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

April 10, 1991

MEMORANDUM FOR: James M. Taylor  
Executive Director for Operations

FROM: *Raymond F. Fraley*  
Raymond F. Fraley  
Executive Director, ACNW

SUBJECT: 29TH 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 29th ACNW meeting, March 20-22, 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
- R. M. Bernero, NMSS
- T. E. Murley, NRR
- E. S. Beckjord, RES
- A. L. Eiss, NMSS
- H. Pastis, NRR
- M. Weber, OCM/KC
- M. V. Federline, OCM/KC
- S. Bilhorn, OCM/KR
- J. Kotra, OCM/JC
- R. R. Boyle, OCM/FR

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SUMMARY OF ACTIONS, AGREEMENTS, ASSIGNMENTS, AND REQUESTS  
29TH ACNW MEETING - MARCH 20-22, 1991

REPORT AND MEMORANDUM

- Staff Technical Position on "Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility" (Memorandum to Mr. Robert Bernero, Director, Office of Nuclear Material Safety and Safeguards, dated March 26, 1991. See attachment 1 [meeting transcript is not included].)
- Stringency of U.S. Environmental Protection Agency High-Level Radioactive Waste Repository Standards (Report to Chairman Carr, dated January 29, 1991, was reissued on March 27, 1991. See attachment 2.)

HIGHLIGHTS OF MATTERS CONSIDERED BY THE COMMITTEE

1. Staff Technical Position (STP) on "Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility" (ESF)

The Committee was briefed by representatives of the NRC staff on the draft final version of the STP on "Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility." The purpose of the STP is to provide guidance to the U.S. Department of Energy (DOE) on ESF design and construction.

During the discussion regarding the NRC staff's draft review plan for reviewing the DOE ESF Alternative Study, Dr. Hinze requested that the Committee be kept informed on the staff's activities and be provided copies of the NRC draft review plan, when available.

2. NRC Oversight and Monitoring of Existing Low-Level Waste Disposal Facilities through the Agreement State Program

The Committee was briefed by representatives of the Office of Governmental and Public Affairs (GPA) on NRC oversight and monitoring of existing LLW disposal facilities through the Agreement State Program.

Mr. Harold Denton noted that NRC is conducting its biannual review of South Carolina's Agreement State program, including the LLW site at Barnwell. Drs. Hinze and Pomeroy expressed interest in meeting with the inspection team upon their return to discuss certain issues, such as groundwater protection, and explore issues for a possible Working Group meeting on LLW

site monitoring activities. A meeting is planned in May, 1991.

During the discussion on 10 CFR Part 20 requirements and abnormal occurrence reports (AOR), Dr. Moeller asked why it appears that the bulk of AORs are coming from the non-Agreement States. Mr. Denton offered to review the statistics and respond.

During the discussion on the state inspection programs, Mr. Carlton Kammerer offered to provide the Committee with several reviews of the state programs, including two General Accounting Office studies, two NRC studies, and a study by the National Governor's Association.

3. Meeting with the NRC Commissioners

The Committee met with the Commissioners to discuss items of mutual interest, including:

Regulation of mixed wastes  
Guidance on dose limits and risks to individuals  
Stringency of EPA high-level waste repository standards  
Part 60.113 Subsystem Performance Criteria

Chairman Carr observed that there was an inconsistency in the ACNW report (page 2) on stringency of the EPA HLW repository standards, dated January 29, 1991. The Committee agreed to correct and reissue the report. [The revised ACNW report was reissued on March 27, 1991.]

Dr. Steindler reported that the Committee has begun to gather technical information on whether there exists a need for a revision of 10 CFR Part 61, pertaining to the leaching resistance of the LLW form, in response to a staff requirements memorandum, dated December 31, 1990. The Commission concurred in the ACNW request that the due date be postponed until the Committee has sufficiently studied the merits of including groundwater protection requirements in 10 CFR Part 61. [SECY suspense date is changed to June 28, 1991.]

The Commission requested that the Committee conduct a thorough analysis of benefits of the individual dose limit approach compared to the release limit approach. [SECY suspense date is July 12, 1991.] The Commission has also requested that the NRC staff analyze the benefits of using each approach (collective dose and individual dose) to determine the risks posed to public health and safety of a release from a waste repository.

Chairman Carr urged the Committee to focus on the NRC's ability to implement the EPA standards rather than whether the standards are achievable at a given site.

4. Leaching Resistance of Waste Form

The Committee considered a response to a recent Staff Requirements Memorandum (SRM) concerning revising Part 61 with regards to leaching resistance of the LLW form. The representatives from the Division of Low-Level Waste Management and Decommissioning (LLWM) informed the Committee that they have met with the Office of Research to formulate plans to examine this issue. The Committee requested that it be kept informed of these plans.

Based on the discussion, the Committee concluded that, at this time, there is no compelling need to initiate revisions to Part 61 to explicitly include a requirement for waste performance that enhances groundwater protection. However, the Committee believes that groundwater protection remains an issue of sufficient importance to warrant further study.

Dr. Steindler is pursuing this issue by requesting additional background information on safeguards already in the regulatory system which provide protection against the potential for groundwater contamination from LLW disposal sites. This study will be conducted with all deliberate speed. Recommendations will be offered to the Commission upon completion.

5. Clarification of NRC Regulations

The Committee discussed a draft ACNW report regarding clarification of specific NRC requirements for monitoring a HLW repository after closure. The Committee agreed to invite representatives from EPA and NRC to brief the Committee on various aspects associated with post-closure monitoring and other related issues.

6. ACNW Future Activities

- The Committee agreed to change the date for the 32nd ACNW meeting from June 19-21 to June 20 (one day only). The Committee is tentatively scheduled to meet with the Commissioners on June 20, 1991. (A Working Group on the Use of Expert Judgment in Performance Assessment will meet on June 18-19, 1991.)
- The Committee was advised that its visit to the Center for Nuclear Waste Regulatory Analyses (CNWRA) in San

Antonio, Texas, has been set for June 26-28, 1991. The Committee will be briefed on the status of the Systematic Regulatory Analysis program and will receive an update on other activities of the Center, such as PRA computer codes and tectonic modelling. The Committee will further define areas of interest during the 30th ACNW meeting. The Committee decided not to visit with Texas LLW officials at this time.

- The Committee agreed to schedule a Working Group meeting on the monitoring activities at LLW disposal facilities, particularly the closed sites at Maxey Flats, Sheffield and West Valley. Representatives of the GPA staff offered assistance.
- Dr. Pomeroy offered to investigate further the merits of being briefed on the DOE military nuclear waste disposal program aside from WIPP. The Committee approved.
- Dr. Pomeroy will visit the West Valley Demonstration Project site on or about June 3-4, 1991.
- The Committee agreed to schedule a Working Group meeting at the Waste Isolation Pilot Plant site. Possible subjects for discussion may include mineral exploration and human intrusion.
- The Committee agreed not to review SECY-90-268, "Proposed Final Environmental Protection Agency Title I Ground-Water Protection Standards."
- The Committee confirmed plans to invite Dr. William E. Kennedy, Pacific Northwest Laboratories, to summarize his work published in NUREG/CR-5512. The report discusses the establishment of contamination limits for residual "radioactivity."

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

30th ACNW Committee Meeting April 23-24, 1991 (Tentative Agenda)

Staff Technical Position on the High-Level Waste Repository Design for Thermal Loads - The Committee will review and comment on a draft NRC Staff Technical Position on the High-Level Waste Repository Design for Thermal Loads.

Individual vs. Collective Doses - In response to a staff requirements memorandum, the Committee will discuss the advantages and disadvantages of using collective dose criteria versus individual dose criteria when determining risk posed to the public health and safety from a potential release from a HLW repository.

Uncertainties in Implementing the EPA's HLW Radiation Protection Standard - The Committee will be briefed on the HLWM staff's approach to dealing with uncertainties in implementing the EPA's HLW radiation protection standard, 40 CFR Part 191. This briefing is for information only.

Decommissioning Activities - The Committee will be briefed on decommissioning activities at selected (non-reactor) sites to be determined. This briefing is for information only.

Human Intrusion - The Committee will discuss ongoing projects concerning human intrusion for a HLW repository.

Leaching Resistance of Waste Form - The Committee will continue to discuss its response to a recent staff requirements memorandum regarding a revision of 10 CFR Part 61 relative to attention to leaching resistance of the low-level waste form.

ACNW Four-Month Plan - The Committee will prepare its next four-month plan to the Commission for the period May-August 1991.

Working Group Report - The Committee will hear a report from its Working Group on the integration of geophysics into site characterization of a HLW repository.

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**

Integration of Geophysics into Site Characterization of a High-Level Waste Repository April 22, 1991, 7920 Norfolk Avenue, Bethesda, MD, 8:30 a.m., Room P-110 - The Working Group will focus on the role of geophysical testing in the characterization of a HLW repository site. The Working Group will discuss the importance and advantage of and potential results from geophysical testing methods as those methods apply to identification of potentially adverse conditions at an HLW site.

Expert Judgment in Performance Assessment of a Geologic Repository June 18-19, 1991, 7920 Norfolk Avenue, Bethesda, MD, 8:30 a.m., Room P-110 - The Working Group will continue the examination of methods for eliciting expert judgment. The meeting will focus on the actual mechanics of elicitation. This includes questions on who will identify and select the experts, as well as how the selected experts are trained and how their opinions are aggregated. Human intrusion will serve as the reference example in relating the elicitation process to a real and useful application. Participants will include normative experts, as well as NRC and DOE staff and consultants involved with Yucca Mountain and WIPP.

Geologic Dating (Date to be determined) - 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 a HLW repository.



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

March 26, 1991

Mr. Robert M. Bernero, Director  
Office of Nuclear Material  
Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Bernero:

**SUBJECT: STAFF TECHNICAL POSITION ON REGULATORY CONSIDERATIONS  
IN THE DESIGN AND CONSTRUCTION OF THE EXPLORATORY SHAFT  
FACILITY**

During the 29th meeting of the Advisory Committee on Nuclear Waste (ACNW), March 20-22, 1991, the staff of the Office of Nuclear Material Safety and Safeguards (NMSS) presented its revised Staff Technical Position (STP) on Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility (ESF). We find this revised STP greatly improved. We recommend that it be issued after incorporation of additional minor revisions discussed by the ACNW with the NMSS staff.

We believe the STP needs a clear introductory statement that the singular purpose of the ESF is to facilitate the characterization of the proposed high-level waste repository. However, the STP should then focus on the requirements as stated in 10 CFR 60.15(c)(1), "Investigations to obtain the required information [on site characterization] shall be conducted in such a manner as to limit adverse effects on the long-term performance of the geologic repository to the extent practical." We also recommend that the staff issue a clarification, either in this STP or as a staff position, of the phrase "to the extent practical." Furthermore, we urge that the staff include an additional statement that the principal focus of this STP is the need for the U.S. Department of Energy (DOE) to demonstrate that an approach has been used to design and construct the ESF that will avoid adverse impacts on the site should the ESF be collocated with the geologic repository operations area.

Several other revisions suggested during our discussions with the NMSS staff include removal of wording in the STP that could be considered as adversarial, modification of the flow chart presented in Figure 1, and expansion of item (7) (Establishment of Ranges of Site Parameters) of section 3. A copy of the transcript of this portion of our meeting is enclosed.

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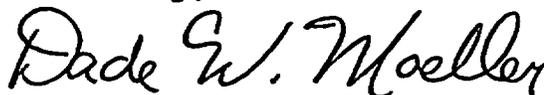
Mr. Robert M. Bernero

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March 26, 1991

Finally, as with most of the technical positions that the staff has presented to the ACNW, it is difficult to ascertain how this STP fits into the overall plan for providing guidance to DOE on site characterization. We request that the staff brief the ACNW on what other technical positions are planned and how they will be integrated.

Sincerely,



Dade W. Moeller  
Chairman

Reference:

U.S. Nuclear Regulatory Commission, "Staff Technical Position on Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility," February 1991, transmitted by memorandum from B. J. Youngblood, NMSS, dated February 25, 1991

Enclosure:

Transcript of 29th ACNW Meeting,  
March 20, 1991, pp. 9-125

REVISED: 3/27/91



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

January 29, 1991

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

Dear Chairman Carr:

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

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

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

1. Comparison of a Repository to a Natural Ore Body

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

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

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

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

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

## 2. Limits for Individual Radionuclide Releases

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

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

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

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

### 3. Release Limit for Carbon-14

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

- a. The total inventory of carbon-14 in a repository containing 100,000 MTHM is estimated to be about 100,000 curies. This compares to a global production of carbon-14 by cosmic radiation of 28,000 curies per year, a global inventory of about 230 million curies, and an atmospheric inventory of 4 million curies (Reference 4). In fact, release of all of the carbon-14 inventory in a repository would increase the atmospheric inventory by only about 2 percent; this compares to natural variations in the atmospheric inventory of 10 percent to 40 percent.
- b. Based on an assumed inventory of 100,000 MTHM, the permissible rate of release of carbon-14 from a repository would be about 1 curie per year. Experience shows that any carbon-14 that is released would rapidly mix in the atmosphere, and estimates are that the accompanying dose rate to a person on top of Yucca Mountain would be far less than 0.01 mSv (1 mrem) per year. It is also interesting to note that the limit on the release rate of 1 curie per year for a repository compares to an average release rate of 10 curies per year from a typical 1,000 MWe light water reactor (Reference 4).

At the time the EPA standards were developed, considerations were limited to evaluations of a saturated site. In such a case, water transport and geochemical barriers would have been strongly influential in retaining the carbon-14. Subsequent

January 29, 1991

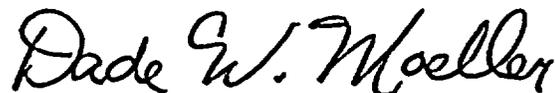
consideration of Yucca Mountain (an unsaturated site) makes the existing EPA standards inappropriate, overly stringent, and in need of revision.

4. Indoor Radon

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

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

Sincerely,



Dade W. Moeller  
Chairman

References:

1. U.S. Code of Federal Regulations, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," 40 CFR Part 191.
2. U.S. Environmental Protection Agency, EPA 520/3-80-009, "Population Risks from Uranium Ore Bodies," October 1980.
3. National Council on Radiation Protection and Measurements, Report No. 91, "Recommendations on Limits for Exposure to Ionizing Radiation," 1987.
4. National Council on Radiation Protection and Measurements, Report No. 81, "Carbon-14 in the Environment," 1985.