THE SITE-CHARACTERIZATION PLAN AND ITS ROLE IN RESOLVING SITING AND LICENSING ISSUES

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ABSTRACT

As required by the Nuclear Waste Policy Act and the Nuclear Regulatory Commission (NRC) in 10 CFR Part 60, the Department of Energy is preparing plans for conducting site characterization at three candidate sites. Prepared according to a detailed annotated outline that is based on the NRC's Regulatory Guide 4.17, these plans will present the information collected to date about the geologic, hydrologic, geochemical, geoengineering, and climatic conditions of each site; describe the design of the repository and the waste package; and discuss the site-characterization program. The most important portions of the plan will be the strategy for resolving siting and licensing issues and the description of the testing and analysis program to be followed in resolving these issues. The issues-resolution strategy consists of identifying issues and the associated information needs; allocating performance goals for various components of the repository system; developing a testing plan to gather the necessary information; gathering and analyzing the information; and documenting the results for use in site selection and licensing. The issues-resolution strategy will allow the Department to define all of the issues that must be resolved in order to demonstrate compliance with applicable regulations and to specify the information needed to resolve these issues. It will provide a consistent framework and establish priorities for the Department's site-characterization effort for the next several years.

INTRODUCTION

The Nuclear Waste Policy Act of 1982 (the Act)[1] requires the Department of Energy to conduct a site-characterization program, including the construction of exploratory shafts, for at least three candidate repository sites. The Act also requires that, before beginning characterization activities at any site, the Department prepare a site-characterization plan for each site. With the final environmental assessments for the first-repository sites scheduled for publication this coming April, the Department's siting program is being focused on the preparation of site-characterization plans (SCPs) for three candidate sites for the first repository. These plans are required not only by Section 113(b) of the Act but also by regulations promulgated by the Nuclear Regulatory Commission (NRC) as 10 CFR Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories."[2] While the three sites to be characterized will not be chosen until the final environmental assessments are issued, the Department currently has activities under way to prepare site-characterization plans for three different host rocks: basalt, salt, and tuff.

The basic objective of site characterization is to establish the geologic, hydrologic, and geochemical conditions at a candidate site, thus providing data needed for the design of the waste package and the repository as well as the performance assessment of the repository system. The performance assessment will be used to demonstrate compliance with regulatory requirements.

The purpose of the site-characterization plans is to present a clear plan for the site-characterization program that will be conducted at each candidate site. Specifically, the plans are to present existing data about the candidate site; to describe the design of the waste package and the repository; to identify unresolved issues concerning the site's compliance with regulatory requirements; and to present the plans to collect and analyze the information necessary to resolve those issues.

Although site preparation and surface-based site-characterization activities may be started as soon as the President approves the candidate sites recommended by the Secretary of Energy, site-characterization plan must be issued before the Department can begin to construct exploratory shafts at any site. The Department must submit these plans to the Nuclear Regulatory Commission, to the Governor or the legislative body of the State in which the site is located, or to the governing body of the affected Indian Tribe on whose reservation the site is located. In addition, the Department must make the plans available to the public and must hold hearings in the vicinity of the candidate site to inform residents of the plan and to receive their comments. During the site-characterization program, the Department must report on the status of site-characterization activities and the information obtained. Such status reports will be presented in periodic progress reports prepared every six months. These progress reports will be the vehicle for reporting on progress toward resolving issues, for identifying new issues that arise during characterization, and for discussing changes that may be needed in the site-characterization program. During site characterization the Department will meet with the staff of the Nuclear Regulatory Commission to work toward the resolution of open issues as early in the process as practicable. Such meetings with the NRC staff have already been

held to discuss performance allocation for repository systems and the annotated outline for the site-characterization plans, and all such meetings are open to the public.

STRUCTURE OF THE SITE-CHARACTERIZATION PLANS

The site-characterization plans will follow an annotated outline that has been developed by DOE Headquarters and the Project Offices. This outline is derived from the NRC's Regulatory Guide 4.17,[3] whose purpose is to provide the Department with guidance on the content of the site-characterization reports required by the Nuclear Regulatory Commission before the passage of the Act. The format of Regulatory Guide 4.17 was modified somewhat for ease and clarity in presenting the Department's plans. The annotated outline incorporates other requirements of the Act, such as basing site evaluations on the siting guidelines.

After the annotated outline was developed, the Department's technical staff met with staff from the Nuclear Regulatory Commission to present the outline and discuss any concerns that the NRC staff might have about implementing the outline. At the same time, copies of the outline were forwarded to first-repository States and to affected Indian Tribes for their information. After the meeting, the NRC staff agreed in a written summary statement that the annotated outline would provide an acceptable framework for the preparation of the plans. The Department has followed the format and content requirements of the annotated outline in proceeding to prepare the plans.

The site-characterization plan is divided into two major parts--Part A, which describes the site, the waste package, and the repository, and Part B, which presents the site-characterization program. Part A contains seven chapters. The first five chapters are devoted to the presentation of the currently existing information in specific technical areas. These chapters cover geology, geoengineering, hydrology, geochemistry, and climatology and meteorology. Chapters 6 and 7, conceptual design of a repository and waste package, respectively, present the status of the current design for the particular candidate site. The identification of the site performance and licensing issues to be resolved during site characterization is based partially on the evaluation of these existing data. Adequate identification of these issues, the information needed to resolve them, and the plans for obtaining and analyzing this information are crucial to the development of an adequate testing program.

To ensure the correlation of issues identified in Chapters 1 through 7 with the testing program presented in Chapter 8, the Department added introduction and summary sections to each of the chapters in Part A. These sections will summarize how the presently available information was obtained, describe the quality of that information, including uncertainties, and discuss its future use. They will synopsize significant results, especially in terms of compliance with performance objectives and the need for further data from site characterization. In addition, they will summarize the status and quality of conceptual models. These sections are intended to create continuity between the descriptive material of Part A and the site-characterization program presented in Part B.

Part B, or Chapter 8, is the heart of the site-characterization plan. Chapter 8 is composed of seven sections: 8.1, the Rationale for the Planned Site Characterization Program; 8.2, Issues To Be Resolved and Information Required During Site Characterization; 8.3, Planned Tests, Analyses, and Studies; 8.4, Planned Site Preparation Activities; 8.5, Milestones, Schedules, and Decision Points; 8.6, Quality Assurance; and 8.7, Decontamination and Decommissioning. Of these sections, Sections 8.2 and 8.3 are the most important portions of the site-characterization plan. Section 8.2 presents the issues-resolution strategy developed by the Department to guide its site-characterization program and ultimately to guide its overall licensing effort. In presenting the issues-resolution strategy, Section 8.2 formally defines the hierarchy of siting and licensing issues that must be satisfactorily resolved in order to demonstrate the overall performance of the repository system and identifies the information needs that must be satisfied to resolve these issues. Section 8.3 presents the planned test and analysis program that will be followed in gathering and evaluating information and data necessary to satisfy the information needs.

Developed by the Department to clearly define and present its strategy for conducting site characterization, the issues-resolution strategy contains a number of individual steps. Simply stated, these steps can be grouped into five general phases: (1) identifying issues and information needs; (2) allocating performance to the various components of the repository system and establishing specific information needs; (3) developing a testing strategy to gather and analyze the information necessary to satisfy the information needs and resolve the issues; (4) gathering and analyzing information; and (5) documenting the results for use in site selection and licensing.

In the first phase, the repository system is described in detail and all applicable regulations and requirements are evaluated. These include regulations such as the Department's siting guidelines,[4] 10 CFR Part 960, the NRC's 10 CFR Part 60, and the Environmental Protection Agency's 40 CFR Part 191[5] and requirements such as those specified in the Mission Plan.[6] By analyzing these regulations and requirements and comparing them against a detailed description of the repository system design an issues hierarchy is developed. This issues hierarchy consists of that set of questions about the performance of the site that must be resolved in order to demonstrate compliance with the applicable regulations and requirements. The issues hierarchy provides the core concept of the issues-resolution strategy, including the tests and analyses to be performed during site characterization.

The complete issues hierarchy developed for each specific candidate site will be correlated in Section 8.2 with the regulations and requirements on which it is based. At the highest level, the issues hierarchy is based on the four key issues and the 23 issues presented in the Mission Plan[6] (Vol. II, Part II, Chapter 1). These key issues and issues were derived directly from the siting guidelines and the design and performance criteria of NRC's 10 CFR Part 60. Each of the Mission Plan key issues correlates

with one of the four system guidelines. Just as each of the system guidelines is associated with a specific set of technical guidelines that contribute to satisfying that system guideline, each of the key issues is associated with a set of issues that contribute to resolving the key issue. These issues correspond to technical guidelines and NRC design and performance criteria. For example, key issue I relates to the ability of the geologic repository to comply with the isolation requirements of 10 CFR Part 60 and 40 CFR Part 191. Key issue I is associated with nine issues that consider, respectively, the characteristics of the geohydrologic setting; geochemical characteristics; rock characteristics; surface erosion; climatic conditions; subsurface rock dissolution; tectonic processes or events; the potential for human intrusion in the future; and the lifetime of the waste package and the performance of the engineered-barrier system.

With these key issues and issues as a common point of departure, each repository project will develop a specific issues hierarchy to guide its site-characterization program. These individual issues hierarchies are expected to be very similar but may contain site-specific variations arising from differences in the host rocks, geographic location, natural processes active at the site, location of the repository horizon in the saturated or the unsaturated zone, etc. For each issue a set of "information needs," or a list of the information required to resolve an issue, will be developed. For example, for the geohydrologic setting issue of key issue I, the pertinent information needs include the following: hydrogeology; regional hydrology; site hydrologic characteristics; models of flow in saturated and unsaturated zones; and flow paths, fluxes, and velocities in saturated and unsaturated zones. In the larger scope of the overall issues-resolution strategy, acquiring the data to satisfy the information needs will allow an issue to be resolved, and the satisfactory resolution of all of the issues in the issues hierarchy will demonstrate the site's ability to comply with all applicable regulations and requirements.

The second phase of the issues-resolution strategy consists of performance allocation--that is, identifying those elements of the repository system that the Department expects to rely on in licensing at each site and the level of performance, or "goal," that is expected for each element. This performance allocation has the purpose of establishing direction and priorities for the Department's testing program and thereby indicating to the Nuclear Regulatory Commission what the rationale for the testing and design program will be. In identifying the repository elements expected to be relied on and indicating the performance goals for each element, the Department will also indicate the level of confidence that is desired for each goal. This level of confidence is a statement of the importance of a particular goal in a project's plan for using components of the repository system to meet regulatory requirements. Establishing the importance of a particular goal allows the Department to develop a testing program that places the proper emphasis on needed information.

It should be clearly understood that performance goals are not performance criteria that must be met. They are simply the initial tentative objectives based on technical experience and expert judgment. They will be revised and refined through time as knowledge of the site increases during site characterization and the designs of the repository and the waste package become more detailed. The goals may be revised at any time without the approval from anyone outside the Department. Performance allocation is a very important part of the comprehensive licensing strategy for a specific site and will contribute to the refinement of the issues hierarchy and the identification of information needs.

In the third phase of the issues-resolution strategy, the strategy for tests to be conducted to acquire necessary information is defined. This testing strategy consists of identification of both the tests and studies that will be conducted to acquire needed information during site characterization and the analyses that will be performed to determine whether the acquired information is adequate to resolve the issues. In the fourth phase the actual tests will be conducted and the information acquired will be analyzed. Once the information is determined to be adequate to resolve a given issue, the fifth and final stage is undertaken, that of documenting the results. Again, because the issues hierarchy is derived directly from the applicable regulations and requirements, the resolution of the entire set of issues is expected to demonstrate compliance with all regulations and requirements.

The information needed for site selection and the license application is expected to be collected and analyzed during the period of site characterization. However, the results will continue to be supplemented as the performance confirmation program continues in conjunction with the development of the license application and the licensing process.

The Department will continue to interact with the Nuclear Regulatory Commission throughout the period of site characterization. The Department believes that following the rigorous process outlined by the issues-resolution strategy will provide the basis for demonstrating the progressive resolution of open issues as information is acquired and analyses are performed. The Department expects to demonstrate the resolution of issues by making information available in periodic progress reports, by preparing topical reports on specific issues, and by interactive discussion of results with NRC staff. In some cases the Department may wish to take advantage of the NRC rulemaking process to resolve issues formally before the submittal of a license application.

CONCLUSION

The Department has developed a comprehensive approach to conducting its site-characterization program--an approach that is based on resolving siting and licensing issues. This approach consists of developing an issues hierarchy and adopting a uniform issues-resolution strategy. This will be of great utility and importance to the Department in preparing site-characterization

plans, for organizing the site-characterization program, for guiding the design of the repository, and ultimately for licensing a repository. This approach will allow clear definition of those pertinent siting and licensing issues that must be resolved concerning the performance of a given site and will result in the identification of the information needed to resolve those issues. The incorporation of this approach by each of the repository projects will result in a consistent framework to guide the Department's site-characterization effort for the next several years. Furthermore, it will provide a consistent basis for the selection and licensing of a repository site.

REFERENCES

1. Nuclear Waste Policy Act of 1982, Public Law 97-425, 97th Congress, January 7, 1983.

2. U.S. Nuclear Regulatory Commission, "Disposal of High-Level Radioactive Wastes in Geologic Repositories," Title 10, Code of Federal Regulations, Part 60, 1983.

3. U.S. Nuclear Regulatory Commission, Standard Format and Content of Site Characterizations Plans for High-Level-Waste Geologic Repositories, Regulatory Guide 4.17, proposed revision 1, Washington, D.C., September 1984.

4. U.S. Department of Energy, "General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories," Title 10, Code of Federal Regulations, Part 960, 1984.

5. U.S. Environmental Protection Agency, "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," Title 40, Code of Federal Regulations, Part 191, Federal Register, Vol. 50, No. 182, September 19, 1985.

6. U.S. Department of Energy, Mission Plan for the Civilian Radioactive Waste Management Program, DOE/RW-0005, Washington, D.C., June 1985.