Vol. 7

Correspondence
from the
Docket 89-01

Comments on Working Draft 2 and 3

40 CFR 191

Background Material for Workshop

Technical Basis for EPA HLW Disposal Criteria

September 24-26, 1991

R-89-01
II-D-9

ENVIRONMENTAL EVALUATION GROUP

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

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July 3, 1991

JUL 15 1991

Part 191 Project
Waste Management Standards Branch
Office of Radiation Programs (ANR-460)
U.S. Environmental Protection Agency
Washington, DC 20460

Dear Sir/Madam:

These are the Environmental Evaluation Group's comments on the Nuclear Regulatory Commission Staff suggested change in the Containment Requirements of 40 CFR Part 191. We received the two page comments from ORP in late April 1991 along with Working Draft #3.

There are uncertainties in definition in the comments and we don't agree with some of the NRC conclusions. The specific items are discussed separately below.

(1) Item (a), "anticipated performance" is not defined either here or in Part 191. The term is defined in 10 CFR Part 60 as applying only to natural processes and events. Human intrusion activities are included under "unanticipated processes and events" in 10 CFR Part 60. Therefore, we presume that NRC is proposing that permissible releases resulting from human intrusion be ten times the values in Table 1 (Appendix B) regardless of the probability of occurrence.

The probability of at least one human intrusion event at WIPP is 1.0. The maximum drilling rate suggested in Appendix C for sedimentary formations leads to an expectation that there will be at least 3 human intrusions into WIPP waste storage rooms in 10,000 years. Therefore it is clearly a reduction in the level of containment to redefine the human intrusion event to have a probability of less than 0.1.

However, of the various suggestions that have been made to modify the human intrusion aspect of the containment requirements, this is probably the best approach because it still requires inclusion and also most of the higher consequence scenarios would likely have probabilities of less than 0.1.

(2) Item (b) states that releases with probabilities of 0.1 to 0.0001 would not be allowed to exceed 10 times Table 1. We understand that NRC did not intend to require inclusion of events with probabilities of less than 0.001.

EEG does not believe it is necessary to include releases from events with probabilities of less than 0.001 in 10,000 years in the containment requirements. After all, the 0.001 value results in a probability of only 10^{-7} per year, which is already below the 10^{-6} per year value often used as the lower boundary of credible accidents in operating facilities.

(3) We fail to see what is gained by the suggestion that probabilities in the 0.1 to 0.001 range need not be accurately determined. While the current wording seems to require accurate probability determinations, it actually makes no difference in showing compliance with the release limits what probability between 0.1 and 0.001 is assigned to a scenario. However, it is required in both working draft #3 and in NRC's recommendation that probabilities be determined with sufficient accuracy to locate them in the proper "bucket" (probabilities of >0.1, 0.1-0.001, or <0.001).

(4) We do not agree with the statement that "It is important to note no change in the level of overall safety is being proposed." The recommendation that projected releases from events with a probability between 0.1 and 0.001 (or 0.0001) not be summed is a clear weakening of the containment requirements. The 1990 "Preliminary Comparison with 40 CFR Part 191 ..." by Sandia predicts multiple events will occur (e.g., the Figure VI-3 CCDF plot in SAND 90-2347 shows about 18 events occurring between 0.1 and 0.001 probability. The largest single event contains only about 60% of the total releases). Furthermore, we believe that a standard that, in effect, requires consideration of only the highest consequence event in the 0.1 to 0.001 probability range will lead to a less thorough evaluation of scenarios that are believed to be less important.

In summary, we like very little about the NRC recommendations because we do not want to see the human intrusion requirements weakened. Some say the present requirements are unreasonable and perhaps unattainable by any facility. However, preliminary comparisons by Sandia indicate the present requirements may be achievable at WIPP even with the current design which has incorporated <u>no</u> features to mitigate the effects of human intrusion. A significant weakening of the standard at this time would permit DOE to show compliance without further experimental

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work and thus convert the facility to a repository without an adequate understanding of possible long-term problems.

Please call Dr. James K. Channell if there are questions.

Sincerely,

Robert H Neill

Robert H. Neill
Director

JKC:jc

cc: D. R. Anderson, SNL
F. Galpin, ORP/EPA
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EEI

EDISON ELECTRIC INSTITUTE

June 14, 1991

Part 191 Project
Waste Management Standards Branch
Office of Radiation Programs (ANR-460)
U.S. Environmental Protection Agency
Washington, D.C. 20460

Re: Responses to Questions Presented in Working Draft #3 of 40 CFR Part 191: Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes

Dear Sir:

The following responses to questions posed by the Environmental Protection Agency (EPA) in connection with Working Draft #3 of 40 CFR Part 191 ("Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes"), dated April 26, 1991, are submitted by the Edison Electric Institute/Utility Nuclear Waste and Transportation Program (EEI/UWASTE). EEI is the association of investor-owned utilities whose members generate and distribute approximately three-quarters of the nation's electricity. EEI/UWASTE is a group of electric utilities with nuclear energy programs that seeks to ensure that radioactive waste management and disposal, and nuclear materials transportation systems, are maintained and developed in a safe, environmentally sound, publicly acceptable, cost effective, and timely manner.

EEI/UWASTE is pleased to respond to the specific questions presented by EPA. However, a number of significant issues have not been addressed by those questions. These include the treatment of human intrusion, and appropriate requirements for post-disposal monitoring. EEI/UWASTE will address these and other issues at a later date.

<u>QUESTION #1</u>

Two options are presented in Sections 191.03 and 191.14 pertaining to maximum exposures to individuals in the vicinity of waste management, storage and disposal facilities: a 25 millirems/year ede limit and a 10 millirems/year ede limit. Which is the more appropriate choice and why?

As a threshold matter, EEI/UWASTE opposes the imposition of <u>any</u> individual protection requirements associated with post-disposal repository performance. The imposition of an individual dose limit would require analysis of highly speculative scenarios concerning the habits and location of a specific category of people in the future human population. There is no practical way to make individual doses the basis for a repository-performance limitation, and none should be prescribed.

However, if an individual protection requirement is -- for some reason -- included as part of repository performance criteria (as well as with respect to management and storage operations), EEI/UWASTE favors a 25 millirems/year ede limit over a 10 millirem/year ede limit. A 25 millirem limit for expected doses from <u>all sources</u> and pathways is appropriate in view of the fact that 10 millirems equates to EPA requirements under 40 CFR Part 61 NESHAPS, pertinent to exposures received as a result of <u>air emissions, alone.</u>

<u>QUESTION #2</u>

A new assurance requirement is presented in Section 191.13 that would require a qualitative evaluation of expected releases from potential disposal systems over a 100,000-year time frame. Are such evaluations likely to provide useful information in any future selecting of preferred disposal sites?

The assurance requirement providing for the qualitative evaluation of expected releases from potential disposal systems over a 100,000-year time frame should not be included as part of the regulation.

There is a substantial increase in the uncertainty of any calculation of repository performance as the period of interest increases from 10,000 to 100,000 years. Further, if this assurance requirement is truly intended, as it states, to involve a qualitative comparison of sites, there is no reason to prescribe a specific time frame. Rather, it would be more appropriate to leave the period open, depending upon the data available for comparison; and to prescribe the comparison in terms of site characteristics, rather than repository performance which is almost impossible to evaluate qualitatively. A better approach, accordingly, would be to call for a qualitative comparison of site characteristics that might influence repository performance beyond 10,000 years, as practical.

QUESTION #3

> *Two options are presented in Section 191.4 and 191.23 pertaining to the length of time over which the individual and ground water protection requirements would apply: a 1,000-year duration and a 10,000-year duration. Which is the more appropriate time frame why?*

As indicated in response to question 1, EEI/UWASTE opposes the imposition of any individual protection requirements associated with post-disposal repository performance, whether specified in terms of "individual" protection requirements, "ground water" protection requirements, or otherwise. However, if such limitations are included in the EPA's Standards -- arguments to the contrary notwithstanding -- they should be applied only over a 1,000-year period. A 10,000-year period simply calls for excessive speculation -- either directly or indirectly -- concerning the future habits and location of a specific category of people in the human population. Further, EEI/UWASTE note that the 1987 Court of Appeals decision rejected the individual protection period primarily on the basis of "EPA's apparent exclusive reliance on considerations of population risk in explaining its reasons for limiting the duration of the individual protection to 1,000 years." NRDC v. EPA, 824 F.2d 1258, 1288 (1st Cir. 1987) (emphasis added). The court did "not conclud[e] that the choice of a 1,000-year duration is inherently flawed." Id. at 1289.

QUESTION #4

In Subpart C the Agency proposes to prevent degradation of "underground sources of drinking waster" beyond the concentrations found in 40 CFR 141 -- the National Primary Drinking Water Regulations. The Agency is aware, however, that there may be some types of ground waters that warrant additional protection because they are unusually high value or are more susceptible to contamination. Should the Agency develop no-degradation requirements for especially valuable ground waters? If so, what types of ground waters warrant this extra level of protection?

EEI/UWASTE does not favor the development of no-degradation requirements for "especially valuable ground waters." Regulations should be based on the protection of public health and safety, rather than on arbitrary "no-degradation" standards. Further, as indicated in the answer to question 1, the designation of "especially valuable ground waters" would be highly speculative over the time period of significance in terms of repository performance.

QUESTION #5

Two options are presented in Notes 1(d) and (e) of Appendix B pertaining to the transuranic waste unit: a 1,000,000 curies option and a 3,000,000 curies option. Which is the more appropriate TRU waste unit and why?

EEI/UWASTE is evaluating the technical considerations pertinent to these options. Regardless of the option, however, the Standards should provide sufficient flexibility for a demonstration of the appropriate TRU unit -- based on the source of the material, cooling time, etc. -- in individual cases.

QUESTION #6

> *The Agency is investigating the impacts of gaseous radionuclide releases from radioactive waste disposal systems and whether, in light of these releases, changes to the standards are appropriate. To assist us in this effort, we would appreciate any information pertaining to gaseous release source terms, chemical forms, rates, retardation factors, mitigation techniques and any other relevant technical information.*

EEI/UWASTE does not have any technical information to provide at this time.

Finally, in a cover note to Working Draft #3, EPA requests comments on an alternative approach to the probabilistic section of the containment requirements. Under this alternative, the quantitative, probabilistic evaluation of certain unlikely scenarios would not be required. EEI/UWASTE believe that the alternative approach is a step in the right direction in that it provides a means of avoiding major difficulties insofar as implementation of the EPA Standards are concerned. The precise prescription contained in the draft offered for comment, however, is inappropriate to the extent that, by requiring that events with probabilities as low as one in 10,000 -- rather than one in 1,000 -- not exceed ten times the quantities of Table 1, it would increase the stringency of the Standards by a factor of ten.

I hope that these responses are helpful. Please call me on (202)508-5510 if you have any additional questions or would like further information.

Sincerely,

Christopher J. Henkel

Christopher J. Henkel
Program Manager, EEI/UWASTE

CJH/ctf

K-89-01
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ENVIRONMENTAL EVALUATION GROUP

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MAY - 1 1991

April 2, 1991

Mr. Richard Guimond
Director, Office of Radiation Programs
Environmental Protection Agency
401 M Street
Washington, DC 20460

Dear Mr. Guimond:

Attached is the EEG position on the definition of transuranic waste equivalence to spent fuel to be used in 40 CFR 191. This is in response to Caroline Petti's request on March 28, 1991 to send copies of the reference we quoted in our May 7, 1990 comments on Working Draft 2 and to respond to DOE's proposed definition.

We believe this definition is an important part of the Standard and appreciate your consideration of our position. Please feel free to call Jim Channell if there are questions.

Sincerely,

Robert H. Neill

Robert H. Neill
Director

RHN:pdg

Enclosures

EEG POSITION ON EQUIVALENCE OF 1000 METRIC
TONS OF HEAVY METAL SPENT FUEL WITH ONE
MILLION CURIES OF ALPHA EMITTING TRANSURANIC
RADIONUCLIDES WITH HALF-LIVES OF
GREATER THAN 20 YEARS.

The Environmental Evaluation Group has objected to the definition (in Appendix B of Working Draft 2) that one million curies of alpha-emitting transuranic radionuclides with half-lives of greater than 20 years (AE-TRU) was equal to 1000 metric tons of heavy metal (MTHM) of spent fuel with a burn-up of 25,000 - 40,000 MWd/MTHM since March 1983 when we testified before the EPA Scientific Advisory Board on the Draft Standard. Our position is that approximately the same degree of containment should be required for TRU waste in a TRU repository as for spent fuel in a High-Level Waste repository.

One thousand MTHM of PWR fuel (33,000 MWd/MTHM burn-up) contains about 3.6 million curies of AE-TRU one year after removal from a reactor. The corresponding value for 1000 MTHM of BWR fuel (27,500 MWd/MTHM burn-up) is about 3.1 million Ci of AE-TRU. Higher burn-ups result in substantially greater amounts of AE-TRU in spent fuel. Also, the quantities of AE-TRU at 100 years after discharge from the reactor are about 60% greater tha at 1 year due to the ingrowth of Americium -241 from decay of Plutonium - 241 (a beta emitter with a 14.4 year half-life). The WIPP inventory decreases to about 57% of its initial value at 100 years which makes the initial inequity in the definition even greater. These relationships are presented in more detail in the attached table for PWR fuel with a 33,000 MWd/MTHM bu--up.

The DOE in August 14, 1990 comments to EPA on Working Draft 2 suggested a redefinition of the 1000 MTHM to 1 million Ci TRU definition as follows:

Note 1(e) should be revised to include additional nuclides as follows:

(e) an amount of transuranic (TRU) waste containing 1,000,000 total curies of 1) alpha emitting transuranic radionuclides with half-lives greater than 20 years, 2) radionuclides with half-lives less than 20 years which produce regulated daughters with half-lives longer than 20 years, and 3) any other regulated radionuclides contained in the (nominally) TRU waste.

This language would include plutonium-241 (half-life 14+ years) and other like radionuclides in the waste unit. Plutonium-241 emplaced in the repository rapidly decays to become regulated radionuclides with half-lives greater than 20 years. The nuclides described in 2) and 3) above will comprise about half of the initial inventory in the repository.

The DOE recommendation is incorrect and would lead to an even greater inequality. If shorter lived radionuclides that decay to AE-TRU are considered the appropriate curie value to use is the quantity of AE-TRU that will ingrow, not the much larger curie value of the short-lived parents. A correct example of how concentrations of short-lived parents should be used is in Table 1 of 10 CFR 61.55 where a concentration of 3500 nanocuries per gram of plutonium - 241 is used. This concentration will result in a maximum Americium - 241 concentration of about 100 nanocuries per gram, the limit for shallow land burial of AE-TRU.

Case II in the attached table shows the ratios that result when applying the DOE recommended definition. EEG believes the most appropriate procedure is to actually calculate the ingrowth of AE-TRU with time from the short-lived parents. the resulting radioactivity and ratios are shown in Case III in the table. The Case III ratios are within a few percent of the Case I ratios for the expected WIPP radionuclide composition.

EEG believes a definition equating 1000 MTHM to either 3 or 4 million curies of AE-TRU would be reasonable equality. The ratios in the attached table suggest that even higher values (e.g. 7 million or 10 million curies per 1000 MTHM) might be justifiable for WIPP wastes. However, the ratios depend on the radionuclide composition and this could vary at WIPP. For example, if only 10% of the expected quantity of Plutonium-238 was shipped to WIPP (and this is conceivable because there are problems with shipment of some of these wastes) the ratios in Case III would be 3.6, 7.9, 4.3, and 2.0 at the appropriate times.

For the above reasons EEG recommends that the definition of equivalency between spent fuel and TRU wastes be changed to: 1000 MTHM with a burn-up of 25,000-40,000 MWd/MTHM be equal to 3 million (or 4 million) curies of alpha-emitting transuranic radionuclides with half-lives of greater than 20 years.

RATIOS OF TRANSURANIC RADIOACTIVITY IN 1000 METRIC TONS OF HEAVY METAL SPENT FUEL AND ONE MILLION CURIES OF ALPHA EMITTING TRANSURANIC RADIONUCLIDES WITH HALF-LIVES OF >20 YEARS

TIME-YEARS	MILLION Ci in 1000 MTHM	MILLION Ci in WIPP in MILLION CI AE-TRU	RATIO SF Ci/WIPP Ci
		Case I	
1	3.64	1.00	3.6
100	5.76	0.55	10.4
1000	1.70	0.11	15.0
10,000	0.43	0.63	6.9
		Case II	
1	136.	1.72	79.2
100	6.85	0.58	11.9
1000	1.72	0.12	14.7
10,000	0.44	0.063	7.1
		Case III	
1	3.64	1.00	3.6
100	5.79	0.57	10.1
1000	1.70	0.12	14.5
10,000	0.43	0.063	6.9

Case I: Radioactivity from alpha-emitting transuranic radionuclides with half-life of >20 years (AE-TRU). Does not include ingrowth with time from other radionuclides.

Case II: Includes all transuranic waste radioactivity, including beta emitters and alpha emitters with half-lives of <20 years.

Case III: Same as Case I except that ingrowth of AE-TRU from decay of other transuranic radionuclides is included.

References: DOE/RW-0184 Volume 1, Table 2.4.6 and DOE/EIS-0026-FS Table B.2.1B.

DOE-RW-0184
VOLUME 1 of 6

Office of Civilian Radioactive Waste Management

CHARACTERISTICS OF SPENT FUEL, HIGH-LEVEL WASTE, AND OTHER RADIOACTIVE WASTES WHICH MAY REQUIRE LONG-TERM ISOLATION

DECEMBER 1987

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

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Table 2.4.6 Variation of radioactivity (Ci/MTIHM) for significant actinides as a function of time since discharge from a 33,000 MWd/MTIHM PWR (Source: Roddy 1986)

Isotope[a]	1.0E+0	1.0E+1	1.0E+2	1.0E+3	1.0E+4	1.0E+5
	Time since discharge (years)					
Ra-226	-	-	2.66E-5	3.12E-3	1.34E-1	1.07E+0
U-234	-	-	-	2.03E+0	1.99E+0	1.61E+0
Np-237	-	-	-	9.99E-1	1.18E+0	1.14E+0
Np-239	1.71E+1	1.71E+1	1.69E+1	1.56E+1	6.68E+0	-
Pu-238	2.45E+3	2.33E+3	1.15E+3	1.08E+0	-	-
Pu-239	3.13E+2	3.13E+2	3.12E+2	3.05E+2	2.37E+2	1.80E+1
Pu-240	5.26E+2	5.27E+2	5.26E+2	4.78E+2	1.84E+2	-
Pu-241	1.20E+5	7.76E+4	1.02E+3	-	-	-
Pu-242	-	-	-	1.72E+0	1.69E+0	1.44E+0
Am-241	3.08E+2	1.69E+3	3.75E+3	8.93E+2	-	-
Am-243	1.71E+1	1.71E+1	1.69E+1	1.56E+1	6.68E+0	-
Cm-242	1.04E+4	5.72E+0	3.78E+0	-	-	-
Cm-243	2.06E+1	1.66E+1	1.86E+0	-	-	-
Cm-244	1.86E+3	1.32E+3	4.21E+1	-	-	-
OTHER	2.74E+2	2.60E+1	1.56E+1	2.68E+0	4.30E+0	1.68E+1[b]
TOTAL	1.36E+5	8.39E+4	6.85E+3	1.72E+3	4.44E+2	3.90E+1

[a]Nuclides contributing >0.1% are listed.

[b]The following isotopes contribute 1.07 Ci each: Pb-210, Pb-214, Bi-210, Bi-214, Po-210, Po-214, Po-218, and Rn-222. Others contributing 0.37 Ci each include: Pb-209, Bi-213, At-217, Fr-221, Ra-225, Ac-225, and Th-229.

Table 2.4.8 Variation of radioactivity (Ci/MTIHM) for significant actinides as a function of time since discharge from a 27,500 MWd/MTIHM BWR

(Source: Roddy 1986)

	Time since discharge (years)					
Isotope[a]	1.0E+0	1.0E+1	1.0E+2	1.0E+3	1.0E+4	1.0E+5
Ra-226	-	-	2.32E-5	2.60E-3	1.11E-1	8.86E-1
U-234	-	-	-	1.68E+0	1.64E+0	1.34E+0
Np-237	-	-	-	8.64E-1	1.02E+0	9.95E-1
Np-239	1.29E+1	1.29E+1	1.28E+1	1.18E+1	5.06E+0	-
Pu-238	1.86E+3	1.78E+3	8.77E+2	8.87E-1	-	-
Pu-239	3.00E+2	3.00E+2	3.00E+2	2.92E+2	2.27E+2	1.72E+1
Pu-240	4.78E+2	4.78E+2	4.76E+2	4.33E+2	1.67E+2	-
Pu-241	1.07E+5	6.95E+4	9.13E+2	-	-	-
Pu-242	-	-	-	1.42E+0	1.39E+0	1.19E+0
Am-241	3.15E+2	1.56E+3	3.39E+3	8.07E+2	-	-
Am-243	1.29E+1	1.29E+1	1.28E+1	1.18E+1	5.06E+0	-
Cm-242	9.42E+3	6.87E+0	4.54E+0	-	-	-
Cm-243	1.67E+1	1.34E+1	1.50E+0	-	-	-
Cm-244	1.25E+3	8.86E+2	2.83E+1	-	-	-
OTHER	3.05E+1	2.29E+1	1.61E+1	2.00E+0	3.90E+0	1.44E+1[b]
TOTAL	1.21E+5	7.45E+4	6.03E+3	1.56E+3	4.12E+2	3.51E+1

[a]Nuclides contributing >0.1% are listed.

[b]The following isotopes contribute 0.89 Ci each: Pb-210, Pb-214, Bi-210, Bi-214, Po-210, Po-214, Po-218, and Rn-222. Others contributing 0.33 Ci each include: Pb-209, Bi-213, At-217, Fr-221, Ra-225, Ac-225, and Th-229.

WIPP Supplemental EIS (Final

TABLE B.2.13 Initial radionuclide inventory in CH TRU waste for the assessment of long-term performance[a]

Radionuclide	Half-life (years)	Radioactivity (curies)
Thorium-232	1.41×10^{10}	3.07×10^{-1}
Uranium-233	1.59×10^{5}	9.48×10^{3}
Uranium-235	7.04×10^{8}	4.59×10^{-1}
Uranium-238	4.47×10^{9}	1.84×10^{0}
Neptunium-237	2.14×10^{6}	1.08×10^{1}
Plutonium-238	8.77×10^{1}	5.25×10^{6}
Plutonium-239	2.41×10^{4}	4.89×10^{5}
Plutonium-240	6.54×10^{3}	1.20×10^{5}
Plutonium-241	1.44×10^{1}	4.70×10^{6}
Plutonium-242	3.76×10^{5}	2.13×10^{1}
Americium-241	4.32×10^{2}	7.72×10^{5}
Curium-244	1.81×10^{1}	1.57×10^{4}
Californium-252	2.64×10^{0}	2.51×10^{4}
TOTAL		1.14×10^{7}

[a] This source term is different from that given by Lappin et al. (1989), because it was scaled up to correspond to the design volume of the WIPP. This was done by scaling the source term, by radionuclide, at each waste facility by the volume increment for that facility.

R-89-01
II-D-6

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D C 20555

January 29, 1991

The Honorable Kenneth M. Carr
Chairman
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

FEB 26 1991

Dear Chairman Carr:

SUBJECT: GUIDANCE ON LIMITS ON DOSES AND RISKS TO INDIVIDUAL MEMBERS OF THE POPULATION

During the 25th meeting of the Advisory Committee on Nuclear Waste (ACNW), held on October 24 and 25, 1990, Mr. Floyd L. Galpin, Chief, Waste Management Standards Branch, Office of Radiation Programs, U.S. Environmental Protection Agency (EPA), requested that the ACNW provide the bases for the recommendation, made in several of our earlier reports to you, that EPA consider incorporating into its high-level radioactive waste repository standards some guidance on limits for doses and risks to individual members of the general population.

The foundations for our position are outlined in the recommendations of the International Commission on Radiological Protection (ICRP), the International Atomic Energy Agency (IAEA) and the so-called "NORDIC" report. As will be noted, all three of these groups endorse the use of individual dose and risk limits in the development of standards for a high-level radioactive waste repository. This approach has also been endorsed by the Board on Radioactive Waste Management, National Research Council. The principal comments and/or recommendations of these organizations are summarized below.

1. Recommendations of the ICRP

The basic principles on this subject, as recommended by the ICRP, are presented in their report on "Radiation Protection Principles for the Disposal of Solid Radioactive Waste," published in 1985. In this report, the ICRP separates the releases from a repository into two categories: (a) those that are gradual and lead to normal releases that are reasonably predictable in terms of estimates of their exposure pattern in space and time; and (b) those that are not gradual and have to be thought of as probabilistic. Included in the latter category are releases that might occur as a result of seismic and tectonic phenomena. (Paragraphs 28 and 29, Reference 1.)

~~9102080057~~

a. Evaluation and Control of Normal Releases

For releases in the first category (i.e., normal releases) the ICRP recommends that its individual dose limits for members of the public should apply. Expanding on this, the ICRP states that its recommendations with respect to the assessment and monitoring of radioactive materials in the environment would also apply, with the results being used in the optimization of protection and in judging compliance of a high-level radioactive waste disposal facility with the applicable dose limits and source upper bounds. (Paragraph 30, Reference 1.)

The ICRP goes on to say that "The application of the individual dose limits to the dose distribution from normal releases from a waste repository is the same as for releases from other types of facilities. Two basic requirements are involved. First, the critical group, i.e. those who are expected to receive the greatest exposure, must be identified. Second, the design and operation of the repository must provide assurance that the average dose in the critical group will not exceed the dose limits . . . ." (Paragraph 45, Reference 1.)

b. Evaluation and Control of Probabilistic Releases

The ICRP recommends that risks from probabilistic events should be limited on a similar basis. In this regard, the ICRP states that "Since significant doses might result from events that disrupt the normal behavior of a disposal facility and which have an assumed probability of occurrence, in a given time, less than one, the objective of protecting individuals from all of the exposure events associated with radioactive waste disposal is best achieved by reverting to an individual risk limitation requirement. By dealing consistently in terms of risk, both the probability of an exposure and the magnitude of the exposure can be included. To take account of this, the Commission recommends that a risk limit and risk upper bound be established in direct analogy to the dose limits and upper bounds for normal releases." (Emphasis Added.) (Paragraph 47, Reference 1.)

c. Allowances for Future Activities and Individuals

"To allow for dose contributions from present practices and to provide a margin for unforeseen future activities, the Commission recommends that national authorities select a fraction of the dose limits as a source upper bound for each source of exposure, to ensure that the exposure of individuals will remain below the relevant dose limit." (Paragraph 54, Reference 1.)

"In a manner similar to the establishment of the source upper bound, the Commission recommends that national authorities select some fraction of the risk limit as a risk upper bound for the source being evaluated." (Paragraph 57, Reference 1.)

Expanding on this theme, the ICRP recommends ". . . that risks to future individuals should be limited on the same basis as are those to individuals living now." (Paragraph 50, Reference 1.)

2. Recommendations of the IAEA

Recommendations of the IAEA on this subject are presented in their preliminary draft report, "Safety Principles and Technical Criteria for the Underground Disposal of High-Level Radioactive Wastes." In this document, the IAEA separates the releases from a repository into those that result from "gradual processes" and those that result from "disruptive events." Since the annual dose limit for prolonged exposure to individuals within the critical group due to releases arising through "gradual processes" is 1 mSv, the IAEA recommends that the dose rate due to "gradual processes" occurring within a single repository be limited to some fraction of this value. For "disruptive events," the annual dose limit for individuals within the critical group is that which has an associated ". . . risk of health effects of one in a hundred thousand per year." On the basis of estimates made at the time, this would correspond to a dose rate limit of 1 mSv per year. (Sections 3.2.1 and 3.2.2, Reference 2.)

In essence, the IAEA report endorses the recommendations of the ICRP.

3. Recommendations of the Nordic Countries

The recommendations of the Nordic countries pertaining to the disposal of high-level radioactive wastes are presented in a report, "Disposal of High Level Radioactive Waste - Consideration of Some Basic Criteria - A Consultative Document," issued in 1989. Recommendations of this group on standards for a high-level radioactive waste repository are specified in terms of four general objectives and principles. Statements of significance are as follows:

The Nordic group endorses the ICRP recommendation by stating that "The predicted risks to human health and the effects on the environment from waste disposal, at any time in the future, shall be low and not greater than would be currently acceptable. The judgement of the acceptability of a disposal option shall be based on radiological impacts to <u>individuals</u> irrespective of any national boundaries." (Emphasis added.) (Paragraph 66, Reference 3.)

In terms of radiation protection criteria, the Nordic countries recommend that "The predicted radiation dose to any individual, excluding doses from unlikely disruptive events, shall be less than 0.1 mSv per year. In addition, the probabilities and consequences of unlikely disruptive events shall be studied, discussed and presented in qualitative terms and whenever practicable, assessed in quantitative terms in relation to the risk corresponding to a dose of 0.1 mSv per year." (Paragraph 85, Reference 3.)

As in the case of the IAEA, the Nordic group endorses the recommendations of the ICRP.

4. <u>Comments of the Board on Radioactive Waste Management National Research Council</u>

The most recent recommendations of the Board on this subject are presented in their report, "Rethinking High-Level Radioactive Waste Disposal," published in 1990. In the recommendations included at the end of this report, the Board makes the following statements:

"The Environmental Protection Agency, during its revision of the remanded 40 CFR Part 191, should reconsider the detailed performance standards to be met by the repository, to determine how they affect the level of health risks that will be considered acceptable. In addition, EPA should reexamine the use of quantitative probabilistic release criteria in the standard and examine what will constitute a reasonable level of assurance (i.e., by what combination of methods and strategies can DOE demonstrate that those standards will be met?).

<u>"All other countries use only a dose requirement. In setting regulatory standards and licensing requirements, the EPA should consider using only dose requirements."</u> (Emphasis added.) (Page 35, Reference 4.)

As may be seen, all four of the organizations and/or groups cited endorse standards for a high-level radioactive waste repository that have an associated limit on dose for normal or gradual releases and an associated limit on risk for disruptive or probabilistic releases. In all cases, the limits apply to individuals within a critical population group. The reasons that the ACNW endorses this approach, and is critical of the EPA approach, may be summarized as follows:

a. The high-level radioactive waste repository standards, currently proposed by EPA, are based on limiting the "global" collective dose, and estimates of the associated health effects, to a certain value (i.e., 1,000 health effects in 10,000 years). In taking this approach, neither the population to be protected nor the associated dose or risk limits are specified. Any advantage to using collective dose as a method for avoiding the dilution and dispersion of radioactive wastes in the environment will be offset by the difficulties in determining compliance with standards based on this approach. There are other regulatory approaches that can be applied to prohibit unacceptable disposal practices such as these.

b. The projection of collective dose estimates far into the future (as is necessary to comply with the high-level radioactive waste repository standards as proposed by EPA) is extremely difficult. Factors that complicate such estimates include errors in predictions of regional and global population demographics (size and location) and of potential radionuclide pathways (groundwater flow and agricultural practices). In contrast, long-range projections of the locations and living habits of individuals who may reside near a repository are relatively straightforward, and estimates of their potential doses can be made with greater certainty.

c. It appears that the EPA is alone in the approach that it recommends. No other country or agency endorses this approach.

Sincerely,

Dade W. Moeller

Dade W. Moeller
Chairman

References:

1. International Commission on Radiological Protection, "Radiation Protection Principles for the Disposal of Solid Radioactive Waste," Publication 46, Annals of the ICRP, Vol. 15, No. 4 (1985).

2. International Atomic Energy Agency, "Safety Principles and Technical Criteria for the Underground Disposal of High-Level Radioactive Wastes" (Preliminary Draft, 1989).

3. "Disposal of High Level Radioactive Waste - Consideration of Some Basic Criteria - A Consultative Document," Report of The Radiation Protection and Nuclear Safety Authorities in Denmark, Finland, Iceland, Norway and Sweden (1989).

4. Board on Radioactive Waste Management, National Research Council, "Rethinking High-Level Radioactive Waste Disposal," National Academy Press, Washington, DC (1990).

R-89-01
II-D-5

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

January 29, 1991

FEB 26 1991

The Honorable Kenneth M. Carr
Chairman
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Chairman Carr:

SUBJECT: STRINGENCY OF U.S. ENVIRONMENTAL PROTECTION AGENCY HIGH-LEVEL RADIOACTIVE WASTE REPOSITORY STANDARDS

During our 25th meeting, October 24 and 25, 1990, Mr. Floyd L. Galpin, Chief, Waste Management Standards Branch, Office of Radiation Programs, U.S. Environmental Protection Agency (EPA), requested that the Advisory Committee on Nuclear Waste (ACNW) provide EPA the bases for the statements, made in several of our reports to you, that the standards developed by EPA for a high-level radioactive waste repository were overly stringent.

There are several factors and considerations that served as a basis for our statements. These are summarized below.

1. <u>Comparison of a Repository to a Natural Ore Body</u>

The introductory information provided in the EPA standards (Reference 1) implies that one of EPA's goals was to ensure that the health impacts of a repository were no greater than those that would have been associated with a comparable amount of unmined uranium ore. Although conservative in its own right, this appeared to be a reasonable approach. Later we learned that this approach did not, in the final version, serve as a basis for the EPA standards. Rather, EPA based its standards for the repository on what was considered to be achievable using modern technology. Nonetheless, the manner in which the existing standards are presented implies that they were based on releases from a comparable ore body. As a result, most groups, including the ACNW, have evaluated the EPA standards with this consideration in mind.

If one assesses the EPA standards for a repository on the basis of a comparable ore body, there appear to be at least two steps taken by EPA that have led to undue stringency:

a. Reports published by EPA (Reference 2) of analyses of actual uranium ore bodies (assuming 100,000 MTHM) indicate that annual releases of Ra-226 over a 10,000-year period would range from 300,000 to 3,000,000 curies.

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The limit on releases for Ra-226 in the EPA standards is 10,000 curies. In a similar manner, estimates of the associated health effects (deaths) due to radionuclide releases from existing ore bodies over a 10,000-year period ranged from 1,000,000 to 10,000,000. The limit in the EPA standards is 1,000.

b. An unmined uranium ore body represents a continuous source of release of radioactive materials into the environment. In other words, the chance or probability that the ore body would cause radiation exposures to neighboring populations is one. In translating the estimated health effects from unmined ore bodies into a table of equivalent radionuclide releases from a high-level radioactive waste repository, EPA stated that there must be no more than one chance in ten of exceeding the given radionuclide release limits (or more than one chance in one thousand of exceeding ten times the release limits) over the initial 10,000-year period of operation of the repository. In other words, EPA added a factor of ten conservatism to releases from a high-level waste repository that are only slightly greater than releases from an unmined ore body.

2. <u>Limits for Individual Radionuclide Releases</u>

In setting permissible limits for releases of individual radionuclides from the repository, EPA assumed that the releases affected the population of the entire world -- projected to number a constant level of 10 billion people over the 10,000-year assessment period. In taking this approach, EPA did not specify a "critical" population group, nor did it specify a dose limit for the people who might be exposed. Rather, it summed the resulting collective doses over the population of the world and set the individual radionuclide release limits so as not to exceed a given collective dose limit (which, in turn, was used to predict the associated health impacts).

Data indicate that a major contribution to the collective dose apparently consisted of dose rates to individual members of the world's population of 0.01 mSv (1 mrem) per year or less. This calculational methodology is in sharp contrast to the procedures recommended by the National Council on Radiation Protection and Measurements (NCRP, Reference 3). To be specific, the NCRP recommends that ". . . assessments of increments of collective annual effective dose equivalents from any particular individual source or practice should exclude those individuals whose annual effective dose equivalents from such a source is 0.01 mSv (0.001 rem) or less." (Section 20, Reference 3.)

The overall impact of the calculational approach used by EPA is to "inflate," by a considerable margin, estimates of the health impacts of radionuclide releases from a repository. This, in turn, results in the allowable quantities of specific radionuclide releases from a repository to be overly conservative; that is, too low.

In making this comment, it is important to acknowledge that the NCRP recommendation was not published until June 1, 1987. Now that it has been issued, however, EPA should be encouraged to reassess its calculations.

3. <u>Release Limit for Carbon-14</u>

Over the past year or two, an increasing number of comments and papers in the literature indicates that gaseous emissions, specifically carbon-14 in the form of carbon-dioxide, may prohibit the proposed Yucca Mountain repository from complying with the EPA standards. The permissible release limits for this radionuclide, as specified in the EPA standards, are one more example of its stringency. This is illustrated by the following examples:

a. The total inventory of carbon-14 in a repository containing 100,000 MTHM is estimated to be about 100,000 curies. This compares to a global production of carbon-14 by cosmic radiation of 28,000 curies per year, a global inventory of about 230 million curies, and an atmospheric inventory of 4 million curies (Reference 4). In fact, release of all of the carbon-14 inventory in a repository would increase the atmospheric inventory by only about 2 percent; this compares to natural variations in the atmospheric inventory of 10 percent to 40 percent.

b. Based on an assumed inventory of 100,000 MTHM, the permissible rate of release of carbon-14 from a repository would be about 1 curie per year. Experience shows that any carbon-14 that is released would rapidly mix in the atmosphere, and estimates are that the accompanying dose rate to a person on top of Yucca Mountain would be far less than 0.01 mSv (1 mrem) per year. It is also interesting to note that the limit on the release rate of 1 curie per year for a repository compares to an average release rate of 10 curies per year from a typical 1,000 MWe light water reactor (Reference 4).

At the time the EPA standards were developed, considerations were limited to evaluations of a saturated site. In such a case, water transport and geochemical barriers would have been strongly influential in retaining the carbon-14. Subsequent consideration of Yucca Mountain (an unsaturated site) makes the existing EPA standards inappropriate, overly stringent, and in need of revision.

4. Indoor Radon

The Office of Radiation Programs of the U.S. Environmental Protection Agency has the responsibility for setting limits for indoor radon as well as setting standards for the high-level waste repository. A comparison of the risks for indoor radon and those for the repository indicates that the health effects resulting from radon exposures at permissible levels indoors will be significantly greater than those from the repository.

In summary, the statements by the ACNW that the EPA standards are overly stringent are based on: (1) restrictions that limit the probability of exceeding the release limits by even a small amount to an order of magnitude less than that for a natural ore body; (2) the application of inappropriate methodology in calculating collective doses that, in turn, were used to establish radionuclide release limits from a repository; (3) the establishment of release limits for certain radionuclides, most notably carbon-14 to amounts that are only a small fraction of the quantities naturally present within the environment; and (4) the inconsistencies of the risk standards proposed for the repository and those for other radiation sources, such as indoor radon.

Sincerely,

Dade W. Moeller

Dade W. Moeller
Chairman

References:

1. U.S. Code of Federal Regulations, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," 40 CFR Part 191.

2. U.S. Environmental Protection Agency, EPA 520/3-80-009, "Population Risks from Uranium Ore Bodies," October 1980.

3. National Council on Radiation Protection and Measurements, Report No. 91, "Recommendations on Limits for Exposure to Ionizing Radiation," 1987.

4. National Council on Radiation Protection and Measurements, Report No. 81, "Carbon-14 in the Environment," 1985.

R-89-01
II-D-4

UNITED STATES
NUCLEAR WASTE TECHNICAL REVIEW BOARD
1100 Wilson Boulevard, Suite 910
Arlington, VA 22209

September 28, 1990

Mr. William K. Reilly
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

OCT 3 0

Dear Mr. Reilly:

The Nuclear Waste Technical Review Board has been reviewing and evaluating the Department of Energy's repository development program for high-level radioactive waste since the Board was established in early 1989. The Board's *First Report to the U.S. Congress and the U.S. Secretary of Energy* was published in March 1990, and the second report is scheduled for publication in mid-November 1990.

Our Board's efforts have included a review and discussions of the standards and regulations that are pertinent to the licensing, operation, closure, and postclosure of a repository for high-level radioactive waste. At this time, there is widespread dialog in the United States and other countries regarding the various issues involved with the disposal of high-level radioactive waste.

It is noted that 10 CFR 60 was published in 1983 and that 40 CFR 191 [part of which is under a July 1987 remand by the U.S. Court of Appeals (First Circuit)] is still under development in a procedure that began in 1978. Also, as recently as July 27, 1990, the U.S. Nuclear Regulatory Commission issued a clarification on the meaning and intent of a subsystem regulation in 10 CFR 60 that pertains to the design lifetime of high-level radioactive waste packages.

In addition, many voices have been raised about the environmental standards and regulations applicable to the disposal of high-level radioactive waste in the United States.

Major issues include:

1. The requirement that the environmental standards and regulations fully protect the public's health and safety without being overly stringent.

2. The obligation that the standards and regulations be consistent and compatible. There must be a closer, workable nexus between 40 CFR 191 and 10 CFR 60.

3. The need to have pertinent standards and regulations stated in a clear and understandable manner.

4. The desirability for having the rationale, including established risk levels, be an inherent part of appropriate environmental standards, rules, and regulations.

5. The need to ensure that the environmental standards are applicable and defensible in the licensing arena.

6. A desire (because of uncertainties and limitations in data) for some degree of flexibility in the regulation and control of a first-time technical venture whose impacts will extend more than 10,000 years.

7. A desire to have environmental standards reasonably consistent with today's standards and have these standards apply to future populations.

In light of these concerns, the Nuclear Waste Technical Review Board believes that the current circumstances and interest suggest a need, and opportunity, for the U.S. Environmental Protection Agency and the U.S. Nuclear Regulatory Commission to enter jointly into negotiated rule making regarding 40 CFR 191 and 10 CFR 60. Such a process would appear to be timely and extremely useful.

Our Board stands ready to be of appropriate assistance to you in such an endeavor.

Sincerely,

Don U. Deere

Don U. Deere
Chairman

cc:
Dr. Kenneth M. Carr
Dr. John W. Bartlett

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

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October 10, 1990

Mr. Richard J. Guimond
Assistant Surgeon General, U.S. Public Health Service
Director, Office of Radiation Programs
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Guimond:

We were pleased to receive your letter of August 6, 1990, as well as your telephone call of the same date, indicating a desire to work with this Committee in resolving certain issues related to the Environmental Protection Agency (EPA) standards for the disposal of high-level radioactive wastes in a geologic repository. In response to your questions pertaining to the letter of May 1, 1990, submitted by this Committee to Chairman Kenneth M. Carr, U.S. Nuclear Regulatory Commission (NRC), we offer the following comments. They correspond to the items as enumerated in your letter.

1. We believe that the EPA standards can be interpreted as being organized in a hierarchical structure. This is based on the assumption that the highest level expression in your hierarchy is a qualitative goal, that is, that the risks to future generations over the first 10,000 years due to the disposal of high-level radioactive wastes in a repository should be no greater than "the risks that would have existed if the uranium ore had not been mined . . . ." We note, however, that this statement is not included in the standards, nor is it identified as the highest level goal. The statement is included only in the "Summary" and the "Supplementary Information" that accompanies the original standards as published in the Federal Register.

What we interpret as the next level, which is quantitative and is a part of the standards, is the statement that there should be no more than 1,000 premature deaths over the first 10,000 years which are attributable to placement in a repository of the high-level wastes from 100,000 metric tons of reactor fuel. We fail, however, to see the connection or comparability between this statement and what we interpret as the highest level goal. We also fail to see the quantitative relationship between this requirement and the limits on the releases of specific radionuclides from a disposal facility which are probabilistic and serve as what we interpret to be the third level in the hierarchy.

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our concern with your apparent hierarchical structure is that the lower level quantitative statements (or standards) appear to be more stringent than the highest level qualitative statement. To assist us in better understanding the approach you have taken, it would be helpful if your staff could (1) state whether we have correctly interpreted the hierarchical structure of your standards, and (2) provide us with the rationale and, indeed, the calculations and assessments that served as a basis for developing the lower level quantitative standards. With respect to the latter request, we note that certain changes have occurred that may impact upon the validity of your earlier calculations. These changes include: (a) analyses of "real" repository sites have shown them to be more complicated than your staff may have assumed for the hypothetical site used in your analyses, (b) the potential impact of indoor radon, which was only generally recognized subsequent to your original assessment, may need to be factored into your risk evaluations, and (c) major advances in environmental modelling techniques over the last few years.

2. (a) We concur with your assumption that a disturbance can occur at any time during the initial 10,000-year period. recognition of this fact, you have specified the radionucl release limits in your standards in a manner so that it does n make any difference whether the entire release occurs within a single year or is spread out over time. We do not concur, however, that this makes it difficult to apply annual risk limits under these types of circumstances.

The principal basis for our position is the guidance provided by the International Commission on Radiological Protection (ICRP) in its Publication 46. In this report, the ICRP recommends that the risks from releases from the undisturbed performance of a waste repository be controlled through the application of annual dose limits. The ICRP further recommends that the risks from releases accompanying the disturbed state (classified as "probabilistic events") be limited on a similar basis, that is, through the application of annual risk limits. In both cases, the limits would apply to the critical population group.

If you maintain your position that application of an annual risk limit to releases occurring during the disturbed state is not workable, an alternative approach would be to apply some form of "accident or event" risk limit to these types of occurrences. This would be comparable to the approach being used in safety assessments of nuclear power plants where annual dose limits are applied for the control of radionuclide releases associated w routine operations and (single-event) risk limits are applied releases occurring as a result of accident situations.

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In making these suggestions, we clearly recognize that there are definite limitations in comparing the standards and approaches used in the regulation of a nuclear power plant to those needed for a high-level radioactive waste repository. Nonetheless, where the transfer of knowledge and experience from one type of nuclear facility to another can be beneficial, such analogies should be encouraged.

(b) We agree that the licensing organization should have the authority for defining the critical population group.

Having stated this, however, we also believe that it would be helpful if the EPA staff could identify and justify the critical population group assumed to be exposed in setting what we have referred to as your intermediate level goal. If we interpret the situation correctly, such information would permit estimation of the average annual risk (dose) limit that corresponds to this goal. In a similar manner, we would appreciate knowing the critical population group that was assumed in calculating the probabilistic radionuclide release limits specified in Table 1 of your standards.

Another item of information that would be helpful would be to know how the collective doses associated with the establishment of these radionuclide releases were calculated. To be specific, was a cutoff used, as was suggested by the ICRP in its Publication 46 and as has more recently been suggested by the National Council on Radiation Protection and Measurements in its Report No. 91, or was the full range of dose rates included in making these estimates?

Please note that our interest in being able to define a critical population group and to estimate this group's associated permissible dose rates is in line with our understanding of the guidelines recommended by the ICRP and by radiation protection authorities in other countries of the world for high-level waste repositories. We believe the guidance provided by these groups is sound and represents a satisfactory basis on which to judge the acceptability of the health risks associated with radioactive waste disposal facilities.

3. In recommending that a disposal facility be addressed as a system, we reaffirm our position that a properly organized system requires a consistent hierarchical structure. The application of remedial actions beyond retrievability of the emplaced waste is an integral part of such a system.

4. (a) We concur with your statement that "what is really important is the total anticipated impact of repository performance." The reason that we called for specific attention to human intrusion is that preliminary performance assessments for the WIPP facility have shown that this concern is the dominant contributor to the risks to the public. We have no data that show the same

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ENVIRONMENTAL EVALUATION GROUP

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

7007 WYOMING BOULEVARD, N.E.
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ALBUQUERQUE, NEW MEXICO 87109
(505) 828-1003

May 7, 1990

AUG 28 1990

Mr. Richard Guimond
Director, Office of Radiation Programs
Environmental Protection Agency
401 M Street S
Washington, DC 20460

Dear Mr. Guimond:

Attached are the Environmental Evaluation Group's comments on Working Draft 2 of 40 CFR Part 191. Dr. James K. Channell of our staff discussed our draft comments with Ray Clark and Caroline Petti of your staff on May 1, 1990.

We appreciate the opportunity to work closely with your staff on this regulation and hope to continue to do so in the future. Please contact Jim Channell if you have questions.

Sincerely,

James K. Channell
for Robert H. Neill
Director

JKC:ct

Enclosure

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ENVIRONMENTAL EVALUATION GROUP

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

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ENVIRONMENTAL EVALUATION GROUP

COMMENTS ON

WORKING DRAFT 2 OF 40 CFR PART 191

Submitted to

U. S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF RADIATION PROGRAMS

MAY 1990

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GENERAL COMMENT

EEG is aware that some individuals or organizations have taken the position that 40 CFR 191 should be drastically changed and perhaps restarted from scratch. We are supportive of the standard and believe that Working Draft 2 needs only fine tuning. Also, we have seen nothing in our evaluations on WIPP to indicate that the standard is likely to be unattainable once the system is adequately understood and necessary engineering modifications made to the facility or to the waste form.

EEG is also aware of the significant amount of public, industry, and Federal agency involvement over a number of years that went into the development of the 1985 standards. We believe that starting over again would delay the repromulgation of 40 CFR Part 191 by years and could cause a great deal of uncertainty in the development of acceptable repositories. Perhaps EPA should, if it agrees with our conclusion about the problem of starting over again, publicize the history of this standard and the degree of consensus that had been developed in the past.

SUBPART A

1. 191.02 Definitions, (g) "Disposal". This definition that disposal does not occur until the shafts of the repository are backfilled and sealed caused a lot of confusion in the remanded standard because of its relation to when the Demonstration of Capability to comply would occur. The proposed wording in 191.17, if it remains in the standard will remove the confusion over the timing of Demonstration of Compliance. However, we would prefer the last sentence to read ". . . disposal of waste in a mined geologic repository occurs when it has been placed in the repository in the final disposal mode with no intent to retrieve."

2. 191.02 Definitions, (l) "Radioactive Waste". The proposed addition of the phrase "and any other radioactive material managed or disposed of with these wastes" is an improvement. This clarifies that radionuclides such as: (a) fission or activation products in transuranic waste; (b) greater than class C low-level wastes; and (c) NARM, such as radium 226, would all be included if managed or disposed of with high-level or transuranic waste.

3. 191.02 Definitions, (p) Transuranic radioactive waste. This definition is unchanged. Item (2) permits DOE and EPA to decide that buried wastes and tank wastes containing >100 nCi/g of TRU can be disposed of with less protection than a repository would offer. Also, there are no limits on volume or concentration applied to this variance. EEG believes

that the full NEPA process and concurrence of the host state or Indian Tribe should also be required before wastes can be declared as non-transuranic and disposed of by a less restrictive standard.

EEG is concerned that, unless requirements of NEPA documentation and state concurrence are included, that the Item (2) exception could be abused. While the problems of setting quantitative limits to apply to all conceivable exceptions is appreciated, we believe this exception should rarely, if ever, be considered for significant quantities of wastes containing greater than 1000 nCi/g of TRU.

4. 191.03 Standards. It is not clear why EPA felt the need to revert to the dose limits of the 1985 standard (25 millirem to the whole body, 25 or 75 millirem to other organs) rather than use the annual committed effective dose equivalent methodology used in Working Draft 1.

   We believe all new standards should use effective dose equivalent methodology. Also, the numerical value of new standards should be consistent with other standards. For example, 40 CFR 61.92 limits the emissions of radionuclides to quantities "that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr". The 191.03 standard in Working Draft 2 is broader than for 61.92 because it includes the dose received from all sources (e.g direct radiation, liquid pathway and contamination as well as from radionuclide emissions). We recommend the limit be 25 mrem/yr effective dose equivalent total from all pathways including radionuclide emissions. The standard for 191.03 (b) could read "shall be conducted in such a manner as to provide reasonable assurance that no member of the public would receive in any year an effective dose equivalent of 10 mrem/yr from radionuclide emissions or 25 mrem/yr combined from discharges of radioactive material and direct radiation".

   It should be made clear in the regulation how doses resulting from accidents are considered in the standard. The explanation under Section II.B.2 of the Supplementary Information portion of 40 CFR 61 seems to be a reasonable interpretation to EEG.

5. Alternative Standards. EEG agrees with the deletion of section 191.04 <u>Alternative Standards</u> frc⁻ Working Draft 1.

<u>SUBPART B</u>

1. 191.12 (b) Active Institutional Control definition. This definition is unchanged since 1985, so perhaps we should leave it alone. However, as worded it implies that any one

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of the 4 items are sufficient to comply with the definition. Is this the intent or must all items be included? EEG prefers requiring all actions.

2. 191.12 (f), Controlled area definition. It is noted that this definition does not require the area to be controlled during the active institutional control period. Activities could be conducted during the active period that would compromise the area to be delineated by passive markers in the passive control period. We recommend that the controlled area for the passive period be required to have been a controlled area during the active institutional control period. This is more than an academic issue for WIPP. One calculation in the Supplement EIS indicated the standard could be met at 5 km, but not at the boundary presently planned for land withdrawal.

3. 191.13 Containment Requirements. The wording is unchanged from 1985. We concur with it except that the last sentence of the section should read: "Instead, what is required is a reasonable expectation, on the basis of the record that compliance with 191.13(a) will be achieved. The decision by the implementing agency should be arrived at by a public process that is responsive to the comments of state and other scientific review groups."

4. 191.14 Assurance Requirements, General. There has been an uncertainty in the past about what was necessary to show compliance with the Assurance Requirements and when compliance had to be shown. The new section 191.17 implies that compliance with section 191.14 would be required before waste are emplaced. It should say so <u>explicitly</u>. Also, the requirements for showing compliance are defined solely by the implementing agency. EEG believes a statement should be made in Section 191.14 that: (1) compliance with the Assurance Requirements must be shown before any wastes are emplaced; and (2) a detailed report and commitments are required and the implementing agency must respond to comments by outside review groups before compliance can be shown.

5. 191.14 Assurance Requirements (a) and (b). Requirement (a) does not allow taking credit for active institutional controls for more than 100 years. Yet (b) requires monitoring (which is included under the active institutional control definition) for as long as there are significant concerns. Is this consistent? EEG agrees that active institutional control should not be considered to <u>completely</u> prevent human intrusion for more than 100 years. However, we find it inconsistent to permit <u>no</u> credit after 100 years for active control but to allow some credit for passive institutional controls. We believe partial credit could be

permitted for up to 200 or 250 years, if active control is committed to and otherwise justified because, if continued, it should be more effective than markers. We realize that an agency could default on its commitment to continue active control after 100 years. Also, they could default on the commitment well before 100 years. Likewise, various things could happen to passive controls before or after 100 years to reduce their effectiveness.

6. 191.14 Assurance Requirement (c). Our comments concerning permanent markers are under Appendix C.

7. 191.14 Assurance Requirement (e). Presumably the term "maximum achievable control technology" has a precise meaning in some EPA regulation. We have been unable to find its definition. It should either be defined and explained or deleted. This ALARA approach to a standard that is already largely an ALARA standard is certain to be objectionable to some. Perhaps with taking economics into account a reasonable value could be obtained. This is probably best considered a motherhood statement that is not rigorously evaluated.

8. 191.14 Assurance Requirement (f). This method of handling the dilemma of the 10,000-100,000 year time frame is a good one. We concur with it.

9. 191.14 Assurance Requirement (g). The inclusion of the word <u>clearly</u> in this item will make it more difficult to show that WIPP is an acceptable site. A resource rich site is already being penalized by a human intrusion rate that is ten times as great. This appears to be double jeopardy.

10. 191.15 and 191.16 Individual Protection and Groundwater Protection Requirement Options. Our preference is Option 2.B with option 3.B (10,000 years) and 4.B (10 millirem) included. Our reasons for this are:

    (a) Option 1 is too complicated. The real concern should be the potential radiation dose a person can get from potable groundwater not determining what groundwater class is applicable.

    (b) Section 191.16 under Option 1A forbids any increase in radioactivity for a special source of groundwater. One cannot prove that no increase has occurred.

    (c) A separate ground water protection requirement is preferable so that the 4 millirem limit can be applied to drinking water only. This is consistent with the SDWA and permits additional

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doses to occur to individuals from airborne, stock watering, or irrigation pathways.

(d) Our preference for the 10,000 year time period is to discriminate against sites where an aquifer is expected to receive wastes and transport radionuclide to the accessible environment in the 1,000 to 10,000 year time frame. We recognize that predictions of human habitation and lifestyle patterns become more speculative as the time span increases, but they are already very speculative before 1,000 years. However, the key predictions involve radionuclide transport which have to be made for these containment requirements.

(e) A 10 millirem per year dose results in an annual risk of a latent cancer fatality of about 4E-6 which would give a lifetime risk of greater than 1E-4 if the event persisted for the lifetime of an individual. However, the calculation procedure will probably result in an event that has less than a 50% chance of occurring for even one year, and an even lower probability of occurring for a lifetime. Also, the 4 millirem per year limit for drinking water will reduce the allowable dose to somewhat less than 10 millirem per year in most cases.

11. 191.17 Demonstration of Capability to Comply. The addition of this section to working draft 2 is very helpful in the oversight of WIPP and EEG appreciate its inclusion. We do have one suggestion. Item (4) requires the concurrence of the administrator before experimental emplacements of waste can be made. We support this requirement but believe that this section should specify that the administrator's concurrence must follow an open process where affected States, Indian Tribes and the public have input.

12. 191.18 Alternative Provisions for Disposal. Any alternative procedures that is proposed to "bypass" these standards needs to be thoroughly and publicly evaluated. The procedures listed in this subsection may be adequate, though we would prefer that the requirements include the full NEPA process and concurrence by affected States and Indian Tribes.

APPENDIX A

1. There is a typo in the second line, next to the last word, on page 2. The word should be as.

2. We question whether the use of a 70 year committed dose

equivalent and committed effective dose equivalent (CEDE) is necessary. It will, of course, show higher values for the same intake for radionuclides with a long effective half-life. But the 50 year CEDE has become standard and has adequate conservatism in it because: (a) few people are exposed for an entire lifetime; and (b) with the long latency periods between receipts of a dose and onsets of most types of cancer the doses received late in life contribute little to latent cancer fatalities.

APPENDIX B

1. We agree <u>strongly</u> with changing the unit of waste back to 1,000 MTHM. Using a unit of 10,000 MTHM would have doubled the permissible release from WIPP, even if the inventory would have dropped significantly from the current estimate of 5 million curies. It also would have allowed 10 times the releases from very small repositories.

2. The footnote says that "New radionuclide risk factors have been evaluated and do not result in any changes to the release limits from those in the 1985 rule". We assume these are the fatal cancers per curie values presented in Table 6-1 of EPA 520/S-85-026 (May 1986). Since EEG has not personally developed risk values we have no basis for objecting to the values calculated by EPA. However, we have the following comment about how these values were used in Table 1.

   The rounding of the release limit values to one order of magnitude causes significant discrimination for or against some radionuclides. For example, those nuclides with a release limit of 100 Ci have fatal cancers per curie ratios from 1.0 to 7.6. Those with a release limit of 10 Ci are 2.1 to 25 times the range of values from the 100 Ci limit radionuclides. Those with release limits of 1000 Ci have values that are 0.06 to 1.0 times the range of value for the 100 Ci limit radionuclides. We question the need to group release limits in such few categories that significant differences between radionuclides are eliminated. We suggest that the release limits be specified to one significant figure and normalized from the fatal cancers per curies released to a river value in Table 6-1 (or whatever values are current). For example, if the Pu-239 value in Table 6-1 were set at 100 Ci, the values for: (a) Pu-238, Pu-240, Am-241 would also be 100 Ci; (b) U-233 would be 200 Ci; (c) Ra-226 would be 30 Ci; and (d) Th-230 and Th-232 would be 10 Ci. Such a change would not present a significant calculation problem and would eliminate criticism of inconsistency.

3. EEG has commented previously on the implications of Note 1,

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item (e) where 1 million Ci of alpha-emitting transuranics with half-lives greater than 20 years are equated to 1000 MTHM. since there are about 3.6 million Ci of alpha-emitting TRU in 1000 MTHM (for 33,000 MWD/MTHM burnup with PWR fuel. source is DOE/RW-0184, Volume 1, table 2.4.6) one year after discharge from a reactor the Note 1 definition is in effect allowing 3.6 times the fractional release from a TRU repository as from a HLW repository. This ratio gets even worse with time; for the expected WIPP radionuclide distribution at 100 years after closing the ratio would be about 9.8 times. EEG believes the definition should be changed to its pre-1982 value where 3 million curies of alpha emitting TRU with a half-life greater than 20 years is equated to 1000 MTHM.

4. Note 2. EEG concurs with this methodology.

5. Note 3. The allowing of a Release Limit multiplier of one for small disposal systems is acceptable to EEG with the qualification here that multiple disposal systems within 40 km must be treated as a combined system.

6. Notes 4 to 6. EEG has not made a detailed evaluation of these adjustments for other wastes and have no specific comment.

7. Note 7. EEG concurs with this methodology.

APPENDIX C

This appendix is a very important portion of the standard and perhaps the most controversial. Although it is labeled "Guidance", there is concern by some that the use of different assumptions may not be acceptable and that it may not be possible to show compliance with 191.13, 191.15 and 191.16 if those assumptions are used.

EEG has expressed definite opinions in the past about some assumptions in this Guidance and some of these are presented below. However, we believe it is not possible for any of us at this time to specifically define the most appropriate assumptions to use throughout the performance assessment. We believe it should be possible for the scientific community to come to a consensus on reasonable assumptions as issues arise during the performance assessment process. However, for this to be a true consensus and be acceptable to the public it will be necessary for the performance assessment to be a public process and to have extensive involvement by scientists and engineers outside of the implementing agencies throughout the process. Technical groups representing affected States should certainly be involved. Other groups representing industry and the public would also be appropriate. Working Draft 2 is vague about how the decision process for the containment requirements will be carried out. Subsection 191.13 says only that "what is required is a reasonable expectation on the basis of the record before the implementing agency, that compliance with 191.13(a) will be achieved".

Perhaps providing assurance in the standard that the assumptions finally used will have a broad consensus, rather than have them decided unilaterally by the implementing agency, will be a better way to address concerns about the assumptions that will be used than placing undue emphasis on Appendix C.

We believe a statement similar to the following should be inserted in the introductory section of Appendix C. "Since it is impossible to predict the assumptions that will be reasonable when evaluating a specific repository and using actual detailed data the Agency believes that assumptions determined by scientific consensus should take precedence over the assumptions listed below. However, this consensus must be determined by an open process that includes scientific evaluation groups from outside the implementing agency."

1. EEG believes the text for the first 2 1/2 pages (through compliance with Sections 191.15 and 191.16) is adequate and does indicate that alternate methods of analysis can be used, if justified.

2. See our comments under Section 191.14 about assumptions for periods of institutional control. In general we believe that it should be possible to take some credit for active control or passive control up to about 250 years provided a detailed justification and appropriate commitments are made. Consistent with our general comment above, we do not believe that the reduction in the likelihood of human intrusion should be determined unilaterally by the implementing agency.

3. Consideration of Inadvertent Human Intrusion into Geologic Repositories. We are not sure what the last sentence in this section is intended to say. We disagree with it if it is saying that once an exploratory driller interacts a waste disposal room be recognizes that something is wrong and quickly performs an appropriate response. Such an interpretation would rule out a brine reservoir scenario at WIPP and would not be completely compatible with items (1) and (2) in the final paragraph of Appendix C.

   EEG does not believe that all drillers would quickly recognize they had encountered a repository and that all human intrusion problems will be solved if the intruders have knowledge of the site and appropriate remedial measures. It seems to us that most cases of intrusion would

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occur only if there is a breakdown in society, specifically:

- (a) "society" doesn't know what is happening;
- (b) "society" knows that is happening, but doesn't care;
- (c) "society" is too weak to prevent the action;

All drillers operating under these societal breakdowns can not be expected to be law-abiding, environmentally conscious, and highly competent. If they were, they would probably know of the repository and not drill.

EEG believes that it should not be assumed that most human intruders will fully comply with good drilling practice and follow all appropriate environmental and borehole sealing regulations. A range of responses should be assumed and justified. This range of responses should take into account the current experiences and practices with drillers. For example, what are the range of responses to encountering brine? How much is allowed to flow before the well is closed or the flow is controlled? Also, what are the ranges of responses to borehole sealing regulations? A November 1989 U. S. Department of Interior, Office of Inspector General audit report (C-LM-BLM-26-89) "Inspection and Enforcement Program and Selected Related Activities Bureau of Land Management", found that current regulations for sealing inactive boreholes are often not followed and the quality of borehole seals that are installed is uncertain. We believe the range of response for specific repository sites should be determined by scientific consensus.

4. Frequency and Severity of Inadvertent Human Intrusion in Geologic Repositories. We believe the higher drilling rate (30 boreholes per square kilometer of repository area per 10,000 years) for sedimentary rock formations is appropriate. This is the only quantitative penalty in the standard for choosing a site in a mineral rich area and its deletion would drastically weaken the Assurance Requirement bias against choosing such sites.

We agree with item (1) and note that it tends to be inconsistent with the assumption in the previous section that "intruders soon detect, or be warned of the incompatibility of the area with their activities". For example, brine reservoirs in the WIPP area are capable of delivering over 55,000 m^3 of brine at the surface by artisan flow.

Item (2) would not be conservative in all cases for present drilling practices according to the above cited Inspector General report. We believe a consensus needs to be developed on the appropriate range of responses.

II-F-5

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

August 27, 1990

Richard Guimond, Director
Office of Radiation Programs, ANR-458
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Guimond:

Enclosed are the comments of the staff of the U.S. Nuclear Regulatory Commission (NRC) on Working Draft Number 2 of the U.S. Environmental Protection Agency (EPA) environmental standards for management and disposal of high-level and transuranic radioactive wastes.

As you know, the Commission plans to issue "conforming amendments" to our regulations (10 CFR Part 60) to adopt the requirements of your standards. Ideally, I would like to propose those amendments to Part 60 concurrently with proposal of your standards, so that both documents can be reviewed by the public simultaneously. In order to achieve this goal, significant interactions between our staffs will be needed. A starting point for these interactions might be the development of a common set of terms for use in both regulations, as addressed in our comments. I propose that our staffs meet as soon as practical to work toward development of the common terminology.

I am concerned that there continues to be considerable controversy regarding the perceived stringency of your standards. Many have argued that the standards are excessively conservative when compared with other accepted standards. We recommend that EPA provide further insight into the basis for the standards to permit a comparison with other regulatory standards and guidance, as well as with other risks experienced by society. I strongly encourage you to explicitly and thoroughly describe the basis for your standards in such a way that the level of safety can be evaluated in public comments, and questions of excessive stringency may be resolved.

Considerable controversy also exists, both within the NRC and outside, about the probabilistic format of your standards and the potential difficulty of implementing them. In the enclosed comments, we reiterate (with slight modification) the same concern expressed in our 1983 comments. We once again suggest rewording the "containment requirements" in a manner that should achieve a level of safety comparable to that sought by EPA. Modifying the text as recommended would, at the same time, eliminate the need for numerical predictions of the probabilities of highly unlikely processes and events. I strongly encourage you to adopt this text as a way to end the debate surrounding the standard's probabilistic format.

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Thank you for the opportunity to review and comment on Working Draft Number 2. We look forward to working closely with EPA during reissuance of your standards.

Sincerely,

RE Browning

Robert E. Browning, Director
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

COMMENTS ON WORKING DRAFT NO. 2
OF EPA'S HIGH-LEVEL WASTE STANDARDS

General

1. There continues to be considerable controversy regarding the stringency of the U.S. Environmental Protection Agency's (EPA's) environmental standards for disposal of spent nuclear fuel, high-level radioactive wastes (HLW) and transuranic radioactive wastes (TRU).[1] This controversy results, at least in part, from concerns over the very low levels of risk which underlie release limits imposed by EPA's standards, particularly when compared to other federal health and safety standards. We are concerned that a clear understanding and acceptance of the standards will not be achieved until EPA has explicitly documented the acceptable risk level that underlies the release limits of the standards and the way in which the release limits were derived from that risk level. The Commission is concerned about this issue. So that the Commission might better understand the basis for the proposed standards and evaluate the stringency issue, we encourage EPA to clearly and concisely document the risk basis for its standards.

To the extent that we understand EPA's development thus far, it consisted of the following:

a) EPA determined that radiclogical impacts from disposal of HLW should be no greater than those experienced by individuals and populations today. EPA therefore surveyed the radiological impacts of natural background radiation exposure, nuclear weapons testing fallout, unmined uranium ore deposits, and nuclear power operations to provide benchmarks for evaluating the waste isolation capability of HLW repositories.

b) EPA described several hypothetical HLW repositories and conducted performance assessments to evaluate their waste isolation capabilities. EPA has asserted that these performance assessments demonstrate that repositories are able to restrict population impacts to less than 1,000 health effects over 10,000 years -- a level comparable to or less than the benchmarks surveyed in step a), above. Individual radiological impacts were found to be very low.

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[1] (*see* Remarks of Leo P. Duffy, Commission Briefing, December 20, 1989; Letter from Dade W. Moeller to Chairman Carr, December 21, 1989; First Report to the U.S. Congress and the U.S. Secretary of Energy from the Nuclear Waste Technical Review Board, March 1990, p. 31; Rethinking High-Level Radioactive Waste Disposal, National Research Council, July 1990.)

c) Because of the large uncertainties involved in calculations of radiation doses far into the future, EPA used a generic environmental model to translate its 1,000 health effects goal into a table of allowable limits for releases of radioactive materials to the environment. While these release limits might correspond to fewer than 1,000 health effects at an actual repository site, EPA's Science Advisory Board found this translation to be appropriate for a generic analysis. In EPA's view, any conservatism involved in developing the table of release limits is justified in light of the implementation difficulties that would be involved if the standards required long-term projections of population locations, sizes, and lifestyles.

d) In view of the long regulatory time period of interest and the sizeable uncertainties involved in projecting releases over that time period, EPA elected to use the term "reasonable expectation" to describe the level of confidence required for a demonstration of compliance with the standards. As EPA stated (50 FR 38071, September 19, 1985), "[t]his phrase reflects the fact that unequivocal numerical proof of compliance is neither necessary nor likely to be obtained."

2. Another reason for the concern over the excess stringency is the technical basis for the standards. We understand that EPA developed descriptions of several hypothetical repositories, and used relatively simple analyses to project the performance of those facilities. The release limits of the standards were then set so as to require actual repositories to perform approximately as well as EPA's hypothetical repositories. We are concerned that standards developed in this way may be overly stringent for the following reasons:

a) In setting the standards, EPA has stated its belief that real repository sites can be found that can be shown to perform as well as its hypothetical sites. But, experience to date in the HLW repository program reveals that real sites that have been investigated are much more complex than EPA's hypothetical sites, and projected performance is much less certain. EPA's release limits may be too restrictive to accommodate the uncertainties at these sites, or more generally, at any real site.

b) EPA's analyses of repository performance are very simplistic. EPA's models are not able to accurately simulate some of the phenomena potentially important for projecting repository performance, such as groundwater flow and contaminant transport in fractured, unsaturated media, and the effects of waste-generated heat on the geochemical, hydrologic, and mechanical properties of a repository. Again, EPA's release limits may be too restrictive to cumulatively. With this structure for the containment requirements, there would be no need to develop precise numerical probability estimates for very unlikely processes and events. The following text for 40 CFR 191.13 illustrates the concept recommended in the Commission's earlier comment:

191.13 Containment Requirements

(a) Disposal systems . . . shall be designed to provide a reasonable expectation that, for 10,000 years after disposal:

(1) anticipated performance will not cause cumulative releases of radionuclides to the accessible environment to have a likelihood greater than one change in 10 of exceeding the quantities calculated according to Table 1 (Appendix B); and

(2) the release resulting from any process, event, or sequence of processes and events that is sufficiently credible to warrant consideration will not exceed ten times the quantities calculated according to Table 1 (Appendix B).

The Commission would, of course, need to evaluate compliance by means of appropriate performance assessments. This would involve analyses that: (1) identify all processes and events that might affect the disposal system and are "sufficiently credible to warrant consideration," and (2) estimate the releases of radionuclides caused by those processes and events. For anticipated performance, a performance assessment would also (3) estimate the probability of likely processes and events, and (4) to the extent practicable, combine the release and probability estimates for likely processes and events into an overall probability distribution of cumulative release.

We strongly recommend that EPA reconsider adopting this concept for the containment requirements, because it would impose almost exactly the same level of safety on a repository, while avoiding the potential pitfalls of probability estimation for very unlikely and speculative events that could occur far in the future.

8. The NRC staff also notes that EPA continues to use the term "reasonable expectation" in the text of the containment requirements. In our previous "conforming amendments," we found that DOE and some other commenters perceived "reasonable expectation" to be a much less stringent standard than "reasonable assurance," as used in Part 60. A dialogue is needed between EPA and NRC staff to identify a single term to be used in both regulations.

Assurance Requirements

9. The NRC staff objects to the two new assurance requirements of Working draft No. 2, and would not recommend to the Commission that it add comparable provisions to its regulations as implied by the parenthetical statement of 40 CFR 191.14. The Commission's views on the impracticality of an "as low as reasonably achievable" (ALARA) requirements were discussed extensively in the Supplementary Information accompanying the technical criteria of 10 CFR Part 60 (48 FR 28194, 28198, June 21, 1983). There the Commission noted that the substantial uncertainties involved with predicting long-term repository performance, the already low EPA limits and the already stringent geologic performance requirements make it doubtful that the ALARA concept could be applied in a meaningful way.

10. The 100,000-year comparison of alternative sites seems superfluous given the previous identification for site characterization of the Yucca Mountain site and selection of the Waste Isolation Pilot Plant (WIPP) site. More importantly, calculations of repository performance over such long periods of time would involve such large uncertainties that they could have little value for judging repository safety. "Undisturbed performance," as defined in Working Draft No. 2, provides little useful information for selecting a preferred site from a slate of alternatives, and could even be counter-productive if it diverted attention away from potentially disruptive features of the sites. In any case, under the provisions of the Nuclear Waste Policy Act, as amended, repository site selection is the responsibility of the Department of Energy, not the Commission. For these reasons, the NRC staff would not propose addition of a comparable provision to the Commission's regulations.

11. The NRC staff also notes that the assurance requirement dealing with natural resources substitutes "ecologically vital" for the previous phrase "vital to the preservation of unique and sensitive ecosystems." Neither concept relates to the Atomic Energy Act policies underlying the standards. Instead, this appears to be a subject for evaluation in DOE's environmental impact statement (which Congress has directed the NRC to adopt to the extent possible) for a repository. The NRC staff would continue to view this as beyond the scope of 10 CFR Part 60 and would not propose that the Commission's regulations be changed.

Individual and Ground Water Protection Requirements

12. The NRC staff prefers those options (1.A and 2.A of EPA's Working Draft No. 2) that would combine the individual and ground water protection requirements into a single standard. Separate ground water protection standards would not provide any significant improvement in public health or environmental protection, but would add substantial complexity to the standards, with a resulting potential for increased difficulties in implementing the standards.

13. The NRC staff finds the definition of the term "man-made radionuclide" confusing since it clearly includes radionuclides that are not man-made. The staff is also puzzled by EPA's use of the term (to refer to concentrations of radioactive materials in ground water) since it does not follow the jurisdictional scheme of the Atomic energy Act. A better explanation of EPA's intent is needed. Alternatively, we note that the staff's preferred options for ground water protection (1.A and 2.A) would eliminate the separate ground water standards where this term is used.

14. The NRC staff objects to any EPA ground water protection requirement that would be applicable within the controlled area. As the staff interprets the language of Reorganization Plan No. 3, EPA's standard-setting authority is limited to releases to the general environment which, in this instance, would exclude activity retained within the controlled area.

15. The NRC staff recommends that EPA reexamine the reasonableness of the part of the individual protection requirement that specifies an assumption of continual ground water use at the boundary of the controlled area. The passive institutional controls permitted by the standards would seem to provide at least some protection against such uninterrupted ground water use. The effectiveness of such controls is in any event a matter of implementation committed to the independent judgment of the Commission.

Demonstration of Capability to Comply

16. The new 40 CFR 191.17, "Demonstration of Capability to Comply," clearly is not a "generally applicable environmental standard" within the meaning of Reorganization Plan No. 3 and therefore is outside EPA's jurisdiction. Two remedies are possible: (1) delete the entire section, or (2) add a statement that the section does not apply to facilities regulated by the Commission (analogous to 40 CFR 191.14).

Appendix C - Guidance for Implementation

17. We recommend that EPA reevaluate the technical base underlying the guidance on frequency and severity of intrusion. It is our understanding that EPA has, to date, limited its consideration to petroleum exploration. Exploration for non-petroleum resources may take much different forms. For example, multiple, closely spaced boreholes may be drilled, the frequency of drilling will be highly site-specific, and borehole sealing may be absent or ineffective. Guidance based on petroleum industry practice may not be representative of other exploratory drilling practices -- especially for borehole sealing.

18. This Appendix to the standards suggests use of "prevalent expert judgment" to select an appropriate analytical model to use for performance assessments. Of course, the Commission will consider expert judgment for all appropriate purposes, but it must arrive at its own conclusions taking into account the persuasiveness of the testimony, including the force of the underlying arguments, and not use expert judgment merely because it is "prevalent."