



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

ACNWR-0255

December 27, 2006

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

SUBJECT: WORKING GROUP MEETING ON USING MONITORING TO BUILD MODEL  
CONFIDENCE

Dear Chairman Klein:

In a Staff Requirements Memorandum (M060111B) dated February 9, 2006, the Advisory Committee on Nuclear Waste (Committee) was requested by the Commission to work with the Nuclear Regulatory Commission (NRC) staff "to identify and assess methods of monitoring for compliance and to identify possible enhancements for increasing confidence in the validity of associated analytical models." The Committee worked closely with staff from the Office of Nuclear Regulatory Research (RES) to organize and conduct a 2-day working group meeting on "Monitoring to Build Model Confidence" during the ACNW 173<sup>rd</sup> meeting, September 18-21, 2006. This letter provides Committee recommendations, along with comments and observations, based on the working group meeting.

The meeting included presentations by invited experts as well as members of the NRC staff, panel discussions, and question-answer sessions involving the participants and Committee members. Outside participants included representatives from the U.S. Environmental Protection Agency, the U.S. Geological Survey, the American Nuclear Society, the Electric Power Research Institute, the Department of Energy national laboratories, private consulting firms, waste management companies, and universities. Professor George Hornberger of the University of Virginia served as moderator for the panel discussions.

#### Recommendations

1. Staff should develop guidance on integrating monitoring and modeling programs to increase confidence in the validity of the performance assessment predictive models and their results, and to demonstrate compliance with regulatory limits at licensed sites. The guidance should consider risk, facility and subsurface complexity, environmental setting, and subsurface flow and transport regimes. The approach should be risk-informed and performance-based.
2. Monitoring and modeling should be used together in a graded approach to demonstrate compliance, including long-term compliance.
3. Licensees and applicants should be offered financial incentives to use integrated monitoring and modeling approaches to demonstrate compliance with the regulations (e.g., reductions in decommissioning costs or other obligations).

4. Licensees and applicants should be encouraged to develop monitoring programs that are designed to include detection near the source and before contaminants reach a point of compliance.
5. Monitoring and modeling should be linked through a dynamic and iterative process beginning with initial site characterization.
6. Performance assessment models should be updated when new information that alters the site conceptual model becomes available.
7. NRC staff should become involved in research designed to identify performance indicators and approaches to their implementation into early warning systems, and in the development and implementation of additional non-invasive monitoring technologies.
8. Post construction monitoring should not be used as a substitute for a robust performance assessment. NRC decisionmaking should be based on robust performance assessment models using site-specific information such as monitoring data, and other supporting information such as laboratory bench-scale testing.

#### Comments and Observations

- There are currently no systematic incentives or requirements to coordinate and integrate monitoring and modeling activities to build model confidence.
- Many decommissioning sites have little to no existing soil and/or ground-water contamination. Monitoring may be of limited utility at sites where the phenomena of interest occur over time spans that exceed the duration of licensed activity and when extending the license is not warranted. In these cases, decommissioning decisions can be made with relatively simple calculational tools. When significant subsurface contamination exists and has reached ground water, a higher level of analysis is required. This analysis would identify the need for and selection of remediation strategies.
- Mining of the monitoring data for temporal and spatial variations can provide important confirmatory feedback that is useful to inform the site conceptual model, performance assessment, choices of performance indicators, monitoring devices, and monitoring locations. The results of the models can provide important confirmatory feedback with regard to the monitoring locations and critical data to be collected, and models can also be used as management tools for the site data.
- Building confidence in performance assessment models through integration with monitoring will yield increased capability and confidence in assessing the necessity for and duration of institutional controls.
- For some facilities, it is appropriate to consider systems that incorporate the monitoring of precursors to engineered system failure (performance indicators) so corrective measures can be taken to prevent contaminant release.

- Natural analogues can provide information that is useful in selecting and assessing long-term performance of engineered contaminant isolation systems.
- Evaluation of engineered barrier performance should consider both the physical (engineered barriers) and chemical (waste form) isolation of radionuclides depending upon the specific source term. The service life of physical barriers may be limited (100's of years).
- There are chemical and physical constraints that limit the development of conceptual models for ground water. There is a need for site characterization to support the development of conceptual ground-water transport models and to establish characterization goals based on existing limitations.
- There are new cost-effective monitoring techniques and approaches that can be pursued and implemented, including geoprobes, tracers, new coring techniques, geophysical measurements, low-rate pumping, and gas-phase monitoring including soil vapor extraction.
- Experts supported the idea of phased monitoring, in which data collection is managed to build confidence in modeling and then optimized to achieve further confidence in modeling results.
- Guidance is needed to assist licensees/applicants and NRC reviewers of radiological environmental monitoring programs and assessments involving releases to ground water. Guidance is needed for determining the level of analysis, and the monitoring and modeling tools and approaches that can be used to build model confidence.
- Historical emphasis for licensed facilities has not been on early site characterization data to develop a conceptual site model to facilitate compliance assessment throughout the facility lifetime. Contamination issues typically emerge during decommissioning rather than during normal operations.

The Committee would like to take this opportunity to acknowledge RES staff for their help in organizing and participation in this working group meeting, and the staff from the Office of Federal and State Materials and Environmental Management Programs for their presentations and participation in the panel discussions. We look forward to continued interaction with the staff on this important subject.

Sincerely,

**/RA/**

Michael T. Ryan  
Chairman