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**Health and Safety Research Division
Progress Report
For the Period October 1,
1979—March 31, 1981**

OPERATED BY
UNION CARBIDE CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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ORNL-5750
Dist. Category UC-41

Contract No. W-7405-eng-28

**HEALTH AND SAFETY RESEARCH DIVISION
PROGRESS REPORT
FOR THE PERIOD OCTOBER 1, 1979—MARCH 31, 1981**

**Stephen V. Kays,
Director**

Date Published: August 1981

**OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
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UNION CARBIDE CORPORATION
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DEPARTMENT OF ENERGY**

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Contents

FOREWORD	v
1. OFFICE OF INTEGRATED ASSESSMENTS AND POLICY ANALYSIS.	1
2. HEALTH STUDIES.	3
Monitoring Technology and Instrumentation	4
Metabolism and Dosimetry.	4
Health Effects and Epidemiology	5
Nuclear Medicine Technology	5
3. TECHNOLOGY ASSESSMENTS.	7
Methodology Development and Evaluations	7
Nonnuclear Applications	8
Nuclear Applications.	9
Off-Site Pollutant Measurements	10
Dosimetry Applications Research	11
4. BIOLOGICAL AND RADIATION PHYSICS.	13
Atomic, Molecular, and high Voltage Physics	13
Physics of Solids and Macromolecules.	14
Submicron Physics	15
Analytic Dosimetry and Surface Physics.	15
5. CHEMICAL PHYSICS.	17
Molecular Physics	17
Photophysics.	18
6. CONTRIBUTIONS TO NATIONAL LEAD LABORATORY PROGRAMS AND ASSIGNMENTS	19
Residential Energy Conservation Program.	19
Synthetic Fuels Program	19
High Voltage Program.	20
Breeder Reactor Program	20
Waste Disposal Program.	21
APPENDIX A. BUDGET AND SUPPORT DISTRIBUTION.	23
APPENDIX B. PERSONNEL SUMMARY.	25
APPENDIX C. ORGANIZATIONAL STRUCTURE AND CHART	27
APPENDIX D. HONORS AND AWARDS.	29
APPENDIX E. SEMINAR PROGRAM.	31
APPENDIX F. ADVISORY COMMITTEE	35
APPENDIX G. PUBLICATIONS	37
APPENDIX H. PRESENTATIONS AT TECHNICAL MEETINGS.	77

Foreword

This progress report covers research activities of the Health and Safety Research Division (HASRD) for the period October 1, 1979, through March 31, 1981, and is the third progress report since the division was organized in April 1977. The format and content of this progress report are more abbreviated than previous reports as an economy measure and because our progress has already been published extensively in reports, journals, and books. This document is meant to merely highlight our research progress, and the reader is referred to the extensive bibliography for further technical details.

The division continued to function effectively with four major research sections reporting directly to the division director. The Biological and Radiation Physics and Chemical Physics Sections are involved principally in basic and fundamental research in the physical sciences, while the Health Studies and Technology Assessments Sections conduct life sciences research and assessments. Another important part of the division's organizational structure is the Office of Integrated Assessments and Policy Analysis which carries out multidisciplinary studies examining the impacts of alternative energy technology and policy options.

Besides maintaining a vigorous publication effort, the division's staff were instrumental in organizing several important technical workshops and symposia. These include the following:

Uncertainties Associated with the Regulations of Geologic Disposal
of High-Level Radioactive Waste - March 1981

Health Risks Associated with Energy Technology - January 1981

Symposium on Intermediate Range Atmospheric Transport Processes and
Technology Assessments - October 1980

Third Annual ORNL Life Sciences Symposium - October 1980

Second International Symposium on Gaseous Dielectrics - March 1980

We believe that the efforts which we made toward the success of these meetings represent a most effective use of the division's resources. We will have had major roles in organizing and conducting four additional workshops and symposia before this progress report leaves the printer.

Although most of the division's work appears in specialized technical publications, we also have made an effort to reach the general science audience by publishing in "science media" publications. These articles are much more difficult for specialists to write because highly specialized subjects must be made understandable and interesting to scientists and engineers of all disciplines. Noteworthy along these lines were papers published in *SciQuest*, *American Scientist*, *Physics News*, and *Physics Today*. We will continue this effort and have already received acceptance of additional science media articles.

Troyce Jones distinguished himself by being named recipient of the 1980 Elda E. Anderson Award presented by the Health Physics Society. Troyce was cited for numerous accomplishments,

including his contributions to dose response theory and human dosimetry calculations based on Hiroshima and Nagasaki data. Loucas Christophorou was designated a Union Carbide Corporate Research Fellow by the President of the Nuclear Division. This designation is reserved for a small number of individuals who have chosen research and development as a professional career and whose contributions have been both significant and numerous over a period of many years. The East Tennessee Chapter of the Health Physics Society named Philip Perdue as recipient of the 1980 Distinguished Service Award. This award was based on the excellent contributions Perdue has made to the field of health physics. The accomplishments by these three individuals are in addition to many appointments of staff to national and international committees, working groups, and panels.

One important organizational change in the Technology Assessments Section was establishment of the Nonnuclear Applications Group under Curtis Travis. This new group is charged with further developing and strengthening the division's assessment capability in biotechnology, synfuels, chemical releases, mining, fossil fuels, and other nonnuclear technologies.

The division published its second long-range plan during this reporting period. Like the first plan that was issued May 1978, it is expected to play a useful role in our research strategies and new initiatives. This document outlines the long-term research plan for the division in terms broad enough so as not to be dependent upon activities or funding in a single project area. At the same time, the document has enough internal flexibility to accommodate the changes in research priorities expected from the new administration.

In addition to the technical progress summarized in this report, the division's clerical staff collaborated to publish the *HASRD Secretarial notebook* which is a handy reference source to standardize and facilitate the necessary paper work of the division.

By all available criteria, I feel that the present reporting period represented a time of great technical progress, explicit growth, valuable experience, and a continuation of the enthusiasm that has been characteristic of HASRD since its organization.

Stephen V. Kaye
Division Director
Health and Safety Research Division

March 27, 1981

1. Office of Integrated Assessments and Policy Analysis

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This office was established to develop research into the policy implications of energy-related federal legislation and to support multidisciplinary studies of the impacts associated with a variety of energy-related activities. Most recently this office has continued investigations into the impacts and control of hazardous wastes. In collaboration with Energy Division staff, we have examined the impacts of proposed nuclear waste repositories on local and state host areas to determine what makes the siting of such facilities desirable or at least acceptable to state and local interests. The goal has been development of a range of evaluated options for inclusion in the siting processes including incentives; compensation mechanisms for risk, damages, and long-term land commitment; state and local participation; local verification and monitoring, and mediated negotiation. Emphasis is placed on determining when, how, and if mitigative measures are sufficient as incentives; and if not, what constitutes true incentives. This research is an attempt to factor institutional arrangements and public perception into the siting of hazardous waste facilities.

Along with studies into hazardous waste facility siting, the office has investigated the health and environmental risks associated with the production of liquid fuels from coal. An interdisciplinary group has been formed with representatives of the Health and Safety Research, Chemical Technology, Environmental Sciences, Biology, and Information Divisions to consider these risks. The objective is to prepare a Health and Environmental Document for the Department of Energy's Health and Environmental Risk Analysis Program. The main purpose of this document is to provide an identification of the principal health and environmental impacts of this technology and to quantify the extent of the impact whenever possible.

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2. Health Studies

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D. J. Crawford	A. R. Hershman	P. P. P.	L. E. G. G.
M. Cristy	J. D. Householder	R. J. P. P.	L. E. G. G.
L. C. Dillman ¹	C. L. Howell	L. E. P. P.	L. E. G. G.
J. M. Dougherty ²	W. M. Johnson	L. E. P. P.	L. E. G. G.
C. S. Judney	C. L. Jones	P. P. P.	L. E. G. G.
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C. E. Easterly	G. L. Kerr	A. E. R. R.	L. E. G. G.
K. F. Eckerman	P. F. Knapp, Jr.	J. L. R. R.	L. E. G. G.
	B. W. Leggett	L. E. R. R.	L. E. G. G.

The Health Studies Section has as its principal mission the development of analytical techniques to characterize health risk associated with a variety of technology-related activities and the development of radiolabeled substances for application in biomedical research. Analytical approaches developed by staff within the section range from those necessary to determine the extent of pollutant exposure to those necessary to determine the extent of health risk resulting from technology-related activities. The Monitoring Technology and Instrumentation Group develops instrumentation to determine the nature and extent of exposure to noxious substances within the outdoor environment, the workplace, and the home. The Metabolism and Dosimetry Group investigates the metabolic behavior of technology-generated substances and determines the radiation dose from substances associated with the nuclear fuel cycle. The Health Effects and Epidemiology Group evaluates the human health risks associated with a wide variety of energy-related activities and seeks to develop a common index to prioritize nuclear and nonnuclear hazards.

The application of nuclear technology to biomedical research is an important complement to the risk assessments carried out by staff in the Health Studies Section. The Nuclear Medicine Technology Group is principally concerned with the development of radiopharmaceuticals for the diagnosis and treatment of disease. In addition, this group is developing radiolabeled agents with a wide variety of applications in biomedical and environmental research.

MONITORING TECHNOLOGY AND INSTRUMENTATION

A number of passive and active formaldehyde monitors suitable for measuring formaldehyde concentrations at the 10 ppb level have been developed. A commercially available, quasi real-time formaldehyde monitor has been adapted to bring about a tenfold improvement in sensitivity. A rapid, non-aqueous formaldehyde collection system was developed based on molecular sieve absorbent and a 2 L/min air sampling pump. For completely passive monitoring, a system was developed that is based on permeation through a semipermeable membrane to a water sink. These devices have been field-tested in local houses with or without urea-formaldehyde-foam insulation and their performances compared against each other and a standard reference method.

A new version of the derivative ultraviolet-absorption spectrometer (DUVAS III) is near completion. The whole unit has been reduced to a size of 10 x 6 x 16 in. and is now truly portable. Improvements have also been engineered into a new version of the lightpipe luminescope. Additional features include the background compensation of skin fluorescence and an audio signal varying with the intensity of the recorded fluorescence. A new passive vapor monitor has also been developed to evaluate exposure to high-boiling point polynuclear aromatic (PNA) hydrocarbons. Preliminary measurements at an H-coal liquefaction plant have shown that it is capable of discriminating between specific PNA compounds.

The synchronous luminescence and room temperature phosphorescence techniques have been applied to the rapid-screening analysis of PNA compounds. These two techniques have been applied to the analysis of an SRC-II coal liquefaction product. The results provided by the two techniques were in good agreement with those obtained using much more elaborate high performance liquid chromatography and gas chromatography/mass spectroscopy techniques.

METABOLISM AND DOSIMETRY

The past year saw the completion of the effort to translate the primary radiation protection guidance set forth by the International Commission on Radiological Protection in Publication 26 into secondary limits. These limits, in the form of annual limits of intake and derived air concentration, are published in the Commission's Publication 30 and supersede the secondary limits of Publication 2 issued in 1959. Publication 30 is being issued in three parts, each accompanied by a supplemental report printed directly from the output of computer codes executed at ORNL. Secondary limits for about 250 radionuclides have been established for the inhalation and ingestion of various chemical forms as well as the submersion in air containing noble gas radionuclides. The dosimetric calculations were carried out by the Commission's Committee 2 Task Group on Dose Calculations, which is centered at ORNL under the chairmanship of M. R. Ford.

The extensive data, descriptive as well as numerical, that have been compiled during the course of Committee 2's effort have been assembled into computerized data bases at ORNL. This extensive repository of information can be utilized to provide future guidance into adequacy of metabolic information for an element and impacts on secondary limits resulting from changes in the primary guidance.

Efforts continue toward development of dosimetric methodologies for age-specific considerations. During the past year, the development of an age-dependent Monte Carlo transport code for use in the calculation of photon absorbed fraction data was completed. Age-dependent physiological models for the respiratory and gastrointestinal tract and models for retention of systemic burdens are under development.

HEALTH EFFECTS AND EPIDEMIOLOGY

Work on generalized methods for treating risks from nuclear and nonnuclear technologies on a common scale has continued. Our primary thrust for carcinogenic risks has been to develop a unifying hypothesis for all carcinogenic insults based upon the initiation, promotion, and competing risks aspects of carcinogens and cofactors. These guidelines will be used ultimately in composite hazard indices to prioritize nuclear and nonnuclear hazards.

A number of experimental projects are in progress to support improved health risk analysis. One project has involved development of a human cell-mediated mutagenesis assay. A second is a study of cytotoxic mechanisms in yeast. Both projects show promise and are improving our mechanistic understanding of toxicological effects. Other experimental work on the cytotoxic effects of PNA hydrocarbons, interactions of mixtures of PNA metabolites, and how cytotoxic mechanisms and immune system perturbations may contribute to mechanisms of carcinogenesis are ongoing.

An epidemiological study of associations between mineral and trace elements in drinking water and cardiovascular disease funded by the Environmental Protection Agency is under way. Data collection is being carried out through a subcontract with the University of Wisconsin, and the resultant data are being incorporated into a data base at ORNL. In addition to project specific epidemiology research, methodological approaches for estimating disease risks are being developed.

Dosimetry and dose-response studies for ionizing radiation continue. Input has been provided to the National Committee on Radiation Protection and Measurement (NCRP) and to The Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR III) on the latest developments related to dosimetry for the Hiroshima and Nagasaki atom bomb survivors. A special update of the dosimetry has been requested by NCRP and is now being carried out.

NUCLEAR MEDICINE TECHNOLOGY

This group is concerned with the preparation of new radiopharmaceuticals for use in nuclear medicine and other radiolabeled agents with application in biomedical and environmental research. Major emphasis has been focused on investigating the properties of radiolabeled long-chain fatty acids containing sulfur, selenium, and tellurium that are "trapped" in the myocardium. The effect of structure on the myocardial uptake of ^{75}Se -, ^{35}S -, and $^{123\text{m}}\text{Te}$ -labeled fatty acids is being investigated. The results have opened a new research area for the labeling with ^{131}I , ^{123}I , or radioisotopes of bromine. The parameters for ^{191}Os production and the development of the $^{191}\text{Os} \rightarrow ^{191\text{m}}\text{Ir}$ generator system are also under investigation because of the unique properties of the short-lived $^{191\text{m}}\text{Ir}$ radionuclide for angiography.

Several new barbiturates radiolabeled with $^{123\text{m}}\text{Te}$ and ^{75}Se substituents have been prepared. Tests in rats have demonstrated for the first time the feasibility of using radiolabeled barbiturates to measure regional blood perfusion in the brain. Various $^{195\text{m}}\text{Pt}$ -labeled antitumor agents are being investigated for cancer therapeutic research. An important $^{197\text{Au}}$ -labeled antirheumatoid agent, Auranofin, is also under investigation. The diffusion chamber assay system is being developed to assess the toxic effects of pollutants from energy technologies.

Our research and development projects continue to be complemented by active extramural collaboration through the Medical Cooperative Programs where new agents are supplied to investigators in clinics, universities, and other research institutions for clinical evaluation.

This program provides an opportunity to investigate new agents in conjunction with established programs in the fields of cardiology, cerebral function, rheumatology, and oncology.

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3. Technology Assessments

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R. W. Doane	D. Holly ⁴	S. Y. Ohr ²	J. E. Till ¹
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		E. M. Rupp	

The principal objective of the Technology Assessments Section is the assessment of impacts on man from environmental pollutants. The section conducts more than a dozen separately funded projects and participates actively in more than a dozen additional projects in cooperation with other parts of the Laboratory. Laboratory and field elements of the section's program are dominated by measurement and survey activities in support of the Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program and by applications of the Health Physics Research Reactor in mixed-field neutron and gamma-ray dosimetry research. Theoretical elements of the section's program are dominated by activities to develop and apply concepts, models, computer codes, and data bases for quantitative simulation of pollutant movement from point of release to point of exposure for man, with subsequent estimation and evaluation of potential impacts on individuals and populations. In response to increasing needs specific to nonnuclear pollutants, a Nonnuclear Applications Group was established during this reporting period. The paragraphs which follow identify many of the projects that constitute the section's program.

METHODOLOGY DEVELOPMENT AND EVALUATIONS

This group is developing for the Environmental Protection Agency (EPA) a general environmental assessment model which can analyze the potential environmental impact and health risk

transport and disposal facility for radioactive low-level waste under different hydrogeologic and meteorologic settings. The model is being implemented by the PRESTO code (Prediction of Radiation Effects of Shallow Trench Operations).

Another project is under way to support the EPA radiation standards development effort, mandated under the 1977 Clean Air Act Amendment. The computer codes AIRDOS-EPA and DARTAB were delivered to EPA as an interim methodology for their initial assessment needs. In coordination with these deliverables, we performed approximately 89 assessments of various facilities continuously releasing radionuclides. We are producing five computer codes and several large data bases to replace the AIRDOS-EPA/DARTAB system with more flexible assessment codes that EPA can use in standards development research. The five codes are PRIMUS, RETADD, ANEMOS, TERRA, and ANDROS. The entire suite of codes is called the CRRIS system for a Computerized Radiological Risk Investigation System. All data bases including meteorological, agricultural, and population are complete and are being documented.

Work of this group for DOE (described on page 20, Breeder Reactor Program) is also complemented with projects supported by the Nuclear Regulatory Commission (NRC). The first NRC-sponsored project has as its purpose the development and implementation of environmental transport models and associated data bases to calculate realistic estimates of radiation doses to the general public. This effort is specifically tailored to meet particular needs of the NRC as the Commission develops capabilities to implement dose limits which satisfy the requirements as low as reasonably achievable. Documentation has been prepared of the improved methods used to calculate dose-rate factors for external exposure to photons for 24 body organs and to calculate electron dose-rate factors for radiosensitive tissues of the skin. These methods are implemented in the revised DOSFACTOR computer code. Also, an interactive computer code, PREREM, was developed to perform routinely internal dose calculations with the INREM II code and associated data files. The RAGTIME code, which implements the time-dependent radionuclide concentrations in beef and milk in a cattle herd, was developed.

Another NRC project examines the capabilities of current assessment models to identify sources and magnitudes of uncertainties characteristic of time-dependent estimates of the dose and health effect impacts from the release of long-lived radionuclides to the environment. A preliminary analysis and identification has been made of uncertainties in the calculation of collective dose and health effects at future times from release of long-lived radionuclides to the biosphere. Work is proceeding on assessing the uncertainties in the calculation of long-term collective dose and health effects arising from groundwater transport of radionuclides from a geologic repository to the biosphere and subsequent transport and delivery to man through the biosphere.

The principal objective of a third NRC-sponsored analysis is to examine the question of whether the risk and consequences of theft or sabotage of facilities or vehicles containing small quantities of special nuclear materials and by-product materials are such that licensees should be required to adopt further measures to safeguard them. Needed data have been gathered from the NRC docket files and by discussion with NRC Inspection and Enforcement Regional Offices.

NONNUCLEAR APPLICATIONS

The work in this group has emphasized the development of mathematical models and computer codes to assist in predicting the environmental transport of toxic pollutants and the assessment of the health and safety risks associated with development and operation of various energy technologies.

A multimedia environmental transport model is being developed for the EPA Office of Toxic Substances. This work involves development and implementation of a system of mathematical models to assist in a screening level identification of new chemical substances or mixtures which may present an unreasonable risk to human health or the environment. To date, algorithms have been developed for assessing downwind concentrations of a pollutant emitted from either a point or area source. Algorithms have also been developed for pollutant dispersion and degradation in aquatic systems. Included are models for estimating pollutant concentrations in rivers, lakes, estuaries, and sediment.

At the request of the DOE Office of Alcohol Fuels, a generic health and safety analysis of commercial-scale (60 to 600 million L/year) anhydrous ethanol facilities has been performed. Several common feedstocks (grains, roots and fibers, sugarcane) and fuels (coal, natural gas, wood, bagasse) were evaluated throughout each step of generic plant operation, from initial milling and sizing through saccharification and fermentation, distillation, and, finally, stillage disposal. The most serious safety hazard is that of explosion from grain dust or ethanol fume ignition and boiler/steam line overpressurization. The most serious health hazard is benzene, which is used in stripping water from ethanol in the final distillation column. Substitution of this fluid by alternative liquids was addressed.

An identification and evaluation of the risks associated with development of alternative energy technologies was made for the Oak Ridge National Energy Prospective. Technologies considered include geothermal, ethanol, woodburning, municipal waste, satellite power systems, synfuels, and shale oil development. Each technology was briefly described and potential risks during construction, operation, and disposal were discussed.

NUCLEAR APPLICATIONS

A broad spectrum of radiological impact assessment work was performed during this reporting period. Assessments both of operating and decommissioned nuclear fuel cycle and non-fuel cycle facilities were performed. In addition, fuel cycle work included light-water, breeder, and fusion reactor cycles.

Our work on breeder reactor fuel cycles for the DOE Division of Nuclear Reactor Programs ended in September 1980. Two major projects were completed and reports were issued on our assessments of a thorium-uranium carbide fast breeder reactor fuel cycle and an environmental and dosimetric analysis of tritium (described on page 21, under Breeder Reactor Program).

Work on environmental impact statements and appraisals continued in collaboration with the Energy Division. Site-specific radiological assessments were completed for two in situ uranium mines (solution mines), a uranium oxide fuel fabrication facility, and a defense waste processing facility. In addition, the radiological impacts of generic fusion reactors were analyzed for an environmental report prepared by ORNL for the Fusion Energy Assessment Program.

At the request of the DOE Environmental and Safety Engineering Division, radiation doses were estimated for current and unrestricted use of 18 formerly utilized Manhattan Engineer District/Atomic Energy Commission (MED/AEC) sites that have been surveyed for residual radioactive contamination.

Our work for the NRC Office of Standards Development involves analyses of the technology and costs associated with making final (certification) surveys on decommissioned nuclear facilities to be released for unrestricted use. In addition, this project is furnishing information on realistic radiation exposure pathways to be included in new NRC regulatory guides.

A new project for the NRC Office of Nuclear Reactor Regulation was initiated in FY 1981. A statistical analysis of dose estimates via food pathways is being performed for radionuclides released from nuclear power reactors.

OFF-SITE POLLUTANT MEASUREMENTS

Since 1975, the Department of Energy has conducted a major radiological resurvey program at sites where work with uranium and thorium was performed under contract with the Manhattan Engineer District (MED) and the Atomic Energy Commission (AEC). From the inception of this program to the present, the Off-Site Pollutant Measurements Group has played a lead role in documenting the present radiological status of these sites and any vicinity properties which may have inadvertently become contaminated. The documentation provided by this group is used by DOE's Environmental and Safety Engineering Division (ESED) to determine the need for remedial action at each site. After remedial action has been performed by other contractors, this group conducts further radiological surveys at each site; ESED uses these survey results to certify the adequacy of the remedial measures and to determine what restrictions, if any, need to be placed on property use.

During this reporting period, a total of 86 properties in the Canonsburg, Pennsylvania, area were given definitive radiological surveys; these included private residences, commercial property, municipal property, streets, and sewers. Preliminary investigations were made for 27 locations in the Tonawanda, New York, area exhibiting anomalous gamma radiation levels in an aerial radiological survey. Furthermore, ten private properties in the vicinity of an inactive uranium milling site in Salt Lake City, Utah, have been surveyed.

Comprehensive radiological surveys were initiated at the former Metal Hydrides Corporation in Beverly, Massachusetts, and the former Shpack Landfill in Morton, Massachusetts. Letter reports were prepared for previously completed preliminary surveys of 18 candidate formerly utilized sites where no further radiological survey work is anticipated. Final reports of initial radiological surveys were published for 21 inactive uranium mill tailings sites and four formerly utilized sites. Also, preliminary surveys were completed and letter reports were prepared for 12 additional sites.

Radiological surveys were conducted to audit the adequacy of decontamination efforts being conducted on four vicinity properties in the Middlesex, New Jersey, area. After the decontaminated areas were backfilled and restoration activities completed, additional surveys were performed to allow DOE to assess the appropriateness of unrestricted use of these properties.

Subcontractor activities directed at environmental evaluations of the former Vitro Rare Metals Plant, Canonsburg, Pennsylvania, were completed. Collection and analysis of baseline environmental data were completed. An analysis of environmental impacts was made for three hypothetical alternatives: (1) no action, (2) demolition and burial of structures on site and subsequent stabilization of all radioactive residues on site, and (3) removal of all contaminated materials to a hypothetical disposal site.

Development of radiological measurement techniques continued. Procedures were developed for field estimation of ^{227}Ac concentrations in soil by collection of progeny of ^{219}Rn emanated by the soil. A cryogenic sampling and analysis technique was developed for measurement of airborne concentrations of ^{219}Rn , ^{220}Rn , ^{222}Rn , and ^{85}Kr . A mobile gamma radiation scanning van was developed to locate and determine the source of anomalously high gamma radiation levels in the vicinity of MED/AEC sites.

DOSIMETRY APPLICATIONS RESEARCH

The Health Physics Research Reactor (HPRR) is the principal research tool for the Dosimetry Applications Research (DOSAR) Facility. The HPRR is a small, unshielded, unmoderated fast reactor which can be operated to yield up to 10^{17} fissions in the pulse mode and can operate up to 10 kW in the steady-state mode.

Two annual mixed-field neutron and gamma-ray dosimetry studies, the Seventeenth Nuclear Accident Dosimetry (NAD) Intercomparison Study and the Sixth Personnel Dosimetry Intercomparison Study (POIS), were held at the DOSAR Facility using the HPRR. Twenty-nine organizations (20 USA, 9 foreign) participated in the Sixth POIS, and eighteen organizations (14 USA, 4 foreign) were represented at the NAD study. These studies continue to increase in importance as dosimeter standards become more strict.

The staff cooperated with the following organizations to perform neutron dosimetry development work using the HPRR: Oak Ridge Associated Universities teamed with the University of California at Los Angeles, Battelle Pacific Northwest Laboratories, ORNL's Industrial Safety and Applied Health Physics Division, Goodyear Atomic Corporation, Ruder Boskovic Institute (Yugoslavia), and Union Carbide (Y-12 Plant).

Assistance in the design and performance of experiments involving the irradiation of soybean and barley seeds was provided by the DOSAR staff to researchers from the Comparative Animal Research Laboratory and from Tennessee Technological University.

Biological effects researchers from ORNL's Biology Division used the HPRR to study tumor induction rates and tumor enhancement, and researchers initiated a cocarcinogenesis study using urethane and neutrons. The University of Tennessee at Memphis used the HPRR to study the incidence of mammary tumors in rats due to acute exposure to neutrons.

The HPRR was used to train reactor operators from the Tennessee Valley Authority and students from Louisiana State University, Mississippi State University, the University of Tennessee, and Virginia Wesleyan College in fundamentals of reactor engineering and physics.

The DOSAR staff installed and checked out an on-line dosimetry system for use with the HPRR, developed a consistent set of reference dosimetry data for all shielded HPRR spectra, investigated anomalies associated with the 20-cm concrete shield, and performed routine reactor tests.

¹Consultant.

²Environmental Sciences Division.

³Visiting Scientist, Pakistan.

⁴Student.

⁵Part-time Employee.

⁶Assignment from University of Guelph, Ontario, Canada.

⁷Operations Division.

⁸Computer Sciences Division.

⁹Guest Research Participant, University of New York - York College.

¹⁰Industrial Safety and Applied Health Physics Division.

¹¹Information Division.

¹²Engineering Division, Part-time Employee.

¹³On loan, Oak Ridge Gaseous Diffusion Plant.

4. Biological and Radiation Physics

H. A. Wright

J. L. Adcock ¹	A. R. Cathers ^b	D. R. James	M. Y. Pui
J. D. Allen ²	C. C. Chen ^b	G. A. Kourouklis ^b	L. R. Painter ⁵
V. E. Anderson ³	C. Chang ^b	E. H. Lee ^b	W. G. Richardson
E. T. Arakawa	L. G. Christophorou	J. W. Little ^b	R. E. Ritchie
J. C. Ashley	Y. T. Chu ^b	D. L. McCorkle ³	M. L. Rustgi ^{1a}
J. K. Baird	P. M. Echaniques ²	J. R. Mason ²	I. Samra
G. Basbas ²	H. V. Ellis ⁶	C. Martin ^b	K. Simons
R. S. Becker ^b	J. Patheddin ^b	S. V. Masingo	G.N.A.A. Sordi ¹¹
D. W. Beaman ^b	T. L. Farrell	R. A. Mathis	S. M. Spyrou ^b
R. D. Birkhoff	L. C. Fries ⁷	D. R. Maughan ^b	S. S. Stokstill
D. W. Bouldin ¹	S. M. Ghemati ^b	D. V. Mazy	C. C. Sung ²
H. Brandt ²	R. H. Ham	L. K. Melton	P. W. Todd ²
A. J. Brandmiser ²	T. L. Hayden ⁶	S. Mitra ^b	A. Todo ^b
M. C. Buncick ^b	A. W. Hols ⁸	S. W. Moore ^b	T. Tran-Thi ⁷
P. J. Caldwell ^b	H. H. Hubbell, Jr. ²	J. Newfeld ²	J. E. Turner
T. A. Callcott ⁵	S. R. Hunter ⁷	S. K. Niyogi ⁸	M. W. Williams
J. G. Carter	K. B. Jacobson ⁸	M. O. Pace ¹	H. R. Witschi ⁸

Activities within this section consist primarily of basic physics research studies directed toward providing new scientific knowledge of the fundamental properties of matter in all phases (gas, liquid, and solid) and of processes and mechanisms important in the interaction of pollutants with the environment and with biological materials. Summaries of the research progress this year are reported under the headings of the four groups within the section.

Over the years the section has had a strong collaborative research interaction with the University of Tennessee which has proven to be very beneficial to our research. Four of our staff members hold Ford professorships at the university, and four university professors have part-time appointments in our section. At the present time, we have 14 graduate students doing their thesis research in our section; and we have had three Oak Ridge Associated Universities (ORAU), one Great Lakes Colleges Association, and two Southern Colleges and Universities Union students this year. We also had two ORAU faculty participants and three postdoctoral fellows working with us this year.

ATOMIC, MOLECULAR, AND HIGH VOLTAGE PHYSICS

In our electron-molecule interaction studies, the delicate dependence of the electron attachment processes on the details of the molecular structure has been investigated, and studies of electron attachment to "hot" molecules have begun. We succeeded in making accurate and quantitative measurements of the effect of density on the motion of slow electrons through dense polar gases. We calculated new sets of electron energy distribution functions for carrier gases and continued our work on fast gas mixtures for particle detectors.

Concerning the dynamics of electrons and ions in liquids, two techniques - the integrated fluorescence and the laser two-photon ionization - have been developed for the study of one- and two-photon ionization processes in liquids. Photoionization onsets for a number of organic molecules in dielectric liquids have been determined. Distinct structure has been observed in the two-photon ionization spectra of the molecules studied due to autoionization. These studies suggest that the photoionization process of a solute molecule in a liquid medium is completed at times $<10^{-13}$ s and is perhaps independent of the "dielectric" nature of the liquid medium.

In our basic and applied research on gaseous dielectrics, many unitary and especially many multicomponent gaseous dielectrics have been found that exhibit excellent breakdown characteristics. These have been tested under a variety of experimental conditions such as those encountered in practical use. Basic studies advanced our understanding of the principal processes influencing gas breakdown and guided worldwide efforts in improving gaseous dielectrics.

Decomposition of gaseous dielectrics under electron impact, in a spark, after repeated breakdowns, and under prolonged electrical stress has been studied quantitatively. Gas dielectrics inhibiting carbonization and corrosiveness of popular insulants (e.g., SF_6 and perfluorocarbons) have been developed. Detection and identification of ions from spark discharges in SF_6 have been achieved and the effects of trace impurities assessed.

In the area of liquid dielectrics, theories of electrical breakdown in liquids have been tested on the basis of our experimental data on hydrofluorobenzenes.

PHYSICS OF SOLIDS AND MACROMOLECULES

In this program we are studying some of the fundamental properties of solids and macromolecules, with particular emphasis on systems of biological interest and on the detection of chemical pollutants and/or their effects. We have initiated some new programs in this reporting period while continuing some well-established programs. We have demonstrated for the first time the feasibility of using resonance ionization spectroscopy as a means of identifying and quantifying trace impurities in solid samples. We have developed and tested free-standing photoresist films for use in high-resolution microlithography in connection with a study of electron scattering from metal surfaces having small-scale surface roughness. The determination of the optical properties of various materials, over an extended energy range from the infrared to soft X rays by a variety of techniques, has continued. Optical methods have been used also to study the interdiffusion of metal alloy systems. A "universal" expression for the mean free path of low-energy electrons in solid organic insulators has been proposed and its consistency tested experimentally. We have developed and tested new techniques, such as the in situ preparation of thin sodium films for use as an expendable filter in the vacuum ultraviolet, and new equipment, such as self-supporting transmission gratings for use in the soft X-ray and extreme vacuum ultraviolet regions. Finally, we are involved in a proposal to build a material science research facility at an electron-synchrotron radiation center featuring a unique soft X-ray fluorescence spectrometer and an Auger electron spectrometer.

SUBMICRON PHYSICS

Our cooperative program with Professor Linda Painter of the Physics Department at the University of Tennessee continued this year with (1) measurements of the optical and dielectric functions of, and photoemission from liquid hexamethylphosphorotriamide, a much used solvent in biology; (2) development of a new, more accurate method for making these measurements that can be used with high vapor-pressure liquids; and (3) construction and use of an apparatus to scatter electrons off of liquids and to determine energy losses in the reflected electron beam. In the latter, we find good evidence for multiple surface plasmon excitation in liquid trimethylpentaphenyltrisiloxane.

In continuing our theoretical and experimental work on the optical properties of submicron fibers, we revised the theory to show explicitly the generation of two creeping waves propagating around a cylindrical fiber. We calculated and measured the attenuation of these waves by radiation and joule heating.

We have analyzed the continuous eigenmodes of surface plasmons on a single-sheeted hyperboloid of revolution for comparison with experiments on energy losses by electrons traversing micropores. We have also obtained the electrical image energy of a charge near such a hyperboloid and applied the results to aerosol deposition.

We have analyzed surface enhanced Raman scattering from organic molecules adsorbed on silver sols showing the key role of spherical surface plasmons. This important surface effect was previously unexplained.

ANALYTIC DOSIMETRY AND SURFACE PHYSICS

This group is involved with a wide variety of basic problems in the areas of dosimetry, microdosimetry, and surface physics. In the context of the electron gas model for condensed matter systems, we examined Z^2 effects on stopping powers, straggling in energy loss of a charged particle, foil thickness corrections to the Landau straggling distribution, and the charge state of a swift ion and its implications for "effective charge" theory. Studies on effects of the state of condensation of water on energy-loss phenomena will form an important part of a forthcoming International Commission on Radiation Units and Measurements report on stopping power.

In our microdosimetry program, we calculated spatial distributions of energy transfer events in irradiated liquid water. We developed a Monte Carlo program to follow events in irradiated liquid water from the initial energy deposition events at $\sim 10^{-15}$ s up to $\sim 10^{-11}$ s when reactants can begin to interact chemically through diffusion controlled processes. We have studied interface effects and pion-stopping distributions.

In the broad area of surface physics, our efforts are directed at elucidating the fundamental physical mechanisms involved in interactions of both microscopic and macroscopic particulates with condensed matter surfaces. To supplement existing classical theories, a quantum theory of the image potential was developed. Some specific problems studied include dynamical and geometrical effects in the physical adsorption of atoms, particle trajectories under the influence of an image potential, and deposition of charged particulates from laminar flow in cylinders. An extensive study of photon interactions with surface plasmons for several surface geometries was completed, and we investigated the electron-plasmon interaction

near a metal surface, electronic surface states on aerosol particles, and the impact parameter dependence of plasmon excitation on small metal spheres.

In collaboration with the Biology Division, the effects of metals at the molecular, cellular, and whole animal levels are being studied both theoretically and experimentally. We have prepared a major review article on the interaction of cadmium and certain other metal ions with proteins and nucleic acids. We have conducted two extensive experiments to determine the median lethal dose (LD_{50}) values for 24 metal ions in mice and *Drosophila*. Our studies indicate that the chemist's concept of hard and soft acids and bases is useful in understanding metal toxicity.

¹University of Tennessee R&D Subcontract.

²Consultant.

³Computer Sciences Division.

⁴Student.

⁵Part-time Employee.

⁶Oak Ridge Associated Universities Faculty Research Participant.

⁷Postdoctoral Fellow.

⁸Biology Division.

⁹Guest Assignment.

¹⁰Sabbatical Leave from State University of New York, Buffalo, New York.

¹¹Visiting Scientist.

5. Chemical Physics

W. R. Garrett

S. L. Allman
H. L. Barnwell¹
H. D. Brashier
A. E. Cartier
C. H. Chen
R. M. Compton
C. D. Cooper²

P. W. Coulter²
W. A. Chupka²
W. R. Ferrell³
G. W. Folta⁴
G. S. Hurst
J. Itarte³
J. P. Judish

C. E. Klotz
M. P. Kopp¹
S. D. Krcmar
B. Lehman⁵
J. C. Miller
M. G. Payne

J. E. Parks²
R. C. Phillips
P. W. Reinhardt
J. A. D. Stockdale
B. F. Thomas
R. D. Willie⁵
J. P. Young⁶

Activities in the Chemical Physics Section consist of a variety of basic physical and chemical studies that are relevant to energy-related problems in atmospheric physics and chemistry, radiation chemistry, pollutant detection technology, laser development, and analytical applications of laser techniques. Experimental techniques employed in these research efforts include molecular beams, mass spectroscopy, sonic-nozzle-jet molecular-cluster sources, conventional laser spectroscopy, and multiphoton ionization and saturated resonance-ionization-spectroscopic methodologies. Theoretical efforts are also carried out in conjunction with some of the studies. The following highlights from the Molecular Physics and Photo-physics Groups provide a general "flavor" for the work.

MOLECULAR PHYSICS

The Molecular Physics Group conducts experimental and theoretical research on the interaction of electrons and photons with polyatomic molecules and molecular clusters. Experiments are carried out in the gas phase using highly monoenergetic electron and photon (laser) beams. Sonic-nozzle beams are used to produce molecular clusters.

Theoretical examination of limiting translational temperatures have been achieved in quasi-isentropic nozzle expansions. Experimental studies were made of the electron impact ionization of van der Waals clusters of methyl halides.

The first experimental multiphoton ionization photoelectron spectroscopy studies were performed. Laser multiphoton ionization of many molecules resulted in considerable fragmentation. The kinetic energy of the fragments were found to be essentially thermal. Such studies are leading to an increased understanding of multiphoton ionization processes.

We have discovered a new mechanism for the generation of third-harmonic light near a three-photon resonance in a gaseous medium. This technique provides a useful source of pulsed, coherent, narrow-bandwidth vacuum ultraviolet radiation for use in other experiments.

A series of measurements on the space-averaged polarizabilities of a number of alkali-halide dimers was performed in cooperation with New York University.

Intense beams of UF_6^- ions were produced by spraying UF_6 on electrically heated carbon filaments. This data has provided an estimate of the electron affinity of UF_6 as 6.5 ± 0.3 eV.

The first measurements of photodetachment cross sections for He^- over the photon energy range from 1.77 to 2.75 eV were made. The energies of the autodetached electrons from the metastable He^- beams were also determined for the first time.

Theoretical demonstrations of several general features of negative ions of polar molecules were reported. A new pseudopotential method was developed for these studies.

PHOTOPHYSICS

Whereas resonance ionization spectroscopy (RIS) grew out of our earlier work on energy pathways in irradiated gases, we now rely heavily on RIS to study the fundamental processes themselves. Absolute cross sections and photodissociation of lithium iodide as a function of wavelength were obtained by first saturating the dissociation process. We find the rate of chemical reaction of lithium with O_2 in the presence of argon (leading to LiO_2) to be strictly three body at low pressures of argon. Other studies of alkali-atom chemistry included $\text{Cs} + \text{O}_2 + \text{Ar}$ and $\text{Cs} + \text{NO} + \text{Ar}$. Other RIS techniques were employed to measure the photoionization cross sections of excited states of cesium atoms. Fluorescence studies of NO_2 revealed lifetimes of individually resolved rotational-vibrational states.

New developments in RIS concentrated on the ionization and sensitive detection of rare gas atoms. We showed that the process $\text{Xe}(w_1w_2e^-)\text{Xe}^+$ is an efficient way to ionize xenon as well as argon, krypton, and radon (using lasers such as Nd:Yag and excimer), leaving only two atoms (helium and neon) presently inaccessible to the RIS process. A machine, which we call Maxwell's Demon, is under development. When completed, Maxwell's Demon should be able to count a few atoms of a particular isotope A even when a neighboring isotope $A \pm 1$ is more abundant by 10^{12} or greater. Such a capability is needed in solar neutrino research, in experiments involving neutrino oscillations and $\beta\beta$ decay, and in problems in oceanography, geochronology, hydrology, polar-ice-cap dating, waste isolation, and neutron dosimetry.

We studied the fluctuations of the concentration of a small population of cesium iodide molecules in an argon gaseous medium. Plots of the frequency for the presence of various numbers of cesium iodide molecules in the laser volume followed a Poisson distribution.

¹Instrumentation and Controls Division.

²Consultant.

³Student.

⁴Postdoctoral Fellow.

⁵Guest Assignment.

⁶Analytical Chemistry Division.

6. Contributions to National Lead Laboratory Programs and Assignments

RESIDENTIAL ENERGY CONSERVATION PROGRAM

R. B. Gammage and P. J. Walsh

The Ad Hoc Interagency Task Force on Indoor Air Pollution was established with funding from the Department of Energy's (DOE) National Program for Building Thermal Envelope Systems and Insulating Material and The Residential Conservation Service Program. This federal task force developed a white paper on policy considerations and research and assessment needs associated with indoor air pollution. Oak Ridge National Laboratory staff served as the principal authors of the white paper. The work of the task force has served to stimulate interest and research programs on monitoring indoor air pollutants and characterization of potential health effects.

Under the sponsorship of the Consumer Product Safety Commission a program was carried out to study the use of urea-formaldehyde-foam (UFF) insulation in residential dwellings. The principal objective was to determine the extent to which formaldehyde was released from the foam based on different modes of preparation and application. Sixty different panels simulating walls in a residence were foamed, and formaldehyde emissions were measured over a period of six months. From this research it was found that the formaldehyde concentrations in a typical corner room of a residence with UFF insulation could be as high as 500 ppb. Both active and passive monitors were developed under this funding. These instruments were sufficiently sensitive to make measurements at background levels of a few tens ppb. Measurements made with these monitors supported the studies carried out with the wall panels. The principal finding to date is that it is difficult to ensure a homeowner with UFF insulation that concentrations of formaldehyde will not exceed the 100 ppb indoor standard set by several other countries.

SYNTHETIC FUELS PROGRAM

P. J. Walsh and R. B. Gammage

Staff of the Health Effects and Epidemiology Group and the Monitoring Technology and Instrumentation Group have provided input to the Life Sciences in Synthetic Fuels Program relevant to health risk assessment. These individuals have contributed to comprehensive health and environmental assessments at the University of Minnesota, Duluth, coal gasifier; the M-coal liquefaction plant at Catlettsburg, Kentucky; and the Pike County, Kentucky, Coal Gasification Project. These assessments benefit from instrumentation developed within the Health and Safety Research Division as well as analyses of the potential impact of exposure to toxic releases from these facilities.

Portable instruments used in these studies include: a derivative ultraviolet-absorption spectrometer (DUVAS) for real-time analysis of vapors; a prototype, passive integrating exposure meter for higher-boiling polynuclear aromatic vapors; a spill spotter for detecting oil and tar contamination on surfaces; and a lightpipe luminoscope for detecting skin contamination. The intention is to provide data on aromatic fugitive emissions and the associated human exposures - data that would be difficult or impossible to obtain with commercially available equipment. Information derived from utilization of these instruments as well as data on the characterization of potential process and effluent source terms are used to carry out the health risk analysis. This analysis includes an evaluation of the toxic properties of the various components of the source term, an assessment of the probabilities of ecosystem or human exposure to the toxic components and an analysis of the impacts of exposure.

Preoperational assessments have been carried out and periodic assessments using the accumulating data base are being conducted in order to prioritize and focus upon major gaps.

HIGH VOLTAGE PROGRAM

M. O. Pace

The Health and Safety Research Division is one of four divisions participating in the High Voltage Technology Program (HVTP) at ORNL, which was designated the lead Laboratory in that area. The program involves monitoring, subcontracting, and performing "in-house" work in high voltage research and development for the DOE Electric Energy Systems Division's Power Delivery Program.

This division's HVTP in-house research has been (1) to synthesize previously unavailable gases needed for dielectrics research and to investigate economic and technical feasibility of mass production processes and (2) to test dielectrics developed in the division's gas dielectrics program in actual industrial sites and then to analyze the test products at ORNL.

The division has awarded and now manages two ORNL subcontracts for HVTP work, provides technical monitoring for three contracts that had been awarded by DOE in Washington before the HVTP inception, and aids DOE in planning future work in high voltage for electric power delivery.

BREEDER REACTOR PROGRAM

C. W. Miller

The first of two projects in this program is entitled Model Evaluation of Breeder Reactor Radioactivity Releases. The models examined in this project to date include those developed for the prediction of atmospheric and hydrologic transport and deposition, terrestrial and aquatic food-chain bioaccumulation, and internal and external dosimetry. Where possible, comparisons have been made between model output and field measurements to estimate the accuracy of various model predictions. Where this has not been possible, with the dosimetry models for example, the precision associated with model output has been estimated on the basis of the statistical distributions associated with the data sets available to evaluate input parameters used in the model. Results to date indicate that relatively simple models such as the Gaussian plume atmospheric dispersion model and a multiplicative chain terrestrial transport model are acceptable for most fast reactor safety assessment applications.

The second project, Environmental Assessment of Breeder Reactor Radioactivity Releases, has centered on the application of available methodologies to the radiological assessment of routine releases from breeder fuel cycle facilities. Through the interaction of Metals and Ceramics, Chemical Technology, and Health and Safety Research Divisions, a summary of analyses of thorium fuel cycle mining and milling, and reprocessing (refabrication), was completed during the review period. Detailed studies of breeder fuel cycle tritium releases and projected (local and global) impacts were also prepared during 1980 and 1981, as was a comparison of ^{233}U and ^{238}Pu breeder cycle radiological impacts. The tritium studies indicated that the global collective dose commitment per unit release of tritiated water to the atmosphere is about four times that of tritiated hydrogen gas, for a specific Illinois release site. It was also concluded that the aquatic release pathway is potentially of greater importance than the atmospheric, for a site located on a major river. Program assessment activities were completed by HASRD in September 1980.

WASTE DISPOSAL PROGRAM

C. A. Little

C. A. Little assisted the national Low-Level Waste Program Office (LLMPO) as secretary of the Interagency Low-Level Waste Modeling Committee. The committee, chaired by Robert S. Lowrie of ORNL, has one representative from each of DOE, EPA, NRC, and the U. S. Geological Survey, Department of Interior. The major objective of the committee was an interagency meeting discussing modeling needs for low-level waste applications. Dr. Little served as scientific secretary and will be editor of the proceedings to be published in April 1981.

The LLMPO also provided funds to produce an assessment of radiological doses to individuals and populations downstream from White Oak Dam. This study resulted in a report (ORNL/TM-7039) by C. A. Little and S. J. Cotter.

Appendix A. Budget and Support Distribution

	Actual FY1979 (\$K)	Actual FY1980 (\$K)	Current FY1981 (\$K)
Army		3	57
Consumer Product Safety Commission		72	35
Department of Energy			
Basic Energy Sciences	83	73	82
Breeder Reactors		276	229
Coal			25
Economic Regulatory Administration		80	60
Electric Energy Systems	359	684	504
Environmental Research-Development	4,569	4,236	4,509
Life Sciences	1,144	1,677	1,602
Remedial Action Program		387	30
Solar	40	74	23
Space Nuclear Systems		192	
Environmental Protection Agency	544	878	1,228
Federal Drug Administration	25	31	
Nuclear Regulatory Commission	883	813	880
Office of Naval Research	12	60	61
United States Air Force	49	80	75
Other		<u>71</u>	<u>41</u>
 In-House Total	 7,708	 9,687	 9,441
 Outside Subcontracts	 576	 1,090	 1,143
 Total Division	 8,284	 10,777	 10,584

The division continues to operate in a sound financial position. Adequate funds are available to support our staff, and we have a wide variety of sources of funding. The proposed Reagan budget cuts for FY1982 should not have a serious adverse effect upon the division.

The table compares the money that was available to the division during FY1979, FY1980, and FY1981. However, the funds for the current year include only the monies that were on hand at March 1. We expect to receive at least an additional \$1,901,000 before the end of the fiscal year. This represents an increase of \$1,723 or 14%.

Appendix B. Personnel Summary

	Technical		Support		Total	
	1980	1981	1980	1981	1980	1981
Permanent employees	95	100	22	24	117	124
Temporary, >10 months	0	3	0	0	0	3
Division supported loanees	5	8	11	13	16	21
Loaned out	1	1	0	0	1	1
Part-time	9	8	0	1	9	9
Assigned guests	9	24	0	0	9	24
Co-ops	0	0	3	5	3	5

To run the division efficiently and effectively requires many types of employees. The various sources used to staff the division are shown in the table. We experienced an increase of seven people in our permanent staff. The only other significant change was in the number of assigned guests which increased from 9 to 24.

During the year there was a total of 29 guests assigned to the division. The guests were from universities, laboratories, and private companies. Some were assigned for a few months but most were assigned for a period of a year or more. We view the use of assigned guests as an economical way to bring different and diversified talents to the division.

G. A. KOURAKIS¹
D. L. MCKAY²
D. V. MAREY³
S. W. MCKEY⁴
M. PACE⁵
R. V. PAI⁶
I. SAUER⁷
E. SMITH⁸
D. H. SMITH⁹
S. H. SPYROU¹⁰
T. H. TRANTH¹¹
R. A. MATHEWS

**PHYSICS OF SOLIDS AND
MACROMOLECULES**
E. T. ARAKAWA¹
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P. J. CALDWELL³
T. A. CALLOTT⁴
A. R. CATHERS⁵
C. CHANG⁶
T. HIGAKI⁷
J. W. LITTLE⁸
C. MARTIN⁹
M. J. NOFZIGER¹⁰
L. R. PAINTER¹¹
J. E. PARRIS¹²
M. W. WILLIAMS¹³

SUBMERGION PHYSICS
R. D. BRENNOFF¹
R. S. BECKER²
M. C. BUNICK³
Y. T. CHU⁴
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L. R. PAINTER⁶

**ANALYTIC COSMETRY
AND SURFACE PHYSICS**
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T. L. FERRELL⁵
R. H. HARRIS⁶
K. E. JACOBSON⁷
A. TODD⁸
J. E. TURNER⁹
M. W. WILLIAMS¹⁰
H. A. WRIGHT¹¹

CONSULTANTS
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A. J. BRAUNDMER³
P. M. SCHENKOW⁴
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A. HOWE⁶
H. H. HUBBELL, JR.⁷
J. R. HANSON⁸
J. NEUFELD⁹
C. C. SUNG¹⁰
P. W. TODD¹¹

T. C. HOWELL¹
C. E. METCALFE²
O. H. MILLER³

**METABOLISM AND
DOSEMETRY**
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S. P. WARREN, SEC.²
S. R. BERNARD³
G. L. CHLO⁴
D. J. CRAWFORD⁵
M. CRISTY⁶
M. R. FORD⁷
C. S. FORE⁸
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R. W. LEGGETT¹¹
S. D. MURPHY¹²
F. F. ROWE¹³
J. C. RYMAN¹⁴
G. G. WARNER¹⁵
S. E. WATSON¹⁶
M. G. VALCINTAS¹⁷

**HEALTH EFFECTS
AND EPIDEMIOLOGY**
P. J. WALSH¹
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E. D. COPELMAYER⁴
C. S. OUDNEY⁵
C. E. EASTERLY⁶
C. S. FORE⁷
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J. E. PHILLIPS¹³
L. W. RICKERT¹⁴
E. A. ZEIGMAN¹⁵
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**NUCLEAR MEDICINE
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M. M. GOODMAN⁵
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W. H. BOINE⁷
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D. E. DUNNING, JR.⁵
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K. R. LONG⁷
B. MEYER⁸
T. PURDUE⁹
A. F. RUFF¹⁰
L. R. SHENTON¹¹
M. SOBEL¹²
J. STELLMAN¹³
L. R. WILLIAMS¹⁴

PHOTOPHYSICS
G. S. HURST¹
W. D. BRASHNER, SEC.²
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W. R. FERRELL⁴
W. FOLTZ⁵
J. TURBE⁶
J. P. ADISH⁷
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J. P. YOUNG¹³
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CONSULTANTS
J. S. BLOOM¹
W. A. CHURKA²
C. D. COOPER³
P. W. COULTER⁴
J. E. PARKS⁵

**PRINCIPAL MEDICAL
COOPERATIVES**
P. A. DISIMONE¹
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M. GUILLAUME⁵
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A. H. W. NIAS⁹
ST. THOMAS HOSPITAL,
LONDON¹⁰
J. K. FODGENBURG¹¹
UNION CARBIDE
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HOSPITAL¹⁴
S. TREVES¹⁵
CHILDREN'S HOSPITAL
BJSTON¹⁶
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S. D. MURPHY²
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R. D. SHARP⁴
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NUCLEAR APPLICATIONS
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E. L. ETHIER⁴
G. S. HILL⁵
P. O. HOFFMAN⁶
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R. W. SHOR⁸

**OFF-SITE POLLUTANT
MEASUREMENTS**
P. F. HAYWOOD¹
R. D. RASE, SEC.²
S. A. SERVEN³
C. CLARK, JR.⁴
W. D. COTTRELL⁵
W. A. GOLDBRYTH⁶
T. E. MYRICK⁷
M. S. OWENS⁸
P. T. PERDUE⁹
D. R. WITT¹⁰
D. L. ANDERSON¹¹
R. W. DOANE¹²
S. S. ELLIS¹³
W. H. SHINPAUGH¹⁴

**DOSEMETRY APPLICATIONS
RESEARCH**
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R. E. SWAJA⁷
R. T. GREENE⁸
G. R. PATTERSON⁹ ISAMP

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²AFFIRMATIVE ACTION REPRESENTATIVE
³SAFETY AND RADIATION CONTROL OFFICER
⁴PART TIME
⁵QUALITY ASSURANCE COORDINATOR
⁶ALTERNATE QUALITY ASSURANCE COORDINATOR
⁷POSTDOCTORAL FELLOW
⁸QUEST ASSIGNMENT
⁹STUDENT
¹⁰SUBCONTRACT
¹¹ORAU FELLOWSHIP PARTICIPANT
¹²ON LOAN FROM ORGP
¹³SABBATICAL LEAVE
¹⁴FINANCE AND MATERIALS DIVISION
¹⁵INFORMATION DIVISION
¹⁶BIOLOGY DIVISION
¹⁷COMPUTER SCIENCES DIVISION
¹⁸ENERGY DIVISION
¹⁹ANALYTICAL CHEMISTRY DIVISION
²⁰PHYSICS DIVISION
²¹ENVIRONMENTAL SCIENCES DIVISION
²²OPERATIONS DIVISION
ISAMP INDUSTRIAL SAFETY AND APPLIED
HEALTH PHYSICS DIVISION
IC INSTRUMENTATION AND CONTROLS
DIVISION
C CHEMISTRY DIVISION

Appendix D. Honors and Awards

L. G. Christophorou

Union Carbide Corporate Research Fellow, 1980.

Correspondent Member of the Academy of Athens, Greece, 1979.

T. D. Jones

Elda E. Anderson Award, Health Physics Society, July 1980.

H. R. Meyer, J. E. Till, E. S. Bomar, W. D. Bond, L. E. Morse, V. J. Tennerly, and M. G. Yalcintas

1980 Technical Communications Award, East Tennessee Chapter of the Society for Technical Communications, and the 27th International Technical Communications Convention Award of Achievement in 1980 for their article "Radiological Impact of Thorium Mining and Milling," *Nuclear Safety* 20(3):319 (1979).

P. T. Perdue

East Tennessee Health Physics Society Distinguished Service Award, January 1981.

D. D. Schuresko, J. E. Mrochek, W. W. Pitt, Jr., G. K. Schulze, M. S. Blair, M. L. Bauer, R. G. Phillips, W. A. Walker, and R. W. Wood

IR-100 Award for Portable Fluorescence Spotter, 1980.

J. P. Witherspoon

Technical Communication Award, 1980, Excellence in Journal Articles and Conference Papers, East Tennessee Chapter of the Society for Technical Communication.

Merit Award, 1980, Periodical Articles, International Society for Technical Communications.

Appendix E. Seminar Program

The seminar program for Health and Safety Research Division is annually organized by a committee composed of a Division Coordinator and representatives from each of the four sections. The committee members for calendar year 1980 were A. P. Watson (Coordinator), J. K. Baird, J. D. Hoeschle, J. A. Stockdale, and C. A. Little.

The 1980 program hosted 23 general-topic speakers for division seminars and initiated an informal luncheon series, where division staff could present their current findings to one another. Staff of the division are an extremely diverse group who perform work in a wide variety of research areas. The following list of seminar speakers and their topics reflects that diversity. Industry, labor, academic institutions, foreign research institutes and other national laboratories were all represented.

John Totter

Institute of Energy Analysis, Oak Ridge Associated Universities, "Spontaneous Cancer and its Relationship to Radiogenic Cancer," January 15, 1980.

Kenneth Skrable

Radiological Sciences, University of Lowell, Lowell, Massachusetts, "Retention Functions for Internal Dosimetry," January 24, 1980.

William Russell

Biology Division, ORNL, "Chemical-Induced Gene Mutations in Mice," February 19, 1980.

Betsey Kagey

Department of Preventive Medicine and Community Health, State University of New York, Brooklyn, "Health Impact of Geochemical Alterations Associated with Coal Resource Development," March 12, 1980.

Bobby Wixson

Department of Environmental Health, University of Missouri, Rolla, "Health Impact of Geochemical Alterations Associated with Coal Resource Development," March 12, 1980.

Richard Holroyd

Department of Chemistry, Brookhaven National Laboratory, Long Island, New York, "Ion and Electron Reactions in Irradiated Liquids," March 25, 1980.

Garnett Bryant

Physics Department, Washington State University, Pullman, Washington, "Interactions of Intense Laser Pulses with Transparent Solids," April 2, 1980.

Hans Oeschger

Physics Institut, University of Bern, Switzerland, "Use of Isotope Studies in Understanding Environmental Systems," April 3, 1980.

K. Z. Morgan

School of Nuclear Engineering, Georgia Institute of Technology, Atlanta, "Appreciation of Risks of Low-Level Radiation vs. Nuclear Energy," May 2, 1980.

William Fairbanks, Sr.

Department of Physics, Stanford University, Stanford, California, "Applications of Superconductivity in Biology and Medicine," May 21, 1980.

Victor Hawthorne

School of Public Health, University of Michigan, Ann Arbor, "Epidemiology, Environment and Health," May 27, 1980.

Lorin Kerr

Department of Occupational Health, United Mine Workers of America, Washington, D. C., "Occupational Health Problems of Coal Miners," June 11, 1980.

Edward Josephson

Department Nutrition and Food Science, Massachusetts Institute of Technology, Cambridge, Massachusetts, "Health Aspects of Food Irradiation," July 24, 1980.

Bernie Cohen

Department Physics and Astronomy, University of Pittsburgh, "Recent Studies of Radioactive Waste Problems," August 14, 1980.

Vaclav Smil

Department Geography, University of Manitoba, "Energetics of the Developing Nations," September 17, 1980.

Nancy Hanis

EXXON Corporation, Linden, New Jersey, "Cancer of the Larynx in Ethanol Workers," September 29, 1980.

Colin Soskolne

Department Research Medicine, University of Pennsylvania, Philadelphia, "Upper Respiratory Cancer among Refinery and Chemical Plant Workers," September 29, 1980.

Henry Wagner

Division of Nuclear Medicine and Radiation Health, Johns Hopkins, Baltimore, Maryland, "The Role of Nuclear Medicine in the Diagnosis and Detection of Heart Disease," October 14, 1980.

James Hammond

Department of Industrial Hygiene, School of Public Health, University of Texas, Houston, "Indoor Air Pollution in Mobile Homes, October 24, 1980.

Duncan Thomas

Department of Epidemiology and Health, McGill University, Quebec, "Choosing Between Causal Models," November 17, 1980.

Richard Wallenstein

Faculty of Physics, University of Bielefeld, West Germany, "Non-Linear Frequency Tripling in the Rare Gases," November 25, 1980.

John Wood

Gray Freshwater Institute, University of Minnesota, Minneapolis/St. Paul, "Bioinorganic Reactions of Environmental Significance," December 3, 1980.

James Cross

Faculty of Engineering, University of Waterloo, Ontario, "A Discussion of the Area Effect in Liquid Breakdown," December 11, 1980.

Appendix F. Advisory Committee

Advisory Committee Members

W. A. Chupka
Yale University

Chemical Physics

J. L. Magee
Lawrence Berkeley Laboratory

Radiation Dosimetry

C. M. Shy
University of North Carolina

Epidemiology

G. H. Whipple
University of Michigan

Health Physics/Public Health

S. Treves
Children's Hospital Medical
Center, Boston

Nuclear Medicine

Appendix G. Publications

D. S. Alberts, Y-M. Peng, G. H-S. Chen, T. E. Mnon, T. C. Cetas, and J. D. Hoeschele

"Therapeutic Synergism of Hyperthermia-*cis*-Platinum in a Mouse Tumor Model," *J. Natl. Cancer Inst.* 65(2):455 (1980).

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"Collisions of UF_6^- with Ar, Xe, SF_6 , and UF_6 ," *J. Chem. Phys.* 74:297 (1981).

E. T. Arakawa and P. J. Caldwell

"Holographically Produced Transmission Gratings for Soft X-Rays," *Nucl. Instrum. Methods* 172:293 (1980).

E. T. Arakawa, P. J. Caldwell, and M. W. Williams

"Transmission Gratings for the Extreme Ultraviolet," *Optical Engineering* (accepted).

"Soft X-Ray Transmission Gratings," pp. 52-55 in *Proceedings of Photo-Optical Instrumentation Engineers 24th International Technical Symposium and Exhibit*, San Diego, California, July 29-August 1, 1980.

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E. T. Arakawa and B. Loisel

"An Application of the Attenuated-Total-Reflection Technique to Thin-Film Alloying Studies," p. 367 in *Proceedings of the 8th International Vacuum Congress*, Cannes, France, September 22-26, 1980.

E. T. Arakawa, M. W. Williams, J. C. Ashley, and L. R. Painter

"The Optical Properties of Kapton: Measurement and Applications," *Journal of Applied Physics* (in press).

J. C. Ashley

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"Straggling and Plasmon Excitation in the Energy Loss Spectra of Electrons Transmitted through Carbon," *Thin Solid Films* 60:361 (1979).

J. C. Ashley and R. H. Ritchie

"Energy Losses of Channeled Ions - The Bohr Theory Revisited," *Proceedings of the VIII International Conference on Atomic Collisions in Solids*, Moscow State University Publishing House, USSR (in press).

J. C. Ashley and M. W. Williams

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S. I. Auerbach, B. G. Blaylock, E. A. Bondietti, C. T. Garten, W. C. Hanson, F. O. Hoffman, C. L. Osterberg, V. Schultz, J. R. Trabalka, and F. W. Whicker

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J. K. Baird

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J. K. Baird, J. McCaskill, and M. H. March

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J. K. Baird and S. A. Rice

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D.W.A. Bourne, J. W. Triplett, T. L. Hayden, P. A. DeSimone, and J. D. Hoeschele

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E. E. Calle

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L. G. Christophorou (Editor)

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High Voltage Research (Breakdown Strengths of Gaseous and Liquid Insulators), and Environmental Effects of Dielectric Gases, Semiannual Report (October 1, 1979-March 31, 1980), ORNL/TM-7405 (1980).

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M. G. Yalcintas, K. F. Eckerman, and G. G. Warner

"Experimental Validation of Monte Carlo Calculations for Organ Dose," *Proceedings of the Third International Radiopharmaceutical Dosimetry Symposium*, Oak Ridge, Tennessee, October 1980 (in press).

M. G. Yalcintas, T. D. Jones, and H. R. Meyer

"Estimation of Dose and Risk Associated with Co-60 Therapy Source Accident," *Health Phys.* 37:846 (1979).

M. G. Yalcintas, T. D. Jones, H. R. Meyer, H. Ozer, and S. Neal

"Estimation of Dose Due to Accidental Exposure to a Co-60 Therapy Source," *Health Phys.* 38(2):187 (1980).

Appendix H. Presentations at Technical Meetings

B. K. Annis and J.A.D. Stockdale

"Collisions of UF_6^- Ions with Ar, Xe, SF_6 , and UF_6 ," Division of Electron and Atomic Physics Meeting, Los Angeles, California, November 30-December 3, 1980.

E. T. Arakawa

"Research Program of Physics of Solids and Macromolecules Group," DOE Five-Year Program Review, ORNL, October 23-25, 1979.

"Research Program of Physics of Solids and Macromolecules Group," HASRD Information Meeting, ORNL, March 5-6, 1980.

"Soft X-Ray Spectroscopic Research at ORNL," Synchrotron Radiation User's Group, National Bureau of Standards, Washington, D. C., March 13, 1980 (invited).

"A Study of the Diffusion of Al into Au Thin Films," Physics Department, University of Madrid, Spain, September 19, 1980.

"Radiation Physics Program at ORNL," German Electron Synchrotron Radiation Physics Seminar, Hamburg, Germany, September 29, 1980.

"Energy Research at ORNL," Florida Atlantic University Physics Department, Boca Raton, Florida, January 29, 1981.

E. T. Arakawa, P. J. Caldwell, and M. W. Williams

"Soft X-Ray Transmission Gratings," Society of Photo-Optical Instrumentation Engineers 24th International Technical Symposium and Exhibit, San Diego, California, July 28-August 1, 1980 (invited).

E. T. Arakawa and B. Loisel

"An Application of the Attenuated Total Reflection Technique to Thin-Film Alloying Studies," IV International Conference on Solid Surfaces, Cannes, France, September 22-26, 1980.

E. T. Arakawa, T. A. Tagle, and T. A. Callcott

"Soft X-Ray Emission Energy Bands Structure of Phosphorous Segregated in Copper," Sixth International Conference on Vacuum Ultraviolet Radiation Physics, Charlottesville, Virginia, June 2-6, 1980.

E. T. Arakawa, K. A. Glastad, A. R. Cathers, and M. W. Williams

"The Optical Properties of Solid and Liquid Bi," American Physical Society Meeting, Phoenix, Arizona, March 16-20, 1981.

J. C. Ashley

"Electron Interactions in Solids," DOE Five-Year Program Review, ORNL, October 23-25, 1979.

"Inelastic Interactions of Low-Energy Electrons with Organic Solids: Simple Formulae for Mean Free Paths and Stopping Powers," IEEE Annual Conference on Nuclear and Space Radiation Effects, Cornell University, Ithaca, New York, July 15-18, 1980.

"Stopping Powers of Organic Solids for Low-Energy Electrons," 28th Annual Radiation Research Society Meeting, New Orleans, Louisiana, June 1-5, 1980.

J. S. Attrey, R. D. Birkhoff, and L. R. Painter

"Electronic Properties of Benzene, Toluene, Xylene, and Trimethylbenzene in the 2 to 9 eV Spectral Region," Southeastern Section of the American Physical Society, University of North Carolina, Chapel Hill, North Carolina, November 6-8, 1980.

C. F. Baes III

"Determination of Leaching Constants Under Agricultural Conditions," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

J. K. Baird

"Many-Body, Lagrangian Formulation of the Ionization Track Recombination Problem," American Physical Society Southeastern Section Meeting, Chattanooga, Tennessee, November 8, 1979.

"Some Puzzles in the Radiation Chemistry and Physics of Liquid Hydrocarbons," HASRD Seminar, ORNL, January 9, 1980.

Physics and Chemistry of Electrons in Dense Fluids," Department of Physics, Auburn University, Auburn, Alabama, February 15, 1980.

"Irving Langmuir's Study of Great Blunders in Science," Regional Meeting, Society of Physics Students, Auburn University, Auburn, Alabama, February 16, 1980.

"Transport and Reactivity of Electron in Nonpolar Liquids," Interuniversitair Reactor Instituut, Delft, The Netherlands, April 22, 1980.

"Transport and Reactivity of Electrons in Nonpolar Liquids," Laboratoire de Physico-chimie des Rayonnements, Universite de Paris - Sud, Orsay, France, April 25, 1980.

"Transport and Reactivity of Electrons in Nonpolar Liquids," Hahn-Meitner Institut für Kernforschung, Berlin, West Germany, May 12, 1980.

"Theory of Photodetachment of Negative Ions Dissolved in Free Electron Liquids," American Physical Society Southeastern Section Meeting, Chapel Hill, North Carolina, September 6, 1980.

"Statistical Thermodynamics of Electron Localization and Drift in Insulating Gases and Liquids," Chemical Physics Seminar, ORNL, September 22, 1980.

"Chemistry of Excess Electrons in Gases and Liquids," Department of Chemistry, University of New Mexico, Albuquerque, New Mexico, October 15, 1980.

"Transport and Chemical Reactivity of Electrons in Gases and Liquids," Westinghouse Research and Development Center, Pittsburgh, Pennsylvania, November 17, 1980.

"Diffusion Controlled Chemicals Reactions," Space Sciences Laboratory, National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Alabama, November 26, 1980.

"Electron Effective Mass in Liquids Calculated from Solute Negative Ion Photodetachment Cross Sections," Chemical Physics Seminar, ORNL, January 19, 1981.

"Photodetachment of Negative Ions in Dense Fluids," National Bureau of Standards, Gaithersburg, Maryland, January 22, 1981.

"Diffusion Controlled Chemical Reactions," Knolls Atomic Power Laboratory, Schenectady, New York, February 9, 1981.

"Electron Transport and Reactivity in Dense Fluids," General Electric Research and Development Center, Schenectady, New York, February 10, 1981.

J. K. Baird, D. V. Maxey, J. G. Carter, and L. G. Christophorou

"Thermodynamics of Electron Drift in Ammonia Vapor," New York Meeting of the American Physical Society, New York, January 26-29, 1981.

D. W. Beekman, T. A. Callcott, S. D. Kramer, E. T. Arakawa, G. S. Hurst, and E. Nussbaum

"Resonance Ionization Source for Mass Spectroscopy," Southeastern Section of the American Physical Society, Chattanooga, Tennessee, November 8-10, 1979.

J. R. Beene, C. E. Bemis, Jr., J. P. Young, and S. D. Kramer

"Study of the Fission Isomer $\text{Am}^{240\text{m}}$ Using Lasers," 1980 Spring American Physical Society Meeting, Washington, D. C., April 28-May 1, 1980.

C. E. Bemis, Jr., J. R. Beene, J. P. Young, and S. D. Kramer

"Optical Isomer Shift for the Fission Isomer $\text{Am}^{240\text{m}}$," Physics Division Annual Information Meeting, ORNL, November 5, 1979.

"Laser-Induced Nuclear Polarization (LINUP): Application to the Study of Short-Lived Nuclides," XI International Quantum Electronics Conference, Boston, Massachusetts, June 23-26, 1980.

"Study of the Fission Isomer $\text{Am}^{240\text{m}}$ Using Lasers," American Chemical Society National Meeting, Las Vegas, Nevada, August 25, 1980.

S. R. Bernard

"An Urn Model Study of Variability in Excretion from a Compartment," 25th Annual Conference on Bioassay, Environmental, and Analytical Chemistry, 1979.

"An Urn Model Approach to Actinide Metabolism," Actinide Workshop, 1979.

S. R. Bernard and S. M. Chen

"Dose to the Gall Bladder from a $^{99\text{m}}\text{Tc}$ Labeled Gall-Bladder Scanning Agent," Third International Radiopharmaceutical Dosimetry Symposium, Oak Ridge, Tennessee, October 1980.

B. A. Berven

F. F. Haywood, and W. A. Goldsmith (authors), "Residual Activity in the Vicinity of Formerly Utilized MED/AEC Sites," DOE Environmental Control Technology Symposium, Reston, Virginia, March 1980.

B. A. Berven and J. E. Johnson

"Depth-Dose in Tissue from Beta Particles of ^{85}Kr ," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

B. A. Berven, W. A. Goldsmith, F. F. Haywood, and K. J. Schiager

"Proposed Training Program for Construction Personnel Involved in Remedial Action Work at Sites Contaminated by Naturally Occurring Radionuclides," Health Physics Society Mid-Year Topical Symposium, Honolulu, Hawaii, December 1979.

R. D. Birkhoff, J. M. Heller, Jr., H. H. Hubbell, Jr., and L. R. Painter

"Optical and Dielectric Functions of Liquid Hexamethylphosphoric Triamide Between 2 and 25 eV," Southeastern Section of the American Physical Society, University of North Carolina, Chapel Hill, North Carolina, November 6-8, 1980.

R. D. Birkhoff, J. M. Heller, Jr., L. R. Painter, and H. H. Hubbell, Jr.

"Photoemission from Liquid Formamide in Vacuum Ultraviolet," Southeastern Section of the American Physical Society, Chattanooga, Tennessee, November 8-10, 1979.

"Absolute Photoemission from Liquid Formamide in the Vacuum Ultraviolet," Sixth International Conference on Vacuum Ultraviolet Radiation Physics, Charlottesville, Virginia, June 2-6, 1980.

P. J. Caldwell and E. T. Arakawa

"Transmission Diffraction Gratings for the 20 to 200 eV Region," Sixth International Conference on Vacuum Ultraviolet Radiation Physics, Charlottesville, Virginia, June 2-6, 1980.

T. A. Callcott, D. L. Ederer, and E. T. Arakawa

"A Wide-Energy Range, High Resolution, High Efficiency Spectrometer for Use in Soft X-Ray Emission and Absorption Studies," Sixth International Conference on Vacuum Ultraviolet Radiation Physics, Charlottesville, Virginia, June 2-6, 1980.

T. A. Callcott, T. A. Tagle, and E. T. Arakawa

"Soft X-Ray Emission from Li-Al and Li-Mg Alloys," American Physical Society, New York, March 24-28, 1980.

E. E. Calle

"Computer Mapping of Cancer Mortality by Census Tract: Columbus, Ohio 1956-1974," and "Health and Coal Utilization in the Rural South: A Cartographic Approach," Fourth International Symposium on Cartography and Computing: Applications in Health and Environment, Reston, Virginia, November 4-8, 1979.

M. R. Cates, L. A. Franks, and C. H. Chen

"Transuranics Analysis by Resonance Ionization of Noble Gases," American Chemical Society Meeting, Houston, Texas, March 23-28, 1980.

A. R. Cathers, J. E. Parks, T. Inagaki, T. A. Callcott, and E. T. Arakawa

"The Optical Properties of Liquid Sn and Pb," Southeastern Section of the American Physical Society, Chattanooga, Tennessee, November 8-10, 1979.

C. C. Chan, M. O. Pace, and L. G. Christophorou

"DC Breakdown Strengths of Some Multicomponent Gas Mixtures in Concentric Cylinder Geometries," Second International Symposium on Gaseous Dielectrics, Knoxville, Tennessee, March 9-13, 1980.

C. H. Chen

"Laser-Induced Fluorescence Spectra of Rotationally Cooled Molecules," Chemical Physics Seminar, ORNL, April 28, 1980.

"Resonance Ionization Spectroscopy: Stable Atom Detection," Workshop on Advanced Laser Technology for Pollutant Measurement, Harpers Ferry, West Virginia, June 10-11, 1980.

C. H. Chen and G. S. Hurst

"Resonance Ionization Detection of Xe Atoms," XI International Quantum Electronics Conference, Boston, Massachusetts, June 23-26, 1980.

C. H. Chen, G. S. Hurst, and M. G. Payne

"Direct Counting of Isotopically Selected Xe Atoms," Division of Electron and Atomic Physics Meeting, American Physical Society, Los Angeles, California, December 1-3, 1980.

Y. T. Chu, R. D. Birkhoff, and H. H. Hubbell, Jr.

"Light Scattering from Micron Size Fibers," Southeastern Section of the American Physical Society, Chattanooga, Tennessee, November 8-10, 1979.

"Attenuation of Creeping Waves on a Cylinder," Southeastern Section of the American Physical Society, University of North Carolina, Chapel Hill, North Carolina, November 6-8, 1980.

L. G. Christophoru

"High Voltage Research and Environmental Effects of Dielectrics," Conservation Program Meeting, ORNL, October 22, 1979.

"The Atomic and Molecular Physics Program," "Electrons and Negative Ions," "Fast Gases for Gas-Filled Detectors," DOE Five-Year Program Review, ORNL, October 25, 1979.

"New Gaseous Dielectrics: The Oak Ridge Program," Gas Cable Subcommittee Meeting of EPRI and DOE, Springhouse, Pennsylvania, November 1, 1979.

"Applied Aspects of Electron-Molecule Scattering and Negative Ion Studies," Department of Physics, Georgia Institute of Technology, March 23, 1980.

"Negative Ion States of Polyatomic Molecules," American Chemical Society Meeting, Houston, Texas, March 23-28, 1980.

"Breakdown Strength of Gaseous Dielectrics," EPRI Gas Cable Subcommittee Meeting, Boston, Massachusetts, April 8-10, 1980.

"Negative Ion States of Polyatomic Molecules," Chemical Physics Seminar, ORNL, May 5, 1980.

"Interactions of Slow Electrons with Environmental Pollutants," Physics and Chemistry of Atmospheric Pollution Program, Harpers Ferry, West Virginia, May 28-30, 1980.

"Electron and Ion Collision Physics and the Development of New Gaseous Dielectrics," Democritus Nuclear Research Center, Athens, Greece, August 13, 1980.

"On the Definition of a 'Better' Gas Than SF₆," International Conference on Gas Discharges and Their Applications, Edinburgh, Scotland, September 7-12, 1980.

"New Directions in Gaseous Dielectrics," Royal Institute of Technology, Stockholm, Sweden, September 17, 1980.

"Recent Work on Gaseous Dielectrics at ORNL," Electrical Engineering Department, Norwegian Institute of Technology, Trondheim, Norway, September 18, 1980.

"New Gaseous Dielectrics for Insulated Cable," Oak Ridge Section of IEEE, Oak Ridge, Tennessee, October 13, 1980.

L. G. Christophorou, D. V. Maxey, D. L. McCorkle, and J. G. Carter

"Xe-Containing Fast Gas Mixtures for Gas-Filled Detectors," 28th Annual Radiation Research Society Meeting, New Orleans, Louisiana, June 1-5, 1980.

R. N. Compton

"Multiphoton Excitation and Ionization in Atoms and Molecules: The New Spectroscopy," University of Notre Dame, Notre Dame, Indiana, December 6, 1979.

"Compound States of He^- ," Physics Division Seminar, ORNL, February 4, 1980.

"Multiphoton Ionization Spectroscopy," HASRD Information Meeting, ORNL, March 6, 1980.

"Multiphoton Excitation and Ionization of Atoms and Molecules," New York University, New York, April 21, 1980.

"Charge Transfer in Collisions Between Neutral Beams," Gordon Research Conference, Wolfeboro, New Hampshire, June 23-27, 1980 (invited).

"Compounds States in Atoms, Molecules, and Clusters," 33rd Gaseous Electronics Conference, Norman, Oklahoma, October 7-10, 1980.

"Compound States of He^- ," Chemical Physics Seminar, ORNL, October 13, 1980.

"Multiphoton Ionization of Atoms and Molecules," Louisiana State University, Baton Rouge, Louisiana, December 16, 1980.

"Compound States of He^- ," University of Georgia, Athens, Georgia, February 26, 1981.

R. N. Compton, G. D. Alton, and D. J. Pegg

"Photodetachment Cross Sections for $\text{He}^-(^4P^o)$," VI Conference on the Application of Accelerators in Research and Industry, North Texas State University, Denton, Texas, November 3-5, 1980.

D. J. Crawford

"An Age-Dependent Lung Model with Applicatons to Radiation Standards," HASRD Seminar, June 1980.

"Age-Dependent Lung Model and Age-Dependent GI Tract (f_1) Model," ICRP Committee 2 Seminar, October 1980.

D. J. Crawford, W. A. Goldsmith, P. T. Perdue, and F. F. Haywood

"Estimates of ^{227}Ac Concentration in Surface Soil through Measurements of Emanated ^{219}Rn ," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

D. J. Crawford and C. R. Richmond

"Epistemological Considerations in the Extrapolation of Metabolic Data from Non-humans to Humans," Third International Radiopharmaceutical Dosimetry Symposium, Oak Ridge, Tennessee, October 1980.

Mark Cristy

"Development of Mathematical Pediatric Phantoms for Internal Dose Calculations: Designs, Limitations, and Prospects," Third International Radiopharmaceutical Dosimetry Symposium, Oak Ridge, Tennessee, October 1980 (invited).

"Mathematical Phantoms for Evaluation of Age-Specific Internal Dose," HASRD Information Meeting, March 1980.

"Mathematical Phantoms for Age-Specific Dosimetry," Interagency Seminar at the Bureau of Radiological Health, 1980 (invited).

"Estimation of Active Marrow Distribution as a Function of Age and Its Significance in Absorbed Fraction Calculations," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

H. W. Dickson

"Planning for Decommissioning Action," DOE Decommissioning Criteria Workshop, Kansas City Missouri, April 15-16, 1980.

"Neutron Activation Foils," Health Physics and Radiation Protection Course, Oak Ridge Associated Universities, Oak Ridge, Tennessee, April 11, 1980.

"Criticality Dosimetry," Health Physics in Radiation Accidents Seminar, Oak Ridge Associated Universities, Oak Ridge, Tennessee, January 23, 1980.

"Risk from Nuclear Power," Powell High School Senior Science Class, Powell, Tennessee, March 25, 1980.

E. L. Keller and W. A. Goldsmith (Authors), "Proposed Relationship Between FUSRAP Radiological Monitoring and Certification Contractors," DOE Decommissioning Criteria Workshop, Kansas City, Missouri, April 15-16, 1980.

D. E. Dunning, Jr., R. W. Leggett, M. G. Yalcintas, and K. F. Eckerman

"Index of Relative Health Hazards from Selected Radionuclides," 25th Annual Meeting of Health Physics Society, Seattle, Washington, July 20-25, 1980.

C. E. Easterly

"Biological Effects of Fusion Reactors," Princeton Plasma Physics Laboratory, March 12, 1980.

DOE Briefing on Status of Magnetic Fusion Energy Environmental Project, Germantown, August 11, 1980.

"Biological Effects of Magnetic Fields," Seminar at Virginia Polytechnic and State University, March 2, 1981.

"Tritium Conversion and Its Influence on Personnel Protection at a Fusion Reactor," American Nuclear Society Meeting, Dayton, Ohio, April 29-May 1, 1980.

K. F. Eckerman

"Impact of Recent ICRP Recommendations on Dosimetry Concepts," 28th Annual Radiation Research Society Meeting, New Orleans, Louisiana, June 1-5, 1980 (invited).

K. F. Eckerman, M. Cristy, and G. G. Warner

"Dosimetric Evaluation of Brain Scanning Agents," Third International Radiopharmaceutical Dosimetry Symposium, Oak Ridge, Tennessee, October 1980.

K. F. Eckerman, G. D. Kerr, and R. Raridon

"Organ Doses from Isotopic and Cloud Sources of Gamma Rays," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

E. L. Etnier

"Dietary Intake of Cadmium in the United States: 1920-1975," Workshop in Environmental Effects of Photovoltaic Energy Technology Development and Use, Brookhaven National Laboratory, Upton, New York, June 18-20, 1980.

E. L. Etnier and P. S. Rohwer

"Estimates of Dose to Man from Environmental Tritium," American Nuclear Society Topical Meeting, Dayton, Ohio, April 29-May 1, 1980.

E. L. Etnier, P. J. Walsh, and A. P. Watson

"Health Implications of Unconventional Energy Production and Use," Third International Conference on Alternative Energy Sources, Miami Beach, Florida, December 15-18, 1980.

T. L. Ferrell

"Current Research in Surface Plasmons," Clemson University Physics Department, Clemson, South Carolina, October 1979.

"Diagrammatic Analysis of Perturbed Quantum Harmonic Oscillators," Southeastern Section of the American Physical Society, Chattanooga, Tennessee, November 8-10, 1979.

"Slow-Ion Energy Losses in Solids," New York University Physics Department Symposium on Energy Losses by Exotic Particles in Matter, New York, January 1980.

"Recent Discoveries in General Relativity," University of South Florida Physics Department, Tampa, Florida, February 1980 (invited).

"Origins and Development of Einstein's Relativity," Valdosta State College, Valdosta, Georgia, April 1980 (invited).

"Physical Interactions of Atmospheric Pollutants with Surfaces," Office of Health and Environmental Research, Department of Energy, Conference on Physics and Chemistry of Energy-Related Atmospheric Pollution, Harper's Ferry, West Virginia, May 1980.

"Plasmons and Surface Physics," Virginia Polytechnic Institute and State University, Physics Department, Blacksburg, Virginia, October 1980.

"Surface Plasmons," University of Alabama Physics Department, Huntsville, Alabama, October 1980.

"Heisenberg-Kramers Dispersion Relationship for Spherical Surface Plasmons," Southeastern Section of the American Physical Society, Chapel Hill, North Carolina, November 6-8, 1980.

T. L. Ferrell, J. K. Baird, D. R. James, M. O. Pace, and L. G. Christophorou

"A Solution of Laplace's Equation for Hyperboloidal Electrodes with Applications to Dielectric Testing in Nonuniform Electric Fields," Second International Symposium on Gaseous Dielectrics, Knoxville, Tennessee, March 9-13, 1980.

G. W. Foltz

"Some Topics in Highly Excited Atom Research," Western Kentucky University Seminar, Bowling Green, Kentucky, October 27, 1980.

M. R. Ford, G. G. Warner, S. B. Watson, and K. F. Eckerman

"Specific Absorbed Fractions of Photons Emitted in the Brain," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 18-25, 1980.

R. B. Gammage

"Ceramic BeO Exoelectron Dosimeters for Tritium and Radon Monitoring," Fourth International Symposium on Exoelectron Emission and Application, Arhenshoop, East Germany, October 6, 1979.

"Track Etch Dosimeters" and "Portable Instrumentation for Non-Nuclear Energy System Pollutants," at Physics Institute, Giessen University, West Germany, October 11, 1979.

"Monitoring of Exposure to Radiation and Chemical Energy System Pollutants," EURATOM, Ispra, Italy, October 13, 1979.

"Proxy Compounds for Workplace Monitoring of PNAs," Fourth International Symposium on PAHs, Columbus, Ohio, October 24, 1979.

"New Portable Instrumentation for Industrial Hygiene," Oak Ridge Associated Universities Industrial Hygiene Training Course, Oak Ridge, Tennessee, February 20, 1980.

"Overview of the Monitoring Technology and Instrumentation Program at ORNL," National Institute of Occupational Safety and Health, Cincinnati, Ohio, March 7, 1980.

"Luminescence Dosimetry for Contamination of Skin by Carcinogenic Oil or Tar," Fourth International Conference on Luminescence Dosimetry, Toulouse, France, April 8, 1980.

"Personnel Neutron Dosimetry," Oak Ridge Associated Universities NRC-Sponsored Health Physics and Radiation Protection Training Course, Oak Ridge, Tennessee, May 16, 1980.

"Fluorescent Skin Contamination Monitor," Symposium on Instrumentation and Controls for Fossil Energy Processes, Virginia Beach, Virginia, June 9-11, 1980.

"Industrial Hygiene Instrument Development," Briefing for the Environmental Working Group for the Gasifiers in Industry, DOE Headquarters, Washington, D. C., June 13, 1980.

"Energy Development and Portable Instrumentation Programs at ORNL," and "Portable Fluorescent Spotter for Detection of Surface Contamination by Polynuclear Aromatic Compounds," DOE Workshop on Portable Instrumentation for Health and Safety, Fallen Leaf Lake, California, October 7-9, 1980.

"New Instruments for Plant Area and Personnel Monitoring," Third Miami International Conference on Alternative Energy Sources, Miami, Florida, December 16, 1980.

R. B. Gammage, A. R. Hawthorne, T. Vo-Dinh, and D. D. Schuresko

"New Instruments for Plant Area and Personnel Monitoring," Third Miami International Conference on Alternative Energy Sources, Miami, Florida, December 15-17, 1980.

R. B. Gammage, S. V. Kaye, and D. C. Parzyck

"Policy Options and Their Health Implications: Petroleum vs Synthetic Fuels and Indoor Air Pollution," Western Electric Seminar Center, Denver, Colorado, February 4, 1980.

R. B. Gammage and T. Vo-Dinh

"Analysis of Real-Life Samples by Synchronous Fluorescence and Phosphorescence at Room Temperature," Second Environmental Protection Agency Symposium on Process Measurements for Environmental Assessment, Atlanta, Georgia, February 25-27, 1980.

W. R. Garrett

"Overview of Chemical Physics Programs," DOE Five-Year Program Review, ORNL, October 24, 1979.

"Collective Emission Following Near-Resonant Three-Photon Atomic Excitation: Quenching of Five-Photon Ionization in Xenon," Division of Electron and Atomic Physics Meeting, Houston, Texas, December 10-12, 1979.

"Bound and Continuum States of Electrons on Polar Molecules," New York University, New York, January 7, 1980.

"Collective Emission Following Near-Resonant Three-Photon Atomic Excitation: Quenching of Five-Photon Ionization in Xenon," 1980 Annual Meeting of the American Physical Society, Chicago, Illinois, January 21-24, 1980.

"Some Favorite Recipes Involving Atoms, Molecules, Electrons, and Photons," HASRD Information Meeting, ORNL, March 5, 1980.

"Molecular Anions: Properties and Species," Physics and Chemistry of Energy-Related Atmospheric Pollution Meeting, Harpers Ferry, West Virginia, May 28-30, 1980.

"Electronically Excited States of Polar Anions," Southeastern Theoretical Chemist Association, University of Tennessee, Knoxville, May 22-24, 1980.

"Electronically Excited 'Dipole States' of Strongly Polar Molecules," Division of Electron and Atomic Physics Annual Meeting, Los Angeles, California, December 1-3, 1980.

"Excited Electron States of Polar Anions," Sanibel Symposia, Palm Coast, Florida, March 9-14, 1981.

W. A. Goldsmith and F. F. Haywood

"Influence of Energy Conservation Measures on Indoor Radon Exposures," Seventh Annual WATtec Energy Conference, Knoxville, Tennessee, February 1980.

W. A. Goldsmith, F. F. Haywood, M. M. Abd El Razeq, and K. J. Schiager

"Routes of ^{222}Rn Entry into Structures Built on ^{226}Rn -Contaminated Materials," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

W. A. Goldsmith, F. F. Haywood, and B. A. Berven

"Ground Verification of Airborne Monitoring Surveys," Environmental Decontamination Workshop, ORNL, December 1979.

G. D. Griffin, C. S. Dudney, P. S. Furcinitti, T. D. Jones, and P. J. Walsh

"Reproductive Survival and Macromolecular Synthesis in Cultured Mammalian Cells Exposed to Single Metabolites and Mixtures of Metabolites of Benzo(a)pyrene," Fifth International Symposium on Polynuclear Aromatic Hydrocarbons, Columbus, Ohio, October 28-30, 1980.

G. D. Griffin, C. S. Dudney, and P. J. Walsh

"Cell Cycle and Macromolecular Synthesis Alterations in Mammalian Cells Produced by Metabolites of Benzo(a)pyrene," Federation of American Societies for Experimental Biology, New Orleans, Louisiana, June 5, 1980.

G. D. Griffin, C. E. Easterly, and P. J. Walsh

"Assessment of Potential Health Effects of Dielectric Gases," Second International Symposium on Gaseous Dielectrics, Knoxville, Tennessee, March 9-13, 1980.

G. D. Griffin, S. A. Owen, G. D. Novelli, A. Solomon, and P. J. Walsh

"Immunoglobulin G (IgG) Production as a Marker of Mutagenesis: Comparison of Chemical Activity in Lymphoid Cells of Human and Mouse Origin," Symposium, Organ and Species Specificity in Chemical Carcinogenesis, Raleigh, North Carolina, March 2-4, 1981.

R. N. Hamm

"Electron Transport in Liquid Water," DOE Five-Year Program Review, ORNL, October 23-25, 1980.

R. N. Hamm, J. E. Turner, H. A. Wright, and R. H. Ritchie

"Calculated Distance Distributions of Energy Transfer Events in Irradiated Liquid Water," Seventh Symposium on Microdosimetry, Oxford, England, September 8-12, 1980.

R. N. Hamm, H. A. Wright, J. E. Turner, and R. H. Ritchie

"Distribution of Ionization in Small Volumes in Liquid Water Due to Proton Irradiation," 28th Annual Radiation Research Society Meeting, New Orleans, Louisiana, June 1-5, 1980.

A. R. Hawthorne

"Proposed Development of Sampling and Analysis Procedures to Support a Formaldehyde Monitoring Program," Consumer Product Safety Commission, Washington, D. C., November 15, 1979.

"The Microcomputer as a Laboratory Instrument," Oak Ridge Associated Universities Lecture at Southwestern, Memphis, Tennessee, January 24, 1980.

"The Microcomputer as a Laboratory Instrument," Oak Ridge Associated Universities Lecture at Duke University, Durham, North Carolina, February 1, 1980.

"The Microcomputer as a Laboratory Instrument," Oak Ridge Associated Universities Lecture at University of Texas at Arlington, Arlington, Texas, February 20, 1980.

"The Microcomputer as a Laboratory Instrument," Oak Ridge Associated Universities Lecture at Methanay Nazarene College, Oklahoma City, Oklahoma, February 21, 1980.

"DUVAS as an Industrial Hygiene Monitor," National Institute for Occupational Safety and Health, Cincinnati, Ohio, March 7, 1980.

"A Real-Time Organic Vapor Monitor for Measuring Coal Conversion Effluents," American Industrial Hygiene Association Conference, Houston, Texas, May 18-23, 1980.

"DUVAS: A Portable Aromatic Vapor Monitor," Symposium on Instrumentation and Control for Fossil Energy Processes, Virginia Beach, Virginia, June 9-11, 1980.

"Microprocessor Enhancement of Portable Instrumentation for Health and Safety," and "DUVAS: A Portable Aromatic Vapor Monitor," DOE Workshop on Portable Instrumentation for Health and Safety, Fallen Leaf Lake, California, October 7-9, 1980.

F. F. Haywood

"A Compact Mobile Laboratory System for Use in Ground-Level Gamma-Ray Scanning," Twenty-Fourth Conference on Analytical Chemistry in Energy Technology, ORNL, October 1980.

F. F. Haywood and P. T. Perdue

"A Cryogenic Air Sampler for Radon," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

J. M. Heller, Jr., T. S. Riedinger, R. D. Birkhoff, and L. R. Painter

"Optical Properties of Polycrystalline Anthracene in the 3.2 to 9.3 eV Spectral Region," Southeastern Section of the American Physical Society, Chattanooga, Tennessee, November 8-10, 1979.

J. D. Hoeschele

"Inorganic Concepts Relevant to Metal Binding, Activity, and Toxicity in a Biological System," Biology Division, ORNL, October 1979.

"Metals and Metal Complexes in Biology and Medicine," Department of Rheumatology, Memorial Hospital Medical Center of Long Beach, Long Beach, California, August 28, 1980.

J. D. Hoeschele, M. W. Williams, J. E. Turner, K. B. Jacobson, and M. T. Christie

"Analysis of Softness Parameters as Potential Numerical Indices of Acute Metal Ion Toxicity," Annual Meeting, American Chemical Society, Las Vegas, Nevada, August 19-24, 1980.

F. O. Huffman and G. Schwarz

"Imprecision of Dose Predictions for Radionuclides Released to the Atmosphere: An Application of the Monte Carlo-Simulation Technique for Iodine Transported via the Pasture-Cow-Milk Pathway," Winter Meeting of the American Nuclear Society, San Francisco, California, November 11-16, 1979.

"Uncertainties in Environmental Radiological Assessments," invited manuscript for the 1980 Summer School of the Health Physics Society.

C. F. Holoway, H. W. Dickson, P. M. Lantz, and T. Wright

"Monitoring for Compliance with Decommissioning Criteria," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

G. S. Hurst

"Resonance Ionization Spectroscopy and Its Applications," DOE Five-Year Program Review, ORNL, October 24, 1979.

"The Detection of Single Atoms," Washington University, St. Louis, Missouri, November 7, 1979.

"Applications of One-Atom Detection," Stanford Research Institute, Menlo Park, California, January 29, 1980.

"One-Atom Detection: Can a Maxwell Demon Sort Insulators for EPRI?" Electric Power Research Institute, Palo Alto, California, January 30, 1980.

"Resonance Ionization Spectroscopy for Ultralow Quantity and Concentration Analysis," American Chemical Society Meeting, Houston, Texas, March 23-28, 1980.

"Applications of One-Atom Detectors in Nuclear Physics," Physics Division Seminar, ORNL, June 18, 1980.

"Can Maxwell's Demon Find the Missing Neutrinos?" Chemical Physics Seminar, ORNL, July 14, 1980.

"Direct Counting of Noble Gas Atoms," Los Alamos Scientific Laboratory, Los Alamos, New Mexico, July 17, 1980.

"Resonance Ionization Spectroscopy and One-Atom Detection," University of Toronto, Toronto, Canada, October 31, 1980.

"Single Atom Spectroscopy," Regional Students Physics Conference, University of Louisville, Louisville, Kentucky, November 21-22, 1980.

"Counting the Atoms," University of Kentucky, Lexington, November 24, 1980.

"Counting the Atoms," University of Illinois, Chicago, November 25, 1980.

G. S. Hurst, and S. D. Kramer, and B. E. Lehmann

"Resonance Ionization Spectroscopy for Low-Level Counting," American Chemical Society Meeting, Houston, Texas, March 23-28, 1980.

G. S. Hurst, M. G. Payne, S. D. Kramer, and J. P. Young

"One-Atom Detection," XI International Quantum Electronics Conference, Boston, Massachusetts, June 23-26, 1980.

Herbert Inhaber

"Risk and Consequences of Energy Production," American Public Health Association Annual Meeting, Detroit, Michigan, October 1980.

"Risk and Consequences of Energy Production," A discussion meeting on "The Perception and Assessment of Risk," Royal Society, London, United Kingdom, November 1980.

"Is Solar Riskier than Nuclear?" Los Alamos Scientific Laboratory, Los Alamos, New Mexico, December 1980.

"H-Coal Liquefaction," Second Annual Contractor Meeting, Health and Environmental Risk Analysis Program, DOE, Alexandria, Virginia, February 1981.

Herbert Inhaber and D. C. Parzyck

"Comparative Health Risks of Energy Production," Institute of Electrical and Electronic Engineers Nuclear Science Symposium, Orlando, Florida, November 1980.

D. R. James, L. G. Christophorou, and R. A. Mathis

"New Unitary and Multicomponent Gaseous Dielectrics," Second International Symposium on Gaseous Dielectrics, Knoxville, Tennessee, March 9-13, 1980.

T. D. Jones

"Empirical Observations in Support of 'Carcinogenic Promotion' as a Tool for Screening and Regulation of Toxic Agents - Including Radiation," Symposium on Energy Resources, Production and Related Health Hazards, West Virginia State College, August 26, 1980 (invited).

"Introduction to UNSCEAR and NAS Reports on Exposure and Risk," NRC-sponsored Health Physics and Radiation Protection Course at Oak Ridge Associated Universities, March 26, 1980 (invited).

"A Generalized Leukemia Response-Function Which Could Resolve the BEIR III Controversy," Comparative Animal Research Laboratory Facility, March 6, 1981.

T. D. Jones, G. D. Griffin, C. S. Dudney, and P. J. Walsh

"Empirical Observations in Support of 'Carcinogenic Promotion' as a Tool for Screening and Regulation of Toxic Agents," Fifth International Symposium on Polynuclear Aromatic Hydrocarbons, Columbus, Ohio, October 29, 1980.

T. D. Jones and P. J. Walsh

"Leukemia Risk - Estimators for Thorotrast Patients and for A-Bomb Survivors Can be Reconciled," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

S. V. Kaye

"Synthetic Fuels Research in the Health and Safety Research Division," Pittsburgh Energy Research Center, Pittsburgh, Pennsylvania, December 3, 1980.

"Synthetic Fuels Research in the Health and Safety Research Division," Morgantown Energy Research Center, Morgantown, West Virginia, December 4, 1980.

"Welcoming Address," Symposium on Uncertainties Associated with the Regulation of the Geologic Disposal of High-Level Radioactive Waste, Gatlinburg, Tennessee, March 10-11, 1981.

K. D. Kerr

"Neutron Dosimetry," Lecture in Health Physics Course, University of Tennessee, Knoxville, April 28, 1980.

"Air Sampling: Radon and Its Daughters," Lecture in Health Physics and Radiation Protection Course (February 25-May 2), Oak Ridge Associated Universities, Oak Ridge, Tennessee, March 25, 1980.

"Air Sampling: Radon and Its Daughters," Lecture in Applied Health Physics Course (September 10-October 12), Oak Ridge Associated Universities, Oak Ridge, Tennessee, October 5, 1979.

G. G. Killough

"Distributions of Transit Time and Age in Several Models of Carbon Turnover in the Ocean," HASRO Luncheon Seminar Series, April 8, 1980.

Program review conducted by Roger Dahlman, DCE Carbon Dioxide Effects Research and Assessment Program for the project "The Global Carbon Cycle and Climate" (J. S. Olson, Principal Investigator), funded through Environmental Sciences Division, December 7, 1979.

Presented results of the study of Item 1 under Measures of Performance at the review session with R. M. Garrels, Environmental Sciences Division Advisory Committee Member and others during Environmental Sciences Division Annual Information Meeting, April 9, 1980.

Review of NRC Project "Biotransport and Dosimetry," B0188, National Academy of Sciences Review, May 28, 1980.

J. F. King, M. L. Randolph, and M. T. Ryan:

"Estimation of Excess Human Mortality Following Exposure to Low Doses of Ionizing Radiations," 28th Annual Radiation Research Society Meeting, New Orleans, Louisiana, June 1-5, 1980.

C. E. Klotz

"Studies of Molecular Clusters," DOE Five-Year Program Review, ORNL, October 24, 1979.

"Self-Scavenging of Electrons in Methyl Iodide," Gordon Research Conference, Wolfeboro, New Hampshire, July 21-25, 1980.

"Electron Attachment to van der Waals Molecules," Division of Electron and Atomic Physics Annual Meeting, Los Angeles, California, December 1-3, 1980 (invited).

"Solubility of Protons in Water," Chemical Physics Seminar, ORNL, March 9, 1981.

C. E. Klotz and R. N. Compton

"Self-Scavenging of Electrons in Methyl Iodide," 28th Annual Conference on Mass Spectrometry, New York, May 28-30, 1980.

"Mechanisms for Ionization of Molecular Clusters," Physics and Chemistry of Energy-Related Atmospheric Pollution Meeting, Harpers Ferry, West Virginia, May 28-30, 1980.

F. F. Knapp, Jr.

"Selenium and Tellurium as Carbon Substitutes," International Symposium on Radiopharmaceuticals: Structure-Activity Relationships, Hartford, Connecticut, March 21-23, 1980.

"Tellurium-123m and Selenium-75-Labeled Radiopharmaceuticals," Department of Nuclear Medicine, Massachusetts General Hospital, Boston, Massachusetts, April 23, 1980.

"New Radiolabeled Fatty Acids for Myocardial Imaging," Department of Nuclear Medicine, The Johns Hopkins Medical Institutions, Baltimore, Maryland, May 5, 1980.

"Tin-117m-Labeled Radiopharmaceuticals - Effects of Structural Modifications on the Adrenal Uptake of Steroids Labeled in the Sidechain with ^{117m}Sn ," International Symposium on Medical Radionuclide Imaging sponsored by the International Atomic Energy Agency, Heidelberg, Germany, September 1-5, 1980.

"Radiopharmaceuticals Labeled with Selenium-75 and Tellurium-123m," Cyclotron Unit, Sart-Tilman University, Liege, Belgium, September 8, 1980.

"Radiopharmaceuticals Labeled with Selenium-75 and Tellurium-123m," Research and Development Department, Cyclotron Isotope Laboratories, BYK-Mallinckrodt, Petten, Holland, September 10, 1980.

F. F. Knapp, Jr., K. R. Ambrose, A. P. Callahan, R. A. Grigsby, and K. J. Irgolic

"The Preparation of Tin-117m-Labeled 12,12-Dimethyl-12-Stannahexadecanoic Acid: The Initial Member of a Potential New Class of Radiopharmaceuticals," and "Potential Myocardial Imaging with the Se-75-Labeled Isostere of Oleic Acid," 20th Annual Southeastern Chapter Meeting, Society of Nuclear Medicine, Orlando, Florida, October 31-November 3, 1979.

F. F. Knapp, Jr., T. A. Butler, K. R. Ambrose, A. P. Callahan, L. A. Ferren, J. A. Roberts, R. A. Grigsby, and K. J. Irgolic

"Myocardial Uptake of ^{123}mTe -Labeled Long-Chain Fatty Acids: Effects of Heteroatom Position and Total Chain Length," Third International Symposium on Radiopharmaceutical Chemistry, Mallinckrodt Institute of Radiology, St. Louis, Missouri, June 16-20, 1980.

F. F. Knapp, Jr., T. A. Butler, and A. P. Callahan

"The Preparation of 24-(Trimethylstanna)-Chol-5-en-3 β -ol: A New Potential Adrenal Imaging Agent," 20th Annual Southeastern Chapter Meeting, Society of Nuclear Medicine, Orlando, Florida, October 31-November 3, 1979.

F. F. Knapp, Jr., T. A. Butler, A. P. Callahan, K. R. Ambrose

"Tin-117m-labeled 23-(Trimethylstanna)-24-Nor-5 α -Cholan-3 β -ol (^{117m}Sn -23-TSC) Shows Significant Adrenal Uptake in Rats," Annual Meeting, Society of Nuclear Medicine, Detroit, Michigan, June 24-28, 1980.

F. F. Knapp, Jr., T. A. Butler, A. P. Callahan, C. E. Guyer, J. A. Roberts, L. A. Ferren, R. A. Grigsby, and K. J. Irgolic

"New Myocardial Imaging Agents - The Influence of Chain Length on the Heart Uptake of ^{75}Se -Labeled Fatty Acids," Symposium on Practical Applications of Nuclear and Radiochemistry, Annual Meeting, American Chemical Society, Las Vegas, Nevada, August 25-29, 1980.

D. C. Kocher

"External Dosimetry," Health Physics Society Summer School, Seattle, Washington, July 14-18, 1980.

"Iodine-129 Dose to the World Population from the Nuclear Power Industry," 1979 Winter Meeting of American Nuclear Society, San Francisco, California, November 11-15, 1979.

"Dose-Rate Conversion Factors for External Exposure to Photons and Electrons," 1980 Annual Meeting of American Nuclear Society, Las Vegas, Nevada, June 9-12, 1980.

"Uncertainties in the Assessment of Long-Term Collective Dose and Health Effects," 25th Annual Meeting of Health Physics Society, Seattle, Washington, July 20-25, 1980.

G. Kourouklis, K. Siomos, and L. G. Christophorou

"Vacuum Ultraviolet Absorption Spectra of Aromatic Molecules in Liquids," 28th Annual Radiation Research Society Meeting, New Orleans, Louisiana, June 1-5, 1980.

S. D. Kramer

"Resonance Ionization Spectroscopy with Amplification," DOE Five-Year Program Review, ORNL, October 24, 1979.

"Resonance Ionization Spectroscopy and One-Atom Detection," Rutgers University, New Brunswick, New Jersey, February 25, 1980.

"Applications of Resonance Ionization Spectroscopy," Harvard University, Cambridge, Massachusetts, June 27, 1980.

"The Detection of Single Atoms," Argonne National Laboratory, Argonne, Illinois, November 27, 1980.

S. D. Kramer, G. S. Hurst, and B. E. Lehmann

"Resonance Ionization Spectroscopy for Rare Event Detection," 1980 Annual Meeting of American Physical Society, Chicago, Illinois, January 21-24, 1980.

R. Kremens, B. Bederson, and J.A.D. Stockdale

"Measurements of Electric Dipole Polarizabilities of Alkali Halide Dimers," 1980 Spring Meeting of American Physical Society, Washington, D. C., April 28-May 1, 1980.

B. E. Lehmann

"On the Applications of Tunable Diode Laser Spectroscopy to the CO₂ Problem," University of Kentucky, Lexington, October 12, 1979.

"Applications of Tunable Diode Laser Spectroscopy to the CO₂ Problem," Western Kentucky University, Bowling Green, March 10, 1980.

"Counting Atoms with Lasers," Center for Analytical Chemistry Seminar, National Bureau of Standards, Washington, D. C., November 14, 1980.

T. G. Matthews

"Formaldehyde Monitoring Program and Development of Sampling and Analysis Procedures," CPSC Technical Workshop on Formaldehyde, Gaithersburg, Maryland, April 9-11, 1980.

"Formaldehyde Monitoring Program," DOE Workshop on Portable Instrumentation for Health and Safety, Fallen Leaf Lake, California, October 7-9, 1980.

D. L. McCorkle, L. G. Christophorou, and I. Szamrej

"Electron Attachment to Chlorofluoromethanes and Chlorofluoroethanes Using the Electron Swarm Method," 31st Gaseous Electronics Conference, Pittsburgh, Pennsylvania, October 9-12, 1979.

L. M. McDowell-Boyer

"Estimated Radiation Dose from Timepieces Containing Tritium," American Nuclear Society Meeting, Dayton, Ohio, April 29-May 1, 1980 (invited).

"Recent Modifications to the ORNL TERMOD Code," Workshop on Terrestrial Effects of Radiation from Off-Site Contamination Around NTS, Colorado State University, Ft. Collins, Colorado, April 22-24, 1980 (invited).

L. M. McDowell-Boyer, G. G. Killough, and J. C. Pleasant

"Dynamic Modeling of Radionuclides in Terrestrial Food Chains," American Nuclear Society Meeting, Las Vegas, Nevada, June 8-12, 1980.

H. R. Meyer, C. A. Little, J. P. Witherspoon, and J. E. Till

"A Comparison of Potential Radiological Impacts of ²³³U and ²³⁹Pu Fuel Cycles," American Nuclear Society Winter Meeting, San Francisco, California, November 1979.

H. R. Meyer, J. E. Till, and E. L. Etnier

"Tritium - Potential Impacts of Nuclear Fuel Cycle Releases," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

C. W. Miller

"Dose Calculations for Atmospheric Radionuclide Releases," Oak Ridge Associated Universities Course, November 8, 1979.

"Review of LOA-4 Program," Fast Reactor Safety Technology Management Center, January 16, 1980.

C. W. Miller, S. J. Cotter, C. A. Little, and R. E. Moore

"Comparison of Observed and Predicted Doses from the TMI Incident," American Nuclear Society Meeting, Las Vegas, Nevada, June 12, 1980.

C. W. Miller, S. J. Cotter, R. E. Moore, and C. A. Little

"Estimates of Dose to the Population Within Fifty Miles Due to Noble Gas Releases from the Three Mile Island Incident," American Nuclear Society Meeting, Knoxville, Tennessee, April 6-9, 1980.

C. W. Miller, D. E. Fields, and S. J. Cotter

"Comparison of Alternative Parameter Selection Methodologies for the Gaussian Plume Atmospheric Transport Model," Spring Meeting of American Geophysical Union, Toronto, Canada, May 27-29, 1980.

C. W. Miller and C. A. Little

"An Evaluation of Uncertainties in Selected Environmental Dispersion Models," 1979 Winter Meeting, American Nuclear Society, San Francisco, California, November 11-15, 1979.

C. W. Miller, C. A. Little, and S. J. Cotter

"Comparison of Observed and Predicted Normalized Air Concentrations for ^{56}m Releases of Fluorescein Particles," Second Joint Conference on Applications of Air Pollution Meteorology, New Orleans, Louisiana, March 24-28, 1980.

J. C. Miller

"Resonantly Enhanced Multiphoton Ionization of Xenon: Photoelectron Energy Analysis," 1980 Annual Meeting of American Physical Society, Chicago, Illinois, January 21-24, 1980.

"Matrix-Isolation Spectroscopy of Stable and Unstable Molecules," University of Georgia, Athens, February 7, 1980.

"Aspects of Multiphoton Ionization Spectroscopy," University of Georgia, Athens, February 8, 1980.

"Multiphoton Ionization Spectroscopy," Chemical Physics Seminar, ORNL, September 15, 1980.

"Where Do Scientists Come From - A Scientific Genealogy," Chemical Physics Seminar, ORNL, February 2, 1981.

J. C. Miller and R. N. Compton

"Multiphoton Ionization of Atmospheric Pollutant Molecules," Physics and Chemistry of Energy-Related Atmospheric Pollution, Harpers Ferry, West Virginia, May 28-30, 1980.

F. R. O'Donnell

"Radioactive Materials in Consumer Products," Health Physics and Radiation Protection Course, Oak Ridge Associated Universities, Oak Ridge, Tennessee, March 13, 1980.

"Radioactive Materials in Consumer Products," Health Physics and Radiation Protection Course, Oak Ridge Associated Universities, Oak Ridge, Tennessee, February 27, 1981.

R. Y. Pai and L. G. Christophorou

"Impulse Breakdown of $\alpha\text{-C}_4\text{F}_8/\text{SF}_6$ and $\alpha\text{-C}_4\text{F}_8/\text{SF}_6/\text{N}_2$," Second International Symposium on Gaseous Dielectrics, Knoxville, Tennessee, March 9-13, 1980.

L. R. Painter, E. T. Arakawa, M. W. Williams, and J. C. Ashley

"Optical Properties of Polyethylene: Measurement and Application," Southeastern Section of the American Physical Society, Chattanooga, Tennessee, November 8-10, 1979.

"The Optical Properties of Kapton: Measurement and Applications," Topical Conference on Basic Optical Properties of Materials, National Bureau of Standards, Gaithersburg, Maryland, May 5-7, 1980.

E. Palacios, G.M.A.A. Sordi, L. S. Endo, and J. E. Turner

"Evaluation of Some Parameters for Fission-Product Retention in the Soil," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

D. C. Parzyck

"Human Health Effects Section," Second Life Sciences Symposium on Atmospheric Sulfur Deposition, Gatlinburg, Tennessee, October 15, 1979.

"Health and Environmental Research Programs at ORNL," Yale University, New Haven, Connecticut, November 8-9, 1979.

"Health Studies Program," HASRD Information Meeting, ORNL, March 5, 1980.

"Health Effects of Energy Production," American Society for Metals, Oak Ridge, Tennessee, March 13, 1980.

"Health Effects Section," University of North Carolina Staff and Graduate Students, Oak Ridge, Tennessee, May 13, 1980.

"Health Studies Research at ORNL," United National Environment Program, Oak Ridge, Tennessee, June 10, 1980.

"Rural Health Implications of Energy Development," American Rural Health Association, Myrtle Beach, South Carolina, June 23, 1980.

"Energy and Environmental Health," Roane State Community College Elderhostel, Knoxville, Tennessee, July 28, 1980.

"Health Studies Research Program," ORNL Management Advisory Council, ORNL, July 31, 1980.

"Energy and Public Information," Health Physics Society, Cincinnati, Ohio, October 9, 1980.

"Comparative Health Risks of Energy Production," IEEE Nuclear Science Symposium, Orlando, Florida, November 5, 1980.

"ORNL Health Effects Program," Union Carbide Corporation Consumer Safety Program Representatives, January 19, 1981.

"Health Studies Research at ORNL," Western Executive Seminar Series, Denver, Colorado, February 6, 1981.

"Health Studies Research Program at ORNL," Electric Power Research Institute, Palo Alto, California, February 5, 1981.

"Health Studies Research Program," DOE Site Review Panel, Oak Ridge, Tennessee, March 5, 1981.

M. G. Payne

"Isotopically Selective Detection of Molecules Using Laser Fluorescence and Molecular Resonance Ionization Spectroscopy," DOE Five-Year Program Review, October 24, 1979.

"Resonance Ionization Spectroscopy and Its Application to Studies in Atomic and Molecular Physics," Joint Meeting of American Physical Society and American Association of Physics Teachers, Chicago, Illinois, January 21-24, 1980.

"Effects of Collective Emission on Three- and Five-Photon Excitation," Chemical Physics Seminar, ORNL, March 3, 1980.

"Effects of Collective Emission on Multiphoton Ionization," Oak Ridge Associated Universities Traveling Lecture, University of Arkansas, Fayetteville, March 28, 1980.

"Effects of Collective Emission on Multiphoton Ionization," Oak Ridge Associated Universities Traveling Lecture, Pennsylvania State University, University Park, Pennsylvania, April 17, 1980.

"Resonance Ionization Spectroscopy of Molecules," Workshop on Advanced Laser Technology for Pollutant Measurement, Harpers Ferry, West Virginia, June 10-11, 1980.

"Collective Emission Following Three-Photon Excitation of Xe," Division of Electron and Atomic Physics, American Physical Society, Los Angeles, California, December 1-3, 1980.

"Applications of Resonance Ionization Spectroscopy to Atomic and Molecular Physics," Oak Ridge Associated Universities Traveling Lecture, University of South Florida, Tampa, Florida, January 16, 1981.

M. G. Payne and W. R. Garrett

"Collective Emission Following Near Resonant Three-Photon Atomic Excitation: Quenching of Five-Photon Ionization of Xe," 1980 Annual Meeting of American Physical Society, Chicago, Illinois, January 21-24, 1980.

M. G. Payne, W. R. Garrett, J. C. Miller, and R. N. Compton

"Collective Emission Following Near Resonant Photon Atomic Excitation: Quenching of Five-Photon Ionization in Xe," Division of Electron and Atomic Physics Meeting, American Physical Society, Houston, Texas, December 10-12, 1979.

P. T. Perdue and F. F. Haywood

"Factors to be Considered in the Selection of Environmental Radon Monitors," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

"The Use of Cryogenic Air Sampling in the Spectroscopy of Airborne Gamma-Ray Emitters," The Second International Conference on Low-Level Counting in High Tatras, Strbské Pleso, Czechoslovakia, November 24-28, 1980.

M. L. Randolph

"Application of ICRP 30 Weighting Factors for Calculation of Overall Health Hazard Factors from Low Levels of Inhaled Radionuclides," 28th Annual Radiation Research Society Meeting, New Orleans, Louisiana, June 1-5, 1980.

R. H. Ritchie

"Research in Radiation Physics," DOE Five-Year Program Review, ORNL, October 23-25, 1979.

"Possible Solid State Effects in the Velocity Distribution of Convoy Electrons," Annual Meeting of the Division of Electron and Atomic Physics, The American Physical Society, Houston, Texas, December 1979.

"Fundamental Problems in Radiation Physics," and "Effective Charge at Low Ion Velocities," Workshop on the Penetration of Charged Particles in Matter Under Extreme Conditions, New York University, New York, January 3-5, 1980.

"The Quantum Image Potential," Physics Department, University of Tennessee, Knoxville, May 7, 1980.

"Studies of Surface Interactions," Physics and Chemistry of Energy-Related Atmospheric Pollution Meeting, Harpers Ferry, West Virginia, May 28-30, 1980.

"The Image Force Near a Metal Surface," Conference on Physics of Submicron Electron Devices, Ft. Collins, Colorado, July 1-2, 1980.

"Wake Phenomena," 1980 Gordon Conference on Particle-Solid Interactions, Andover, New Hampshire, August 1980.

"The Self Energy of an Electron Near a Surface," Institute of Physics, Odense University, Odense, Denmark, October 15, 1980.

"The Charged-Particle Wake," Institute of Physics, Odense University, Odense, Denmark, November 18, 1980.

"Sum-Rules and the Dielectric Function of Solids," Institute of Physics, Odense University, Odense, Denmark, November 25, 1980.

"Quantum Theory of the Charged Particle Wake," Bat Sheva Seminar on Molecular Ion Projectiles, The Weizmann Institute, Rehovot, Israel, January 3-11, 1981 (invited).

"The Z^2 Effect in an Electron Gas," Institute of Physics, Odense University, Odense, Denmark, February 23, 1981.

R. S. Rohrer

"Calculation of Population Dose," 1980 Health Physics and Radiation Protection Course, Oak Ridge Associated Universities, March 26, 1980.

I. Sauer, L. G. Christophorou, L. C. Frees, and H. W. Ellis

"Aspects of Environmental Effects of Dielectric Gases," Second International Symposium on Gaseous Dielectrics, Knoxville, Tennessee, March 9-13, 1980.

I. Sauer, L. G. Christophorou, L. C. Frees, and D. L. McCorkle

"Electron Impact Fragmentation and Attachment Cross Sections for 1,1,1- $C_2Cl_3F_3$ and 1,1,2- $C_2Cl_3F_3$," American Chemical Society, Houston, Texas, March 23-28, 1980.

I. Sauer, L. C. Frees, and L. G. Christophorou

"Spark Induced Products of SF_6 and SF_6 /Fluorocarbon Mixtures," EPRI Workshop on Arc By-Products in Gas Insulated Equipment, Chicago, Illinois, June 4-5, 1980.

D. D. Schuresko

"Portable Fluorometric Spotter for Detection of Surface Contamination by Polynuclear Aromatic Hydrocarbon Compounds," Seventh Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, FACSS-VII, Philadelphia, Pennsylvania, September 28-October 3, 1980.

"Portable Fluorometric Spotter for Detection of Surface Contamination by Polynuclear Aromatic Hydrocarbon Compounds," Fifth International Symposium on Polynuclear Aromatic Hydrocarbons, Columbus, Ohio, October 28-30, 1980.

D. D. Schuresko, W. D. Bostick, S. R. Dinsmore, and J. E. Mrochek

"Induction of Cytochrome-P450 Mixed Function Oxidase (MFO) Activity in Hamster Embryo Culture by Exposure to Coal-Derived Tars," Seventh Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, FACSS-VII, Philadelphia, Pennsylvania, September 28-October 3, 1980.

H. C. Schweinler and L. G. Christophorou

"Calculation of Electric Field-Induced Detachment Rate of Electrons from Mononegative Ions' Relevance to Gaseous Dielectrics," Second International Symposium on Gaseous Dielectrics, Knoxville, Tennessee, March 9-13, 1980.

K. Siomos and L. G. Christophorou

"Two-Photon Ionization of Organic Molecules in Dielectric Liquids," New York Meeting of The American Physical Society, New York, January 26-29, 1981.

K. Siomos, G. Kourouklis, and L. G. Christophorou

"On the Photoionization of Pyrene in Dielectric Hydrocarbon Liquids and the Effect of Electron Attaching Additives on the Photoionization Onset," 14th Conference on Photochemistry, Newport Beach, California, March 30-April 3, 1980.

J.A.D. Stockdale

"Collisional Ionization of Fast K Atoms by D_2S ," 1980 Annual Meeting of American Physical Society, Chicago, Illinois, January 21-24, 1980.

"Energy Loss of UF_6^- Ions in Collisions with UF_6 Molecules," 1980 Spring Meeting of American Physical Society, Washington, D. C., April 28-May 1, 1980.

"Collisions of Hexafluoride Negative Ions with Atoms and Molecules," Chemical Physics Seminar, ORNL, March 23, 1981.

J.A.D. Stockdale and B. K. Annis

"Collisions of MoF_6^- Ion with Ar Atoms," 1981 Annual Meeting of the American Physical Society, New York, January 22-29, 1981.

R. E. Swaja

"Neutron Activation," Health Physics and Radiation Protection Course, Oak Ridge Associated Universities, Oak Ridge, Tennessee, March 31, 1981.

I. Szamrej, D. L. McCorkle, L. G. Christophorou, and S. M. Spyrou

"Electron Attachment to Halocarbons," 33rd Gaseous Electronics Conference, Norman, Oklahoma, October 7-19, 1980.

V. J. Tennery, E. S. Bomar, W. D. Bond, L. E. Morse, H. R. Meyer, J. E. Till, and M. G. Yalcintas

"Environmental Impact of Radioactive Releases from Recycle of Thorium-Based Fuel Using Current Containment Technology," Second DOE Environmental Control Symposium, Washington, D. C., March 1980.

J. E. Till, H. R. Meyer, and E. L. Etnier

"Updating the Tritium Quality Factor - the Argument for Conservatism," American Nuclear Society Topical Meeting, Dayton, Ohio, April 29-May 1, 1980.

C. C. Travis

"Cooperative-Competitive Processes in Ecological Systems," Memphis State University, Memphis, Tennessee, October 3, 1979.

"Nonlinear Age-Dependent Population Growth Models," University of New Mexico, Albuquerque, October 17, 1979.

"Structural Identification of Distributed Parameter Systems," Annual Midwest Conference on Differential Equations, Oklahoma State University, October 18-19, 1979.

"Endemic Disease in Environments with Spatially Heterogeneous Host Populations," Pomona College, Claremont, California, October 25, 1979.

"Environmental Sources of Radon," American Nuclear Society Winter Meeting, San Francisco, California, November 12, 1979.

"Simulation Models and Their Application to the Control of Toxic Substances," Toxics Control Conference, Washington, D. C., December 10-11, 1979.

"Nonlinear Age-Dependent Population Growth Models," North Texas State University, Denton, Texas, December 20, 1979.

"Compensatory Leslie Matrix Models for Competing Species," East Tennessee State University, Johnson City, Tennessee, January 16, 1980.

"Compensatory Leslie Matrix Models for Competing Species," Virginia Polytechnic Institute and State University, Blacksburg, Virginia, January 17, 1980.

"Assessment of Risks from Environmental Pollution," University of Missouri, Rolla, March 18, 1980.

"Differential Equations in Banach Space," and "Mathematics at a National Laboratory," University of Missouri, Rolla, March 19, 1980.

"Tritium Population Dose in the Northern Hemisphere," American Nuclear Society, Las Vegas, Nevada, June 9-12, 1980.

C. C. Travis and A. G. Maddock

"On Structural Identification of Biological Systems," International Conference on Nonlinear Phenomena in Medicine, Dallas, Texas, June 18, 1980.

C. C. Travis and L. M. McDowell-Boyer

"Potential Health Effects of Radon-222 to the General Public from Uranium Milling, Second International Conference on Energy Use Management, Los Angeles, California, October 22-26, 1979.

C. C. Travis, W. M. Post, and D.L. DeAngelis

"Infectious Disease in a Spatially Heterogeneous Environment," Eighth Fall Conference on Differential Equations, Oklahoma State University, October 18-19, 1979.

J. E. Turner

"Selected Aspects of Metal Chemistry Potentially Relevant to Carcinogenesis," American Cancer Society Symposium on Metals and Carcinogenesis, University of Tennessee, Knoxville, October 8, 1979.

"Minimum Dipole Moment to Bind an Electron," State University of New York, Buffalo, February 21, 1980.

"Radioactivity and Radioactive Decay," East Tennessee Chapter of the Health Physics Society NRRPT Pre-exam Course, Oak Ridge, Tennessee, March 11, 1980.

"The Health Physics Society and the American Board of Health Physics," NRC-ORAU Ten-Week Health Physics and Radiation Protection Course, Oak Ridge, Tennessee, March 21, 1980.

"Minimum Dipole Moment to Bind an Electron," Clemson University, Clemson, South Carolina, April 17, 1980.

"Radiotherapy: Pions," NRC-ORAU Ten-Week Health Physics and Radiation Protection Course, Oak Ridge, Tennessee, April 30, 1980.

"Physicochemical Properties of Trace Metals," Four lectures in BMS-5510, Trace Elements in Biology, 'T-OR Biomedical School, Oak Ridge, Tennessee, April 1980.

"Neue Ergebnisse der ORNL Elektronen-Transportrechnungen," Gesellschaft für Strahlen-und Umweltforschung, Neuherberg, Germany, July 11, 1980.

"The Health Physics Society and the American Board of Health Physics," NRC-ORAU Ten-Week Health Physics and Radiation Protection Course, Oak Ridge, Tennessee, March 4, 1981.

J. E. Turner, J. L. Magee, R. N. Hamm, A. Chatterjee, H. A. Wright, and R. H. Ritchie

"Early Events in Irradiated Water," Seventh Symposium on Microdosimetry, Oxford, England, September 9, 1980.

I. Vo-Dinh

"Recent Developments in the Analysis of Air Samples by Luminescence Techniques," 1981 Symposium of the Instrument Society of America, St. Louis, Missouri, March 23, 1981.

"Room Temperature Phosphorimetry and Synchronous Luminescence: Two Simple Techniques for the Analysis of Complex Coal Products," Second Chemical Congress of the North American Continent, Las Vegas, Nevada, August 24-29, 1980.

"Molecular Luminescence: Current Techniques and Instrumentation," "The Use of Fiber-Optics Waveguides in Portable Monitors for the Detection of Skin Contaminant and Organic Pollutants in Synfuel Industries," and "A Tape Sampler Device for Direct Analysis of Polynuclear Aromatic Compounds," DOE Workshop on Portable Instrumentation for Health and Safety, Fallen Leaf Lake, California, October 7-9, 1980.

"A New Approach in Phosphorimetry: Measurement at Room Temperature," Wake-Forest University, Winston-Salem, North Carolina, November 14, 1979.

"Synchronous Luminescence and Room Temperature Phosphorescence for Trace Organic Analysis," 1980 Symposium on Luminescence Analysis in Complex Samples, New Orleans, Louisiana, December 10-13, 1980.

I. Vo-Dinh and R. B. Gamage

"The Lightpipe Luminoscope for Monitoring Occupational Skin Contamination," 20th Annual American Industrial Hygiene Conference, Houston, Texas, May 18-23, 1980.

"The Luminoscope for Skin Contamination Survey at a Coal Gasifier," and "Analysis of Coal-Derived Products and Environmental Systems by Synchronous Luminescence," 1980 Symposium on Instrumentation and Control for Fossil Energy Processes, Virginia Beach, Virginia, June 9-11, 1980.

"A Portable Fiber-Optics Luminoscope for Monitoring Skin Contamination in the Workplace," Second Chemical Congress of the North American Continent, Las Vegas, Nevada, August 24-29, 1980.

"Analysis of Polynuclear Aromatic Compounds in Environmental Samples by Room Temperature Phosphorimetry," Fourth International Symposium on Polyaromatic Hydrocarbons, Columbus, Ohio, October 2-4, 1979.

P. J. Walsh for Speaker's Bureau

"Health and Environmental Effects Related to Nuclear and Non-Nuclear Energy Technologies," Second Presbyterian Church, Knoxville, Tennessee, December 12, 1979.

"Health Effects of Nuclear and Coal Energy Generation," B'nai B'rith Lodge, Memphis, Tennessee, February 13, 1980.

"Health Effects of Nuclear and Coal Electricity Generation," Oak Ridge High School Advanced Biology Class, June 3, 1980.

P. J. Walsh

Panel Discussion on SRC II Demonstration Plant, held by West Virginia Student Public Interest Group, Morgantown, West Virginia, December 1980.

Fifth Annual Governor's Conference on the Environment, Ft. Mitchell, Kentucky, October 1-3, 1980.

Workshop on Exposure Metabolism and Mechanisms of Toxicity (Interagency Task Force on Environmental Cancer, Heart, and Lung Disease), Rockville, Maryland, January 27-30, 1981.

M. W. Williams and J. C. Ashley

"Electron Mean Free Paths in Solid Organic Insulators," Sixth International Conference on Vacuum Ultraviolet Radiation Physics, University of Virginia, Charlottesville, Virginia, June 2-6, 1980.

R. D. Willis

"Application of Isotope Tracers to Oceanic Mixing and Circulation Studies," Chemical Physics Seminar, ORNL, February 8, 1980.

J. P. Witherspoon

"Environmental Impact Analysis," Applied Health Physics Course, Oak Ridge Associated Universities, Oak Ridge, Tennessee, June 16, 1980.

"Taking Risks," Tennessee Technological University Aquatic Station, Smithville, Tennessee, August 14, 1980.

"Implications of Radioactivity in Coal," Department of Religion, University of Tennessee, Knoxville, Tennessee, February 20, 1981.

"Comparative Radiological Impacts from Fossil Fuel and Nuclear Power Plants," WATtec Energy Conference, Knoxville, Tennessee, February 20, 1981.

"Review of Nuclear Applications Work," Florida Institute of Phosphate Research, Radiation Research Workshop, Bartow, Florida, March 5, 1981.

H. A. Wright

"Calculations of Dose Distributions from Negative Pions," Clemson University Physics Department, Clemson, South Carolina, October 4, 1979.

"Introduction to Monte Carlo Techniques," 25th Annual Meeting of Health Physics Society, Seattle, Washington, July 20-25, 1980.

"Monte Carlo Calculations in Support of Pion Cancer Radiotherapy," Radiation Biology Department, Colorado State University, Ft. Collins, Colorado, March 12, 1980.

"Monte Carlo Calculations of Pion Dose Distributions," DOE Five-Year Program Review, ORNL, October 23-25, 1980.

H. A. Wright, R. N. Hamm, and J. E. Turner

"Interface Effects on Dose Distributions in Irradiated Media," Seventh Symposium on Microdosimetry, Oxford, England, September 8-12, 1980.

H. A. Wright, J. E. Turner, and R. N. Hamm

"Effects of a Bolus and Inhomogeneities on Pion Stopping Distributions," 28th Annual Radiation Research Society Meeting, New Orleans, Louisiana, June 1-5, 1980.

M. G. Yalcintas, D. E. Dunning, Jr., and R. W. Leggett

"Comparison of Risk Associated with Doses from CT and Other Diagnostic Procedures," 25th Annual Meeting of the Health Physics Society, Seattle, Washington, July 20-25, 1980.

J. P. Young, G. S. Hurst, S. D. Kramer, M. G. Payne, and M. K. Kopp

"Application of Resonance Ionization Spectroscopy to Low-Level Counting," 23th ORNL Conference on Analytical Chemistry in Energy Technology, Gatlinburg, Tennessee, October 9-11, 1979.

E. A. Zeigami

"The Rarity Assumption in the Estimation of the Odds Ratio in Case-Referent Studies," 1980 Annual Meeting of the Society for Epidemiological Research, Minneapolis, Minnesota.

"Human Cancer and Chemicals in Food," Oak Ridge Associated Universities Speaker Series, Grambling College, October 30, 1980.

"Human Cancer and Chemicals in Food," Oak Ridge Associated Universities Speaker Series, Barry College, Miami, Florida, November 20, 1980.

"The Healthy Worker Effect - An Examination of its Meaning for Comparative Measures of Risk," UCLA Department of Epidemiology Seminar Series, March 16, 1981 (invited).

"Epidemiology at Oak Ridge National Laboratory," Department of Epidemiology, University of Alabama, March 30, 1981.

E. A. Zeigami, C. Soskolne, and W. W. Hanis

"Toward Bias Elimination in Occupational Epidemiology Case-Control Studies," Ninth Scientific Meeting, International Epidemiological Association, Edenburg, Scotland, 1981.