effects. It is

concluded that the French and Chinese test series to the end of 1972 may be responsible over the next 20 years for up to 1.4 and 0.2 cases of cancer per year respectively in Australia. Of these cases, 0.25 per year would be leukemia, 0.75 per year thyroid cancer and 0.6 per year all other forms. Available evidence on the mutagenic effects of radiation suggests that the total number of cases of severe genetic diseases produced may be of the same order as the total number of cases of cancer, with the former spread over many generations whereas the latter are not.

- 3163 (PB--246095) APPLICATIONS OF PROTON RADIATION TO CANCER THERAPY. QUARTERLY REPORT 1 JAN-31 MAR 1973. Preston, W.M. (Harvard Univ., Cambridge, Mass. (USA)). Mar 1973. 10p. (PR--73/1). NTIS \$3.50.

The preparation of the Harvard 160 Mv synchrocyclotron for general cancer therapy is discussed. The following projects are briefly described: Construction of a collimator with a 30 cm. aperture for the proton beam; methods to provide a uniform proton flux over a 30 cm. diameter circle; design of a method to produce a vertical beam; work on a computer program for calculation and graphic presentation of isodose distributions; dose measurements in a water tank phantom; and treatment planning. Possible applications of proton radiography to medical diagnosis are being investigated. Application of this technique to the visualization of cerebral vascular lesions and to tissue density measurements is discussed. (GRA)

- 3164 (CONF-730915-- , pp 4-19) ATMOSPHERIC CONCENTRATIONS OF FISSION PRODUCT NOBLE GASES. Bernhardt, D.E.; Moghissi, A.A.; Cochran, J.A. 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Electrical power production by nuclear reactors, in addition to other nuclear activities, results in the production of radioactive noble gases. The release of these radioactive gases, at their source of production or through reprocessing of the fissile materials, results in radiation exposure to the world population. This paper considers past, present, and future fission-related radioactive noble gas production and releases. These releases of noble gases are then related to atmospheric concentrations, population exposures, and appropriate feasible control technologies. Krypton-85, because of its long half-life and fission yield, presents the greatest potential radiation exposure to the world population. The primary sources of production are nuclear power generation and plutonium production reactors. Naval propulsion reactors, nuclear weapons testing, and the postulated peaceful uses of nuclear explosives are secondary sources of production. The other releases associated with reactors primarily take place during fuel reprocessing.

- 3165 (CONF-730915-- , pp 109-114) ENVIRONMENTAL RADON. Harley, J.H. (Atomic Energy Commission, New York). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Of all the noble gases, radon has been the one which could be most easily measured in the atmosphere. This may very well be the reason why a bibliography of a thousand references to radon and its daughters can be easily assembled. Taking a more charitable view it may be that concern for the radiation dose to man

or the use of radon and its particulate daughters as tracers has brought on this flood of literature. Radon-222 is the most interesting of the three radon isotopes since its half-life is of the same order as many atmospheric processes. This allows tracing on a global scale and even the development of global inventories. While radon-222 and its daughters present the highest natural dose to man, we have been much more concerned by certain special cases of exposure. These include the occupational exposure of miners, the use of high radium content materials in housing, and the high radon content of certain local water supplies. These latter will be described briefly along with the more normal distribution of radon levels in the environment.

- 3166 (CONF-730915-- , pp 134-143) CONTRIBUTION OF RADON IN NATURAL GAS TO THE DOSE FROM AIRBORNE RADON-DAUGHTERS IN HOMES. Barton, C.J.; Moore, R.E.; Rohwer, P.S. (Oak Ridge National Lab., TN). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Data have been obtained on the radon concentration in natural gas supplied to several metropolitan areas in the United States. The average value of 20 pCi/l was selected to estimate the contribution of this source of natural radioactivity to doses from radon-daughters received by individuals in homes. Radon-daughter concentrations in the home atmosphere were calculated by use of computer programs for an 8000 ft³ house in which 27 ft³ of gas per day was used for cooking in an unvented kitchen range. The total estimated dose to the bronchial epithelium included contributions from radon plus daughters in the outside ventilation air, each of which was assumed to be present at a concentration of 0.13 pCi/l, and from the radon plus daughters in the natural gas. The latter contribution averaged approximately 3 percent of the total dose. There was a 3.5 percent decrease in the estimated total dose when the air change rate increased from 0.25 to 2.0 per hour. We conclude that radon and radon-daughters entering the home with natural gas produce a negligible fraction of the total dose to the respiratory system of home occupants from airborne radon-daughters.

- 3167 (CONF-730915-- , pp 175-191) INTEGRATED ENVIRONMENTAL MODELING SYSTEM FOR NOBLE GAS RELEASES AT THE SAVANNAH RIVER PLANT. Cooper, R.E. (E.I. du Pont de Nemours and Co., Aiken, SC). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

The Savannah River Plant (SRP) is a large nuclear complex engaged in varied activities and is the AEC's major site for the production of weapons material. As a result of these activities, there are continuous and intermittent releases of radioactive gases to the atmosphere. Of these releases, the noble gases constitute about 11 percent of the total man-rem exposure to the population out to a distance of 100 km. Although SRP has an extensive radiological monitoring program, an environmental modeling system is necessary for adequately estimating effects on the environment. The integrated environmental modeling system in use at SRP consists of a series of computer programs that generate and use a library of environmental effects data as a function of azimuth and distance. Annual average atmospheric dispersion and azimuthal distribution of material assumed to be released

as unit sources is estimated from a 2-year meteorological data base--assuming an arbitrary point of origin. The basic library of data consists of: ground-level concentrations according to isotope, and whole body gamma dose calculations that account for the total spatial distribution at discrete energy levels. These data are normalized to tritium measurements, and are subsequently used to generate similar library data that pertain to specific source locations, but always with respect to the same population grid. Thus, the total additive effects from all source points, both on- and off-site, can be estimated. The final program uses the library data to estimate population exposures for specified releases and source points for the nuclides of interest (including noble gases). Multiple source points are considered within a single pass to obtain the integrated effects from all sources.

- 3168 (CONF-730915-- , pp 488-491) POSSIBLE EFFECTS OF NOBLE GAS EFFLUENTS FROM POWER REACTORS AND FUEL REPROCESSING PLANTS. Whipple, G.H. (Univ. of Michigan, Ann Arbor). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

The noble radioactive gas of principal interest in the nuclear industry is krypton-85 because of its relatively large fission yield and its long half-life. This paper considers the various ways in which krypton-85 can deliver radiation doses to the human body; external irradiation by beta particles and gamma rays, and internal irradiation from the gas inside the respiratory tract and dissolved in body tissues. Equilibrium and transient conditions are discussed. The calculations summarized in this paper indicate that the present maximum permissible concentration of krypton-85 in public air (3×10^7 $\mu\text{Ci}/\text{ml}$) delivers a dose rate of about $1/5$ of that recommended by the ICRP. The long-term significance of krypton-85 and other noble radioactive gases from the nuclear power industry is reviewed.

- 3169 (CONF-730915-- , pp 654-665) CONSIDERATIONS IN SITING LONG-TERM RADIOACTIVE NOBLE GAS STORAGE FACILITIES. Cohen, J.J.; Peterson, K.R. (Univ. of California, Livermore). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Projections of future fission reactor capacity indicate that the present practice of releasing radioactive noble gases (primarily krypton-85) to the atmosphere cannot safely be allowed to continue indefinitely. Ongoing research programs are developing methods of extracting and concentrating these waste gases so they may be stored for extended periods, thereby allowing them to decay to relatively safe levels. Anticipating the need for facilities specifically designed for long-term storage of noble gases, we have reviewed some factors which might be considered in developing optimum siting criteria. Among these factors are, above- vs. below-ground storage, meteorology, geography, and demography. The objective used in these considerations is minimization of resulting population doses, both long- and short-term, from a major release, either instantaneous or continuous from the various facilities. Those sites considered are remote islands, continental shorelines, mountain tops, deep water, and inland low-population-density areas. Assuming an equal probability of containment failure at

each of the site options, we conclude that siting is relatively inconsequential for long-term population doses. Siting, however, is important for short-term exposures to local populations, especially where there might be a possibility of exceeding Radiation Protection Guides. The relative significance of long- vs. short-term doses resulting from exposures to radioactive noble gases is also discussed.

- 3170 (UERL--2) COMPARATIVE LEVELS OF ENVIRONMENTAL RADIOACTIVITY IN UTAH FROM INDUSTRY AND FALLOUT. A PROGRESS REPORT OF RADIOECOLOGICAL INVESTIGATIONS OF AIRBORNE RADIOACTIVITY IN THE UTAH ENVIRONMENT, JULY 1, 1972--JUNE 30, 1973. Pendleton, R.C. (Utah Univ., Salt Lake City (USA). Lab. of Environmental Radioactivity). 1973. Contract E(26-1)-0462. 194p. Dep. NTIS \$7.50.

Radioactivity in air, vegetation, soil, and wild animals in Utah was determined during July 1972 through June 1973, and results are presented. Methods for continuous measurement of the daughter products of radon and thoron were developed and used for calculations of the integrated dose to the lungs of humans.

- 3171 PROCEEDINGS OF THE 6TH CONFERENCE ON RADIATION HYGIENE, 1973. Hradec Kralove, Czechoslovakia; Purkyne Medical Research and Postgraduate Institute Press (1973). 340p.
The communications to this conference, held at Jasna pod Chopkom, reproduced in this volume, include: investigation of immunoglobulin levels in the blood serum of uranium miners; the influence of work stress on immunoglobulin levels of uranium miners; exposure to radiation of the hands of laboratory workers and medical assistants working with products labelled with radionuclides; excretion of tritium in workers preparing labelled compounds; individual dosimeter for fast neutrons; histological types of lung cancer at different exposures to radon daughters; radiation-induced lung cancer; relation between lung cancer and long-term exposure to radon daughters; determination of the radium 226 body burden on the sole basis of radon exhalation measurement of whole-body gamma radiation; use of biochemical indicators of exposure in the uranium industry.

- 3172 GENERAL PRINCIPLES OF RATING FISSION PRODUCTS UPTAKE INTO THE BODY OF FARM ANIMALS AND RADIONUCLIDE CONCENTRATION IN THE FORAGE. Skryabin, A.M. pp 172-180 of Radiobiologiya i radioekologiya selskokhozyajstvennykh zhivotnykh. Annenkov, B.N.; Dibobes, I.K.; Aleksakhin, R.M. (eds.). Moscow: Atomizdat (1973). (In Russian)
6 refs..

Some principles of establishing norms for the content of main fission products such as Sr^{89} , Sr^{90} , I^{131} and Cs^{137} in fodders for farm animals are described. These norms are established on the bases of the norms of radionuclide contents in human foods. It is emphasized that no generally applicable norms of radionuclide contents in the diets of farm animals can be worked out because of the great diversity of possible radiation situations, of geographical zones, and of conditions of agricultural production.

- 3173 (TID--27811) AEC INVESTIGATION OF TRITIUM RELEASE OCCURRENCE AT THE ROCKY FLATS PLANT. (USAEC, Washington, D.C.). 1973. Contract EY-76-C-04-3533. 14p. Dep. NTIS, PC A02/MF A01.

Eighteen conclusions are presented concerning tritium levels in holding ponds, evaporation ponds, and other locations; release of tritium from processing of plutonium scrap; occupational exposures; public health hazards; analyses of liquid process wastes; and the Colorado department of health surveillance program. Recommendations are presented concerning safety of accidental discharge prevention, environmental monitoring, and other procedures. (HLW)

- 3174 (AERE-R--7486) NUCLEAR ACCIDENT DOSIMETRY. PART 2. DOSE ASSESSMENT PROCEDURE. Delafield, H.J.; Dennis, J.A.; Gibson, J.A.B. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). 1973. 44p. UK pounds1.00.

The report provides detailed operational instructions on procedures of dose assessment with the UKAEA personnel criticality dosimeter, the installed neptunium dosimeter and the AERE/RPS personnel film dosimeter. Sections cover: general procedure for making a dose assessment; personnel monitoring; dosimeter measurements; body measurements; derivation of doses from dosimeter measurements; and estimation of doses from body, hair and clothing measurements. Appendices are devoted to measuring equipment and calibration procedures, and radiochemical analysis procedures for wool and hair.

- 3175 (CONF-730915-- , pp 261-268) ENVIRONMENTAL RADIATION MONITORING WITH THERMOLUMINESCENT DOSIMETERS. Geiger, E.L.; Sanchez, E.A. (Eberline Instrument Corp., Santa Fe, NM). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Thermoluminescent dosimetry (TLD) provides one method of documenting environmental radiation dose rates near nuclear facilities. Factors that affect the accuracy and precision of TLD measurements have been evaluated using badges with five solid lithium fluoride dosimeters sealed in plastic. Data obtained from 1968 to date (July 1973) indicate that careful attention to annealing and reading can provide an accurate and precise documentation of background radiation dose rates. In-transit exposure was found to be the largest variable, and this error can be eliminated by local annealing and reading. With the TLD program described, a change at the site perimeter as small as 10 mrem/year can be measured, but the problem is to identify the reason for the change. Changes in background radiation dose rates due to snow cover, soil moisture, and various other natural phenomena, and natural differences in dose rates at various locations near a nuclear power station complicate the interpretation of TLD data. For best results, the monitoring program should be designed to compare indicator and reference station measurements as well as pre-operational and operational measurements.

- 3176 (CONF-730915-- , pp 432-438) DOSIMETRY FOR RADIOACTIVE NOBLE GASES. Soldat, J.K.; Bramson, P.E.; Parker, H.M. (Battelle Pacific Northwest Lab., Richland, WA). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

This is a survey of conventional methods and results in the dosimetry of the noble gases, with special reference to the environmental considerations relating to nuclear energy applications. Radon problems will be excluded, as will all issues specific to medical

applications of the gases. (Physiological input data from medical work is, of course, an important part of the required dosimetry information.) Among the dosimetry methods is the well-known Monte Carlo method of W. Snyder, et al., at ORNL. This will be briefly put in perspective, as a relevant paper by the ORNL group is included in this volume. The normally low and variable concentrations of the mixed noble gases in the environment lead to problems both in "calculational dosimetry" and in field measurements. The phases selected for comment will mainly relate to reasonable perspective in accounting for such secondary and tertiary intake pathways as the drinking of water containing dissolved noble gases.

- 3177 (CONF-730915-- , pp 420-431) CALCULATIONS OF THE ABSORBED DOSE TO A MAN IMMERSED IN AN INFINITE CLOUD OF KRYPTON-85. Snyder, W.S.; Dillman, L.T.; Ford, M.R.; Poston, J.W. (Oak Ridge National Lab., TN). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

A person exposed to an infinite cloud of krypton-85 is exposed to at least seven sources of radiation: (1) photons emitted in air, (2) beta particles emitted in air, (3) photons and beta particles emitted by krypton-85 present in the air passages of the lungs, (4) photons and beta particles emitted by krypton-85 present in body tissues, (5) bremsstrahlung produced in air, (6) bremsstrahlung produced by beta particles incident on the body, (7) bremsstrahlung produced within the body. The energy spectra of scattered photons are calculated by the method of Dillman and half these spectra are taken as incident on the body, producing doses to body organs as in MIRD Pamphlet No. 5. Doses to various organs, e.g., red bone marrow, gonads, etc., from sources (1) and (5) above are calculated by interpolation from these results. Dose to skin from source (2) is calculated by integration of Berger's point kernel (MIRD Pamphlet No. 7) in air. Doses from sources (3), (4), (6), and (7) are calculated by methods developed by the authors of internal sources of photons and beta particles. If the intensity in the cloud is 1 $\mu\text{Ci}/\text{m}^3$, a dose to skin at a depth of 7 mg/cm^2 is approximately 1.8 rad/a; to the lungs, 32 mrad/a; ovaries, 6.2 mrad/a; and testes, 16 mrad/a.

- 3178 (FRNC-TH--681) GAMMAGRAPHY IN ODONTOLOGY. Faure-Baumann. (Paris-7 Univ., 75 (France)). 1973. 54p. (In French). Dep. NTIS (US Sales Only), PC A04/MF A01.

Copies available from Service de Documentation, CEN Saclay, B.P. No.2, 91190 Gif-sur-Yvette (France).

The application of gammagraphy to odontology, using a miniaturized gamma source, was studied. The new portable system presented, consisting of a sealed source of ^{125}I and its shielding, is 7 mm wide and 10 cm long. The operation and advantages of this apparatus are described.

- 3179 (HRF--0003704) RADIATION THERAPY. SUBCOMMITTEE REPORT. (Health Planning Association of Northwest Ohio, Maumee (USA)). 1973. 8p. NTIS \$3.50.

Availability of radiation therapy services within Lucas County, Ohio, was investigated. No hospital-based cobalt unit exists in the county, which incorporates Toledo, Ohio; three units exist in private physicians' offices. There is one full-time radiotherapist in the

entire northwest Ohio area. Centralization of radiotherapy in centers with a minimum case load in compliance with recommended guidelines is the suggested approach to eliminating deficiencies in availability of radiation therapy services. Criteria for such centralized centers are set forth. The development of a major radiotherapy center at the Medical College of Ohio is recommended, as is the addition of a cobalt unit at two local hospitals. No additional cobalt units -- private or hospital based -- are recommended for Lucas County without further consideration of utilization data. Portions of this document are not fully legible. (GRA)

- 3180 SAFE USE OF IONIZING RADIATIONS. London; Dept. of Health and Social Security (1973). 17p.

Based on the "Code of Practice for the protection of persons against ionizing radiations arising from medical and dental use" (CIS 74-423), this handbook shows how hospital staff can avoid exposing themselves and others to these hazards. It is designed particularly for junior and student nurses. Contents: ionizing radiations, their types and characteristics; their uses and dangers; basic principles in their safe use; safe use in practice; explanation of terms.

- 3181 NATURAL RADIATION EXPOSURE IN THE UNITED STATES. Oakley, D.T. (Environmental Protection Agency, Washington, D.C. (USA)); Moeller, D.V. (Harvard School of Public Health, Boston, Mass. (USA)). pp 407-412 of Health physics problems of internal contamination. Bujdosó, E. (ed.). Budapest; Akadémiai Kiadó (1973).

From IRPA 2 European Congress on Radiation Protection; Budapest, Hungary (3 May 1972).

3 figs., 1 ref., 1 table.

An estimation of the population dose from radiation of natural origin and its variation was made on the basis of the series of Aerial Radiological Measurement Surveys (ARMS) conducted over major areas of the U. S. The mean terrestrial dose equivalent was calculated to be 40 mrem/year. On the basis of knowledge of the distribution of population with elevation the average dose equivalent from cosmic radiation was found to be 44 mrem/year. In order to get an estimate of the gonadal dose equivalent, the influence of housing, biological shielding, and the DE contribution from internal emitters was also considered, and it was calculated to the U. S. population to be 88 mrem/year. (INIS)

- 3182 Radiopharmaka - biokinetische Daten und Ergebnisse von Neuberechnungen der Strahlendosis. (RADIOPHARMACEUTICALS: BIOKINETIC DATA AND RESULTS OF RADIATION DOSE CALCULATIONS). Deff, K.; Kaul, A.; Roedler, H.D.; Vogelsang, T. Berlin, F.R. Germany; Informationsdienst fuer Nuklearmedizin der Freien Universitaet Berlin (1973). 654p. (In German).

With tabs. and refs..

By the submitted compilation for the first time values of absorbed doses for most radiopharmaceuticals are available, for which the retention in the different organs has been described according to a uniform mathematical model and for which the absorbed dose calculations have been performed by means of an extended 'concept of absorbed fractions'. The biokinetic data taken as a basis for absorbed dose calculations represent the majority of the data available from literature and suitable for absorbed dose calculations. Contrary to earlier

tabulations of absorbed doses without presentation of biokinetic data and methods of calculation the submitted publication enables the reader not only to look up target doses, but also to get detailed information on the biokinetics of radiopharmaceuticals.

- 3183 (BMVg-FBWT--73-24) BIOLOGICAL EFFECT OF FAST NEUTRONS. NUMBER OF RETICULOCYTES AND WEIGHT OF SPLEEN OF MICE FOLLOWING WHOLE-BODY IRRADIATION. Otto, F.J. (comp.). (Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Abt. Wehrtechnik; Bundesministerium der Verteidigung, Bonn (Germany, F.R.). Dokumentationszentrum der Bundeswehr). 1973. 20p. (In German). INIS.

6 figs.; 4 tabs.; 19 refs..

The efficiency of fast neutrons of the energy range from 1.7 to 5 MeV in reducing the reticulocyte count and in diminishing the spleen weight was studied in male NMRI mice and compared with the effects of 250 kV X-rays. The neutron induced decrease of reticulocyte number in the peripheral blood is complete two days after irradiation. At this time even low doses cause a maximal effect. The relation between the rise of effect and the increase of exposure is great in the range of low doses and small in high doses. The relative biological effectiveness of neutrons in reducing the reticulocyte count is 2.5 after low doses and 1.2 after high doses. The spleen of irradiated mice shows a marked loss of weight, the lowest weight values are observed at the second day after irradiation. The relative effectiveness of neutrons in diminishing the spleen weight is 2.1 at low doses, the RBE decreases to 1.4 and rises again to 1.9 at higher doses. These results are compared with previous findings on mortality response and leucocyte and lymphocyte decrease in mice after neutron irradiation. Reticulocyte and lymphocyte count are found to be useful indicators for the detection and evaluation of neutron damage in the sublethal dose range.

- 3184 ACTION OF LOCAL IRRADIATION OF BONES ON THE ALKALINE PHOSPHATASE ACTIVITY. Wawrzekiewicz, M. Radiobiol. Radiother.; 14: No. 4, 385-391(1973). (In Russian). ALKALINE PHOSPHATASE; BIOLOGICAL RADIATION EFFECTS; BIOLOGICAL REPAIR; BONE MARROW; DIAGNOSIS; DOSE-RESPONSE RELATIONSHIPS; INACTIVATION; PARTIAL BODY IRRADIATION; RATS; SKELETON; TIME DEPENDENCE; X RADIATION

- 3185 RESPIRATION AND PHOSPHORYLATION IN LIVER AND KIDNEY MITOCHONDRIA OF RATS EXPOSED TO HIGH-ENERGY GAMMA AND BETA RADIATION. Mokhoreva, S.I.; Vetlugina, N.S. Aktual. Probl. Onkol. Med. Radiol.; 3: 364-367(1973). (In Russian).

The effect of whole-body irradiation with γ rays (radiation source ^{60}Co) at 40 rad and β rays (source, a linear accelerator, electron energy 25 MeV) at 43 rad on oxidative phosphorylation in liver and kidney mitochondria was studied in rats. Gamma radiation gradually slowed the esterification of phosphate and respiratory rate during the oxidation of succinate in the liver and kidney mitochondria. The decrease was largest on day 15 after irradiation. However, the P/O ratio did not decrease by more than 10 to 12 percent. Despite the oxidation of glutamate in the mitochondria, respiration, phosphate consumption, and P/O ratio scarcely changed. Irradiation with electrons slowed the rate of oxidation of succinate and glutamate in liver mitochondria within 3 to 7 days. Phosphate

consumption decreased at the same time so that the P/O ratio remained unchanged. Beta irradiation had virtually no effect on liver mitochondria. There is a discussion of the mechanism of action of high-energy radiation on the phosphorylation system of the mitochondria.

- 3186 RADIATION--BIOCHEMICAL MECHANISM IN THE DEVELOPMENT OF RADIATION DAMAGE TO THE GENETIC APPARATUS IN ANIMAL CELLS. Grigorovich, N.A.; Monastyrnaya, P.L.; Aleksa, T.F. Aktual. Probl. Onkol. Med. Radiol.; 3: 330-335(1973). (In Russian).

In experiments on rats, the effect of irradiation at 50 to 500 rads on some properties of chromatin isolated from the spleen and thymus was investigated. Irradiation of DNA solutions resulted in the appearance of single-strand breaks at a frequency of 0.2 break/molecule (mol. weight DNA = 6 - 8.10⁶). Breaks were not found in DNA isolated from mouse spleen 10 minutes after irradiation, but 1 to 1.5 breaks per molecule were found in the DNA of irradiated animals 1.0 to 1.5 days after irradiation. Irradiation of isolated chromatin had no effect on its hydrodynamic characteristics, but chromatin from tissues of irradiated animals was characterized by structural anomalies only in the later periods of irradiation when the lysosomal enzymes (acid DNase and kathepsin) were activated. There is a discussion of the role of lysosomal enzymes in injuries to the genome during irradiation of animals.

- 3187 EFFECT OF γ RADIATION IN RELATIVELY LOW DOSE ON THE ACTIVITY OF GLUTAMINASE IN SUBCELLULAR FRACTION OF BRAIN AND LIVER CELLS. Tkach, V.M. Aktual. Probl. Onkol. Med. Radiol.; 3: 385-389(1973). (In Russian).

The effect of γ -irradiation at a dose of 40 rads was studied on the exchange of glutamine in rats. It has been shown that the irradiation leads to a significant lowering of the activity of glutaminamidohydrolase (I) in brain mitochondria and in the liver after 1, 3, 7, 15, and 30 days post exposure. In the fractions containing nuclei, fraction of myofibrillae and connective tissue, a slow down of the deamidation of glutamine also takes place, and only after 7 days the ammonium separation from glutamine increases and returns to normal. At the 15 and 30 days a second wave of the lower rate of the activity of I takes place. The type of the changes of I is the same in both organs, but in the liver it is expressed to a lesser degree. (JPRS)

- 3188 EFFECT OF X RAY IRRADIATION ON A NUMBER OF ASPECTS OF KIDNEY FUNCTION. Minasyan, G.N.; Uganesyan, A.S. (Inst. of Biochemistry, Erevan). Zh. Eksp. Klin. Med.; 13: No. 6, 22-23(1973). (In Russian).

The experiments were carried out on white rats, 3 to 5 months in age, who were subjected to a whole-body, x ray dose of 700 R. All the animals died on the 6th to 7th day. The results of the study showed that starting from the second day after irradiation the content of ammonia and urea in the urine increased significantly over a period of 4 to 5 days with a subsequent gradual decrease which was associated with a sharp decrease in daily diuresis. The content of ammonia in the blood and tissues hardly changed, while the content of glutamine increased significantly. Beginning from the third day after irradiation the amount of urea in the blood and liver increased to significant values before death of the animal. It was established that after irradiation the content of free amino acids (glutamine,

aspartic) in the blood and in a number of tissues (brain, liver, muscle, kidney) increased slightly, while a significant increase was noted in the urine. The irradiated animals showed a significant increase in the content of endogenous glutamine in the bone marrow, liver and kidney tissues. (SJR)

- 3189 QUANTITATIVE HISTOLOGICAL STUDIES ON AGING CHANGES IN CEREBRAL CORTEX OF RHESUS MONKEY AND ALBINO RAT WITH NOTES ON EFFECTS OF PROLONGED LOW-DOSE IONIZING IRRADIATION IN THE RAT. Brizzee, K.R. (Delta Regional Primate Research Center, Covington, La. (USA). Dept. of Neuropathology and Anatomy). pp 141-160 of Neurobiological aspects of maturation and aging. Ford, D.H. (ed.). Amsterdam, Netherlands; Elsevier (1973).

From Symposium on neurobiological aspects of maturation and aging; Brooklyn, N.Y., USA (26 Jun 1972).

Brains of a series of eight young adult control (150 days) and eight middle-aged control (550 days) rats were fixed by a two-stage perfusion procedure employing Heidenhain's 'susa' solution. An equal number of rats were exposed to γ irradiation at 6.5 R/day beginning on the 50th postnatal day and were sacrificed in the same manner and at the same age levels as the previous group. Paraffin sections were cut at 20 and 6 μ from cerebral cortical area 3 in the rat brains. Sections used for cell counts were stained with Harris' hematoxylin and eosin or iron hematoxylin, gallocyanin, acid fuchsin and ponceau de xylidene. Counts of neurons and glia were carried out at 20 equally spaced submolecular depth levels, and cell frequency profiles were plotted for each of the two cell types. The mean neuron and glial packing density for the total depth of the submolecular cortex of area 3 was not significantly different in young adult and middle-aged controls or in young adult irradiated (total dose 650 R) and control animals. However, statistical evaluation of data for relative depth levels 7 through 20 indicated that the packing density in this zone was significantly less ($P < 0.02$) in middle-aged controls than in young adult animals. In middle-aged irradiated rats (total dose about 3250 R) neuron and glial packing densities for total depth of submolecular cortex were not significantly different than in control animals at the same age level. However, the values obtained for neuron packing density at relative depth levels 1 through 8 were significantly lower in middle-aged irradiated than in middle-aged control rats. The neuron packing density in middle-aged irradiated rats was significantly lower than in the young adult irradiated males. In electron micrographs, an increase in the amount of glycogen granules in astrocyte cell processes in cerebral cortex of irradiated middle-aged rats was noted, but there was no evidence of any other ultrastructural alterations.

- 3190 (CONF-730915--), pp 469-471 BIOLOGICAL EFFECTS OF THE RADIOACTIVE NOBLE GASES. Morken, D.A. (Univ. of Rochester, NY). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

The biological effects of the noble gases depend on the physical properties of these gases, since they are nonreactive chemically under physiological conditions. A property of interest for the non-radioactive gases is their solubility in the various body tissues and fluids. Some of these noble gases have the additional property of radioactivity. The

combination of radioactivity and solubility permits the identification of a critical organ according to established procedures. The pathological response is not always greatest, or even of singular importance, in the organ so identified by calculation. Biological responses are desired for a prudent evaluation of the biological effect, but the choice of response and the mode of irradiation pose a large problem. The radioactive gases decay schemes include the emission of alpha particles, beta particles, positrons, and electron capture; and this decay is sometimes accompanied by gamma radiation. The resulting daughter products may be foreign or natural to the body; whether stable or radioactive, all are reactive chemically. The effects due to the radiation, however, probably exceed those chemical effects which may result. Radon has no stable isotope. The radon isotopes decay primarily through the emission of alpha particles. The biological effects from radon may arise in greater measure from its daughter products, which include alpha particle, beta particle, and gamma ray emitters, than from the parent radon. The consequences of these properties are discussed with particular reference to krypton-85 and radon-222.

- 3191 (CONF-730915-- , pp 492-500) RELATION BETWEEN CUMULATIVE EXPOSURE TO RADON-DAUGHTERS, LUNG DOSE, AND LUNG CANCER RISK. Jacobi, W. (Inst. for Radiation Protection, Munich). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

The dose/exposure-ratios regarding the influence of uncombined radon-daughters for the bronchial region resulting from different dosimetric models are compared. For dose evaluation, the uncombined fraction of the total potential α -energy in the inhaled air seems to be a more suitable parameter than the uncombined activity-fraction of RaA only. The mean dose to the basal cell layer in the medium bronchi is probably not considerably higher than the mean dose to the total bronchial tree. Under normal conditions in mines, a ratio of 0.4 to 1.0 rad/WLM can be expected. In the second part of the paper, the observed lung cancer-risks among uranium miners in the USA and the CSSR are discussed. Although the relative risk coefficient is similar for both groups, the absolute risk coefficient in the CSSR-group is significantly higher than in the USA-group of miners. On the basis of these data, an absolute lung cancer-risk of 10 to 20 cases/ 10^6 person-years per WLM is recommended for radiation protection purposes. Finally, the risk concept for the assessment of an exposure limit for uranium miners is discussed. The derived life time limit of 100 to 200 WLM for occupational exposure is comparable with the limit derived from the 15 rem/year-concept.

- 3192 (CONF-730915-- , pp 501-506) BIOLOGICAL EFFECTS OF RADON ON THE LUNG. Morken, D.A. (Univ. of Rochester, NY). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

The biological effects of radon on the lung arise primarily from the alpha decay of the short-lived decay products of radon inhaled. Radon is chemically inert and so is distributed throughout the body according to its solubility in the various body tissues. The daughter products are isotopes of polonium, bismuth, and lead, which are treated individually by the tissues and fluids, within the confines of their brief half-lives. Experiments with

inhaled decay products indicate the dose to lung is much greater than to the rest of the body. Extensive injury was done to the bronchial tree, but the lesions did not lead to bronchial tumors. After irradiation ceased, these lesions were quickly repaired. Permanent changes, but no cancer, were seen in the region of the respiratory bronchioles. Compared to other alpha emitters in the lung, the alpha radiation from radon is particularly inefficient in producing radiation-specific tumors. The conclusion is taken that the radiation effects of alpha emitters may be inconsequential compared to the chemical effects of the alpha emitters.

- 3193 (CONF-730915-- , pp 527-531) REVIEW OF THE URANIUM MINER EXPERIENCE IN THE UNITED STATES. Hilberg, A.W. (National Academy of Sciences, Washington, DC). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Mining of uranium ores on a very small scale began in the United States in 1898. In 1948 mining of uranium ores increased significantly as a result of the increasing demands of the atomic energy program, particularly, the weapons program. It was well-known that radioactivity was associated with uranium ore and potential health hazards had been identified as early as 1921. It was then suggested that the large number of lung cancers found in the Schneeberg miners could possibly be caused by ionizing radiation. Radiation exposure to the lungs of uranium ore miners comes about because of varying concentrations of radon decay products in the mine atmosphere. Measurements of the amount of radioactivity in mine atmospheres began in the United States in 1950 and between 1951 and through 1968, approximately 43,000 measurements were made in about 2,500 uranium mines. Periodic medical surveys were made starting in 1950, but it was not until 1954, that a concerted effort was made to examine all miners. At this time an epidemiological study was begun by the U.S. Public Health Service to determine the effects of uranium mining with particular emphasis on the problem of lung cancer induction. The study of the miners, the results of which have been published, revealed a distinct and somewhat dramatic increase in lung cancer. This increase has been ascribed to the radiation exposure to radon-daughters. Because of the presence of a number of other potential occupational carcinogens in the dust of underground mines, there has been some question as to whether radon and radon-daughters constitute the principal cause of increased lung cancer risk among these miners.

- 3194 (CONF-730915-- , pp 532-539) RADIOLOGICAL HEALTH SIGNIFICANCE OF RADON IN NATURAL GAS. Johnson, R.H. Jr.; Bernhardt, D.E.; Nelson, N.S.; Calley, H.W. Jr. 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Natural gas contains varying amounts of radon-222 which becomes dispersed within homes when natural gas is used in unvented appliances, such as kitchen ranges and space heaters. The average dose equivalent to the bronchial epithelium of an individual from use of natural gas in these appliances was estimated for typical exposure conditions to be 0.015 and 0.054 rem per year respectively. When extrapolated to the United States population at risk, the estimated population tracheobronchial dose equivalents were 1,874,000 and 854,000 person rems per year for these appliances, or a

total of 2,728,000 person-rems per year. A review of exposure conditions, lung model parameters, dose conversion factors, and health effects data indicated this population dose could possibly result in up to 15 deaths per year. For perspective, the concentrations and health effect consequences from use of natural gas containing radon were compared to current radon guides, natural background radon, and normal lung cancer mortality statistics. These comparisons indicated that natural gas represents about 0.9 to 1.5 percent of the guide of 0.33 pCi/l derived from ICRP No. 2, 0.3 to 3 percent of normal radon background, and 0.03 to 0.08 percent of normal lung cancer mortality. It was concluded that radon in natural gas does not contribute significantly to respiratory cancer mortality in the United States.

- 3195 (CONF-730915-- , pp 602-604) RADIATION PROTECTION IN URANIUM MINES: A REVIEW. Holaday, D.A. (City Univ. of New York). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

The consequences of the exposures to external and internal radiation which can occur in the mining of uranium ores are well-documented. Methods for evaluating and controlling these hazards have been developed by health protection agencies and the uranium mining companies. These procedures have been described in numerous reports from a number of the uranium-producing countries. The only feasible procedure for reducing exposure to external radiation is limitation of working time. Controls of radon and radon-daughters are directed at reducing influx of radon and dilution ventilation to supply uncontaminated air to working areas. Many different methods are employed depending on the particular circumstances. There is no "typical" uranium mine so the health protection group must adjust procedures to fit the conditions in each situation. Control of long-lived radioactive dust is usually accomplished by the dust-suppression methods used to control silica dust. In some circumstances, where high-grade ore is being mined, additional controls may be required to reduce concentrations of long-lived alpha emitting elements to acceptable levels.

- 3196 (CONF-730915-- , pp 605-611) RADON PROTECTION IN URANIUM MINES. Pradel, J. (Atomic Energy Commission, Fontenay-aux-Roses, France). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

In uranium mines, radon is present with its daughter products which may be fixed on different particles, the form of which is described. It is well-known that uranium miners may contract some pulmonary diseases when radon-daughter concentrations are too high during long periods. The origin of lung cancer is confirmed by animal experiments. To have a good protection, practical limits for radon and radon-daughter concentrations are established and individual monitoring is initiated. This monitoring must be well-fitted because the actual levels are almost up to maximum permissible levels. Ventilation is the most important technique to control radon and radon-daughter concentrations. Some ventilation investigations in an experimental mine are described.

- 3197 (CONF-730915-- , pp 612-629) SOME

RADIOLOGICAL HEALTH ASPECTS OF RADON-222 IN LIQUIFIED PETROLEUM GAS. Gesell, T.F. (Univ. of Texas, Houston). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Natural Gas (NG) produced at the wellhead contains varying quantities of radon-222. Previous studies of wellhead gas from several gas fields have indicated concentrations ranging to 1450 pCi/l at standard temperature and pressure. When natural gas is processed to remove impurities and heavier, more valuable hydrocarbons, the radon becomes concentrated in the ethane and propane fractions. This concentration apparently takes place during fractionation because of the similar boiling points of radon, propane, and ethane. Liquified Petroleum Gas (LPG), which is widely used as a domestic fuel and as a chemical feedstock, is composed principally of propane and ethane. Potential human exposure to radon-222 and its progeny contained in NG and LPG can occur in a variety of ways to both occupational groups and to members of the general public. The paper includes an identification of the pathways of human exposure, the results of approximately 400 measurements of radon-222 concentrations in retail LPG and domestic NG supplies, and measurements of radon-222 concentrations in gas processing plant streams. An exposure model for the domestic fuel usage pathway is also presented.

- 3198 (CONF-730915-- , pp 630-636) PERSONNEL DOSIMETRY OF RADON AND RADON-DAUGHTERS. Becker, K. (Oak Ridge National Lab., TN). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

During the past five years there has been increasing interest in monitoring the individual exposure of persons to radon and, more importantly, the radon progeny attached to aerosol particles. Several devices have been proposed. These include the following: passive detectors based on nuclear track emulsions and track etching foils; semi-active systems in which the aerosols are collected electrostatically and detected by scintillator/film combinations or track etching; and active systems based on the collection of aerosols on a filter, and integrating measurement of the alpha flux from the filter by TLD or track films. All these systems have drawbacks, which have been minimized in a small active system based on alpha particle track etching which was originally developed at ORNL in 1969. Since then it has undergone substantial laboratory and field testing, and has been subjected to various improvements. The system is briefly discussed.

- 3199 (CONF-730915-- , pp 647-653) ENVIRONMENTAL RADIATION STANDARDS CONSIDERATIONS FOR KRYPTON-85 AND RADON. Martin, J.E.; Mills, W.A. (Environmental Protection Agency, Washington, DC). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

To ensure adequate public health protection, the Environmental Protection Agency is charged with the responsibility of establishing appropriate standards for controlling radioactive materials in the environment. Two noble gases are presently of interest to EPA, namely naturally occurring radon (radon-222) and fission-produced krypton (krypton-85). To establish standards pertaining to these gases, information on source concentration, source

control and effectiveness, and estimates of health effects must be utilized when available. From this viewpoint, the control of krypton emission from nuclear fuel reprocessing plants and the concentrations of radon in natural gas will be discussed.

3202 (CONF-730915-- , pp 472-483) KINETICS AND DISTRIBUTION OF XENON-133 AND KRYPTON-85 IN THE HUMAN BODY. Turkin, A.D.; Moskalev, Yu.I. (Inst. of Biophysics, Moscow). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

The kinetics of ^{85}Kr and ^{133}Xe metabolism were studied in experiments on 15 male human beings whose ages ranged from 25 to 50 years. The half-life of ^{133}Xe in the lungs varied from 18 to 42 seconds, with an average half-life of 30 seconds. The elimination of ^{133}Xe from the blood is nearly the same as that for the lungs. The half-lives of ^{133}Xe in the muscle and fat tissues ranged from 0, 1 to 0, 42 and 4.6 to 7.4 hours, respectively. The ^{133}Xe uptake by the skin does not exceed 0.4 percent. The elimination of ^{85}Kr from the human body is well described by the sum of exponents. The average half-life of ^{85}Kr in the blood and lung is the same as those for ^{133}Xe , however, in the fat tissue it ranged from 1.8 to 3.7 hours, with an average half-life of 2.7 hours, and in the muscle tissue it ranged from 4 to 11 minutes.

3203 (CS-INIS--13) INTERNAL THORIUM CONTAMINATION IN THOROTRAST PATIENTS. Dvorak, V.; Malatova, I.; Tuscany, R.; Ruzickova, V.; Klanova, K.; Kaufman, B.; Pazderova, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zarení). 1973. 115p. (In Czech). Dep. NTIS (US Sales Only), PC A06/MF A01.

Available from Institut Hygieny a Epidemiologie. Centrum hygieny zarení, Prague, Czechoslovakia.

The results are presented of a radiotoxicological study in the internal contamination with thorium of thorotrast patients administered ThO_2 within 1930 to 1950 in Czechoslovakia in X-ray examinations. Dosimetric information was obtained using a whole-body counter; the information obtained by excretion analysis on the content of ^{232}Th daughters, such as ^{212}Pb , ^{212}Bi , and ^{208}Tl in the blood, urine and feces was completed with karyological examination of selected patients. Detailed information on ^{208}Tl organ distribution in 10 thorotrast patients showed that 62% of the whole-body activity of the radionuclide was retained in the liver and in the spleen.

3204 (ORNL-tr--4499) METHOD OF EVALUATING THE CONTENT OF NATURAL RADIOACTIVE ISOTOPES OF THE URANIUM AND THORIUM FAMILY IN DRINKING WATER AND FOOD. Mordberg, Ye.L.; Shalayev, I.L. Translated by G.D. Lord from Gig. Sanit.; No. 8, 52-55(1973). 6p. Dep. NTIS, PC A02/MF A01.

Methods for calculating the annual maximum permissible intake limits for naturally-occurring radioisotopes found in drinking water, soil, and agricultural products are discussed. It is pointed out that these radioisotopes occur in mixtures with daughter products, and it is suggested that analysis be limited to those members of the uranium and thorium family with the highest radiation danger, including ^{238}U , ^{235}U , ^{234}U , ^{231}Pa , ^{234}Th , ^{232}Th , ^{230}Th , ^{228}Th , ^{227}Th , ^{227}Ac , ^{226}Ra , ^{224}Ra , ^{223}Ra , ^{210}Po , ^{210}Bi , and ^{210}Pb . Maximum permissible intake data are included.

3205 (CONF-730915-- , pp 439-468) BEHAVIOR OF KRYPTON-85 IN ANIMALS. Kirk, W.P. (Environmental Protection Agency, Research Triangle Park, NC). 1973.

3200 A COMPARATIVE STUDY OF TWO METHODS OF ESTIMATING HUMAN INTERNAL EXPOSURE HAZARDS RESULTING FROM THE INGESTION OF SEA FOODSTUFFS. Bittel, R. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Niveaux de Contamination Radioactive du Milieu Ambiant et de la Chaine Alimentaire). pp 413-416 of Health physics problems of internal contamination. Proceedings of the IRPA 2nd European Congress on Radiation Protection organized by the Eotvos Lorand Physical Society, Health Physics Section. Bujdosó, E. (ed.). Budapest; Akademiai Kiado (1973).

From IRPA 2 European Congress on Radiation Protection; Budapest, Hungary (3 May 1972). 5 refs., 1 table.

A discussion is presented on the advantages and drawbacks of two methods (the concentration factor and the specific activity methods) of estimating human internal exposure hazards resulting from the ingestion of contaminated sea foodstuffs. The methods have been applied to several different diets to be considered as critical in the European Community. The agreement between the two methods was fairly satisfying; but a deviation over one magnitude was found in the case of ^{45}Ca (in bone), ^{90}Sr (in bone), ^{137}Cs (whole body), ^{131}I (in thyroid), and ^{54}Mn (in liver). (INIS)

3201 (CONF-730915-- , pp 507-519) BIOLOGICAL EFFECTS OF DAILY INHALATION OF RADON AND ITS SHORT-LIVED DAUGHTERS IN EXPERIMENTAL ANIMALS. Palmer, R.F.; Stuart, B.O.; Filipy, R.E. (Battelle Pacific Northwest Labs., Richland, WA). 1973.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

Syrian golden hamsters, C57BL mice, and specific-pathogen-free rats were exposed simultaneously in groups of 16 animals each for 90 hours per week to aerosols consisting of radon plus 3000--6000 Working Levels of radon-daughters with and without 18 mg/m³ carnotite uranium ore dust. Condensation nuclei concentrations ranged from 2000--4000 per ml and from 90,000--120,000 per ml in the chamber without and with uranium ore dust, respectively. At 4 months of exposure only one of the rodents remained alive. Histopathology of radon-daughter exposed mice includes acute interstitial pneumonitis, severe pulmonary congestion, and suppurative rhinitis; mice inhaling radon-daughters with ore showed these lesions plus macrophage proliferation, alveolar septal cell hyperplasia, and bronchial epithelial hyperplasia. Hamsters inhaling radon-daughters showed proliferating lesions characterized by alveolar septal thickening, bronchiolar epithelial hyperplasia, septal fibrosis, and occasionally adenomatoid metaplasia and squamous metaplasia. Hamsters inhaling radon-daughters with ore dust showed similar effects plus granulomatous response and intense septal fibrosis. Rats inhaling radon-daughters showed lesions similar to those of hamsters but more focalized with classic radiation pneumonitis; rats exposed to radon-daughters with ore showed similar lesions, with greater consolidation and pneumoconiosis. These findings will be discussed in relation to pulmonary pathology in uranium miners.

From Symposium on noble gases; Las Vegas, NV, USA (24 Sep 1973).

Symposium on noble gases.

The in vivo behavior of ^{85}Kr can usually be predicted if the protein/water/fat composition of a body or tissue and its blood perfusion characteristics are known. The amount of isotope taken up by the tissue is the weighted sum of component tissue: air partition coefficients multiplied by the concentration of ^{85}Kr in alveolar air, while the rates of saturation or desaturation are determined by perfusion. Equations describing postulated kinetic behavior of noble gases are presented and compared with ^{85}Kr data reported for individual organs and tissues from several species in the literature, and data obtained with whole guinea pigs and rats. Partition coefficients are discussed and theoretical values compared with in vitro data from this laboratory and the literature, and with in vivo data for blood and 22 other organs/tissues obtained with guinea pigs in current work. Equilibrium beta radiation doses to various organs/tissues from a contained isotope in guinea pigs breathing ^{85}Kr at present MPC/sub a/ are given.

- 3206 (NRPB-R--6) ATOMIC ENERGY AND THE ENVIRONMENT. Marley, W.G. (National Radiological Protection Board, Harwell (UK)). Dec 1972. 18p. NTIS (US Sales Only). Available from H.M. Stationery Office, price Pound0.50.

A review is given of the radiation doses used as criteria for protecting populations from the effects of a nuclear power programme. These include the levels recommended by ICRP for doses to the population and the acceptable variations in the natural background. The latest available data on risks of radiation-induced biological effects are discussed. Estimates of the radiation doses to the public from the current nuclear power programmes are very low and even the predicted values in the year 2000 are only 2×10^{-3} of the dose from natural background. This level of dose taken in conjunction with our present knowledge of risks shows that the biological impact on the world population is negligibly small. Finally, a comment is made on the sources of population exposure from radioactivity associated with possible thermonuclear reactors.

- 3207 (NRPB-R--8) FUTURE IMPLICATIONS OF SOME LONG-LIVED FISSION PRODUCT NUCLIDES DISCHARGED TO THE ENVIRONMENT IN FUEL REPROCESSING WASTES. Bryant, P.M.; Jones, J.A. (National Radiological Protection Board, Harwell (UK)). Dec 1972. 21p. NTIS (US Sales Only).

Available from H.M. Stationery Office, price Pound0.50.

Current reprocessing practice leads to the discharge to the environment of virtually all the krypton-85 and tritium, and a large fraction of the iodine-129, formed as fission products in reactor fuel. As nuclear power programmes expand the global inventory of these long-lived nuclides is increasing. The radiological significance of these discharges is assessed in terms of radiation exposure of various population groups during the next few decades. The results of this assessment show that krypton-85 will give higher dose rates than tritium or iodine-129, but that on conventional radiological protection criteria these do not justify taking action to remove krypton-85 from reprocessing plant effluents before the 21st century.

- 3208 RENAL SCINTISCANNING WITH $^{99\text{m}}\text{Tc}$ -IRON ASCORBATE IN CHILDREN. Mussa, G.C.; Martini-Mauri, M.; Bacolla, D.; Bona, G.; Favetta, S. (Univ., Turin). *Precis. Met. Molding*; 14: No. 11, 359-364 (Nov 1972).

A comparison is made between renal scintiscans obtained with ^{197}Hg and $^{99\text{m}}\text{Tc}$ -iron ascorbate with a view to determining whether the latter tracer gives more significant data. In some cases, both isotopes were experimented in the same subject. Illustrative examples from a large series are given for 2 normal children, 2 with congenital deformities and 3 with unilateral or bilateral nephroblastoma. The conclusion is reached that both isotopes offer the same results. The $^{99\text{m}}\text{Tc}$ complex is responsible for a much lower kidney irradiation dose, but practical difficulties militate against its routine use.

- 3209 COLOUR SCINTISCANS IN THE DIAGNOSIS OF HEPATIC TUMORS IN CHILDREN. Mussa, G.C.; Martini-Mauri, M.; Bacolla, D.; Bona, G.; Favetta, S. (Univ., Turin). *Panminerva Med.*; 14: No. 10, 314-319 (Oct 1972).

Attention is drawn to the use of $^{99\text{m}}\text{Tc}$ sulfur colloid for liver scintiscans in paediatric practice. In addition to providing the most satisfactory results from the technical point of view, this tracer enables the attainment of virtually negligible whole body and liver radiation absorption dose levels. The examination is of particular importance as a means of detecting the presence of primary or metastatic liver tumors. Personal cases of liver tumor (1 primary; 5 metastatic) in children aged 3 months to 12 years are presented. Emphasis is laid on the fact that in paediatric subjects, particularly those in the first few months of life, scintiscanning with $^{99\text{m}}\text{Tc}$ sulphide colloid led to the solution of diagnostic problems that would otherwise have involved the employment of more laborious and traumatic techniques. A further important facet of the use of scintiscanning is that the efficiency of antitlastic treatment can be followed.

- 3210 ESTIMATING THE PRECIPITATION OF RADIOACTIVE AEROSOLS IN THE RESPIRATORY SYSTEM. Bykhovskii, A.V.; Zarayev, O.M.; Rakhmanov, B.N. *Gig. Sanit.*; 37: 46 (Sep 1972). (In Russian).

A method for estimating the accumulation of radioactive aerosols in the respiratory system of workers occupationally exposed to such conditions is described. The method utilizes a six-stage impactor such that the data obtained characterizes the distribution of aerosol radioactivity directly, i.e., by the aerodynamic diameter of the particles. A pulmonary dynamics model in conjunction with a logarithmic normal characterization of radioactivity distribution is used to determine the relative portion of radioactive aerosol retained in different sections of the respiratory tract (nasopharynx, tracheo-bronchial section, and lower section of the lungs). Coefficients of the retention of radioactivity, calculated with a logarithmic normal distribution and the aid of a linear programming method are given in tables. If aerosol radioactivity is more or less equally distributed throughout a controlled room, then readings from a stationary or portable aerosol sampler can be accepted as a satisfactory estimate of the true concentration and physicochemical properties of radioactive particles in air breathed by working personnel.

- 3211 (UERL--1) COMPARATIVE LEVELS OF

RADIOACTIVE AIR POLLUTANTS FROM INDUSTRY AND FALLOUT. A PROGRESS REPORT OF RADIOECOLOGICAL INVESTIGATIONS OF AIRBORNE RADIOACTIVITY IN THE UTAH ENVIRONMENT. Pendleton, R.C. (Utah Univ., Salt Lake City (USA). Lab. of Environmental Radioactivity). 31 May 1972. Contract E(26-1)-0462. 354p. Dep. NTIS \$10.50.

Results are reported of measurements carried on during the year 1971 and the first two months of 1972 on the radioactivity from natural as compared to artificial radiation sources in the environment in Utah. During this time, a major portion of our work was devoted to analyses of the data and preparation of a report related to the Baneberry venting event and the accumulation of data on fallout from the January 7, 1972 Chinese nuclear explosion. Calibration procedures were developed for air samplers for the establishment of the numbers of pCi/m³ in air. The responses of the air monitors in relationship to the ventilation index, seasonal effect, and the industrial complexity of the area were analyzed. Continuous measurements were made of the levels of radioactive materials in soils and vegetation and the results of these studies are presented mainly in tabular form. Comparisons have been made of the levels of radioactive materials in soils on the basis of square mile levels and the distribution of the radioactive materials in the soil profiles. Measurements of farm crops, including the major sources from which dairy products would be produced, have been made, and some comparisons by year and location have been made. Studies of secondary aerosols have been made using the dust accumulated on farm implements as the indicator of the kinds of secondary aerosols to which farmers and outdoorsmen might be exposed. These results would also be indicative of the kinds of dusts produced when high winds resuspend soil deposited radionuclides.

3212 (UCRL-Trans--11093) INTEGRAL METHODS OF PERSONAL DOSIMETRY OF FAST NEUTRONS. I. SURVEY OF EXISTING METHODS. Spurny, F. Translated from Jad. Energ.; 18: No. 10, 332-341(1972). 45p. Dep. NTIS \$4.00.

The paper is devoted to a survey of integral methods used in personal dosimetry of fast neutrons. The first part deals with methods currently used in practice. It discusses nuclear emulsions, sets of activation detectors, methods based upon moderation of fast neutrons, gas ionization, and radiation damage to semiconductors. For each method, the basic dosimetric characteristics are discussed, such as the energy dependence, dose, influence of dose rate, fading, γ -radiation effects. Some are characterized by directional dependence and the method of evaluation.

3213 (ORNL-tr--4339) LINES OF EXPERIMENTAL RESEARCH IN DEVELOPING MATHEMATICAL MODELS FOR ESTIMATING INTERNAL RADIATION. Bad'in, V.I.; Ermilov, A.P.; Margulis, U.Ya.; Khrushch, V.T. (Institut Biofiziki, Moscow (USSR)). 1972. Translation by S.D. Blalock Jr. from pp 81-86 of SZS--148. (CONF-7206102--1). 7p. Dep. NTIS \$3.50.

From Working meeting on the question of radiation protection; Berlin, F.R. Germany (8 Jun 1972).

The report presents material involved with the statistical approach to the problem of modeling internal radiation and the trend of experimental research dictated by that approach. The content of a radioactive isotope in an organ must be viewed as a random function for which the ratio of two independent incorporations, on the average by probability,

corresponds to the ratio of the corresponding amounts of the isotope that have accumulated in the organism. This tenet determines the principle of similarity. Specifically, it follows from it that the distribution of the arbitrary amount in the organism with multiple repetition of the experiment will be subordinate to a log-normal law. Second, the vital condition for creating the quantitative statistical model of the metabolism is a large volume of experimental data. This requires perfection of the unified rapid methods of research.

3214 (PB--244163) PION DEPTH-DOSE DISTRIBUTION INCLUDING THE EFFECT OF INTERACTIONS IN FLIGHT. Boyd, D. (Stanford Univ., Calif. (USA). High-Energy Physics Lab.). Feb 1971. 18p. (HEPL-TN--71-1). NTIS \$3.25.

The computer design of a toroidal superconducting pion channel is described. The design is aided by means of an interactive graphic display of pion trajectories through the system. Several examples of such pion trajectory groups are presented and these illustrate the focussing quality of the channel under various conditions of interest. The computer ray tracing program is described and listed in the appendix. The final design parameters of pion channel are: solid angle greater than 1 sr, delta p/p of several per cent, and final focal spot dimensions of 1 cm. These parameters are suitable for the proposed applications in cancer therapy. (GRA)

3215 EXPERIENCES IN THE COUNTRY-WIDE RADIOLOGICAL PROTECTION SURVEYS IN INDIA. Bhargava, V.K.; Supe, S.J.; Samuel, K.M. (Bhabha Atomic Research Centre, Bombay (India). Div. of Radiation Protection). Indian J. Radiol.; 31: No. 1, 12-19(Feb 1971).

The radiological protection surveys constitute an essential part of the radiation safety program of any country. The surveys are arranged for on-the-spot monitoring of areas in the vicinity of the radiation sources and the inspection of source, housing and storage facilities and scrutinising the work practices of the personnel handling these sources. In India the program of conducting radiological protection surveys was taken up by the Division of Radiological Protection, Bhabha Atomic Research Centre, in the year 1958. An analysis of 1612 surveys covering 750 x-ray medical diagnostic units, 255 gamma radiography units, 108 x-ray radiographic units, 156 isotope laboratories, and 75 brachytherapy installations is presented. These surveys were carried out during the period from 1958 to 1973. The analysis shows that the percentage of installations unsatisfactory from the radiation safety viewpoint for various common inadequacies ranged between 20 % and 40 %. It further reveals that 5 % of the total radium stock in the country is either damaged or in leaking conditions.

3216 (AD--888503) BETA-RADIATION DOSES FROM FALLOUT PARTICLES DEPOSITED ON THE SKIN. FINAL REPORT, 17 APR 1970--30 JUN 1971. Mikhail, S.Z. (Environmental Science Associates, Burlingame, Calif. (USA)). Jan 1971. Contract DAHC20-70-C-0289. 105p. (ESA-TR--71-01). NTIS \$5.50.

Absorbed beta-radiation dose expected from fallout particles deposited on the skin was estimated by use of the Beta Transmission, Degradation and Dissipation (TDD) model and a Condensed-State Diffusion-Controlled model that describes the mechanism of fission-product

absorption in fallout. A fission density of 10 to the 15th power fissions per cubic centimeter of fallout material was assumed. Comparison of computed doses with the most recent experimental data relative to skin response to beta-energy deposition leads to the conclusion that even for fallout arrival times as early as 1000 seconds (16.7 minutes post-detonation), no skin ulceration is expected from single particles 500 micron or less in diameter. Absorbed gamma doses calculated for one particle size (100 microns) show a beta-to-gamma ratio of about 15. Dose ratio for larger particle sizes will be smaller. Doses from arrays of fallout particles of different size distributions were computed, also, for several fallout mass deposition densities; time intervals required to accumulate doses sufficient to initiate skin lesions were calculated. These times depend strongly on the assumed fallout-particle-size distribution. Deposition densities in excess of 100 mg per square foot of the skin will cause beta burns if fallout arrival time is less than about three hours, unless the particles are relatively coarse (mean particle diameter more than 250 microns). (Author) (GRA)

- 3217 POISONED POWER: THE CASE AGAINST NUCLEAR POWER PLANTS. Gofman, J.W.; Tamplin, A.R. Emmaus, PA; Rodale Press Inc. (1971). 368p.

Book. NUCLEAR POWER;NUCLEAR POWER PLANTS; HAZARDS;HEALTH HAZARDS;REACTOR SAFETY;REACTOR ACCIDENTS;RADIOACTIVE WASTES;PUBLIC RELATIONS

- 3218 NUCLEAR POWER, TECHNOLOGY, AND ENVIRONMENTAL LAW. Gofman, J.W.; Tamplin, A.R. (Univ. of California, Berkeley). Environ. Law; 2: No. 1, 57-73(1971).

NUCLEAR POWER;NUCLEAR POWER PLANTS;LEGAL ASPECTS;HAZARDS;REACTOR SAFETY;ENVIRONMENTAL EFFECTS

- 3219 (RFP-Trans--222) QUANTITATIVE THORIUM DETERMINATION IN 30 ORGANS DURING HUMAN THOROTRASTOSIS. Kampmann, H.; Wesch, H.; Wegener, K. Translated from Nucl.-Med., Suppl. (Stuttgart); No. 9, 579-585(1971). 7p. Dep. NTIS, PC A02/MF A01.

Using neutron-activation analysis, quantitative thorium determinations were carried out in 30 organs and tissues of 5 thorotrast patients. The measured results were compared with autoradiographic findings. With one exception, neutron-activation analysis was able to detect measurable, quantitative but very variable thorium concentrations in the various organs and tissues. The detection limit was around 0.2 μg thorium per g of tissue. With the autoradiograph, thorium could be found in organs with a thorium content above 10 μg per g of tissue, as indicated by neutron-activation analysis. The highest thorium concentrations were found in the spleen, liver, bone marrow and lymph nodes and adrenal glands. The measured results are in agreement with findings of recent animal experiments and clinical studies.

- 3220 CYSTEAMINE PROTECTION AGAINST LETHAL AND GROWTH-INHIBITING EFFECTS OF PRENATAL X AND GAMMA IRRADIATION. Roberts, J.M. (Univ. of Detroit). Teratology; 3: No. 4, 319-324(Nov 1970).

Exposure of pregnant rats to gamma radiation on day 16 of gestation produced nearly double the number of neo- and postnatal offspring deaths as did x irradiation. Dose level (185 R), dose rate (10-12 R/minute), and distance

from the source were the same in both groups. Cysteamine given prenatally prior to either gamma or x irradiation significantly decreased mortality. In the gamma-irradiated group the mortality rate remained significantly higher than in the control group, but in the x-irradiated group it was reduced to the control level by pretreatment with cysteamine. Cysteamine given to pregnant rats immediately following gamma irradiation had no effect on offspring mortality.

- 3221 POSSIBILITIES OF THE TEST OF INHIBITION OF ^{131}I STORAGE IN THE THYROID GLAND. Vlahov, N. Folia Med. (Plovdiv); 10: No. 3, 176-181(1968). (In German).

Results are reported on the use of the inhibition test for ^{131}I absorption in which on six successive days thyroid extract was administered in 30 cg pills containing 0.51 to 0.69 mg I. The test results on 102 patients showed that in thyreotoxicosis the ^{131}I accumulation was reduced only slightly with a variation W in the limits from 0.53 to 4.74. In illnesses in which the increased absorption had an extrathyroid character W varied between 31.88 and 52.95. The normal accumulation oscillates between 5.91 and 16.08. The differential diagnostic value of the tests for the determination of the proper therapy was discussed. (JSR)

- 3222 (AD-A--036044) RADIATION MEASUREMENTS UTILIZING THE USAF CHEMICAL DOSIMETERS. FINAL REPORT. Sigoloff, S.C.; Logie, L.C.; Borella, H.M.; Pickering, J.E. (School of Aviation Medicine, Randolph AFB, Tex. (USA)). Mar 1960. 84p. (SAM--59-21). NTIS PC A05/MF A01.

The Operation Teapot program for the correlation of prompt-neutron and prompt-gamma radiation dose with biologic effects includes: (1) Prompt-neutron and prompt-gamma angular distribution measurements as a function of distance; (2) prompt-neutron spectra measurements; (3) the determination of neutron and gamma attenuation coefficients for structural and other shielding materials, including terrain; (4) correlation of radiation dose measurements with effects in several species of animals; (5) gamma air-phase propagation measurements; (6) gamma and neutron depth-dose measurements. To accomplish these objectives two dosimeter technics were used. One (the water-equivalent, single-phase dosimeter) is sensitive to fast neutron and gamma rays. The other (the 2-phase, fast neutron insensitive gamma-ray dosimeter) is less than one percent sensitive to fast neutrons but responds to gamma radiation. Both systems are sensitive to thermal neutrons but can be shielded with lithium to reduce this response. These two systems were used primarily for gamma measurements.

- 3223 (AD-A--036099) LATE EFFECTS OF TOTAL-BODY ROENTGEN IRRADIATION. LONGEVITY AND INCIDENCE OF NEPHROSCLEROSIS AS INFLUENCED BY PARTIAL BODY SHIELDING. Lamson, B.G.; Billings, M.S.; Bennett, L.R. (School of Aviation Medicine, Randolph AFB, Tex. (USA)). May 1959. 16p. (SAM--59-33). NTIS PC A02/MF A01.

Two hundred forty-two female Wistar rats were observed throughout their life span following 1,000 R hypoxic total-body or partial-body irradiation. Hypoxic radiation superimposed anesthesia resulted in 67 percent 30 day mortality, compared to 9 percent mortality without anesthesia. Selection of the colony by acute postirradiation deaths did not

influence the magnitude of late radiation sequelae as measured by life shortening. Growth retardation during the second postirradiation year was well correlated with life-shortening. Life-shortening was observed after partial-body irradiation to an extent approximately proportional to the weight of radiated tissue. Nephrosclerosis was not observed unless the upper abdomen was included within the radiation field. Other than nephrosclerosis, a similar incidence of disease was observed at death in control and irradiated rats whether partial-body or total-body irradiated.

- 3224 (AD-A--036166) SOME EFFECTS OF NUCLEAR RADIATION EXPOSURE ON PRELIMINARY WGTA TRAINING PERFORMANCE OF RHESUS MONKEYS. McDowell, A.A.; Brown, W.L.; Wicker, J.E. (School of Aviation Medicine, Randolph AFB, Tex. (USA)). May 1959. 7p. (SAM--59-53). NTIS PC A02/MF A01.

Sixty-four naive rhesus monkeys, divided into three radiation subgroups, were studied with respect to progression through a series of training stages designed to prepare the subjects for object discrimination testing on the Wisconsin General Test Apparatus (WGTA). The subgroups were also compared on simple object-quality discrimination learning. The exposure to a nuclear radiation predated the present study by approximately 11 months. The results were as follows: (1) The higher the previous radiation dosage, the faster the response to food when initially placed in the WGTA. (2) The higher the previous radiation dosage, the slower the response to a wooden object block as a sign for food. (3) The higher the previous radiation dosage, the faster the discrimination of a food-rewarded object block after object blocks has acquired the stimulus value of food.

- 3225 (AD-A--036039) STUDIES ON THE MECHANISM OF LEUKEMOGENESIS BY IONIZING RADIATION. Upton, A.C. (School of Aviation Medicine, Randolph AFB, Tex. (USA)). Jan 1959. 16p. (SAM--59-17). NTIS PC A02/MF A01.

The induction of leukemia by ionizing radiation is influenced by many variables, including radiation intensity, radiation dose, fraction of the body irradiated, genetic differences in susceptibility, age at irradiation, sex, and other physiologic factors. The influence of these variables on the induction of leukemia varies with the hematologic type of leukemia induced. Irradiation increases the susceptibility of adult mice to filterable leukemogenic agents that, administered after irradiation, enhance the development of leukemia.

- 3226 (AD-A--036097) EFFECTS OF IONIZING RADIATION UPON HUMAN PSYCHOMOTOR SKILLS. Payne, R.B. (School of Aviation Medicine, Randolph AFB, Tex. (USA)). Dec 1958. 11p. (SAM--59-29). NTIS PC A02/MF A01.

With the possible exception of the quadratic component of the 10-day performance sequence, there is no evidence that exposure to ionizing radiation has affected the psychomotor skills in question. Whether this exception is a true radiation effect is debatable. It could just as well have been a disease effect, for it must be presumed that the prescribed exposure intensity bore some relationship to the severity of the disease. This confoundment, of course, was unavoidable. What may be present in this analysis of the curvature aspect of performance sequence is some combination of radiation effect and the general debilitating effect of

the disease. In any event, the absolute magnitude of change from group to group seems too slight to be of any practical significance.

- 3227 (HW--51317) SURFACE DOSE FROM PLUTONIUM. Roesch, W.C. (Hanford Works, Richland, Wash. (USA)). 10 Jul 1957. 22p. Dep. NTIS \$3.50.

The surface dose rate for plutonium metal was studied to provide a basis for estimating what the surface dose rate would be for any relative isotopic composition. The chief practical conclusion of this report is that there is an advantage of smaller total dose rate if Pu is processed immediately after its purification from other radioactive materials. If this is done, the main dose rate will come from neutrons emitted during spontaneous fission. In general, the total dose rate will be so high as to rule out manual handling of the Pu. To show how this report can be used and to supply the above conclusions, the surface dose rate was calculated for Pu made from uranium that had received high reactor exposure (megawatt-days/ton, MWD/T). For freshly purified Pu, the surface dose rate from α and γ rays rises from about one rad/hr at low exposure to an equilibrium value of a little over four rad/hr at about 10,000 MWD/T. The neutron dose rate rises from zero to an equilibrium value of about one rem/hr. The α rays from Pu are quite low energy. If they are absorbed in some way, the remaining hard component rises from about 0.1 rad/hr to an equilibrium value of about 0.2 rad/hr. This is small compared with the neutron dose rate, but as the decay products of plutonium begin to emit significant numbers of gamma rays, the hard component increases rapidly. At the end of a week the hard component may be as much as twice the neutron dose rate. The same general behavior may be expected for all reactor methods of handling Pu. The main part of the dose rate of freshly purified plutonium will come from neutrons. The hard component of the γ rays will increase rapidly and within a few days will exceed the neutron dose rate. A general theory for calculating surface dose rate due to γ rays from a high atomic number emitting material in contact with tissue is discussed. (auth)

- 3228 (CH--3783) TOXICITY AND METABOLISM OF PLUTONIUM IN LABORATORY ANIMALS. Finkle, R.D.; Jacobson, L.O.; Kisielleski, W.; Lawrence, B.; Simmons, E.L.; Snyder, R.H. (Chicago Univ., Ill. (USA). Metallurgical Lab.). Aug 1946. Contract W-7401-ENG-37. 97p. Dep. NTIS \$5.00.

Separate abstracts were prepared for five sections included in this reissue of a 1947 report on the tissue distribution and biological radiation effects of injected Pu in mice, rats, and rabbits. (CH)

- 3229 (CH--3783, pp 33-45) SURVIVAL AND GROWTH OF PLUTONIUM-INJECTED ANIMALS. Snyder, R.H.; Kisielleski, W.; Finkle, R.D. Aug 1946. Toxicity and metabolism of plutonium in laboratory animals.

The experiments showed that the lethality of Pu in rats and mice does not depend greatly on the valence state or on the salt administered. Only slight differences were noted in the lethal effects on mice as compared with rats. From the mortality curves there was some indication that the mice (ABC and CF₁ averaged) were somewhat more sensitive than rats to doses that were acutely lethal but somewhat less sensitive to doses that caused death after several months. Further study with larger

numbers of animals and smaller increments in the doses of each salt might well bring out differences which were not detected here. This is suggested particularly since the metabolism of Pu has been found to be very similar but quantitatively different for rats and mice. In rats, the 30-day LD₅₀ was about 0.09 μ Ci/g. The 60-day LD₅₀ was only slightly less, while at 90 days it was 0.06 μ Ci/g. At 220 days the LD₅₀ was about 0.03 μ Ci/g. Some of the lower doses (0.016 and 0.0038 μ Ci/g) appeared to be lethal, but in those cases death was believed to be due to secondary infections. It is possible that the Pu in the animal increased the susceptibility to these infections. For mice, the corresponding values were: 30-day LD₅₀ = 0.08 μ Ci/g, 50-day LD₅₀ = 0.07 μ Ci/g, and 210-day LD₅₀ = 0.05 μ Ci/g. (auth)

- 3230 (CH--3783, pp 47-52) EFFECTS OF INGESTED PLUTONIUM. Snyder, R.H.; Lawrence, B.; Finkle, R.D. Aug 1946.

Toxicity and metabolism of plutonium in laboratory animals.

The first of the three Pu ingestion experiments indicated that less than 0.5 percent was absorbed from the G. I. tract of the rat, and that there was no large difference between the plus-4 and plus-6 states. The activities measured were extremely low, most of the samples yielding only 1 or 2 counts/min over the background count. The experiment was designed to detect absorption in amounts greater than 0.5 percent, and absorption of this magnitude was definitely ruled out. The second experiment, in which rat femurs only were measured, is a more accurate measure of the actual absorption, although it is based on a femur-to-carcass ratio of 1 to 30, whereas experiments with injected Pu showed that this ratio may vary over a wide range. Although the mouse experiment was based on just one animal, it was the best controlled, and was at such a level of activity that accurate measurements were possible. It was found that the retention at 26 days was 0.06 percent; hence the amount absorbed was equal to this figure plus the amount excreted in the urine. This absorption may be higher than normal as a result of the temporary damage to the intestinal tract caused by the large dose of alpha radiation. (auth)

- 3231 (CH--3783, pp 53-92) HEMATOLOGICAL EFFECTS OF PARENTERALLY ADMINISTERED PLUTONIUM IN MAMMALS. Jacobson, L.O.; Simmons, E.L. Aug 1946.

Toxicity and metabolism of plutonium in laboratory animals.

Hematological studies of the peripheral blood after the administration of Pu as the citrate in the plus-6 state or nitrate in the plus-4 or plus-6 states were made on mice, rats, and rabbits. The doses given were 0.001 to 0.119 μ Ci/g intravenously and intracardially to mice, 0.0006 to 0.006 μ Ci/g intracardially to rabbits, and 0.0003 to 0.125 μ Ci/g intravenously and intramuscularly to the rats. Morphological changes which were largely comparable to those previously described in animals after external irradiations with x rays, gamma rays, and fast neutrons, were seen in the nucleated cells of the peripheral blood after Pu administration. As evidenced by an increased erythrocyte diameter and increased mean corpuscular hemoglobin, a macrocytic anemic became apparent in rats after the parenteral administration of doses of plutonium between 0.0063 and 0.063 μ Ci/g. This effect was less significant in mice and rabbits after comparable doses. The acute and subacute hematological changes seen in the peripheral blood following plutonium administration were

paralleled by concomitant histological changes in the hemopoietic tissues. (auth)

- 3232 (BM-IC--6667) RADIUM IN MEDICAL USE IN THE UNITED STATES. Sayers, R.R. (Bureau of Mines, Washington, D.C. (USA)). 1932. 6p. TIC.

History of production and use of radium is outlined, dwelling particularly on distribution of radium for medical use in the United States.

- 3233 (INIS-mf--3331) NATIONAL RADIOBIOLOGICAL CONFERENCE AND SCIENTIFIC CONFERENCE OF THE INSTITUTE OF NATIONAL HEALTH IN URANIUM INDUSTRY. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)). [nd]. vp. (CONF-7605132--). NTIS (US Sales Only).

From National radiobiological conference of the Institute of National Health in Uranium Industry; Pribram, Czechoslovakia (17 May 1976).

Items are indexed separately. (PCS)

- 3234 (INIS-mf--3331, pp 74) EXPOSURE PARAMETERS AND SOME PROPERTIES OF ERYTHROCYTES OF URANIUM MINERS. Vich, Z.; Prochazka, J.; Brychtova, V.; Safandova, M. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)). [nd]. (In Czech).

From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

BIOLOGICAL RADIATION EFFECTS;CATALYSIS; DEHYDROGENASES;ERYTHROCYTES;GLUTATHIONE; METABOLISM;MINERS;OXIDOREDUCTASES;RADIATION DOSES;URANIUM ORES;URANIUM MINES

- 3235 (VZUPPR-P--2146/74) PERMISSIBLE LEVELS PERTAINING TO RADIATION HAZARDS IN THE MINING AND MILLING OF URANIUM AND THORIUM ORES. Dousset, M. (Vyvojovy Zavod Uranoveho Prumyslu, Kamenna (Czechoslovakia)). [nd]. 17p. (In Czech). (CONF-740935--4). TIC.

From International symposium on radiation protection in mining and milling of uranium and thorium; Bordeaux, France (9 Sep 1974).

Translation of a paper presented at an international symposium. Available from Vyvojovy zavod uranoveho prumyslu, Kamenna, Czechoslovakia.

The maximum permissible levels pertaining to radiation hazards in the mining and processing of uranium and thorium ores are discussed. The results are summed up of various authors related to this subject.

- 3236 (DOCKET-50213--652) HADDAM NECK PLANT. SEMIANNUAL RADIOACTIVE EFFLUENT AND WASTE DISPOSAL REPORT: JULY--DECEMBER 1976. (Connecticut Yankee Atomic Power Co., Hartford (USA)). [nd]. 55p.

Semiannual radioactive effluent and waste disposal report: July--December 1976. CONNECTICUT YANKEE REACTOR;RADIOACTIVE EFFLUENTS;ACTIVITY LEVELS;RADIOACTIVE WASTE DISPOSAL;LIQUID WASTES;GASEOUS WASTES;SOLID WASTES;PERSONNEL;RADIATION DOSES;METEOROLOGY; TRANSPORT;FISSION PRODUCT RELEASE;RELEASE LIMITS;KRYPTON 85;KRYPTON 87;KRYPTON 88;XENON 133;XENON 135;XENON 131;CARBON 14;TRITIUM;ARGON 37;IODINE 131;IODINE 133;IODINE 135;STRONTIUM 89;STRONTIUM 90;CESIUM 134;CESIUM 137;BARIUM 140;LANTHANUM 140;MANGANESE 54;COBALT 58;COBALT

60;RUTHENIUM 103;IRON 59;ZINC 65;ZIRCONIUM 95;
NIOBIUM 95;MOLYBDENUM 99;CERIUM 141;EUROPIUM
154;BERYLLIUM 7;CERIUM 144;RUTHENIUM 106;SILVER
110;ANTIMONY 124;ANTIMONY 125;COBALT 57;ARGON
37

BLOOD SERUM;CARBOXYLIC ACIDS;DAILY VARIATIONS;
LIVER;METABOLISM;QUANTITY RATIO;RATS;
TRIGLYCERIDES;WHOLE-BODY IRRADIATION;X
RADIATION

3237 (DOCKET-50219--1083) OYSTER CREEK
NUCLEAR POWER PLANT, UNIT 1. ANNUAL OPERATING
REPORT NO. 1: JANUARY--DECEMBER 1976.
(Jersey Central Power and Light Co.,
Morristown, N.J. (USA)). [nd]. 49p.

Net electrical power generated was 3,860,347
MWH with the reactor on line 6,967.3 hrs.
Information is presented concerning operations,
power generation, shutdowns, corrective
maintenance, chemistry and radiochemistry,
occupational radiation exposure, release of
radioactive materials, reportable occurrences,
fuel performance, and leak rate testing. (FS)

3238 (DOCKET-50266--599) POINT BEACH
NUCLEAR PLANT, UNITS 1 AND 2. ANNUAL
OPERATING REPORT: JANUARY--DECEMBER 1976.
(Wisconsin Electric Power Co., Milwaukee
(USA)). [nd]. vp. (DOCKET-50301--579).
TIC.

Unit 1 generated 227,877 MWH with the
generator on-line 540 hrs and Unit 2 generated
324,954 MWH with the generator on-line 696 hrs.
Information is presented concerning operating
experience; procedure changes, tests, and
experiments; maintenance, licensee event
reports and other events of interest; data
tabulations of electric power generation, unit
shutdowns, forced power reductions, and number
of personnel and Man/Rem exposure; eddy current
testing of steam generator tubes; and fuel
history. (FS)

3239 (DOCKET-50293--806) PILGRIM NUCLEAR
POWER STATION, UNIT 1. ANNUAL OPERATING
REPORT FOR 1976. (Boston Edison Co., Mass.
(USA)). [nd]. 54p.

Net electrical power generated was 2,415,511
MWH with the generator on line 5,333.6 hrs.
Information is presented concerning operations,
procedure changes, tests, experiments,
maintenance, unit shutdowns and power
reductions, and radiation doses to personnel.
(FS)

3240 (DOCKET-50334--474) BEAVER VALLEY
POWER STATION, UNIT 1. ANNUAL OPERATING
REPORT FOR 1976. (Duquesne Light Co.,
Pittsburgh, Pa. (USA)). [nd]. 300p.

Net electrical energy generated was 441,530
MWH with the generator on line 1714.9 hours.
Information is presented concerning operations,
maintenance, changes, licensee event reports,
power generation, shutdowns and forced power
reductions, personnel radiation exposures, and
unique reporting requirements. (FS)

3241 (INIS-mf--3331, pp 74) DAILY VARIATION
OF THE EFFECT ON METABOLISM OF SUBLETHAL X-RAY
EXPOSURE OF RATS. II. SERUM AND TISSUE
LIPIDS. Ahlers, I.; Ahlersova, E.; Sedlakova,
A.; Praslicka, M. (Univerzita P.J. Safarika,
Kosice (Czechoslovakia). Katedra Vseobecnej
Biologie). [nd]. (In Slovak).

From National radiobiological conference and
scientific conference of the Institute of
national health in uranium industry; Pribram,
Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and
scientific conference of the Institute of
national health in uranium industry .

ADIPOSE TISSUE;BIOLOGICAL RADIATION EFFECTS;

3242 (INIS-mf--3331, pp 74) DAILY VARIATION
OF THE EFFECT ON METABOLISM OF SUBLETHAL X-RAY
EXPOSURE OF RATS. I. BLOOD GLUCOSE AND TISSUE
GLYCOGEN. Ahlersova, E.; Ahlers, I.;
Paulikova, E.; Praslicka, M. (Univerzita P.J.
Safarika, Kosice (Czechoslovakia). Katedra
Vseobecnej Biologie). [nd]. (In Slovak).

From National radiobiological conference and
scientific conference of the Institute of
national health in uranium industry; Pribram,
Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and
scientific conference of the Institute of
national health in uranium industry .

ADIPOSE TISSUE;BIOLOGICAL RADIATION EFFECTS;
BLOOD;DAILY VARIATIONS;GLUCOSE;GLYCOGEN;LIVER;
METABOLISM;MYOCARDIUM;QUANTITY RATIO;RATS;WHOLE-
BODY IRRADIATION;X RADIATION

3243 (AECL--5540) PROGRESS REPORT, BIOLOGY
AND HEALTH PHYSICS DIVISION, JANUARY 1 TO MARCH
31, 1976. (Atomic Energy of Canada Ltd.,
Chalk River, Ontario. Chalk River Nuclear
Labs.). [nd]. 67p. (PR-B--109). NTIS
(US Sales Only).

Interim results are reported on research
under such broad classifications as dosimetry,
radiation monitoring, thermal pollution,
radionuclide migration, and radiation effects
on human populations and mammals.

3244 (AECL--5602) PROGRESS REPORT, APRIL 1
TO JUNE 30, 1976, BIOLOGY AND HEALTH PHYSICS
DIVISION. (Atomic Energy of Canada Ltd.,
Chalk River, Ontario. Chalk River Nuclear
Labs.). [nd]. 74p. (PR-B--110). NTIS
(US Sales Only).

Preliminary results are reported on research
covering such broad topics as dosimetry,
radiation monitors and detectors, aquatic
ecology, radionuclide migration, radiation
carcinogenesis, the effects of radiation on
human populations, and molecular biological
radiation effects.

3245 (INIS-mf--3331, pp 74) LEVELS OF
IMMUNOGLOBULINS, LYSOZYME AND TRANSFERRIN IN
BLOOD PLASMA AND OF LYSOZYME AND IGA IN SALIVA
OF MEDICAL PERSONNEL EXPOSED TO RADIATION.
Wagnerova, M.; Skokanova, K.; Wagner, V.;
Zikmundova, L. (Krajska Hygienicka Stanice,
Prague (Czechoslovakia)). [nd]. (In Czech).

From National radiobiological conference and
scientific conference of the Institute of
national health in uranium industry; Pribram,
Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and
scientific conference of the Institute of
national health in uranium industry .

AGE DEPENDENCE;BIOLOGICAL RADIATION EFFECTS;
BLOOD SERUM;IMMUNOGLOBULINS;IONIZING RADIATIONS;
LYSOZYME;MEDICAL PERSONNEL;RADIOLOGICAL
PERSONNEL;SALIVA;TRANSFERRIN;MEDICAL
SURVEILLANCE;PERSONNEL MONITORING

3246 (INIS-mf--3331, pp 74) EFFECT OF SMALL
URANYL AMOUNTS ON ENZYMATIC REACTION CHAINS IN
CELLS. Nosek, J. (OUNZ Praha 4
(Czechoslovakia)). [nd]. (In Czech).

From National radiobiological conference and
scientific conference of the Institute of
national health in uranium industry; Pribram,

Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

CATALYSIS;DEHYDROGENASES;ERYTHROCYTES; METABOLISM;MINERS;PHOSPHATASES;URANIUM ORES; URANYL COMPOUNDS;BIOLOGICAL RADIATION EFFECTS; HEALTH HAZARDS

- 3247 (INIS-mf--3331, pp 74) EFFECT OF ⁹⁹MO VALENCY ON ITS BONDING TO HUMAN AND RAT SERUM COMPONENTS. Kselikova, M. (Ustav Hematologie a Krevni Transfuzie, Prague (Czechoslovakia)); Bibr, B. (Ceskoslovenska Akademie Ved, Prague. Isotopova Laborator Biologickych Ustavu); Lener, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

ALBUMINS;BLOOD SERUM;ELECTROPHORESIS; GLOBULINS-ALPHA;GLOBULINS-BETA;GLOBULINS-GAMMA; MAN;MOLYBDENUM 90;RADIONUCLIDE KINETICS;RATS; TRACER TECHNIQUES;VALENCE;BIOLOGICAL RADIATION EFFECTS

- 3248 (INIS-mf--3331, pp 74) MEDICAL TRANSFER OF ACCIDENTALLY IRRADIATED AND CONTAMINATED PERSONS. Dostal, M.; Blaha, M.; Mazak, J.; Neruda, O.; Splino, M.; Vanasek, J.; Vondracek, V.; Zadak, Z. (Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J.E. Purkyne, Hradec Kralove (Czechoslovakia)); Homola, M. (Atomova Elektraren Bohunice, Jaslavske Bohunice (Czechoslovakia)); Vodicka, I. (Karlova Universita, Hradec Kralove (Czechoslovakia)). Lekarska Fakulta). [nd]. (In Czech).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

DECONTAMINATION;FIRST AID;PATIENTS;POST-IRRADIATION THERAPY;RADIATION ACCIDENTS; TRANSPORT

- 3249 (KR--153) LITERATURE SURVEY: HEALTH EFFECTS OF RADIATION. Tveten, U.; Garder, K. (Institut for Atomenergi, Kjeller (Norway)). [nd]. 66p. NTIS (US Sales Only).

49 references.

This report was originally written as a chapter of a report entitled 'Air pollution effects of electric power generation, a literature survey', written jointly by the Norwegian Institute for Air Research (NILU) and the Institutt for Atomenergi (IFA). (INIS RN242406). A survey is presented of the health effects of radiation. It has not, however, been the intention of the authors to make a complete list of all the literature relevant to this subject. The NILU/IFA report was meant as a first step towards a method of comparing the health effects of electric power generation by fission, gas and oil. Consequently information relevant to quantification of the health effects on humans has been selected. It is pointed out that quantitative information on the health effects of low radiation and dose rates, as are relevant to routine releases, does not exist for humans. The convention of

linear extrapolation from higher doses and dose rates is used worldwide, but it is felt by most that the estimates are conservative. As an example of the use of the current best estimates, a calculation of normal release radiation doses is performed.

- 3250 (PUB--107) INTRODUCTION TO RADIATION PROTECTION AT THE LAWRENCE BERKELEY LABORATORY. Thomas, R.H.; Haley, J.T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). [nd]. Contract W-7405-ENG-48. 24p. Dep. NTIS, PC A02/MF A01.

The script given here has been incorporated into a synchronized slide show, which will be of value in presenting to new personnel the basic information necessary to work efficiently and safely with ionizing radiations. It is also hoped that the slide-show will provide interesting information to personnel who do not, in the normal course of their employment, work with ionizing radiations. This script will be most efficiently used after seeing the slide show and is provided to refresh the viewer's memory.

- 3251 (CRSSA--1974, pp 46-49) ENZYMIC COLLECTION TEST AS TOTAL GAMMA IRRADIATION PROGNOSTIC TEST IN RAT, RABBIT AND MAN. Breuil, G.; Dinnequin, B. [nd]. (In French).

1974 scientific works.

The purpose of this study is to determine, during 30 days, what becomes the animal whose enzymatic co-ordinates are well known. Both 100, 160, 200, 325, 400, 650, 850, 975, 1000, 1300 rads irradiated rabbit serum enzymatic evolution and that of two 1000 rads in toto irradiated leukemic men for a cord graft are studied.

- 3252 (CRSSA--1974, pp 85-89) PRELIMINARY STUDY OF HAEMOSTASIS IN IRRADIATED ENTERECTOMISED DOG. DYNAMIC ASPECT OF COAGULATION: THROMBELASTOGRAM. Dubos, M.; Hainaut, J.; Drouet, J.; Niauxsat, P.M.; Nguyen, T.L.; Neveux, Y. [nd]. (In French).

1974 scientific works.

Some hematological changes due to the combined effects of ionizing radiations and surgery were studied in dogs irradiated at 250, 300 and 350 R. A constant hemorrhagic syndrome was observed with a dose-response relationship for 250 and 300 R and an increase or hypocoagulability for dose higher than 300 R, till total incoagulability.

- 3253 (CRSSA--1974, pp 77-84) PRELIMINARY STUDY OF HAEMOSTASIS IN IRRADIATED-ENTERECTOMISED DOG. PRIMARY HAEMOSTASIS, COAGULATION, PLASMA FACTORS EXPLORATION. Dubos, M.; Niauxsat, P.M.; Neveux, Y.; Nguyen, T.L.; Drouet, J.; Bac, P. [nd]. (In French).

1974 scientific works.

Some hematological changes due to the combined effects of ionizing radiations and surgery were studied in dogs irradiated at 250, 300 and 350R. A constant hemorrhagic syndrome was observed with an impairment of the platelets functions and a depletion of several coagulation factors.

- 3254 (CRSSA--1974, pp 117-119) INFLUENCE OF RADIOPROTECTORS ON PLASMATIC CORTICOSTEROID RATE OF WHOLE-BODY IRRADIATED MOUSE. Fatome, M.; Roge, C.; Andrieu, L. [nd]. (In French).

1974 scientific works.

Whole body irradiation of mammalia provides two increases of plasmatic corticosteroid rate: the first one, few hours after irradiation, is taken as a non specific response to irradiation stress; the second one is taken as a reaction of suprarenal-hypophyso-hypothalamosystem to radiation injury. Cysteamine injected before irradiation seems to decrease significance of this second increase. Therefore plasmatic corticosteroid assay seems to be an interesting test in biological dosimetry.

- 3255 (INIS-mf--3331, pp 74) DNA CAPACITY FOR BINDING ³H-AMD IN NUCLEI OF NON-IRRADIATED AND IRRADIATED LS/BL CELLS. Velcovsky, V.; Benes, L.; Rotreklova, E. (Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav). [nd]. (In Czech).

From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

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National radiobiological conference and scientific conference of the Institute of national health in uranium indus .

ACTINOMYCIN; CELL CYCLE; CELL NUCLEI; CHEMICAL BONDS; CHEMICAL RADIATION EFFECTS; EXTERNAL IRRADIATION; IN VITRO; LABELLED COMPOUNDS; LYMPHOSARCOMAS; MICE; TRACER TECHNIQUES; TRITIUM COMPOUNDS; TUMOR CELLS; DNA

- 3256 (INIS-mf--3331, pp 74) CHANGES IN SOME SERUM PROTEIN LEVELS IN CONTINUOUSLY IRRADIATED RATS. Chlebovska, K.; Chlebovsky, O.; Praslicka, M.; Palagyi, S. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie). [nd]. (In Slovak).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

BIOLOGICAL RADIATION EFFECTS; BLOOD SERUM; CHRONIC IRRADIATION; PROTEINS; QUANTITY RATIO; RATS; TRANSFERRIN

- 3257 (INIS-mf--3331, pp 74) EFFECT OF CONTINUOUS IRRADIATION ON FERTILITY OF MALE AND FEMALE RATS OF THE WISTAR STRAIN. Horak, J.; Horakova, A. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie); Mechirova, E. (Vysoka Skola Veterinarska, Kosice (Czechoslovakia). Ustav Histologie a Embryologie). [nd]. (In Slovak).

From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

BIOLOGICAL RADIATION EFFECTS; CHRONIC IRRADIATION; FEMALES; FERTILITY; MALES; RATS; TERATOGENESIS

- 3258 (INIS-mf--3331, pp 74) UNDERCOOLING TEST USED TO PREDICT RADIOSENSITIVITY IN MICE. Hosek, B.; Novak, L.; Misustova, J. (Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav). [nd]. (In Czech).

From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
COOLING; EXTERNAL IRRADIATION; HYPOTHERMIA; METABOLISM; MICE; OXYGEN; RADIOSENSITIVITY; TESTING; TEMPERATURE EFFECTS

- 3259 (INIS-mf--3331, pp 74) MORPHOMETRIC EVIDENCE OF RADIOPROTECTIVE EFFECT OF CYSTAMINE AND MEXAMINE ON RAT TESTES. Kamarad, V. (Palackeho Universita, Olomouc (Czechoslovakia). Lekarska Fakulta); Dostal, M. (Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J.E. Purkyne, Hradec Kralove (Czechoslovakia)). [nd]. (In Czech).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

Gamma radiation. CYSTAMINE; GAMMA RADIATION; MEXAMINE; MORPHOLOGICAL CHANGES; RADIATION PROTECTION; RATS; TESTES; RADIOSENSITIVITY EFFECTS; BIOLOGICAL RADIATION EFFECTS

- 3260 (INIS-mf--3331, pp 74) SOME CHANGES IN BLOOD COAGULATION AFTER LOW-DOSE AND FRACTIONATED IRRADIATION. Klir, P.; Pospisil, J.; Dienstbier, Z. (Karlova Universita, Prague (Czechoslovakia). Biofyzikalni Ustav); Skala, E. (Ustredni Vojenska Nemocnice, Prague (Czechoslovakia)). [nd]. (In Czech).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

BIOLOGICAL RADIATION EFFECTS; BLOOD COAGULATION; BLOOD COAGULATION FACTORS; BLOOD PLATELETS; FRACTIONATED IRRADIATION; RABBITS; RATS; WHOLE-BODY IRRADIATION

- 3261 (INIS-mf--3331, pp 74) INFLUENCE OF RADIATION DISEASE ON CENTRAL EFFECTS OF NITRAZEPAM IN MICE AND RATS. Kvetina, J.; Kvetinova, M.; Herink, J.; Michlova, J.; Polidar, J. (Karlova Universita, Hradec Kralove (Czechoslovakia). Farmaceuticka Fakulta). [nd]. (In Czech).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

BIOLOGICAL RADIATION EFFECTS; DRUGS; MICE; RADIATION SYNDROME; RATS; CHEMOTHERAPY

- 3262 (INIS-mf--3331, pp 74) GENETIC DAMAGE TO SOMATIC AND GAMETIC CELLS OF MICE DUE TO COMBINED APPLICATION OF X RADIATION AND CHEMICAL MUTAGEN. Kypenova, H.; Sram, R. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). [nd]. (In Czech).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

ALKYLATING AGENTS;BONE MARROW;CHROMOSOMAL
ABERRATIONS;DOMINANT MUTATIONS;GENETIC
RADIATION EFFECTS;LETHAL MUTATIONS;MICE;
MUTAGENESIS;MUTAGENS;X RADIATION;SYNERGISM;
RADIOINDUCTION

- 3263 (INIS-mf--3331, pp 74) POST-IRRADIATION CHANGES IN PLASMA BINDING CAPACITY OF DIAZEPAM IN RATS AND MICE. Laznicek, M.; Kvetina, J.; Komarkova, J. (Karlova Univerzita, Hradec Kralove (Czechoslovakia). Farmaceuticka Fakulta). [nd]. (In Czech).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

BIOLOGICAL RADIATION EFFECTS;BLOOD PLASMA; MICE;RATS;TRANQUILIZERS;WHOLE-BODY IRRADIATION; POST-IRRADIATION THERAPY

- 3264 (INIS-mf--3331, pp 74) REPAIR PROCESSES IN MICE CONTINUOUSLY IRRADIATED WITH DAILY DOSES OF 50, 100 AND 500 R UP TO A TOTAL DOSE OF 1000 R. Mackova, N.; Praslicka, M. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie). [nd]. (In Slovak).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

Gamma radiation. BIOLOGICAL REPAIR;BLOOD PLATELETS;BONE MARROW CELLS;CHRONIC IRRADIATION; DOSE RATES;GAMMA RADIATION;LEUKOCYTES;MICE; RADIATION INJURIES;SPLEEN CELLS;BIOLOGICAL RADIATION EFFECTS

- 3265 (INIS-mf--3331, pp 74) EFFECT OF 250 R OF WHOLE-BODY X-IRRADIATION AND 48 HOURS OF STARVATION ON DIURNAL RHYTHM OF PLASMA AND ADRENAL CORTICOSTERONE IN RATS. Malatova, Z.; Ahlers, I. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie). [nd]. (In Slovak).

From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

ADRENAL GLANDS;BIOLOGICAL RADIATION EFFECTS; BLOOD PLASMA;CORTICOSTERONE;DAILY VARIATIONS; FASTING;MALES;RATS;WHOLE-BODY IRRADIATION;X RADIATION;RADIOSENSITIVITY EFFECTS

- 3266 (INIS-mf--3331, pp 74) RADIATION DAMAGE TO CHROMATIN - RELEASE OF DNP SUBUNITS. Matyasova, J.; Skalka, M.; Ceykova, M. (Ceskoslovenska Akademie Ved, Brno. Biofyzikalni Ustav). [nd]. (In Czech).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

CHEMICAL RADIATION EFFECTS;CHROMATIN;DNA; MICE;RADIATION INJURIES

- 3267 (INIS-mf--3331, pp 74) CHANGES IN MI, M/P AND CHROMOSOMAL ABERRATIONS IN LIVER OF RA EMBRYOS AT VARIOUS TIME INTERVALS AFTER CONTINUOUS IRRADIATION. Mechirova, E. (Vysoka Skola Veterinariska, Kosice (Czechoslovakia). Ustav Histologie a Embryologie); Horak, J.; Horakova, A. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie). [nd]. (In Slovak).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

BIOLOGICAL RADIATION EFFECTS;CHROMOSOMAL ABERRATIONS;CHRONIC IRRADIATION;EMBRYOS;LIVER; MITOTIC INDEX;RATS;CHROMOSOMES

- 3268 (INIS-mf--3331, pp 74) RADIOPROTECTIVE AND HYPOTHERMAL EFFECTS OF ADETURON IN MICE. Misustova, J.; Novak, L.; Kautska, J. (Ceskoslovenska Akademie Ved, Brno. Biofyzikalni Ustav). [nd]. (In Czech).

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National radiobiological conference and scientific conference of the Institute of national health in uranium industry.

DOSE-RESPONSE RELATIONSHIPS;HYPOTHERMIA; INTRAPERITONEAL INJECTION;METABOLISM;MICE; OXYGEN;RADIATION PROTECTION;RADIOPROTECTIVE SUBSTANCES;RESPIRATION;TIME DEPENDENCE;TOXICITY; BIOLOGICAL EFFECTS

- 3269 (INIS-mf--3331, pp 74) EFFECT OF ANTIBIOTICS ADMINISTRATION ON ENDOGENOUS AND EXOGENOUS STEM CELLS OF HEMOPOIESIS AND THEIR MIGRATION ACTIVITY. Petyrek, P. (Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J.E. Purkyne, Hradec Kralove (Czechoslovakia)). [nd]. (In Czech).

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Gamma radiation, mice. BIOLOGICAL RADIATION EFFECTS;BLOOD FORMATION;CHLORAMPHENICOL;GAMMA RADIATION;LETHAL IRRADIATION;MICE;SPLEEN CELLS; STEM CELLS;STREPTOMYCIN;SUBLETHAL IRRADIATION; TETRACYCLINES;TRANSPLANTS;BIOLOGICAL EFFECTS

- 3270 (INIS-mf--3331, pp 74) EFFECT OF PRE-IRRADIATION ADMINISTERED THYROIDINE ON RAT SURVIVAL. Pospisilova, J.; Pospisil, E. (Palackeho Univerzita, Olomouc (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech).

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X radiation. ACUTE IRRADIATION;LETHAL RADIATION DOSE;RATS;RESPONSE MODIFYING FACTORS; SURVIVAL CURVES;THYROID;WHOLE-BODY IRRADIATION; X RADIATION;RADIOPROTECTIVE SUBSTANCES;

BIOLOGICAL RADIATION EFFECTS

- 271 (INIS-mf--3331, pp 74) CHANGES IN ESTEROLYTIC ACTIVITY OF BLOOD SERUM IN WHOLE-BODY IRRADIATED RATS AND GUINEA-PIGS. Pouckova, P.; Pospisil, J. (Karlova Universita, Prague (Czechoslovakia). Biofyzikalni Ustav). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
AMINO ACIDS;BLOOD SERUM;CARBOXYLIC ACID ESTERS;CHEMICAL RADIATION EFFECTS;GUINEA PIGS; HYDROLYSIS;RATS;WHOLE-BODY IRRADIATION; BIOLOGICAL RADIATION EFFECTS
- 3272 (INIS-mf--3331, pp 74) CHANGES IN CONJUGATION OF BIOTRANSFORMATION CHLORPROMAZINE PRODUCTS IN RATS AT VARIOUS TIMES AFTER IRRADIATION. Pulpanova, J.; Krizala, J.; Ledvina, M. (Karlova Universita, Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
Gamma radiation, rats. BIOLOGICAL RADIATION EFFECTS;CHLORPROMAZINE;EXCRETION;GAMMA RADIATION;METABOLISM;RATS;TIME DEPENDENCE;WHOLE-BODY IRRADIATION;RADIOSENSITIVITY EFFECTS; RESPONSE MODIFYING FACTORS
- 3273 (INIS-mf--3331, pp 74) EXCRETION OF PRODUCTS OF CHLORPROMAZINE METABOLISM IN IRRADIATED RATS. Pulpanova, J.; Malanik, V.; Ledvina, M. (Karlova Universita, Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
Gamma radiation. BIOLOGICAL RADIATION EFFECTS;CHLORPROMAZINE;EXCRETION;GAMMA RADIATION;METABOLISM;RATS;TIME DEPENDENCE;WHOLE-BODY IRRADIATION
- 3274 (INIS-mf--3331, pp 74) EFFECT OF ACUTE WHOLE-BODY X-RAY IRRADIATION ON TISSUE LIPOPROTEIN LIPASE ACTIVITY IN RATS. Sedlakova, A.; Ahlers, I.; Praslicka, M. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie). [nd]. (In Slovak).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
Published in summary form only.
National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
ACUTE IRRADIATION;ADIPOSE TISSUE;BIOLOGICAL RADIATION EFFECTS;FASTING;LIPASES;LIPOPROTEINS; MYOCARDIUM;RATS;TESTES;WHOLE-BODY IRRADIATION;X RADIATION
- 3275 (INIS-mf--3331, pp 74) EFFECT OF ANTILYSIN AND TRASYLOL ADMINISTRATION ON POST-IRRADIATION CHANGES IN RATS AND MICE. Simsa, J.; Vondracek, V.; Svoboda, V.; Petyrek, P. (Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J.E. Purkyne, Hradec Kralove (Czechoslovakia)); Moravek, F. (Karlova Universita, Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
HISTOLOGY;MICE;POST-IRRADIATION THERAPY; RADIOPROTECTIVE SUBSTANCES;RATS;SMALL INTESTINE; WHOLE-BODY IRRADIATION;BIOLOGICAL EFFECTS; BIOLOGICAL RADIATION EFFECTS
- 3276 (INIS-mf--3331, pp 74) EFFECT OF NON-HOMOGENEOUS EXTERNAL ⁶⁰CO IRRADIATION ON DEVELOPMENT OF RADIATION SYNDROME IN RATS. Svoboda, V.; Dostal, M.; Neruda, O. (Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J.E. Purkyne, Hradec Kralove (Czechoslovakia)). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
ACUTE IRRADIATION;BONE MARROW;GAMMA RADIATION;PARTIAL BODY IRRADIATION;RADIATION INJURIES;RATS;SURVIVAL CURVES;COBALT 60; BIOLOGICAL RADIATION EFFECTS;PATHOGENESIS
- 3277 (INIS-mf--3331, pp 74) CELLULARITY OF THYMUS AFTER EXTERNAL IRRADIATION OR ²³⁹PU ADMINISTRATION IN MICE. Svoboda, V.; Kofranek, V.; Kotaskova, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zarení). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
BIOLOGICAL RADIATION EFFECTS;MICE;PARTIAL BODY IRRADIATION;PLUTONIUM 239;RADIOISOTOPE KINETICS;THYMUS;THYMUS CELLS;WHOLE-BODY IRRADIATION;X RADIATION
- 3278 (INIS-mf--3331, pp 74) USE OF ADAPTIVE LINEAR NEURON IN DIAGNOSTICS OF ACUTE RADIATION DISEASE IN RATS. Vodicka, I. (Karlova Universita, Hradec Kralove (Czechoslovakia). Lekarska Fakulta); Hradil, J.; Neruda, O. (Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J.E. Purkyne, Hradec Kralove (Czechoslovakia)); Smid, A. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

ACUTE IRRADIATION;DIAGNOSTIC TECHNIQUES;
GAMMA RADIATION;NERVE CELLS;RADIATION SYNDROME;
RATS;WHOLE-BODY IRRADIATION;BIOLOGICAL
RADIATION EFFECTS;DIAGNOSIS;NUCLEAR MEDICINE

EXTERNAL IRRADIATION;GLUCURONIDASE;METABOLISM;
RATS;WHOLE-BODY IRRADIATION;BIOLOGICAL
RADIATION EFFECTS

- 3279 (INIS-mf--3331, pp 74) RECOVERY OF SOME SUBSYSTEMS OF WHOLE-BODY IRRADIATED ORGANISM. Vodicka, I.; Vachatova, V.; Vavrova, E. (Karlova Universita, Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
BIOLOGICAL RECOVERY;FRACTIONATED IRRADIATION; GAMMA RADIATION;RADIATION INJURIES;RATS; SURVIVAL CURVES;WHOLE-BODY IRRADIATION; BIOLOGICAL RADIATION EFFECTS

- 3280 (INIS-mf--3331, pp 74) CHANGES IN ORGAN BLOOD FLOW IN RATS UNDER VARIOUS X-RAY IRRADIATION CONDITIONS. Volenec, K.; Chmelar, V.; Vodicka, I. (Karlova Universita, Hradec Kralove (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
ABDOMEN;BIOLOGICAL RADIATION EFFECTS;BLOOD CIRCULATION;BLOOD FLOW;INTESTINES;LIVER;LOCAL IRRADIATION;RATS;RUBIDIUM 86;SPLEEN;TIBIA; TRACER TECHNIQUES;WHOLE-BODY IRRADIATION;X RADIATION

- 3281 (INIS-mf--3331, pp 74) CHANGES IN CELLULARITY OF CAECUM IN EXTERNALLY AND INTERNALLY IRRADIATED RATS. Vondracek, V. (Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J.E. Purkyne, Hradec Kralove (Czechoslovakia)). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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National radiobiological conference and scientific conference of the Institute of national health in uranium industry .
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- 3282 (INIS-mf--3331, pp 74) ACTIVITY OF ACID PHOSPHATASE AND BETA-GLUCURONIDASE IN ISOLATED BLOOD PLATELETS OF WHOLE-BODY IRRADIATED RATS. Vranovska, J.; Pospisil, J.; Dienstbier, Z. (Karlova Universita, Prague (Czechoslovakia). Biofyzikalni Ustav). [nd]. (In Czech).
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- 3283 (INIS-mf--3331, pp 74) CHANGES OF BLOOD PLASMA PHOSPHOLIPIDS IN WHOLE-BODY IRRADIATED RATS. Zitko, M.; Pospisil, J. (Karlova Universita, Prague (Czechoslovakia). Biofyzikalni Ustav). [nd]. (In Czech).
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- 3284 (INIS-mf--3331, pp 74) URACIL METABOLISM IN IRRADIATED GOLDEN HAMSTER B. Buric, L.; Muzniak, I.; Novak, F.; Dienstbier, Z. (Karlova Universita, Prague (Czechoslovakia). Biofyzikalni Ustav); Grinberg, A.; Vitol, M. (Latvijskij Gosudarstvennyj Univ., Riga (USSR)). [nd]. (In Czech).
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- 3285 (INIS-mf--3331, pp 74) FINDINGS IN MICE AFTER REPEATED 22NDTH ADMINISTRATION. Dvorak, V.; Julisova, D.; Malatova, I.; Svoboda, V. (Karlova Universita, Prague (Czechoslovakia). Lekarska Fakulta Hygienicka); Onyskowska, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). [nd]. (In Czech).
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- 3286 (INIS-mf--3331, pp 74) USE OF 4,7,13,16,21,24-HEXAAXA-1,10-DIAZABICYCLO(8,8,8)-HEXACOSANE IN THERAPY OF INTERNAL CONTAMINATION IN RATS. Knayfl, J.; Vondracek, V.; Neruda, O. (Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J.E. Purkyne, Hradec Kralove (Czechoslovakia)); Smid, A. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)). [nd]. (In Czech).
From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).
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EXCRETION;RADIOISOTOPES;RADIONUCLIDE ADMINISTRATION;RADIONUCLIDE KINETICS;RATS; STRONTIUM;STRONTIUM 85;BIOLOGICAL RADIATION EFFECTS;RADIOTHERAPY

- 3287 (ORO--2401-95) MODEL OF IODINE METABOLISM IN A T_3 -THYROTOXIC PATIENT UNDERGOING I-131 THERAPY. Ahuja, S.; Price, R.; Brill, A.B.; Dobyns, B.M.; Berman, M. (Vanderbilt Univ., Nashville, Tenn. (USA). Div. of Nuclear Medicine and Biophysics; Cleveland Metropolitan General Hospital, Ohio (USA); National Cancer Inst., Bethesda, Md. (USA). Lab. of Theoretical Biology). [nd]. 30p. Dep. NTIS \$4.00.

Data on radioactivity in the thyroid, urine, serum, butanol-extractable iodine (BEI) and chromatographic fractionations of BEI, obtained during four I-131 therapeutic treatments of a T_3 -thyrotoxic patient, have been analyzed and simulated with the help of a 7-compartment model. Good fits to most of the data can be obtained with both the dose-independent and dose-dependent models. A model with 3 or 4 compartments, which provides adequate fits to iodine kinetic data in most euthyroid and hyperthyroid patients is not satisfactory in the case of this patient. Thus, to represent iodine metabolism during T_3 -thyrotoxicosis therapy, we find that it is necessary to provide for separate biochemical pathways for the BEI components as well as the butanol-insoluble compounds released by the thyroid gland. (auth)

- 3288 (CRSSA--1973, pp 54-59) CALCULATIONS OF LOADS AND DOSES DELIVERED, FROM RADIOCHEMISTRY AND HUMAN SPECTROMETRY EXPERIMENTAL RESULTS IN A CASE OF INTERNAL CONTAMINATION IN MAN. (VALIDITY OF MORROW'S TEST AND RETENTION EQUATIONS). Fatome, M.; Frossard, H.; Gueguen, J.P.; Prat, G.; Quentric, Y.; Rocquet, G. [nd]. (In French).

Centre de Recherches du Service de Sante des Armees 1973 scientific works.

The results of a previous study giving fecal and urinary excretion curves of five radioelements (cesium 137, cobalt 60, cerium 144, strontium 90, and plutonium 239) after radioactive aerosol inhalation by a man were interpreted. It is tried to draw conclusions on the validity of the theoretical parameters needed for calculating the load and the dose in man.

- 3289 (CRSSA--1974, pp 129) EMERGENCY PROCESSING OF RESPIRATORY RADIOCONTAMINATIONS: DTPA AEROSOL AUTONOMOUS GENERATORS. Ducouso, R. [nd]. (In French). 1974 scientific works.

Previous studies have shown the need of inhaling a DTPA aerosol as soon as possible when a respiratory contamination by radionuclides such as plutonium and transplutonium elements, yttrium and rare earths is supposed. In order this emergency processing was applied, exposed people must have a portable and personal aerosol generator. Two devices able to respond to imposed criteria are described.

- 3290 (INIS-mf--3331, pp 74) CONTAMINATION BY INHALATION OF ^{32}P RADIOAEROSOLS IN INSOLUBLE FORM. Halik, J.; Lenger, V. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). [nd]. (In Czech).

From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

CALCIUM PHOSPHATES;EXCRETION; GASTROINTESTINAL TRACT;INHALATION;PHOSPHORUS 32; RADIOACTIVE AEROSOLS;RADIONUCLIDE KINETICS;RATS; RESPIRATORY SYSTEM;RETENTION;TIME DEPENDENCE; BIOLOGICAL RADIATION EFFECTS

- 3291 (INIS-mf--3331, pp 74) INTERNAL RADIONUCLIDE CONTAMINATION IN PERSONNEL OF NUCLEAR MEDICINE WARDS AND SOME CAUSES THEREOF. Truelle, M.A. (Krajska Hygienicka Stanice, Ceske Budejovice (Czechoslovakia). Oddeleni Hygieny Zareni); Broz, J.; Matzner, J. (Krajska Nemocnice s Poliklinikou, Ceske Budejovice (Czechoslovakia). Oddeleni Nuklearni Mediciny). [nd]. (In Czech).

From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

AIR;CONTAMINATION;MEDICAL PERSONNEL; RADIONUCLIDE KINETICS;RADIOLOGICAL PERSONNEL; DOSIMETRY;NUCLEAR MEDICINE;HEALTH HAZARDS

- 3292 (CRSSA--1974, pp 91-93) STUDY OF AN ACCIDENTAL CASE OF INTERNAL RADIOCONTAMINATION. Guegen, J.P.; Rocquet, G. [nd]. (In French). 1974 scientific works.

This is the case of a technician subjected to an accidental contamination. It was localized on face and in superior aerial tracts. After external decontamination by repeated washings, this technician was subjected to a human gamma spectrometry investigation. The presence of alpha emitters was detected.

- 3293 (INIS-mf--3331, pp 74) USE OF GOMPERTZ'S TRANSFORMATION IN ANALYSIS OF MORTALITY DATA ON MICE CONTAMINATED WITH ^{226}Ra AND ^{224}Ra . Sedlak, A.; Klener, V.; Thomas, J.; Kofranek, V.; Dvorak, V.; Onyskova, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni). [nd]. (In Czech).

From National radiobiological conference and scientific conference of the Institute of national health in uranium industry; Pribram, Czechoslovakia (17 May 1976).

Published in summary form only.

National radiobiological conference and scientific conference of the Institute of national health in uranium industry .

MICE;RADIONUCLIDE KINETICS;RADIUM 224;RADIUM 226;SURVIVAL CURVES;BIOLOGICAL RADIATION EFFECTS

- 3294 (ERDA--76-23) EMERGENCY HANDLING OF RADIATION ACCIDENT CASES: FIREMEN. (Energy Research and Development Administration, Washington, D.C. (USA)). [nd]. 16p. TIC.

Procedures for the emergency handling of persons exposed to radiation or radioactive contamination are presented, with emphasis on information needed by firemen. The types of radiation accident patients that may be encountered are described and procedures for first aid, for preventing the spread of radioactive contamination, and for reporting the accident are outlined. (CH)

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Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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CONF-7605156-	(8. annual national conference on radiation control, Springfield, IL, USA, 2-7 May 1976)	
	286	See FDA-77-8021
CONF-760622-	(American Nuclear Society 1976 annual meeting, Toronto, Ontario, Canada, 13-18 Jun 1976)	
42	2235	See HEDL-SA-1086-FP
54	1951	See HEDL-SA-1087
CONF-760634-	(Pacific regional symposium, Seattle, WA, USA, 24-25 Jun 1976)	
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5	2261	See LA-UR-76-1718
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3	1938	See BNWL-SA-5816
5	1306	See BNWL-SA-5672
6	2250	See BNWL-SA-5659
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CONF-760744-	(Conference on energy sources of the future, Oak Ridge, TN, USA, 5-23 Jul 1976)	
2	2135	Dep. NTIS, \$3.50
CONF-760802-	(11. international conference on medical and biological engineering, Ottawa, Canada, 2-6 Aug 1976)	
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1	1935	See BNL-21924	6	619	See RS-II-4-517-318/6
CONF-760547-	(Conference on genetic effects on aging, Bar Harbor, ME, USA, 12-17 Sep 1976)		CONF-770208-	(Symposium on public health aspects of radioactivity in consumer products, Atlanta, GA, USA, 2-4 Feb 1977)	
3	2136	Dep. NTIS, \$3.50	1	626	See UR-3490-1072
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CONF-760552-	(2. international symposium on biological effects of Ra-224, Neuherberg/Muenchen, F.R. Germany, 20 Sep 1976)		3	586	See BNL-22307
4	2296	See AED-Conf-76-430-005	CONF-770321-	(NBS international specialists symposium on neutron standards and applications, Gaithersburg, MD, USA, 28-31 Mar 1977)	
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7	2298	See AED-Conf-76-430-012	CONF-770337-	(Conference on marmosets in experimental medicine, Basel, Switzerland, 16-18 Mar 1977)	
8	2299	See AED-Conf-76-430-014	1	596	Dep. NTIS, PC A02/MF A01
9	1930	See AED-Conf-76-430-018	CONF-770357-	(Conference on biological implications of nuclear energy, Providence, RI, USA, 9 Mar 1977)	
11	2238	See AED-Conf-76-430-011	1	611	See BNL-22938
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17	2256	Dep. NTIS, PC A02/MF A01	3	695	Dep. NTIS, PC A02/MF A01
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	1926	See AED-Conf-76-345-003	9	694	See BNWL-SA-5855
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3	1944	Dep. NTIS, \$3.50	CONF-770615-	(National conference on campus safety on the University of Hawaii Campus, Honolulu, HI, USA, 9-16 Jun 1977)	
CONF-761230-	(Advisory group meeting on intercomparison and standardization procedures in the dosimetry of Co-60 gamma radiation and x-rays, Vienna, Austria, 6-10 Dec 1976)		2	612	NTIS, MF A01
1	1945	Dep. NTIS, PC A02/MF A01	CONF-770663-	(Workshop on repair mechanisms and exposure standards, Oak Ridge, TN, USA, 28-30 Jun 1977)	
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DP-1415	1595	Dep. NTIS, \$5.00
DP-MS-75-126	1871	Dep. NTIS, \$3.50
76-89	591	Dep. NTIS, PC A02/MF A01
77-18	564	Dep. NTIS, PC A02/MF A01
77-116	587	Dep. NTIS, PC A03/MF A01
DPSPU-77-30-1	1857	Dep. NTIS, PC A04/MF A01
DPST-74-551(Rev.)	2676	Dep. NTIS, \$3.50
E-9035	722	See N-77-17840
EMSL-LV-539-4	1477	Dep. NTIS, \$5.50
EPA-520/1-75-001	2501	Environmental Protection Agency, Office of Radiation Programs, Washington, DC
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520/1-76-010	1411	Environmental Protection Agency, Washington, DC		FRNC-TH-624	2801	NTIS (US Sales Only), PC A04/MF A01	
520/4-76/002	1611	See PB-258167		681	3178	Dep. NTIS (US Sales Only), PC A04/MF A01	
520/4-76-012	1383	See PB-259866		GA-A-13617(Vol.7)	1738	Dep. NTIS, \$4.50	
520/4-77-005	89	Environmental Protection Agency, Washington, DC		GEAP-14034-5	2388	AT	
520/5-76-005	1245	Environmental Protection Agency, Washington, DC		14034-6	1593	AT	
520/5-76-014	730	Environmental Protection Agency, Montgomery, AL		14034-7	1313	AT	
520/5-76-015	1021	Environmental Protection Agency, Washington, DC		14034-8	1018	AT	
520/7-76-004	1323	NTIS		14144	1017	AT	
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520/7-76/007	1419	See PB-258159		00257	74	AT	
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ERDA-76-23	3294	TIC		6S	27	Dep. NTIS, PC A04/MF A01	
76/89	1562	Dep. NTIS, \$4.50		7	38	Dep. NTIS, PC A09/MF A01	
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76-104 (Vol.2)	1158	Dep. NTIS, \$18.75		8	28	Dep. NTIS, PC A08/MF A01	
76/115	3062	Dep. NTIS, \$4.00		8S	29	Dep. NTIS, PC A04/MF A01	
77-24	359	Dep. NTIS, PC A10/MF A01		9	40	Dep. NTIS, PC A05/MF A01	
77-25	2800	Dep. NTIS, PC A03/MF A01		9S	41	Dep. NTIS, PC A04/MF A01	
77-101	90	Dep. NTIS, PC A03/MF A01		GKSS-76/E/47	1950	NTIS (US Sales Only), PC A04/MF A01	
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ERDA-tr-222	2157	Dep. NTIS, \$7.75		GSF-B-642	2883	INIS	
250	885	Dep. NTIS, \$5.00		GSF-K-75	3148	INIS	
267	2997	Dep. NTIS, PC A02/MF A01		75	3149	INIS	
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EUR-5176	2715	NTIS (US Sales Only)		75	3152	INIS	
5428	1242	NTIS (US Sales Only)		75	3153	INIS	
5441	1867	NTIS (US Sales Only)		75	3154	INIS	
5460	1947	Dep. NTIS (US Sales Only), PC A07/MF A01		75	3155	INIS	
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5484	2733	NTIS (US Sales Only)		GSF-S-400	1414	TIC	
5524	1948	Dep. NTIS (US Sales Only), PC A9S/MF A01		GWI-R-2-76	1898	Dep. NTIS (US Sales Only), PC A02/MF A01	
5624	1949	Dep. NTIS (US Sales Only), PC A06/MF A01		12-75	2884	Dep. NTIS (US Sales Only), PC A02/MF A01	
FDA-76-8027	1699	GPO		HASL-308	911	Dep. NTIS, \$8.50	
76-8030	1412	GPO, \$1.95		310	917	Dep. NTIS, \$5.00	
76-8031	1413	GPO		313	91	Dep. NTIS, PC A03/MF A01	
76-8034	1488	GPO, \$1.30		314	916	Dep. NTIS, \$3.50	
76-8035	1754	Bureau of Radiological Health, Rockville, MD		318	264	Dep. NTIS, PC A12/MF A01	
76-8043	1324	HEW		329	37	Dep. NTIS, PC A18/MF A01	
76-8054	1182	BRH Technical Information,		HEDL-SA-1086-FP	2235	Dep. NTIS, \$3.50	
77-8003	923	GPO, \$2.50		1087	1951	Dep. NTIS, \$3.50	
77-8013	516	GPO		HEDL-TI-75001-1	268	AT	
77-8016	558	GPO		HEDL-TME-76-42	1314	AT	
77-8021	286	BRH Technical Information,		76-75	1016	AT	
77-8034	100	BRH Technical Information Staff, Rockville, MD		76-98	195	Dep. NTIS, PC A03/MF A01	
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76/88	1417	See PB-255363		0005527	2551	NTIS, \$5.00	
76/92	1418	See PB-256678		0006878	2427	NTIS PCA02/MF A01	
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FMI-1000-763	2258	Dep. NTIS, \$3.50					
1000-764	2259	Dep. NTIS, \$3.50					

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0010759	3063	Available from Q Corp., 45 Sheridan Ave., Albany, N.Y. 12210.
0015136	924	NTIS PCA03/MF A01
HW-51317	3227	Dep. NTIS, \$3.50
IA-1321	1325	INIS
1321	1326	INIS
IAEA-CN-36/9	565	NTIS (US Sales Only), PC A02/MF A01
36/114	566	NTIS (US Sales Only), PC A02/MF A01
36/205	567	NTIS (US Sales Only), PC A02/MF A01
36/222	613	NTIS (US Sales Only), PC A02/MF A01
36/233	573	NTIS (US Sales Only), PC A02/MF A01
36/280	562	NTIS (US Sales Only), PC A02/MF A01
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36/355	616	NTIS (US Sales Only), PC A02/MF A01
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1189-F	1652	NTIS (US Sales Only)
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1365-F	2671	NTIS (US Sales Only)
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INIS-mf-1840	3064	INIS
1905	2992	INIS
1906	2802	INIS
1942	2885	NTIS (US Sales Only)
2010	2569	NTIS (US Sales Only)
2010	2571	NTIS (US Sales Only)
2010	2575	NTIS (US Sales Only)
2010	2592	INIS
2013	3065	NTIS (US Sales Only)
2015	3132	NTIS (US Sales Only)
2078	2739	INIS
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2078	2741	INIS
2078	2803	INIS
2098	2725	NTIS (US Sales Only)
3133	2804	TIC
3135	2995	NTIS (US Sales Only)
3141	2805	TIC
3141	2806	TIC
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3148	2497	INIS
3156	1755	INIS
3159	1952	INIS
3179	2809	NTIS (US Sales Only)
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3243	2454	INIS
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3257	2810	NTIS (US Sales Only)
3305	1851	INIS
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3312	2377	NTIS (US Sales Only)
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3331	3234	INIS
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3331	3286	INIS
3331	3290	INIS
3331	3291	INIS
3331	3293	INIS
3344	1327	INIS
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3363	3048	INIS
3431	1836	Dep. NTIS (US Sales Only), PC A03/MF A01
3518	1678	Dep. NTIS (US Sales Only), PC AX/MF A01
3620	717	Dep. NTIS (US Sales Only), PC A06/MF A01
3625	456	Dep. NTIS (US Sales Only), PC A10/MF A01
3789	1960	NTIS
INS-R-195	1183	Dep. NTIS (US Sales Only), PC A03/MF A01
196	1030	Dep. NTIS (US Sales Only), PC A02/MF A01
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190-76-01	1607	NTIS (US Sales Only)
IRS-290	1146	Dep. NTIS (US Sales Only), PC A03/MF A01
JPRS-67629	1232	NTIS, \$3.50
Juel-1361	507	Dep. NTIS (US Sales Only), PC A03/MF A01
Juel-Conf-17	2429	INIS
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2245	2849	Stuttgart; Gentner (1975).
2259	1704	INIS
2262	1325	INIS
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2266	1415	INIS
2348	1184	NTIS (US Sales Only)
2433	217	Dep. NTIS (US Sales Only), PC A07/MF A01
KFK-EXT- 20/75-1	2537	INIS
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KFK-tr- 483	2336	TIC
484	1185	NTIS (US Sales Only)
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KR- 153	3249	NTIS (US Sales Only)
KURRI-IR- 125	3049	INIS
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L- 11280	218	See N-77-23045
LA- 6313-FR	1547	Dep. NTIS, \$5.00
6321-MS	1478	Dep. NTIS, \$4.50
6337-FR	1403	Dep. NTIS, \$3.50
6604-FR	813	Dep. NTIS, \$3.50
6716-MS	470	Dep. NTIS, \$3.50
6801-MS	272	Dep. NTIS, PC A04/MF A01
6898-PR	147	Dep. NTIS, PC A08/MF A01
LA-NUREG- 6427-FR	1285	Dep. NTIS, \$3.50
LA-UR- 76-1718	2261	Dep. NTIS, \$3.50
76-2057	2262	Dep. NTIS, \$3.50
77-2080	617	Dep. NTIS, PC A02/MF A01
77-2385	618	Dep. NTIS, PC A02/MF A01
LBL- 2654	3045	Dep. NTIS, PC A02/MF A01
4678	1479	Dep. NTIS, \$6.00
6405	360	Dep. NTIS, PC A05/MF A01
LF-tr- 111	3126	Dep. NTIS, \$3.50
121	1660	Dep. NTIS, \$3.50
123	1510	Dep. NTIS, \$5.00
LURI- 1974-02	3031	INIS
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MD/PUB- 251	2447	INIS
MLM- 2339(CF)	2347	Dep. NTIS, \$3.50
2347(CF)	2263	Dep. NTIS, \$3.50
2365(CF)	2264	Dep. NTIS, \$3.50
N- 75-24329	3066	NTIS, \$3.25
75-25541	2566	NTIS, \$3.25
75-32733	3067	Dep. NTIS, \$8.00
76-16746	2383	NTIS, \$3.50
76-16513	2813	NTIS, \$4.50
76-15801	2647	NTIS, \$4.50
76-23145	1534	NTIS, \$10.50
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NBS-SP- 456	854	GPO, \$5.15
NCRP- 32	3147	National Council on Radiation Protection and Measurements, Washington, DC, \$2.00
33	3160	National Council on Radiation Protection and Measurements, Washington, DC, \$2.00
48	2021	Washington, DC; National Council on Radiation Protection and Measurements (1976).
50	708	National Council on Radiation Protection and Measurements, Washington, DC
52	704	Washington, DC; National Council on Radiation Protection and Measurements (1977).
53	634	Washington, DC; National Council on Radiation and Measurements (1977).
54	636	Washington, DC; National Council on Radiation Protection and Measurements (1977).
55	703	Washington, DC; National Council on Radiation Protection and Measurements (1977).
NIOSH- 75-117	3007	GPO
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75-171	2639	Public Health Service, Salt
NIRS-M- 7	2682	INIS
7	2683	INIS
NOAA-TM-ERL-SEL- 46	289	See PB-270284
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21325	1892	Dep. NTIS (US Sales Only), PC A06/MF A01
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NRPB-R- 6	3206	NTIS (US Sales Only)
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19	3037	TIC
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40	2462	NTIS (US Sales Only)
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46	1036	NTIS (US Sales Only)
47	925	Dep. NTIS (US Sales Only), PC A06/MF A01
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52	855	Dep. NTIS (US Sales Only), PC A03/MF A01
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NUREG-0090-6	340	Dep. NTIS, \$4.00	5332	2681	See AD-A-022183
0109	1310	See PB-257054	PAEC(D)-76004	1610	NTIS (US Sales Only)
0119	981	Dep. NTIS, \$4.00	76008	1666	NTIS (US Sales Only)
0129	504	Dep. NTIS, \$10.00	PATENTS-DE-		(German: Deutsches Patentamt, Dienststelle Berlin, Gitschiner Str. 97-103, 1000 Berlin 61, F.R. Germany, DM 3.- per copy, plus postage)
0301	172	Dep. NTIS, PC A05/MF A01		2,364,935/A/	2426
0322	44	NTIS, \$4.50		2,406,717/A/	2535
0332(Draft)	73	Nuclear Regulatory Commission, Washington, DC		2,430,895/A/	1740
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ORNL-			PATENTS-US-		(US: Commissioner of Patents, Washington, D.C. 20231, USA, \$.50 per copy. Government Patent Applications available from NTIS)
4992	1596	Dep. NTIS, \$12.50		A 527,669	1739
5113	1608	Dep. NTIS, \$9.25		3,920,808	2425
5169	1159	Dep. NTIS, \$5.00		3,942,023	1587
5191	1037	Dep. NTIS, \$4.00		3,984,695	909
5195	874	Dep. NTIS, \$8.00		3,984,696	910
5245	316	Dep. NTIS, PC A08/MF A01		4,041,994	82
5269	213	Dep. NTIS, PC A05/MF A01			
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7	123	Dep. NTIS, PC A15/MF A01			
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5251	1858	Dep. NTIS, PC A06/MF A01			
5277	1671	Dep. NTIS, \$4.00			
5278	1371	Dep. NTIS, \$5.00			
5293	1655	Dep. NTIS, \$5.50			
5336	1416	Dep. NTIS, \$4.00			
5337	1609	Dep. NTIS, \$4.00			
5358	1560	Dep. NTIS, \$4.00			
5453	1038	Dep. NTIS, \$4.00			
5454	1035	Dep. NTIS, \$4.00			
5538	1307	AT			
5830	273	Dep. NTIS, PC A05/MF A01			
5873	45	Dep. NTIS, PC A11/MF A01			
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4247	2286	Dep. NTIS, \$3.50			
4302	2494	Dep. NTIS, PC A09/MF A01			
4335	3213	Dep. NTIS, \$3.50			
4499	3204	Dep. NTIS, PC A02/MF A01			
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1643-126	2305	Dep. NTIS, \$4.00			
2401-27	2265	Dep. NTIS, \$3.50			
2401-54	1454	Dep. NTIS, \$4.50			
2401-55	3287	Dep. NTIS, \$4.00			
2832-164	599	Dep. NTIS, PC A04/MF A01			
3857-4	1961	Dep. NTIS, \$3.50			
4465-15	2143	Dep. NTIS, \$4.00			
4568-3	1905	Dep. NTIS, \$3.50			
4568-7	600	Dep. NTIS, PC A02/MF A01			
4568-9	601	Dep. NTIS, PC A02/MF A01			
ORP/CSD-75-3	2545	Environmental Protection Agency, Washington, DC			
75-4	2532	Environmental Protection Agency, Washington, DC			
76-2	530	Environmental Protection Agency, Washington, DC			
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109	3243	See AECL-5540	2475	2565 INIS
110	3244	See AECL-5602	2592	1613 Dep. NTIS (US Sales Only), PC A02/MF A01
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RD/B/N-3496	2502	Dep. NTIS (US Sales Only), \$3.50	76003	1726 Dep. NTIS, \$3.50
			76004	1189 Dep. NTIS, \$3.50
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RFP-Trans-222	3219	Dep. NTIS, PC A02/MF A01	1975-004	2966 INIS
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RLC-2405-2	1962	Dep. NTIS, PC A04/MF A01	1975-016	2625 INIS
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194	1706	INIS	1976-004	1667 NTIS (US Sales Only)
195	1612	INIS	1976-011	1553 NTIS (US Sales Only)
197	1507	INIS	1976-038	508 Dep. NTIS (US Sales Only), PC A02/MF A01
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204	807	INIS	27080	625 Dep. NTIS, \$4.75
204	810	INIS	27097	2144 Dep. NTIS, \$3.50
205	518	Dep. NTIS (US Sales Only), PC A05/MF A01	27160	1289
207	458	Dep. NTIS (US Sales Only), PC A02/MF A01	27286	1859 Dep. NTIS, \$3.50
208	395	Dep. NTIS (US Sales Only), PC A02/MF A01	27333	814 Dep. NTIS, \$3.50
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77-0616	274	Dep. NTIS, PC A02/MF A01	13766	898 Dep. NTIS, PC A06/MF A01
77-0844C	624	Dep. NTIS, PC A02/MF A01	51444-76	1015 Dep. NTIS, \$4.00
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52138(Rev.1)	448	Dep. NTIS, PC A03/MF A01
52164	900	Dep. NTIS, \$4.00
52176	986	Dep. NTIS, \$3.50
78409	1233	Dep. NTIS, \$3.50
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11093	3212	Dep. NTIS, \$4.00
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Issue 4

October 1977

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A12.....	10.75	E12.....	25.00	T12.....	650.00
A13.....	11.00	E13.....	28.00	T13.....	675.00
A14.....	11.75	E14.....	31.00	T14.....	750.00
A15.....	12.00	E15.....	34.00	T15.....	800.00
A16.....	12.50	E16.....	37.00	T16.....	850.00
A17.....	13.00	E17.....	40.00	T17.....	900.00
A18.....	13.25	E18.....	45.00	T18.....	950.00
A19.....	14.00	E19.....	50.00	T19.....	1,000.00
A20.....	14.50	E20.....	60.00	T99.....	*
A21.....	15.00	E99.....	*		
A22.....	15.25				
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