POLICY ISSUE

(NEGATIVE CONSENT)

September 20, 1991

SECY-91-299

For: The Commissioners

From: James M. Taylor
Executive Director
for Operations

Subject: REVISED COMMENTS ON WORKING DRAFT NO. 3 OF EPA'S HIGH-LEVEL WASTE STANDARDS

Purpose: To request Commission approval to transmit comments to the U.S. Environmental Protection Agency (EPA) on Working Draft No. 3 of EPA's environmental standards for high-level radioactive waste (HLW).

Background: SECY-91-218, dated July 22, 1991, proposed to transmit to EPA comments on Working Draft No. 3 of EPA's HLW standards. Included in the staff's proposed comments were the separate views of the staff and of the Advisory Committee on Nuclear Waste (ACNW) regarding six questions raised by EPA. Commissioner Remick observed that sending two sets of comments could give a mixed signal of the NRC's views. In response, SECY-91-266, dated August 20, 1991, informed the Commission of the staff's intent to meet with the ACNW to develop a single set of answers to EPA's questions.

Discussion: On August 29, 1991, the staff and ACNW reached agreement on a single set of answers to EPA's questions, as indicated in the enclosure to this paper. The staff has also revised comment 1 of SECY-91-218 to recommend that EPA consider a dose-based alternative standard for unique release pathways, and has revised comment 5 to encourage EPA

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to distinguish between the estimated frequencies of release scenarios and the level of confidence with which the sizes of releases and frequencies of release scenarios are to be estimated. All other comments remain unchanged from SECY-91-218.

Recommendation: The staff will send the enclosed comments to EPA 10 working days after the date of this paper, unless directed otherwise by the Commission.

Coordination: The Office of the General Counsel has reviewed this paper and has no legal objection.

James M. Taylor
Executive Director
for Operations

Enclosure:
NRC comments on Working
Draft 3 of EPA's standards

SECY NOTE: In the absence of instructions to the contrary, SECY will notify the staff on Friday, October 4, 1991, that the Commission, by negative consent, assents to the action proposed in this paper.

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Thank you for the opportunity to review and comment on Working Draft 3. We look forward to working closely with EPA during reissuance of your standards.

Sincerely,

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

Enclosure:
NRC Comments on Working Draft 3
of EPA's HLW Standards

NUCLEAR REGULATORY COMMISSION COMMENTS ON WORKING DRAFT 3 OF ENVIRONMENTAL PROTECTION AGENCY'S HIGH-LEVEL WASTE STANDARDS

1. In the Nuclear Regulatory Commission (NRC) staff's comments on Working Draft 2, concerns were raised about the fundamental basis underlying the containment requirements of the U.S. Environmental Protection Agency's (EPA's) high-level radioactive waste (HLW) standards. Those comments recommended that EPA reexamine the stringency of the standards in light of other risks experienced by society and the risk levels used as the basis for other safety standards, particularly those for the uranium fuel cycle. EPA's analyses of hypothetical repository performance would then play a less prominent role in supporting the standards. The NRC staff wishes to elaborate on its earlier comment regarding the technical achievability basis underlying EPA's containment requirements.

First, it is the staff's view that EPA's analyses of hypothetical repository performance, as documented in EPA's 1985 "Background Information Document" (EPA 520/1-85-023), provide only a limited basis for judging the waste-isolation capabilities of geologic repositories. Of particular concern is the incompleteness of EPA's analyses. Table 8.9.1 of the 1985 document indicates that only four disruptive events were evaluated by EPA -- fault movement, brecciation, drilling for petroleum, and volcanism. Many other disruptive processes and events could contribute to releases, including development of pluvial conditions, other climate modification such as the "greenhouse effect," gaseous release of carbon-14, elevation of the water table at an unsaturated site, and exploratory drilling for non-petroleum minerals. The incompleteness of EPA's analyses may have caused EPA to underestimate the level of releases likely to occur and, in turn, to set release limits for the standards that might not be achievable at a real repository site.

The NRC staff is also concerned that EPA did not evaluate the full range of disposal technologies under consideration for disposal of high-level and transuranic wastes. In deriving its release limits, EPA evaluated a single disposal technology -- a repository for spent fuel located in the saturated zone of a geologically quiescent site. Every disposal concept currently being considered in the U.S. differs in a substantive way from the assumptions used by EPA. For example, a repository at Yucca Mountain would be located in the unsaturated zone where gaseous releases of carbon-14 might be larger than projected by EPA. EPA has not demonstrated that such releases would pose an unacceptable threat to public health or the environment, yet EPA's standards might require costly remedial measures to control those releases. Similarly, the waste forms and packaging destined for the Waste Isolation Pilot Plant are much different from those assumed for a spent fuel repository. Additional processing of those wastes might be needed to meet EPA's release limits, even though no threat to public health or the environment has been demonstrated. Finally, various "greater confinement" and near-surface disposal concepts have been explored for disposal of transuranic and Hanford tank wastes. EPA has not evaluated the performance capabilities of these disposal technologies, yet EPA proposes that such facilities meet the same release limits as a deep geologic repository. If EPA is unable to demonstrate that such a stringent level of performance is necessary to protect public health or the environment, EPA might

arbitrarily eliminate from consideration alternative disposal methods capable of providing an acceptable degree of waste isolation.

The NRC staff is concerned about EPA's ability to develop a defensible basis of support for its cumulative release standards using technical achievability considerations. The wide range of potential technologies and the lack of development of many of them raise questions about EPA's approach. Current concerns over the release limits for carbon-14 show that standards derived from the projected performance of a particular type of disposal facility may not be appropriate for the unique release pathways associated with other types of facilities. An alternative standard, expressed in terms of radiation dose and derived from comparisons with the risk levels of other accepted standards and activities, would help to ensure that EPA's standards could be reasonably applied to different types of disposal facilities. For this reason, the NRC staff urges EPA to derive its standards from an evaluation of the acceptability of various risk levels, including those previously determined to be acceptable for uranium fuel cycle facilities, and to consider adding a dose-based alternative to the cumulative release limits of the standards.

2. There appears to be an editing error on page 45 of the draft Supplementary Information, where EPA states that assessments of compliance with the individual-protection requirements "must assume that individuals consume all of their drinking water (2 liters per day) from any portion of an underground source of drinking water outside of the 'controlled area' surrounding the disposal system." EPA has deleted this provision from Working Draft 3, as we recommended in our comments on Working Draft 2.

3. In the NRC staff's comments on Working Draft 2, we recommended that EPA reevaluate the technical base underlying the guidance on frequency and severity of potential human intrusion. There we noted that EPA has apparently based its guidance on data from petroleum exploration. Exploration for non-petroleum resources may take much different forms, including multiple, closely spaced boreholes with highly site-specific drilling frequencies and borehole sealing practices. We continue to urge EPA to reexamine the basis for its guidance, including the credit, if any, given by EPA for deterrence of potential intrusion by passive institutional controls.

4. The NRC staff appreciates EPA's solicitation of comment on the staff's suggested alternative wording for the probabilistic containment requirements. We note, however, that our suggestion included a qualitative, rather than a numerical, definition of the boundary between "unlikely" and "very unlikely" release categories. If comments on the staff's basic concept are supportive, the staff urges EPA to reconsider the wisdom of a numerical classification of releases of such low likelihood.

5. EPA's probabilistic containment requirements refer to the "likelihood" of releases from a repository. Two extremes of interpretation of "likelihood" are possible, neither of which seems to be that intended by EPA. To some observers, the only permissible way to estimate the likelihood of a release is to extrapolate from the past frequencies of occurrence of the processes and events contributing to a release. In this interpretation, "likelihood" implies a degree of scientific rigor that may be unattainable because the data

base for previous occurrences may be sparse or nonexistent. On the other hand, the Bayesian school of probability theory would interpret "likelihood" as a "degree of belief" on the part of an analyst or decision-maker. In this school of thought, the degree of belief may be established independent of any scientific basis. Neither interpretation seems to be that intended by EPA.

Compounding potential implementation difficulties is a tendency to use the term "probability" or "likelihood" to refer to a combination of (1) the projected probability of a scenario leading to a release, (2) uncertainties in the estimate of that probability, and (3) uncertainties in the estimate of the size of the release. When all three of these uncertainties are combined into a single CCDF, it is possible to interpret EPA's standards as requiring a 90% level of confidence that releases will not exceed the values of Table 1, and a 99.9% level of confidence that releases will not exceed ten times the values of the table. However, it is our understanding that EPA's containment requirements are intended to refer only to the projected probability of release.

In order to more clearly express EPA's intent, we recommend that EPA distinguish between the projected probabilities of releases and the uncertainties in those projections. This distinction could be made by adding the following definition to EPA's standards:

> "Likelihood" means the probability of a scenario leading to a release of a particular size as projected from (1) the existing state of scientific knowledge regarding the frequencies of previous occurrences of the processes and events that could cause the release, and (2) for processes and events that have not previously occurred, the existing state of scientific knowledge regarding the frequency with which such processes and events are expected to occur in the future. "Likelihood" does not refer to uncertainties in projections of probabilities and sizes of releases or to the level of confidence with which the probability of a release must be projected.

6. The draft Supplementary Information accompanying Working Draft 3 includes six questions on which public comment would be solicited by EPA. The NRC's views, including those of the Advisory Committee on Nuclear Waste, on these questions are discussed below.

Question 1: 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 [effective dose equivalent] limit and a 10 millirems/year ede limit. Which is the more appropriate choice and why?

NRC View: The International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP) recommend an overall dose limit of 100 millirem/year averaged over the lifetime of an individual. This limit applies to the total radiation exposure received from all sources and practices excluding medical and natural sources. Exposures of short duration are permitted to be larger, provided that the lifetime average remains within the recommended limit. Because post-closure radionuclide releases from a high-level waste repository, if they occur, could continue for

a number of years, EPA's dose limits should be apportioned from the 100 millirem/year recommended limit.

Limits for specific sources of exposure, such as a repository, are to be apportioned in a way that ensures that combined doses from all sources will not exceed 100 millirem/year. For EPA's HLW standards, the proper apportionment must take into account the range of facilities to which the dose limits would be applied. EPA proposes to apply the dose limit of Section 191.03 to the combined doses from HLW facilities and all other uranium fuel cycle facilities. Since the uranium fuel cycle includes several potential sources of exposure, it seems reasonable to allow a relatively large fraction of the overall dose limit for these facilities. Absent a clear demonstration by EPA that the 10 millirem/year limit is necessary to protect public health and safety, 25 millirem/year would be the more appropriate dose limit for the combined doses addressed by Section 191.03.

The proposed dose limit of Section 191.14 would apply only to the projected post-closure performance of a repository -- not to the combined doses from a repository and other sources. For this section, a dose limit of 10 millirem/year would allow an ample margin so that other future sources of radiation exposure would not cause total doses to exceed the limits recommended by ICRP and NCRP.

We also note that sections 191.03 and 191.14 both impose limits on the radiation dose "to any member of the public." Consistent with the recommendations of ICRP and NCRP, EPA should revise these sections to limit the average dose within the "critical group" of individuals expected to receive the largest doses.

Question 2: 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 timeframe. Are such evaluations likely to provide useful information in any future selecting of preferred disposal sites?

NRC View: We recognize that specification of the 10,000-year time limit is somewhat arbitrary. It is important that geologic or climatic changes not occur in the near-term period following the 10,000-year limit if such changes could cause significant releases of radioactive material. The siting criteria and performance objectives of 10 CFR Part 60 are intended to reduce the potential for, and the consequences of, such disruptive changes. Thus, the NRC is sympathetic to EPA's concerns about repository performance in the post-10,000 year period. However, EPA's HLW standards are being promulgated under Atomic Energy Act authority. Accordingly, they should be "generally applicable environmental standards" as defined in Reorganization Plan No. 3 of 1970, that is, "limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the general environment . . . ." Therefore, we do not believe that a requirement for comparison of alternative sites is an appropriate subject for EPA to address in these standards. Any long-term comparison of candidate sites should be part of a broader evaluation of alternatives under the provisions of the National Environmental Policy Act.

If EPA is concerned that the post-10,000 year performance of a repository could cause significant releases of radioactive material to the environment, an environmental standard, rather than an "assurance requirement," should be considered. Such an environmental standard would provide a basis for judging the acceptability of a single proposed repository site, rather than comparing the merits of alternative sites. However, the large uncertainties in projections of post-10,000 year performance raise questions about the practicality of such a standard. Because 10 CFR Part 60 already contains siting criteria and performance objectives that reduce the potential for significant post-10,000 year releases, NRC recommends that EPA limit application of its standards to 10,000 years.

Question 3: Two options are presented in Sections 191.14 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 timeframe and why?

NRC View: EPA states that "our own analyses show that either time frame is achievable." However, we are not aware that EPA has ever published those analyses or subjected them to independent review. NRC urges EPA to make available the analyses that support EPA's views on achievability of the individual and groundwater protection requirements.

More importantly, EPA has not demonstrated that either time period is appropriate for protection of public health or the environment. Other regulatory criteria, including those for disposal of radioactive and non-radioactive hazardous wastes, generally provide protection for shorter periods of time. EPA should explain the basis for believing that a longer period of protection is needed for disposal of high-level radioactive wastes.

Question 4: In Subpart C the Agency [EPA] proposes to prevent degradation of "underground sources of drinking water" 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 of 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?

NRC View: The NRC opposes adoption of a no-degradation requirement for special sources of groundwater. EPA's previous attempt to apply graduated levels of protection to groundwaters of different characteristics caused an unnecessary level of complexity in the standards. The simplicity and improved clarity of the groundwater protection requirements of Working Draft 3 represent a significant improvement over earlier drafts. The NRC strongly recommends that EPA not regress to the multiple groundwater classifications and protection levels of earlier drafts, especially in light of the extremely stringent protection levels imposed by the groundwater protection requirements of Working Draft 3.

We believe it is important to recognize that the dose rate from underground sources of drinking water, even if contaminated to the limits specified in the National Primary Drinking Water Regulations, would still contribute only a small fraction (4 percent) of the current long-term dose rate limit (100 millirem/year) for members of the public. Even if EPA adopts a 10 millirem/year individual protection standard for an HLW repository, groundwater complying with the Drinking Water Regulations would contribute no more than 40 percent of the dose rate limit. In this sense, application of the Drinking Water Regulations to a repository represents additional stringency, especially because the primary pathway for public exposures from undisturbed performance of such facilities is through drinking water.

As EPA is aware, long-term projections of the performance of an HLW repository will contain significant uncertainties. These uncertainties might make it impossible to demonstrate compliance with a no-degradation requirement, even for a relatively good site. Thus, a no-degradation requirement could become a de facto criterion for eliminating certain candidate repository sites. Instead, evaluation of the resource value of groundwaters present at a potential site should be made within the context of the National Environmental Policy Act evaluation of alternatives, rather than application of EPA's HLW standards.

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?

NRC View: As discussed in Comment No. 1 above, the release limits to which these notes apply were derived from EPA's analyses of the waste-isolation capabilities of a deep geologic repository for spent nuclear fuel. EPA's fundamental premise is that the fractional releases permitted from a transuranic waste disposal facility must be no greater than those thought to be achievable by a spent fuel repository. However, EPA has not demonstrated that either option is appropriate for protection of public health or the environment. As noted in Comment No. 1, the NRC strongly urges EPA to derive its standards from an evaluation of the acceptability of various risk levels, including those previously determined to be acceptable for uranium fuel cycle facilities. This derivation would include a determination by EPA of the appropriate transuranic waste unit to use for application of the release limits.

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.

NRC View: Two reports that may be helpful are:

1. W.B. Light, et al., "C-14 Release and Transport from a Nuclear Waste Repository in an Unsaturated Medium," Lawrence Berkeley Laboratory, Report LBL-28923 (June 1990).

2. W.B. Light, et al., "Transport of Gaseous C-14 from a Repository in Unsaturated Rock," Lawrence Berkeley Laboratory, Report LBL-29744 (September 1990).

The "C-14 issue" illustrates the reason for the NRC staff's concern about the technical achievability basis underlying EPA's standards. When EPA originally derived its release limits, gaseous releases of C-14 were not foreseen. Now, it appears that the C-14 release limit of EPA's standards might not be achievable at reasonable cost even though EPA has not shown that exceeding the limit would pose a significant threat to public health or the environment. It is possible that other release modes remain to be discovered which will again require reevaluation of EPA's release limits. Standards based on comparisons with other risks and safety standards, rather than on technical achievability, would not be vulnerable to such surprises in the future.

At the September, 1990 symposium hosted by the National Research Council's Board on Radioactive Waste Management, R. Guimond of EPA suggested that an individual dose rate criterion might be considered as an alternative to the cumulative release limits of EPA's containment requirements. Such an alternative appears to be particularly appropriate for C-14. The individual dose rate limit would protect against very rapid or highly concentrated releases, while allowing a degree of flexibility in the event that the cumulative release limits could not be achieved at reasonable cost. The NRC strongly urges EPA to further develop the concept suggested by Mr. Guimond, and to solicit public comment on its merits.

7. In the NRC staff's view, there are several additional questions that EPA should ask, to solicit public comment on the standards:

-Is the technical achievability basis underlying the "containment requirements" an appropriate way to derive the standards, or should EPA base the standards on comparisons with other risks and radiation-protection standards, including those for the uranium fuel cycle?

-Is the two-step, probabilistic formulation of the "containment requirements" necessary, or would it be more appropriate to simply require that no credible release of radioactive material exceed the limits of Table 1?

-NRC's Advisory Committee on Nuclear Waste has suggested that the "containment requirements" be limited to releases caused by natural processes and events, and that separate standards be established to limit the potential for releases due to human intrusion. Would such standards be feasible and, if so, how should they be formulated?

-Are separate individual and ground water protection requirements necessary, or should they be combined into a single individual protection requirement?

-The ground water protection requirements of these standards delete a feature of the 1985 standards that allowed an incremental increase in radionuclide concentrations in ground waters that exceed EPA's drinking water standards before repository construction. The effect of this deletion may be to eliminate from consideration any candidate sites with high natural radionuclide concentrations. Should the incremental increase provision of the 1985 standards be restored?

-EPA's drinking-water standards were derived from evaluations of the water-treatment capabilities of public water-supply facilities. Does this provide a reasonable basis for evaluating the waste-isolation capabilities of waste management facilities? Should EPA require compliance with potential changes in the drinking-water regulations without first evaluating the achievability of the new regulations at waste-management facilities?

-EPA proposes to impose its individual protection and ground water protection requirements only for "undisturbed performance." Recognizing that some disturbances might be quite likely to occur, at least for certain repositories, would "anticipated performance" be a more appropriate set of conditions for these sections of the standards?