

Attachment I

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Yucca Mountain
The eMKayan
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The Department of Energy project to determine if the Yucca Mountain site in Nevada is suitable for geologic disposal of high-level nuclear waste reached a major milestone in late April when a 25-foot-diameter tunnel boring machine "holed through" completing a five-mile-long, horseshoe-shaped excavation through the mountain.

When the cutting-head of the giant machine broke through to daylight at the tunnel's south portal, it ended a 2 1/2-year excavation through the mountain that was completed ahead of schedule and with an outstanding safety record. Video of the event was transmitted live by satellite to Washington, D.C., where it was watched by Secretary of Energy Frederico Pena and other high-level DOE officials, signifying the importance of the project's mission to find a repository for high-level nuclear waste and spent nuclear fuel produced by nuclear power plants.

This critical undertaking is being performed by DOE's Office of Civilian Radioactive Waste Management (OCRWM).

The tunnel is the major feature of the Exploratory Studies Facility (ESF), which serves as an underground laboratory for engineers and scientists to help determine if Yucca Mountain is suitable to serve as a repository for the safe disposal of high-level nuclear waste.

Morrison Knudsen's Environmental/Government Group is providing design and construction-management services on the project. The MK team is performing final design for the ESF and "viability" assessment design for the underground waste repository that will be built only if the site is found suitable for such a mission. In fact, if at anytime during the ESF phase, the site is found unsuitable, the studies will be stopped and the site restored to its natural state.

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MK is participating in the project as part of a multi-company team, led by TRW Environmental Safety Systems, Inc., as DOE's Management and Operating Contractor. The project is located on the southwestern edge of the Nevada Test Site, about 100 miles northwest of Las Vegas.

If the scientific and engineering efforts find Yucca Mountain to be a suitable site for a repository, DOE will file a formal application to the Nuclear Regulatory Commission in 2002 for a license to begin constructing the repository. The target date for commencement of nuclear waste disposal is 2010.

Excavation of the tunnel began in September, 1994, at the north portal, from where the tunnel proceeds down grade at 2.1 percent to the west for about 7,200 feet, then turns south at a 1.35 per cent upgrade for 12,400 feet along the proposed repository level, then turns to the east proceeding at 2.6 percent up slope another 6,100 feet to the south portal. Along the tunnel are various alcoves for use by the scientists to conduct tests of the geologic formation. An extensive program is also in place to map the tunnel and install instrumentation as part of the characterization process.

Construction of the ESF includes support facilities and utilities for the underground work. These include a switchgear building, substation, conveyor system, miner's change house and control building, warehouse, shop, compressor complex, standby generators, wastewater systems for sanitary, storm and mine waste, potable and fire-water systems including a booster pump station and storage tanks.

The MK team of scientists, engineers and administrative personnel developing the "viability" assesement design of the underground facilities is based in Las Vegas and faces several challenges. The underground facility must have two completely separate and independent

ventilation systems, and must be able to receive waste for emplacement in one part of the underground facility while other parts are still being excavated. The high-level waste inventory produces large amounts of heat and radioactivity as it decays, and it must be possible to remove any, or all, of the waste packages for a period of one hundred years after the start of repository operations. MK is developing innovative solutions for these and other challenges during the current preliminary design phase.

MK also is responsible for preliminary design and cost analysis for regional transportation (within the State of Nevada) that would be used in transporting waste from a mainline railroad to the potential repository site at Yucca Mountain. The design effort currently is being performed by Environmental/Government Group engineers in Boise. This design effort also supports the engineering evaluation in the environmental impact statement (ESI).

Scientists have made a great deal of progress in the investigation of the Yucca Mountain site. Data from extensive scientific and analytical work performed since site characterization began has confirmed various early hypotheses about the mountain. Some scientific and technical uncertainties about its potential performance as a repository site have been reduced.

An important milestone in this effort was the completion of the third in a series of total system performance assessments. This is an analytical technique that uses computer models to evaluate the ability of a repository and its engineered and geologic systems to safely contain and isolate radioactive waste.

Scientists and engineers are using the insights produced by this assessment to refine the waste-containment and isolation strategy. This strategy will help focus future scientific and engineering efforts on important technical issues that need to be resolved. Outstanding issues concern long-term behavior of the natural geologic system, as well as features and processes of the

natural geologic and hydrologic system that might impact the engineered systems being designed for the repository.

While some tests will continue for a number of years, for the viability assessment due in 1998, engineers and scientists will perform work designed to further confirm the hypotheses underlying their waste-isolation strategy.

The earliest picture of conditions at Yucca Mountain from surface-based tests and observations date as far back as the late 1970s. These included drilling efforts and seismic testing. This understanding has been complemented by studies in the new tunnel. During the last year, the rapid progress of the tunnel boring machine advanced excavation of the exploratory tunnel through the proposed repository level. This has provided confirmation of many early assumptions about conditions at the site.

Among some of the important scientific results that have emerged:

- Observations of the natural system and data collected since 1978 suggest that the natural system is robust, which is to say that the geological characteristics of the site appear to be complementary — can work together — in their ability to isolate waste.
- Numerical models and calculations will be able to bound, or set limits upon, many of the uncertainties for radiological safety evaluations. This leads to greater confidence in predicting how the site will respond once the repository is built.
- Recent performance assessments provide confidence that a Yucca Mountain repository would contain and isolate radioactive waste, and would assure public health and safety.
- Geologic evidence is consistent with models of the site that have been the basis of

performance calculations for more than 10 years. However, scientists still must determine the long-term importance of potential fast pathways for water movement.

- Very recent work has challenged the extent of the potential for the lateral diversion of infiltration. This new, preliminary information is being evaluated. Ongoing exploration and planned testing will help determine the extent to which infiltration may be expected to be diverted near the surface of Yucca Mountain.
- The rock quality at the potential repository level is as good or better than assumed when scientists first considered a repository at Yucca Mountain that could safely dispose of spent nuclear fuel and high-level radioactive waste.
- The potential repository area is also as dry as expected. No liquid-phase water has been encountered anywhere in the five-mile ESF tunnel.
- The probability of a future volcanic eruption directly intersecting a repository at Yucca Mountain is now estimated to be about 1 in 70 million per year.

Activities during the next two years will focus on the scientific and technical questions about waste containment and isolation that remain to be resolved. In particular, scientists will address:

- The rate of water seepage into the proposed repository level.
- The integrity of waste packages.
- The rate of release of radionuclides from waste in waste packages that have been penetrated by water.
- Radionuclide movement through the repository's engineered and natural barriers.
- The rate and manner in which radionuclides from waste packages dissolve in the groundwater which moves down through the repository level.

MK's Yucca Mountain team is headed by Dr. Kalyan Bhattacharyya, the project director, based in Las Vegas. Richard McDonald is deputy director in charge of construction and is based at the site. Dave Knighton is general manager of business. Daniel McKenzie and William Kennedy are the design supervisors for the repository and ESF subsurface design.