



## Office of Civilian Radioactive Waste Management



*Artist's conception of one of the large warning monuments that also serve as information centers on the crest of Yucca Mountain after permanent closure of the proposed geologic repository.*

### The monumental task of warning future generations

Describing preliminary concepts for permanent warning monuments or markers on the mountain's surface will be part of the U.S. Department of Energy's license application to the Nuclear Regulatory Commission (NRC) for a proposed repository at Yucca Mountain, Nevada. The NRC requires that the monuments or markers "accurately identify the location of the repository, be designed to be as permanent as practicable and convey a warning against intrusion into the underground repository, because of risk to public health and safety from radioactive wastes."

Current concepts include both monuments and markers, but the designs will not be final for some time because they will not be approved by the NRC until shortly before the repository is to be permanently sealed and closed. Closure of the repository would be at least 50 years, and possibly up to 300 years, after the first waste is emplaced deep underground.

Design ideas for the monuments and markers have been drawn from a broad range of sources: Yucca Mountain's natural conditions, worldwide archeological studies, materials science, and verbal and symbolic linguistics. The monumental challenge is to address how warnings can be coherently conveyed for thousands of years into the future when human society and languages could change radically.

### Current monument and marker concepts

The current concept calls for a redundant message system consisting of perimeter monuments, smaller markers, and larger monuments serving as information centers. They would convey information by an unnatural-looking design, the strategic placement and use of materials, and the use of many languages and symbols.

### Perimeter monuments

A series of tall enduring monuments about 25 feet high would be placed along the site's perimeter as well as on and near the mountain's crest. They would be designed to be noticed and to

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endure natural events, even water from future floods or the build-up of sand dunes deposited by wind. The warning messages on the monuments would be inscribed in several languages as well as pictures and symbols. The languages that would be used are the six official languages of the United Nations: Arabic, Chinese, English, French, Russian, and Spanish. The messages may also be displayed in some simplified form of the sign language used by the hearing impaired. Linguists have recommended that a variety of picture symbols be used, including perhaps a unique international symbol for "nuclear waste repository."

These messages would be inscribed about 40 inches or higher above the ground's surface to prolong legibility. To better withstand corrosion and erosion, the monuments could be constructed from either granite or basalt. The messages must survive natural forces and remain legible and comprehensible as long as possible. Natural factors to be considered are abrasion from wind-borne particles, general surface erosion, and "desert varnish," a dark coating or polish often found on rock surfaces after long exposure in desert regions; desert varnish is typically caused by a buildup of iron and manganese oxides.

The shapes and dimensions of the monuments are also important factors. The current concept calls for the perimeter monuments to be six-sided cones pointing upwards at varying angles. As shown in the schematic drawing, they would rise out of the ground

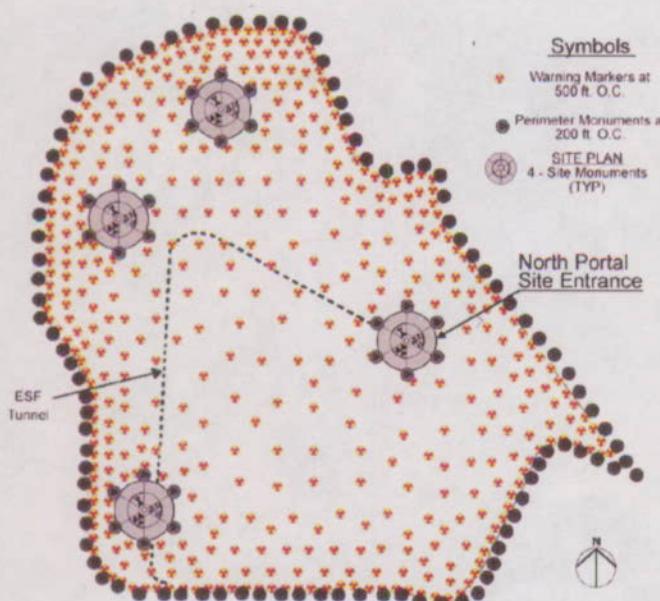
above the repository near the larger monuments, as well as around the entire surface perimeter of the underground repository. They would be designed to be unnatural-looking so they would draw attention, but not be misconstrued as memorials of honor.

### Smaller markers

Numerous nine-inch warning markers would be anchored into the ground and easily visible by a wandering human being. These markers would be designed as a redundant message system. To ensure the markers would last, they could be made of diverse durable materials such as granite, fired clay, and stainless steel. Each marker would display the international radiation symbol and one of the written messages.

### Information centers

Several larger monuments would serve as information centers. They would likely be in the shape of the universal radiation symbol. The roofs of these monuments could include rock that is naturally yellow and magenta, the standard colors of the radiation symbol. The walls would carry the same messages in the same languages as the perimeter monuments. The information centers would also contain documents explaining and illustrating the repository, its location, its contents, and the worldwide locations of other copies of the same documents. At least one of the perimeter monuments would also contain this essential information.



The schematic shows the approximate locations of the information centers or large monuments (4 large circles) and the perimeter monuments (small black circles) around the surface boundaries of the repository area. The smaller round circles with radiation symbols indicate the general locations of additional ground markers.



U.S. Department of Energy  
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### Yucca Mountain Project

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