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**Department of Energy** Washington, DC 20585

R. Browning

August 2, 1990

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

Dear Mr. Guimond:

This is to provide you with the Department of Energy's (DOE) comments on Working Draft 2 of 40 CFR Part 191, Environmental Radiation Protection Standards for Management and Disposal of Spent Fuel, High-Level and Transuranic Radioactive Waste. This draft was placed in your rulemaking docket on January 31, 1990, for information purposes, as part of your efforts to revise 40 CFR Part 191 in response to a remand by the U.S. Court of Appeals for the First Circuit. We hope that you will find the information and preliminary views expressed in our comments useful in developing a proposed rule.

Since the Environmental Protection Agency (EPA) completed its scoping calculations on a set of hypothetical high-level waste repositories as a basis for the standard, much additional information has been developed. For example, specific compliance calculations have proven much more difficult to complete than expected, and the uncertainties in all the models and data sets used in the calculations are much larger than expected. The human intrusion scenarios required by the standard dominate compliance analyses and make all geologic formations look There is now a significant body of data on transuranic similar. and high-level waste and spent fuel and disposal systems. Also, in the years since Part 191 was first promulgated, the qualifying statements in it relative to the degree of proof to be required have been interpreted so as to render them virtually meaningless. Furthermore, the Department cannot emphasize enough the need for uniform, consistent, and compatible regulations at the Federal level. In this regard, we recommend that EPA and the NRC reconcile their regulations to accomplish this objective.

The Department's primary comments on Working Draft 2 are as follows:

1) DOE supports the clarification of the definition of undisturbed performance.

2) DOE is concerned with the implementability of the containment standards, as they are being interpreted. because of their quantitative, probabilistic nature and the stringency of the numerical release limits.

3) The difference between geologic repositories for 9008080059 Same Sec จกุ่มกระกับเป็น -WASTE FDR Tin.

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radioactive waste and underground injection wells should be clarified.

4) The consideration of human intrusion should be separated from the complementary cumulative distribution function (CCDF) and treated on a qualitative basis using reasonable assumptions regarding future human behavior such as borehole sealing and passive markers.

5) DOE believes that the assurance requirements in section 191.14 are unnecessary, and that their inclusion in the rule would exceed EPA's regulatory authority.

DOE supports EPA's efforts to develop a generic ground water protection strategy and will continue to work with EPA in developing such a strategy. However, for the individual and ground water protection requirements in 40 CFR Part 191, DOE prefers EPA's Option 1A, no separate ground water requirements, in combination with Options 3A and 4A (1,000 year period of applicability and a dose limit of 25 millirem).

These and other important concerns are described more fully in the enclosed set of comments. The DOE is currently developing policy and positions on issues related to the rule, such as the ground water protection strategy. Moreover, because DOE has not seen EPA's discussion and rationale for the suggested rule revisions, these comments cannot represent final DOE positions. DOE expects to submit additional, and possibly revised, comments as the rule is developed.

We believe, and we know EPA shares our belief, that we have a joint responsibility to ensure that the wastes covered by this standard will be disposed of safely. We appreciate the willingness of your staff to work with the DOE in developing the new rule. This will allow the Department's recent data and experience to be considered by EPA. A standard that is technically justified and capable of being implemented is necessary for proper disposal to proceed.

Any questions concerning these comments may be directed to me at 586-8505 or to Edward Kegnier of my staff at 586-5027.

Sincerely,

Raymond F. Pelletier Director Office of Environmental Guidance

Enclosure

cc: Mr. Floyd Galpin Mr. Robert Browning, NRC Mr. Victor Sgobba, GAO

# U.S. DEPARTMENT OF ENERGY

COMMENTS ON WORKING DRAFT 2 OF 40 CFR PART 191

### DIFFERENCE BETWEEN GEOLOGIC DISPOSAL AND WELL INJECTION

EPA should modify Part 191 to establish unequivocally the difference between the Underground Injection Control (UIC) program under the Safe Drinking Water Act (SDWA) and the 40 CFR Part 191 environmental radiation protection standards for management and disposal of spent nuclear fuel, high-level and transuranic radioactive wastes in geologic repositories. Failure to clarify this important distinction will cause continued controversy over an issue for which the policy and record are clear. Language which specifically explains that emplacement of radioactive wastes in a geologic repository does not constitute underground injection, as defined under the SDWA, should be added to the rule.

Emplacement of non-liquid radioactive wastes in a geologic repository does not constitute underground injection (UI) of fluids subject to regulation under the SDWA. In its Generic Environmental Impact Statement on the Management of Commercially Generated Radioactive Waste (DOE/EIS-0046F, October, 1980), DOE clearly distinguished between the alternative of well injection and the preferred alternative of disposal in geologic repositories.

Injection wells are wells in which fluids flow, normally pumped under pressure, into formations for the purpose of maintaining pressure in the formation (e.g., for secondary oil recovery) or for the irretrievable disposal of hazardous or toxic waste. But, radioactive waste to be disposed of will not be a fluid and will not "flow" into a geologic repository and the waste is retrievable for a substantial period of time.

In the draft 40 CFR Part 193 regulations (April 6, 1989) for the management and disposal of low-level radioactive waste (LLW) EPA expressed an opinion that deep geological disposal is not underground injection subject to regulation under the SDWA. According to the draft regulation:

EPA does not believe that deep geological disposal of LLW constitutes emplacement of a fluid within the meaning of the UIC program.... EPA believes that the time to assess whether the material flows or moves is the time of emplacement and the term "injection" itself connotes delivery by flow. Congress focused on injection practices when directing EPA to control underground injection... EPA's regulatory program has also focused on the identification and control of

injection practices. Focusing on the practice of injection ties the concept of a fluid directly to the emplacement. This connection is expressed practically by examining the material at the time of injection and, if the injected material flows into the well, then the well is subject to the requirements of the UIC program. Therefore, even if deep geological repositories were considered to be wells within the meaning of the Safe Drinking Water Act, the process of lowering the LLW into a geological formation ... is not considered to be well-injection because the waste is not fluid at the time of injection, i.e., it does not flow into the injection vehicle. The activity therefore is not subject to the regulatory provisions of the UIC program.

A discussion of the differences between injection of fluids into a well and emplacement of radioactive waste in a mined geologic repository should be included in the preamble to the Part 191 regulations to clarify that the SDWA UIC program does not apply to geologic disposal of high-level radioactive waste, spent nuclear fuel, and transuranic radioactive wastes.

In addition, it would be appropriate for EPA to propose the following changes in its definitions for "fluid" and "well" under its SDWA UIC regulations at 40 CFR 144.3 and 146.3 to eliminate ambiguity about the possible application of those regulations to disposal of radioactive wastes and spent nuclear fuel in a geologic repository (changes are highlighted):

"Fluid" means any uncontainerized material or substance which, at the time of emplacement, flows or moves whether in a semisolid, liquid, sludge, gas, or any other non-solid form or state. Radioactive materials associated with spent nuclear fuel or radioactive wastes disposed of in a geologic repository do not constitute fluids for purposes of this Subchapter.

"Well" means a bored, drilled or driven shaft, or dug hole, whose depth is greater than the largest surface dimension. Geologic repositories, for the disposal of spent nuclear fuel or radioactive wastes, are not wells for the purposes of this Subchapter.

Also, add to 40 CFR 144.3 and 146.3 the following definition:

"Geologic repository" means a system which is used for the disposal of spent nuclear fuel or radioactive wastes in excavated geologic media.

Also, add the following to the 40 CFR 144.1 (g)(2) list of items not covered by the UIC regulations:

(vi) Geologic repositories, for the disposal of spent

# nuclear fuel or radioactive wastes.

#### SECTION 191.01 -- APPLICABILITY

The highlighted language "(except for transportation)" should not be highlighted as it is not a change from the 1985 rule.

### SECTION 191.02(1) -- DEFINITION OF RADIOACTIVE WASTE

The definition of "radioactive waste" in Working Draft 2 on page 4 was modified by the addition, without explanation or justification, of the phrase "and any other radioactive waste material managed or disposed of with" high-level or transuranic waste. The phrase "any other radioactive material" should be deleted because, to some degree, all materials are radioactive. This modified definition appears to anticipate the possibility of disposal of greater-than-Class C (GTCC) low-level waste in a geologic repository subject to Part 191. If EPA's intention is to include GTCC radioactive wastes, then the definition should be modified to include that additional term, and only that term. Even though additional waste has been included in the "units of waste" for determining the allowable release to the accessible environment (Appendix B of Subpart B, Note 1), no basis is provided for establishing the equivalency of either 1 million or 100 million curies of this material to 1,000 MTHM.

The data supporting the 1985 rule provides no basis for justifying application of the numerical limits in the rule to GTCC waste. The 1985 rule was developed by assessing the achic rability of, and risks from, the disposal of high-level waste and the conclusions of this analysis are not directly transferable to GTCC waste, or to "any other radioactive material."

# SECTION. 191.03 -- TANDARD

Section 191.03 should incorporate the committed effective dose equivalent concept utilized in Sections 191.15 and 191.16 rather than the outdated dose limits of 25 mrem to the "whole body" and 75 mrem to any critical organ. Dose limits in both Subparts of 40 CFR Part 191 should be in terms of the effective dose equivalent to be consistent with the internationally accepted approach.

SECTION 191.12(e) -- DEFINITION OF COMMITTED EFFECTIVE DOSE EQUIVALENT

The definition of the term "committed effective dose equivalent" (CEDE, page 8) is incorrect. The CEDE is not "the total dose equivalent received by an individual..., multiplied by

appropriate weighting factors...." The CEDE is the sum of the doses to specified organs of an individual which have been multiplied by appropriate weighting factors (the multiplication precedes the summation). The established and widely accepted definition of the term in the National Council on Radiation Protection and Measurements (NCRP) Report 91 or EPA Publication EPA-520/1-88-020 should be used.

In addition, the equation for "committed effective dose equivalent" on page 22 should be corrected. Because the time integration is to be carried out first, the equation (with a 50 year dose commitment) should read:

$$H_{z,50} - \sum_{T} W_{T} H_{50}$$
.

The period of the dose commitment specified by the International Commission on Radiation Protection (ICRP) and the NCRP is fifty rather than seventy years as proposed in Working Draft 2. Extension of this period to seventy years would require development of new dose conversion factors and is unnecessary considering the low likelihood that individuals would be exposed to the releases for their entire lifetimes and other uncertainties in the calculation of committed effective dose equivalent (e.g., suitability of using the listed values for weighting factors, developed for occupational exposures, for assessing public exposure). DOE recommends that EPA use the ICRP/NCRP approach of 50-year dose commitments in the 40 CFR Part 191 rulemaking.

SECTION 191.12(1) -- DEFINITION OF ECOLOGICALLY VITAL GROUNDWATER

A definition has been added for "ecologically vital ground water" (pages 8-9). This groundwater supplies "an aquatic or terrestrial ecosystem which is located <u>either</u> in a ground water discharge area and supports a habitat for a listed or proposed endangered or threatened species, as designated pursuant to the Endangered Species Act, as amended, <u>or</u>, on Congressionally designated Federal Lands managed for the purpose of ecological protection regardless of the presence of threatened or endangered species." Ecologically vital ground water is one of the resources to be avoided during site selection (p. 12, 191.14(g)). The term also is included in the definition of Class I groundwater under Option 1 for the Individual Protection and Ground Water Protection Requirements (page 14, definition (b)).

DOE has two concerns about the proposed definition of "ecologically vital ground water." First, it is uncertain which species will be endangered or threatened in the future or which lands Congress will designate in the future, as Federal lands managed for the purposes of ecological protection. Therefore,

the word "currently" should be inserted before each of the words "listed," "proposed," and "Congressionally." Second, the definition is too broad. Under the definition in Working Draft 2, the ground water does not have to be vital, or even important, to the maintenance of the ecosystem. The definition should be revised to read "... ground water <u>providing an</u> <u>essential supply</u> to an aquatic or terrestrial ecosystem which is located either in a ground water discharge area and supports a <u>critical</u> habitat ...." (changes highlighted). Without the word "critical" prior to habitat, any groundwater system discharging into an endangered or threatened species habitat would be classified as ecologically vital, regardless of its importance to the species. If the word "critical" were included, the definition would apply only to ground water systems that were truly vital to an endangered or threatened species.

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# SECTION 191.12(1) -- DEFINITION OF IMPLEMENTING AGENCY

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Differences of opinion on the appropriate classification to be assigned to specific ground water supplies may occur. The rule should make it clear that the implementing agency is responsible for classifying the ground water. This clarification would be consistent with the draft 40 CFR Part 193 regulations.

#### SECTION 191.12(n) -- DEFINITION OF MAN-MADE RADIONUCLIDE

A definition has been added for "man-made radionuclide" (page 9). "Mill tailings or other radioactive materials stored or disposed of by man .... " (emphasis added) are expressly included as manmade radionuclides" for purposes of Subpart B. Virtually all materials stored or disposed of by man have come small amount of radioactivity. No de minimis level has been established to provide appropriate qualification to the term "other radioactive materials". Also, it is unclear whether "man-made radionuclide" includes that portion of background radiation resulting from weapons testing in the 1950s and 1960s. Further, by using the terminology "any radionuclide" instead of "any radioactive material," it is not clear whether this definition would include naturally occurring materials containing radionuclides which, in other circumstances, have previously been classified as byproduct or special nuclear materials. This ambiguity results because the common usage of the term "radionuclide" is to refer to a species of atom. For the above reasons, the proposed definition is too broad, technically questionable, and could set an undesirable precedent. This definition should be deleted from Subpart B.

# SECTION 191.12(q) -- DEFINITION OF UNDISTURBED PERFORMANCE

DOE agrees with the modified definition of "undisturbed performance" (page 10) used in Working Draft 2. The application of this definition would limit consideration of scenario

probabilities to the containment requirements in Section 191.13. Eliminating required consideration of disruptive external natural events in determining compliance with individual and ground water protection requirements removes unnecessary uncertainty from the dose calculations. DOE recommends that appropriate language from the guidance in Appendix C be more explicitly reflected in the definition itself.

#### SECTION 191.13 -- CONTAINMENT REQUIREMENTS

The DOE is concerned with the implementability of the containment requirements as they are being interpreted. A literal interpretation of the requirements would preclude the use of qualitative judgment by the implementing agency as intended by EPA. Without a significant measure of qualitative judgment allowed by the rule, the combination of the quantitative, probabilistic nature of the standard and the stringency of the numerical limits for allowable releases would make it difficult to demonstrate compliance at any site. In addition, risk levels implied by these release limits are inconsistent with the criteria and methodologies established by the International Commission on Radiological Protection (ICRP) - the internationally recognized body for establishing radiation protection standards. The standards should be consistent with the principles and criteria established by the ICRP; any inconsistencies should be technically justified and fully documented.

Given the current probabilistic nature of the standard, DOE believes that some wording changes are needed to assure that the containment requirements are not misinterpreted and a more stringent requirement imposed than originally intended. The August 1985 rule contained several qualifying statements relative to the degree of proof to be required and providing for incorporating performance assessment results into a complementary cumulative distribution function (CCDF) only to the extent practicable. These qualifying statements were believed essential to the implementability of the standard. Unfortunately, the NRC staff, and others, seem to have overlooked and/or misinterpreted these qualifying statements so as to render them virtually meaningless. DOE believes that the following additions to the proposed rule are necessary to assure that the rule is implemented as EPA intends (changes highlighted):

191.13(a) Disposal systems for spent nuclear fuel or highlevel or transuranic radioactive wastes shall be designed to provide a reasonable expectation, based upon performance assessments and qualitative judgments, that the cumulative releases ---.

191.13(b) Complete assurance that the requirements of 191.13(a) will be met is not required. --- Instead what is required is only a reasonable expectation, based on

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qualitative judgments and performance assessments, that compliance with 191.13(a) will be achieved.

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In Appendix C the following should be added after the first paragraph: In determining compliance with these regulations the standard of proof required is a "reasonable expectation." This standard of proof is not the same as "reasonable assurance," as that term is used in NRC regulations in Title 10. A "reasonable expectation" allows a substantially greater degree of uncertainty than does "reasonable assurance." This is appropriate because of the uncertainties associated with predicting environmental conditions and geologic and hydrological phenomena over unprecedented periods of time. The terms are not interchangeable.

Appendix C, Compliance with Section 191.13. Add following the first sentence: It is intended that the above qualifier, "whenever practicable," be applied in a manner to give it significant effect and to facilitate implementation of this rule. The Agency expects that there will likely be instances where it is not practicable to assemble the results of performance assessments into a CCDF, for example, due to unavailable data, uncertainties in data, or inadequacy of models for describing long term future events and processes. The resulting impracticality could be either a practical inability to execute the calculations or a CCDF with such a large band of uncertainty surrounding it as to make it essentially meaningless.

Revise the last sentence of the first paragraph of Appendix C, compliance with Section 191.13, as follows: The Agency assumes that a disposal system can be considered to be in compliance with Section 191.13 if, considering this single distribution function and relevant qualitative factors, there is a reasonable expectation that the disposal system will meet the requirements of Section 191.13(a).

# Human Intrusion Considerations

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The standard should be revised so that consideration of human intrusion is separated from the CCDF. In 1985, the methodology proposed for evaluating compliance could be tested only in theory. Since that time, data and understanding have been developed by the Department to complete a preliminary analysis for the WIPP repository. This first real-system analysis shows that the human intrusion considerations in the containment requirements dominate the analysis. It is not technically possible to use human-intrusion analyses to compare geologic formations for siting repositories because the intruding borehole bypasses the host formation and removes it as a barrier to radionuclide transport. Analysis of the probability of human intrusion requires projection of future societal requirements and activities. Uncertainties in these projections dominate and are

propagated throughout the analyses. The unfortunate result is that the standard provides little incentive to locate a repository in a site with favorable geologic properties, and minimizes these properties in the performance process.

This is exactly opposite EPA's stated intent that the human intrusion scenario provide a basis for comparing alternate sites. Thus, the standard should be revised so that consideration of human intrusion is separated from the CCDF and treated on a qualitative basis using reasonable assumptions regarding future human behavior such as borehole sealing and passive markers. The Department is continuing to evaluate human intrusion issues and will provide more specific suggestions in the near future. For example, the Department is in the process of analyzing the implications of future societal requirements and activities for the WIPP Project. This effort should provide useful insights into the feasibility of evaluating human intrusion scenarios. A report discussing the impacts of human intrusion on the containment analysis and on the repository design is expected to be available within a few months.

#### SECTION 191.14 -- ASSURANCE REQUIREMENTS

The Department believes that the Assurance Requirements in Section 191.14, which are applicable only to facilities not regulated by the Commission, are unnecessary and that their inclusion in the rule exceeds EPA's regulatory authority to establish generally applicable environmental standards for radiation protection under the Atomic Energy Act of 1954 and Reorganization Plan No. 3. Requirements for site selection, for design of disposal systems, for monitoring and for permanent markers are the responsibility of the implementing agency, not EPA. Although DOE intends to incorporate the requirements of these assurance requirements into its planning, the Department objects to EPA imposing the requirements as a part of the 191 Standards.

In addition to exceeding EPA's authority, the new 40 CFR 191.14(e) is unacceptably ambiguous. The term "maximum achievable control technology" (MACT) in the context of 40 CFR Part 191 is unclear. The technical community, including the NRC, is in agreement that the release limits specified in Table 1 are so restrictive as to constitute de facto compliance with the Applying a new concept of MACT to a geologic ALARA concept. repository is inappropriate, primarily because of the passive nature of such a facility and its functional lifetime. This t would make the natural system itself subject to MACT; requir an unwarrinted and unworkable extension of the concept. The DOE strongly opposes the use of MACT in Section 191.14(e) and understands from discussions with EPA staff that EPA plans to eliminate this assurance requirement from the next draft. DOE strongly supports deleting this assurance requirement; however, it should not be replaced with a requirement for ALARA. An ALARA

requirement would be inappropriate because of the extremely low release limits in the rule and is inappropriate for geologic systems and for time frames where action cannot be taken to control unplanned releases.

Further, the new assurance requirement added for a 100,000 year projection of undisturbed performance when comparing alternative sites [Section 191.14(f)] is unacceptable. Predictions beyond 10,000 years are extremely speculative and not justified on the basis of protection of human health or the environment. This requirement addresses the site selection process. Involvement in site selection is not an appropriate role for EPA. Moreover, the U.S. Court of Appeals in the decision vacating and remanding this rule specifically found that the 10,000 year time period of consideration was adequately justified.

The only stated purpose for the assurance requirements in 191.14 is "To provide the confidence needed for long term compliance with the requirements of 191.13 ---." The only basis suggested in the rule for the assurance requirement in 191.14(g) avoidance of areas where there is an expectation of exploration for resources - is to reduce the chances that people may inadvertently disrupt a disposal system. Although it is not clear, the term "valuable geologic formation" would seem to refer to valuable in an aesthetic or academic sense and not to economic value, because mineral, petrolcum, gas and water resources are covered in other clauses.

In Section 191.14(g) "water for agricultural use" and "ground waters that are ecologically vital" have been added to the list of resources to be considered during site selection.

The requirements to avoid valuable geologic formations, ground water which may be extracted outside the controlled area for drinking or agricultural use, and ecologically vital ground water, are without justification because such resources would not make disruption by exploration at the site any more likely. These requirements apparently are intended, not to assure the performance of the repository, but rather to protect the resources. It is not clear that EPA has authority to promulgate regulations protecting "valuable geologic formations" and (as defined under ecologically vital) "endangered species" and "Federal lands managed for the purpose of ecological protection ---." In any event, no basis has been provided to establish that location of a repository or any potential releases of radioactive material from a repository would cause unacceptable harm to these resources. Therefore, the above enumerated resources should be deleted from the list of those to be avoided.

Further, the identification of the ground waters to be considered in this section is unnecessarily complicated because the term "water for agricultural use" has not been defined in Section 191.12 and terminology found in existing legislation has not been

used. As previously discussed, DOE recommends that all of Section 191.14 be deleted. However, if it is retained, DOE suggests that the Section 191.14(g) requirement should be reworded as follows (changes highlighted):

Places where there has been mining for resources, or where there is a reasonable expectation of exploration for resources that, based on current knowledge, are predictably scarce or easily accessible, or where there is a significant concentration of any material that is not widely available from other sources, should be avoided in selecting disposal sites. Resources to be considered shall include minerals, petroleum or natural gas of currently recognized economic value or strategic importance; ground waters inside the controlled area that are currently either a sole source of drinking water as defined in the Water Quality Act of 1987 and the Clean Water Act of 1977 as amended or ground waters which serve an area classified as prime farmland subject to provisions of the Farmland Protection Act. Such places ----.

The above suggested changes more precisely define resources to be avoided.

SECTIONS 191.15 & 191.16 -- INDIVIDUAL AND GROUND-WATER PROTECTION REQUIREMENTS

DOE recommends the adoption of Option 1A for Section 191.15 and 191.16. DOE cannot support either Options 1B, or 2B as outlined in the Working Draft 2 proposal. They should be deleted from the proposed rule for the following reasons:

- 1. There is no adequate rationale for the dual dose-limiting standards under Options 1B and 2B of 4 mrcm/yr for gioundwater pathways and 25 or 10 mrem/yr for all pathways combined. Both sets of standards govern the same radioactive waste disposal activity. In Options 1B and 2B, EPA proposes to formulate a separate ground water pathway requirement even though the 25 mrem/yr individual dose limit would control the dose from all pathways combined, including the ground water pathway. EPA has provided neither a health-based justification nor a cost-benefit optimization rationale for a separate ground water provision.
- 2. There is no statutory requirement for a separate ground water pathway standard.
- 3. EPA has not presented any rationale or technical justification for the Option 1B proposed zero degradation standard for Class I ground water. Also, many qualitative terms in the definitions of the ground-water classes are vague. For example, the term "interconnected" in the definitions for Class IIIA and IIIB ground waters under

Option 1 (page 14) is vague and should be defined to avoid compliance demonstration problems. The quantitative measures associated with determinations of "potable ground water" and "high-yield aquifer" have not been peer reviewed or otherwise technically justified.

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- 4. Option 1B relies on EPA's internal ground-water protection strategy, which has never been formally proposed and is undergoing revision. This classification system, which divides ground waters into various classes based on qualitative and quantitative measures, should be appropriately justified and established by rulemaking before its incorporation into any other regulations.
- 5. Prenxisting background radiological dose from natural or man-made radionuclides should not be incorporated into the proposed Section 191.16 standards (Options 1B and 2B). If EPA decides to include separate ground-water standards in the rule, DOE strongly believes that the standards should be applied only to radionuclides and pathways from the disposal system itself.

DOE generally supports Option 1A because it does not rely on the draft ground-water classification system and contains one standard for all pathways of exposure. Option 1A should be the only regulatory approach presented in the proposed rule. Although Option 2A is a similar standard, the term "high-yield aquifer" is more precisely defined and more restrictive than "potable water." Formations may contain potable water, but m Formations may contain potable water, but may be over 2,500 feet below the land surface and not able to produce significant quantities of water for human use. However, it is not apparent that the quantitative measures defining a "high-yield aquifer" are appropriate. For example, the limit of 10,000 mg/L total dissolved solids may not be appropriate for all types of dissolved colide. Limits for individual species (e.g., carbonates, phosphates, brine) may be more appropriate. Under Option 1A, DOE supports a dose limit of 25 mrem (Option 4A) and a time period of 1,000 years (Option 3A) as part of the Individual and Ground water Protection Requirements. Other options are inappropriate and should not be presented in the proposed rule. DOE believes that the 25 mrem dose limit for all pathways combined provides an adequate margin of safety in protecting the public health. Extension of the Individual and Ground water Protection Requirements to 10,000 years would likely complicate demonstration of compliance without necessarily increasing the degree of public protection due to the increased uncertainty in the projection of performance. Although Appendix C provides additional clarification on implementation of the standard, projecting climatic changes and socio-cultural factors, such as populatio, agriculture, and lifestyle statistics, over 10,000 years with any certainty, is not likely to be possible. At a minimum, this difficulty is appropriately addressed in Appendix C's recognition of the need for "expert judgment." In addition, because the NRC is not bound by the language in the

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appendix, it is not certain that EPA's assumptions regarding qualifying statements and strictness of interpretation will be reflected in NRC's licensing process.

DOE supports the guidance provided by Appendix C in Working Draft 2, particularly the concept of "undisturbed performance" (related to gradual processes) and "best estimate predictions" (used to analyze compliance).

### SECTION 191.17 -- DEMONSTRATION OF CAPABILITY TO COMPLY

Working Draft 2 added a new Section 191.17 on demonstration of capability to comply. The new section requires preliminary performance assessment calculations (which are undefined), written test plans for experiments, plans and tested procedures for the removal of the waste, and concurrence of the EPA Administrator before temporary emplacement of the waste when the implementing agency is not the Commission. For WIPP, test plans already exist; the DOE has committed to plans and tested procedures for waste removal; and the EPA has indicated that they are in favor of the tests. Thus the WIPP already seems to be complying with these requirements; and, by the time this rule is promulgated testing should be well underway. However, this section exceeds EPA's authority and should be deleted. EPA has no statutory authority to implement the standards or to require concurrence in an implementing agency's determination.

### APPENDIX B NOTE 1 -- UNITS OF WASTE

Several independent assessments of health effects of HLW and TRU wastes have arrived at different equivalencies for some of the radionuclides in the table. To clarify the basis for the equivalency factor used, EFA should explain its methodology for determining that 1000 MTHM HLW is the equivalent, for the purposes of this standard, of 1,000,000 Ci TRU waste.

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.

#### APPENDIX C -- GUIDANCE FOR IMPLEMENTATION OF SUBPART B

#### Compliance with Section 191.13

It is not clear whether the guidance suggests combining multiple distribution functions into a single function or consideration of multiple distribution functions instead of using a single distribution function. Some ambiguity has resulted from the reference to a single distribution <u>function</u> in the first paragraph while referring to distribution <u>function(s)</u> in the second paragraph. This could be clarified by revising the second paragraph to read:

"--- use prevalent expert judgement to assist it in determining which distribution function(s) to consider and whether to combine them in evaluating compliance with 191.13."

Frequency and Severity of Inadvertent Human Intrusion into Geologic Repositories

After the second sentence insert the following:

"These parameters represent the most pessimistic upper bound that ever need be assumed. They are not required to be used by the implementing agency. Instead of assuming these parameters, the implementing agency is encouraged to develop and use a probability distribution function for borehole drilling rates which is justified for application at the particular site under consideration."

Revise the last sentence to read:

... newly sealed in accordance with the least protective practices required by current law for exploratory drilling... These consequences represent an upper bound and are the most pessimistic that ever need be assumed. They are not required to be used by the implementing agency which is encouraged to develop and justify the use of other consequences. For example; the permeability of an intruding borehole may be represented by a distribution for uncertainty analysis.



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

May 1, 1990



R-89-0

II-F-3

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

Dear Chairman Carr:

# SUBJECT: CRITIQUE OF THE ENVIRONMENTAL PROTECTION AGENCY'S STANDARDS FOR DISPOSAL OF HIGH-LEVEL WASTES

In response to your request during our meeting on February 21, 1990, the Advisory Committee on Nuclear Waste offers the following comments on the problems we see with the EPA standards (Ref. 1) for the disposal of high-level wastes. These comments are an outgrowth of our ongoing review of these standards, including a full-day session on this matter during our 18th meeting, March 22-23, 1990, and additional discussions during our 19th meeting, April 26-27, 1990. Organizations whose representatives took part in the discussions during our 18th meeting included the Environmental Protection Agency, the Nuclear Waste Technical Review Board, the staff of the Board on Radioactive Waste Management of the National Academy of Sciences, the Environmental Evaluation Group of the State of New Mexico, the Advisory Committee on Nuclear Facility Safety of the U.S. Department of Energy, and the General Accounting Office. Members of the NRC staff also attended these meetings.

Key technical problems with the EPA standards include the following:

1. All such standards should be organized in a hierarchical structure with the higher levels expressing the objectives in a qualitative sense and the lower levels stating the objectives quantitatively. Of utmost importance is that the several levels be consistent and that lower levels not be more stringent or conservative than the higher levels, so that they become <u>de facto</u> new standards. This is not the case with the EPA standards.

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# May 1, 1990

- The Honorable Kenneth M. Carr
- 2. Although lower level standards can be stated probabilistically, they should be expressed in terms of annual risk limits from a disposal facility in an undisturbed and a disturbed state. The critical population group being considered should be clearly defined. This approach is in accord with recommendations of organizations such as the International Commission on Radiological Protection and the United Kingdom's National Radiological Protection Board.

- 3. The standards should apply to the disposal facility as a system. Subsystem standards, if expressed, should be given only as guidance, with qualifying statements clearly specifying that they are not to be applied in a regulatory sense.
- Evaluations of the anticipated performance of the proposed 4. Waste Isolation Pilot Plant indicate that, for the disturbed state, human intrusion is the dominant contributor to risk. Early indications suggested that performance analyses for the proposed Yucca Mountain repository may also show human intrusion to be important. This appears to be a direct result of how the standards for evaluating such intrusions are interpreted, compounded by the overly conservative requirements of the standards. To ameliorate this issue, we suggest that the standards be rewritten to separate the evaluations anticipated performance into three parts: of (a) the undisturbed repository; (b) the disturbed repository, exclusive of human intrusion; and (c) the repository as it might be affected by human intrusion. This would clearly s-parate out the problem of human intrusion and permit it to be addressed directly. In this regard, we join with the Advisory Committee on Nuclear Facility Safety, U.S. Department of Energy, in recommending that EPA's standards be reworded to permit "considerations such as expectations for future borehole sealing at least as good as the current state-ofthe-art." We also believe that more realistic assessments should be made of the potential impacts of human intrusions and that greater credit should be allocated to the ability of future generations to be aware of the presence of a geologic repository through identifying markers and associated records.
- 5. Experience has shown that probabilistic risk analyses cannot be used reliably to determine the compliance of a single nuclear power plant with a set of standards. A high-level waste repository, which must function for 10,000 years, is still more difficult to assess quantitatively. The E standards should clearly specify that risk assessments are but one of several inputs into the evaluation of a given highlevel waste repository site and/or facility. Such assessments should not be the only factor in evaluating compliance of such a facility with the EPA standards.

The Honorable Kenneth M. Carr

May 1, 1990

In summary, our key recommendations are:

1. The existing EPA standards need to be revised; now is the time to accomplish this task;

3

- 2. The standards should be revised to define what is considered to be an acceptable risk from a high-level waste repository;
- 3. The standards should specify that a probabilistic approach is acceptable so long as it is but one of several factors to be used in determining the acceptability of a specific site; and
- 4. The standards should be revised to include separate considerations for evaluating the impacts of human intrusion.

We stand ready to join you and the NRC staff in working with EPA to help develop an acceptable set of standards for a high-level radioactive waste repository. We believe this is the best course of action at the present time. If, however, after a reasonable period of time these efforts do not appear to be accomplishing our mutual goals, we believe other approaches should be considered. One would be for you, as Chairman of the NRC (perhaps joining with the Secretary of DOE) to approach the EPA Administrator with a suggestion that an appropriate organization be selected to review the standards and make recommendations for change. Suggestions for two such organizations are the National Academy of Sciences and the Council on Environmental Quality.

We hope that these comments are helpful. We will be pleased to discuss these matters with you at your convenience.

Sincerely,

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Dade W. Moeller Chairman

References:

 U.S. Environmental Protection Agency, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," (40 CFR Part 191), Working Draft 2, dated January 31, 1990

# The Honorable Kenneth M. Carr

- 2. Letter dated April 17, 1990 from F. L. Galpin, Environmental Protection Agency to Dade W. Moeller
- 3. Letter dated December 11, 1989 from John F. Ahearne, Advisory Committee on Nuclear Facility Safety, DOE, to James D. Watkins, Secretary of Energy, DOE
- 4. Sandia National Laboratories, SAND89-2027, "Performance Assessment Methodology Demonstration: Methodology Development for Evaluating Compliance With EPA 40 CFR 191, Subpart B, for the Waste Isolation Pilot Plant," Printed December 1989
- 5. International Commission on Radiological Protection, ICRP Publication 46, "Radiation Protection Principles for the Disposal of Solid Radioactive Waste," published for the International Commission on Radiological Protection by Pergamon Press, Oxford, England, July 1985
- 6. National Radiological Protection Board, NRPB-GS 1, "Radiological Protection Objectives for the Disposal of Solid Radioactive Wastes," published in Oxfordshire, England, 1983

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

December 21, 1989

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



Dear Chairman Carr:

SUBJECT: COMMENTS ON PROPOSED REVISIONS OF EPA'S HIGH-LEVEL WASTE STANDARDS

During its 15th meeting on December 20, 1989, the Advisory Committee on Nuclear Waste met with the NRC staff and representatives from the Department of Energy (DOE) and the Environmental Protection Agency (EPA) for additional discussions pertaining to the Standards for a high-level waste (HLW) repository currently being revised by EPA. We previously discussed this matter with a representative from EPA during our 14th meeting on October 11-13, 1989 and the ACNW or its predecessor, the ACRS, have had continuing interactions with the NRC staff on the matter over the past several years. We also had the benefit of the documents referenced.

On the basis of these discussions, we continue to doubt that compliance with the EPA standards can be demonstrated for a specific repository site, even recognizing the caveats included in the standard, such as the "reasonable assurance" phrase that allows for certain flexibilities in the interpretation of probabilistic analysc. If the construction cf a Complementary Cumulative Distribution Function clearly demonstrates compliance with the EPA Standards, then the need for interpreting the "reasonable assurance" phrase is removed. If, as is more likely, demonstration of compliance is not clear, it will be necessary to have a definitive understanding of how the NRC staff plans to interpret the wording in the EPA Standards that:

Proof of the future performance of a disposal system is not to be had in the ordinary sense of the word in situations that deal with much shorter time frames. Instead, 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.

The preferred alternative in the plan as outlined in SECY-89-319 for implementation of the EPA Standards calls for the NRC staff is resolve the major problems concerning implementation of Section 191.13 (a) through rulemaking. It is not clear to us, however, how

#### The Honorable Kenneth M. Carr

# December 21, 1989

such rulemaking would resolve the uncertainties in applying probabilistic techniques, nor is it clear that this method represents the best approach for coping with problems that are, in the main, a result of what we consider to be an unacceptable set of standards.

2

We believe that the NRC staff in SECY-89-319 has not provided the Commission an adequate range of alternatives. One such alternative that we recommend would be that the Commission object to the EPA Standards on the basis that:

- 1. There are no obvious ways for demonstrating compliance of any specific repository site with the Standards. In this sense, the Standards may be unrealistic.
- 2. The Standards are also overly stringent and inconsistent. There is strong evidence that they will be wasteful of resources with little commensurate benefit.

The EPA Standards are internally inconsistent, in that lower level quantitative limits are more stringent than upper level qualitative goals. Thus far we have been provided no information to convince us that less stringent Standards would not provide adequate protection of the public health and safety. The NRC subsystem performance criteria have the potential for imposing even more stringent requirements on the repository.

While EPA has attempted to justify the added conservatisms as a means for allowing for uncertainties, we fail to understand the logic of this approach. Resolution of the problems of uncertainties would best be pursued through site characterization and performance assessment. The latter process, in particular, can be used to reveal where and to what degree uncertainties exist, and can provide guidance on where additional and better data are needed.

To resolve these issues, we recommend that the NRC staff be more aggressive in dealing with EPA. The task of the NRC staff, as we interpret it, should be to ensure that the EPA Standards are scientifically sound, consistent, and readily subject to interpretation and implementation. With the EPA in the process of revising their Standards, and DOE having announced an overall reassessment of its HLW program, this would appear to be an opportune time for the NRC to undertake these initiatives.

We will be pleased to discuss these matters with you in additional detail, if you desire.

Sincerely, ! Moeller

Dade W. Moeller, Chairman

The Honorable Kenneth M. Carr 3

77

# <u>References:</u>

- 1. SECY-89-319, "Implementation of the U.S. Environmental Protection Agency's High-Level Waste Disposal Standards," dated October 17, 1989
- 2. EPA Working Draft 1 of 40 CFR Part 191, dated June 2, 1989, "Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes"
- 3. 40 CFR Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes"