



UNITED STATES  
**NUCLEAR REGULATORY COMMISSION**  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555-0001

August 12, 1999

The Honorable Greta Joy Dicus  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

SUBJECT: SUMMARY — 110TH MEETING OF THE ADVISORY COMMITTEE ON NUCLEAR WASTE, JUNE 28–30, 1999, AND OTHER RELATED COMMITTEE ACTIVITIES

Dear Chairman Dicus:

During its 110<sup>th</sup> meeting on June 28–30, 1999, at the Center for Nuclear Waste Regulatory Analyses (CNWRA or the Center), Southwest Research Institute, 6220 Culebra Road, Building 189, San Antonio, Texas, the Advisory Committee on Nuclear Waste (ACNW or the Committee) discussed the following 12 issues.

**HIGHLIGHTS OF KEY ISSUES CONSIDERED BY THE COMMITTEE**

1. **Developing the NRC/CNWRA Review Capability**

Dr. Wes Patrick, President of CNWRA, outlined the Center's organization and staffing, its capabilities, and its approach to problemsolving.

He stressed that the focus of the Center is explicitly on the NRC mission, complementing the technical capabilities of the NRC staff. When necessary, external expertise is obtained. The potential roles for external experts were noted, as were the possible constraints on their use. Since the use of outside expertise was one of the areas commented upon by the ACNW, Dr. Patrick purposefully indicated that currently, approximately one-quarter of the work performed by the CNWRA is accomplished by outside experts thereby doubling the former utilization percentage for outside experts.

Dr. Patrick discussed the CNWRA's four-pronged approach to problem solving, its approach to systems analysis, and its laboratory, modeling, and computing facilities.

Dr. Garrick thanked Dr. Patrick for his insights but noted that he still had difficulty in understanding, from a scientific/technical perspective, the difference between technical assistance (TA) activities and those classed as "research." The answer given was that within the NRC, if the work was site specific and short term (1 to 3 years) it was considered a TA activity.

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### **Conclusions/Action Items**

The Committee continues to believe that the use of outside experts is important and appreciates the strides the CNWRA has made in this regard.

#### **2. Risk Informing the Planning and Prioritizing Process**

Mr. William Reamer, Branch Chief in the Office of Nuclear Material Safety and Safeguards (NMSS), after noting relevant past Committee recommendations, discussed the factors influencing the establishment of the priorities and the general process utilized in determining priorities and allocating resources.

He presented, in some level of detail, the four-step prioritization process used by the staff. As an example as to how the process works, he showed how efforts related to the Repository Design and Thermal-Mechanical Effects (RDTME) key technical issue (KTI) have evolved from Fiscal Year (FY) 1996 to FY 2000 with regard to priority assigned, funding, and associated activities.

In his concluding remarks, Mr. Reamer stated that although the prioritizing process is based on many factors, it must also be able to respond to a multiplicity of potential changes. His three related goals are to finalize 10 CFR Part 63, a risk-informed rule; to develop and use a risk-informed, performance-based Yucca Mountain Review Plan (YMRP); and to maintain and use performance assessment (PA) tools.

The Committee questioned the staff as to how it intended to handle the stated engineering challenges, noting that these challenges were indeed significant. Dr. Timothy McCartin stated that because of the associated uncertainties, the staff's approach must be conservative without being overly so.

### **Conclusions/Action Items**

The Committee noted that 10 CFR Part 63, the YMRP, and PA-related issues have been designated by the ACNW as high-priority issues and, as such, will be closely followed.

#### **3. Program Overview—Progress Toward KTI Resolution**

Dr. Budhi Sagar, Technical Director at the CNWRA, presented an introductory overview of the high-level waste (HLW) program. This session, as well as all other presentations, was interactively tied in by way of video teleconferencing capability, with both NRC Headquarters in Bethesda, Maryland, and a Department of Energy (DOE) conference room in Las Vegas, Nevada. Dr. Sagar noted that in addition to addressing the capabilities of the Center, presentations would also address some of the Center-related comments made by the ACNW in various reports and letters. At the very least, it was intended that the concerns expressed by the Committee and the Center's approach to those concerns be mutually understood.

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Dr. Sagar briefly discussed the following topics:

1. Key HLW program milestones
2. The overall approach to achieving the milestones
3. The strategy for resolving the KTIs
4. The purpose/role, content, and status of the Issue Resolution Status Reports (IRSRs) and the status of the staff-level resolution of the KTIs, including a discussion of some of the major difficulties in issue resolution.

After discussing the viability assessment review process, the status of the total system performance assessment (TPA) and auxiliary codes, and after providing a draft outline of the YMRP, Dr. Sagar outlined several future activities. The Committee was particularly interested in these activities and queried both staff and Center representatives as to the approach they intended to take with each of these activities.

#### **Conclusions/Action Items**

The Committee will continue to follow closely the next step in the IRSR development, as well as the development of the YMRP. Upon conclusion of its visit to the Center, the Committee noted that the trip was extremely productive from the perspective of a detailed technical information exchange. ACNW members further noted that the interactions possible through the video teleconferencing system were indeed constructive. Furthermore, misconceptions on the part of any of the parties involved could be immediately noted and corrected.

#### 4. **Evaluating and Explaining Contributions to Risk**

The NRC and CNWRA staffs briefed the Committee on a variety of methods that they employ in the repository performance assessment to identify parameters and models that contribute the most to risk. Dr. Sagar presented an overview of the different approaches and the rationale for the ranking of parameters, events, processes, and components and/or subsystems. Dr. Richard Codell, NMSS, discussed system-level sensitivity studies and alternative conceptual models evaluated using the NRC's TPA 3.2 code. He described the basic approach to sensitivity analysis and described different methods used. Dr. Codell also discussed the analysis and results of evaluating alternative conceptual models. The results showed the importance of assumptions about waste form dissolution, cladding performance, and wetting models. Dr. Gordon Wittmeyer, CNWRA, discussed the Center's Parameter Tree Method that is being developed to help identify the most important combinations of parameters to performance. Dr. Norman Eisenberg, NMSS, discussed the importance analysis methodology that the staff has developed to identify the most important parameters to system performance.

**Conclusions/Action Items**

The Committee will continue to follow the staff's development of different methods for analyzing uncertainty, sensitivity, and importance of PA parameters and models.

5. **Investigating the Risk Contribution of Igneous Activity**

The CNWRA staff presented an overview of the status of the igneous activity KT1. Topics covered included risk insights from PA, technical bases and uncertainties, evaluation of conservatism in risk estimates, and remaining work. The staff reported that the expected annual dose from volcanism is around 1 mrem/yr, which is the largest contribution to overall dose. This estimate is supported by direct data, realistic interpretations, and conservative evaluations of complex processes. Work is underway to reduce large uncertainties that may affect the risk estimate by an order of magnitude.

**Conclusions/Action Items**

The Committee plans to write a letter to the Commission next winter on the overall HLW research program.

6. **Repository Design and Thermal-Mechanical Effects**

Dr. Mysore Nataraja, NMSS, and Dr. Simon Hsuing, CNWRA, shared the presentation on this topic. Their presentation addressed such items as the following:

1. principal subissues associated with the preclosure design of the repository,
2. use of an integrated safety analysis (ISA) for assessing preclosure performance compliance,
3. thermal-mechanical effects on postclosure performance and risk insights gained from PA (the dose contribution from rockfall was provided as an example).
4. plans to evaluate the selected DOE (of the five evaluated) enhanced design alternatives, and
5. "path forward" (which includes more focus on preclosure safety concerns).

The Committee had several questions regarding the ISA. The staff noted that it was necessary to develop the capability to apply ISA in the regulatory framework and that it was its intention to incorporate ISA in the YMRP. In light of its interest in the topic, the staff proposed, and the Committee agreed, to discuss the ISA early in calendar year 2000.

Dr. McCartin, NMSS, discussed a question concerning the likelihood of increased difficulty in monitoring the repository during preclosure as a result of the new DOE design and noted that the proposed 10 CFR Part 63 requires preclosure and postclosure monitoring of the repository.

**Conclusions/Action Items**

The Committee will follow closely the ISA development and was pleased to note the increased emphasis on the preclosure period.

**7. Thermal Effects on Flow**

The CNWRA staff presented an overview of ongoing modeling studies and experiments designed to evaluate the thermal effects on flow (TEF). Topics covered include risk insights from PA, abstraction of TEF into the NRC TPA code, results of sensitivity analysis, objectives of tests and comparison of results with DOE, proposed DOE design modifications, progress to date, and the path forward. The CNWRA has completed two experiments designed to test theories of reflux shedding, penetration of the boiling isotherm, and DOE instrumentation in the drift scale heater test (DST). The CNWRA is beginning a third experiment designed to test the corrosion potential of the drift environment. Some results of the laboratory heater test indicate that reflux was not detected using thermocouples, which are being used by DOE in the DST; reflux into drift was observed using drip sensors; a muddy residue was deposited in drift during heating; post-test saturation indicated dry-out zones; and both the DOE's DST and CNWRA laboratory scale heater test indicate highly concentrated water above the heater drift. The future goals of the TEF KTIs are to assess thermal effects for the new repository design, to determine the time and flux of water arrival at the waste package, to scrutinize key assumptions in the DOE TPA, to continue sensitivity calculations to identify critical heat and mass transfer mechanisms important to repository performance, and to continue to update the IRSR.

**Conclusions/Action Items**

The Committee will continue to follow further developments.

**8. Evolution of the Near-Field Environment**

Dr. William Murphy, CNWRA, briefed the Committee on work in the Evolution of the Near-Field Environment (ENFE) KTI. He presented information on coupled thermal-hydro-chemical processes in the near field, the technical basis for NRC's review of DOE's work, risk insights gained from PA and sensitivity analyses, and the impacts of DOE design changes on staff efforts in this KTI. He also discussed staff accomplishments, including revisions to the ENFE IRSR, and planned work.

**Conclusions/Action Items**

The Committee will continue to follow the staff's work on coupled processes in the near field, revisions to the IRSR, improvements in source term models, and resolution of specific subissues.

**9. Laboratory Visits and Discussions**

The Committee visited four principal laboratory areas and met with the principal investigators.

**Conclusions/Action Items**

The face-to-face discussions with the appropriate Center technical specialists, coupled with the tour of applicable research facilities, were most beneficial.

**10. Container Life and Source Term**

Staff members from the NRC and CNWRA presented information to the Committee on work in the Container Life and Source Term (CLST) KTI. These presentations included risk insights, the technical bases for the staff's positions, progress for ongoing studies, and planned activities. Dr. Tae Ahn, NMSS, discussed waste form studies aimed at the better understanding of spent fuel degradation, cladding performance, and the degradation of HLW glass waste forms. He summarized some of the main results, including the sensitivity of dose to cladding performance and realistic waste form dissolution models. He also described future work on uncertainties in this KTI, and planned tests of HLW glass and cladding performance. Dr. Gustavo Cragnolino, CNWRA, discussed waste package performance, particularly emphasizing on corrosion data and models for candidate waste package materials. He also discussed the need for a solid technical basis for estimating the number of initial waste package failures. Dr. Cragnolino described in detail the important parameters and methods for evaluating waste package corrosion and the impact of different container alloys on waste package lifetimes. He also discussed the progress in issue resolution for the CLST KTI and the path forward.

**Conclusions/Action Items**

The Committee will continue to follow the staff's work on the CLST KTI, revisions to the CLST IRSR, and resolution of specific subissues.

**11. DEIS Review Guidance (including transportation)**

Mr. Michael Lee, NMSS, provided an overview of the documents directing DOE to prepare an Environmental Impact Statement (EIS) for the proposed repository at Yucca Mountain and the NRC's role in that review. He indicated that since the NRC had not yet seen any sections of the DOE draft EIS (DEIS), his presentation would be somewhat limited.

He discussed the requirements of the Nuclear Waste Policy Act (NWPA) of 1982, as amended, during his presentation, and in response to questions, also discussed related aspects of the National Environment Policy Act and the guidelines of the Council of Environmental Quality.

The NWPA requires that NRC's comments on the EIS accompany any DOE site recommendation. NRC's regulations also require that before DOE is given a license to construct and operate a geologic repository, in addition to other required documentation, an EIS must be provided. The NWPA does not require DOE to consider other alternative sites, only design alternatives.

DOE's current schedule is to issue the DEIS for comment on July 30, 1999, with a 90-day comment period. It is understood that the State of Nevada has asked for an extension of that period and it is possible that other stakeholders will also request an extension. The staff intends to comment on radiological health and safety issues, spent nuclear fuel transportation safety issues, and any other issues that might be considered during a judicial review.

### **Conclusions/Action Items**

In light of the current schedule (a relatively compressed public comment period), the Committee intends to

1. Hear a presentation on DOE's plans for the DEIS at the 111<sup>th</sup> meeting of the ACNW.
2. Attend (if its schedule permits) one of the 14 DOE scheduled public briefing/comment sessions (currently to be held in various cities during August, September, and early October 1999).
3. Hear the NRC staff's comments on the DEIS during the 112<sup>th</sup> meeting of the ACNW.
4. Briefing by the DOE on the public comments it has received.
5. Develop its own comments in its areas of expertise recognizing that the final DEIS, which the NRC is to "adopt," is still several years away from promulgation.

### 12. **Defense in Depth (the Multiple Barriers Approach)**

The staff summarized its proposed strategy for clarifying defense-in-depth (DID) requirements in the proposed 10 CFR Part 63 regulation for HLW disposal at Yucca Mountain. The staff described the underlying bases for implementing DID, how it will clarify its expectations for demonstrating multiple barriers, when and how clarifications may be made available to stakeholders, and the schedule for planned activities. The staff also described the DID philosophy in the proposed 10 CFR Part 63, including the definition of the DID concept in the NRC's Risk-Informed, Performance-Based Regulation white paper; requirements in 10 CFR Part 63, including multiple barriers; and possible quantitative approaches for demonstrating DID. The Committee indicated that the staff was moving in the right direction and suggested that the focus of 10 CFR Part 63 should be on requiring multiple barriers rather than DID.

### **Conclusions/Action Items**

The ACNW will review the staff's final approach later this year.

### **PROPOSED SCHEDULE FOR THE 111<sup>th</sup> ACNW MEETING**

The Committee agreed to consider the following issues at its 111th meeting on July 19–21, 1999:

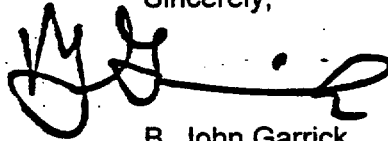
- **ACNW Planning and Procedures** — The Committee will be briefed by its staff on issues to be covered during this meeting. The Committee will also consider topics proposed for future consideration by the full Committee and Working Groups. The Committee will discuss ACNW-related activities of individual members.
- **Risk Communications** — The Committee will continue to prepare for sessions with the local stakeholders to be held this fall in the Las Vegas, Nevada, area.
- **Revised Design for the Proposed Yucca Mountain Repository** — Representatives from the DOE and its contractor will discuss the license application design selection process and describe the current final revised repository design.
- **Results of the Arthur Andersen Review of the Division of Waste Management Activities** — The Deputy Director of NMSS will discuss the results of recent strategic planning activities within the Division of Waste Management and their potential impact on ACNW activities.
- **DOE Presentation on the Draft Environmental Impact Statement (DEIS) for the Proposed Yucca Mountain Repository** — A DOE representative will discuss the scope of the DEIS and the review process, providing additional background information for the Committee's future comments once the document is made public.
- **Spent Fuel Project Office Briefing** — A representative of the Spent Fuel Project Office will present an update and overview of its activities. Also to be discussed is the relationship of current spent fuel transportation study initiatives to sites such as Yucca Mountain and the private fuel storage facility.
- **Meeting with the Director of the Division of Waste Management** — The Committee will meet informally with the Director of the Division of Waste Management to discuss items of mutual interest.
- **Preparation of ACNW Reports** — The Committee will discuss planned reports, including a white paper on Repository Design Issues at Yucca Mountain, a white paper on Near-Field Chemistry Issues, a joint ACRS/ACNW letter report on an NMSS approach to risk-informed, performance-based regulation in NMSS, and other topics discussed during this and previous meetings.



**OTHER RELATED ACTIVITIES OF THE COMMITTEE**

The 112th ACNW meeting has been scheduled for September 14 and 15, 1999.

Sincerely,

A handwritten signature in black ink, appearing to read 'B. John Garrick', written in a cursive style.

B. John Garrick  
Chairman