

August 23, 2002

MEMORANDUM TO: Chairman Meserve
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
Commissioner Merrifield

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

SUBJECT: STATUS OF U.S. DEPARTMENT OF ENERGY AND U.S. NUCLEAR
REGULATORY COMMISSION INTERACTIONS ON KEY
TECHNICAL ISSUE RESOLUTION ASSOCIATED WITH THE
PROPOSED HIGH-LEVEL WASTE REPOSITORY AT YUCCA
MOUNTAIN, NEVADA

The purpose of this memorandum is to update the Commission on U.S. Department of Energy (DOE) and U.S. Nuclear Regulatory Commission (NRC) staff interactions associated with key technical issue (KTI) resolution for the proposed high-level waste (HLW) repository at Yucca Mountain, Nevada. This memorandum addresses the following KTI resolution areas: (1) KTI resolution background; (2) the status of the NRC/DOE KTI agreements; (3) DOE's KTI Agreement Planning Strategy; and (4) an NRC communication and integration initiative.

1. BACKGROUND

The NRC HLW performance assessment program originated in the mid-1970s and since the late 1980's the staff has used this capability, developed through a series of iterative performance assessments (IPA) exercises, to risk-inform its activities. The staff has used insights, from its advancing IPA capabilities, to formulate the NRC's HLW risk-informed, performance based regulation (10 CFR Part 63); develop the Yucca Mountain Review Plan; generate comments on the EPA standard; and to support on-going pre-licensing activities, which included the DOE Viability Assessment and the NRC comments on DOE Site Recommendation. In 1995, these insights were used to refocus the pre-licensing HLW repository program on what the NRC staff termed the key technical issues most significant to repository performance. The staff identified 10 post-closure KTIs and their associated subissues (see attachment for KTI definitions) from an ongoing review of DOE site characterization program (including its total system performance assessment (TSPA)) as well as the staff independent work (including the IPA, sensitivity and uncertainty analysis, and total system performance assessment (TPA) code development). Nine of the KTIs represent major

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processes and related staff concerns regarding the post-closure safety of a geologic repository. The last KTI pertains to development of the NRC regulations in 10 CFR Part 63 and is not part of the KTI resolution process described and discussed here.

To ensure that resolution of the KTIs was documented, the NRC staff initiated a formal issue resolution process which includes continuing independent quantitative assessment through NRC's performance assessment activities, reviewing DOE documents, interacting with DOE in public technical meetings, and identifying the information that DOE will need to provide in any potential license application. More recently, the NRC staff intensified its pre-licensing interactions with DOE. During the period August 2000 to September 2001, the NRC staff and DOE staff held 18 technical exchanges to address and resolve NRC staff questions and concerns. The meeting summaries and the agreements reached during the meetings are available on the NRC web-site. The public meetings were used to discuss the status of issue resolution and reach agreements documenting additional DOE work pertaining to a potential license application. In this context, issues are defined as complete when there are no further questions at the staff level; however, issue resolution does not signify that, with respect to that issue, a licensing decision has been reached.

The staff considers all issues open, in terms of a potential licensing decision, unless and until DOE submits a high-quality license application and the staff completes its independent safety review and issues a safety evaluation report reflecting its final determination of whether DOE's license application meets NRC's regulations. Any decision will be based on all the information available at that time.

The results of the intensified interactions have already been presented to DOE in formal letters and public meetings, and were summarized in an attachment to NRC's November 13, 2001, letter to DOE, providing the Commission's preliminary comments regarding a possible geologic repository at Yucca Mountain. The attachment described the nine post-closure KTIs and their associated subissues, the pre-closure safety topics, and a general description of the additional work that DOE will need to complete before submitting any potential license application.

In addition, in July 2002, NRC staff published NUREG-1762, "Integrated Issue Resolution Status Report." The report provides background information on the prelicensing interactions with DOE (to October 2001). In particular, the report provides the technical bases for the staff views presented in the public meetings with DOE from August 2000 to September 2001. The report also documents the information staff considered in formulating their views, including the results of the in-depth review of DOE and contractor documents; the independent work of NRC and its contractor, the Center for Nuclear Waste Regulatory Analyses; published literature; and other publicly available information.

2. STATUS OF KTI AGREEMENTS

As a result of the previously mentioned interactions, NRC and DOE have reached 293 agreements, to date. These agreements cover the nine post-closure KTIs, as well as pre-closure safety topics. The NRC staff continues to interact with DOE on, and closely track the status of, the KTI agreements. This includes interacting with DOE to clarify the intent of the agreements, monitoring the DOE schedule to provide the information, tracking the NRC review of documents DOE submits, and formally documenting the NRC staff review of the information

provided by DOE. To help ensure that the staff is applying a risk-informed, performance-based approach to identifying needed information, the staff is using the review guidance in the draft Yucca Mountain Review Plan. The draft Yucca Mountain Review Plan outlines the review methods and acceptance criteria the staff will use in reviewing any potential license application. The staff also continues to conduct independent performance assessment activities (e.g., TPA code runs, risk-insights initiative, sensitivity and uncertainty analysis, and in-depth review of DOE's Total System Performance Assessment for Site Recommendation) to further clarify its own understanding of the issues, refine its risk insights, and continually re-assess the importance of the issues to repository performance based on new information or design changes. As a final check, all issue resolution letters are being reviewed by individuals knowledgeable about overall repository performance, before sending the request to DOE.

As of August 15, 2002, the NRC staff has reviewed and documented the completion of 54 agreements. Of the remaining 239 agreements, 40 are under staff review, and 199 remain to be fully addressed by DOE. The DOE schedule and its progress on addressing the agreements are periodically discussed with DOE management during frequent telephone conversations and quarterly NRC/DOE public management meetings. In addition, NRC staff weekly status reports are provided to NRC Division of Waste Management managers so that any DOE or NRC delays can be highlighted and discussed as appropriate, including raising concerns to DOE senior management in a timely manner.

3. DOE's DRAFT KTI AGREEMENT PLANNING STRATEGY

During public meetings on February 5 and April 15-16, 2002, DOE discussed the process it is using to evaluate and prioritize proposed work, for the remainder of fiscal year 2002, regarding a potential license application. DOE summarized the process by stating that: (1) it is a decision-aiding tool rather than a decision-making tool; (2) it is based on both technical and management input; (3) consideration is given to quantitative and qualitative regulatory requirements, confidence in technical defensibility, and fiscal constraints; (4) decisions will be integrated with other project activities; (5) the basis for decisions will be documented; and (6) decisions will be reevaluated as new information becomes available.

As part of its draft KTI Agreement Planning Strategy, DOE described binning the open agreements into four disposition methods. The four methods are: (1) providing the information and documentation method specified in the original agreement to NRC; (2) providing information or a documentation method different from that specified in the agreement, but still meeting the intent of the agreement; (3) providing an alternative basis for closing the agreement, such as providing additional risk information or sensitivity studies; and (4) providing other information as a basis for closing the agreement, such as a change in design or licensing basis. DOE stated that it plans to address all the agreements by the time of a potential license application. The staff noted, during the meetings, that it would not endorse nor challenge the binning of the agreements, but was more interested in how DOE planned to address NRC's information needs for each agreement.

During a public meeting on July 23, 2002, DOE discussed its draft plan and schedule to address the remaining open KTI agreements. DOE provided a draft table of the open KTI agreements, which listed the binning and schedule for the next three fiscal years. DOE stated that it plans to address a majority of the open agreements in the July 2003 to March 2004 time

frame, with a number of agreements (15) to be addressed in fiscal year 2005. The NRC staff stated that early interactions on the open KTI agreements would be beneficial, in that it would help the staff understand and comment on DOE's approach to addressing the KTI agreements. The staff noted that this would be especially helpful for those KTI agreements where DOE planned to use sensitivity studies (Bin 3) or were scheduled to be submitted for NRC staff review in the later half of fiscal year 2004 or fiscal year 2005. DOE stated that its approved plan and schedule would be formally submitted to the NRC shortly.

4. NRC RISK INSIGHTS

Over the last several months, the NRC staff has been conducting a risk insights exercise to document existing risk insights and communicate among NRC staff the risk-informed basis for the KTI agreements. This exercise also prepares the staff for discussions with DOE on its prioritization of KTI agreements. To date, this joint exercise between NRC staff and the Center for Nuclear Waste Regulatory Analyses staff has involved all KTI team members and the performance assessment staff. Staff members were asked to rate the importance of each KTI agreement that was relevant to their areas of expertise. To foster staff discussion, the staff was asked to define the risk insights and other factors used to rate an agreement's importance. Risk insights were not specifically defined, but the KTI teams were to consider information that is:

- 1) Tied to the regulatory requirements -- this implies the performance objective as set out in 10 CFR Part 63, as well as the multiple barriers requirement;
- 2) Based upon the DOE safety case;
- 3) Derived from independent performance assessment (sensitivity and uncertainty analysis, TPA code runs, off-line calculations, evaluation of DOE TSPA, etc.); and
- 4) Needed to be understood by other KTI teams.

The staff ratings were then used in facilitated discussions with the KTI teams, to arrive at a common understanding of the importance of the information provided by each agreement to the performance of the proposed repository and the level of effort expected for DOE to complete the agreement. When a common understanding was reached, the agreement was given a composite rating reflecting staff ratings and discussion. The composite ratings are being used, within each KTI, as a guide to which agreements and subissues are considered to be more important. For agreements where a common understanding was not reached, analyses will be conducted to reach the desired understanding of risk insight.

When complete, this effort will communicate the specific risk insights that support the NRC staff's understanding of the performance of the proposed repository, thereby assisting the staff in reviewing DOE's KTI Agreement Planning Strategy, providing better staff integration, and identifying any impacts on NRC's current programs.

The first risk insights exercise was an initial step toward compiling and communicating an integrated baseline of quantitative risk insights associated with the important issues affecting repository performance. The staff presented this initiative to the Advisory Committee on Nuclear Waste (ACNW) at its April 2002 meeting. The ACNW generally supports the staff's approach and by letter dated July 2, 2002, provided comments on the initiative to the Commission. In the future, the exercise will focus on further developing and integrating this baseline of quantitative risk insights, and determining the risk significance of the issue, based on the insights. The quantitative risk insights will include both the risk information generated through current and future NRC and DOE performance assessment activities and agreement resolutions, and the findings and conclusions drawn from the information. The baseline will

provide a common reference point for the quantitative, risk component of a risk-informed regulatory program; will help focus our regulatory activities; and will support risk-informed project management and decision-making during pre-licensing issue resolution activities and license application review.

5. CONCLUSIONS

The NRC staff will continue to interact with DOE on a regular basis, and is participating aggressively as DOE works toward issue resolution. The staff will continue its independent performance assessment activities which have been and will continue to be critical to issue resolution and to completing a risk-informed, performance-based review of DOE's potential license application. Multiple public meetings with DOE are being planned, in the next several months, to discuss the technical issues and their associated agreements. The NRC staff has a system in place to track the agreements and the documents DOE submits to address them. NRC management monitors DOE's progress on addressing the agreements and discusses this progress with DOE. NRC staff will provide status reports to the Commission as the KTI resolution process proceeds.

Attachment: Key Technical Issue Definitions

cc: SECY
OGC
OPA
OCA
OCFO

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- OPA
- OCA
- OCFO

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Key Technical Issue Definitions

Unsaturated and Saturated Zone Flow Under Isothermal Conditions – How does water move above and below a potential repository at Yucca Mountain?

Thermal Effects on Flow – How does temperature affect the timing and mechanisms whereby water reaches the waste containers?

Container Life and Source Term – How long do we expect the containers and waste forms to last and what will happen to the waste as the containers and waste forms degrade over time?

Evolution of the Near Field Environment – How do water and heat affect the chemical environment of the containers, waste forms, and the immediate area around the repository?

Radionuclide Transport – How do radionuclides released from degraded waste move away from the repository?

Repository Design and Thermal Mechanical Effects – How do engineering design, construction, and operation of a repository affect short- and long-term repository safety?

Structural Deformation and Seismicity – How do the physical characteristics of the rock in the repository and the likelihood of earthquakes affect repository safety?

Igneous Activity – How likely is it that volcanic eruptions or intrusion will disrupt the repository and what would be the potential consequences to people and the environment?

Total System Performance Assessment and Integration – How can we best describe how well the entire system of engineered and natural barriers will work together to retain waste, so we can decide whether DOE's proposed repository at Yucca Mountain will comply with safety and environmental standards?

Activities Related to Development of the U.S. Environmental Protection Agency Yucca Mountain Standard - Activities related to the development of the NRC regulation in 10 CFR Part 63.