Disposal and Storage of High-Level Waste (HLW) in Salt
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In 1955, salt was recommended as a potentially suitable host rock for high-level waste (HLW) disposal by the National Academy of Sciences National Research Council. Geologic salt deposits, which occur in both salt beds and in salt domes, have several characteristics that are favorable for isolating radioactive waste:

- There are widespread salt deposits in the United States that are sufficiently deep, thick, and laterally extensive to accommodate a repository and generally occur in areas of low seismic and tectonic activity.

- Many salt bodies have remained undisturbed and dry for tens of millions to several hundred million years.

- Because of its high thermal conductivity, salt has the ability to efficiently dissipate the heat that will be generated by the waste.

- Salt deforms in a relatively plastic manner under high confining pressure so that fractures that might develop at repository depth would tend to close and seal themselves.

- Salt undergoes only minor, highly local change as a result of exposure to radiation.

- Salt has excellent radiation-shielding properties.

Bedded salt deposits and salt domes are quite different. Bedded salt occurs as laterally extensive sedimentary layers of salt and impurities, while salt domes are vertical penetrations of sedimentary layers. Bedded salt deposits are typically bounded by aquifers “above and below” the deposit, while salt domes are “surrounded” (i.e. above, below, and on the sides) by aquifers at different depths. Thus the geohydrologic conditions around bedded and salt dome sites are different. Additional differences are:

- Because of its higher water content, bedded salt has a lower strength than dome salt.

- At equal depths of burial, bedded salt has lower geothermal temperatures than dome salt.

- Bedded salt has a faster rate of creep than dome salt.

- Bedded salt deposits have interbeds of other rock types and thus more variability in it’s chemical, mechanical, and thermal properties.

- Bedded salt deposits have a simpler structure than salt domes.

The waste isolation capability of a salt deposit is heavily impacted by the chemical composition and configuration of the salt deposit. All sites primarily rely on salt’s extremely low permeability and the isolation of the host rock from surrounding aquifers. Dissolution of salt in groundwater,

whether initiated by inadvertent human intrusion or as a natural process common to all salt deposits is a potential failure mechanism. Dissolution at both type of sites could be initiated by future well drilling or excavation activities. Natural dissolution differs significantly between bedded and salt dome sites. For example, at salt domes, dissolution would occur along the flanks by groundwater from surrounding sedimentary strata. Whereas at bedded sites, the dissolution of bedded salt could be induced by laterally migrating dissolution fronts, inter-salt-bed sedimentary aquifers, or vertically circulating water in fault zones.

DOE conducted siting studies in the 1970s and 1980s for the disposal of HLW in a "geologic repository". The entire United States was screened as part of these studies. The screening resulted in identifying the following four large regions that represented diverse geohydrologic conditions and are underlain by rock salt of sufficient depth and thickness to accommodate a repository.

- Bedded salt in the Salina Basin, which included the Michigan and Appalachian Basins of southern Michigan, northeastern Ohio, western Pennsylvania, and western New York.

- Salt domes within a large part of the Gulf Coastal Plain in Texas, Louisiana, and Mississippi.

- Bedded salt in the Permian Basin of southwestern Kansas, western Oklahoma, northwestern Texas, and eastern New Mexico.

- Bedded salt in the Paradox Basin of southeastern Utah, southwestern Colorado, and northern-most Arizona and New Mexico.

Further screening by DOE eliminated additional study of the Salina Basin. This left salt domes and bedded salt sites in the Permian and Paradox Basins. Additional screening and area characterization by DOE narrowed the search to 3 dome and 4 bedded areas. DOE identified the following 7 areas as potentially acceptable sites in 1983.

1. Vacherie dome in Lousiana (Salt Dome)
2. Cypress Creek dome in Mississippi (Salt Dome)
3. Richton dome in Mississippi (Salt Dome)
4. Deaf Smith bedded in Texas (Permian Basin)
5. Swisher County bedded in Texas (Permian Basin)
6. Davis Canyon bedded in Utah (Paradox Basin)
7. Lavendar Canyon bedded in Utah (Paradox Basin)

In 1984, DOE published Draft Environmental Assessments for all 7 sites and in 1986 published Environmental Assessments for and identified, Deaf Smith bedded, Davis Canyon bedded, and Richton dome as suitable for site characterization. Also in 1986, a ranking study was completed by DOE with the purpose of informing their site characterization nomination decision. In order of preference, the top 3 salt sites were Richton dome, Deaf Smith bedded and Davis Canyon bedded. Further analysis by DOE led to their selection in 1986 of Deaf Smith bedded as the salt site to be characterized. The Deaf Smith bedded site along with the Hanford and Yucca Mt. sites were nominated to the President of the United States and approved by him (1986) as characterization sites for the 1st repository. Work on salt as a medium for the

disposal of HLW in the United States stopped, with the passage of the Nuclear Waste Policy Amendment Act of 1987. Under this act, only the Yucca Mt site was to be characterized for the first repository and all site specific activities at the Deaf Smith bedded salt and the Hanford sites ceased.

During the 1970s and 1980s, DOE studied the Waste Isolation Pilot Project site, which is located in a bedded salt deposit near Carlsbad, New Mexico. This site was approved by EPA for the disposal of transuranic radioactive waste and began receiving waste in 1999. This project has resulted in more than 20 years of extensive and successful experience with characterizing bedded salt deposits, conducting safety assessments, and in repository design, construction, operation, and waste emplacement.