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RESULTS OF SCREENING ACTIVITIES IN SALT STATES PRIOR TO THE ENACTMENT OF THE NATIONAL WASTE POLICY ACT

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THE SCREENING PROCESS

Site screening criteria being employed under the Nuclear Waste Policy Act and the actual screening of sites for a nuclear waste repository are an interesting example of "What came first...the chicken or the egg?" Largely, the techniques and requirements used in site screening after the enactment of the Act are derived from extensive experience in site screening before the Act was passed. This is a concern to some, but it is not a serious problem because there has been adequate communication between those who have been involved in site screening and those who have been developing Guidelines for the "recommendation of Candidate Sites for Site Characterization," as required by the Act itself.

In specifying detailed geologic and other considerations, the Guidelines thus represent a compilation of what already has been learned about selecting a repository site. This process has been particularly useful in those states where salt formations are being investigated as potential repository sites.

The process was described in April 1980 in the Waste Confidence Rulemaking Document:

> "In a subjective process, geologic information is analyzed in terms of multiple working hypotheses until it yields a 'picture' of the relationships among all the geologic variables. Based on the geographic density of the data collection points, reasonable bounds can be established for interpretations of geologic conditions. As more data become available, the 'picture' comes into ever sharper focus. Continuous peer review is essential; it serves not only to evaluate conclusions but also, and perhaps more importantly, to guide the geologist responsible for determining the character and condition of unseen rocks."[1]

Similar processes are suitable for interpretation of the surface environment or socioeconomic conditions.

In this way, the activities of the salt site selection program have focused on narrowing the number and size of areas under consideration as candidate repository sites. Since 1978 this program has been conducted for the Department of Energy by the Office of Nuclear Waste Isolation operated by the Battelle Project Management Division. Detailed, intensive, field-oriented, original exploration and testing have superseded broad-based studies relying heavily on literature and other existing data.

We have been taking part in a series of increasingly detailed studies to obtain geological and environmental information. The steps begin with national surveys of rock types which have potential for waste containment. Prior to the Waste Act, regions with potentially suitable salt formations were identified. Then areas of 1,000 or more square miles and locations of fewer square miles were recommended. At each step, the study focused on a smaller area and more data were collected. Application of the Siting Guidelines developed under the Nuclear Waste Policy Act will permit further screening to one site in each of the three geohydrologic settings in salt.

RESULTS OF SCREENING ACTIVITIES

Three areas have been designated as centers of screening activity in the salt site identification program. We will discuss each of them briefly and describe recent field work.

Gulf Coast Interior Salt Domes

The Gulf Coastal Plain of Texas, Louisiana, and Mississippi contains more than 260 salt domes on land. In 1963 the U.S. Geological Survey evaluated these domes and identified 36 domes as potentially acceptable for siting a nuclear waste repository. A later Department of Energy study selected 125 domes for detailed studies. Beginning in 1978, these domes were selectively screened for depth, size, and presence of other mineral-related

activities. This study resulted in the selection of eight salt domes for the "area" phase. Further screening removed three of the domes, and drilling and seismic investigations were conducted at five domes: Palestine in Texas, Vacherie and Rayburns in Louisiana, and Cypress Creek and Richton in Mississippi. As further information became available, Rayburns and Palestine domes were dropped from consideration--leaving Cypress Creek and Richton salt domes in Mississippi and Vacherie dome in Louisiana.

Field investigations have been carried out in the Gulf Coast region to a point where it has been possible to rank the three salt domes. The domes were ranked based on site geometry, geohydrology, geochemistry, geologic characteristics, tectonic environment, human resources, surface characteristics, demography, environmental conditions, and potential socioeconomic impacts. The domes were ranked in a report published in 1982 (ONWI-109), Evaluation of Area Studies of the U.S. Gulf Coast Salt Dome Basins.[2] Additional data were considered in a further report (ONWI-484)[3] published in August 1983; however, the ranking was not changed.

The domes, in order of preference according to screening criteria developed before the Nuclear Waste Policy Act, are Richton in Mississippi, Vacherie in Louisiana, and Cypress Creek in Mississippi. Further field work may be carried out at one or more of these dome sites before the nomination of sites for detailed characterization. However, this work, which may include environmental monitoring, is not required for site screening and would be done primarily to develop information for addressing concerns raised by the states of Mississippi and Louisiana.

Paradox Basin in Southeastern Utah and Southwestern Colorado

Approximately 12,000 square miles of the Paradox basin are underlain by layers of bedded salt deposited about 300 million years ago. In some parts of the basin there are more than 25 layers of salt, separated by interbeds of shale, carbonates, and anhydrite. The Paradox basin was one of the salt regions identified during a national screening (published in 1978)[4] as having potential for the eventual siting of a waste repository. Evaluation of the basin by the U.S. Geological Survey had begun in 1972.[5]

Regional studies of the Paradox basin led to recommendations for more intensive coverage in four areas of southeastern Utah: Salt Valley in Grand County and Gibson Dome, Elk Ridge, and Lisbon Valley in San Juan County. Area characterization reports for these four areas were completed in 1980. The four areas had been selected on the basis of geologic factors such as depth from the earth's surface to salt, thickness of salt, and location of mapped faults, and also on the basis of environmental screenings. One of the four--Salt Valley--had previously been identified by the U.S. Geological Survey.

Based on work carried out between 1979 and 1981, it was determined that both Salt Valley and Lisbon Valley have potentially unfavorable conditions related to faults, existing boreholes, and dedicated lands. In addition, Salt Valley has an extremely complicated geologic structure and Lisbon Valley has a history of resource production and the potential for future production. As a result, these two areas were removed from consideration. By contrast, parts of the Elk Ridge and Gibson Dome areas appeared to meet the site selection criteria that had been identified by the Department of Energy and the Nuclear Regulatory Commission.

Next, a 57-square-mile area of Gibson Dome and a 6-square-mile area of Elk Ridge were subjected to comparative evaluation. This evaluation, using 110 comparison factors, was based on information gathered during the area phase of the study. The evaluation showed only 12 comparison factors that differentiated between Gibson Dome and Elk Ridge. Eight of these factors were more favorable at Gibson Dome. The Gibson Dome preferred location was further examined to identify parts of the 57 square miles that would be more favored based on both surface and subsurface considerations. Emphasis was placed on such distinguishing features as topography, access, and aesthetics. These considerations indicated that the more concealed places in the southern part of the location were favored. Thus, within Gibson Dome, Davis Canyon and Lavender Canyon are two prime examples of sites suitable for further investigation in the Paradox Basin. This screening process was delineated in the Paradox Area Characterization Summary and Location Recommendation Report (ONWI-291).[5]

Further field work may be carried out in the vicinity of Gibson Dome before sites are nominated for detailed characterization. This work would include both environmental and deep hydrological studies using a small number of drill holes. As is the case in the Gulf, this work is not required for site screening and would be done mainly to develop information for addressing concerns raised by the state.

Permian Basin

The Permian basin is a series of sedimentary basins in which salt has accumulated for more than 200 million years. It includes the western parts of Kansas, Oklahoma, and Texas and the eastern parts of Colorado and New Mexico. In the New Mexico portion of the Permian basin is the Los Medanos site, where the Department of Energy is constructing the Waste Isolation Pilot Plant (WIPP) for transuranic wastes from defense-related activities.

The Palo Duro and Dalhart basins were identified as areas with potential for siting a waste repository. These basins are subunits of the Permian basin located in the Texas Panhandle. Field activities in Texas have developed substantial new information about the geologic, hydrologic, environmental, and socioeconomic characteristics of the Texas Panhandle

in general, and about the Palo Duro Basin in particular. Two reports on this work have been finalized: the Area Geological Characterization Report (ONWI-292)[7] and the Area Environmental Characterization Report (ONWI-102).[8]

Based on these reports and other work, a Location Recommendation Report (DOE-CH/10140-2)[9] has been prepared. This report summarizes relevant knowledge about the geology, hydrology, environment, and socioeconomics of the Palo Duro and Dalhart basins and compares characteristics of the basins to criteria that were developed to permit investigations to focus on smaller parcels of land. Two locations in the Palo Duro Basin were identified as preferred for further study--about 300 square miles in Deaf Smith County and 180 square miles in Swisher County.

During 1982, field activities in support of site screening were most vigorously pursued in Texas to bring together all of the information that would be needed to compare the potential sites in Deaf Smith and Swisher Counties with other potential salt sites. Field work included completing four exploratory wells. To tie information from existing wells into a coherent stratigraphic and structural framework, nearly 600 miles of seismic reflection data strategically located over portions of the Palo Duro basin were acquired and interpreted.

Limited additional field work in Deaf Smith and Swisher Counties also is planned before sites are nominated for detailed characterization. This work will include some hydrologic, stratigraphic, and seismic testing to address state and local concerns and optimize planning for any future site characterization studies.

SUMMARY

The identification of potential sites for a nuclear waste repository through screening procedures in the salt states is a well-established, deliberate process. This screening process had made it possible to carry out detailed studies of many of the most promising potential sites, and general studies of all the sites, in anticipation of the siting guidelines specified in the Nuclear Waste Policy Act. The screening work completed prior to the passage of the Act allowed the Secretary of Energy to identify seven salt sites as potentially acceptable under the provisions of Section 116(a) of the Act. These sites were formally identified by letters from Secretary Hodel to the states of Texas, Utah, Mississippi, and Louisiana on February 2, 1983. The potentially acceptable salt sites were in Deaf Smith and Swisher Counties in Texas; Davis and Lavender Canyons in the Gibson Dome location in Utah; Richton and Cypress Creek Domes in Mississippi; and Vacherie Dome in Louisiana. Further screening will include comparison of each potentially acceptable site against disqualification factors and selection of a preferred site in each of the three geohydrologic settings from those remaining, in accordance with the siting guidelines. These steps will be documented in statutory Environmental Assessments prepared for each site to be nominated for detailed characterization.

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