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COVER Dried intestinal contents of a hawksbill turtle (*Eretmochelys imbricata*). Glass-like needles are siliceous sponge spicules (ash content 92 percent of dry mass). The reef-dwelling hawksbill, endangered throughout its circumtropical range, feeds almost exclusively on choristid and hadromerid sponges in the Caribbean. See page 393. [Anne Meylan, Bureau of Marine Research, State of Florida Department of Natural Resources, St. Petersburg, FL 33701]

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Storage of Spent Nuclear Fuels in Nevada

The thousand pages of the recently enacted comprehensive budget bill contained language designating Nevada as the prime candidate to host a spent nuclear fuel deposit site (News & Comment, 1 January, p. 15). The mechanism by which the choice was implemented is controversial, but the decision was a good one.

The Yucca Mountain site is located in a desert region in southern Nevada. The area is owned and guarded by the federal government. A large number of aboveground and underground tests have been conducted about 15 miles away, depositing enormous amounts of plutonium and fission products. Wells located within a quarter-mile from shot holes have been monitored by the Environmental Protection Agency. Neither notable amounts of fission products nor above-regulatory limits of tritium have been detected. The absence of lateral movement of fission products is partially related to the hydrology of the region. Annual rainfall is on the order of 6 inches. With the exception of storm flow into dry lakes, much of the moisture is dissipated by evapotranspiration. The distance down to the water table is about 2000 feet. Flow in the liquid below the water table (very slow) is toward Death Valley, about 50 miles to the west.

When fuel assemblies are removed from nuclear reactors, they essentially cease to undergo fission, but decay of fission products continues to produce much radiation and heat. In practice, the spent assemblages are immersed in pools of water which provide shielding and cooling. After a year in the pool, short-lived nuclides such as the 8-day iodine-131 have disappeared; after 10 years, the radiation is only a small fraction of that originally present; the heat production in a typical spent-fuel assemblage containing 461 kilograms of uranium has dropped to 550 watts. However, potentially dangerous amounts of radioactivity remain—for example, the 29-year strontium-90 and the 30-year cesium-137. In the early time span beyond 10 years, heat production diminishes with a half-life of about 30 years.

Burial of fuel assemblages would provide shielding against radiation, but emission of heat would continue. It is this heat that makes burial in holes drilled in silicate rocks in the saturated zone suspect, for the heat would induce convective motion of hot water with accompanying corrosion. In contrast, the relatively dry environment above the water table would be comparatively free from corrosive effects. Archeological finds of ancient delicate objects of both organic and inorganic composition testify to the benign influence of dry environments on their preservation.

At the proposed location of burial in welded tuff at Yucca Mountain, uncertainties remain, such as effects of heat on the containing rock. In addition, there is some possibility of unexpected tectonic events. However, hazards in Nevada seem small in comparison with those that already exist elsewhere. Today more than 100 nuclear power reactors have been operating at 60 locations in about 30 states. Nationwide, they are the energy source of about 18 percent of the nation's electricity, and in some states account for more than half the electricity. Even if use of nuclear power were stopped, the problem of disposing of spent fuel would remain. Maintaining the spent fuel indefinitely in the many present locations near rivers or other bodies of water would multiply the risk of a future crisis.

The current legislation provides for further studies of the Nevada site at a cost estimated at more than a billion dollars, though the region has already been studied exhaustively by the U.S. Geological Survey and National Laboratories. The next phase of investigation will probably include excavation of tunnels into Yucca Mountain. The study should include emplacing and monitoring the effects of a limited number of spent fuel containers. A highly instrumented experimental facility that included retrieval capability could safely produce information that would permit design of a large-scale burial site.

Procedures for and politics of the disposal of nuclear waste both here and abroad are the subject of a scholarly study by Luther J. Carter.* His book and articles were a factor in the congressional action selecting the Nevada site for further study.—PHILIP H. ABELSON

**Nuclear Imperatives and Public Trust* (Resources for the Future, Washington, DC, 1987).