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OCRWM Background

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Office of Civilian Radioactive Waste Management
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ACTIVITIES DURING THE SITE CHARACTERIZATION PHASE OF THE GEOLOGIC REPOSITORY PROGRAM

BACKGROUND

The site characterization phase of the geologic repository program includes two kinds of activities: (1) a program of extensive field and laboratory testing and studies to collect and evaluate geologic, hydrologic, and geochemical information (in this background, the studies are referred to as site characterization); and (2) environmental and socioeconomic studies that assess the potential impacts of repository development and operation. The site characterization phase is expected to last about 5 years and cost as much as \$1 billion for each site (in 1985 dollars). As many as 200 to 500 persons will be employed at each site at the peak of site characterization activity.

The Nuclear Waste Policy Act of 1982 (NWPAA) became law (P.L. 97-425) in January 1983. The U.S. Department of Energy (DOE) formally identified nine sites as being potentially acceptable sites for the first repository. The nine sites are: Vacherie Dome in Louisiana [salt dome]; Richton Dome and Cypress Creek Dome in Mississippi [both salt domes]; Yucca Mountain in Nevada [tuff (compacted volcanic ash)]; Deaf Smith County and Swisher in Texas [bedded salt]; Davis Canyon and Lavender Canyon in Utah [bedded salt]; and Hanford in Washington [basalt (a very fine-grained rock that is formed by the solidification of lava)].

Using the repository siting guidelines (10 CFR 960) developed by DOE and concurred by the U.S. Nuclear Regulatory Commission (NRC), DOE issued for public comment and review the draft environmental assessments (EAs) on the nine potentially acceptable sites in December 1984. In those draft EAs, DOE identified five of the nine sites for nomination as suitable for site characterization and proposed three of the sites for recommendation to the President for site characterization.

As a result of the public comment period, DOE received

over 20,000 comments and has incorporated those comments into the final EAs, as appropriate. Following consideration of the comments and other information, Secretary of Energy John S. Herrington issued a *Federal Register* Notice nominating five sites that he determined suitable for site characterization. Herrington recommended to the President in writing Yucca Mountain, Deaf Smith County, and Hanford for site characterization. The President approved the recommendation on May 28, 1986. Two sites, Richton Dome and Davis Canyon, were nominated but not recommended for site characterization.

SITE CHARACTERIZATION

Overview

The objectives of the site characterization program are to (1) determine the geologic, hydrologic, and geochemical conditions at a candidate site; (2) provide information needed to design a package for the disposal of spent fuel and high-level radioactive waste that will meet the licensing requirements of the NRC; (3) provide information for the design of the repository facility; and (4) evaluate whether the site can meet the requirements of the NRC and the Environmental Protection Agency (EPA).

The program will consist of surface-based investigations (e.g., geologic mapping; geophysical surveys; and seismologic, paleoclimatologic, and hydrologic studies) as well as subsurface investigations conducted by deep and shallow boreholes that will be used for ground water monitoring; core extraction; laboratory testing; and stratigraphic, tectonic, geochemical, and geohydrologic studies. Most importantly, investigations will be conducted in the host rock at repository depth through the construction and use of exploratory shafts and underground test facilities. Geochemical studies of the host rock and surrounding strata will assess the effect

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To provide current background information on program facts, issues, and initiatives. For further information write to: Information Services Division, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, Mail Stop RW-40, Washington, DC 20585, Telephone (202) 586-5722.

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of the *insitu* environment on the waste package, the ability of the host rock to contain radionuclides, and the ability of surrounding units to retard radionuclides by chemical interaction.

Hydrologic testing and monitoring of surface and subsurface water flow systems will assess surface flooding potential and help in the construction of computer models to analyze subsurface hydrologic flow systems and their potential for transport of radionuclides.

Although site evaluation studies comparable to the site characterization activities in the repository program are commonly conducted in preparing environmental impact statements for large construction projects such as dams and powerplants, site characterization for a repository departs from those studies in that it requires the sinking of a deep exploratory shaft to conduct preliminary tests in the repository host rock. However, there is considerable experience with deep shaft construction. The mining industry frequently constructs deep shafts to extract minerals. For example, the Stripa Mine in Sweden was excavated to a depth of 1,150 feet in saturated rock. Furthermore, the Climax Stock mine, near the Nevada Test site, was excavated to a depth of 1,400 feet in unsaturated rock.

Exploratory Shafts

DOE is planning to sink two exploratory shafts at each candidate site. Having a second shaft is necessary for the safety of operating personnel.

At the Deaf Smith County site, shafts will be constructed by drill-and-blast techniques. They will be sunk to depths ranging between 2,600 and 3,000 feet, with horizontal workings (subsurface facilities and ventilation tunnels) extending about 5,400 feet from the base of the shafts. The shafts will penetrate the Ogallala and Dockum aquifers as they are sunk to repository depth. To control water migration and to stabilize the ground during this operation, portions of the ground will be frozen to ensure isolation of the aquifers. Ground freezing is a well-documented procedure used in the mining industry. The frozen ground will be maintained until the final concrete lining is emplaced.

At the Hanford site, shafts will be drilled using a large drill rig. Shafts will be sunk to the candidate repository depth, or approximately 3,000 and 4,000 feet. The shafts will be lined with watertight steel casing and sealed in place with a cement grout. Effectiveness of the seal to prevent water intrusion will be verified before beginning horizontal excavations at repository depth.

At the Yucca Mountain site, the planned exploratory shaft will use drill-and-blast techniques. Shaft depths will be approximately 1200 and 1500 feet. The Yucca Mountain site is different from the other sites in that, from the surface to repository depth, the rock is unsaturated. Water will be used sparingly during shaft construction so that tests to characterize the unsaturated zone will not be affected. The liners for the first shaft will be concrete, with steel possibly used for the second shaft. Underground test facility rooms will be excavated at about the 500-foot level and at the shaft bottom.

The exploratory shafts will be incorporated into the repository design after a site is found suitable and is selected for development as the repository. If a site is not selected for further development, then the shafts will be filled and sealed, and the site will be restored as nearly as possible to its original condition.

Site Characterization Plans

Prior to exploratory shaft construction at each candidate site, the Secretary of Energy will submit a Site Characterization Plan (SCP) to the NRC, the Governor and legislature of the State in which such candidate site is located, the governing body of affected Indian Tribes, and the public. The site plans are scheduled to be issued for Hanford and Yucca Mountain in December 1986 and Deaf Smith County in April 1987. A 3-month public comment period, including public hearings, will follow the issuance of each SCP.

The "Annotated Outline" for the SCP, derived from the NRC's Regulatory Guide 4.17 (*Standard Format and Content of Site Characterization Plans for High-Level Waste Geologic Repositories*), was approved by the NRC and distributed to other recipients. The outline is divided into Part A describing the candidate site, the waste package, and the repository; and Part B presenting the site characterization program. Part A will present existing information pertaining to geology, geoengineering, hydrology, geochemistry, climatology, and meteorology. Part B will be the heart of the SCP. It will be composed of (1) the rationale for the planned site characterization program; (2) issues to be resolved and information required during site characterization; (3) planned tests, analyses, and studies; (4) planned site preparation activities; (5) milestones, schedules, and decision points; (6) quality assurance activities; and (7) the decontamination and decommissioning activities related to the repository.

ENVIRONMENTAL AND SOCIOECONOMIC STUDIES

In parallel with the site characterization program, DOE will conduct environmental and socioeconomic studies to assess the potential impacts of repository development and operation. The studies will support the preparation of the environmental impact statement (EIS) for the site that is ultimately selected and the development of plans to mitigate any significant adverse impacts. The environmental studies will also evaluate whether repository development and operation can be conducted in compliance with environmental regulatory requirements.

Environmental data collection and analysis will focus on (1) land use and mineral resources, (2) terrestrial and aquatic ecosystems, and (3) ecology, threatened and endangered animal species, air quality and meteorology, surface waters and water quality, soils, and noise. Aesthetic, archeological, cultural, and historical resources, background radiation, and transportation systems affected by repository development will also be studied. Socioeconomic studies will address potential demographic and economic impacts, as well as changes in community services, social conditions, fiscal conditions, and government organization.

Plans will be developed and implemented to detect significant adverse environmental and socioeconomic impacts resulting from site characterization activities. These plans, developed in consultation with the affected States, Indian Tribes, and local governments, will also identify procedures for developing and implementing programs to mitigate significant adverse impacts.

Following site characterization, DOE plans to send a site selection report to the President in late 1994 and submit the license application to the NRC in early 1995, as soon as the site designation becomes effective. Construction of the geologic repository could begin in 1998, with initial operation commencing in 2003.

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