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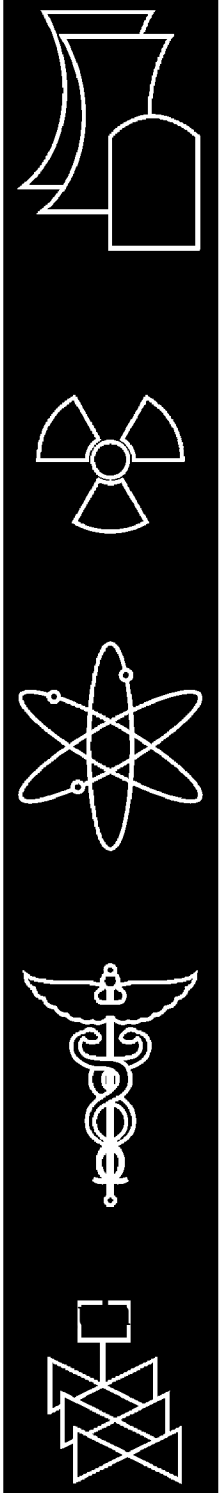

Integrated Issue Resolution Status Report

Chapters 1 through 8

U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Washington, DC 20555-0001

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Washington, DC 20555-0001

ABSTRACT

This Integrated Issue Resolution Status Report provides background information about the status of prelicensing interactions between the U.S. Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission (NRC) concerning a potential high-level waste geologic repository at Yucca Mountain, Nevada. The NRC staff has, for many years, engaged in prelicensing interactions with DOE and various stakeholders. In recent years, DOE and NRC have reached a number of agreements related to key technical issues important to repository performance after permanent closure and items important to safety during the period before permanent closure. During the prelicensing period, the NRC staff also have undertaken a risk insights initiative to enhance the use of available risk information and develop, as a common basis for understanding, the significance of features, events, and processes that may affect the performance of potential engineered and natural barriers at Yucca Mountain.

This report provides an overview of available information and status (as of March 2004, with exceptions as noted) of the Key Technical Issue agreements reached between DOE and NRC. The report also documents the risk insights (Appendix D) and information considered by the NRC staff in formulating their views, including the results of in-depth reviews of available DOE and contractor documents; the independent confirmatory work of NRC and its contractor, the Center for Nuclear Waste Regulatory Analyses; published literature; and other publicly available information.

This report may be of value to stakeholders in understanding the technical rationale used by the NRC staff to identify certain information as being necessary for a quality license application. The staff has not made any determination about compliance with regulations applicable to a potential repository at Yucca Mountain. If DOE submits a license application for a potential repository at Yucca Mountain, the staff will review the information provided by DOE and make determinations based on information provided at that time.

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EXECUTIVE SUMMARY

Introduction

This Integrated Issue Resolution Status Report provides the status of prelicensing interactions between the U.S. Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission (NRC) concerning a potential high-level waste geologic repository at Yucca Mountain, Nevada. The NRC staff has, for many years, engaged in extensive interactions with DOE and various stakeholders including the State of Nevada, Indian Tribes, affected units of local government, representatives of the nuclear industry, and interested members of the public. In recent years, the interactions focused on what the NRC staff termed key technical issues. Defined by the NRC staff in 1995–1996, the intent of the key technical issues is to focus prelicensing work on those topics most critical to the postclosure performance of the potential geologic repository.

To address and document the key technical issues, the NRC staff initiated a formal issue resolution process that includes reviewing the technical information presented in DOE documents; conducting independent confirmatory analyses, experiments, and field work; interacting with DOE in public technical meetings; and identifying the information DOE will need to provide in any potential license application. During the past several years, NRC documented the status of issue resolution through individual status reports for each of the key technical issues to address questions concerning technical information. More recently, the NRC staff intensified their prelicensing interactions with DOE, conducting a series of technical exchanges to address and resolve the remaining questions and concerns. These public meetings discussed the status of issue resolution and reached agreements documenting the additional information DOE needs to provide in a potential license application.

NRC previously documented the status of issue resolution in NUREG–1762 (NRC, 2002). This report updates the earlier report, with a staff assessment of information available as of the end of March 2004 (with exceptions as noted). The status of items covered in this report predates the issuance of the July 2004 D.C. Circuit Court opinion that, among other things, vacated portions of the regulations in 10 CFR Part 63. The report is based on the structure and the review methods contained in NUREG–1804 (NRC, 2003). Discussion of each technical issue also reflects the risk insights currently being developed by NRC to focus its preparations to review a potential DOE license application. The report documents the risk insights (Appendix D) and information considered by the NRC staff in formulating their views, including the results of the in-depth reviews of available DOE and contractor documents; the independent confirmatory work of NRC and its contractor, the Center for Nuclear Waste Regulatory Analyses (CNWRA); published literature; and other publicly available information.

This report is not a licensing review, and no conclusions are drawn with respect to whether or not the Yucca Mountain site is licensable or whether it meets applicable NRC regulatory requirements. The licensing review will begin only after a license application is submitted, and the review will be documented in a safety evaluation report.

The information in this report may be of value to stakeholders interested in understanding the staff technical rationale for identifying certain information as necessary to a high-quality license application.

Background

The U.S. Congress, in the Nuclear Waste Policy Act (1982), directs DOE to submit information to NRC about site characterization activities before submitting a license application for a potential high-level waste geologic repository at Yucca Mountain, Nevada. The U.S. Congress also directed (i) that the NRC preliminary comments concerning the extent to which the at-depth site characterization analysis and the waste form proposal for such site seem sufficient for inclusion in any application that should be submitted by DOE as part of the site recommendation process, and (ii) that NRC shall issue a final decision approving or disapproving the issuance of a construction authorization not later than the expiration of 3 years after the date of the submission of such application (except that NRC may extend such deadline by not more than 12 months).

As a result of this direction, DOE and NRC made issue resolution a major part of the prelicensing interaction specified in the Nuclear Waste Policy Act (1982). The NRC staff issue resolution process includes reviewing the DOE technical documents, interacting with the DOE staff in public technical meetings, and identifying the information DOE will need to provide in any potential license application. The public meetings involve DOE and other stakeholders (including the State of Nevada, Tribal governments, affected units of local governments, and interested members of the public) who have the opportunity to participate. Although public meetings are conducted on a variety of topics, the information presented in this report relates primarily to technical exchanges, which are public meetings that focus on technical or regulatory issues. During prelicensing interactions, issues are considered resolved when there are no further questions at the staff level; however, issue resolution does not signify that a licensing decision has been reached. If DOE submits a license application for a potential repository at Yucca Mountain, staff will review the information provided by DOE and make determinations based on information provided at that time.

The NRC risk-informed, performance-based approach to high-level waste disposal makes use of results from the DOE and NRC laboratory and field experiments, natural analog studies, expert elicitations, and performance assessments. In 1996, these activities led to the development of what the NRC staff termed key technical issues identified as important to the performance of a potential repository. The NRC staff continued to emphasize these key technical issues in the prelicensing interactions with DOE.

The NRC understanding of the site, the potential design, and key technical issues evolved through prelicensing interactions with DOE, results from NRC confirmatory studies, and consideration of independent investigations and evaluations by other stakeholders. As a result, the individual key technical issues were refined into subissues that more clearly specified important areas the NRC staff determined DOE needed to address. In the process, NRC made publicly available numerous technical and program status reports that reviewed the DOE site characterization and design work and identified additional information DOE would need to submit a license application. The NRC staff has consistently emphasized that the extent to which DOE addresses the key technical issues for Yucca Mountain provides assurance that DOE can submit a high quality license application for NRC review.

Starting in August 2000, the DOE and NRC staffs engaged in a series of public technical exchanges to identify the information necessary to ensure the key technical issues are addressed in a potential license application for Yucca Mountain. As a result of these technical

exchanges, DOE and NRC reached 293 agreements to ensure a high-quality license application. In June 2003, the NRC staff provided the Commission with its ranking of the significance of the 293 high-level waste key technical issue agreements between DOE and NRC. The staff noted that evaluating the significance of the key technical issue agreements was part of a larger effort, referred to as the high-level waste risk insights initiative, and that the agreement risk rankings were based on the risk insights baseline.

In previous years, NRC reported status of issue resolution through individual status reports for each of the key technical issues. Beginning in fiscal year 2001, the NRC staff decided the issue resolution process was mature enough to develop a single Integrated Issue Resolution Status Report to clearly and consistently reflect the interrelationships among the various key technical issue subissues and the overall resolution status. At the same time, NRC began to develop the Yucca Mountain Review Plan to document the review methods and acceptance criteria for the detailed technical review of the DOE license application (NRC, 2003).

Report Structure

This update to the Integrated Issue Resolution Status Report is organized to reflect the structure of the Yucca Mountain Review Plan (NRC, 2003, NUREG–1804) and the results of the NRC risk insights initiative. This report captures the status of progress towards issue resolution through March 2004 (with exceptions as noted).

Based on 10 CFR Part 63 and review of the DOE reports (CRWMS M&O, 2001, 2000), and other support documents, the NRC staff preliminarily identified 10 preclosure topics that DOE should address in any future license application regarding the potential high-level waste repository at Yucca Mountain: (i) Site Description As It Pertains to Preclosure Safety Analysis; (ii) Description of Structures, Systems, Components, Equipment, and Operational Process Activities; (iii) Identification of Hazards and Initiating Events; (iv) Identification of Event Sequences; (v) Consequence Analyses; (vi) Identification of Structures, Systems, and Components Important to Safety, Safety Controls, and Measures to Ensure Availability of the Safety Systems; (vii) Design of Structures, Systems, and Components Important to Safety and Safety Controls; (viii) Meeting the 10 CFR Part 20 As Low As Is Reasonably Achievable Requirements for Normal Operations and Category 1 Event Sequences; (ix) Plans for Retrieval and Alternate Storage of Radioactive Wastes; and (x) Plans for Permanent Closure and Decontamination, or Decontamination and Dismantlement of Surface Facilities. The NRC staff is developing the risk insights to prioritize review of the preclosure aspects of the potential DOE license application. The type of risk information to be used in developing these insights will include available DOE design documents, previous operational experience, and independent confirmatory preclosure safety analyses.

The postclosure section of this report is organized according to a set of integrated subissues as described in NUREG–1804 (NRC, 2003). The NRC staff used an integrated subissue approach, adapted from independent performance assessments conducted by DOE and NRC, in preparing information for many of the key technical issue technical exchanges beginning in August 2000. This approach provides an integrated, transparent structure to review the DOE information pertaining to the key technical issues (Figure 1). The structure is primarily based on the natural progress of moisture downward to the repository level, various processes in the

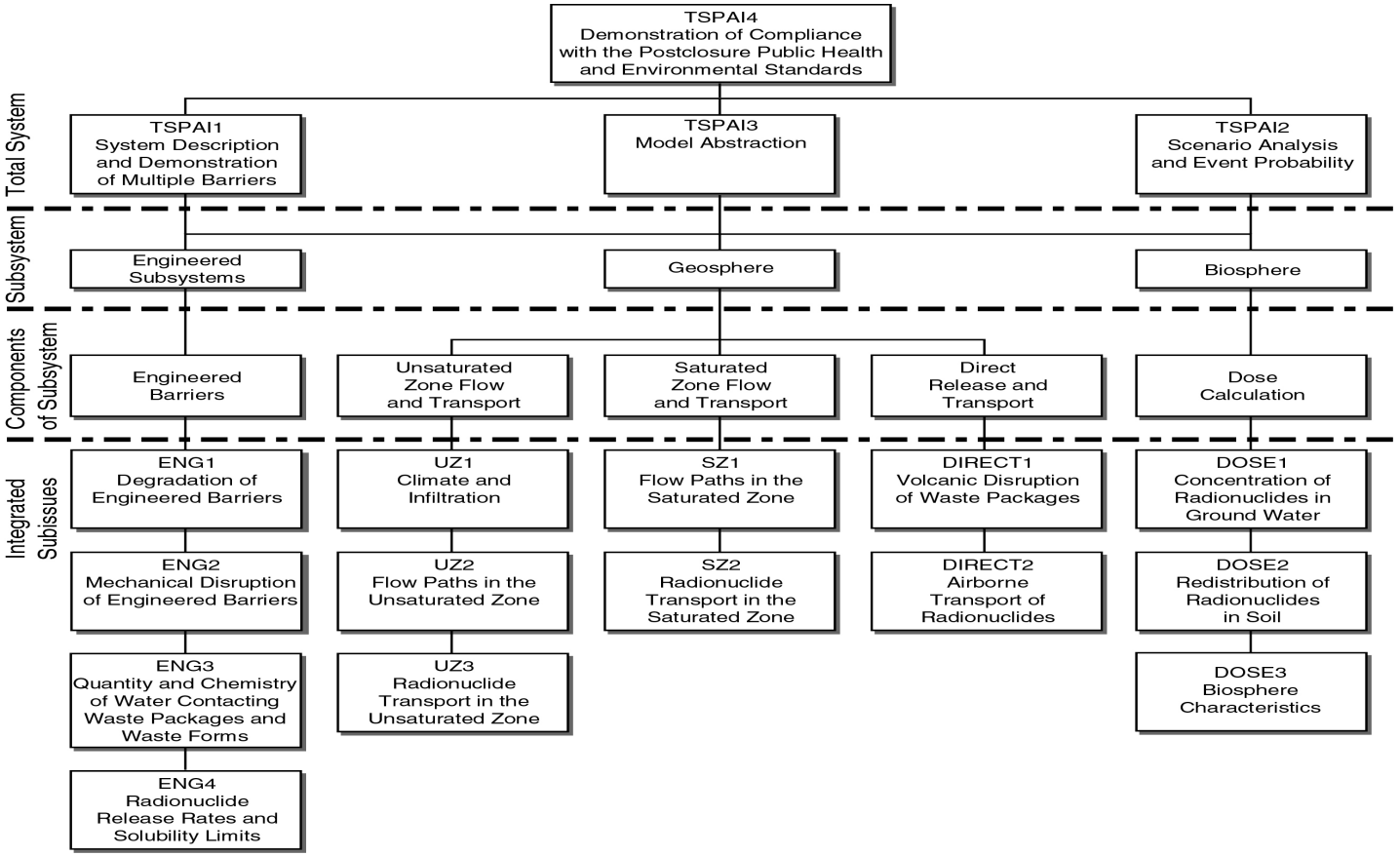

Figure 1. Components of Postclosure Performance Assessment Review

vicinity of the engineered barrier system and the emplaced waste, and potential radionuclide release and transport to a receptor group distant from the Yucca Mountain site. Processes and events that could potentially disrupt the repository also are considered. The topics (14) at the most detailed level in Figure 1 are called integrated subissues or model abstractions, mainly because each integrated subissue draws information from multiple key technical issues. The integrated subissues represent an interdisciplinary and logical approach to reviewing the DOE performance assessment. The integrated subissue format and the interdisciplinary questions posed for each of the integrated subissues assist the staff in more formally integrating the related processes and effects of the key technical issue subissues. In addition, information presented in this report is prioritized to reflect the risk information used as part of the NRC risk insights initiative.

Preclosure Summary

Because significant experience already exists at NRC in regulating safety during construction and operation of other nuclear facilities, the NRC staff emphasized developing licensing review capabilities with respect to postclosure during the early years of the program. Beginning in fiscal year 2000, however, the importance of preclosure safety was elevated in view of the DOE plans to proceed with a design and submit a possible site recommendation.

During past DOE and NRC preclosure interactions and conversations, technical issues associated with preclosure topics (i) through (vii) have been discussed. Prelicensing activities on preclosure topics will continue, including interactions between DOE and NRC, until the submittal of a potential license application. During prelicensing, the NRC will continue to conduct independent confirmatory preclosure safety analyses, as needed, to better risk inform prelicensing activities.

Postclosure Summary

Consistent with the issue resolution process, the NRC staff intensified prelicensing interactions with DOE to develop information in the areas of the key technical issues. Since August 2000, DOE and NRC have held numerous public technical exchanges focused specifically on the status of issue resolution related to these questions. Results from this increased prelicensing interaction have been documented in formal letters to DOE and in agreements reached in the public meetings between DOE and NRC. In addition, the NRC staff has used the results from its risk insights initiative to focus review on those features, events, and processes most significant to waste isolation.

Prelicensing activities on postclosure topics will continue, including interactions between DOE and NRC, until the submittal of a potential license application. During prelicensing NRC will continue to conduct independent confirmatory postclosure safety analyses, as needed, to better risk inform prelicensing activities.

Summary

This report provides the status of issue resolution between DOE and NRC for a potential high-level waste repository at Yucca Mountain, through March 2004. The issue summaries include updated, risk-informed assessments of the technical bases presented by DOE in the areas of the key technical issues identified for a potential Yucca Mountain repository.

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PREFACE

The Integrated Issue Resolution Status Report documents the status of preclosure and postclosure technical issues that have been the focus of prelicensing interactions related to the potential high-level nuclear waste repository at Yucca Mountain. The process of issue resolution during the prelicensing phase is based on review of information (i) contained in the U.S. Department of Energy (DOE) and DOE contractor documents; (ii) obtained during technical exchanges, which are meetings open to the public; (iii) obtained from independent confirmatory investigations conducted by the U.S. Nuclear Regulatory Commission (NRC) and its contractor, the Center for Nuclear Waste Regulatory Analyses; and (iv) available from a variety of open literature sources. The prelicensing consultations between NRC and DOE are consistent with the Nuclear Waste Policy Act (1982).

This update to the Integrated Issue Resolution Status Report tracks progress toward the resolution of issues and provides this information in a single document to interested parties. Because of the broad scope of this report, however, publication will lag a few months behind availability of the information. For example, although DOE is revising its technical basis to address the key technical issue agreements, this update of the report includes the NRC assessment of status based on information available through March 2004 (with exceptions as noted). The primary organization of this report is based on the structure and review methods developed in NUREG–1804 (NRC, 2003). In addition, information presented in this report is prioritized to reflect the use of risk information as part of the NRC risk insights initiative.

Some sections are absent from this report and others are incomplete. For example, only certain sections are included in Chapter 7, which is devoted to administrative and programmatic requirements for a potential license application.

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ACKNOWLEDGMENTS

This Integrated Issue Resolution Status Report is a joint product of the U.S. Nuclear Regulatory Commission (NRC) and the Center for Nuclear Waste Regulatory Analyses (CNWRA). Staff from both organizations provided information, prepared text, and served as technical, editorial, and programmatic reviewers. The report was coordinated by James L. Rubenstone and Gregory P. Hatchett at NRC and David R. Turner at CNWRA. They thank all participants for their hard work and diligence in preparing this revision to the integrated issue resolution product.

This report was produced in accord with the quality assurance requirements described in the CNWRA Quality Assurance Manual. Data and analyses from many sources other than the CNWRA are included in this document. Referenced sources of data and analyses should be consulted for determining levels of quality assurance.