April 29, 2004

MEMORANDUM TO: Chairman Diaz
Commissioner McGaffigan
Commissioner Merrifield

FROM: William D. Travers ***/RA/***
Executive Director of Operations

SUBJECT: "RISK INSIGHTS BASELINE REPORT" FOR THE HIGH-LEVEL WASTE PROGRAM

The U.S. Nuclear Regulatory Commission (NRC) staff has completed the "Risk Insights Baseline Report," and is providing the report to the Commission, for information. The report is also being made publicly available through ADAMS and the NRC website.

The "Risk Insights Baseline Report" documents the results of the staff's risk insights initiative, an activity conducted internally to enhance the staff's use of risk information in the NRC's high-level radioactive waste (HLW) regulatory program. The "Risk Insights Baseline Report" serves as a common reference for the staff to use in risk-informing the NRC's HLW regulatory activities, as it continues through pre-licensing in preparation to review a potential U.S. Department of Energy (DOE) license application for a proposed HLW repository at Yucca Mountain, Nevada.

The staff has not made any determinations about the technical conditions or the adequacy of a repository at Yucca Mountain. If the DOE submits a license application for a repository at Yucca Mountain, the staff will review the information provided by the DOE, and make its determinations based on information available at that time.

Background

On June 5, 2003, the staff provided the Commission with a final response to the staff requirements memorandum (SRM) on the waste arena briefing (ML030840056). In the SRM response, the staff provided the Commission with its ranking of the risk significance of the 293 HLW Key Technical Issue (KTI) agreements. The staff noted that evaluating the risk significance of the KTI agreements was part of a larger effort, referred to as the HLW risk insights initiative, and that the KTI agreement risk rankings were based on the staff's HLW risk insights baseline.

In the SRM response, the staff provided the Commission with a preliminary draft of the HLW risk insights baseline. This memorandum provides the Commission with the revised HLW "Risk Insights Baseline Report."

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HLW Risk Insights Baseline

The staff has been generating risk information in the HLW program for many years through its risk assessment activities. Through the risk insights initiative, the staff has attempted to document the risk assessment results, and to synthesize and integrate the knowledge and insights gained through these risk assessments. This has been done to formulate an independent understanding of how the components of a repository system at Yucca Mountain might function together to isolate waste, and thus affect risk to public health and safety. This has also allowed the staff to develop a shared perspective on which components staff has estimated as most important to waste isolation, and why.

Through the risk insights, the staff presents its perspective on the important parameters, models, and assumptions, importance being judged relative to risk. The risk insights also reflect uncertainties in the understanding of the relevant features, events, and processes. Generally, important uncertainties for estimating repository performance are addressed in the current analyses through a variety of approaches such as use of parameter ranges (e.g., range of retardation factors of radionuclides in alluvium) and conservative modeling approaches (e.g., assume southerly blowing wind direction for igneous activity). The risk insights provide a basis for focusing the staff's attention and resources on the more important technical issues, relative to risk, and indicate where the staff can benefit most from additional information (e.g., reduction in uncertainty in dose estimates).

The staff has compiled a set of system-level and detailed risk insights, related to postclosure performance of the potential geologic repository system at Yucca Mountain, to form the risk insights baseline. The staff based these risk insights on its experience in conducting and reviewing performance assessments for an HLW repository at Yucca Mountain. The staff developed the risk insights baseline by synthesizing the results of total system performance assessments, subsystem analyses, and auxiliary calculations.

The "Risk Insights Baseline Report" includes a discussion of the quantitative technical bases for the insights and associated uncertainties. The staff did not attempt to develop a risk insights baseline to address all the components of a potential repository system at Yucca Mountain, but has, instead, focused on those staff have estimated as most important.

The staff rated the significance of the individual risk insights to assess the relative importance of staff activities. The risk insights were rated by considering the contribution to, or adverse effect on, the waste isolation capabilities of the repository system. The staff rated the significance of a risk insight as "high" if the feature, event, or process addressed by the insight could significantly affect the waste isolation capabilities of the repository system. The significance of a risk insight was rated as "medium" if there could be some effect. The significance was rated as "low" if there would likely be negligible effect. The effect on waste isolation was evaluated by considering potential effect on:

- The integrity of the waste package;
- The release of radionuclides from the waste form and waste package; and
- Radionuclide transport through the geosphere and biosphere.

The magnitudes of the effects were quantified through performance assessment analyses. The individual risk insights and their significance ratings are summarized in the "Executive Summary" of the report, and are discussed in detail in Chapter 4 of the report.

How this Information Will Be Used

The "Risk Insights Baseline Report" serves as a reference to help promote a clearer and more consistent staff position on the relative risk significance of technical issues in the HLW program. The staff intends to use the information generated through the risk insights initiative, and documented in the "Risk Insights Baseline Report," to help prioritize its pre-licensing activities, focus staff resources, and support risk-informed project management and decision-making in the HLW program.

For example, the staff is currently using the risk insights baseline in the pre-licensing issue resolution process. The staff is presently reviewing numerous technical basis documents and agreement responses that the DOE is submitting. The staff is using the risk insights baseline, and the risk ranking of the agreements, to identify and focus attention on the more important aspects of each topical area, and to guide the level of effort expended in reviewing the submittals. The risk insights baseline also helps the staff in identifying and justifying the additional information, if any, requested from the DOE.

In addition, staff recently used the risk insights baseline to risk-inform its three-part evaluation of the DOE's Yucca Mountain Project Office. During the evaluation, the staff sought to obtain independent objective evidence regarding the adequacy of technical information presented in risk-significant analysis model reports (AMRs), as well as the adequacy of the DOE's processes for developing and controlling those AMRs. The staff identified the significant AMRs, based on the risk insights baseline.

Another example is the use of the risk insights baseline in developing the inspection program for Yucca Mountain. The Yucca Mountain inspection program will rely on risk information to ensure that inspection resources are appropriately applied. The staff is currently developing guidance using the risk insights baseline to: (1) focus inspections based on risk significance and (2) implement a risk-informed assessment process, to determine the safety significance of inspection findings. The significance assessment process will feed enforcement and the Yucca Mountain oversight process to trend the DOE performance and reallocate inspection resources as necessary.

The staff is also incorporating the risk insights baseline into the update of the "Integrated Issue Resolution Status Report" (NUREG-1762), currently underway. This report provides background information on the status of prelicensing interactions between the NRC staff and the DOE. For each model abstraction described in NUREG-1762, the staff is using the risk insights baseline to develop the discussion of the importance of the model abstraction to repository performance.

The staff expects to use the "Risk Insights Baseline Report," together with the "Yucca Mountain Review Plan" (NUREG-1804) and NUREG-1762, to conduct a risk-informed review of a potential DOE license application for a Yucca Mountain repository. The risk insights baseline will help to focus the staff's review, help determine the depth of the staff's review in particular areas, and help develop requests for additional information. The "Risk Insights Baseline

Report" will contribute to the staff's independent thinking during license application review regarding the relative risk significance of technical issues. The relevance of the risk insights baseline is dependent upon the DOE repository design and performance assessment approaches presented in the license application, however, the staff's independent analyses provide additional confidence for review of the strengths and limitations of the DOE demonstration of compliance.

It is the responsibility of the DOE to demonstrate compliance with the regulations at 10 CFR Part 63. The NRC staff, using guidance in NUREG-1804, will consider the safety strategy of the DOE. This approach is consistent with the NRC policy regarding risk-informed, performance-based regulations in which risk insights, engineering analysis, expert judgment, the principle of defense-in-depth, and safety margins, are incorporated in licensing decisions.

Attachment:
"Risk Insights Baseline Report"

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