TESTIMONY OF LESTER ROGERS
DIRECTOR, DIVISION OF RADIOLOGICAL AND ENVIRONMENTAL PROTECTION
U. S. ATOMIC ENERGY COMMISSION
IN THE MATTER OF THE TOLEDO EDISON COMPANY, ET AL,
DAVIS-BESSE NUCLEAR POWER STATION

The construction and operation of nuclear power plants in the United States is carried out under a comprehensive Federal program of licensing and regulation administered by the Atomic Energy Commission. The program is designed to protect health and safety from exposure to ionizing radiation that may result from radioactivity reaching the environment either from accidental releases or in effluents released during the normal operation of nuclear facilities. This testimony is limited to a discussion of regulations that apply to the controlled release of radioactivity in air and water.

The regulatory framework for controlling levels of radioactivity in effluents from nuclear power plants is set out in the Commission's regulations Part 20 and Part 50 published under Title 10 of the Code of Federal Regulations. Part 20, "Standards for Protection Against Radiation", sets the general standards for protection against radiation, including limits on levels of radioactivity released to the environment. Part 50, "Licensing of Production and Utilization Facilities", establishes general design, construction, and operating requirements for nuclear power plants and other nuclear facilities. It also sets forth requirements for obtaining a permit to construct and a license to operate a nuclear power plant. Each of these regulations, their interrelationship in controlling releases of radioactivity to the environment, and their implementation in the licensing process will be discussed.

Basis of AEC Regulatory Standards

An understanding of the integrity of the system within which radiation protection standards have been developed is fundamental to an understanding and evaluation of the validity of the standards. The formal procedure and scientific bases for developing and establishing standards for protection against ionizing radiation are among the most comprehensive of any applied to environmental stresses. The scientific information required in radiation protection standards setting activities is developed through investigations and analyses by the medical and scientific communities throughout the world and provides the basis for recommendations by various standards setting bodies. The National Academy of Sciences in the United States, the Medical Research Council in the United Kingdom, and the United Nations Scientific Committee on the Effects of Atomic Radiation have played a particularly outstanding role in evaluating the available data on biological effects and estimating risks from exposure to ionizing radiation. These bodies have issued comprehensive reports on the biological effects of ionizing radiation that form, in large part, the scientific basis for the standards.

The general radiation protection standards, applicable to all licensed activities, set forth in Part 20 were first published as an effective regulation in 1957. At the outset the Part 20 regulation was based on the recommendations of the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP).

Since 1959 official guidance for control of exposures to radiation has been provided to Federal agencies through recommendations of the Federal Radiation Council (FRC), established in 1959. The FRC is directed 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...". The basic recommendations of the FRC, NCRP and ICRP are mutually compatible.

The Federal Radiation Council recommends a radiation protection guide of 0.5 rem per year for whole body exposure of individual members of the public. For the total population, it is recommended that the average genetically significant exposure should not exceed 5 rems in 30 years or an average annual exposure of 170 mrems per year.

For purposes of controlling levels of radioactivity in the environment, the Federal Radiation Council provides that, as an operational technique, where it is impractical to determine individual radiation doses, exposures will be considered to meet radiation protection guides, if the estimated average doses to a suitable sample of the exposed population do not exceed one-third of the radiation protection guides applicable to individual members of the public or 170 mrems per year for whole body exposure. The FRC guides are not intended to apply to radiation exposure resulting from natural background or the purposeful exposure of patients by practitioners of the healing arts.

In discussing these standards, it is helpful to compare them with radiation exposures that we all incur from natural background radiation. Such a comparison appears in Exhibit I.

In addition to the numerical guidance on dose limits, ICRP, NCRP and FRC have generally recommended that exposure to radiation be kept as low as practicable. The ICRP adds "... that it is important to ensure that no single type of population exposure takes up a disproportionate share of the total."

The ICRP and NCRP have published tables of recommended maximum permissible concentratons of radionuclides in air and water. These concentrations are estimated to be the highest concentrations of the respective radionuclides which may be permitted in air or water used continuously by an average of "standard" man without resulting in a radiation dose that would exceed a maximum permissible occupational dose. For application to individual members of the general public these limits are reduced by a factor of 10. In its Report No. 1, the Federal Radiation Council recommended that concentration guides then in use by Federal agencies, i.e., the maximum permissible concentrations published by the ICRP or NCRP, be used on an interim basis. In its Report No. 2, the FRC included specific guidance for exposures of the general public to strontium-89, strontium-90, iodine-131, and radium-226 that differed from the then current recommendations of the ICRP and NCRP. Subsequent modifications of ICRP and NCRP limits have eliminated some of these differences.

These are the basic guidelines within which the AEC regulations to control releases of radioactivity to the environment have been formulated.

It is noted that under the President's Reorganization Plan No. 3 which became effective on December 2, 1970, the functions of the FRC were transferred to the new Environmental Protection Agency. Also transferred to EPA is that part of the AEC's authority, as administered by its Division of Radiation Protection Standards, to develop and set generally applicable environmental radiation standards for the protection of the general environment. The AEC continues to have the responsibility for the implementation and enforcement through its licensing and regulatory authority of the radiation standards developed by EPA.

Part 20 Provisions on Releases of Radioactivity in Effluents

The objectives of the Commission's regulatory program as related to the protection of the environment from releases of radioactivity in effluents from the normal operation of nuclear facilities are:

(1) to limit releases of radioactivity to the environment from each nuclear facility or other licensed activity so that exposures of the general public to ionizing radiation from the cumulative effects of all licensed atomic energy activities, when added to exposures from other sources, are not likely to exceed radiation protection guides recommended by the FRC and approved by the President;

(2) to provide reasonable assurance that levels of radioactivity added to the environment are well below levels that could

result in perceptible adverse effects on the ecology of the environment; and

(3) to provide reasonable assurance that appropriate efforts are made to keep releases of radioactive materials in effluents to unrestricted areas as far below limits specified in the regulations as practicable.

For purposes of regulation, the AEC has considered it impractical to impose legal limits on licensees expressed as dose to individuals in the population or to population groups. Rather, regulatory requirements are formulated as limits on concentrations and/or quantities of radioactivity in air and water effluents released to the environment. The requirements are designed to provide reasonable assurance that resultant exposures of individual members of the public generally and of the population as a whole from nuclear activities from all important pathways of exposure are well within recommended radiation protection guides.

Appendix B to Part 20 regulations lists, for approximately 250 radionuclides, limits on concentrations in air and water which, with few exceptions, are one-tenth of the most restrictive maximum

The radiation dose limits recommended by the ICRP and NCRP and the radiation protection guides established by the Federal Radiation Council apply to total exposures to all sources of radiation except natural background and medical procedures. The limits applied by the AEC under the provisions of Part 20, to concentrations of radioactivity in effluents make it improbable that radiation doses to the public from such radioactivity will exceed small fractions of limits applicable to total exposures from all sources of interest. It is necessary, however, for the AEC and other regulatory agencies to keep in mind the possibility that some combination of separately regulated sources of exposure might result in total doses in excess of these limits. This possibility is of especial concern in the regulation of nuclear facilities (e.g., uranium processing mills, reactor fuel chemical reprocessing plants and nuclear power plants) which may release large volumes of air or water containing a mixture of radionuclides. In such cases the total quantity of each type of radionuclide released may be more critical with respect to limiting exposures of the public than are concentrations in effluent air and water.

Part 20 clearly recognizes this concern in providing that, in addition to limiting concentrations in effluent streams, the Commission may limit total quantities of radioactive materials released in effluents during a specified period of time if it appears that in any situation the daily intake of radioactive material from all pathways of exposure (air, food and water), by a suitable sample of an exposed population group, averaged over a period not exceeding one year would otherwise exceed the daily intake resulting from continuous exposure to air or water containing one-third the concentration of radioactive material specified as limits in the regulations. In effect, this provision would limit the dose to the critical organ of the suitable sample of an exposed population group from all sources of exposure to one-third the dose limit for individuals in the population recommended by the FRC, NCRP and ICRP.

It is intended that this provision of the regulation be implemented in the licensing process if it appears likely that sufficiently large quantity of radioactivity will be released that exposures to people offsite will be a significant fraction of radiation protection guides. In such cases, it would be necessary to make an assessment of the types and quantities of radionuclides released, their chemical and physical behavior in the environment, including reconcentration factors, important pathways to humans, population groups likely to be exposed and predicted doses to such groups. Quantity limits based on such a study would then be derived so that actual exposures to the public from all pathways would be well within radiation protection guides.

For some nuclear activities it may not be practicable to comply with the concentration limits at the point of release from a restricted area as specified in the regulation. The regulation provides for Commission approval of concentration limits higher than those specified in the regulation on a case-by-case basis provided the applicant demonstrates that he has made a reasonable effort to minimize the radioactivity contained in effluents to unrestricted areas and that exposures of individuals and of a suitable sample of exposed population groups do not exceed the exposure criteria specified in the regulation.

In administering the regulatory program, the Commission also subscribes to the general principle that, within radiation protection guides, radiation exposures to the public should be kept as low as practicable. This general principle has been a central one in the field of radiation protection and the nuclear industry for many years. Experience shows that licensees have generally kept exposures to radiation and releases of radioactivity in effluents to levels that are well below Part 20 limits.

The Commission published on December 3, 1970, amendments to Part 20 that expresses 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 Part 20 as practicable. I will later discuss amendments to Part 50 that were published at the same time to improve the regulatory framework to further assure that radioactivity in effluent releases from nuclear power reactors are maintained as low as practicable.

The implementation of this general principle will help to assure that any one class of activity does not contribute a disproportionate share of total exposure to the public and the cumulative effects of all sources of exposures will remain well within radiation protection guides.

Application of Part 20 and Part 50 in Licensing Nuclear Power Plants

I have discussed the Part 20 general standards for the control of radioactivity in effluents released to the environment from nuclear facilities. I would now like to discuss more specifically how these standards are applied in the licensing process for nuclear power plants.

The Part 50 regulation requires a utility to apply to the Commission for a permit to construct and for a license to operate a nuclear facility. Prior to issuance of a construction permit, the applicant is required to provide detailed information concerning the proposed site including population distribution near the site, meteorology, hydrology, and special environmental conditions. For liquid effluents the information includes an analysis of surface drainage, dilution provided in bodies of water, water usage and possible reconcentration of radionuclides in aquatic life that may be an important pathway to exposure of people. For gaseous effluents information is provided on such factors as wind speed, wind direction and persistence, severe weather conditions and topographic effects. Information on the design and operation of radioactive waste treatment and fission product removal systems is also provided. Preoperational and operational monitoring programs for both onsite and offsite are described in detail to demonstrate that reliable data will be developed on any increase in environmental levels of radioactivity. This information is provided to demonstrate that radioactive material from both accidental and normal releases can be controlled.

The proposed te is evaluated by the regulatory staff to ascertain its suitability for a specific nuclear power station. As a practical matter the suitability of a site for a particular reactor is governed primarily by considerations related to accidental releases. The waste treatment technology available for controlling planned routine releases is capable of limiting the quantities of radioactivity to such low levels that such releases are not an important factor in site selection. However, the detailed environmental data developed are useful for evaluating the consequences of either accidental or normal releases of radioactivity.

The information on environmental parameters and the design of the waste treatment system submitted by the applicant is analyzed and in many areas independent calculations, based on conservative models, are performed to verify the validity of the applicant's conclusions.

The expertise of other Federal agencies in such fields as meteorology, hydrology, and ecology is brought to bear in the safety reviews. The U. S. Fish and Wildlife Service recommendations are requested on potential radiological effects on aquatic life and wildlife, the technical capabilities of the U. S. Geological Survey is regularly used with respect to the hydrological aspects of the site and of the U. S. Weather Bureau with respect to meteorology. Experts from AEC national laboratories, universities and private organizations are routinely consulted on special problems. The design of the reactor and environmental aspects of its operation are also reviewed by the independent statutory Advisory Committee on Reactor Safeguards.

Derivation of Limits on Radioactive Material in Liquid and Gaseous Effluents

In licensing the operation of a nuclear power plant, an upper operating limit is established in the license on concentrations or quantities of radioactive material in liquid and gaseous effluents.

Where several nuclear power reactors or other nuclear facilities are located on a single site, the combined releases of radioactivity from normal operations from all facilities at that site may not exceed Part 20 limits or facility license conditions implementing these limits.

This means that for gaseous releases the cumulative total release limit established for the site would be the same regardless of the number of reactors located on the site (i.e., as the number of facilities at the site increases, the internal limits on the several facilities are adjusted so that the total release limit for the site is not exceeded). The Part 20 limits on concentrations of radionuclides in liquid effluents released from the site are also the same regardless of the number of reactors on a site.

I want to emphasize that the release limits established in the license as technical specifications are upper limits beyond which the reactor is not allowed to operate. The Part 50 regulation as amended effective January 2, 1971 provides, among other things, that in order to keep releases of radioactive materials to unrestricted areas during normal reactor operations, including expected operational occurrences, as low as practicable, each license authorizing operation of a nuclear power reactor will include technical specifications requiring that operating procedures for the control of effluents be established and followed and that equipment installed in the radioactive waste system be maintained and used. The technical specifications will also require the submission of a report to the Commission every six (6) months specifying the quantity of each of the principal radionuclides released to unrestricted areas in liquid and gaseous effluents during the previous six (6) months of operation, and such other information as may be required by the Commission to estimate maximum potential annual radiation doses to the public resulting from effluent releases. If quantities of radioactive materials released during the reporting period are significantly above design objectives, the report shall cover this specifically. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

In establishing and implementing the operating procedures, the licensee shall be guided by the following considerations: Experience with the design, construction and operation of nuclear power reactors indicates that compliance with the technical specifications described above will keep average annual releases of radioactive material in effluents at small percentages of the limits specified in Part 20 and the operating license. At the same time, the licensee is permitted the flexibility of operation, compatible with considerations of 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 percentages, but still within the limits specified in Part 20 and the operating license. It is expected that in using this operational flexibility under unusual operating conditions, the licensee will exert his best efforts to keep levels of radioactive material in effluents as low as practicable.

Noble Gases

External exposure from gaseous releases is due almost entirely to isotopes of the noble gases of xenon and krypton. In deriving the release rate limits, "annual average site meteorology" based on site data is determined and a total dilution factor is derived from the meteorology, topography, stack air flow and elevation and site boundary distance. The release rate is derived so as to limit the annual average exposure rate at the site boundary or at the point of maximum ground level exposure offsite (whichever is more restrictive) to not more than 500 millirems per year from external radiation. This means that if the reactor were releasing radioactive gases at the limit, an individual present outdoors on the site boundary or other point of highest exposure rate offsite 24 hours a day, 365 days a year is not likely to receive an external whole body exposure in excess of 500 millirems per year.

Nuclear power reactor waste treatment systems are designed to limit releases of radioactivity in effluents to small percentages of AEC limits. It is not expected that actual releases will approach the upper limits during normal operations. However, it is of interest to examine theoretical estimates of the potential annual average radiation dose that the population living in the vicinity of nuclear power plants could receive if the plants did release noble gases at the limit.

Values of the dose from zero altitude releases of beta-emitting isotopes typical of pressurized water reactors (PWR) and 100-meter stack releases of gamma-emitting isotopes typical of boiling water reactors (BWR) normalized for a dose rate of 500 millirems per year at a site boundary distance of 500 meters (.31 miles) are shown in Exhibit II. The dose rates shown are for outdoors. Gamma dose rates indoors would be less perhaps by a factor of two depending on the shielding properties of the building. The dose rates become smaller with increasing distance from the source. At a distance of 15 miles the theoretical dose rates are about 2.5 millirems per year for a BWR and about 1 millirem per year for a PWR. At distances beyond 30 miles and 20 miles, respectively, the dose rates are less than 1 millirem per year.

The theoretical average annual dose to the population living in the vicinity of these power plants, if noble gases were released at the limit, are functions of the population distribution with respect to the wind direction frequency distributions and the distance from the emitting point from the site boundary where the controlling dose rate of 500 millirems per year exists (dose rates at other locations on the site boundary would be equal to or less than 500 millirems per year). Using realistic population distributions and wind direction frequencies for 13 different power reactor sites, the theoretical average population dose rate for the whole population included within a circle with a radius of 50 miles of these plants would be approximately 1 millirem per year.

Operating experience for thirteen (13) nuclear power plants in 1969 is shown in Exhibit III. This experience shows that eight (8) of the plants released less than 0.1 percent of the limit; three (3) plants released 1 percent (1%) or less of the limit; one (1) plant released 3.6 percent of the limit; and one (1) plant released 31 percent of the limit. It is estimated that average exposures to the total population living within a radius of 50 miles of these plants were less than one-one hundredth (0.01) of 1 millirem.

Radioiodine and Particulate Air Releases

To control exposures from airborne radioactive materials that may enter terrestrial food chains, the calculations of stack release limits for halogens (primarily radioiodines), and particulates with a half-life greater than 8 days include a reduction factor of 700 applied to Part 20 air concentrations. These materials are released in such small amounts that they contribute very little to external exposure or to exposure by inhalation of the materials in air. Although this factor of 700 was derived for iodine-131 in milk, it is applied as a measure of conservatism to all radionuclides in particulate form with a half-life greater than 8 days. The release rate for iodine-131 is sufficiently conservative that an individual could receive his entire milk supply from cows grazing near the point of highest iodine deposition. The radiation exposure to the thyroid of such an individual would be less than 1.5 rems per year. Experience has shown that actual releases of iodine from power reactors have been less than a few percent of limits. Environmental monitoring programs around power reactors have shown no measurable exposures to the public from iodine-131 or particulates.

Liquid Releases

Licenses authorizing the operation of nuclear power reactors limit concentrations in liquid effluents in the condenser coolant discharge canal prior to release offsite to concentrations given in Appendix B, Part 20. The concentration permitted for any one radioisotope must take into account other radioisotopes that may be present. Under this requirement an individual member of the general public could obtain all his drinking water from the power reactor condenser coolant discharge canal without exceeding radiation protection guides developed by the FRC, the NCRP and the ICRP.

If the licensee desires to compute the gross activity limit taking into account only those radionuclides known to be present in the mixture, he must determine the radioisotopic composition of the radioactivity in the effluent. The licensee may elect to forego some or all of such determinations if he uses more restrictive limits which assume that all of the unidentified radioisotopes in the mixture have the same concentration limit as does the most restrictive radioisotope which has not been determined to be absent from the unidentified portion of the mixture.

The limit of 1×10^{-7} uc/ml selected by most of the licensees is sufficiently restrictive that it can be used for any mixture of fission and corrosion products without any identification of the specific radionuclides present in the mixture. The typical radionuclides present in water effluents from power reactors are such that, if the licensee wishes to identify them and measure their concentrations by radioisotopic analysis, limits which are less restrictive than 1×10^{-7} uc/ml by a factor of 100 or more could be selected.

A rough assessment can be made of the potential exposure through drinking water supply and food pathways from radioactivity released in liquid effluents by considering the isotopic ratios of the principal radionuclides present in water cooled power reactor liquid effluents (e.g., Cs-137, I-131, I-133, Sr-90, Sr-89, Na-24, BaLa-140, Mo-99, Co-60, Co-58, Mn-56, Cr-51), known reconcentration factors in salt and fresh water organisms, and dietary habits. Such an assessment indicates that if the concentration of radionuclides commonly present in power reactor effluents do not exceed an annual average concentration of 1×10^{-7} uc/ml, in the condenser coolant discharge canal, the value used by most operating power reactors, no environmental dilution would be required to permit an individual to obtain his entire drinking water supply from the effluent and ingest 150 grams of fish per day, grown in the effluent, (an average of one-half pound per meal for approximately 240 meals per year) without exceeding about one-third the FRC radiation protection guide for an individual in the population.

Quantities of effluent water returned to the environment from nuclear power reactors are so large that the quantities of radioactivity which the operator of the reactor is likely to release in water result in concentratons very small compared to the limits specified in the regulations. Taking into account the large factors of environmental dilution normally available, the quantities of radionuclides released are generally too small to result in measurable exposures of the public from any pathway of exposure. Environmental monitoring programs carried out by licensees, State Health Departments, the Division of Environmental Radiation (formerly the Bureau of Radiological Health of the U. S. Public Health Service), and the AEC confirm this assessment. For this reason, it has not been necessary to apply specific quantity limits, in addition to concentration limits, on effluents from power plants.

Summary of Experience and Measures to Keep Radioactivity in Effluents As Low As Practicable

In summary, experience with licensed light water cooled power reactors to date shows that radioactivity in water and air effluents have generally been kept at less than a few percent of the limits specified in Part 20. Environmental monitoring programs and detailed studies carried out in the environs of nuclear power plants by licensees, State Health Departments, the Division of Environmental Radiation (formerly the Bureau of Radiological Health of the U. S. Public Health Service), and the Atomic Energy Commission have in most cases revealed little or no increase in environmental radioactivity resulting from plant operations.

The Commission published on December 3, 1970, amendments to its regulations to become effective on January 2, 1971, that will help to further assure that radioactivity in effluent releases is indeed maintained as low as practicable by requiring:

(1) that a description of the design objectives and the waste treatment equipment and handling technology that will be included in the design of power reactors to keep levels of radioactivity in effluents as low as practicable be included in each application for a permit to construct a power reactor;

(2) that waste treatment equipment installed in the reactor be maintained and used during operation of the reactor; and

(3) that the licensee report on a semi-annual basis the quantities of radioactivity released in air and liquid effluents and specifically cover in the report any releases significantly above design objectives. On the basis of such reports and other information, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

We are confident that the design and operation of nuclear power plants within these requirements will assure that radiation exposures to the public living in the near vicinity of these plants from radioactivity released in effluents will be less than a few percent of exposures from natural background radiation. Average annual exposures to the total U. S. population from this source of exposure are not likely to exceed a small fraction of 1 millirem.

Attachments:

EXHIBIT I - Radiation Exposures (Comparative Information)

EXHIBIT II - Dose Rates as a Function of Distance for a BWR and a PWR Normalized to Give 500 Mrem/Year at 0.31 Miles

EXHIBIT III - Experience on Releases of Radioactive Material in Nuclear Power Reactor Effluents - 1961

<u>EXHIBIT I</u>

REM - Radiation Dose Unit
MILLIREM - 1/1000 of a Rem

RADIATION EXPOSURES
(COMPARATIVE INFORMATION)

<u>ANNUAL WHOLE BODY EXPOSURES FROM NATURAL BACKGROUND RADIATION</u> (Cosmic Radiation; Radioactivity in Rocks, Soil, Building Materials, Radioactivity in Body)

United States	70-200 Millirem (.07-.2 Rem)	
<u>Special Areas</u>	<u>Average</u>	<u>Population</u>
Brazil - Monazite Sand Areas	500 Millirem (.5 Rem)	30,000
India - Monazite Sand Areas	1300 Millirem (1.3 Rem)	100,000
France - Granitic, schistous, sandstone areas	180-350 Millirem (.18 - .35 Rem)	7,000,000 (one-sixth French population)

<u>FEDERAL RADIATION COUNCIL (FRC) GUIDES - ANNUAL WHOLE BODY EXPOSURE</u>

Occupational Exposure	5000 Millirem (5 Rem)
Individual in Population	500 Millirem (.5 Rem)
Suitable Sample Population Group	170 Millirem (.17 Rem)

<u>FIRST DETECTABLE CLINICAL EFFECTS - ACUTE WHOLE BODY EXPOSURES</u>

25,000 - 100,000 Millirem
(25 - 100 Rem)

<u>ADDITIONAL EXPOSURE TO COSMIC RADIATION FROM LIVING IN DENVER, COLORADO, RATHER THAN PORT CLINTON, OHIO</u>

About 70 Millirem Per Year

<u>ADDITIONAL EXPOSURE FROM LIVING IN A STONE OR BRICK HOUSE AS COMPARED TO A WOODEN HOUSE</u>

Generally higher by values that range up to more than 50 millirem per year.

<u>ANNUAL WHOLE BODY EXPOSURE FROM TYPICAL OPERATING POWER REACTOR TO PERSONS LIVING NEAR SITE BOUNDARY</u>

Persons living near site boundary	5 Millirem (.005 Rem)
Average to persons living within 4 miles	Less than 1 Millirem (.001 Rem)

FIGURE 1 - DOSE RATES AS A FUNCTION OF DISTANCE FOR A BWR AND A PWR NORMALIZED TO GIVE 500 MREM/YEAR AT 0.31 MILES.

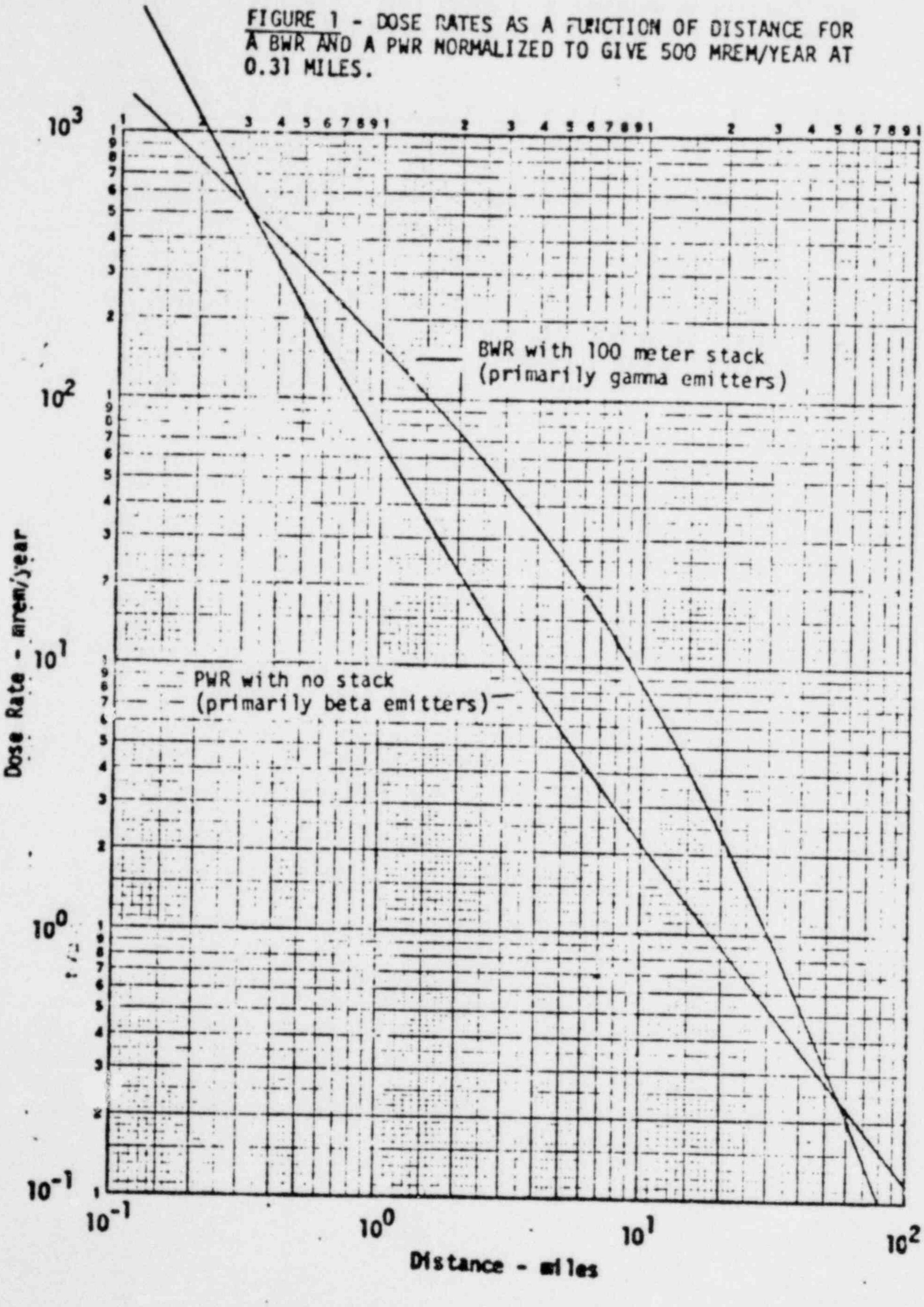

EXHIBIT III

EXPERIENCE ON RELEASES OF RADIOACTIVE MATERIAL
IN NUCLEAR POWER REACTOR EFFLUENTS - 1969

TABLE I - RELEASES OF RADIOACTIVITY FROM POWER REACTORS IN LIQUID EFFLUENTS, 1969

	MIXED FISSION & CORROSION PRODUCTS			TRITIUM	
Facility	Released (Ci)	Concentration Limit 1/ (10^{-7} µCi/ml)	Percent of Limit 2/	Released (Ci)	Percent of MPC 3/
DRESDEN 1	9.5	1	22	~6	< 0.001
SAN ONOFRE	8	1	14	3500	0.2
HUMBOLDT BAY	1.5	1	8.7	< 5	< 0.001
NINE MILE POINT	0.9	1	8.2	< 1	< 0.001
BIG ROCK	12	22	5.6	28	0.01
OYSTER CREEK	0.48	1	4.1	5	0.001
SAXTON	0.01	1	2.5	< 1	0.008
INDIAN POINT 1	28	37	1.5	1100	0.07
CONN. YANKEE	12	12	1.4	5200	0.24
GINNA	0.02	1	0.4	< 1	< 0.001
LA CROSSE	8.5	300	0.11	~25	0.003
YANKEE	0.019	1	0.07	1200	0.14
PEACH BOTTOM	< 0.001	1	0.002	40	0.031

TABLE II - RELEASES OF RADIOACTIVITY FROM POWER REACTORS IN GASEOUS EFFLUENTS, 1969

	NOBLE AND ACTIVATION GASES			HALOGENS AND PARTICULATES		
	Curies			Curies		
Facility	Released	Permissible[4/]	Percentage of Permissible	Released	Permissible[5/]	Percentage of Permissible
DRESDEN 1	800,000	22,000,000	3.6	0.26	85	0.3
SAN ONOFRE	260	567,000	0.045	< 0.0001	0.8	< 0.001
HUMBOLDT BAY	490,000	1,560,000	31	0.65	5.6	12
NINE MILE POINT	55	25,800,000	< 0.001	< 0.001	63	< 0.001
BIG ROCK	200,000	31,000,000	0.65	0.2	38	0.53
OYSTER CREEK	7,000	9,450,000	0.075	0.003	126	0.002
SAXTON	1	3,750	0.035	< 0.0001	10	< 0.001
INDIAN POINT 1	600	5,360,000	0.01	0.025	7.6	0.33
CONN. YANKEE	190	18,900	1	0.001	0.27	0.37
GINNA	< 1	360,000	< 0.001	< 0.0001	1.7	< 0.001
LA CROSSE	480	480,000	0.1	< 0.063	1.6	< 4
YANKEE	4	6,600	0.062	< 0.0001	0.03	0.01
PEACH BOTTOM	72	189,000	0.038	< 0.0006	0.12	< 0.5

TABLE III - COMPARISON OF EFFLUENTS 1967-1969

Facility	LIQUIDS Curies Released 1969	1968	1967	GASES Curies Released 1969	1968	1967
DRESDEN 1	9.5	6	4.3	800,000	240,000	260,000
SAN ONOFRE	8	1.5	0.32	260	4.8	4
HUMBOLDT BAY	1.5	3.2	3.1	490,000	897,000	900,000
BIG ROCK	12	7.9	10	200,000	232,000	264,000
SAXTON	0.01	0.009	0.02	1	18.6	22
INDIAN POINT 1	28	34.6	28	600	55.2	23
CONN. YANKEE	12	3.8	0.39	190	3.7	0.02
LA CROSSE	8.5	0.074	< 0.005	480	< 1	< 5
YANKEE	0.019	0.009	0.056	4	0.66	2.3
PEACH BOTTOM	< 0.001	< 0.001	0.002	72	108	7.5