

## U.S. DEPARTMENT OF ENERGY'S SITING GUIDELINES AT 10 CFR 963

Christopher A. Kouts  
U. S. Department of Energy, Office of Civilian Radioactive Waste Management  
1000 Independence Avenue, S.W., Washington, D.C. 20585

Robert C. Murray  
Booz Allen Hamilton, Inc.  
1551 Hillshire Drive, M/S 471, Las Vegas, NV 89134

Michael D. Voegele  
Bechtel SAIC Company  
1180 Town Center Drive North  
Las Vegas, NV 89144

William J. Boyle  
U.S. Department of Energy, Yucca Mountain Site Characterization Office  
P.O. Box 364629, M/S 523, North Las Vegas, NV 89036

### ABSTRACT

The U.S. Department of Energy (DOE) has amended the policies under the Nuclear Waste Policy Act of 1982 for evaluating the suitability of Yucca Mountain, Nevada, as a site for development of a nuclear waste repository. The final rule at Title 10, Part 963 of the Code of Federal Regulations (10 CFR Part 963) focuses on the criteria and methodology to be used for evaluating relevant geological and other related aspects of the Yucca Mountain site. Consistent with the longstanding policy to conform the DOE suitability guidelines for its nuclear waste repository program to licensing regulations of the U.S. Nuclear Regulatory Commission (NRC), the DOE's criteria and methodology are consistent with the NRC's recently final regulations for licensing a nuclear waste repository at Yucca Mountain.

### INTRODUCTION

The Nuclear Waste Policy Act of 1982 provides for a multi-stage siting process including preliminary site screening, site characterization, DOE site recommendation to the President, and Presidential approval of a site for the location of nuclear waste repositories (1). One of the requirements for characterizing multiple sites is a general plan for site characterization activities that includes criteria to be used to determine the suitability of such sites for the location of a repository. In 1984, responding to the original 1982 Nuclear Waste Policy Act (2), the DOE promulgated general guidelines for evaluating sites at 10 CFR Part 960 (3). These guidelines were based on and consistent with the repository licensing requirements promulgated by the U.S. Nuclear Regulatory Commission (NRC) at 10 CFR Part 60 (4) and applied the generally applicable standards for the protection of the general environment promulgated by the U.S. Environmental Protection Agency (EPA) at 40 CFR Part 191 (5).

In 1987, the Nuclear Waste Policy Act was amended and the DOE was directed to characterize only one site at Yucca Mountain, Nevada. Site characterization activities at the other two candidate sites (Deaf Smith County, Texas and the Hanford Reservation, Washington) were terminated. The DOE proceeded with site characterization at Yucca Mountain in accordance with the Site Characterization Plan (6) and indicated that the general siting guidelines at 10 CFR Part 960 would be the suitability criteria used to determine site suitability.

The 1992 Energy Policy Act (7) directed the EPA to promulgate public health and safety standards for protection of the public from releases from radioactive materials stored or disposed of in the repository at the Yucca Mountain site. In accordance with the Energy Policy Act, the EPA contracted with the National Academy of Sciences to conduct a study and provide findings and recommendations on reasonable standards for the protection of public health and safety. In 1995, the National Research Council of the National Academy of Sciences released their report, "Technical Bases for Yucca Mountain Standards" (8). The Energy Policy Act also directed the NRC to modify its technical requirements and criteria, as necessary, to be consistent with the EPA's new standards.

## **RATIONALE FOR RULEMAKING**

In 1996, the DOE proposed amendments to the general guidelines to clarify and focus their application to evaluating the suitability of the Yucca Mountain site (9). It was believed that concentrating regulatory review on analyses of overall system performance would enhance the ability of the DOE to provide the public a more understandable conclusion about the suitability of the site for development as a repository. The proposed amendments cited recent advancements in four major areas that led to the conclusion that a total-system approach was appropriate:

1. Analysis and integration of data collected from surface-based testing and regional studies
2. Examination of the potential repository horizon made possible by the excavation of the Exploratory Studies Facility (ESF)
3. Development of a site-specific conceptual design of the engineered facilities
4. Improvements in performance assessment analyses

The general guidelines were largely comparative, having been developed to screen and then compare multiple characterized sites. As such, their applicability and the methods by which they could be used to evaluate a single site were topics of prolonged uncertainty and discussion (10).

On November 30, 1999, the DOE issued a Supplemental Notice of Proposed Rulemaking, proposing to add a new part to the Code of Federal Regulations at 10 CFR Part 963 (11). The DOE explained that comments had been received from the public on the December 16, 1996, proposal that criticized the omission of essential details of the criteria and methodology for evaluating the suitability of the Yucca Mountain site. There were also comments critical of the legal basis for the DOE's proposal and its consistency with what commenters viewed as DOE's past position on the meaning of relevant provisions of the Act. In the interim, however, three events had occurred that helped the DOE to further refine and more definitively explain the

proposed approach: the issuance of the DOE's Viability Assessment and the proposal of site-specific rules for Yucca Mountain by the NRC and the EPA.

In December 1998, the DOE had issued the Viability Assessment of a Repository at Yucca Mountain, which set forth the basis for the site suitability criteria DOE subsequently proposed to use and the methodology for applying those criteria to a proposed repository. The DOE stated that it could now assist commenters in responding to the DOE's proposal with descriptions of and references to key portions of the Viability Assessment.

Then, in February 1999, the NRC proposed to eliminate the Yucca Mountain site from coverage under 10 CFR part 60 and to issue site-specific licensing requirements in a new 10 CFR Part 63 (12). In August 1999, the EPA proposed the Congressionally mandated public health and safety standards for a repository at Yucca Mountain, to be codified at 40 CFR Part 197 (13). Together, these rules would establish the standards, methods, and technical criteria by which a repository at Yucca Mountain would be evaluated by the NRC in a licensing proceeding.

Consistent with the NRC's proposal to limit Part 60 and to establish a new Part 63 for the Yucca Mountain site, DOE proposed to limit Part 960 and establish a new Part 963 to set out the site suitability criteria and methods for considering the potential of the Yucca Mountain site for a nuclear waste repository. DOE proposed the new rule to better define policies and criteria to guide the determination of the suitability of the Yucca Mountain site in terms of, and based on, the information and data developed through the site characterization program that the DOE has conducted over the years. The EPA issued their final rule at 40 CFR part 197 on June 13, 2001 (14) and the NRC finalized 10 CFR Part 63 on November 2, 2001 (15). With the concurrence of the NRC Commissioners, the DOE issued the final 10 CFR Part 963 on November 14, 2001 (16).

The DOE will evaluate whether the Yucca Mountain site is suitable for the location of a repository on the basis of evaluations of whether or not the repository is likely to meet the applicable radiation protection standards for the preclosure and postclosure periods. As referenced in 10 CFR part 963, the applicable standards are those issued by the EPA at 40 CFR part 197, as implemented by the NRC at 10 CFR part 63. In this way, DOE's regulatory evaluation for site suitability will remain consistent with the standards and technical criteria issued by the EPA and the NRC.

### **STRUCTURE AND CONTENT OF 10 CFR PART 963**

The rule is divided into two subparts, a Subpart A, General Provisions, which explains the purpose of the rule and provides definitions for specialized terms used in the rule, and a Subpart B, which sets forth the site suitability determination methods, and criteria. Subpart B contains separate guidelines for both the preclosure (or operational) and postclosure (or after permanent closure of the repository) periods. These guidelines are separate and distinct as is befitting the different types of issues and information of interest during these two periods. Findings of site suitability for both the preclosure and postclosure periods are overlain by a separate provision whereby the DOE may determine that the Yucca Mountain site is a suitable location for the development of a repository (16).

For both the preclosure and postclosure periods, the DOE has defined methods and criteria for evaluating site suitability. The methods are analytical processes, a preclosure safety evaluation and a postclosure total system performance assessment (TSPA). These analyses rely on computer models of repository operations and performance to calculate potential doses from possible releases from the repository. The criteria are characterizing traits relevant to assessing the performance of a repository at the Yucca Mountain site.

For the preclosure period, the DOE described a preclosure suitability evaluation method that is consistent with the preclosure integrated safety analysis of the NRC in their rule at 10 CFR Part 63 (15) as well as with standard industry methods for analyzing the radiological safety of licensed nuclear facilities. However, the method referenced at 10 CFR 963.13 is preliminary in nature as is appropriate at the site characterization phase for a repository. This method considers preliminary descriptions of:

1. Site characteristics, surface facilities, and underground facilities
2. Design bases for the operating facilities and any associated limits on operation
3. Potential hazards, event sequences, and their consequences
4. Structures, systems, components, equipment, and operator actions intended to mitigate or prevent accidents

The preclosure criteria at 10 CFR 963.14 are the ability to:

1. Contain radioactive material and to limit releases of radioactive material
2. Implement control and emergency systems to limit exposure to radiation
3. Maintain a system and components that perform their intended safety functions
4. Preserve the option to retrieve wastes during the preclosure period

The postclosure suitability evaluation method at 10 CFR 963.16 provides that the DOE will conduct TSPAs to evaluate the ability of the repository to limit radiological doses and radionuclide concentrations for two scenarios, with and without a stylized inadvertent human intrusion into the repository. The separate TSPA for the human intrusion event postulates the drilling of a single water well that penetrates a single waste package and then continues to the water table below the repository, consistent with specific requirements established by the NRC for such an event (15).

In both scenarios, the DOE is to evaluate 12 specific elements of a TSPA that are consistent with similar provisions set forth by the NRC. These include the use of data, accounting for parameter uncertainties and variabilities, and consideration of alternative models. The DOE will provide the technical bases for the inclusion or exclusion of specific features, events, and processes (FEPs) and for the models used in the TSPA. Further, the DOE will identify and describe the capabilities of the barriers important to isolating radioactive waste and provide the technical basis for the description of the barrier's capabilities. These provisions ensure consistency with the NRC's philosophy of meeting dose standards through a system of multiple barriers (15).

There are nine postclosure suitability criteria stipulated for nominal (or undisturbed) performance and three more criteria for disruptive FEPs. The criteria for nominal performance

trace the movement of water through the site and repository system from the infiltration of precipitation on the surface of Yucca Mountain to the saturated zone and out to the accessible environment and the location of the hypothetical receptor, the reasonably maximally exposed individual. The criteria for disruptive events require additional consideration of volcanism, seismic events, and criticality.

For both the preclosure and postclosure periods, site suitability is evaluated on the basis of whether or not the applicable evaluation method shows that the Yucca Mountain site is likely to meet the applicable radiation protection standard. The applicable standard is defined in Subpart A by reference to the numerical radiation dose limits and radionuclide concentration limits (for postclosure only) in 10 CFR Part 63. These limits represent the standards set by the EPA in 40 CFR Part 197, as implemented by the NRC in their final rule.

## 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. U.S. Department of Energy, "General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories; Final Siting Guidelines," Code of Federal Regulations, Title 10, Part 960, 49 FR 47714 (December 6, 1984).
4. U.S. Nuclear Regulatory Commission, "Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada; Proposed Rule," Code of Federal Regulations, Title 10, Part 60, 48 FR 28194 (June 21, 1983).
5. U.S. Environmental Protection Agency, "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes; Final Rule," Code of Federal Regulations, Title 40, Part 191, 50 FR 38066 (September 19, 1985).
6. U.S. Department of Energy, "Site Characterization Plan, Yucca Mountain Site, Nevada Research and Development Area, Nevada (DOE/RW-0199)," Office of Civilian Radioactive Waste Management, Washington, D.C. (December 1988).
7. Energy Policy Act of 1992, Public Law 102-486 (1992).
8. National Research Council/National Academy of Sciences, "Technical Bases for Yucca Mountain Standards," National Academy Press, Washington, D.C. (1995).
9. U.S. Department of Energy, "General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories; Proposed Rule and Public Hearing," Code of Federal Regulations, Title 10, Part 960, 61 FR 66158 (December 16, 1996).
10. U.S. Department of Energy, "Use of the 10 CFR Part 960 Siting Guidelines in Evaluating the Suitability of the Yucca Mountain Site; Notice," 60 FR 47737 (September 14, 1995).
11. U.S. Department of Energy, "General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories; Yucca Mountain Site Suitability Guidelines; Supplemental Notice of Proposed Rulemaking," Code of Federal Regulations, Title 10, Parts 960 and 963, 64 FR 67054 (November 30, 1999).
12. U.S. Nuclear Regulatory Commission, "Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada; Proposed Rule," Code of Federal Regulations, Title 10, Part 63, 64 FR 8640 (February 22, 1999).

13. U.S. Environmental Protection Agency, "Environmental Radiation Protection Standards for Yucca Mountain, Nevada; Proposed Rule," Code of Federal Regulations, Title 40, Part 197, 64 FR 46976 (August 27, 1999).
14. U.S. Environmental Protection Agency, "Environmental Radiation Protection Standards for Yucca Mountain, Nevada; Final Rule," Code of Federal Regulations, Title 40, Part 197, 66 FR 32074 (June 13, 2001).
15. U.S. Nuclear Regulatory Commission, "Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada; Final Rule," Code of Federal Regulations, Title 10, Part 63, 66 FR 55732 (November 2, 2001).
16. U.S. Department of Energy, "General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories; Yucca Mountain Site Suitability Guidelines; Final Rule," Code of Federal Regulations, Title 10, Parts 960 and 963, 66 FR 57298 (November 14, 2001).