CONF-700408--4

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**DISCUSSION OF PROPOSED AMENDMENTS
TO AEC REGULATIONS ON
RADIOACTIVE EFFLUENTS FROM LIGHT WATER COOLED
NUCLEAR POWER REACTORS**

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**Public Affairs and
Information Program**

**Atomic Industrial Forum, Inc.
850 Third Avenue
New York, New York 10022**

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DISCUSSION OF PROPOSED AMENDMENTS TO AEC REGULATIONS ON
RADIOACTIVE EFFLUENTS FROM LIGHT WATER COOLED NUCLEAR POWER REACTORS *

The Atomic Energy Commission announced on March 27, 1970, issuance of proposed amendments to its regulations in Part 20 and Part 50 to improve the regulatory framework for assuring that reasonable efforts are made to keep exposures to radiation and releases of radioactivity in effluents from light water cooled power reactors as low as practicable.

Limits on releases of radioactive material in effluents from all Commission licensed activities currently are set forth in Part 20, the regulation which sets forth standards for protection against radiation. These limits are based on radiation protection guides recommended by the Federal Radiation Council (FRC) and approved by the President; the recommendations of the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP). The radiation protection standards recommended by these groups are mutually compatible and represent the work of an impressive body of scientific expertise in the fields of radiation biology, genetics, medicine, physics, biophysics, chemistry, health physics, and other disciplines related to the field of radiation protection. As a result of the important work of the NCRP and the ICRP dating as far back as the late 1920's, the same basic recommendations

* Presented by Lester Rogers, Director, Division of Radiation Protection Standards, U.S. AEC, at the Atomic Industrial Forum Workshop on Radiation and Man's Environment, April 20, 1970, Buck Hill Falls, Pennsylvania

on radiation protection standards are used by all countries throughout the world as a basis for regulations controlling radiation exposures to workers and to the public. The statutory Federal Radiation Council created in 1959 to advise the President " * * * with respect to radiation matters, directly or indirectly affecting health, including guidance for all Federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with States", depended heavily on the recommendations of the NCRP and ICRP in formulating its guidance published in FRC Report No. 1 in 1960. The recommendations of these groups take into account comprehensive studies and reports on the biological effects of ionizing radiation that have been issued by the Committee on Biological Effects of Atomic Radiation of the National Academy of Sciences in the United States, the Medical Research Council in the United Kingdom, and by the United Nations Scientific Committee on the Effects of Atomic Radiation.

Specifically, FRC guidance as related to control of radiation exposures to the public is as follows:

For individual members of the general public, the radiation protection guide for whole body exposure is 0.5 rem per year.

For the total population, it is recommended that the average genetically significant exposure should not exceed 5 rems in 30 years.

For purposes of controlling releases of radioactivity to the environment, the most pertinent radiation protection guide established by the FRC provides that as an operational technique where the individual whole body exposures are not known, a suitable sample of the exposed population should be developed whose protection guide for annual whole body exposure will be 0.17 rem per capita per year.

The population exposure resulting from natural background radiation provides an important bench-mark for the establishment of radiation protection guides for the general population. This exposure has been present throughout the history of mankind. Radiation exposures received by different individuals and population groups as a result of natural background are subject to appreciable variation depending on where the individual lives. Average exposures range from about 100 millirem per year for persons living at sea level in the United States to more than 1,000 millirems per year to persons living in high background areas of India and Brazil (Appendix I). The FRC radiation protection guides for exposures to the public are well within the variation in natural background which exists in different parts of the world.

The FRC numerical guidance applies to total radiation exposure from all sources, except medical procedures and natural background. It is expected that no one source shall contribute a disproportionate share of the total exposure. The FRC added to the numerical guidance on maximum limits the further guidance that "every effort should be made to encourage the maintenance of radiation doses as far below this guide as practicable". Similar statements are also included in NCRP and ICRP statements.

The Part 20 limits are designed to assure that exposures to the public from all AEC licensed activities that may be sources of environmental contamination are well within FRC radiation protection guides. This is accomplished by limiting concentrations and/or quantities of radioactivity permitted in air and water effluents at their source prior to release from a restricted area into the environment. A description of AEC limits on radioactivity in effluents and a discussion of how they are applied are included in "Background Information on AEC Regulatory Program Applicable to Releases of Radioactivity to the Environment from Nuclear Power Reactors and Other AEC-Licensed Facilities" (Reference 9 of the attached Bibliography).

The proposed amendments, announced on March 27, would not modify the limits on radiation exposure, or on concentrations of radioactivity in effluents set forth in Part 20. These upper limits are now and will continue to be based on the recommendations of the FRC, as approved by the President. The proposed amendment to Part 20 would express in the regulation the intent that consistent with FRC guidance all AEC licensees should make every reasonable effort to maintain radiation exposures and releases of radioactive materials in effluents to unrestricted areas as far below the limits specified in the regulation as practicable.

This general principle of keeping exposures to radiation as far below limits as practicable has been a central one in the field of radiation protection and the nuclear industry for many years.

Experience has shown that licensees have generally kept exposures to radiation and releases of radioactivity in effluents to levels well below Part 20 limits.

The proposed amendments to Part 50, the regulation which establishes design criteria and operating requirements for nuclear power plants, are intended to give appropriate regulatory effect, with respect to radioactivity in effluents from light water cooled power reactors, to the guidance of the FRC that radiation doses should be kept as far below the radiation protection guides as practicable.

Experience with licensed light water cooled power reactors to date shows that radioactivity in water and air effluents has generally been kept at less than a few percent of the limits specified in Part 20. We believe that with the use of advances in reactor and waste treatment technology, further reduction of levels of radioactivity in effluent releases can be achieved.

The proposed amendments to Part 50 would assist in achieving this objective by requiring that an application for a permit to construct a light water cooled power reactor include a description of the equipment to be installed to maintain control over radioactive materials in effluents during normal reactor operations, including expected operational occurrences. In addition, in the case of an application filed on or after the effective date of the proposed

amendments, the application would be required to identify the design objectives and the means to be employed for keeping levels of radioactive materials released in effluents as low as practicable. This would provide assurance that advances in waste treatment and handling technology are used in the design of nuclear power plants in the future.

Each application for a permit to construct a light water cooled power reactor would also be required to include an estimate of curie quantities of radionuclides expected to be released annually to unrestricted areas in plant effluents produced during normal operations and a description of the provisions for packaging, storage and shipment offsite of solid wastes containing radioactive materials from treatment of gaseous and liquid effluents and from other sources. Each application for an operating license would be required to include a description of procedures for the control of gaseous and liquid effluents and for the maintenance and use of equipment installed in radioactive waste systems.

The Commission would review the proposed design of the reactor, the waste treatment equipment, and the description of the operating procedures for maintenance and use of the equipment to determine whether the required design objectives of keeping levels of radioactivity in effluents as low as practicable are met.

Each operating license for a light water cooled power reactor would include technical specifications that would: (1) require adherence to operating procedures for control of effluents and for the maintenance and use of equipment installed in the waste treatment system and (2) the submission of semi-annual reports containing information on quantities of radioactive material released.

If quantities released during the reporting period are unusual for normal reactor operations, including expected operational occurrences, the licensee would be expected to cover this specifically in his report. This reporting requirement would be in addition to existing Part 20 provisions requiring more prompt reporting of incidents involving overexposures or the release of excessive levels of radioactivity. On the basis of these reports and other information the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

We believe, based on experience, that waste treatment and handling systems designed and operated in accordance with the proposed amendments will keep releases of radioactive materials in effluents from light water cooled power reactors at small fractions of the limits specified in Part 20 and in operating licenses. However, the licensee is permitted flexibility of operation, compatible with health and safety, to assure that the public is provided a dependable source of power even under unusual operating conditions which may temporarily result in releases higher than such small fractions but

still well within the limits in Part 20 and the operating license. In using this operational flexibility, the licensee is expected to exert his best efforts to keep levels of radioactive material in effluents as low as practicable.

The design objectives in the proposed amendments are stated in rather general terms. We plan to consult with the nuclear power industry and other competent groups to determine the feasibility of developing more definite criteria for design objectives and means for keeping releases of radioactivity in effluents from light water cooled power reactors as low as practicable.

Attachments:

1. Appendix I - Radiation Exposures (Comparative Information), April 8, 1970.
2. Bibliography

APRIL 8, 1970

rem - radiation dose unit
 millirem - 1/1000 of a rem

RADIATION EXPOSURES
 (COMPARATIVE INFORMATION)

ANNUAL WHOLE BODY EXPOSURES FROM NATURAL BACKGROUND RADIATION

(Cosmic radiation; radioactivity in rocks, soil, building materials; radioactivity in body)

United States 70-200 millirem (.07-.2 rem)

Special Areas Average

Brazil

Volcanic Areas 1600 millirem (1.6 rem)

Monozite Sand Areas 500 millirem (.5 rem)

India

Monozite Sand Areas 1300 millirem (1.3 rem)

FEDERAL RADIATION COUNCIL (FRC) GUIDES - ANNUAL WHOLE BODY EXPOSURE

Occupational Exposure 5000 millirem (5 rem)

Individual in Population 500 millirem (.5 rem)

Suitable Sample Population Group 170 millirem (.17 rem)

MEDICAL EXPOSURES TO LOCALIZED PORTION OF BODY

Range for Chest X-Ray 20-500 millirem (.02-.5 rem)

Range for Fluoroscopic Examination
 of Gastro-Intestinal Tract 5000-400,000 millirem (5-400 rem)

FIRST DETECTABLE CLINICAL EFFECTS - ACUTE WHOLE BODY EXPOSURES

25,000-100,000 millirem (25-100 rem)

COSMIC RADIATION EXPOSURE TO WHOLE BODY DURING ROUND TRIP FLIGHT - WASHINGTON, D.C.
 TO WEST COAST AT 35,000 FEET

3-5 millirem (.003-.005 rem)

ANNUAL WHOLE BODY EXPOSURE FROM TYPICAL OPERATING POWER REACTOR TO PERSONS
 LIVING NEAR SITE BOUNDARY

Persons living near site boundary 5 millirem (.005 rem)

Average to persons living within
 4 miles less than 1 millirem (.001 rem)

BIBLIOGRAPHY

1. Federal Radiation Council (FRC) Report No. 1 - "Background Material for the Development of Radiation Protection Standards", May 13, 1960 and Memorandum for the President dated May 13, 1960. Available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.
2. Federal Radiation Council (FRC) Report No. 2 - "Background Material for the Development of Radiation Protection Standards", September 1961 and Memorandum for the President dated September 13, 1961. Available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.
3. "Recommendations of the International Commission on Radiological Protection (Adopted September 17, 1965)", ICRP Publication 9. Published for the International Commission on Radiological Protection by Pergamon Press.
4. National Bureau of Standards (NBS) Handbook 59, "Permissible Dose from External Sources of Ionizing Radiation", issued September 24, 1954. Available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.
5. National Bureau of Standards (NBS) Handbook 69, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure", issued June 5, 1959. Available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.
6. Title 10, Part 20, "Standards for Protection Against Radiation", Code of Federal Regulations. Available from the USAEC.
7. Notice of Proposed Rule Making [10 CFR Parts 20, 50], Control of Releases of Radioactivity to the Environment, Federal Register, Vol. 35, No. 63, page 5414-5415, Wednesday, April 1, 1970.
8. AEC Press Release No. N-48 - March 28, 1970: AEC Proposes Amendments to Regulations on Radioactive Effluents from Light Water Cooled Nuclear Power Reactors.
9. Background Information on AEC Regulatory Program Applicable to Releases of Radioactivity to the Environment from Nuclear Power Reactors and Other AEC-Licensed Facilities, July 23, 1969.