ACNWS-0118

January 5, 2001

The Honorable Richard A. Meserve
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Chairman Meserve:

SUBJECT: SUMMARY REPORT — 123RD MEETING OF THE ADVISORY COMMITTEE ON NUCLEAR WASTE ON NOVEMBER 27–29, 2000, AND OTHER RELATED COMMITTEE ACTIVITIES

During its 123rd meeting November 27–29, 2000, at the Center for Nuclear Waste Regulatory Analyses (CNWRA or Center), 6220 Culebra Road, Building 189, San Antonio, Texas, the Advisory Committee on Nuclear Waste (ACNW or Committee) discussed several matters and approved the following reports:

"Alloy C-22 Corrosion Studies" (Report to The Honorable Richard A. Meserve, Chairman, NRC, from B. John Garrick, Chairman, ACNW, December 6, 2000).

"Exemption in 10 CFR Part 40 for Materials Less Than 0.05 Percent Source Material — Options and Other Issues Concerning the Control of Source Material" (Report to The Honorable Richard A. Meserve, Chairman, NRC, from B. John Garrick, Chairman, ACNW, December 11, 2000).

HIGHLIGHTS OF KEY ISSUES CONSIDERED BY THE COMMITTEE

1. Planning and Procedures

The ACNW approved issues to be considered during the 124th ACNW meeting to be held on January 16–18, 2001. Topics to be discussed include the following:

- **Planning and Procedures** — The Chairman will open the meeting with a few brief remarks. The Committee will then review items under consideration at this meeting and consider topics proposed for future consideration by the full Committee.

- **Discuss Progress on ACNW's Sufficiency Review Application Task Action Plan** — The Committee will discuss the ACNW's task action plan (TAP), its approach to conducting a sufficiency review, and its progress on proposed vertical slices.

- **Meeting With the Director of the Division of Waste Management, Office of Nuclear Material Safety and Safeguards** — The Committee will meet with the Director of the Division of Waste Management, Office of Nuclear Material Safety and Safeguards (NMSS), to discuss items of mutual interest.

- **Entombment Option for Decommissioning Power Reactors** — The Committee will discuss, with cognizant NMSS staff, selected issues related to this topic (tentative).

- **Institutional Control Status** — The Committee will discuss with and hear a presentation by the NRC staff on the status of considerations regarding long-term custodial responsibilities for sites whose license is terminated under restricted release conditions.

- **National Research Council Report, "Long-Term Institutional Management of U.S. Department of Energy Legacy Waste Sites"** — The Committee will discuss with and hear a presentation by Dr. Thomas S. Leschine, Chairman of the Academy group that authored the report on the principal findings in that report.

- **ACNW 2001 Action Plan** — The Committee will review the ACNW 2000 Action Plan and discuss relevant changes for its 2001 Action Plan.

- **Preparation for Meeting With the NRC Commissioners** — The Committee will review its proposed presentations. The next meeting with the Commissioners is scheduled to be held March 22, 2001.

- **Discussion of Proposed ACNW Reports** — The Committee will discuss proposed ACNW reports on entombment, key technical issue (KTI) resolution, the NRC staff's progress on total performance assessment, its annual research report to the Commission, and other matters considered during this meeting.

2. Objectives of ACNW's Center for Nuclear Waste Regulatory Analyses Review

Dr. Garrick provided an overview of the ACNW's objectives for conducting the CNWRA review. The primary objective was to gather information to support its oversight of the NRC staff's sufficiency review of the DOE's site recommendation considerations report (SRCR). In addition, the Committee was gathering information to support its annual review to the Commission of the NRC's waste-related research and technical assistance program. Dr. Garrick iterated that the focus of the meeting would be on the staff's tools, guidance, and capability. The ACNW was interested in learning more about the staff's pre- and postclosure analysis tools and emerging risk insights being used to understand the risk significance of issues and to guide the NRC's issue resolution process. He commented that the Committee is also interested in how the technical information across the key technical issues (KTIs) and subissues is being integrated and abstracted into performance assessment (PA). Dr. Garrick concluded by indicating that the Committee expects to develop several products from this meeting. In the short term, the ACNW plans to write reports on (1) the staff's progress in the KTI issue resolution program and (2) the NRC's research and technical assistance program.

Conclusions/Action Items

During FY 2001, the Committee plans to write a report on the staff's sufficiency review of the DOE's SRCR, and one or more letters pertaining to the vertical slice reviews conducted by the ACNW.

3. Program Overview: Developing Review Capability and Risk Information for Pre-closure and Postclosure

Mr. Joseph Holonich, NMSS, presented an overview of the high-level waste (HLW) program, with emphasis on developing review capability and using risk information. Mr. Holonich addressed the NRC performance goals, the HLW program strategy, the HLW regulatory framework, the HLW review capability, the staff's sufficiency review, and the CNWRA facilities.

Conclusions/Action Items

The Committee made no conclusions or agreements following the presentation.

4. Progress Toward Key Technical Issue Resolution

The Committee heard presentations from and held discussions with representatives of the NRC staff regarding the relationship among issue resolution, Site Recommendation (SR) review, license application (LA), safety evaluation activities, overview of issue resolution process, and status of subissues of each KTI. The staff stated that subissue closure does not involve any compliance determinations which will be made during LA review. Sufficiency review is required to fulfill NRC obligations under the Nuclear Waste Policy Act. The NRC staff will provide preliminary comments on the sufficiency review of DOE's site characterization analyses and waste form disposal. Sufficiency review provides a progress report on the DOE's data and analyses.

The NRC staff also provided the progress and status toward KTI resolution. The issue resolution has been an ongoing focus staff activity for over ten years, with specific attention to KTIs since 1996.

Conclusions/Action Items

The Committee plans to write a letter report to the Commission during its 124th ACNW meeting, January 16–18, 2001.

5. Department of Energy Update on Progress in Issue Resolution

The Committee heard a presentation by and held a discussion with a representative of the DOE staff regarding the overview of issue resolution process and status of subissues of each KTI. Since August 2000, DOE and NRC have held 6 technical exchange meetings on KTIs in the areas of unsaturated and saturated flow under isothermal conditions, igneous activity, structural deformation and seismicity, and container life and source term. As of this date, of the 20

subissues discussed, 16 are now closed pending, 3 are closed, and 1 open. The remaining 18 subissues will be discussed in future DOE/NRC technical exchange meetings. These remaining KTIs are scheduled to be completed by February 2001.

Conclusions/Action Items

The Committee plans to write a letter report to the Commission during its 124th meeting.

6. ACNW's Sufficiency Review and Task Action Plan

The Committee members and its staff discussed the status of the ACNW's vertical slice approach for overseeing the NRC staff's sufficiency review of DOE's SRCR. Lynn Deering described the ACNW's revised approach for conducting a vertical slice review of the staff's issue resolution process and the DOE's SRCR. Instead of evaluating independently the DOE's SRCR documents, the ACNW plans to use a vertical slice approach for evaluating the staff's KTI issue resolution process, in addition to conducting a review of the staff's sufficiency comments on DOE's SRCR. The ACNW's objectives, purpose, and desired outcome for overseeing the staff's sufficiency review remain unchanged.

Ms. Deering described the general approach for conducting vertical slices. It was suggested and agreed upon that the ACNW strategy be expanded to allow for the ACNW to provide comments on the DOE's SRCR itself, if relevant insights are developed through the vertical slice process. The ACNW members discussed ideas for conducting their vertical slice reviews.

Conclusions/Action Items

It was agreed that Ms. Deering would develop a template to guide the reviews and provide a draft by December 15, 2000. The Committee members agreed to complete a draft of its vertical slice for discussion during the January meeting. Products will include a report to the Commission on the staff's issue resolution process and licensing capability, and a report on the staff's sufficiency comments and review of DOE's SRCR, reports on the individual vertical slices, and possibly a report of ACNW's SRCR comments.

7. Yucca Mountain Total System Performance Assessment Code and External Review

Staff from the CNWRA discussed the main findings of an external peer review group that evaluated the NRC's Total System Performance Assessment (TPA) Code Version 3.2. The peer review process was described in some detail. The reviewers generally thought the code was well developed and that it addressed most of the physical processes associated with the repository. The peer group thought the code would be sufficient for NRC's review purposes with some improvements. These included the following: better documentation, modeling coupled processes, obtaining needed data for the saturated zone, providing a clearer basis for screening radionuclides, and better modeling of water chemistry. The Committee also heard about the staff's approach for addressing the reviewers' comments and the current status of the action plan for addressing the comments. The NRC staff discussed the current status and planned enhance-

ments of the TPA code. This briefing also included discussion of the role of the TPA code in NRC's approach to reviewing DOE's Total System Performance Assessment modeling, the key features of the code used to estimate repository performance, and the staff's approach for gaining confidence in performance assessment.

Conclusions/Action Items

The ACNW plans to write a letter to the Commission on the progress the staff has made in developing the TPA code and addressing previous Committee recommendations for improving staff PA capability.

8. Capability of the NRC Staff to Evaluate Risk-Significance of Information Submitted by the Department of Energy for Postclosure

Representatives from the NRC and CNWRA staffs provided a detailed overview of techniques for parameter level sensitivity and importance analyses, graphical post-processor (GPP) techniques, the regulator's perspective for addressing uncertainty in HLW PA, and use of the TPA code to support regulatory reviews.

Dave Esh, NRC, discussed NRC's uses of sensitivity and importance analyses to evaluate uncertainties and risk significance of subsystems when DOE submits an LA for the Yucca Mountain repository. Two different approaches to importance analyses are used to analyze the expected performance and potential performance of repository subsystems. This methodology will allow the staff to evaluate possible under performance of repository subsystems (e.g., natural or engineered barriers). Mr. Esh also discussed a variety of sensitivity analyses methods being used to evaluate parameter level and subsystem level contributions to performance.

Stan Kaplan (consultant to CNWRA) presented preliminary results of the ongoing effort to develop a GPP for the TPA code. The objective is to improve the transparency of the TPA modeling results and clarify the effects of individual submodels on the movement of water and radionuclides through the repository system as it degrades over time. The GPP will permit the uncertainties in parameters and submodels to be displayed. It will also help to visualize the effects of uncertainties, assumptions, and design changes on performance.

Gordon Wittmeyer, CNWRA, discussed NRC's approach for evaluating uncertainty in DOE's submittal of an LA. This approach includes evaluating compliance with a dose standard, demonstrating that the TSPA accounts for uncertainty and variability of parameters, and considers alternate conceptual models. DOE must also demonstrate a system of multiple barriers consisting of both natural and engineered components. He discussed the use of conservatism in dealing with large uncertainties in performance.

Timothy McCartin, NMSS, discussed the role of the PA code in NRC's decision making process and provided specific examples. The TPA code provides an independent tool for the staff to evaluate DOE's prelicensing and licensing activities and information. The TPA code is used to do confirmatory calculations and to do bounding or conservative calculations. It provides a tool to

evaluate the importance and significance of assumptions and parameters and models. The TPA code also provides the approach for integrating and coupling of processes and models and is used in the evaluations of uncertainty and the completeness of DOE's demonstration of compliance with NRC's regulations.

Conclusions/Action Items

The ACNW plans to write a letter to the Commission on the progress the staff has made in developing the TPA code and for addressing previous Committee recommendations for improving staff PA capability.

9. Pre-Closure Safety Analysis Tool

The Committee heard presentations by and held discussions with representatives of NRC and CNWRA staff's regarding overview and status of the Pre-Closure Safety Analysis (PCSA) tool and the examples of its application. The PCSA tool is necessary to demonstrate compliance with preclosure performance objectives outlined in 10 CFR Part 63.111 that meets the requirements specified in a draft 10 CFR Part 63.112. The PCSA tool is under development and is intended to assist the NRC staff in its review of the DOE Integrated Safety Analysis for the pre-closure period for the proposed Yucca Mountain repository. The PCSA tool will be used to verify quickly and systematically, DOE identification of structures, systems, and components (SSCs) important to safety in the preclosure safety analysis. The PCSA tool is developed using visual basic coupled with a data base of SAPHIRE and RSAC software. The PCSA tool has the capability to perform safety analysis for the entire operation or for selected operations.

Conclusions/Action Items

This presentation was an information briefing only and no Committee action is required on this matter.

10. Alloy C-22 Studies

The DOE and the NRC presented their work on alloy C-22 corrosion to the ACNW. This meeting followed the October18th briefing by the State of Nevada on this topic. Dr. Nirasi Sridhar, CNWRA, presented a brief historical perspective on alloy C-22. He said that risk insights from performance assessments show the importance of maintaining a uniform passive corrosion rate for C-22 to promote long container lifetimes. He also discussed the importance of near-field chemistry to bound corrosion processes that may occur over long time frames. He compared experimental corrosion results for different candidate waste package materials. He described the effects of fabrication conditions, such as thermal annealing treatments, and the presence of minor or trace elements on stress corrosion cracking (SCC) and impacts on waste package lifetimes. The CNWRA representative said that it is important to establish the window of susceptibility of C-22 to this type of corrosion and then evaluate the anticipated conditions at Yucca Mountain. The NRC staff specified that further work be done by DOE to close the issue. It was also recommended that a focused investigation by NRC/CNWRA be conducted to understand the extent of the effect of

minor elements and establish the window of susceptibility of the alloy to SCC and localized corrosion.

Dr. David Stahl, DOE/M&O, presented an extensive amount of material on the DOE corrosion program. He discussed the basis for material selection and the general properties that lead them to select alloy C-22. This included resistance to a variety of corrosion processes, phase stability as C-22 ages, and the ease of fabrication, welding, and inspection. He discussed continuing and planned research on C-22 corrosion. He described the chemical and physical environment that they believe the waste packages will experience, concerns about the uncertainties, and the path forward that they believe will help resolve some of the outstanding issues. He discussed experimental results for both general corrosion and localized corrosion of C-22 and testing in the Long-Term Corrosion Test Facility. He also described the studies that they are doing on the long-term stability of the passive oxide film that protects C-22 form localized corrosion processes such as pitting corrosion. He also discussed, in detail, the work that DOE has done on SCC. To resolve concerns about these issues, he said that they were initiating a series of short- and long-term tests and applying a suite of analytical methods and tools to better understand degradation mechanisms.

Conclusions/Action Items

The ACNW wrote a letter to the Commission on this issue and recommended staff actions that will help resolve some of the concerns.

11. Draft NRC/Office of Nuclear Regulatory Research Plan for Waste Research

The Committee heard a presentation on waste-related research. Included in this program is radiation protection, environmental risk, and waste management. The staff discussed a preliminary version of the Research Program Plan for Radionuclide Transport in the Environment. The staff also explained the system used to prioritize research on an office wide basis. Recent accomplishments and projects underway or planned were discussed. Funding available for this research was reviewed.

Conclusions/Action Items

The ACNW intends to issue a report to the Commission on waste-related research and technical assistance in the next few months.

12. Tour of Experimental Facilities

The Committee toured several of the Center's experimental laboratory facilities. Of particular interest were those laboratory experiments intended to provide information relevant to closure of KTIs for the proposed repository at Yucca Mountain.

The opportunity to observe the experiments while in progress, coupled with the ability to discuss the objectives of the tests and the results obtained thus far with the principal investigators was deemed extremely valuable.

Conclusions/Action Items

The Committee intends to continue its periodic visits to the CNWRA, and should time and resources permit, extend the visits to allow more time to be dedicated to the laboratory tours.

13. Investigation and Importance of Coupled Processes Related to Repository Design

Debra Hughson and Roberto Pabalan, CNWRA, discussed the ongoing CNWRA work related to the study of coupled process as it relates to the proposed Yucca Mountain repository design. The CNWRA work is directed toward the effects of coupled processes on seepage and flow and the near-field chemical environment. The DOE will need to provide an acceptable methodology for evaluating thermal loads and thermally induced mechanical, hydrological, and chemical processes in assessing the performance of the proposed repository at Yucca Mountain. The CNWRA work will provide information that the NRC needs in its review of DOE's LA. The CNWRA program includes work related to the performance of HLW glass. The NRC/CNWRA evaluation of coupled processes is focused on a risk-informed, performance-based approach.

Conclusions/Action Items

The Committee's views on this work will be addressed in its report on NRC-sponsored research.

Sincerely,

/RA/

B. John Garrick
Chairman