YUCCA MOUNTAIN – LOOKING AHEAD TO POTENTIAL LICENSING

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ABSTRACT

If Yucca Mountain, Nevada is designated as the site for development of a geologic repository for disposal of spent nuclear fuel and high-level radioactive waste, the Department of Energy (DOE) must obtain Nuclear Regulatory Commission (NRC) approval first for repository construction, then for an operating license, and, eventually, for repository closure and decommissioning. The licensing criteria at 10 CFR Part 63 establish the basis for these NRC decisions.

Submittal of a license application to the NRC for authorization to construct a repository at the Yucca Mountain site is, at this point, only a potential future action by the DOE. Although the DOE has established schedules for the activities leading to submittal of an application, given the complexity of the policy process involved, there is no way to predict with any certainty whether or when the necessary authorization to submit a license application might be obtained. In spite of this uncertainty, the DOE must take prudent and appropriate action now, and over the next several years, to prepare for timely submittal of an application and to facilitate NRC review of this application if the Yucca Mountain site is recommended and approved for repository development.

INTRODUCTION

The Nuclear Waste Policy Act of 1982, as amended (NWPA) (1, 2), establishes the policy process and defines the steps that must be taken before the DOE can submit a license application to the NRC for authorization to construct a repository at the Yucca Mountain site in Nevada. First, the Secretary of Energy must decide whether to recommend to the President that the President approve the site for development as a repository. Second, if the Secretary recommends approval of the site, and if the President considers the site qualified for application for a construction authorization, the President must submit a recommendation to Congress. Third, if the President recommends approval of the site to Congress, the designation of the Yucca Mountain site for a repository must be approved as required by the NWPA. Although the DOE has established schedules for the activities leading to submittal of a license application, given the complexity of the policy process defined in the NWPA, there is no way to predict whether or when the necessary authorization to submit a license application might be obtained. In spite of this uncertainty, the DOE must take prudent and appropriate action now, and over the next several years, to prepare for submittal of an application and to facilitate NRC review of this application if the Yucca Mountain site is recommended and approved for repository development.

REGULATORY FRAMEWORK

The NWPA and the Energy Policy Act of 1992 (EnPA) (3) define the roles and responsibilities of the Environmental Protection Agency (EPA) and the NRC in setting the radiation protection

standards and establishing the licensing criteria, respectively, for a geologic repository at the Yucca Mountain site. Under the NWPA (1), the standards issued by the EPA and the licensing criteria established by the NRC were intended to be generic so that they could be applied in evaluating and licensing a geologic repository at any site. The 1987 amendments to the NWPA (2) limited DOE's repository siting activities to a single site, the Yucca Mountain site in Nevada, but did not direct any change in the regulatory framework for repository licensing. In 1992, the EnPA changed this situation, requiring the EPA to develop radiation protection standards specifically for a repository at the Yucca Mountain site, with the stipulation that these standards are the only standards that will apply to the site. The NRC is required to revise its requirements and criteria to be consistent with the EPA's standards.

The EPA is in the process of finalizing the radiation protection standards for Yucca Mountain that it proposed in 1999 at 40 CFR Part 197 (4). The NRC is finalizing the licensing criteria for a potential Yucca Mountain repository that it proposed in 1999 at 10 CFR Part 63 (5). The final NRC criteria for repository licensing must be consistent with the final EPA standards as required by the NWPA and the EnPA. The EPA's radiation protection standards and the NRC's licensing criteria, which will implement the EPA's standards, must be in place early enough to permit the DOE to effectively respond to both the procedural and technical requirements of the applicable NRC regulations in its application for construction authorization.

The NRC's licensing criteria at 10 CFR Part 63 specify the performance objectives for the geologic repository that must be met through permanent closure and those performance objectives that must be met after permanent closure. In the final rule, these requirements must be consistent with the standards established by the EPA for a Yucca Mountain repository. The NRC rule specifies the requirements for the safety analysis of the geologic repository to demonstrate compliance with the preclosure performance objectives. The safety analysis would be a systematic examination of the potential hazards, which would ensure that all relevant hazards that could result in unacceptable consequences have been adequately evaluated and protective measures have been identified so that the repository will comply with the pre-closure performance objectives. The rule also specifies the requirements for the performance assessment that must be used to demonstrate compliance with the postclosure performance objectives, including requirements regarding the characteristics of the reference biosphere and population group that must be used in the analysis.

In addition to establishing the performance objectives and other technical criteria to be met, the NRC rule also specifies the general content requirements for the license application that must be submitted for review and the findings required for the NRC to authorize construction of a repository. Consistent with the NWPA, the NRC rule requires that the DOE submit its final environmental impact statement (EIS) with its license application. The NWPA requires that the NRC adopt the DOE's EIS to the extent practicable as part of its licensing action. The NRC rule also establishes requirements for updating the license application and standards for issuance of a license that would permit the DOE to receive and possess waste at the repository once construction of the facilities required for initial repository operations is substantially complete. Finally, the rule establishes requirements for the issuance of a license amendment that would permit permanent closure of the repository and, eventually, an amendment to terminate the license.

The NRC Rules of Practice for Domestic Licensing Proceedings are found at 10 CFR Part 2 (6). The specific procedures applicable to licensing proceedings for a geologic repository for high-level radioactive waste are found at Subpart J of this rule. Subpart J was revised in 1998 to take advantage of Internet technology to link geographically dispersed sites as part of an electronic information management system - the Licensing Support Network (LSN) – to provide for discovery, electronic submission of information and filings, and access to an electronic version of the licensing docket (7). The LSN is intended to facilitate a thorough and comprehensive technical review of the DOE's license application by parties to the proceeding. It is also intended to permit completion of the NRC licensing proceeding, including the required adjudicatory hearing before an Atomic Safety and Licensing Board panel, within the three-year time frame specified in the NWPA. In August 2000, the NRC proposed further amendments to Subpart J to establish the design standards for participant web sites of the LSN and requirements on the time for information to be made available by the participants, including the DOE (8). The final rule governing a repository licensing proceeding and the role of the LSN in this proceeding must be in place prior to submittal of an application and in sufficient time to permit DOE compliance with NRC requirements on the availability of the LSN to support licensing review and discovery.

NRC GUIDANCE FOR LICENSING REVIEW – DOE GUIDANCE FOR LICENSE APPLICATION PREPARATION

Although 10 CFR Part 63 establishes the general requirements for the content of the DOE's license application, it is silent on the format of the application and the detailed criteria for NRC staff review of the information presented. The NRC is in the process of preparing guidance to its staff for their review of a DOE license application for a Yucca Mountain repository. This guidance will be documented in the Yucca Mountain Review Plan (YMRP). The DOE understands that the YMRP will be consistent with the risk-informed, performance-based licensing approach reflected in the NRC licensing criteria. The goal appears to be to focus staff review on issues that are significant to conclusions about performance, rather than on technical information outside the context of its importance to conclusions about performance. The structure of the YMRP and the acceptance criteria and review methods it provides are expected to be consistent with the NRC's regulatory approach and review goal.

The DOE developed its own Technical Guidance Document for License Application Preparation (the TGD) to assist authors in preparing the application for submittal to the NRC (9). This document currently reflects the NRC's proposed licensing criteria and content requirements for the license application, and the DOE's position on the level of design detail needed for an application for construction authorization. The TGD distinguishes between the content requirements and related guidance for the license application for construction authorization and the updated application for a license to receive and possess radioactive waste. This distinction is consistent with the NRC's requirements for and conditions placed on issuance of a construction authorization (5). A license to receive and possess waste will not be issued by the NRC until the DOE updates its license application and meets the requirements for the issuance of a license, including substantial completion of construction of those facilities necessary for initial repository operations. In addition to providing guidance to authors for demonstrating compliance with NRC regulatory requirements and acceptance criteria for review, the TGD identifies NRC

regulatory guides, and industry codes and standards that will be cited in the application. The DOE will revise the TGD when the NRC issues its final licensing criteria and its review plan so that any application prepared by the DOE will be consistent with NRC guidance in the YMRP. The goal is to prepare a license application that is structured to facilitate a performance-based review by the NRC staff as well as providing a reasonable and workable framework for the DOE to present the required information.

DOE-NRC INTERACTIONS AND PRE-LICENSING ISSUE RESOLUTION

Interactions between the NRC and DOE prior to submittal of a license application continue to focus on early resolution of both technical and regulatory issues in order to facilitate NRC acceptance and review of an application for construction authorization. The NRC has identified nine key technical issues (KTIs) that it believes are critical to assessing the post-closure performance of the proposed repository system (10). The central and integrating issue for the other eight KTIs relates to the approach for the total system performance assessment (TSPA) that is required by 10 CFR Part 63 to be used by the DOE in demonstrating compliance with the NRC's postclosure performance objectives. The other eight KTIs are igneous activity, structural deformation and seismicity, evolution of the near-field environment, container life and source term, thermal effects on flow, repository design and thermal-mechanical effects, unsaturated and saturated flow under isothermal conditions, and radionuclide transport. The NRC is documenting the status of resolution of these nine issues in a series of Issue Resolution Status Reports (IRSRs) that are updated as necessary to reflect current status based on interactions with the DOE and review of DOE technical documents. The acceptance criteria for resolution of each KTI were originally developed as part of the IRSRs and are now being considered by the NRC in developing its review plan for the Yucca Mountain license application. Since August 2000, the DOE and NRC have met nine times to discuss the status of resolution of the KTIs and to agree on a path forward for closing the remaining open items associated with each KTI. Additional meetings will be held to discuss the remaining issues as well as the relevance to issue resolution of new information that is developed.

The NRC has defined two categories of issue closure prior to the DOE's submittal of a license application. An issue is "closed" if the NRC has no further questions and the current DOE approach and information are likely to be acceptable for use in licensing. An issue is "closed pending" if the NRC has no further questions and the approach and information are likely to be acceptable, pending review of additional information to be provided by the DOE. The agreements reached in the recent series of meetings with the NRC identify the activities that the DOE will conduct and the information that the DOE will provide as the basis for closure of the issues by the time license application is submitted. In a few instances, an issue may not be closed until the NRC has reviewed the license application itself. It is important to remember that even though the NRC staff may consider an issue closed or closed-pending as a result of pre-licensing interactions, this does not preclude the issue being raised and considered during the licensing proceeding if there is cause to do so.

Although the current focus of interactions between the DOE and NRC is primarily on issues related to compliance with postclosure performance requirements, the licensing criteria at 10 CFR Part 63 also establish requirements for the evaluation of preclosure safety and the use of an

safety analysis in this evaluation. As part of an ongoing process to deal with preclosure safety issues, the DOE and NRC have met to discuss the level of detail needed for repository design for a license application for construction authorization. These meetings included discussions of classification of structures, systems, and components regarding their importance to the radiological safety of the public and workers, and the identification and evaluation of design-basis events for consideration in the assessment of preclosure safety. Further interactions will take place to discuss issues related to preclosure requirements and the level of design detail in the context of the final NRC licensing criteria and the approach reflected by the acceptance criteria in the YMRP.

In two instances, the DOE has prepared Topical Reports and submitted them to the NRC for its review and acceptance of the methods that the DOE will rely on in support of its evaluations for the license application. Issuance by the NRC of Safety Evaluation Reports (SERs) covering these methods will document the degree to which NRC accepts the proposed methods for use in support of a repository license application. A series of three Topical Reports covers the methods that will be used in evaluating the potential for seismicity and faulting at the site and for establishing the seismic design-basis for the repository. The first two of these Topical Reports have been reviewed and accepted by the NRC. Final acceptance of the DOE's proposed methods for the evaluation of faulting and seismicity is contingent on NRC review and acceptance of the third report in the series. This report will be submitted in time to support preparation of the license application. Another Topical Report covers the methods that the DOE will use in evaluating postclosure disposal criticality for spent nuclear fuel and high-level waste placed in a potential Yucca Mountain repository. The NRC issued a SER for this report, documenting its acceptance of portions of the DOE's approach as well as identifying open items that must be resolved for the approach to be fully accepted for use in licensing. The DOE plans to provide additional information for NRC review to support closure of most of these open items prior to submittal of a license application.

TECHNICAL DOCUMENTS THAT SUPPORT LICENSE APPLICATION PREPARATION

A substantial number of technical documents were developed by the DOE to support preparation of a report to document the basis for consideration by the Secretary of a possible site recommendation. If the process defined in the NWPA continues to the next step, updates will be developed for some of these documents to support completion of a comprehensive report to provide a basis for a decision by the Secretary on site recommendation. These technical documents, with further updates or revisions as appropriate, will be used by the DOE in preparing a license application for submittal to the NRC if the site is recommended and approved for a repository.

The technical documents developed to support the site recommendation process include a TSPA supported by nine Process Model Reports and 121 Analysis and Model Reports that provide the basis for conclusions about performance for the postclosure period. System Description Documents and supporting Engineering Analyses were developed to document the repository design basis. A preliminary preclosure safety assessment for a geologic repository was documented to provide a basis for conclusions about performance for the preclosure period. A

comprehensive site description was also prepared to document the DOE's understanding of site conditions derived from site characterization activities. This understanding forms the foundation for the development of the repository design bases and the models used in assessing repository performance.

These technical documents were provided to the NRC for its review as a basis for developing preliminary comments on the sufficiency of the DOE's information for inclusion in a possible license application. These comments are required by the NWPA to be submitted as part of any basis for a site recommendation by the Secretary. The comments provided by the NRC, together with agreements reached with the NRC for resolution of the KTIs, will provide useful feedback regarding technical areas that require additional work prior to completion of a license application for submittal to the NRC if the Yucca Mountain site is recommended and approved for development as a repository.

CONCLUSION

Submittal of a license application to the NRC for authorization to construct a repository at the Yucca Mountain site is, at this point, only a potential future action by the DOE. Although the DOE has established schedules for the activities leading to submittal of an application, given the complexity of the policy process defined in the NWPA, there is no way to predict whether or when the necessary authorization to submit a license application might be obtained. In spite of this uncertainty, the DOE must take prudent and appropriate action now, and over the next several years, to prepare for timely submittal of an application and to facilitate NRC review of this application if the Yucca Mountain site is recommended and approved for repository development. This is particularly true given the need for the DOE to develop, load, and certify the operation of its electronic information system to provide access to its relevant records as part of the LSN in compliance with NRC requirements in preparation for a licensing proceeding. The NRC is currently proposing to require that the DOE's system be certified within 30 days of a site recommendation. The DOE must also develop a license application, which is substantially different from the documents supporting a possible Site Recommendation. The application must satisfy NRC licensing criteria and content requirements, and address the acceptance criteria defined by the NRC in its license application review plan, the YMRP. The content of the application must be adequate to facilitate NRC acceptance and docketing for review, and the application and its supporting documents must provide the documented basis for the NRC findings required for a construction authorization. The application must also support an adjudicatory proceeding before an Atomic Safety and Licensing Board panel prior to Commission action on any decision to authorize construction.

REFERENCES

1. Nuclear Waste Policy Act of 1982, Public Law 97-425 (1983).
2. Nuclear Waste Policy Amendments Act of 1987, Public Law 100-203 (1987).
3. Energy Policy Act of 1992, Public Law 102-486 (1992).
4. 40 CFR (U.S. Code of Federal Regulations) Part 197, "Environmental Radiation Protection Standards for Yucca Mountain, Nevada; Proposed Rule," 64 FR (Federal Register) 46975 (August 1999).

5. 10 CFR Part 63, "Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada; Proposed Rule," 64 FR 8640 (February 1999).
6. 10 CFR Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders; Subpart J, Procedures Applicable to Proceedings for Issuance of Licenses for the Receipt of High-Level Radioactive Waste at a Geologic Repository."
7. 10 CFR Part 2, Subpart J, "Procedures Applicable to Proceedings for Issuance of Licenses for the Receipt of High-Level Radioactive Waste at a Geologic Repository, Final Rule," 63 FR 71729 (December 1998).
8. 10 CFR Part 2, Subpart J, "Procedures Applicable to Proceedings for Issuance of Licenses for the Receipt of High-Level Radioactive Waste at a Geologic Repository: Licensing Support Network, Design Standards for Participating Websites; Proposed Rule," 65 FR 50937 (August 2000).
9. DOE, "Technical Guidance Document for License Application Preparation," YMP/97-03, Revision 1 (September 1999).
10. NRC, "NRC High-Level Radioactive Waste Program Annual Progress Report: Fiscal Year 1996," NUREG/CR-6513, No. 1 (January 1997).