APPENDIX D

GENERIC REPOSITORY DESCRIPTIONS

Candidate Geologic Media

The rock types being studied as potential repository media include salt, basalt, and tuff. Crystalline rocks have also reeived some attention. Bedded salt is found in Utah (Paradox Basin); New Mexico and Texas (Permian Basin); and in Michigan, Ohio, Pennsylvania, Kansas, Oklahoma, and New York (Salina Basin). Salt domes are located in Mississippi, Louisiana, and Texas. Basalt has been studied at the DOE Hanford Reservation in Washington, and tuff at the Nevada Test Site (Figure D-1).

Each type of rock has properties that are considered important for waste containment. Salt is being studied because of its long-term stability, strength, and heat-dissipating characteristics. Basalt appears suitable because of its strength, thermal conductivity, and expansion properties. Tuff is being studied because of its strength, high sorptive qualities, and location adjacent to other sorptive strata.

Bedded Salt. Bedded salt[1] occurs in multiple horizontal strata, separated by strata of other minerals. A single salt bed may be as much as 60 meters thick and many kilometers wide in the horizontal directions. The thick salt beds are surrounded by thinner, more porous and permeable strata. Overlying much of the salt-bearing section are sediments which locally serve as aquifers.

Salt beds considered to be of possible interest as repository sites are required to be at least 21 m thick, to contain at least 85 per cent salt, to have no non-salt interbeds thicker than 3 m, and to lie between 300 and 900 m below the surface.

The presence of aquifers above the repository level requires special seals along the vertical shafts and horizontal tunnels.[2] Seals include relatively impermeable bulkheads keyed into the walls to intercept flow of water, and backfills such as concretes, clays, and crushed salt.

Domed Salt. Salt domes are very large vertically oriented extrusions of underlying deposits of essentially pure halite, principally occurring in the Gulf Coast region.[3] No two domes are alike. The horizontal cross section of a typical dome is slightly elliptical, having dimensions of 3000 m by 4000 m and having its greatest diameters at depths of 600 to 1200 m below the surface.

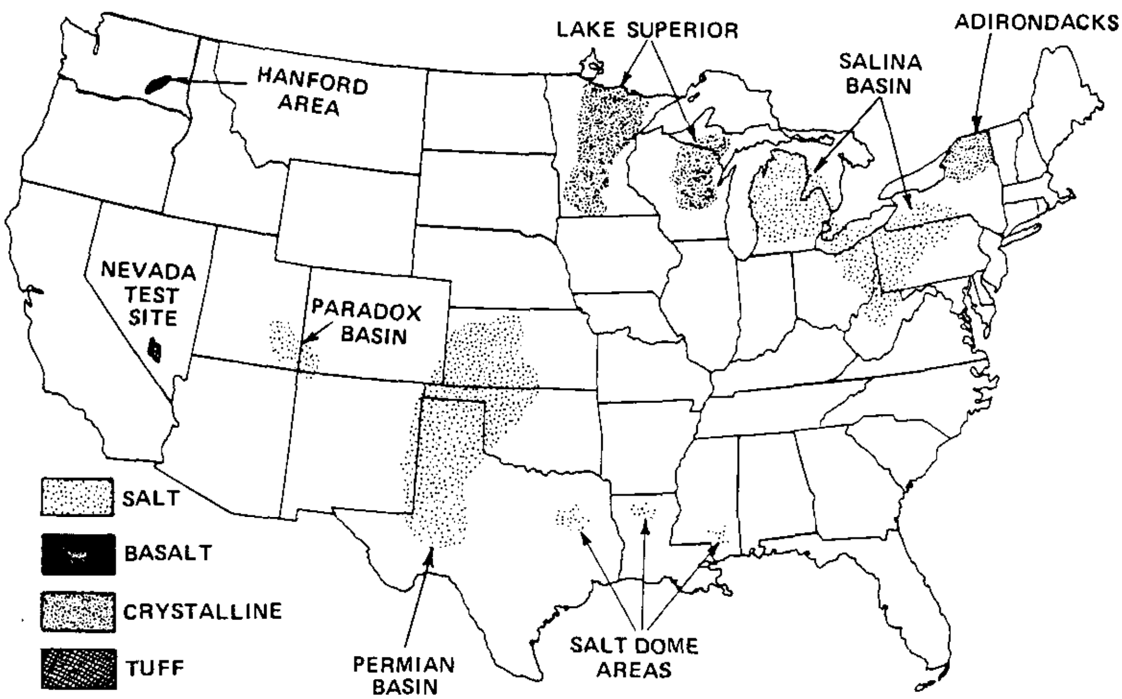

FIGURE D-1. Possible Locations of Geologic Repositories in Various Types of Rock

The top of the salt dome is typically about 400 m below the land surface and is overlain with about 30 m of caprock consisting of limestone and anhydrite. Strata along the flanks are swept up near the dome, and may be faulted with as much as 60 m of offset. Aquifers overlie and are adjacent to the flanks of the dome. The typical dome is overlain by several sedimentary formations.

Basalt. The Columbia Plateau basalts are igneous rock composed of individual lava flows, layered one on top of the other, which extend to depths of approximately 2700 m beneath the land surface at the Hanford Reservation, near Richland, WA.

The one site under consideration for a possible repository is the Umtanum Flow, 15 million years old, 45 to 60 m thick, and 1100 m below the surface.[4] The interior of the Umtanum has a glass-rich texture and secondary mineral content which provides sorptive minerals and alteration products along potential groundwater pathways. The hydrology of this area has been studied extensively down to 1370 m below ground level.

Tuff. Detailed investigations are in progress to determine the suitability of tuffs at Yucca Mountain, in the southwest corner of the U.S. DOE Nevada Test Site, for storage of high-level radioactive waste.[5] A site selection committee is scheduled to provide a specific recommendation by December 1982.

Repository Arrangement

The three main components of the generic repository, the underground facilities, the shafts, and the surface facilities are illustrated in the cutaway view shown in Figure D-2. The underground surface area is 840 hectares (ha), including the buffer zone, and the net underground working area is approximately 560 ha.

The shafts are drilled in a protective zone of the host rock about 640 meters on a side, called the shaft pillar. Access to the repository is through 5 shafts bored in the shaft pillar, which[3] is located centrally to equalize any thermal loads on the shafts and to minimize haul distances for both the excavated rock and the waste. The shaft pillar provides structural support for the shafts and contains facilities required for underground development and waste emplacement operations. All shafts are lined with steel and grouted to about 30 m into host rock formation.

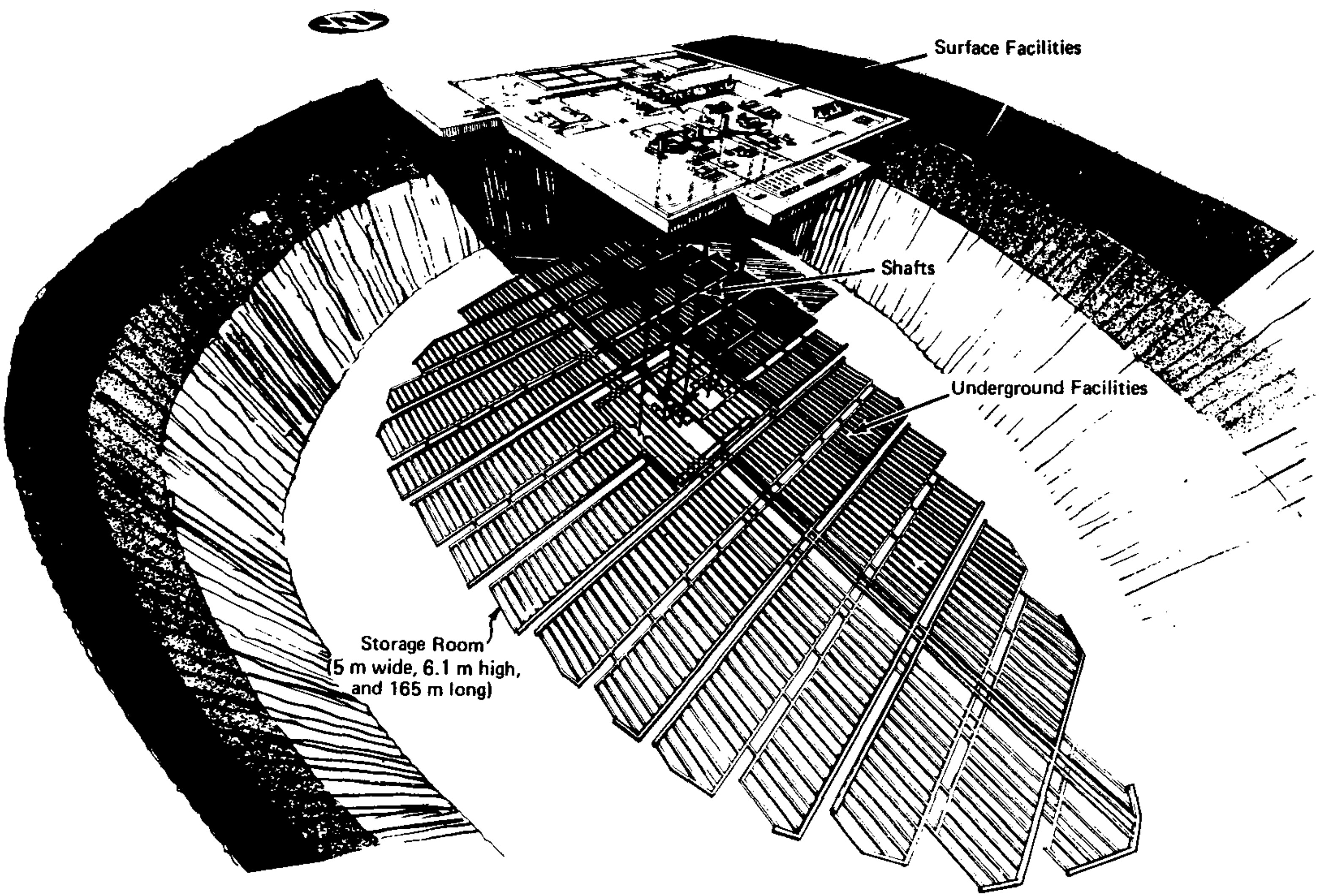

FIGURE D-2. Generic Repository[3]

Corridors, 9 m wide and 5 m high, extending from the principal axis of the underground facility provide for movement of mining equipment, rock conveyors, waste and materials movement, and the ventilation systems. Branch corridors at right angles to the main corridors provide access to the waste storage rooms. Storage rooms are 5 m wide by 6 m high by 165 m long, separated by 21-m-wide support pillars. The waste canisters are emplaced in pre-drilled holes in the floor of the storage room. The spacing of holes depends on mechanical limitations and the thermal characteristics of the waste.

The most important surface facilities are located in the exclusion area, directly over the shaft pillar. In the waste-handling building, waste canisters are received, unloaded from shipping casks, overpacked if necessary, and transferred to the terminal storage area. This building is built over the waste transfer shaft. Auxiliary facilities include four additional shafts which combine functions for men and materials handling, rock handling, and underground ventilation.

REFERENCES FOR APPENDIX D

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