UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, DC 20555 - 0001

ACNWR-0237

April 14, 2006

The Honorable Nils J. Diaz
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 2005-0001

SUBJECT: REVIEW AND EVALUATION SUMMARY OF THE U.S. NUCLEAR REGULATORY COMMISSION WASTE SAFETY AND TECHNICAL ASSISTANCE PROGRAMS

Dear Chairman Diaz:

The Advisory Committee on Nuclear Waste (ACNW) conducts reviews of the U.S. Nuclear Regulatory Commission (NRC) nuclear waste safety research and high-level waste (HLW) technical assistance programs. This report, which supplements the ACRS's research report (NUREG-1635, Volume 6), summarizes the ACNW reviews and evaluations of 2004 and 2005 research related to the safety of the nuclear fuel cycle and waste management and HLW technical assistance work being conducted under NRC sponsorship.

Discussion of Specific Programs

RES-Sponsored Research in Conceptual Model Uncertainty

A research team sponsored by RES, under the leadership of Dr. Shlomo Neuman, has developed a method for incorporating model uncertainty. This Maximum Likelihood Bayesian Model Averaging method has been applied to hydrologic modeling, but has more extensive potential applications. The insights derived are important, although direct regulatory applications of the method are currently limited in number and scope (Reference 1).

RES-Sponsored Research Evaluating Model Abstraction by Application to Estimates of Groundwater Recharge

RES has been conducting a cooperative research program with the Agricultural Research Service of the U.S. Department of Agriculture (USDA) at a highly instrumented, densely sampled watershed site in Beltsville, MD. Soil moisture measurements coupled with ground-penetrating radar have been used at the site to identify preferred subsurface pathways for groundwater flow and to improve understanding of subsurface transport of solutes. In addition, measurements made at this site have aided RES in abstracting and simplifying models of subsurface flow. ACNW (Reference 2) has observed that both the field studies and the model abstraction research may apply to site characterization, modeling of contaminant transport, and performance assessment. The ACNW has recommended coordinating this program with similar programs that study a range of subsurface geologic and hydrologic regimes.

RES-Sponsored Research Related to Radiation Protection and Health Effects

Research related to radiation protection and health effects is part of the NRC mission. Ongoing areas of research supported by RES are:

1) Monitoring developments in the radiation effects research in order to maintain currency in health-protection regulation

2) Monitoring studies of radiation epidemiology of exposed human populations in order to identify trends that could better define low-dose radiation effects

3) Evaluating existing and new dosimetry, bioassay, radiation detection, and radioanalytical techniques and methods in order to support implementation of radiation protection standards

4) Supporting development of technical bases for radiation protection

The ACNW heard a presentation on several alternative RES recommendations on the use of collective dose (items 1 and 2, above). The ACNW believes that collective dose has little value in the absolute sense, and has recommended that individual risk or risk to a critical group be used to estimate radiological risk (Reference 3). The ACNW recommended against adoption of any of the proposed options for the use of the collective dose concept.

In April of 2004, the ACNW convened an expert panel to discuss biosphere dose calculations (items 3 and 4). The ACNW recommended that NRC staff consider the panel's suggestions and recommendations for improving dose calculations (Reference 4).

The Committee reviewed the 2005 Draft Recommendations and Foundation Documents of the ICRP, and recommended (in 2004 and 2005) that the Commission consider the following when regulations are being updated:

5) The radiation weighting factors for neutrons and protons (quality factors in 10 CFR Part 20)

6) The tissue-weighting factors that reflect the ICRPs current thinking about cancer risk

7) The ICRPs more recent methods and models for assessment of internal radiation exposures

The Committee found no evidence to support a nonhuman biota standard and recommended that such a standard not be adopted.

The Committee notes that licensees currently have the option of using more recent methods and models of assessing internal doses by requesting this option. Several recent environmental impact statements make use of this option.

RES continues to monitor ICRP and NCRP activities and participate in formulating these agencies recommendations. Other current RES programs include developing and enhancing a radiological toolbox, developing a list of natural and accelerator-produced radionuclides to be considered in regulation, risk-informing 10 CFR Part 40, and providing regulatory support.

Package Performance Demonstration (PPS) Tests

The RES staff met with the ACNW in 2004 and discussed plans for demonstration tests of spent fuel transportation cask performance. The ACNW has provided comments on technical aspects of these planned tests to the RES staff and to the Commission in 2002 and 2003, and most recently in its July 30, 2004 letter report (Reference 5). The ACNW concluded from previous investigations and presentations that transportation packages for spent nuclear fuel and high-level radioactive waste that meet the regulatory requirements are adequate to protect public health and safety, that several tests using scale models would be preferable to a single full-scale test for purposes of code validation, and that the proposed PPS test would yield no new technical information. In accordance with the Commissions direction, the Committee will conduct a review of the PPS protocol as soon as it is made available to the Committee.

Ongoing Studies of Environmental Transport of Radionuclides

RES discussed ongoing studies of radionuclide sorption and transport at the November and December 2005 meetings of the ACNW. Like other RES studies, these are cooperative investigations with other agencies, predominantly the U.S. Geological Survey. These cooperative investigations included laboratory studies of geochemical systems relevant to radionuclide migration and field studies of uranium sorption at Naturita, Colorado, a contaminated uranium mill tailings site where uranium was mined and milled. RES and its collaborators are using the resulting data to construct improved models of radionuclide sorption and its relationship to local variations in geochemistry. These studies may improve parameters used in modeling radionuclide transport in the subsurface.

NMSS-Sponsored Technical Assistance

NMSS is funding a technical assistance program at the CNWRA. Most of the effort is directed to addressing risk-significant topics related to the proposed Yucca Mountain repository. The remainder supports NRC activities in other areas, including decommissioning, environmental reviews, and specific licensing actions. In February 2005, ACNW met with the NMSS and CNWRA staffs and discussed these programs. A team of ACNW members and consultants visited CNWRA in April of 2004 and again in April of 2005 to gather information on a number of specific issues. The ACNW subsequently provided advice to the Commission (References 6, 7, and 8).

The CNWRA has programs in the areas of container life, source term characterization, and the understanding of the near-field environment and radionuclide retardation that have improved understanding corrosion of the Alloy 22 container. The NMSS and CNWRA staffs are in the process of using the information developed in these programs to update the total performance assessment (TPA) code.

NMSS and CNWRA are addressing topics related to estimating the risks associated with potential igneous activity at the proposed Yucca Mountain site with emphasis on the consequences of an igneous event. ACNW held a Working Group meeting on this topic in September 2004, and summarized its conclusions in a November 4, 2004 report to the Commission (Reference 9). Issues related to igneous activity were discussed during the April 13-15, 2005 ACNW members visit to the CNWRA and subsequent deliberations of the ACNW. A letter was provided to the Commission on December 9, 2005 (Reference 8).

General Observations

1) The Office of Nuclear Regulatory Research (RES) has a program addressing radionuclide transport, engineered barrier and groundwater system interactions, and radiation protection that is responsive to NRC regulatory responsibilities. Collaborative arrangements with other research groups are being used effectively to leverage the limited resources available to RES.

2) It should be noted that the ACNWs views concerning the validity of some approaches and assumptions that are important to estimating the consequences of an igneous activity event differ from those of the NRC and CNWRA staffs. The ACNW and staffs are engaged in a continuing dialog on these topics.

3) The ACNW will conduct a review of the planned revised PPS protocol when it is available.

General Recommendations

1) The collaborative arrangements between RES and other agencies facilitate research that the NRC could not otherwise undertake because of resource limitations. These collaborative arrangements should be continued and expanded.

2) Innovative research, like the research in conceptual model uncertainty, may not have immediate application but should be continued to be supported as resources allow. This work will likely be useful in developing tools for assessing model uncertainty.

Sincerely,

/RA/

Michael T. Ryan
Chairman

References:

1. U.S. Nuclear Regulatory Commission, “Research on Model Uncertainty,” August 4, 2004.
2. U.S. Nuclear Regulatory Commission, “Briefing on RES-USDA Research: Estimating Ground Water Recharge and Evaluating Model Abstraction techniques,” April 27, 2005.
3. U.S. Nuclear Regulatory Commission, “Comments on USNRC Staff Recommendation of the Use of Collective Dose,” September 30, 2005.
4. U.S. Nuclear Regulatory Commission, “Working Group Session on Biosphere Dose Calculations,” May 3, 2004.
5. U.S. Nuclear Regulatory Commission, “Nuclear Regulatory Commissions Package Performance Study-Demonstration Test,” July 30, 2004.
6. U.S. Nuclear Regulatory Commission, CNWRA Proposed Experimental Program on Spent Nuclear Fuel Dissolution, July 6, 2004.
7. U.S. Nuclear Regulatory Commission, “Report on Selected NRC-Sponsored Technical Assistance Programs at the Center for Nuclear Waste Regulatory Analyses,” August 3, 2005.
8. U.S. Nuclear Regulatory Commission, “Review of the NRC Program on the Risk from Igneous Activity at the Proposed Yucca Mountain Repository,” December 9, 2005.
9. U.S. Nuclear Regulatory Commission, “Working Group on the Evaluation of Igneous Activity and its Consequences for a Geologic Repository at Yucca Mountain, Nevada,” November 3, 2004.

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