June 5, 2003

MEMORANDUM TO: Chairman Diaz
Commissioner Dicus
Commissioner McGaffigan
Commissioner Merrifield

FROM: William D. Travers ***/RA by William F. Kane Acting For/***
Executive Director of Operations

SUBJECT: FINAL STAFF RESPONSE TO MARCH 19, 2003, STAFF REQUIREMENTS MEMORANDUM ON THE WASTE ARENA BRIEFING - M030303A

On March 3, 2003, the Commission was briefed by the U.S. Nuclear Regulatory Commission (NRC) staff on the status of the waste safety programs, performance, and planning in the Office of Nuclear Material Safety and Safeguards (NMSS). Following this briefing, the Commission directed the staff, in the subject Staff Requirements Memorandum (SRM), to provide a report documenting the status of Key Technical Issue (KTI) agreements and report on the risk-significance ranking of the 293 KTI agreements. The staff provided the status of the KTI agreements to the Commission on April 8, 2003 (memorandum from William D. Travers). This memorandum reports on the risk-significance ranking and constitutes the final response to the SRM.

Background

The NRC is tracking the U.S. Department of Energy's (DOE's) progress on these agreements to further its understanding of the DOE program and the issues before receipt of the license application for Yucca Mountain, which is currently expected in December 2004. With assistance from the Center for Nuclear Waste Regulatory Analyses, the NRC reviews DOE submittals relevant to each agreement to determine the completeness and technical adequacy of the information provided. NRC documents its review results and the status of issue resolution through publicly available letters to DOE.

In public technical exchanges and management meetings during 2000 and 2001, DOE agreed to address information gaps, which NRC identified, by the time of the license application. If DOE provides the needed information, completion of each agreement will enhance the likelihood that the license application will be complete and of high quality. Collectively the agreements represent information the staff believes is necessary to provide a credible

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representation and understanding of the performance of the Yucca Mountain repository. Approximately 95 percent of the agreements relate to post-closure safety and the remaining agreements relate to pre-closure safety. Not all agreements are equally important. Two primary factors govern how the staff will address each agreement: risk significance and technical difficulty. Based on its understanding of current performance assessments, the staff rated the 293 KTI agreements according to their risk significance. The staff judged risk significance by evaluating the impact the requested information could have on current risk estimates and uncertainties in the risk estimates, taking into account the performance of multiple barriers (i.e., defense-in-depth). In a second step, the staff evaluated the technical difficulty of each agreement, and assessed the staff resources that would be required to evaluate the associated DOE responses. Further details are provided in the next section of this paper.

Discussion of the Risk-Ranking of the Agreements

The staff categorized the 293 agreements into: (i) High-Risk Significance — the information requested has the potential to alter the risk estimates significantly; (ii) Medium-Risk Significance — the information requested has some influence on the risk estimates; and (iii) Low-Risk Significance — the information requested is expected to have little effect on the risk estimates. Generally, high-risk significance during the post-closure period is associated with features, events, and processes that could affect a large number of waste packages or significantly affect the releases from the waste package, or significantly affect the transport of radionuclides through the geosphere. Using this criterion, the following six areas have the highest significance for estimating performance: (1) corrosion of the drip shield and waste package, including the chemistry of water contacting the drip shield and waste package; (2) mechanical degradation of the drip shield and waste package caused by the long-term degradation of repository drifts; (3) effects of in-package chemistry on the dissolution of the waste form; (4) radionuclide transport in the saturated zone; (5) probability of volcanic disruption of the repository; and (6) entrainment and transport of radionuclides in volcanic ash. Thus, agreements that provide the technical basis supporting DOE's understanding and representation of the proposed repository in these six areas are ranked as high-risk significant. For example, results from testing of the waste package materials under representative repository conditions and evaluation of aeromagnetic data to determine the probability of volcanic activity would be ranked as high-risk-significant agreements.

The remaining agreements, which are of medium- and low-risk significance, provide information that is: secondary or supportive of the high-risk-significant agreements; or related to less risk significant features, events, and processes; or needed to provide baseline information representative of the proposed repository that is not risk significant nor very uncertain. Agreements are ranked as medium-risk significant when the information is needed to support other high-risk significant agreements and involves consideration of significant uncertainty. For example, estimating infiltration is considered to be medium-risk significant because it supports the determination of the hydro-chemical environment for the drip shield and waste package, and a variety of uncertainties are associated with estimates of infiltration (e.g., evaporation and transpiration processes in the near surface, and near-surface flow processes). Agreements that are necessary to provide the more routine baseline information of the site are ranked as

low-risk significant such as, hydrologic gradients in the saturated zone, and the average diet of locally produced food.

In addition to the six areas of high-risk significance for the post-closure performance, two other areas were identified as high-risk significant. First, development of confidence in the model abstractions used in the performance assessment was ranked as high-risk significance. Agreements related to DOE's evaluation of the degree of realism and conservatism in the models, and the representation of uncertainty in the models were ranked as high-risk significance. Second, the consideration of accidental aircraft crashes during the operational or pre-closure phase of the repository was ranked as high-risk significant. Based on this understanding of risk significance, the agreements were categorized as 41 of high-risk significance, 92 of medium-risk significance, and 160 of low-risk significance (see Attachment 1 for details on the status and risk ranking of the agreements).

The risk insights provided in this memorandum are part of a larger effort referred to as the High-Level Waste Risk Insights Initiative. As part of this initiative, staff has developed an integrated synopsis of its current understanding of key issues in repository performance. This risk baseline information is provided in Attachment 2. The baseline will be updated as appropriate to address changes in DOE's proposed repository design and modeling approach. We plan to brief the Advisory Committee on Nuclear Waste during its public meeting in June 2003 and address any recommendations as we complete the initiative report by October 2003. The risk baseline will also be updated prior to receipt of the license application.

Discussion of the Technical Difficulty of the Agreements

As requested in the subject SRM, the staff also developed a broad ranking of the anticipated technical difficulty of each agreement and the anticipated staff effort to complete each agreement after DOE submittal. Staff's experience to date indicates that the time required to complete agreements varies greatly. The completion time is determined primarily by the technical difficulty of the agreement, and the completeness and quality of the information provided by DOE. The staff's experience in reviewing agreements is that the actual calendar time necessary to review an agreement can be expected to range from approximately 2 months to a year. The calendar time needed to complete a review reflects time needed for further required actions after DOE's initial submittal, such as the need for DOE to submit additional information, or technical exchange meetings between NRC and DOE. Generally, the staff expects to spend up to 1 to 6 months of staff effort for review of agreements. Staff considers the review of low, medium and high technical difficulty agreements to require up to 2, 4, and 6 months of staff effort, respectively.

The staff examined the relationship between the risk significance of the agreements, the technical difficulty of the agreements, and DOE's current schedule for submitting the agreements to identify schedule concerns (see Attachment 1). The high-risk-significant agreements are relatively evenly distributed up to the anticipated time of DOE's submittal of the license application, which is currently expected December 2004 (see Figure 1 in Attachment 1). Of the 31 high-risk-significant agreements, yet to be submitted, the vast majority of these agreements are judged to be of high and medium technical difficulty (i.e., 13 high, 14 medium, and 4 low). The majority of the agreements, which are categorized as either medium- or low-risk significant, are scheduled to be submitted by the second quarter of fiscal year 2004. So

far, of the 252 medium- and low-risk-significant agreements, 75 are completed, 50 are currently in review, and 105 are scheduled to be submitted by the second quarter of 2004, and 22 are scheduled to be submitted after the second quarter of 2004. Of the 57 medium-risk-significant agreements yet to be submitted, most are considered to be of high and medium technical difficulty (i.e., 18 high, 28 medium, and 11 low). Of the 70 low-risk-significant agreements yet to be submitted, the vast majority are considered to be of medium and low technical difficulty (i.e., 4 high, 34 medium, and 32 low).

Attachment 3 provides information for each of the individual agreements. The information includes approximate submittal dates, the level of risk significance, the technical difficulty and staff effort for agreements not yet completed. Additionally, summary tables are provided for the level of risk significance, technical difficulty, and staff effort.

How this Information Will Be Used

As stated earlier, the staff intends to use the information generated through the High-Level Waste Risk Insights Initiative, and summarized, in part, in this memorandum, to help prioritize its pre-licensing activities, focus staff resources, and support risk-informed project management and decision-making in the high-level waste program. For example, the staff will consider the baseline of risk insights and risk-significance rankings of the KTI agreements in assessing the appropriate level of effort to expend on review of DOE agreement submittals, and to support the need for, and benefit of, additional DOE submittals prior to the license application. The staff will also consider the information in establishing its priority of its pre-licensing interactions with DOE, such as the scheduling of pre-licensing technical exchanges and review of agreements, in case of resource conflicts. Additionally, management discussions with DOE can focus on concerns and schedules related to the agreements of high-risk significance, as well as high technical difficulty and the related amount of staff effort.

The staff will also use the baseline of risk insights and risk-significance rankings in evaluating alternative approaches proposed by DOE to complete agreements. For example, DOE has proposed to close 37 of the agreements by demonstrating that the agreements have little impact on its risk assessment models and results. The staff is using its own risk insights and risk-significance rankings to assist the review of these DOE proposals.

The staff will look for opportunities to use the baseline of risk insights in activities beyond pre-licensing issue resolution. For example, the staff will use the baseline as a tool to communicate its current understanding and assessment of the repository system to both internal and external stakeholders. The staff will also use the information in planning for activities such as reviewing the DOE performance confirmation program; developing a risk-informed inspection program, and an enhanced quality assurance program; and conducting a risk-informed review of a license application, in accordance with the Yucca Mountain Review Plan.

Conclusion

If DOE maintains its current schedule for submitting agreements and the submittals are of sufficient quality to allow for a meaningful review by NRC, the staff believes it will be able to: (1) understand the level of information DOE intends on submitting in the license application; and (2) communicate to DOE, through public letters and interactions, the majority of staff expectations for information to be included in the license application. The staff plans three

specific actions in the months ahead. First, because it is concerned that the current schedule is ambitious, particularly since many of DOE's initial agreement responses, to date, have not been complete, staff will continue to carefully monitor the status of DOE's submissions through the first quarter in 2004, to determine if any schedule delays could impact NRC's ability to provide timely review of DOE's submissions later in 2004. Second, the staff will inform the Commission of any significant schedule changes that may arise from the re-planning effort that DOE is conducting based on its reduced budget for 2003, which could impact the current DOE agreement schedule. Third, the staff will continue to risk-inform the process it uses to review DOE submittals and determine when to request additional information. In this way, staff intends to use the risk insights to enhance the efficiency of the high-level waste program to ensure timely review with available resources.

Attachments:
1. "Summary of Risk-Significance Rankings for KTI Agreements"
2. "Baseline of Risk Insights"
3. "Risk Significance, Technical Difficulty, and Staff Effort for Individual Agreements"

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