



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

**ACNWS-0175**

October 11, 2007

The Honorable Dale E. Klein  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Dear Chairman Klein:

SUBJECT: SUMMARY REPORT – 182<sup>ND</sup> MEETING OF THE ADVISORY COMMITTEE ON NUCLEAR WASTE AND MATERIALS, SEPTEMBER 18-20, 2007, AND OTHER RELATED ACTIVITIES OF THE COMMITTEE

During its 182<sup>nd</sup> meeting, September 18-20, 2007, the Advisory Committee on Nuclear Waste and Materials (ACNW&M) discussed several matters and completed the following letters to Dr. Dale E. Klein, Chairman of the Nuclear Regulatory Commission (NRC), from Dr. Michael T. Ryan, Chairman of ACNW&M:

- “Engagement with the International Commission on Radiological Protection (ICRP),” dated September 25, 2007
- “Low-Level Radioactive Waste (LLW) Minimization Strategies and Views on Commercial LLW Management,” dated October 01, 2007
- “NRC Plans for Monitoring Disposal Actions for Waste Incidental to Reprocessing at U.S. Department of Energy Facilities at the Idaho National Laboratory and Savannah River Sites,” dated October 02, 2007
- “Background, Status, and Issues Related to the Regulation of Advanced Spent Nuclear Fuel Recycle Facilities,” dated October 11, 2007

**HIGHLIGHTS OF KEY ISSUES**

**1. Corrosion of Waste Package and Drip Shield Materials in a Repository Environment**

Dr. Tae Ahn, Senior Materials Engineer, from the Division of High-Level Waste and Repository Safety (DHLWRS) briefed the Committee on key processes affecting corrosion in the waste package (WP) and the drip shield (DS) to be used at the Yucca Mountain (YM) repository. In addition, he summarized the staff's current understanding of potentially significant uncertainties in corrosion processes for Alloy 22 and titanium alloys. This information will be used by the staff to support review of the license application.

In the geologic repository for high-level nuclear waste disposal at YM, Alloy 22 is the candidate material for the WP outer container, and titanium alloy grades 7 and 29 are the candidate

materials for the DS. Performance and integrity issues related to the WP outer container primarily include: (1) long-term persistence of protective passive film in general corrosion; (2) corrosion at temperature above 100 °C from dust deliquescence during the early repository period; (3) localized corrosion from seepage water, such as crevice corrosion; and (4) microbially influenced corrosion. Performance and integrity issues related to the DS include hydrogen-assisted failure.

Dr. Ahn reported that long-term chemical or structural changes in passive film stability strongly affect uncertainties in Alloy 22 general corrosion rates. He also reported that current data indicates that crevice corrosion by dust deliquescence does not affect WP performance significantly. The staff believes that crevice corrosion from seepage water would require tight crevices and aggressive brines. Additionally, Dr. Ahn informed the Committee that microbially influenced corrosion appears unlikely because of short induction. Data also shows that there appears to be no evidence that hydrogen could affect the long-term integrity of titanium alloy in the YM environment. He concluded his presentation by informing the Committee that uncertainties in persistence of passive film appear more significant than uncertainties in other corrosion processes.

#### Committee Action

The Committee plans to write a letter addressing the staff's presentation on corrosion of the WP and DS in a repository environment.

#### 2. Mechanisms for Estimating Juvenile Waste Package Failures

Mr. Darrell Dunn, Manager of the Materials Performance and Characterization Group, Center for Nuclear Waste Regulatory Analyses (the Center), updated the Committee on key processes and associated uncertainties that may contribute to juvenile/early failure of WPs under potential repository conditions. This information will be used by the staff to support review of the license application.

In the geologic repository for high-level nuclear waste disposal at YM, Alloy 22 will be used for the WP outer container, and two grades of titanium alloys will be used for the DS. During the fabrication of the WP and DS, various types of discontinuities may be introduced due to welding flaws, improper materials, improper heat treatment, or contamination. Discontinuities could lead to early failure of WP and DS. Therefore, the Center reviewed and evaluated literature related to industrial failures and failure mechanisms of the relevant analog industrial components such as pressure vessels and aircraft engine components. Also, the Center reviewed factors involved in initial failures such as human error probabilities, equipment failure rates, and reliability of ultrasonic examination. The Center's review and evaluation concluded that industrial failure rates are not directly applicable to waste packages and drip shields, however, a correlation can be made to general industrial fabrication technologies and inspection methods/criteria that will be utilized in WP construction.

#### Committee Action

The Committee plans to write a letter addressing the Center's presentation on mechanisms for estimating early WP and DS Failures.

### 3. Dissolution Processes for Commercial Spent Nuclear Fuels in a Repository Environment

Dr. Tae Ahn, Senior Materials Engineer, from DHLWRS, briefed the Committee on key processes and associated uncertainties for the dissolution of commercial spent nuclear fuels (CSNF) under potential repository conditions. Models for CSNF dissolution kinetics in the performance assessment were presented. Risk insights and uncertainties along with some results of system-level performance assessment studies, based on independent process-level modeling and analysis were also presented to the Committee. This information will be used by the staff to support review of the license application.

In the geologic repository for high-level nuclear waste disposal at YM, radionuclides can be released by waste dissolution in groundwater following WP failure. When evaluating dissolution, the environmental in-package chemistry must be considered. The in-package chemistry should consider the following: the amount and types of dissolved ions (e.g., carbonate, calcium, and silica), pH effects, temperature, and the condition of the CSNF. Condition of the CSNF is an important factor and consideration is given to the amount of oxidation on the cladding and pellets and the grain boundary inventory of radionuclides. Hydrides are also considered.

Dr. Ahn informed the Committee that while CSNF dissolution rates are most sensitive to variations in temperatures, the silicon ions could decrease spent fuel dissolution rates by more than an order of magnitude. Furthermore, release of radionuclides from the grain boundary/gap is a substantial component in affecting release rates (by a factor of 2-10 of the long-term matrix dissolution rates). Dr. Ahn explained that, for low drip-rates, cladding containing a small opening in the presence of iron compounds has an effect of decreasing dissolution or release rates. However, low pH and pre-oxidation and hydration of spent fuel before water contact could potentially increase dissolution rates. The data was mostly collected from uranium dioxide and CSNF samples; however, some of the results were based on data obtained from simulated fuel (SIMFUEL). Dr. Ahn concluded his briefing by stating that there is a range of information in analog, primarily from laboratory experiments, to support staff review of CSNF dissolution models.

#### Committee Action

The Committee plans to write a letter addressing the staff's presentation on dissolution processes for CSNF in a repository environment.

### 4. Discussion of the NRC Role in the International Commission on Radiological Protection (ICRP)

Drs. Donald Cool and Vincent Holahan (both with the NRC staff) briefed the Committee about NRC's participation in recent activities of the International Commission on Radiological Protection (ICRP). The presenters outlined the major areas of NRC activity in international radiation protection and the staff's strategy and involvement.

International standards and guidance are developed by the International Atomic Energy Agency (IAEA) and individual countries. The NRC staff engages in development of IAEA standards by participating in Consultant and Technical Meetings, Safety Committees, the Commission on

Safety Standards, and Member State Comments. IAEA is now revising the Basic Safety Standards based on the anticipated publication of the new recommendations, ICRP 103, later in 2007. NRC staff is participating in the drafting and review of these standards. ICRP, as an independent international commission organized under the International Congresses of Radiology, provides recommendations for radiation protection internationally. Reports expected to be available for comment include: Task Group on Emergencies, Task Group on Existing Exposure Situations, and Task Group on Reference Plants and Animals. The NRC staff's strategy includes active engagement at each opportunity to influence draft documents for scientific consistency and implementation issues. The staff pursues both direct and indirect opportunities to provide NRC views, and provide the Commission with approved comments on general recommendations.

The NRC staff actively engage in ICRP activities through: membership on Committee 4 of ICRP, direct review and comment on ICRP documents, participation in the Nuclear Energy Agency's (NEA) Committee on Radiation Protection and Public Health and its expert groups, Federal Interagency coordination of views through International Steering Committee on Radiation Standards (ISCORS), and financial support via grants.

#### Committee Action

The Committee issued a letter to Dr. Klein, NRC Chairman, on this matter dated September 25, 2007, recommending that the Commission invite representatives of organizations such as the ICRP, NEA, IAEA, and the National Council on Radiation Protection & Measurements to meet with the Commission, staff, and key U.S. stakeholders. This exchange should provide the Commission with important insights about radiation protection issues and initiatives, and the programs that address them. This engagement and follow-up actions will offer opportunities for the Commission to take a leadership role and set a course for radiation protection practice. Also, the staff should consider instituting a more formal process to assess the potential impacts of emerging issues on current NRC regulations, and develop strategies for reacting to changes in national and ICRP recommendations.

#### 5. Nuclear Energy Institute (NEI)/ Electric Power Research Institute (EPRI) Briefing on Low-Level Radioactive Waste (LLW) Minimization Strategies

On the behalf of EPRI, Dr. Ralph Andersen of NEI briefed the Committee on a study performed by EPRI concerning minimization strategies to reduce the volume of Class B/C commercial LLW that is currently being generated. Dr. Andersen discussed some of the plans to safely and securely store Class B/C LLW at nuclear power plant sites. Additionally, he discussed the operational changes needed to reduce Class B/C LLW generation.

Dr. Andersen started by focusing on operational strategies to reduce Class B/C waste and on-site storage guidelines. A media management strategy plan for waste storage was also discussed. Dr. Andersen told the Committee that Cesium-137 is the classification controlling radionuclide in resins and filter waste. Furthermore, he believes that nuclear power plant resins and filter waste could potentially be classified as Class A waste on the basis of averaging. This action could possibly provide a safe disposition pathway for LLW volumes currently being sent to Barnwell and that implementation could occur within current regulatory framework. He also reported that NEI/EPRI are looking at the original technical bases (waste volumes and

characteristics) underlying the 10 CFR Part 61 regulation and are evaluating these bases. Dr. Andersen indicated that publication of the NEI/EPRI study will be released in December 2007.

Dr. Andersen's final point to the Committee was that EPRI will continue to support dialogue with NRC via NEI on this issue.

A Class B/C technical transfer workshop will be held in the middle of 2008. The primary objective of the workshop will be to assist industry with implementation of Class B/C waste reduction strategies and implementation of on-site storage operating guidelines.

#### Committee Action

The Committee plans to write a letter addressing the NEI/EPRI's presentation on LLW minimization strategies.

#### 6. NEI Executive Committee Views on Commercial LLW Management Issues

Dr. Ralph Anderson, an NEI representative, briefed the Committee on recent activities related to the Executive Level task force (hereafter the Task Force) for the management of commercial LLW. He reported that the NEI Task Force was in the process of developing a position paper that will focus on the following issues related to the management of commercial LLW: (1) feasibility of central processing, packaging, and storage of LLW; (2) access to Federal disposal as an option; (3) creation of a Federal title for some classes of LLW; (4) encouragement by the industry and government to develop other LLW commercial disposal sites; (5) petitioning by the industry for rulemaking to Title 10 of the *Code of Federal Regulations*, Part 61 (10 CFR Part 61), "Licensing Requirements for Land Disposal of Radioactive Waste"; (6) improved U.S. alignment with the IAEA framework for waste classification; and (7) need for changes to the LLW Policy Act and its amendments.

Dr. Anderson noted that the NEI Task Force intends to issue a report in early 2008 with its views on the aforementioned issues.

#### Committee Action

This briefing was intended for information purposes only. The Committee intends to track developments related to the forthcoming NEI Task Force findings and compare those with the staff's 2006 LLW strategic planning recommendations.

#### 7. Observations from ACNW&M Members and Staff on Recent Activities

ACNW&M Members and staff presented summaries of their:

- A. Visit to decommissioning sites in Pennsylvania (TMI plant) and Missouri (Hematite site)

Dr. James Clarke reported on the visits in August 2007 to the Three Mile Island (TMI) Plant in Pennsylvania and the Westinghouse Hematite Site in Missouri. The purpose of the trip was to observe decommissioning activities and the results of these activities to

contribute to the Committee's White Paper on lessons learned in decommissioning. Dr. Clarke reported that the lessons learned at TMI were somewhat exclusive because the decommissioning activities conducted to date involved the cleanup of a relatively severe accident and included considerations not found at a typical nuclear power plant. He reported that the actions taken by AmerGen in response to the Tritium Task Force actions were interesting and valuable. Dr. Clarke reported that the lessons learned at Hematite were also somewhat exclusive since many of their issues have to do with the possibility of excavating significant quantities of special nuclear material. Dr. Clarke said that the trip report would be completed soon and distributed to each of the Members.

#### B. Visit to the U.S. Department of Energy (DOE) Grand Junction site in Colorado

Committee Member Dr. Ruth Weiner informed the Committee that on August 14-16, 2007, she along with Committee Member Dr. Bill Hinze and ACNW&M staff member Dr. Latif Hamdan visited the U.S. DOE's Office of Legacy Management in Grand Junction Colorado, as well as a number of legacy uranium mill tailings sites that have been subject to remedial action by DOE. She indicated that the visit was undertaken to collect information that can support the Committee's planned review of the technical basis for a draft rule on groundwater protection at in situ leach (ISL) uranium mining sites, currently under development by the NRC staff. She said that the ACNW&M team held a 1-day meeting at DOE's Office of Legacy Management to discuss issues and concerns about groundwater protection at uranium mining sites, and that participants included representatives from DOE and its contractors, the States of Colorado and Wyoming, and Native American Indians. She also said that the site visits included an old tailings site and a reclaimed tailings impoundment near Rifle, Colorado, as well as the Atlas tailings site in Moab, Utah. Dr. Weiner indicated that a trip report was under preparation.

#### C. Attendance to the First Annual Radwaste Summit

Committee Chairman Dr. Michael Ryan and ACNW&M staff member Dr. Latif Hamdan informed the meeting about the First Annual Radwaste Summit on LLW that they attended in Las Vegas, Nevada on September 4-7, 2007. They said the meeting was well attended and covered a broad spectrum of LLW topics and stakeholder concerns. Dr. Ryan gave a presentation at the meeting on ACNW&M responsibilities and ongoing ACNW&M activities. Dr. Hamdan will be preparing a trip report soon.

### 8. Regulatory Guide Revisions

Sher Bahadur, Andrea Valentin, and John Ridgely presented a discussion on the revision process the Office of Research (RES) is utilizing to revise regulatory guides in Phases 2 through 4 of the phased approach implemented by RES in revising the guidance documents. Mr. Ridgely described the process as a two-step evaluation, with the first step assessing the individual guides in a vertical direction where references to rules and other references needed to be modernized, and the second step assessing regulatory guides together in a cross-cutting fashion to identify similarities where a change in one guide would necessitate a change in another, or where redundant information could be redacted. Chairman Ryan briefly discussed the review of the current regulatory guides conducted by the Committee after its 181<sup>st</sup> Meeting and explained that the Committee particularly evaluated the technologies and methodologies

that form the technical basis for the guides and looked to see if they required updating or revision. He also discussed the potential use of consensus industry standards for reference in a regulatory guide to provide updated methodologies rather than NRC trying to improve on its own work.

### Committee Action

The Committee agreed to write a letter report on the regulatory guide revision process described in the RES presentation. The Committee agreed to include a table as part of the letter report showing the results of the Committee's evaluation, undertaken since its 181<sup>st</sup> Meeting, of selected regulatory guides in Divisions 1, and 3 through 8.

#### 9. Semi-Annual Briefing by the Office of Federal and State Materials Safety and Environmental Protection Programs (FSME)

The Committee received a semiannual briefing by the NRC Office of Federal and State Materials Safety and Environmental Management Programs (FSME). Participating FSME managers included FSME Office Director Mr. Charlie Miller and other FSME SES managers from the Divisions of Materials Safety and State programs (DMSSA), Intergovernmental Liaison and Rulemaking (DILR), and Waste Management and Environmental Protection (DWMEP).

Mr. Charlie Miller noted that FSME was established nearly a year ago and gave an overview of office activities including office accomplishments to date, budget trends, knowledge management, and areas where the Committee's help will be needed. He highlighted FSME's work activities in the Integrated Materials Performance Evaluation Program (IMPEP), working with the States, interfacing and interacting with the IAEA, and other ongoing work on rulemaking activities, irradiated gemstones, waste incidental to reprocessing, and radioactive sources. He discussed budget trends and noted that there are indications that there is now recognition of the importance of the waste and materials areas. He also discussed knowledge management activities, and said that the regulatory guides are important knowledge management tools. He indicated that FSME wants ACNW&M collaboration on the updating of existing guides and creation of new guides, as well as other FSME knowledge management activities and initiatives currently underway.

DMSSA Director Janet Schlueter discussed the recent GAO sting operation and other work areas and activities in the Division. She stated that the Commission has approved the staff action plan regarding the GAO sting operation and that the staff is proceeding to implement the plan. She discussed the DMSSA organization and highlighted a number of ongoing activities including supporting the NARM rulemaking, new Agreement State application reviews, IMPEP and other Agreement State program reviews, support for the Organization of Agreement States and Conference of Radiation Control Program Directors, direct interactions with States, and other work on irradiated gemstones and knowledge management. She highlighted a new initiative that involved development of an internal web page that provides information and a forum for information exchange in the materials area.

DILR Deputy Director Patrice Bubar discussed the DILR organization and rulemaking priorities and process. She emphasized the importance of the technical basis documents, and cited an example of a rulemaking development activity. She indicated that DILR is currently working on

a rulemaking activity on the groundwater protection at ISL sites, that the Committee's input has been received and will be considered in the development of this rule, and that other Committee input on the rulemaking as well as the guidance documents is welcomed. She noted that most of the rulemaking effort in the next 2 years will be in the materials area. She also indicated that DILR is working on revitalizing the Interagency Jurisdictional Working Group to handle low activities of uranium.

DWMEP Deputy Director Scott Flanders discussed ongoing activities in DWMEP and planned activities that are subject of future interaction and collaboration with the Committee. He discussed work related to the U.S. DOE's waste incidental to reprocessing, and noted previous interactions that had taken place between the DWMEP and the Committee in this area. He discussed the LLW strategic assessment, and indicated that a paper on this subject has been completed and will soon be submitted to the Commission. He mentioned that a rulemaking activity for decommissioning of legacy sites was underway. He discussed the following activities that he said will be the subject of future interactions and collaboration with the Committee: onsite storage guidance, dose modeling evaluation, ISL rulemaking, monitoring at the Savannah River site, West Valley Project erosion issues, and LLW strategic assessment implementation.

#### Committee Action

The Committee will work with the ACNW&M staff to plan briefings and reviews of future work activities identified by FSME management in this meeting.

#### RECONCILIATION OF ACNW&M COMMENTS AND RECOMMENDATIONS/EXECUTIVE DIRECTOR FOR OPERATIONS COMMITMENTS

During its Planning and Procedures meeting on September 18, 2007, the Committee considered:

- The response of the Executive Director for Operations (EDO) dated August 10, 2007, to comments and recommendations included in the June 27, 2007, ACNW&M letter entitled, "NRC Office of Nuclear Regulatory Research Long-term Research: Fiscal Year 2009 Activities." The Committee decided that it was satisfied with the EDO's response; however, the ACNW&M members strongly encourage RES to enhance their longer term (10 years and beyond) planning.
- The EDO's response dated June 14, 2007, to comments and recommendations included in the October 17, 2006, ACNW&M letter entitled, "Prevention of Legacy Sites." The Committee decided that it was partially satisfied with the EDO's response.

On August 13, 2007, the Committee issued a letter to Dr. Klein, NRC Chairman, entitled, "Concerning the Response from the EDO Regarding the Committee Letter on Prevention of Legacy Sites," clarifying its earlier recommendation on the reduction of financial assurance requirements from licensees. The Committee will be reviewing the proposed revisions to 10 CFR 20.1406 and hearing a presentation from the staff on the proposed rule for prevention of legacy sites at the 183<sup>rd</sup> Committee meeting in October 2007. The Committee will



examine the proposed requirements and the guidance addressing chronic release and contamination migration at that time.

- The EDO's response dated July 23, 2007, to comments and recommendations included in the June 6, 2007, ACNW&M letter entitled, "Igneous Activity at Yucca Mountain: Technical Basis for Decision Making." The Committee decided that it was satisfied with the EDO's response.

#### PROPOSED SCHEDULE FOR THE 183<sup>rd</sup> ACNW&M MEETING

The Committee agreed to consider the following topics during the 183<sup>rd</sup> ACNW&M meeting to be held on October 16-18, 2007:

- Working Group Meeting on Preclosure Seismic Analysis Evaluation at the Proposed Yucca Mountain, Nevada, Repository
- GE - Hitachi Nuclear Energy Spent Nuclear Fuel Recycling Processes
- NRC's Total-System Performance Assessment Code for Review of Performance Assessment of the Yucca Mountain Site
- Draft Proposed Rule/Guidance on Preventing Legacy Sites
- Mallinckrodt Site Decommissioning Plan
- Vendor's Views on the Transportation-Aging-Disposal Performance Specifications
- Revision of NUREG-1854, "NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations - Draft Final Report for Interim Use"

Sincerely,

**/RA/**

Michael T. Ryan  
Chairman

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Sincerely,

**/RA/**

Michael T. Ryan  
Chairman

**DOCUMENT NAME:** ML072820171

\*See previous concurrence.

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