UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

CHAIRMAN

Comm
Corr

June 22, 1979

The Honorable Douglas M. Costle
Administrator
Environmental Protection Agency
401 M. Street, S. W.
Washington, D. C. 20460

Dear Mr. Costle: Doug,

Our staffs have been in close contact since last August, examining ways of relating the EPA numerical standard for high-level radioactive waste to the associated NRC regulation which is currently being developed. In this effort we have been using a working draft of the EPA standard which we received informally on January 18, 1979 (Enclosure A). I am writing this letter to provide you NRC staff comments on the technical and the structural aspects of the draft EPA standard.

With regard to the technical aspects, the NRC staff conducted a weeklong peer group review of the supporting technical information for the EPA numerical standard, including the work done by Arthur D. Little, Inc. (ADL). This review was made possible by the active participation and cooperation of the EPA staff with the peer group, which was composed of selected members of the NRC staff and consultants. Enclosure B is a copy of the report of that peer group entitled "Risk Assessment of Radioactive Waste Isolation in Deep Geologic Formations - NRC Review Group Report." We believe that the conclusion of this report should be given your serious consideration.

In summary, the peer review group concluded:

- Although analysis of risk (i.e., product of probability and consequence) can be useful in establishing environmental standards, its use does not necessarily require a standard based upon explicit probability values.

- The material available for review did not provide adequate technical support for the draft EPA standard.

- The degree of conservatism in the resultant risk curves is not known since the ADL work did not include uncertainty analysis (i.e., estimation of error bands for consequences and probabilities). Therefore it is impossible to determine how realistic the "high" and "low" risk estimates actually are.

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- Neither a rigorous sensitivity analysis nor a systematic examination of a comprehensive set of potential repository failure mechanisms were included in the ADL work. The potential risk to public health and safety will depend upon the properties of the site -- including the radionuclides released -- as well as the particular failure mechanism chosen for calculation. Because the ADL repository model considered a limited range of site properties and possible repository failure mechanisms, the EPA conclusion which identified specific nuclides as dominating the risk cannot be confirmed.

As indicated previously, the peer review group used the Enclosure A working draft of the EPA standard to evaluate its structural aspects. This working draft includes explicit probabilities in its requirements. Without careful clarification, these probabilities could be presumed to be either based upon engineering judgment or upon highly sophisticated models -- complete with error band estimates for the probabilities. We are specifically concerned about the analytical precision which may be implied by citing a probability of as low as one in a million over 10,000 years, for releases from the repository exceeding proposed EPA limits. As it is presently drafted, the EPA standard would apparently require NRC to make a formal licensing finding in accordance with these specific probabilities. We have serious doubts that this would be possible because of the paucity of probability data in this field. Our experience, even in areas where the availability of data is significantly greater, convinces us that we must use a deterministic approach for licensing -- at least for the near future. This conclusion was previously conveyed to Dr. Mills by Mr. Minogue. (Letter dated December 27, 1978 -- Enclosure C.) We are particularly concerned that a proposed repository located at a hypothetically ideal site, with all the appropriate engineering barriers, might not qualify for licensing under the draft standard simply because DOE, as the license applicant, will be constrained by the geo-sciences state-of-the-art for predicting repository failures and might not be able to carry the burden of persuasion that the EPA criteria will be met. In this sense the NRC may not be able to implement the draft standard in a licensing context.

In addition to our concern about use of probabilities, the staff seriously doubts that a set of the key nuclide contributors to risk, as deduced from the ADL study with its limitations and as listed in the EPA standard, can be applied generally to determine the acceptability of a specific site since nuclide transport scenarios depend so strongly on the characteristics of the actual site.

In summary, while I feel our staffs have made progress in developing effective standards for the regulation of high level waste repositories, much work on both the technical basis and the form of the standard remains to be accomplished. We are especially concerned because our regulation development effort is proceeding on the assumption that a workable standard will be in place when it is needed. We are firmly committed to continue to assist in this challenging area of developing practical standards that assure protection of the public health and safety.

As you know, the Interagency Review Group Report called for EPA and NRC to develop a Memorandum of Understanding (MOU) on their development of standards for all phases of waste management activities. I would like to take this opportunity to propose that we start immediately to develop this MOU, giving the highest priority to an understanding on high level waste standards. The principal NRC staff contact in this matter is Karl R. Goller, Director of our Division of Siting Health and Safeguards Standards (443-5991).

Sincerely,

Joseph M. Hendrie

Enclosures:
(A) EPA Standard
(B) Peer Review Report
(C) Letter dated 12/27/78

ENCLOSURE A

A new Part 191 is proposed to be added to Subchapter F, Chapter I, of Title 40, Code of Federal Regulations, as follows:

SUBCHAPTER F - RADIATION PROTECTION PROGRAMS

PART 191 - ENVIRONMENTAL RADIATION PROTECTION REQUIREMENTS FOR SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

Subpart A - General Provisions

Sec.

Subpart B - Environmental Protection Requirements for Management Operations

Sec.

Subpart C - Environmental Protection Requirements for Disposal of High Level Radioactive Waste

Sec.

AUTHORITY: The Atomic Energy Act of 1954, as amended; Reorganization Plan No. 3 of 1970.

SUBPART A - GENERAL PROVISIONS

191.01 Applicability.

The provisions of this Part apply to: a) radiation exposure of members of the public and to radioactive materials introduced into the environment due to the disposal of high-level radioactive waste, and b) management operations, including storage but not transportation, incident to disposal of spent nuclear fuel and high-level radioactive waste which are conducted at locations not subject to the provisions of Part 190 of this Subchapter.

191.02 Definitions.

(a) "Accessible environment" means those portions of the environment directly in contact with or readily available for use by human beings. It includes the earth's atmosphere, the land surface, ground and surface waters, and the oceans to the extent that these are outside sites which contain a radioactive waste management operation or disposed radioactive waste.

(b) "Curie" (Ci) means that quantity of radioactive material producing 37 billion nuclear transformations per second. A nanocurie is one one-billionth of a curie.

(c) "Disposal" means placement or abandonment of radioactive wastes with no intent or planned capability to recover or retrieve them.

(d) "Disposal system" means any combination of engineered and natural barriers which is used to provide containment of radioactive waste.

(e) "Dose equivalent" means the product of absorbed dose and appropriate factors to account for differences in biological effectiveness due to the quality of radiation and its spatial distribution in the body. The unit of dose equivalent is the "rem." (One millirem (mrem) = 0.001 rem).

(f) "High-level radioactive waste" means: i) any radioactive waste separated from spent nuclear reactor fuel of any type during reprocessing; ii) spent nuclear fuel if disposed without reprocessing, iii) waste containing alpha emitting transuranic elements of half-lives greater than one year in excess of 100 nanocuries per milliliter; or iv) other radioactive sources which, without control, could produce an annual exposure to a member of the public in excess of 500 millirems to the total body or any organ for longer than 100 years.

(g) "Management operations" means any activity, operation, or process, except for transportation, conducted to prepare high level radioactive waste or spent nuclear fuel for storage or disposal, the storage of these materials, or activities associated with the disposal of these materials prior to abandonment.

(h) "Member of the public" means any individual that can receive a radiation dose in the accessible environment, whether he may or may not also be exposed to radiation in an occupation associated with radioactive waste management operations; such an individual is not considered a member of the public during any period in which he is engaged in carrying out any radioactive waste operations.

(i) "Organ" means any human organ exclusive of the dermis, the epidermis, or the cornea.

(j) "Radiation" means any or all of the following: alpha particles, beta particles, gamma rays, x rays, neutrons, high-energy electrons, protons, or other atomic particles.

(k) "Radioactive material" means any material which spontaneously emits radiation.

(l) "Site" means any location inside which one or more activities covered by this Part are conducted.

(m) "Spent nuclear fuel" means any nuclear fuel removed from a nuclear reactor after it has been irradiated .

(n) "Storage" means placement of radioactive wastes with intent or planned capability to recover or retrieve such materials.

191.03 Effective Date

This standard shall become effective for disposal on the promulgation date, and two years after promulgation for management operations.

SUBPART B - ENVIRONMENTAL PROTECTION REQUIREMENTS FOR MANAGEMENT OPERATIONS

191.10 Limitations for Normal Operations

All normal waste management operations involving spent nuclear fuel and high-level radioactive wastes, excepting transportation and those operations conducted at locations subject to the provisions of Part 190 of this Subchapter, shall be conducted in such a manner that:

a) The annual dose equivalent to any member of the public is less than 25 millirems to the whole body, 75 millirems to the thyroid, or 25 millirems to any other organ,

b) The exposure of any member of the public due to waste management operations and Uranium Fuel Cycle operations combined will not exceed either the provisions of Part 191.10 a) or Part 190 of this Subchapter, and

c) The total quantity of radioactive material entering the accessible environment, for each metric ton of heavy metal initially contained in or present in spent nuclear fuel, contains less than ____ millicuries of ruthenium-106, ____ millicuries of alpha-emitting transuranic radionuclides with half lives greater than one year, or . . . .

SUBPART C - ENVIRONMENTAL PROTECTION REQUIREMENTS FOR DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE

191.20 Environmental Protection Requirements for Disposal

Disposal of high-level radioactive wastes shall provide reasonable assurance for 10,000 years after disposal that:

a) In the absence of unplanned natural or human-induced processes or incidents which could disrupt the isolation, no release would occur to the accessible environment,

b) Cumulative releases of radioactivity into the accessible environment from any site due to reasonably foreseeable human-induced or natural processes or incidents will be less than the following radionuclide quantities:

Radionuclide	Release for 10,000 years *
Tc-99	10,000 Ci
Pu-239	1,000 Ci
I-129	100 Ci
C-14	50 Ci
Np-237	10 Ci

* Releases would be reasonably foreseeable if their cumulative likelihood of occurrence is in excess of one chance in 100 in 10,000 years.

c) Cumulative releases from any site are less than ten times the quantities in 191.20 b) due to highly unlikely natural events, which have a likelihood of occurrence less than one chance in 100 in 10,000 years,

d) Releases to the accessible environment of more than 10 percent of the total mass of high-level radioactive waste disposed of at any location are virtually impossible; this may be established by expert consensus that the likelihood of occurrence of these releases are less than one chance in a million for 10,000 years after disposal; and

e) In addition

191.21 Protection Requirements for Members of the Public

Disposal of high-level radioactive wastes shall, in addition to the provisions of 191.20, limit radiation exposure of any member of the public by:

a) Providing reasonable assurance that the annual exposure of any member of the public in the accessible environment beyond the area of the original sites which contain the disposed material is less than 5 millirems to the whole body or any organ for 10,000 years following disposal, and

b) Preventing unintentional intrusion into locations where high-level radioactive wastes are disposed of by establishing supplemental controls which use the most permanent markers and records practicable to communicate without impairment or loss the nature and hazard of the material and its location. Markers and records should be in several languages including the one of the country so placed and be recorded on long-lasting, low-value material; records should be placed in the major archives of the world to assure their perpetuation.

ENCLOSURE B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

March 16, 1979

MEMORANDUM FOR: Saul Levine, Director, Office of Nuclear Regulatory Research
Robert B. Minogue, Director, Office of Standards Development
William J. Dircks, Director, Office of Nuclear Material Safety and Safeguards

THRU: Karl R. Goller, Director, Division of Siting, Health and Safeguards Standards, SD
Anthony R. Buhl, Director, Probabilistic Analysis Staff, RES

FROM: I. Craig Roberts, Assistant Director for Siting Standards, SD
Michael C. Cullingford, Head, Fuel Cycle Section, PAS, RES

SUBJECT: TRANSMITTAL OF THE NRC REVIEW GROUP REPORT ON THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) RISK ASSESSMENT OF RADIOACTIVE WASTE ISOLATION IN DEEP GEOLOGIC FORMATIONS

This memorandum transmits the report of the NRC Review Group convened to review the EPA-sponsored work of Arthur D. Little, Inc. (ADL) on Risk Assessment of Radioactive Waste Isolation in Deep Geologic Formations. EPA staff had previously informed us (memo from Martin to Roberts, dated 11/30/78) that the ADL work would be an important part of the basis for their detailed HLW standard. The standard and its technical basis are of considerable importance to the NRC staff. Also, the analyses performed by ADL are similar to those that might be performed as a part of the licensing review of a repository. Further, EPA requested that NRC staff review the draft ADL report. A critical scientific review was therefore performed.

The objectives of the review were:

(1) To identify any significant weaknesses in the ADL work and recommend further work to correct any deficiencies. This would assist NRC in the direction and management of research projects in similar areas, in addition to assisting EPA.

(2) To consider the capabilities and limitations of probabilistic risk assessment techniques with respect to waste isolation in deep geologic media.

(3) To examine the manner in which the ADL work was utilized to formulate the EPA draft standards and the degree to which the ADL results support those standards. The examination would provide insights into the use of probabilistic risk assessment [illegible] standards for nuclear waste isola[illegible]

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