

1  
APR 12 1993

Ms. Margo T. Oge, Director  
Office of Radiation and Indoor Air  
U.S. Environmental Protection Agency  
Washington, D.C. 20460

Dear Ms. Oge:

Enclosed are U.S. Nuclear Regulatory Commission (NRC) comments on the February 10, 1993, U.S. Environmental Protection Agency (EPA) proposal to adopt certain environmental standards applicable to transuranic (TRU) and high-level radioactive waste (HLW) disposal facilities other than Yucca Mountain.

NRC notes, with regret, EPA's intent not to accept comments on those portions of its standards that were legislatively reinstated. As EPA is well aware, significant concerns have been raised within the technical community regarding the scientific basis for, and the appropriateness of, EPA's 1985 standards. Some of those concerns will be addressed in the National Academy of Sciences' (NAS) study of appropriate standards for the candidate HLW repository site at Yucca Mountain. When the NAS review has been completed, NRC believes it would be appropriate for EPA to review its non-Yucca-Mountain standards to determine whether additional amendments are warranted.

EPA solicits comments on the two specific questions shown below. NRC's views on these questions follow.

(1) Are there reasons for adopting a different regulatory time frame for the individual and ground-water protection requirements than the 10,000-year period of analysis associated with the containment requirements of 40 CFR 191.13?

In 1987, a Federal court found that EPA had provided an adequate explanation for the 10,000-year time limit for the containment requirements of the 1985 standards. At that time, EPA argued that a 10,000-year period was long enough to distinguish repositories with relatively good capabilities to isolate waste from those with relatively poor capabilities, and yet short enough so that major geologic changes were unlikely and repository performance might reasonably be projected. In our view, the same reasoning would apply for protection of individuals and of groundwater. While we see no obvious reason why different regulatory periods should be adopted for different parts of EPA's standards, the appropriateness of the 10,000-year period of analysis will likely be a major focus of the NAS review. Thus, EPA adoption of this time period in any generally applicable environmental standard may warrant reconsideration once the NAS review is completed.

(2) In subpart C, the Agency [EPA] proposes to prevent radioactive contamination of "underground sources of drinking water" beyond the limits found in 40 CFR part 141--the National Primary Drinking Water Regulations. The Agency is aware, however, that there could be some types of ground water that warrant additional protection either because

140035

9304140220 930412  
NMSS SUBJ  
406.3.3 CF

NHX/11  
406.3.3

they are of unusually high value or are more susceptible to contamination. Should the Agency adopt non-degradation requirements for especially valuable ground water? If so, what types of ground water warrant this extra level of protection?

EPA's current proposal is, in effect, a non-degradation requirement. EPA's maximum contaminant levels (MCLs) are so low that even very minor releases from an otherwise very good repository could cause groundwater concentrations to approach the MCLs. Any further restrictions on groundwater concentrations would be unnecessary for protection of public health, would likely prove unachievable for some disposal facilities, and should not be adopted by EPA. As a related matter, the NRC is concerned about EPA's proposal to establish a "moving target" for allowable contaminant levels in groundwater. Under EPA's proposal, design of a disposal facility would be very difficult since EPA could revise the environmental standards for the facility at any time for reasons that have nothing to do with waste disposal. We strongly urge EPA to establish a fixed environmental standard for contaminant levels in groundwater near a disposal facility.

Specific NRC comments regarding EPA's proposed rule of February 10th are enclosed. Initial comments on EPA's draft "Background Information Document" and "Economic Impact Analysis" are also enclosed. From the NRC staff's preliminary review, however, it appears that the "Background Information Document" employs a highly-simplified conceptual model. The analyses based on this model should not be viewed as a sound indication of whether EPA's release limits are achievable at any real repository site. Additional comments on these supporting documents may be submitted after the NRC staff has had an opportunity to thoroughly review them.

Sincerely, *RS*

Robert M. Bernero, Director  
Office of Nuclear Material Safety  
and Safeguards

Enclosure:  
Comments on 58 ER 7924,  
February 10, 1993

cc: (two copies)  
Docket No. R-89-01  
Air Docket, room M-1500 (LE-131)  
U.S. Environmental Protection Agency  
401 M Street, SW  
Washington, DC 20460

DISTRIBUTION

Central File                      BYoungblood, HLWM                      JJLinehan, HLWM                      HLHP r/f  
MVFederline, HLHP                      RLBallard, HLGE                      JHolonich, HLPD                      NMSS r/f  
NMSS Dir.Off.r/f

OFC	<i>HLHP</i>	<i>E</i>	<i>HLHP</i>	<i>HLHP</i>	<i>HLWM</i>	<i>HLWM</i>	<i>NMSS</i>
NAME	DJFehringer/cj	NEisenberg	MVFederline	JLinehan	BYoungblood	RBernero	
DATE	04/12/93	04/14/93	04/12/93	04/12/93	04/12/93	04/12/93	

C = COVER

E = COVER & ENCLOSURE

N = NO COPY

**NRC COMMENTS ON EPA'S PROPOSED  
INDIVIDUAL AND GROUNDWATER PROTECTION STANDARDS**

**GENERAL**

1. The Environmental Protection Agency's (EPA's) description of the legal basis for Nuclear Regulatory Commission (NRC) licensing authority (58 FR 7929) notes (NRC's) licensing role for Yucca Mountain under the Nuclear Waste Policy Act (NWPA), as amended. However, NRC's authority is broader than this and has a different genesis. The Energy Reorganization Act of 1974 (P.L. 93-438), which established NRC, is the fundamental authority for NRC licensing of facilities for storage (including disposal) of both defense- and commercially generated high-level wastes (HLW). Thus, NRC would have licensing authority for any repository for commercially generated HLW, including Yucca Mountain, that might be developed. In addition, NRC would have licensing authority for any defense-only HLW facility that might be pursued separate from the provisions of NWPA. Finally, the Low-Level Radioactive Waste Policy Amendments Act of 1985 (P.L. 99-240) authorized NRC licensing of disposal facilities for commercially-generated "greater-than-Class C" wastes, including any such wastes containing transuranic radionuclides. Thus, there exists a significant potential for NRC implementation of these proposed EPA standards, even though they do not apply to Yucca Mountain.

2. EPA proposes to define "radioactive material" as "...matter composed of or containing radionuclides, with radiological half-lives greater than 20 years, subject to the Atomic Energy Act of 1954, as amended." This proposed definition is contrary to common usage, since most people refer to all radioactive material as "radioactive material." More importantly, the qualifying terms seem to serve no purpose. EPA proposes to use "radioactive material" to define environmental standards for limiting individual doses and groundwater contamination. EPA's proposed criteria would apply to "disposal systems for waste and any associated radioactive material." However, the specific language proposed by EPA (sections 191.15 and 191.24) seems to refer to the impacts of all radionuclides, including those with short half-lives and those not subject to the Atomic Energy Act. NRC recommends that EPA delete this term altogether as it will only add confusion. If EPA is concerned about Greater-than-Class-C waste disposal then the standards should be specific to Greater-than Class-C waste, and not try to encompass a wide range of materials or waste.

3. Significant concerns have been raised within the technical community regarding the scientific basis for, and the appropriateness of, EPA's 1985 standards. Some of those concerns will be addressed in the National Academy of Sciences' (NAS) study of appropriate standards for the candidate HLW repository site at Yucca Mountain. When the NAS review has been completed, NRC believes it would be appropriate for EPA to review its non-Yucca-Mountain standards to determine whether additional amendments would be appropriate.

### 10,000-Year Time Limit

4. EPA proposes to adopt a 10,000-year time period for application of the individual and groundwater protection standards, and solicits comment on whether there are reasons for adopting a different time period. In 1987, a Federal court found that EPA had provided an adequate explanation for the 10,000-year time limit for the containment requirements of the 1985 standards. At that time, EPA argued that a 10,000-year period was long enough to distinguish repositories with relatively good capabilities to isolate waste from those with relatively poor capabilities, and yet short enough so that major geologic changes were unlikely and repository performance might reasonably be projected. In our view, the same reasoning would apply for protection of individuals and of groundwater, and there would be no obvious reason why different regulatory periods should be adopted for different parts of EPA's standards.

While we see no obvious reason why different regulatory periods should be adopted for different parts of EPA's standards, the appropriateness of the 10,000-year period of analysis will likely be a major focus of the NAS review. Thus, EPA adoption of this time period in any generally applicable environmental standard may warrant reconsideration once the NAS review is completed.

### Individual Dose Limits

5. In 1985, EPA established individual protection requirements of 0.25 mSv/yr (25 mrem/yr) for the whole body or 0.75 mSv/yr (75 mrem/yr) for other organs. At that time, EPA did not provide a convincing basis of support for those dose limits. In 1985, EPA equated its dose limits to a lifetime risk of  $5E-4$ . However, EPA did not argue that  $5E-4$  was the maximum level of risk that could be considered acceptable, nor did EPA demonstrate that its dose limits were reasonably achievable. In addition, EPA never proposed its individual protection requirements for public comment. (EPA's 1982 proposed standards solicited comment on whether individual doses should be regulated, but did not propose specific dose limits.) Because of the sketchy history of the dose limits in EPA's 1985 standards, it is inappropriate for EPA now to defend its current proposal on the basis of "consistency" with those dose limits. Instead, EPA should defend the current proposal on its own merits. Specifically, EPA should identify the maximum individual dose rate that EPA would consider acceptable for future exposures of individuals (e.g., that suggested in the following comment).

6. The International Commission on Radiological Protection (ICRP) has recommended radiation protection standards for radioactive waste disposal in its Publication No. 46. The ICRP recommends that no individual in the future should be exposed to more than 1 mSv/yr (100 mrem/yr) attributable to non-medical man-made radiation sources (or an equivalent level of risk if exposures are unlikely), and that each source of potential exposure should be allocated a portion of the overall limit. (The basis for the ICRP recommendation is comparison with risks now accepted by society.) The fundamental idea is to restrict each potential source of long-term exposure (e.g., a HLW repository) so that the total dose rate from all sources is

unlikely to exceed the recommended limits of the ICRP. EPA should do two things: a) endorse the overall dose limit of 1 mSv/yr (100 mrem/yr) recommended by the ICRP, or explain why EPA prefers a different limit, and b) explain how EPA's proposed HLW and TRU standards are derived from an overall dose (or risk) limit for all sources of future human radiation exposures.

7. EPA's proposed individual protection standards would restrict potential doses to "any member of the public." This seems to mean the most highly exposed member of the public. In contrast, the ICRP has recommended that dose limits should be applied to the average dose within a "critical group" of the most highly exposed members of the public. The Federal Register notice does not provide the reasons for EPA's rejection of the ICRP's critical group concept. EPA should clearly describe its reasons for restricting doses to the maximally-exposed individual rather than the average dose within a critical group.

8. EPA states (page 7929) that use of groundwater within the controlled area need not be considered when evaluating compliance with the individual protection requirements. EPA reasons that the geologic media within the controlled area are an integral part of the disposal system. NRC agrees with this view, but is concerned that the wording of EPA's standards might permit other interpretations. Specifically, if withdrawal of groundwater from within the controlled area does not "disrupt" the disposal system, such withdrawal might be considered to be part of "undisturbed performance." To ensure that there is no ambiguity about this point, the existing (1985) definition of the term "undisturbed performance" should be altered to read:

"Undisturbed performance" means the predicted behavior of a disposal system, including consideration of the uncertainties in predicted behavior, assuming no withdrawal of groundwater from within the controlled area, and assuming if the disposal system is not disrupted by human intrusion or the occurrence of unlikely natural events.

Note also that the word "unlikely" should be deleted from this definition. EPA's existing definition of "undisturbed performance" is confusing because it includes disturbed performance to the extent that natural disruptions are likely to occur. Alternatively, if EPA wishes to apply the individual protection requirements to performance following likely disruptions, the term "undisturbed performance" could be replaced with "anticipated performance" or some similar term.

9. In sections 191.15(c) and 191.24(b), it would be helpful to substitute "performance assessment" for "compliance assessment." The term "compliance assessment" is sometimes used to refer to a licensing agency's determination that an applicant's performance assessment is an adequate demonstration of compliance with a regulatory requirement.

#### Groundwater Protection Standards

10. EPA proposes to require a disposal facility to comply with the provisions of whatever EPA drinking water standards are in effect at the time

when compliance is demonstrated. This constitutes a "moving target" that will make it difficult to design a disposal facility. It is also impossible to evaluate the stringency of the proposed standards or the technical or economic practicality of achieving compliance with them. Instead of a "moving target," EPA should determine the level of groundwater protection appropriate for HLW and TRU disposal, and should codify that level of protection in these standards.

11. EPA proposes to require that groundwater adjacent to a TRU or HLW disposal facility be protected to the maximum contaminant levels (MCLs) developed by EPA under the Safe Drinking Water Act (SDWA). In our October 16, 1992, comments on EPA's proposed drinking water standards, we stated:

EPA should evaluate the indirect impact of the proposed MCLs. There are other activities, such as environmental restoration, to which the MCLs will be applied as default values for groundwater and surface water protection. EPA has consistently adopted MCLs as groundwater protection criteria for high-level waste management and uranium mill tailings (and draft standards for low-level waste disposal) because the MCLs are established to protect humans in accordance with the Safe Drinking Water Act. Minimal justification has been provided by EPA in these individual rulemakings to adopt the MCLs as relevant criteria other than the fact that they have already been established as MCLs in 40 CFR Part 141. These criteria include the MCLs for radium, gross alpha, and uranium, as well as the 4 mrem/year dose standard for beta and gamma emitters. Although the \$/rem impact for the proposed standards is acceptable to EPA for municipal treatment, since EPA has chosen to rely on the drinking water standards as sufficient justification for adopting these MCLs in other contexts, EPA is obligated to consider the potential impacts associated with establishing or changing the MCLs in 40 CFR Part 141. In addition, this analysis should consider potential impacts on other activities to which the MCLs will likely be applied as relevant and appropriate criteria (e.g., for site cleanups under CERCLA), in the absence of alternative health-based criteria.

EPA's current proposal is a continuation of EPA's practice of using the MCLs without appropriate justification.

12. EPA proposes to require that radionuclide levels in offsite underground sources of drinking water not exceed such MCLs as EPA might determine to be appropriate. EPA's past derivation of MCLs has been based on consideration of the technical capabilities of water treatment plants and of the cost-effectiveness of various types of water treatment. Specifically, EPA's MCLs have been derived to apply to public water supplies after treatment in a water treatment plant. EPA now proposes to apply the same MCL levels to groundwater supplies before treatment. In other words, EPA proposes to obviate use of the very water treatment technologies EPA has previously found to be technically practical and cost-effective. Not only is this use of the MCL levels incompatible with their derivation, it is inconsistent with the concept of "endangerment," as used in the SDWA. EPA notes (page 7930) that:

"Endangerment" occurs if an underground injection "may result in the

presence [in] underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons."

Setting aside the question of whether repository disposal constitutes underground injection, "endangerment" would seem to occur only if contaminant levels in groundwater are high enough so that treatment by a public water system cannot reduce those levels to MCLs.

The NRC does not object to use of MCLs as general goals for groundwater protection. However, EPA should further consider the potential costs associated with a rigid regulatory requirement for prevention of contamination above MCLs. In some cases, the technical or economic practicality of water treatment may be much more favorable than the practicality of prevention of groundwater contamination that only moderately exceeds EPA's MCLs. As EPA notes (page 7933), the technology for treating groundwater with high levels of "total dissolved solids" (i.e., salts) is advancing. The same technology would presumably be effective in removing dissolved radionuclides from groundwater. EPA should not require the expenditure of billions of dollars to prevent potential contamination of groundwater that would require treatment prior to use anyway. Instead, EPA's standards should permit a decision to spend much smaller sums for water treatment in the event that such contamination should occur.

13. EPA's proposed rule implies that the MCLs have already been implemented in standards to protect groundwater for uranium mill tailings sites and hazardous waste disposal facilities. However, there are flexibilities associated with MCL compliance in other programs that EPA has not provided for in the TRU and HLW standards. Specifically, in the hazardous waste and uranium mill tailings disposal program, EPA has provided flexibility in meeting MCLs through the use of alternate concentration limits (ACLs) (cf. 40 CFR 264.94). ACLs may be applied in situations when compliance with MCLs is not feasible, provided that the environment is sufficiently protected and other conditions are met. Additionally, in accordance with SDWA sections 1415(a)(1)(A) and 1416(a), respectively, EPA or a State may grant a variance or issue an exemption to a public water system from any MCL requirement. EPA concluded in each of these programs that such flexibility was necessary and appropriate. To the extent allowed by the legal authority under which EPA is proposing these standards, EPA should provide comparable flexibility in implementing drinking water MCLs in the TRU and HLW standards or justify why it is not necessary for TRU and HLW disposal facilities.

14. In the "Supplementary Information" (page 7932), EPA references its groundwater protection strategy and indicates that the strategy recommends use of MCLs as "reference points" for protection of water resources that are potential sources of drinking water. EPA should explain why it has proposed to apply MCLs in these standards as absolute limits rather than more flexible reference points.

15. EPA's proposed groundwater protection standards restrict the combined

concentrations of natural and man-made radionuclides from all sources. Thus, a site with natural radionuclide concentrations exceeding EPA's MCL levels could not be used for waste disposal (unless groundwater cleanup were practical). This is a substantial departure from EPA's 1985 standards, which restricted the incremental increase in groundwater concentrations caused by a disposal facility. Arguably, rather than risking contamination of pristine aquifers, EPA should encourage siting waste disposal facilities at locations where groundwater is already unsuitable for consumption without treatment. EPA provides no explanation for the change from the 1985 standards, nor does EPA even identify the change in the Federal Register notice. EPA should allow an incremental increase, above natural levels, unless EPA can demonstrate that doing so would unacceptably endanger the health of the public.

16. The proposed standards require (section 191.23(b)) that the analytical methods in 40 CFR Part 141 be used "...to determine the levels for comparison with the limits in 40 CFR part 141." This requirement is inappropriate, since compliance with Subpart C (the groundwater protection criteria) must be demonstrated before a facility is placed in operation. A determination of compliance with Subpart C is to be made before a disposal facility is operated, not after wastes have been emplaced. To the extent that Part 191 is being proposed under Atomic Energy Act authority, specification of use of particular analytical methods is also inappropriate since such specification does not constitute a "generally applicable environmental standard."

#### Appendix B

17. Appendix B appears to be based on ICRP Publication 60. This is inconsistent with current Federal guidance and the consensus developed in a Federal Interagency Working Group. The consensus of that group (chaired by EPA) is that the incremental benefit associated with adoption of ICRP 60 methodology is not sufficient to justify the associated cost and regulatory burden. Thus, EPA's proposed Appendix B should be rewritten, based on ICRP-26 methodology, to be consistent with current Federal guidance and the practices of other Federal agencies.

18. The symbols used in the equations of the proposed Appendix B ("Calculation of Annual Committed Effective Dose") cause confusion. In the second equation, " $H_T$ " is used to denote the equivalent dose in tissue T. Then, in the third equation, the same symbol is used for both the integrated 50-year equivalent dose and the equivalent dose rate. The right-hand side of the third equation should use a symbol that clearly indicates the dose rate (i.e., the derivative of  $H_T$  with respect to time).

#### Background Information Document (BID)

19. EPA's proposed standards would restrict radionuclide concentrations in groundwater and potential doses to individuals outside a "controlled area" that is allowed to extend up to five kilometers from a disposal facility. The analyses of EPA's draft BID evaluate potential concentrations and doses at a 2-kilometer distance, rather than the full 5-kilometer distance allowed by EPA's standards. In EPA's analyses, an individual is assumed to withdraw groundwater for drinking at a distance of 2-kilometers from a deep geologic

repository containing transuranic wastes. In general, EPA's analyses show that no impacts occur, even at the 2-kilometer location, until about 50,000 years after disposal. Then, doses to the individual are estimated to range from several tens of millirem/year to several rem/year, and to remain relatively constant until the end of EPA's analyses at 100,000 years after disposal. Had EPA estimated impacts at the 5-kilometer boundary of the controlled area, rather than at a 2-kilometer distance, few releases would have occurred within 100,000 years and estimated doses would have been reduced by radioactive decay and dispersion during transport through the controlled area. Thus, it would be inappropriate to interpret the results of EPA's analyses as a demonstration that a 10,000-year regulatory period is inadequate and as a rationale for extending the regulatory period for longer times.

20. EPA uses essentially the same conceptual model for all four hypothetical repositories considered in its BID. Using the NEFTRAN-S code, EPA uses a single "pipe" to simulate transport of radionuclides from a repository to an overlying or underlying aquifer, and then uses a second "pipe" to simulate transport to a groundwater well located 2 kilometers away. The coarseness of this model precludes simulation of fractures, failures of borehole or shaft seals, or other inhomogeneities in the geologic media. NEFTRAN-S may not be adequate for such purposes anyway, and a computer program implementing mathematical models of the appropriate processes would have to be used. Thus, EPA is unable to determine whether relatively rapid transport of small amounts of waste might occur, leading to potential violations of the proposed individual and groundwater protection standards.

21. Some of EPA's simplifying assumptions may be causing EPA to be underestimating doses. For example, Table 7.5-15 postulates an aquifer thickness of 2400 meters at a tuff site. Even if the physical thickness of an aquifer were this great, the effective thickness within which radionuclides would be mixed and transported would be much less. Thus, EPA may have overestimated dilution of releases (and underestimated doses) by 1 to 2 orders of magnitude.

22. EPA uses retardation factors originally developed for the National Academy of Sciences' 1983 Waste Isolation Systems Panel's HLW report. The waste form for EPA's current analyses is transuranic waste, which includes organic trash, chelating agents, etc. EPA should explain why it thinks the retardation factors developed for HLW would be appropriate for transuranic wastes with much different chemical characteristics.

23. The reinstated criteria of 40 CFR Part 191 define "undisturbed performance" as "...the predicted behavior...if the disposal system is not disrupted by human intrusion or the occurrence of unlikely natural events." As noted in comment 8, use of the term "undisturbed performance" is confusing because it includes disturbed performance to the extent that natural disruptions are likely to occur. Comment 8 recommends that EPA drop the word "unlikely" from the definition of undisturbed performance. However, if EPA retains the current wording, EPA should demonstrate that the limits of its standards are achievable for likely disturbances. EPA's draft BID makes no attempt to even identify likely disturbances, let alone estimate their effects on repository performance. If EPA is to provide a convincing demonstration

that its proposed standards are technically achievable, EPA needs to identify likely disruptions and to evaluate the effects of those disruptions on the performance of disposal facilities.

24. Section 7.6.2 of EPA's BID seems to endorse use of elicited expert judgment in a performance assessment for demonstration of compliance with the proposed standards. While we recognize that use of expert judgment will be a necessary part of any demonstration of compliance with these standards, NRC staff believe that it is inappropriate to substitute judgment for data unless data are not reasonably obtainable.

Reliance on expert judgment is a matter of implementation of the standards. It would be more appropriate for EPA to offer its views regarding reliance on elicited judgments in conjunction with development of EPA's compliance criteria for WIPP rather than as part of these generally applicable environmental standards.

25. As noted in our cover letter, additional comments may be provided to EPA after the NRC staff has had an opportunity to thoroughly review the BID.