



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

July 17, 1991

MEMORANDUM FOR: James M. Taylor
Executive Director for Operations

R. Sawin for

FROM: Raymond F. Fraley
Executive Director, ACNW

SUBJECT: 32ND ACNW MEETING FOLLOW-UP ITEMS

Based on discussions regarding methods for improving implementation and follow-up of ACNW recommendations, a summary of "Actions, Agreements, Assignments, and Requests" made during each ACNW meeting is sent to your office following each meeting.

Attached is a summary of the "Actions, Agreements, Assignments, and Requests" made at the 32nd ACNW meeting, June 20, 1991, that deal with requests made of the NRC staff or that are pertinent to NRC staff activities.

Attachment: As stated

cc: H. L. Thompson, EDO
J. L. Blaha, EDO
S. J. Chilk, SECY
E. J. Jordan, AEOD
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T. E. Murley, NRR
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SUMMARY OF ACTIONS, AGREEMENTS, ASSIGNMENTS, AND REQUESTS
32ND ACNW MEETING - JUNE 20, 1991

REPORTS AND MEMORANDA

- Comments Regarding 10 CFR Part 61 Proposed Revisions Related to Groundwater Protection (Report to Chairman Carr, dated June 27, 1991, Enclosure 1)
- Response to Questions Accompanying Working Draft #3 of the EPA Standards (Report to Chairman Carr, dated June 27, 1991, Enclosure 2)
- Continuation of Semi-Annual Reports (Memorandum for Mr. James M. Taylor, Executive Director for Operations, from Mr. Raymond Fraley, dated June 24, 1991)

HIGHLIGHTS OF MATTERS CONSIDERED BY THE COMMITTEE

1. Leaching Resistance of LLW Waste Form

The Committee continued its discussion and issued a report in response to a Staff Requirements Memorandum (SRM) dated December 31, 1990, concerning proposed revision of Part 61 with regard to leaching resistance of the low-level waste form and groundwater protection requirements (Enclosure 1).

Representatives of the Office of Research briefed the Committee on a recent "brainstorming" meeting on the retention and retardation of radionuclides. There were some new ideas that came out of this meeting that will need to be addressed by further research. The results of the "brainstorming" meeting will be issued as a report and staff representatives agreed to provide copies to the Committee.

2. Trip Reports

- Dr. Pomeroy reported on his visit to the West Valley Demonstration Project, New York, on June 4, 1991.
- Dr. Hinze and Dr. Pomeroy summarized the results of a number of papers given at the American Geophysical Union (AGU) Meeting, held in Baltimore, Md. During the AGU meeting, a special day-long symposium was held on the potential for tectonic and volcanic water table excursions. Presentations were made on the hypotheses on coupled processes proposed by Mr. Szymanski. Based on the presentations at the meeting, Drs. Pomeroy and Hinze noted that the arguments presented by the supporters of Mr. Szymanski's hypotheses were not well supported by relevant data.

The members noted their intent to continue to monitor events and publications related to the hypotheses of Mr. Szymanski. The members also expressed interest in the review on the coupled processes problem being conducted by the National Academy of Sciences.

3. Joint Meeting of ACNW Working Groups on Expert Judgment and Human Intrusion

- The Committee heard a report on a joint meeting of the Working Group on Expert Judgment and the Working Group on Human Intrusion, held on June 18-19, 1991. The meeting focused on the actual mechanics of eliciting of expert opinion. This included questions on who will identify and select the experts, as well as how the selected experts will be trained and how their opinions will be aggregated. Human intrusion served as the reference example in relating the elicitation process to a real and useful application. Participants included normative experts, a representative of the State of Nevada, and NRC and DOE staff and consultants involved with Yucca Mountain and WIPP.
- The Committee agreed to continue its discussion and prepare a report on the use of expert judgment in high-level and low-level waste management during the next meeting on July 25-26, 1991.

4. Working Draft #3 of the 40 CFR Part 191, High-Level Waste Repository Standards

- The Committee continued its discussion of a response to the six questions accompanying working draft #3 of 40 CFR Part 191, Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes.
- After a discussion of potential clarifications and modifications, the Committee approved a report to Chairman Carr with a recommendation that it be forwarded to Mr. Floyd Galpin, Environmental Protection Agency.

5. ACNW Future Activities

- Dr. Moeller reported that the NRC staff met on May 15, 1991, with representatives from EPA, ORNL, and the contractor (Cox and Associates) to review plans for beginning Phase II of the project to develop a national mixed waste profile. Phase II will involve the design

and execution of a mixed waste survey. Dr. Hinze recommended that the Committee be briefed on Phase II review plans after the report is issued.

- Dr. Moeller informed the Committee that the Office of Research will develop a regulatory guide on "Performance Assessment of Low-Level Radioactive Waste Disposal Facilities." The Committee requested that it be kept informed on the development of this regulatory guide.
- Dr. Moeller noted that the Defense Nuclear Facilities Safety Board recently conducted a review of the Waste Isolation Pilot Plant (WIPP). One of the questions raised by the Board was whether the DOE will license the operators for WIPP. The members discussed whether the NRC should license the operators of the WIPP repository.
- Dr. Moeller noted that Ms. Charlotte Abrams will provide monthly reports to the members on the status of the DOE Study Plans. He stated that the NRC staff conducted a Phase I review on the following DOE Study Plans, however they will not conduct a Phase II (in-depth) review:
 - The Characterization of the Flood Potential and Debris Hazards
 - Historical and Current Seismicity
 - Quaternary Faulting Within the Site Area
 - Characterization of the Unsaturated Zone Infiltration

The Committee agreed not to take any action at this time.

- The Committee will meet with the Commissioners during the 33rd ACNW meeting (July 25-26, 1991) to discuss items of mutual interest. The Committee identified the following tentative topics for discussion:
 - Introduction and preview of future working group meetings
 - Leaching resistance of the low-level waste form and groundwater protection requirements
 - Uncertainties in implementing the EPA HLW standards and the response to six questions accompanying working draft #3 of the EPA standards

- Visit to the Center for Nuclear Waste Regulatory Analyses
- The use of expert judgment in performance assessment for a geologic repository
- Integration of geophysics into site characterization of an HLW repository

Appendix A summarizes the proposed items for future meetings of the Committee and related Working Groups. This list includes items proposed by the Commissioners and NRC staff as well as ACNW members.

APPENDIX A. FUTURE AGENDA

33rd ACNW Committee Meeting July 25-26, 1991 (Tentative Agenda)

Meeting with the NRC Commissioners - The Committee will meet with the NRC Commissioners to discuss items of mutual interest, including:

- Leaching resistance of the low-level waste form and groundwater protection requirements (Steindler)
- Uncertainties in implementing the EPA HLW standards and the response to six questions accompanying working draft #3 of the EPA standards (Moeller)
- Introduction and preview of future working group meetings (Moeller)
- Visit to the Center for Nuclear Waste Regulatory Analyses (Moeller with additional comments from other members)
- The use of expert judgment in performance assessment for a geologic repository (Pomeroy)
- Integration of geophysics into site characterization of an HLW repository (Hinze)

Visit to the Center for Nuclear Waste Regulatory Analyses - The Committee will discuss its recent trip to and meeting at the Center for Nuclear Waste Regulatory Analyses.

Expert Judgment - The Committee will discuss and continue preparation of a report on the use of expert judgment in conducting performance assessments in support of licensing of high-level and low-level waste repositories.

Committee Activities - The Committee will discuss anticipated and proposed Committee activities, future meeting agenda, and organizational matters, as appropriate. The members will also discuss matters and specific issues that were not completed during previous meetings as time and availability of information permit.

Working Group Meetings

Review of Regulatory Guides for Implementing Revisions to 10 CFR Part 20, (Date to be determined) 1991, 7920 Norfolk Avenue, Bethesda, MD - The Working Group will review, discuss and make recommendations on seven regulatory guides:

- Interpretation of Bioassay Measurements
- Instruction on Health Risks from Occupational Radiation Exposure
- Instructions to Pregnant Women
- Criteria and Procedures for Summation of Internal and External Occupational Doses
- Dose to Embryo/Fetus
- Assessing External Radiation Doses from Airborne Radioactive Materials
- Air Sampling

The following two draft regulatory guides will also be considered:

- Preparation of Applications for Use of Sealed Sources and Devices for Performing Industrial Radiography
- Preparation of Applications for Medical Uses

NRC Staff Computer Modeling and Performance Assessment Capabilities in HLW and LLW, September 11-13, 1991, 7920 Norfolk Avenue, Bethesda, MD - The Working Group will review, discuss and make recommendations regarding the NRC staff capabilities to make independent evaluations of licensee proposals with respect to the performance of low-level and high-level radioactive disposal facilities. Emphasis will be placed on computational capabilities involving computer modeling, documentation, verification and validation.

Geologic Dating, October 22, 1991, 7920 Norfolk Avenue, Bethesda, MD - The Working Group will review and discuss the problems and limitations associated with the various quaternary dating methods to be used in site characterization of an HLW repository.

Residual Contamination Clean-up Criteria, October 25, 1991, 7920 Norfolk Avenue, Bethesda, MD - The Working Group will review, discuss and make recommendations regarding the soil clean-up criteria and acceptable levels for unrestricted use of contaminated sites that have been, or were at one time, under AEC or NRC license. The NRC staff is in the process of determining acceptable radionuclide concentrations for uranium- and thorium-contaminated soils and surface level contamination limits for structures to be released for unrestricted use.

Long-Term Climate Change in the Area of the Southern Basin and Range, November 19, 1991, 7920 Norfolk Avenue, Bethesda, MD - The Working Group will review and discuss potential long-term climate changes and their impact on performance assessments of a proposed HLW repository.

Post-Closure Monitoring, November 22, 1991, 7920 Norfolk Avenue, Bethesda, MD - The Working Group will review the potential

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problems and possible limitations associated with the post-closure monitoring of a proposed HLW repository. The potential utilization of non-invasive methods in providing such a capability as well as the duration of such monitoring, and the significance and impact of the results will also be considered.

Presence of Natural Resources at the Proposed HLW site, December 17, 1991, 7920 Norfolk Avenue, Bethesda, MD - The Working Group will discuss methodologies for the assessment of the potential for natural resources at the proposed HLW disposal site.



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June 27, 1991

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

Dear Chairman Carr:

**SUBJECT: COMMENTS REGARDING 10 CFR PART 61 PROPOSED REVISIONS
 RELATED TO GROUNDWATER PROTECTION**

In a report dated September 6, 1990, the Advisory Committee on Nuclear Waste (ACNW) urged that the revised technical position on the waste form be published, and stated that the Committee had several additional concerns, including the need to revise Part 61 to show more direct emphasis on the resistance of low-level waste (LLW) forms to leaching by groundwater. The report also called attention to the effects of aging on the waste and the consequent changes in chemical and physical properties. These concerns were focused on the question of groundwater protection.

In a Staff Requirements Memorandum (SRM) of December 31, 1990, the Commission requested that we specify our current position on the need to revise 10 CFR Part 61 and justify our position by an evaluation of the efficacy of the existing Part 61 in meeting our concerns. In a subsequent SRM dated April 18, 1991, the Commission indicated the response date was postponed until June 28, 1991, so that we could study this subject further.

We have discussed with representatives of the Office of Nuclear Material Safety and Safeguards (NMSS) and the Office of Nuclear Regulatory Research (RES) the general topic of groundwater protection as reflected in NRC regulations and the related regulatory background. The staff noted the history and experiences of the six licensed LLW disposal facilities, particularly as related to the migration of radioactive elements into and with the groundwater. The staff considered this experience in developing Part 61, and the environmental impact statement for that regulation clearly demonstrates that groundwater migration is the most significant radionuclide pathway to the environment.

We approve of the recently initiated effort by NMSS to develop a specific regulatory guide for the performance assessment of LLW disposal facilities. During the development of this regulatory guide, we expect that additional insight into issues such as groundwater protection will be garnered by the staff and, through such a mechanism, transferred to the LLW disposal facility developers. We tentatively plan to schedule a Working Group

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meeting to discuss, among other related topics, the modeling and performance assessment of LLW disposal facilities. Staff progress on the development of this regulatory guide will be included in the agenda for this meeting, and we plan at that time to explore further the role of groundwater protection provisions.

During our 32nd meeting we heard a presentation on the May 23, 1991 "brainstorming" session involving NMSS, RES and several contractors. In this session, the participants explored options that might be used to improve radionuclide retention in, or to retard radionuclide migration from, low-level radioactive waste. We are interested in the technical evaluations associated with these activities and intend to follow their evolution.

We are mindful of the staff's response to our discussions of last September, we appreciate the cooperation of the staff in its endeavors to better understand the relevant issues, and we look forward to continuing the dialogue on relevant major technical issues and developments.

On the basis of these interactions, we have concluded that we can set aside our suggestion that Part 61 be revised to explicitly include a requirement for waste performance that enhances groundwater protection. We plan to provide periodic reports to you concerning progress made on this matter.

Sincerely,



Dade W. Moeller
Chairman



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June 27, 1991

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

Dear Chairman Carr:

**SUBJECT: RESPONSE TO QUESTIONS ACCOMPANYING WORKING DRAFT #3 OF
 THE EPA STANDARDS**

Draft #3 of the proposed Environmental Protection Agency (EPA) Standards for the management and disposal of spent nuclear fuel, high-level and transuranic radioactive wastes includes six questions. With the thought that our comments would be helpful, we have prepared the following summary responses to each of these questions.

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 limit and a 10 millirems/year ede limit. Which is the more appropriate choice and why?

Response:

The question, as phrased, refers to "maximum" exposures to "individuals." Because radionuclide releases from a high-level waste (HLW) repository, if they occur, could continue for a number of years, we have responded to the question in the sense of what would be the maximum acceptable annual exposure (dose) to members of the public over an extended period of time, in contrast to what might be considered an acceptable maximum exposure over a single year. This is in accord with the approach taken by both the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP).

In a similar manner, we assume that by maximum exposures to "individuals," the EPA means maximum exposures to a "critical population group," following the approach recommended by the ICRP. With those caveats, our response follows.

We believe an effective dose rate limit of 0.10 mSv (10 mrem) per year is more appropriate for several reasons:

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1. Recent evaluations indicate that the biological effects of ionizing radiation may be higher than previously estimated.
2. The population in question may be exposed to more than one radiation source.
3. A fraction of the current dose limit should be reserved for potential future radiation sources.
4. Radionuclide releases from a repository, if they occur, could continue over a long period.

Such a dose rate limit would also be consistent with the recommendations of international organizations such as the ICRP, the International Atomic Energy Agency, and as noted in the 1989 report prepared by the radiation protection and nuclear safety authorities of Denmark, Finland, Iceland, Norway and Sweden (commonly referred to as the "Nordic" Study).

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?

Response:

We recognize that the specification of the 10,000-year time limit is somewhat arbitrary. It is important that significant geologic or climatic changes do not occur in the near-term period following the 10,000-year limit. We also agree that many geologic and climatic events that may affect the evaluation of site performance can be meaningfully extended beyond 10,000 years. In these cases, such an extension could provide information that would be useful for comparing the relative merits of several potential repository sites. In general, however, and particularly in the evaluation of the merits of a single site, the uncertainties involved in such an extension would make the value of the associated assessments questionable. It is important to note that, although evaluations of site performance may be quantitative, the results are subject to interpretation.

Question 3:

Two options are presented in Section 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?

Response:

Title 10 Part 60 of the NRC regulations specifies that containment of the radionuclides within the waste be substantially complete for a period not less than 300 years nor more than 1,000 years. This constraint, coupled with other requirements, including the stipulation that the groundwater travel time to the accessible environment be at least 1,000 years, is designed to ensure that protection of the individual and the groundwater will extend well beyond 1,000 years.

When one also considers the fact that, after only a few thousand years of decay, the health hazards of the high-level wastes will be no greater than that of the original unmined uranium ore, it becomes readily apparent that it should be possible to ensure individual and groundwater protection for a duration of 10,000 years. We therefore endorse the extension of this time period. Such an extension would also make this requirement compatible with the limitation on health effects resulting from an HLW repository.

Question 4:

In Subpart C the Agency proposes to prevent degradation of "underground sources of drinking water" beyond the concentrations found in 40 CFR Part 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?

Response:

We agree that pollution of "underground sources of drinking water" should not be permitted beyond the limits specified in the National Primary Drinking Water Regulations. We believe that a no-degradation requirement for certain large volume aquifers, that represent major long-term existing or potential drinking water sources, may represent undue stringency. A preferred approach would be to reject as potential sites for the storage or disposal of high-level radioactive wastes those land areas which, if contaminated, could have the potential for polluting such aquifers. However, the volume and present value of an aquifer should not be the sole criteria for identifying those that should be protected. Other criteria may become significant with the passage of time.

At the same time, 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 for members of the public. Even considering the more restrictive limit for an HLW repository (as suggested in our response to Question 1 above), 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 a degree of stringency, especially because the primary pathway for public exposures from such facilities is through drinking water.

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?

Response:

The number of curies of transuranic waste that would be comparable to 1,000 MTHM of spent fuel ranges from 1 to 6 million curies, depending on when the assessment is made. Accordingly, we believe that it would be reasonable to adopt the 3 million curie option.

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.

Response:

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).

In commenting on this subject previously, we have noted the following:

- a. The total inventory of carbon-14 in a repository containing 100,000 MTHM is estimated to be about 100,000

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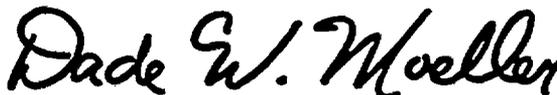
curies. This compares to a global production of carbon-14 by cosmic radiation of 28,000 curies per year, a global inventory of about 230 million curies, and an atmospheric inventory of 4 million curies. In fact, release of all of the carbon-14 inventory in a repository would increase the atmospheric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

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

At the time the EPA Standards were developed, considerations were limited to evaluations of a saturated site. In such a case, water transport and geochemical barriers would have been strongly influential in retaining the carbon-14. Subsequent consideration of Yucca Mountain (an unsaturated site) makes the existing EPA Standards inappropriate. We believe the limit for carbon-14 as specified in the proposed Standards should be relaxed. For additional discussion on this topic, we refer you to the transcript and minutes of the Advisory Committee on Nuclear Waste Working Group meeting held on March 19, 1991.

We trust these comments will be helpful. If appropriate, we request that you forward them to Mr. Floyd L. Galpin of the U.S. Environmental Protection Agency.

Sincerely,



Dade W. Moeller
Chairman

Reference

EPA, 40 CFR 191 - Draft Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes, dated April 26, 1991, with attachments.