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IDENTIFICATION OF SITES WITHIN THE PALO DURO BASIN: VOLUME 3—RESPONSES TO COMMENTS

NOVEMBER 1984

U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SALT REPOSITORY PROJECT OFFICE

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1 INTRODUCTION

1.1 SUMMARY

This document responds to comments received by the U.S. Department of Energy (DOE) on the draft report entitled Identification of Sites Within the Palo Duro Basin: Volume I--Palo Duro Location A (in Deaf Smith County) and Volume II--Palo Duro Location B (in Swisher County), BMI/ONWI-531, February, 1984. The purpose of the report was to review existing geologic, environmental, and socioeconomic data for previously identified potentially acceptable sites consisting of approximately 200 square miles in Swisher County and 400 square miles in Deaf Smith County in the Texas Panhandle and to narrow them to preferred smaller sites for possible further study for a nuclear waste repository. The smaller sites thus identified within the two counties would then be more comparable in size to those in salt deposits in Louisiana, Mississippi, and Utah (see further description of the site identification process described in the executive summary and chapters 1 and 4 of volumes 1 and 2 of the final report).

Seven salt sites in four states, along with a site in tuff at the Nevada Test Site and a site in basalt at the Hanford Site near Richland, Washington, are being considered for further study for a high-level nuclear waste repository. Each site nominated is to be evaluated in an environmental assessment, according to the Nuclear Waste Policy Act (NWPA) of 1982.

The draft report was received by DOE from Battelle's Office of Nuclear Waste Isolation (ONWI) in March, 1984. It recommended two nine-square-mile sites for further consideration, one each in Deaf Smith and Swisher counties. As part of its decision-making process, DOE distributed the report for review to the Texas Nuclear Waste Programs Office (TNWPO) on March 19, 1984, and subsequently to the public for comment. Release of the draft report began an extensive DOE/state/public interaction process.

- On March 19, 1984, DOE notified, by letter, those property owners within the recommended nine-square-mile sites of the content of the draft report and invited them to attend briefings on the report.

- DOE briefed property owners within the nine-square-mile sites, local officials, media representatives, and the public on the report on March 20-21, 1984, in Amarillo, Tulia, and Hereford. Copies of the report were provided to property owners, local officials, and libraries in the Panhandle.
- TNWPO distributed copies of the report to various state agencies for review and DOE, at TNWPO request, provided copies to more than 400 residents of the Panhandle on its public information mailing list.
- TNWPO requested an extension of the 45-day review period for the report to allow time for additional public involvement; DOE agreed to the extension.
- TNWPO conducted hearings on the report in Hereford, Texas, on April 26, 1984, and Tulia, Texas, on April 28, 1984. The hearings were attended by DOE and Battelle representatives.
- DOE held public meetings to describe the report and answer questions in Vega, Texas, on May 1, 1984, and in Tulia, Texas, on May 3, 1984. These meetings were planned with area representatives in Canyon, Texas, on April 3, 1984.

At the end of the public comment period, TNWPO submitted to DOE its written comments, as well as those of various state agencies and the public. Transcripts of the two hearings were also provided.

1.2 CONSIDERATION OF COMMENTS

Comments were received by mail from TNWPO, nine state agencies, various groups and organizations, and more than 65 members of the public on May 30. All were read and analyzed by DOE representatives and a report review team was established to evaluate the comments, produce the final report, and prepare a comment/response document.

The comments were divided into two categories: (1) those that addressed the subject of the draft report (methodology and data used to identify smaller sites within the two Panhandle locations), which were considered "within the scope" of the report; and (2) those that did not address the subject of the report, but discussed other issues or aspects of the civilian radioactive waste management program, which were considered "out of scope".

Comments received from TNWPO directly, as part of the letter transmitting the full set of state and public comments, were responded to in a separate letter. (These comments and the DOE responses are contained in Section 2 of this response document.)

1.2.1 Within-Scope Issues

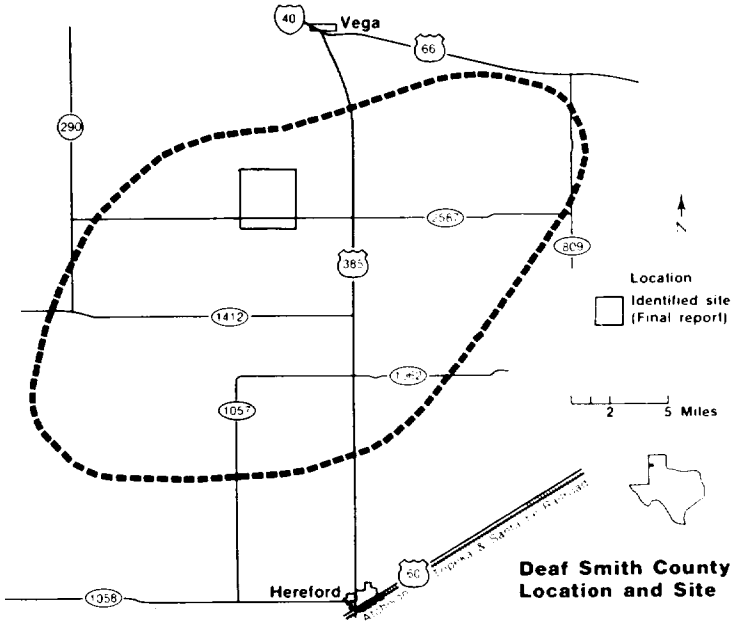
This document addresses those comments that were determined by the review team to be within the scope of the report. General comments about the program were not considered within the scope of the report. Comments directed specifically to the content and purpose of the report, the narrowing to nine-square-mile sites in the Texas locations, were considered within the scope of the report.

All comments received from TNWPO are individually addressed in Section 2 of this document. Other questions and comments were divided into (1) those regarding DOE program or policy decisions and (2) technical issues. Because of the number and similarity of the comments, they were grouped by subject and a general response provided. Additional reports or references are suggested for further information.

Consideration of several of the technical comments caused the review team to reevaluate the data considered in the draft report. This reevaluation led to a decision to reposition the nine-square-mile sites originally identified for possible further consideration. There is overlap with the earlier proposed sites. Based principally on a corrected use of salt depth data, the new site in Swisher County is one mile east and one mile north of the original recommendation (see Sections 3.6.1 and 3.6.2 of this document). The new location in Deaf Smith County is two miles east of that indicated in the draft report, based principally on newer data on projected saturated thickness of the Ogallala aquifer in the year 2030 (see Sections 2.1.7 and 3.5.2 of this report). Figure 1-1 illustrates the locations of the new sites. Final copies of this report have been mailed to TNWPO, commenters, and Panhandle libraries.

1.2.2 Out-of-Scope Issues

Questions or comments determined to be outside the scope of the draft report are not responded to in this document. Issues judged to be outside the



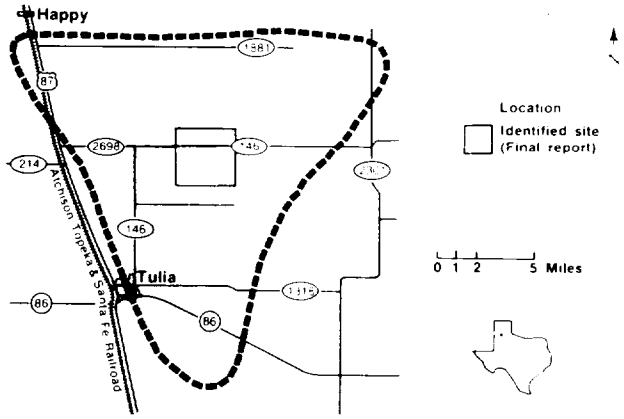


Figure 1-1. Potential Study Sites in Texas Panhandle

report's scope included those about the DOE high-level waste program in general, schedules, changing policies and credibility, siting guidelines, or plans; nuclear power, nuclear weapons, or other toxic waste concerns; equity of siting, repository performance and other safety issues and guarantees; transportation or repository operational risks; emergency response capabilities; effect of shafts and the repository on the Ogallala aquifer; responsiveness to public concerns; and adequacy of data to resolve issues.

Many of these questions and concerns have been expressed at previous hearings and meetings held by DOE, TNWPO, and local groups. DOE will address many of them in the draft environmental assessments that will be provided for public review and comment later this winter. DOE has attempted to respond to concerns in official reports, policy statements, individual letters, printed materials, public information exchanges, presentations to various groups, and in two documents required by the Nuclear Waste Policy Act--the general siting guidelines, to be issued in final form in Fall, 1984, and the draft mission plan. These two documents, and the publications listed below, are available in libraries throughout the Panhandle (library locations are listed at the end of this section). Copies may also be obtained by writing to: U.S. Department of Energy, Salt Repository Project Office, 601 W. Fifth Avenue, Columbus, OH 43201.

The index of this document contains an alphabetical list of all commenters. Numbers by each name indicate where the comments are addressed. If you feel your comment has not been answered in this document or in one of the publications listed below, please write to the above address.

1.3 REFERENCES DISCUSSING DOE PROGRAM, POLICY, AND GENERAL ISSUES

1. Nuclear Waste Policy Act of 1982, Public Law 97-425, January 7, 1983.

2. U.S. Department of Energy, 1984. Environmental Assessment for the Permian Basin, draft expected to be available this winter.

3. U.S. Department of Energy, 1984. General Guidelines for Recommendation of Sites for Nuclear Waste Repositories, final edition available this fall.

4. U.S. Department of Energy, 1984. Mission Plan for the Civilian Radioactive Waste Management Program, Volumes I and II, draft, April.

5. U.S. Department of Energy, 1984. Annual Report to Congress, DOE/RW0004, Washington, DC, February.

6. Office of Nuclear Waste Isolation, 1983. Response Report from U.S. Department of Energy Hearings on Proposed Salt Site Nominations, BMI/ONWI-519, draft, prepared by Battelle Memorial Institute, Columbus, OH, November.

7. U.S. Department of Energy, 1980. Final Environmental Impact Statement, Management of Commercially Generated Radioactive Waste, DOE/EIS-0046F, Washington, DC, October.

8. U.S. Department of Energy, 1982. NWTS Program Criteria for Mined Geologic Disposal of Nuclear Waste: Program Objectives, Functional Requirements, and System Performance Criteria, DOE/NWTS-33(1), Office of NWTS Integration, Battelle Memorial Institute, Columbus, OH, March.

9. U.S. Department of Energy, 1981. NWTS Program Criteria for Mined Geologic Disposal of Nuclear Waste: Site Performance Criteria, DOE/NWTS-33(2), Office of NWTS Integration, Battelle Memorial Institute, Columbus, OH, February.

10. U.S. Department of Energy, 1982. NWTS Program Criteria for Mined Geologic Disposal of Nuclear Waste: Repository Performance and Development Criteria, DOE/NWTS-33(3), public draft, Office of NWTS Integration, Battelle Memorial Institute, Columbus, OH, July.

11. U.S. Department of Energy, 1982. NWTS Program Criteria for Mined Geologic Disposal of Nuclear Waste: Waste Package Performance Criteria, DOE/NWTS-33(4), public draft, Office of NWTS Integration, Battelle Memorial Institute, Columbus, OH, July.

Texas Libraries Containing Referenced Reports:

Deaf Smith County Library
211 East Fourth Street
Hereford, TX 79045

Swisher County Library
Swisher County Memorial Building
Tulia, TX 79088

Randall County Library
201 16th Street
Canyon, TX 79015

Amarillo Public Library
413 East Fourth Street
P.O. Box 2172
Amarillo, TX 79189

Texas Nuclear Waste Programs Office
Sam Houston Office Building, Room 204
200 East 14th Street
Austin, TX 78711

Rhoads Memorial Library
102 S.W. 2nd Street
Dimmitt, TX 79027

Gabie Betts Burton Memorial Library
314 South Sully
P.O. Box 783
Clarendon, TX 79226

Austin Public Library
800 Guadalupe Street
P.O. Box 2287
Austin, TX 78768

University of Texas General Library
P.O. Box P
Austin, TX 78712

2 COMMENTS FROM TEXAS NUCLEAR WASTE PROGRAMS OFFICE *

2.1 GENERAL COMMENTS

2.1.1 Comment 1

"The logic diagram which appears on page 24 of both volumes exhibits omissions and ambiguities. First, at decision step 2, any descriptor for which data are not available is immediately eliminated as a discriminator. Judging the utility of a descriptor on the basis of availability of data or information is entirely inappropriate. Such decisions should rather be made based on the necessity of the descriptors in arriving at valid site identifications.

"Elimination of a descriptor in step 4 because of inability to interpret variation or lack of variation is also unacceptable. As above, the utility of the descriptor in arriving at legitimate and defensible site decisions should be evaluated independent of any shortcomings in format or sufficiency of the associated data or information.

"Conditions leading to step 5 from step 4 are ambiguous. That path is followed (a) if variation is shown, or (b) if lack of variation is shown. In many cases, even careful examination of the narrative for particular descriptors does not reveal which of the two reasons controlled that path on the logic diagram. In cases where representative data can be interpreted to depict lack of variation, immediate elimination of the descriptor as a discriminator seems more appropriate than further consideration of the already useless parameter. As a result of the ambiguity in input to step 5 from step 4, the output from step 5 is also ambiguous. With the present logic, a descriptor may be eliminated for one of two reasons at that step: (a) no discernible variation or (b) no potential impacts from discernible variation. Those two circumstances are clearly quite different and should not be ambiguously combined preventing a clear understanding of the reason for going from step 5 to step 7."

Response

The logic diagram and description of steps have been modified to more clearly define the process. The basic premise that existing data would be used for this site narrowing process results in the need to make a judgment regarding each descriptor. The utility of each descriptor is essentially dictated by program performance criteria. The fact that many descriptors are shown to be nondiscriminators after working through the logic diagram is not inappropriate; it merely indicates the similarity of the land areas being compared or the lack of location-wide data for a particular discriminator.

---

*These comments are printed verbatim.

This emphasizes the importance of detailed site characterization* to obtain data necessary to more precisely apply these descriptors.

Eliminating descriptors because they result in lack of variation is as valid as including descriptors because of variation. Some descriptors will lack significant variation within a specific site even after detailed site characterization. An example for the Palo Duro Basin is the wind. Although wind direction and wind speed may vary from time to time, the predominant direction and maximum speeds are quite similar throughout the Deaf Smith location. This, however, does not mean that wind should or will be neglected as a factor in the selection of the first repository site, repository design, or in the comparison of the Texas sites with others in the nation.

Conditions leading to step 5 from step 4 may have been ambiguous for some descriptors in the draft report. An additional explanation in the narrative has been provided to clarify this. However, the results of step 4 and step 5 are not ambiguous. In the case of step 4, the descriptor is either a nondiscriminator or goes to step 5 for further examination. Step 5 determines whether or not the variation is significant, i.e., if a descriptor is a discriminator or nondiscriminator for the purposes of this narrowing process.

2.1.2 Comment 2

"Criteria Descriptors--according to the text of the documents, the criteria descriptors appearing in Table 1-1 of each document are derived from DOE/NWTS-33(2) NWTS Program Criteria for Mined Geologic Disposal of Nuclear Waste, Site Performance Criteria. The ten major site performance criteria appearing in Table 1-1 are identical to the ten major criteria which appear in NWTS-33(2). However, the selection of individual subcriteria as descriptors for use in the Site Identification Documents requires interpretation of the

---

*Site characterization consists of activities, whether in the laboratory or in the field, undertaken to establish the geologic condition and the ranges of the parameters of a candidate site relevant to the location of a repository, including borings, surface excavations, excavations of exploratory shafts, limited subsurface lateral excavations and borings, and in situ testing needed to evaluate the suitability of a candidate site for the location of a repository, but not including preliminary borings and geophysical testing needed to assess whether site characterization should be undertaken.

subcriteria appearing under the major criteria in NWTS-33(2) and the criteria descriptors. The primary concern regarding this step in the site identification methodology is that key subcriteria may have been omitted from Table 1-1. For example, under geohydrology, the ninth subcriterion listed is saturated thickness of Ogallala. Based on available information, the quality and availability of water from the Dockum Group could have also been included as a geohydrology subcriterion. While the subcriteria listed in Table 1-1 are numerous, there is no direct correlation with the subcriteria appearing in NWTS-33(2)."

Response

In general, we agree that selection of descriptors requires interpretation of subcriteria of NWTS-33(2) (DOE, 1981). The selection of descriptors from each of the ten site performance criteria was done by the authors in consultation with DOE contractors and subcontractors and was reviewed both internally by ONWI and by DOE. Table 1-1 lists descriptors--not subcriteria. The case cited relative to the Dockum Group resulted in additional narrative covering this topic in Chapter 3 of the final report. However, no new descriptor has been added. If a descriptor for the Dockum were added, it would not affect the results of the report because there are insufficient data on the Dockum. Such a descriptor would have been a nondiscriminator.

The descriptors listed in Table 1-1 do correlate with the ten NWTS-33(2) performance criteria. They represent a consensus of the authors' interpretation of the performance criteria and the consensus of numerous reviewers.

2.1.3 Comment 3

"Establishment of Discriminator Hierarchy -- The hierarchy of major discriminator groups is consistent with the hierarchy presented in the draft siting guidelines (10 CFR 960): (1) long-term performance, (2) operational performance, and (3) environmental/constructibility impacts. The details of the establishment of this hierarchy do, however, involve two points of judgment which bear examination. First, the assignment of specific discriminators to the appropriate major group of criteria is in some cases questionable. For example, in the case of proximate streams and floodplains (see Vol. 1, section 3.7.1, pages 104-107; Vol. 2, section 3.7.1, pages 103-105), the descriptor was identified as a discriminator but was classified as an environmental/constructibility impact rather than operational performance impact. Reference to section 3.7 (Vol. 1. page 104; Vol. 2, page 103) clearly shows that the primary intent of these criteria '. . . is to avoid unacceptable impacts on repository operation and system performance'. This particular discriminator should have been classified as an operational performance discriminator which would place it in the second group of discriminators which is assigned greater importance than the third group in which this discriminator was incorrectly placed.

"A second element of judgment is introduced into the discriminator hierarchy in the prioritization within the environmental/constructibility impacts. According to the site identification reports (Vol. 1, pages 139-140; Vol. 2, pages 137-138), 'The prioritization of these impact discriminators is the consensus of the authors of this report'. The discussion of the rationale underlying this prioritization is totally inadequate. In each volume, four isolated reasons are cited for the prioritization of over a dozen discriminators which include: (1) ecological habitat, (2) projected water yields from the Ogallala in the year 2020, (3) saturated thickness of the Ogallala, (4) depth to host rock, (5) proximity to road access, (6) proximity to rail rights-of-way, (7) proximity to streams and floodplains, (8) proximate water bodies, (9) depth to base of Dockum, (10) cultural/historical resources, (11) prime farmland, (12) aesthetics, and (13) proximity to transportation installations. This prioritization within the environmental/constructibility impact grouping is rendered even more significant by their sequential application in site screening which resulted in ignoring all discriminators lower than priority 2 in Volume 1 (nine discriminators ignored) and lower than priority 3 in Volume 2 (eight discriminators ignored). With different rationale and prioritization, an entirely different set of discriminators would have been developed for the final screening step. Since the rationale for the discriminators is incomplete, the prioritization used in the documents is arbitrary and could be modified by different rationales. A comprehensive discussion of criteria and rationale for this prioritization is essential."

Response

The guiding objective for development and implementation of the site-narrowing methodology was that it be consistent and reproducible. After extensive review, DOE believes that this objective has been met.

The hierarchy used in this report was developed after weeks of analysis and discussion concerning the criteria statements contained in NWTS-33(2) (DOE, 1981). The resultant discriminator listing and prioritization were subjected to numerous internal and external technical reviews, a peer review process, several reviews by various DOE components, a peer review by Argonne National Laboratory, and a review of the preliminary draft report by the Texas Bureau of Economic Geology. All of the resulting comments were evaluated and considered during preparation of the draft report that was distributed to the state of Texas and the public in March, 1984.

The discriminator on proximate streams and floodplains is one of several "surface characteristics" descriptors included in Section 3.7 of the report. The primary intent of the surface descriptors as a group is to avoid unacceptable impacts on repository operation and performance. However, the individual discriminator on proximate streams and floodplains is a construction concern. Engineering measures can be incorporated into the design

to protect the facility from floods. In addition, the 9-square-mile area allows some flexibility in siting the repository surface facilities to avoid flood-prone areas, if any.

In response to the second part of the comment, the NWTS criteria document (DOE, 1981, p.B-4) states ". . . The siting process is a complex set of choices and tradeoffs that can be made in any number of ways, but the eventual proof of suitability of a selected site will be based on the assessment of its (acceptable) performance. . .". The rationale for the prioritization groupings within the environmental/constructibility category was the consideration of impact tradeoffs for each discriminator relative to the others. Some discriminators were similar in importance and were grouped within a subcategory such as Priority 1; e.g., ecological habitat and projected saturated thickness of Ogallala in the year 2030. Ecological habitat was considered highly important because "natural or native" vegetation is scarce in this area of the Texas Panhandle due to modification and disturbance to facilitate farming, transportation, and other amenities. The report also includes consideration of ecological habitats for protected plant and animal species (threatened and endangered species) or the potential presence of those species and wildlife migration routes. The ecological habitat discriminator (see Figure 3-36) also, coincidentally, included large portions of the potential prehistoric resources locations (Figure 3-35), streams and floodplain areas (Figure 3-31), and playas (Figure 3-31). Because the ecological habitat tends to be in areas less suitable for farming, these areas remain largely unmodified except for grazing use. Similarly, potential prehistoric areas are likely to be near water sources (streams, playas). Each of the latter three discriminators (cultural resources, proximate streams and floodplains, and proximate water bodies) was separately placed in a lower priority than ecological habitat because impacts are related to construction disturbance, actual structure design, or structure placement on a specific, relatively small land area and can readily be mitigated.

Proximity to road access and rail rights-of-way received a relatively high priority because they represent a physical disturbance that may affect ecological habitats and agricultural land. The closer the site is to appropriate transportation corridors, the less land surface would be disturbed.

Prime farmland received a lower priority than ecological habitat, water-related potential resource conflicts, access proximity or the safety-related discriminators (probable maximum flood areas, playas, host rock depth). Extensive areas of prime farmland are present in both locations; however, not all land designated as prime farmland is cultivated, and many areas not designated as prime are cultivated. Prime farmland is a designation based on the land's potential to produce crops, not on actual use of the land. Some prime farmland, due to its topographic location, was included in the ecological habitat priority (rangeland). During the final step of the narrowing process, every appropriate reduction in prime farmland impact was considered, as long as it was consistent with the methodology. (See also Sections 3.2.1 and 3.7.3 of this document.)

2.1.4 Comment 4

"Assumption of location acceptability -- The methodology developed for selection of nine-square-mile sites from the hundreds of square mile locations identified in the Texas Panhandle assumes that there is at least one acceptable site within the location. The first sentence in paragraph three, page 7 of Volume 1 states, 'Any portion of the Swisher County location could potentially serve as a suitable repository site' (see also Vol. 2, page 7) (emphasis added). This language is substantially more presumptive than is justified by the concluding statement of the preceding Permian Basin Location Recommendation Report (DOE/CH/10140-2) which states 'Future repository siting and characterization efforts should focus on (these locations). . . because these (locations) have the greatest likelihood of containing a suitable site with relatively fewer licensing issues or concerns' (page 81) (emphasis added). Clearly, the location recommendation report does not assert that any site within the designated locations is acceptable or even that there is a single acceptable site within each location. On the other hand, the subject document does assert that the entire identified locations are potentially acceptable. The hiatus between these two reports must be reconciled."

Response

There is no inconsistency between the two reports identified in this comment. The terminology may vary somewhat, but the intent is the same.

The LRR conclusions that the Palo Duro locations have a ". . .greatest likelihood of containing a suitable site. . ." means that, based on data from area studies, these locations are more likely to contain a suitable site than the rest of the Palo Duro and Dalhart areas studied in the Permian Basin. To

say that any portion ". . . could potentially serve as a suitable repository site" means that given our current level of knowledge, both locations appear everywhere suitable for further consideration (with the exception of a small area containing Tulia which would be disqualified based on a provision of the NWPA). These statements do not contradict each other. Only after detailed characterization can licensability of a site be fully determined.

2.1.5 Comment 5

"At many points in the site identification reports, the phrase, 'a site' is utilized where the more appropriate phrase 'the best site' should be used (see, for example, Vol. 1, page 1, paragraph 3). We recognized that the overall goal of the repository development program is to simply locate a licensable site. However, as the Texas Office responsible for oversight of DOE activities in the state and for maintaining the highest degree of protection for the citizens and environment of the State of Texas, we vehemently object to the implication that any licensable site is acceptable in the absence of a concerted effort to locate the best sites available within the locations."

Response

DOE is conducting the repository siting program in accordance with federal laws, including the Nuclear Waste Policy Act of 1982 (NWPA). This act establishes a schedule for siting, constructing, and operating repositories that will provide a reasonable assurance that the public and the environment will be adequately protected from the hazards posed by high-level radioactive waste and spent nuclear fuel. If, at any time during the siting process, sites are determined to be unsuitable, DOE will drop them from further consideration. Any site recommended for a repository must meet stringent licensing criteria.

2.1.6 Comment 6

"As was noted above, a descriptor which could have been included in the original list (Table 1-1) is the availability and quality of water from the Dockum Group beneath the Ogallala Formation. A specific example that came to our attention is a well at the Richardson Seed Farm in Deaf Smith County, which has been drawing high quality water from a saturated stratum in the Dockum over two hundred feet thick at a rate ot 500 to 1,000 acre-feet per year for over 7 years. Total drawdown of that well has reportedly amounted to only 4 feet over the past 7 years. In addition, the City of Tulia, in Swisher County, obtains municipal water from the Santa Rosa Aquifer. Since the saturated thickness of the Ogallala has been used as a discriminator, the Santa Rosa could be included as a discriminator because it is clearly an important water source over portions of the designated locations in Deaf Smith and Swisher Counties."

Response

Additional narrative discussing the Dockum Group aquifer has been included in Chapter 3 of the revised text. Protection of the Dockum is of equal concern as protection of the Ogallala. However, as discussed in response to comment 3, there are not enough data from the Dockum to develop the maps and interpretations required for its use as a discriminator. We do know the Dockum lithologies are quite variable throughout the area. If a Texas site is approved for characterization, the Dockum will be studied in detail. If a repository were to be built at that site, the same safety measures as discussed many times (DOE, 1984a, pp. A-50 to A-56) concerning protection of the Ogallala would apply.

2.1.7 Comment 7

"Projected water yields from the Ogallala in the year 2020 is one of the highest priority discriminators within the environmental/constructibility impact grouping. We have reviewed the source of information for those projected yields and find that they are based on information developed by the Texas Department of Water Resources in the late 1970's. The projections are based on water consumption rates, using less efficient irrigation methods which are being replaced by newer methods requiring less water. The agricultural industry in that area has become more cognizant of the need for water conservation, and 1983 records indicate recent drawdown rates of the Ogallala have decreased dramatically. A model for projecting water yields from the Ogallala in the year 2020 must take into consideration the implementation of improved irrigation technologies as a result of greater awareness of and sensitivity to the need for water conservation. Technological advances that are likely to further reduce future irrigation consumption rates should also be considered. Identification of areas with projected well yields from the Ogallala Aquifer of less than 100 gallons of water per minute in the year 2020 as 'more-preferred for siting' because 'these areas are projected to be unable to support irrigated agriculture, but could produce sufficient water for the repository' is arbitrary and without identified basis in fact. The Ogallala is, without question a major source of groundwater, and will continue to be such for many years beyond the year 2020, given recent drawdown trends. Working Draft No. 4 of the U.S. Environmental Protection Agency's Proposal Rule 40 CFR 191 (dated 5/21/84) regarding management of high-level radioactive wastes defines a 'Major source of ground water' as an aquifer that: '(1) is saturated with water having less than 10,000 milligrams per liter of total dissolved solids; and (2) is within 2,500 feet of the land surface; and (3) has a transmissivity greater than 200 gallons per day per foot, provided that each formation or part of a formation included in the major source of ground water has an individual hydraulic conductivity greater than 2 gallons per day per square foot; and (4) is capable of continuously yielding at least

10,000 gallons per day to a pumped or flowing well for a period of at least a year'. While this may not be adopted in the Final Rule, the trend through the working papers has been to develop a quantitative definition for identification of important aquifers that merit special protection. An earlier working paper referred to a standard for yield of 20 gallons per minute, and this later definition results in an even lower yield standard.

"The standard yield set in the Draft Site Identification Report as more-preferred must be fully substantiated as a realistic and relevant value that is sensitive to both the expected conditions and uses of the Ogallala and standards that are found to be developing for inclusion in federal regulations that will be applied in the licensing of a recommended high-level nuclear waste repository site."

Response

The report has been revised to use more recent ground-water projections made by the Texas Department of Water Resources (TDWR) (Knowles et al, 1982). This more recent TDWR report makes projections of saturated thickness based on 1980 water levels, and considers various water management practices anticipated to reduce irrigation application. The revised report uses projected Ogallala saturated thicknesses in the year 2030 rather than projected water yields in 2020; this is because these are the most recent maps available (see also Section 3.5.2 of this document). The result is similar trends in more-preferred and less-preferred areas because the ability of an aquifer to yield water is dependent in large part on the saturated thickness. Selection of a boundary between more-preferred and less-preferred areas has a basis in that well yields are generally not considered a limiting factor on irrigation if saturated thickness is 100 feet or greater. In order to reduce the likelihood of siting in areas with greatest potential for future irrigated agriculture, the revised report selects the saturated thickness contour of 60 feet on the TDWR maps as a conservative boundary between more-preferred and less-preferred areas (see also Section 3.5.1 of this document).

EPA standards regarding management of high-level radioactive wastes will be used by the NRC in evaluating the suitability of a site for construction authorization. The site identification process used in the report increases the potential for meeting the proposed EPA standards in that areas of lesser saturated thickness in 2030 are more preferred for siting.

2.1.8 Comment 8

"In spite of the detailed methodology established for identification of discriminators, the final step of map overlaying did not utilize all of the identified discriminators. In the case of Volume 1, seven discriminators were actually utilized and nine discriminators were not. In Volume 2, eleven discriminators were used and eight discriminators were not. Furthermore, the discriminators used resulted in preferred parcels of land smaller than nine square miles. In order to overcome that problem, some of the land already rejected as less preferred was ultimately included in the final sites. Totally disregarding about half of the discriminators clearly illustrates the importance of the priorities that were established within the environmental/constructibility impacts discriminator grouping--the lower priority discriminators are totally ignored. A far preferable methodology which would allow some consideration of these unused discriminators would involve assigning weighting factors to all discriminators and then summing their relative preferability in order to select the most preferred sites. The text of the reports notes on page 134 of Volume 1 (page 132, Volume 2) that the current status of data and information will not allow the use of a numerical method, such as is implied by the weighting factor methodology suggested above. Rather than rejecting this more suitable methodology for lack of information and data, the required data should be collected and a numerical selection methodology employed to identify the best potential sites within the proposed locations."

Response

Areas defined as less preferred are not rejected; they are simply less preferred. As stated previously, more-preferred/less-preferred does not mean or imply qualified/disqualified or suitable/unsuitable. Current knowledge of the locations does allow us to say all land within the two Palo Duro locations is potentially suitable for repository development. Only after detailed site characterization is completed can the licensability of a site be fully determined.

We agree that there are several types of methodologies that could have been used, including a numerical approach as suggested by the commenter. The study team selected the methodology used in the report as the one that would be most reproducible, defensible, and appropriate for the level and amount of data available.

2.1.9 Comment 9

"In some cases, descriptors were inappropriately rejected as discriminators. One of the best examples of this appears on page 110 of Volume 1, Section 3.7.9, 'Proximate Industrial and Commercial Installations' (see also Volume 2, page 109). In both counties, the sites tentatively selected include

major industrial/commercial installations which would suffer substantial loss if relocation were required. In Deaf Smith County, the site includes most of the production lands for a major commercial seed production operation as well as the seed preparation facility itself. Many years are required to properly prepare land for producing foundation seeds of high quality and genetic purity for agricultural purposes. Furthermore, substantial tracts of land must be pieced together in order to minimize the possibility of wind blown contamination from adjoining properties. This particular operation is one of the largest and most important operations of its kind in Texas and surrounding states. In Swisher County, the proposed site contains a major farm implement manufacturer which could lose a substantial portion of the market if relocation resulted in an interruption or slowing of production. Both of the operations mentioned make significant contributions to the economies of the counties involved. Failure to cite the presence of these facilities and evaluate their significance in the report demonstrates a complete neglect and lack of study of economic elements that may be impacted in each county."

Response

The logic led to these descriptors being considered nondiscriminating in Section 3.7.2 of the report because the facilities would not affect or be affected by the repository if outside the controlled area. However, if inside the controlled area, the facilities may need to be relocated. The final text recognizes that even though facilities can be moved, they may not, in some cases, be readily relocated. Therefore, there is a potential land use conflict. This descriptor now appears in the text as a site narrowing discriminator in Section 3.9.2 of the report. However, application of higher priority discriminators identified a site before this discriminator could be applied. (See also Section 3.8.5 of this document.)

2.1.10 Comment 10

"The form of the logic diagram and the discussion of individual descriptors in Chapter 3 comprise a complex system which on balance amounts to disregarding virtually all of the primary data produced by the DOE investigations in the Texas Panhandle. Other data used were from the open literature or other available sources. Careful examination of the discriminators used and the source of their data reveals that the site identifications derived in these documents would be almost equally legitimate if only one activity (the stratigraphic logging of the Zeeck No. 1 borehole in Swisher (County) had been performed.

"In the case of Volume A (Deaf Smith County) only seven discriminators were employed to screen the locations to sites of less than nine square miles, and then the lowest priority discriminator (depth to host rock) was overridden to bring the area of the preferred site back up to an area of nine square miles. The discriminators used were:

(1) hydrocarbon resource potential -- based on trends identified by oil exploration companies,

(2) location of boreholes reaching host rock -- obtained from records of the Texas Railroad Commission and commercial sources.

(3) population risk -- operations -- established based on widely available census data,

(4) ecological habitat -- largely unfarmed land and readily available from land use maps,

(5) projected water yields from the Ogallala in the year 2020 -- taken from dated Texas Department of Water Resources publications even though more recent trends demonstrate dramatic decreases in drawdown rates,

(6) saturated thickness of the Ogallala -- available from water well records,

(7) depth to host rock -- limited corroborating data provided by DOE boreholes to complement the record of oil and gas exploration wells, but this parameter was overridden in the final screening step to bring the site size back up to nine square miles.

"As a final check on the utility of the primary data collected by DOE during its investigations in the Texas Panhandle, the descriptors eliminated because of demonstrated lack of variation or sensitivity were examined to determine whether the DOE investigations led to that conclusion (logic sequence 1, 2, 3, 4, 5, 7 with the 4, 5 step taken because of demonstrated lack of variation). In the case of Deaf Smith County, a total of 19 descriptors were eliminated at step 5 because of demonstrated lack of variation or sensitivity and of that number only one (salt dissolution) could have been so evaluated based on data uniquely provided by DOE studies. Analysis of Volume 2 reveals a similar fundamental flaw.

"In summary, virtually none of the investigatory work that has been done by DOE in the Texas Panhandle was used in preparing the site recommendations."

Response

The work performed in the Texas Panhandle by DOE was used in preparing the documents. Although the direct sources for much of the data used are external to DOE, much has been added to these data bases by DOE as a result of DOE field studies; investigations and a considerable amount of work have been performed by DOE in the area of data interpretation and analysis. For example, determination of the thickness of the lower San Andres Unit 4, a discriminator in Swisher County, was based on investigations conducted by Stone and Webster Engineering Corporation, an ONWI* subcontractor. In addition,

*Battelle's Office of Nuclear Waste Isolation, the prime contractor to DOE for Salt Repository Project studies.

evaluation of hydrocarbon resource potential, a discriminator in Swisher County, was based on mapped hydrocarbon fairways from the Texas Bureau of Economic Geology, a DOE contractor. DOE uses data from other credible sources when it is of value in the study program. DOE and other studies will be the principal basis for future evaluation of site suitability.

2.1.11 Comment 11

"In the case of continuously variable discriminators, the decision to divide the location so that about 50% is less preferred and the rest is considered more preferred is totally arbitrary. The rationale offered for that concept states that it was devised to avoid overemphasizing or underemphasizing the continuously variable discriminators. Nevertheless, succeeding portions of Chapter 4 are devoted to development of a hierarchy of discriminators which essentially places more or less emphasis on individual discriminators. The crude 50/50 separation of less preferred and more preferred portions of the locations is a baseless artifact of DOE's unwillingness to set defined, substantiated standards for repository design and development in advance of executing a site selection strategy."

Response

The choice of the 50/50 separation is not baseless and has no connection with setting design standards. The 50/50 separation was made to avoid overemphasizing the effect of a continuously variable discriminator. The evaluation of descriptors and discriminators is based on DOE's current belief that, based on existing information, both locations appear everywhere suitable for further consideration (with the exception of a small area containing Tulia which would be disqualified based on a provision of the NWPA). The repository must comply with NRC regulations and EPA standards. Both performance and design criteria must be shown to be met prior to start of construction. This judgment will be made by the NRC based primarily on information generated during detailed site characterization.

2.1.12 Comment 12

"A significant number of 1984 topical reports are cited in the references for these two volumes. Comprehensive review of the site selection requires access to those reports as well as the data they include, although some of the reports apparently are not yet available for our review."

Response

Several of the referenced reports have been finalized and published since the draft report was issued. All references were available upon request during the review period. Any reports or documents which are referenced but not published in final form can and will be made available upon request.

2.2 SPECIFIC COMMENTS

2.2.1 Comment 1

"Page 1, paragraph 3, both volumes -- The citation for National Plan for Siting High-Level Radioactive Waste Repositories, DOE/NWTS-4 should specify that the document never progressed beyond draft form and a final version was never published. This document should be properly cited as 'Public Draft' in the report references. It was correctly cited in the Permian Basin Location Recommendation Report."

Response

This has been corrected in the final reports.

2.2.2 Comment 2

"Page 4, Table 1-2, both volumes -- Under the major category 'Geohydrology', the saturated thickness of the Dockum Group could be included."

Response

Greater reference to the Dockum Group is made in Chapter 3 of the final report; however, it is not possible to map its saturated thickness or consider it as a discriminator because location-wide data do not exist.

2.2.3 Comment 3

"Page 5, paragraph 3, Volume 1 -- The saturated thickness of the Ogallala Aquifer is significantly greater than the figures cited. (See Figure 3-13). The range of saturated thickness should be described."

Response

This paragraph was intended to be a summary of characteristics within the identified site and not for the entire Deaf Smith location. Fifty feet was chosen as an approximate mid-point for the range of thicknesses within the site.

2.2.4 Comment 4

"Page 5, paragraph 3, both volumes -- The land use in the areas under consideration should be referred to as prime farmland rather than simply farmland. In Volume 1, an important land use overlooked is the major foundation seed facility located within the selected site. In Volume 2 on Swisher County, an important land use overlooked is a major farm implement manufacturer within the proposed site."

Response

The term "prime farmland" relates to capability of the land as determined by the Soil Conservation Service and has nothing to do with the actual use of the land. (See Sections 2.1.3, 3.2.1, and 3.7.3 of this document for further discussion of prime farmland considerations.) The term "farmland" implies a land use relating to cropland and associated farming activities. The intent in the report was to show land use, including the fact that most of the site is indeed cropland with some rangelands.

Industrial/Commercial Installations are discussed under other descriptors. (See Section 3.8.5 of this document for further discussion of consideration of these installations.) These installations have been given greater attention in the final report.

2.2.5 Comment 5

"Page 7, paragraph 3, both volumes -- The assertion that any portion of the locations in the affected counties 'Could potentially serve as a suitable repository site' is not substantiated by the previous Location Recommendation Report."

Response

See the response to general comment 4.

2.2.6 Comment 6

"Page 9 -- The reference 'NUS, 1982a' for Area Studies should read 'NUS, 1982a and 1982b'."

Response

The reference to the NUS 1982 reports was incorrect in Figure 2-2 of the draft report. However, this figure has been eliminated in the final report.

2.2.7 Comment 7

"Page 13, paragraph 2 -- Insufficient rationale and reference is provided for the selection of the lower San Andres Unit 4 in Swisher County and units 4 and 5 in Deaf Smith County as the possible host strata. Critical decisions such as these require significantly more detailed substantiation."

Response

The selection of these target salt horizons (or possible host strata) was made in the Location Recommendation Report (LRR) (ONWI, 1983). (See also Section 3.6.1 of this document.)

2.2.8 Comment 8

"Page 13, paragraph 4 -- The Pierce and Rich reference should read 1962, rather than 1982."

Response

This typographical error has been corrected in the final report.

2.2.9 Comment 9

"Page 14, paragraph 3, both volumes -- Citing the site selection guidelines (10 CFR 960) as the rationale for not applying those very guidelines to the site screening phase is inappropriate because those guidelines have not yet been finalized. Furthermore, the reference cited, part 960.3-2-1, explicitly applies to the identification for sites other than the first repository and is, therefore, entirely irrelevant for site screening in the Texas Panhandle unless a decision has been made to consider those sites only for later repositories."

Response

The first sentence of the comment is appropriate in its objection to citation of the yet unfinalized DOE site selection guidelines in the draft report. Reference to these guidelines was removed from the final report. The second sentence of the comment reflects exactly what was said on page 14 of the draft report: "The site screening phase for the first repository is specifically exempted by the guidelines". (See also Section 3.2.2 of this document.)

2.2.10 Comment 10

"Page 15, paragraph 1 -- The Site Characterization Plan is to be submitted to the State, and affected Indian Tribes, as well as the Commission [NWPA, Sec. 113(b)]."

Response

This comment is correct in its documentation of Sec. 113(b) of NWPA, and the appropriate change has been made in the final report.

2.2.11 Comment 11

"Page 17, both volumes -- The paragraph beginning 'Characterization of geologic strata . . .' states that aquifers above the host rock were considered. In fact, as pointed out above, the availability and quality of water from the Dockum Group was entirely ignored."

Response

The Dockum Group aquifer has repeatedly been acknowledged as a possible aquifer and water resource. All available data were considered during the effort to identify more-preferred sites within the locations: however, data on the Dockum are limited. (See also Section 3.5.4 of this document.)

2.2.12 Comment 12

"Page 18, paragraph 2, page 17, last paragraph -- Why was consideration given only to solubilities and retardation in non-potable groundwaters?"

Response

Nonpotable ground waters were considered because current analyses indicate that any release of radionuclides from the repository horizon would likely be downward into nonpotable aquifers.

2.2.13 Comment 13

"Page 21, section 2.2.9, paragraph 3 -- Land use conflicts especially relating to capital intensive operations were clearly not carefully reviewed as evidenced by the document totally ignoring a major foundation seed production facility in the site in Deaf Smith County and a major farm implement manufacturing facility in Swisher County."

Response

As stated previously, these descriptors have been treated in greater detail in the final report (see the response to general comment 9, Section 2.1.9, and Section 3.8.5 of this document).

2.2.14 Comment 14

"Page 25 -- Discussion of logic step 5, both volumes -- The discussion includes the statement 'When a connection related to performance or impact was not evident, regardless of descriptor availability, that descriptor was not

identified as a discriminator.' Because these descriptors were derived from the basic site performance criteria, DOE/NWTS-33(2), all of the descriptors should have some relevant connection to performance or impact."

Response

The evaluation made in Step 5 is whether the descriptor is significant in that it affects performance or shows variable impact across the location. Each descriptor must be evaluated in order to assess a relationship to site performance. If it is determined that for this particular study area the descriptor has no effect on performance, then it becomes a nondiscriminator.

2.2.15 Comment 15

"Page 33, both volumes -- These diagrams should clearly indicate the more preferred and less preferred areas selected."

Response

None of the figures in Chapter 3 are intended to indicate more-preferred and less-preferred areas. This chapter discusses the characteristics of the entire location and current status of information/data. The overlays in the pocket were provided along with the "a" numbered figures so that the reader could refer back to the data discussion. The more-preferred/less-preferred split is shown in Chapter 4 of the report for the discriminators used in identifying the sites (see especially Figure 4-4).

2.2.16 Comment 16

"Page 34, paragraph 2, page 35, paragraph 2 -- The method by which geophysical logs were used to interpret interbeds and poor quality salt should be described and the lack of compatibility of determinations of 'thick salt beds' among the AGCR, LRR, and this report discussed."

Response

A footnote with an appropriate reference has been included in the final text. Detailed discussion of interpretation is not appropriate for this report. Explanations of the differences in mapped salt thickness are provided in Section 3.6.2 of this document.

2.2.17 Comment 17

"Page 57, footnote 59 -- Irrigation techniques in the Texas Panhandle are changing rapidly and dramatically. The use of 1979 figures for water consumption per acre of irrigated land is inappropriate because of recent improvements in irrigation methods which have substantially reduced the water required per acre of land irrigated."

Response

The most recently available data have been used in the final reports (see Section 3.5.2 of this document)

2.2.18 Comment 18

"Page 61, paragraph 1, page 60, paragraph 1 -- Other models for groundwater flow rates in the Wolfcamp have been developed. The recent interpretation of these outputs should also be discussed."

Response

All models of ground-water flow in the Wolfcamp are quite consistent in their predictions of flow directions and rates. References in Section 3.2.1 of the report are intended to inform the reader of the major hydrologic studies undertaken for the Palo Duro Basin. Further discussion in this volume is not necessary or appropriate.

2.2.19 Comment 19

"Page 62, last paragraph, Volume 1 only -- The text states that Unit 4 salt dissolution occurs more than 30 miles from the Deaf Smith location, but reference to the relevant map (Figure 3-15) shows this dissolution occurring approximately 20 miles away from the Deaf Smith location."

Response

The text of the final report has been revised to correct this error.

2.2.20 Comment 20

"Page 67, last paragraph before section 3.3, both volumes -- The statement that 'dissolution of shallow salts is of concern only from the standpoint of construction and maintenance of shafts and seals' (emphasis added) belies the substantial potential significance of this phenomenon."

Response

Calculations in Appendix B of the report demonstrate that such dissolution is not a direct threat to exposing radionuclide waste at the depths being

considered. Consequently, the remaining unknowns are the engineering properties of any dissolution residue and its behavior behind a shaft liner. These unknowns will be investigated and evaluated prior to repository licensing.

2.2.21 Comment 21

"Page 70, paragraph 1, page 69, paragraph 1 -- What is the expected composition of waters in the clay-rich interbeds and its significance to the waste package in the disturbed zone? The presence of interbeds in the thick salt may be a discriminator if more data were available."

Response

Very little data exist on which to predict the chemical composition of the water in the clay-rich interbeds. Such data can probably only be obtained, with confidence, after the excavation of underground test facilities during site characterization. However, these data are not believed to be critical to the program at present for the following reasons: (1) the estimated total brine volume of the host salt includes water from the clay-rich interbeds, (2) the chemical composition of the total volume of brine is assumed to be that of the brine from fluid inclusions, a conservative assumption because the fluid-inclusion in brines are high in magnesium (about 50,000 mg/L) and have the highest corrosion rates known for natural brines, and (3) calculations of expected waste package lifetimes assume 5.0 volume percent brine in the host salt, rather than the total of 1.8 volume percent estimated to be present, and find acceptably long lifetimes against corrosion by the brine. (See also Section 3.6.3 of this document.)

2.2.22 Comment 22

"Page 74, paragraph 1, page 72, paragraph 4 -- A more refined assessment and discussion of interbeds in the salt layers selected is necessary, especially in the case of the Deaf Smith site where a choice was made between units 4 and 5 in spite of the apparently minor differences."

Response

We agree that detailed assessment of interbeds within the repository horizon is important. The currently available drill hole and laboratory test data are being evaluated. Many questions relative to room and roof stability

can only be answered, however, after construction at potential repository depth of the test facilities associated with detailed site characterization. Results from preliminary evaluations and tests are not yet available for inclusion in the report, nor are they of sufficient density to assist in screening decisions within the location. (See also Section 3.6.3 of this document.)

2.2.23 Comment 23

"Page 76, paragraph 3, page 77, paragraph 2 -- It would seem reasonable to apply any existing data regarding faults in and above the Permian section as a discriminator in support of a technically conservative decision."

Response

This comment confuses "data" with "interpretation". As stated in the cited section of the report, the current sparsity of data results in a wide range of possible interpretations. Consequently, existing interpretations are speculative. Thus, as concluded in the text, such data uncertainty would not warrant identification as a discriminator. While DOE has not yet concluded its study of faults that may lie in and above the Permian section, it believes few, if any, exist in the locations. Seismic reflection interpretation by a consultant, G. J. Long & Associates, failed to identify any faults that penetrate beyond the oldest Permian unit. The Texas Bureau of Economic Geology has postulated, in unpublished manuscripts, a few faults which may cross the Permian section. The mapped locations of those faults, however, are not well constrained, and are very likely to change as interpretations are reviewed. In summary, while a few varied interpretations exist, there is little data upon which a discriminator could be reasonably applied in site narrowing. DOE recognizes the risk in identifying a site without this data and acknowledges that careful study of Permian and younger rocks will be necessary during site characterization.

2.2.24 Comment 24

"Page 103, paragraph 1, volume 1 only -- If hydrocarbon potential in the Deaf Smith County location is as low as suggested by this discussion, why is it utilized as the top priority discriminator in site screening for the Deaf Smith County location? In addition, recent oil and gas exploration activity does not substantiate agreement regarding the low hydrocarbon potential of the area. This should be noted and discussed."

Response

The descriptor is used as the highest priority discriminator because it is the most likely discriminator which might result in disruption of the repository horizon integrity. Recent oil and gas exploration activity supports the conclusion that hydrocarbon potential is very low, i.e., only dry holes have resulted from recent hydrocarbon exploration activity near the identified sites. (See also section 3.4 of this document.)

2.2.25 Comment 25

"Page 110 and 111, section 3.7.10 -- In this section proximity to transportation installations is considered a disadvantage because of potential accidents on those thoroughfares. Section 3.9.1.2, Aesthetics, also supports sites distant from transportation thoroughfares. However, section 3.9.2.3 argues in favor of close proximity to transportation thoroughfares for ease of access. If, in fact, those 3 discriminators had all been considered, they would have been internally inconsistent. As a practical matter, only proximity to transportation thoroughfares was utilized in the screening for the Swisher County site. None of these three discriminators was used in the screening for the Deaf Smith County site."

Response

This comment is essentially true. There are many descriptors which seem to be inconsistent with one another, hence the need to prioritize those selected as discriminators. Another example is depth to salt: from the standpoint of isolating waste, deeper is better; however, from the standpoint of construction and safety of miners, shallower is more preferred.

2.2.26 Comment 26

"Page 129, page 128, section 3.10, paragraph 2, Socioeconomic impacts -- The text states 'The magnitude of impacts on a specific community relative to a specific site, whether they are positive or negative impacts, cannot be determined reliably until site characterization is complete.' That assertion is not substantiated and may not be substantiable. It would be more accurate to simply state that the magnitude of impact will not be reliably determined rather than cannot be reliably determined."

Response

Socioeconomic impacts cannot be fully determined based on the current data base. Studies which will take place concurrent with site characterization will allow a complete assessment of socioeconomic impacts to be made.

2.2.27 Comment 27

"Page 133, page 131, section 4.1, paragraph 1, page 14, paragraph 2 -- Why is a square the preferred site configuration?"

Response

The square site configuration is an appropriate shape based on the current preliminary design and calculations of the required control area. It also allows the identification of site boundaries along existing survey lines. The final area needed for a site may vary from the square configuration. (See also Section 3.3.3 of this document.)

2.2.28 Comment 28

"Page 135, page 133, paragraph 1 -- The reference to 40 CFR 191 should specify that the rule is still in draft form."

Response

This reference has been changed in the reference list to indicate that 40 CFR 191 is a proposed rule.

2.2.29 Comment 29

"Page 139, last sentence, page 138, first sentence -- The presence of large areas of prime farmland in the situs [sic] counties has no bearing on the absolute quantity of lost production. The prime farmland discriminator should not be lowered in priority simply because there is a substantial area of prime farmland in the region that may not be directly affected. For example, federal wetlands regulations are quite clear about protection of wetlands regardless of their relative size."

Response

The prime farmland discriminator's priority was assigned in the same manner as other priorities; based on the hierarchy implicitly established by NWTS-33(2) (DOE, 1981): long-term performance, operational performance, and environmental/constructibility impacts. Additional subpriorities were established within the environmental/constructibility categories because of the large number of surface parameters to be considered. The principal consideration within this category was the impact on ecological habitat, particularly on natural habitats. One of the larger impacts on habitat is the conversion to cropland or other initially disturbing use. Since prime

farmland is a designation based on land capability, not actual use, it was designated as a lower priority for consideration. This lower priority is supported by the fact that some areas not currently used for growing crops are designated as prime farmland.

2.2.30 Comment 30

"Page 150, item 9 -- The stated saturated thickness of the Ogallala in the respective counties is not consistent with the data appearing in the referenced Figure 3-13."

Response

This section has been deleted from the final report.

2.2.31 Comment 31

"Page 155, page 151, section 4.3.5 -- '20 c/km' should read '20^0 c/km'."

Response

It is a matter of preference whether to use degree symbols. This is an appropriate style that is frequently used in technical reports.

3 TECHNICAL COMMENTS FROM OTHER GOVERNMENT AGENCIES, ORGANIZATIONS, BUSINESSES, AND INDIVIDUALS*

3.1 CREDIBILITY OF DOE AND CONTRACTOR REPORTS

3.1.1 Disclaimer

3.1.1.1 Comments

The disclaimer on the inside front cover of the site identification report raised the issue of the credibility of the Department of Energy.

3.1.1.2 Response

The disclaimer paragraph which appears inside the front cover of all volumes of the Texas site identification report is similar in nature to the disclaimer paragraphs printed in nearly all reports of contract research done for a federal agency. The disclaimer printed in DOE reports is required by DOE Order No. 1430.2, Implementation of the Scientific and Technical Information Management Program, Chapter IV, Section 9k. Use of such a paragraph essentially assists in protecting the objectivity of both the contractor and the contracting federal agency. The contractor presents its best information and evaluation, which may or may not be used in making federal policy. The disclaimer also protects federal agencies in cases of patent or copyright infringement of which they may not be aware.

In practice, DOE has assumed responsibility for its reports and decisions throughout the nuclear waste management program. For example, in the letter from DOE to Mr. Steve Frishman, director of the Texas Nuclear Waste Programs Office, which accompanied copies of the draft Identification of Sites Within the Palo Duro Basin, DOE clearly stated: "The Salt Repository Project Office believes the screening recommendation to be the result of a sound, logical, and reproducible process. We welcome your review comments, which will be given careful consideration before DOE formally approves the recommendation."

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* Comments were grouped into similar subject areas and summarized. Individual commenters are listed beginning on page 109.

3.1.2 Credibility and External Review

3.1.2.1 Comments

Questions were also raised about the fact that most of the data orginated from contractor research and about the apparent lack of external peer review.

3.1.2.2 Response

Because of the unique and detailed nature of this research and development program, it is not unusual that many of the references are to contractor or subcontractor reports. In fact, it is essential to reference research conducted as a part of this program by DOE's contractors and its subcontractors in order to allow review and evaluation of that source material. Also referenced are reports prepared by individuals and organizations outside the program when those reports have been used in the evaluations or when they provide useful, relevant data. DOE and its contractors do not systematically select data that support their case or "disregard" or "hide" reports or data that dispute their conclusions, as was stated by one of the commenters. The many levels of technical peer review and public oversight of the program help assure that this is not done, even inadvertently.

The program has been and will continue to be reviewed and scrutinized by hundreds of independent professionals, federal agencies, and four multidisciplinary peer review groups: the Argonne National Laboratory Review Committee, the Technical Advisory Committee, the Geologic Review Group, and the Program Review Committee. The latter three have been assembled by Battelle's Office of Nuclear Waste Isolation (ONWI). All reviewers are selected on the basis of their professional reputations and expertise in their fields. Their professional reputations depend on their conducting objective, unbiased, thorough reviews. Those who serve on peer review groups are normally reimbursed for their time and expenses, but this should not lead to the assumption that their professional judgments or assessments could be compromised. Reimbursements for services are customary in the scientific and academic communities.

State governments, including Texas, also provide technical review of the program, funded by grants from DOE. State reviews may be conducted either by appropriate state agency representatives or by independent consultants

contracted with by the state. In either case, the agency representatives or outside contractors would normally be reimbursed for their time by the state, using part of the DOE grant.

Additional review is provided by other federal agencies--such as the Nuclear Regulatory Commission (NRC), the Environmental Protection Agency (EPA), and the U.S. Geological Survey (USGS)--and the technical community at large, since all technical reports receive wide distribution to interested scientists. The NRC currently reviews all reports and, ultimately, all data and decisions will be formally scrutinized by the NRC as part of the licensing process.

The NRC also has a representative at each project office to conduct onsite review, have access to data, and attend all important meetings. The NRC reviewed and concurred on June 22, 1984, with the siting guidelines developed by DOE.

In a letter (related to the DOE draft siting guidelines) to the NRC on February 1, 1984, the USGS said: "There are enough independent, technically objective scientific groups in this country (such as the National Academy of Sciences and the U.S. Geological Survey) who will closely review any site screening and selection decision by the DOE. It is unlikely that grossly unjustified or technically undefensible decisions will escape serious inquiry from these and other groups."

3.1.3 Availability of References

3.1.3.1 Comments

Complaints were made that some of the reports on which the site selection was based were still in draft form or not available for review.

3.1.3.2 Response

In order to use the most relevant, up-to-date information, it is often necessary to reference draft publications when preparing review copies of reports. Any referenced report that is not yet published will be sent to reviewers upon request. DOE complies with such requests.

3.2 CREDIBILITY OF SITE SELECTION PROCESS

3.2.1 Farmland Protection Policy Act

3.2.1.1 Comments

Several commenters said the Department of Energy was violating the intent of the Federal Farmland Protection Policy Act by justifying the selection of a Texas site on the basis that it encompasses less than 5 percent of the prime farmland in the location.

3.2.1.2 Response

On page 124 of draft Volume 1 (Palo Duro Location A) and page 132 of draft Volume 2 (Palo Duro Location B) requirements under the Farmland Protection Policy Act are discussed. Farmland use was a factor in screening the locations. However, other factors, including safety, also had to be considered in the interest of long-term and operational performance of a repository. The prioritization of these factors does not mean that farmland was not considered or that there was a lack of concern for agricultural uses. As the report explains, a determination was made that the most important concerns were those related to operating a repository that is safe from an environmental standpoint and provides long-term isolation of nuclear waste.

The Federal Farmland Protection Policy Act (U.S. DOA, 1981) requires federal agencies to consider the consequences of their actions in converting farmland to nonagricultural purposes. The general purpose of this act is to "minimize the extent" of the role of federal programs in the conversion of farmland to nonagricultural uses and to "assure that federal programs are administered in a manner that, to the extent practicable, will be compatible with state, local, and private programs and policies to protect farmland", (Section 1540(b)). The act directs federal agencies to "identify and take into account the adverse effects of federal programs on the preservation of farmland; consider alternative actions, as appropriate, that could lessen such adverse effects; and assure that such federal programs, to the extent practicable, are compatible with state, unit of local government, and private programs and policies to protect farmland".

In accordance with the act, DOE is considering alternatives and mitigation measures to reduce the impact of withdrawing the land from agricultural use. It is important to note that, according to the act, the federal agency (in this case DOE) has discretion on whether or not to modify any project solely to avoid or minimize the effects of conversion of farmland to nonagricultural uses. The act requires that, before taking or approving any action that would result in conversion of farmland, the agency examine the effects of the action using criteria set forth by the Department of Agriculture, and, if there are adverse effects, consider alternatives to lessen them. The identification of sites in the Palo Duro Basin was carried out (page 7 of both draft volumes) to narrow the two previously designated potentially acceptable sites. This site narrowing therefore does not result in the conversion of farmland to other uses. (See also Section 3.7.3 of this document.)

3.2.2 Siting Guidelines

3.2.2.1 Comments

The propriety of proceeding with site selection in Texas before approval of the siting guidelines was questioned.

3.2.2.2 Response

The process described in the report is not site selection; previously identified locations were narrowed to nine-square-mile sites. The narrowing to nine-square-mile sites in Texas was conducted in a manner consistent with the way in which similar-sized sites have been identified in Louisiana, Mississippi, and Utah. The criteria used (NWTS Program Criteria for Mined Geologic Disposal of Nuclear Wastes: Site Performance Criteria, DOE/NWTS-33(2), February, 1981) to narrow the potentially acceptable sites in Texas were also applied in screening to sites in the other salt states. DOE believes the use of the NWTS-33(2) criteria and the process followed in selecting sites is in full accord with the requirements of the Nuclear Waste Policy Act.

3.2.3 Sites Previously Selected

3.2.3.1 Comments

Commenters said that only those discriminators were chosen that supported sites previously selected.

3.2.3.2 Response

It is essential to narrow the study focus to smaller sites to produce comparable environmental assessments and to focus site characterization studies. The purpose of the report was to narrow the large, potentially acceptable sites to sites comparable in size to those being considered in salt in other states (Louisiana, Mississippi, and Utah). DOE had not selected the sites before developing the methodology described in the report. As the report states, the first step was to develop a logical and reproducible methodology, then to apply the methodology to the data available. The report describes the process. DOE did not select sites and then determine discriminators that would lead to the pre-selected sites.

3.2.4 1983 Deaf Smith County Site

3.2.4.1 Comments

Several commenters requested an explanation for the difference between the site in Deaf Smith County reportedly preferred by DOE in March, 1983, and the two sites identified in the current report.

3.2.4.2 Response

The 1983 Palo Duro site recommendation was proposed by ONWI in March, 1983, as a supplement to the Permian Basin Location Recommendation Report (ONWI, 1983), referred to as the LRR. The LRR, which was issued in draft form in December, 1982, for state and public review, identified locations of approximately 200 square miles in Swisher County and 400 square miles in Deaf Smith County as suitable for further study. In the proposed supplement, ONWI recommended that a 16-square-mile site in northeastern Deaf Smith County be compared with sites in other states as a candidate for further study. The

report indicated, however, that a review of available data provided no evidence that would eliminate any portions of the two locations. The site recommendation was based primarily on engineering factors (i.e., cost and ease of construction, including the depth, thickness, and quality of the salt beds) for construction of a repository.

DOE chose not to act on ONWI's recommendation of a site in Deaf Smith County for the following reason. The recommendation was based on information available through March 1, 1983, and emphasized engineering considerations. A more balanced application of all siting criteria was preferable. ONWI was requested to prepare another recommendation reflecting this point.

3.3 METHODOLOGY OF SITE IDENTIFICATION

3.3.1 Availability of Information

3.3.1.1 Comments

A large number of comments were made concerning the treatment of descriptors for which there was no information/data available (or insufficient data to show variation). Some commenters also believed that DOE should have addressed the quality, accuracy, or confidence level of the currently available information.

3.3.1.2 Response

The purpose of the report is to narrow to specific sites within the locations, based on available data, not to determine the suitability of a site or to compare it with other sites. The purpose of the logic diagram was to allow a systematic review of each descriptor to determine if information/data for that descriptor could be useful in narrowing to a more-preferred site within each location. The report is a review of information/data available and a discussion of why each descriptor is useful or not useful in this site narrowing process.

3.3.2 Application of All Discriminators and Descriptors

3.3.2.1 Comments

Some commenters said that all the discriminators should be applied, thereby eliminating the entire locations from consideration. One commenter was concerned that DOE would not consider prime farmland in future studies comparing Texas and Utah because it was considered in this report.

3.3.2.2 Response

DOE agrees that lower priority discriminators are important factors in site selection. All descriptors should eventually be treated as discriminators in the site selection process. The objective of the report is not site selection but site narrowing; i.e., reducing the locations to smaller areas for which large amounts of data can be generated. Therefore, a narrowing

methodology was developed to define a more-preferred area in each location within which a detailed site characterization effort can be concentrated.

The site-narrowing procedure does not disqualify any areas within the locations. The shaded areas (less preferred) are in no way unacceptable or disqualified; they are simply less preferred than non-shaded areas. The boundaries drawn around the nonshaded areas are based on re-examination of the priority discriminators that resulted in narrowing to that area. The purpose of this report is not to compare Texas sites to salt sites in other states.

3.3.3 Site Identification Process

3.3.3.1 Comments

Several commenters voiced concern over the methodology used to identify sites in the locations. Because discriminators were applied only until identification of more-preferred areas smaller than a desired nine-square-mile site, the methodology was criticized. A commenter objected to the statement that any portion of the location could potentially be a suitable repository site. One commenter asked why a square was the preferred site configuration. Another noted that the control zone could extend beyond the nine-square-mile site. Commenters said that if all discriminators had been applied, both locations would have been found unsuitable and without potential sites. Many commenters considered "less preferred" to mean "disqualified" or "unsuitable". The prioritizing of discriminators was called "unscientific". Another commenter suggested including a discussion of the rationale for the prioritization in the report. One commenter said that a numerical method of weighting the factors and screening the locations should have been used. DOE was accused of violating the law because it is not selecting the "best" site, but is searching for a "suitable" site.

3.3.3.2 Response

The objective of the report is to identify sites which have a lower risk of being disqualified or found unsuitable during site characterization. The term "less-preferred" does not mean "unsuitable" or "disqualified".

Once the discriminators were prioritized, there was no reason to apply all of them in defining the more-preferred areas. Those discriminators not used are, by definition, less important than those with higher priority which were used.

A comprehensive discussion of criteria and rationale for prioritization is now provided in the final report (see Sections 4.1 and 4.2.1 of Volumes 1

and 2 of the report). The criteria used are both legally and technically sufficient for this stage of site screening activity and support the conclusions that were reached.

The response in Section 2.1.8 of this response document addresses the comment about using a numerical method. The square configuration was chosen partially because it is a convenient configuration within which the facilities can be located. The final area needed for a site may vary from the square configuration and could also vary in size (see Section 3.7.4 of this document). The final controlled area requirement cannot be defined until after site characterization is completed. Data required for defining the controlled area size can only be attained with confidence from performing tests underground at the sites being characterized.

More information responding to these comments can be found in the responses in Sections 2.1.3, 2.1.4, 2.1.5, and 2.1.8.

3.3.4 Lack of Variation

3.3.4.1 Comments

Some commenters objected to factors not being selected as discriminators because of lack of variation in the data throughout the location. Commenters believed this indicated that the factors were considered "unimportant".

3.3.4.2 Response

The lack of variation of data does not imply that a particular descriptor is not important. It simply means that it is not useful in differentiating among units of land, hence in the identification of a more-preferred site within the Texas locations. As stated in Section 3.3.2 of this document, the purpose of this report is not to compare the Texas sites with other salt sites in other states.

3.4 HUMAN INTRUSION

3.4.1 Comments

The assessment of hydrocarbon resource potential as "low" was disputed by several commenters. Some commenters questioned the ranking of hydrocarbon resource potential as a top priority discriminator if potential within the locations is low. Recent oil and gas exploration in the area was noted, as well as existing oil and gas leases, and the possible use of data from a Texaco borehole on the west edge of the Swisher site. One commenter asked why hydrocarbon resource potential was not considered important in the earlier location-recommendation stage.

3.4.2 Response

A primary objective in the site narrowing process is to select areas perceived to have less potential for human intrusion that could create an artificial pathway (open borehole) between major aquifers and shorten the travel time of radionuclides to the accessible environment. Therefore, an area with low hydrocarbon resource potential is preferred. Existing NRC regulations and proposed EPA standards require that DOE recognize hydrocarbon resource potential as a potentially adverse condition and minimize the risk by siting a repository where potential for human intrusion is less. Therefore, DOE has adopted a methodology which promotes siting within the location where, based on available data, there is less potential for hydrocarbon production or human intrusion. As stated in the report, it is impossible to identify any site which could not be potentially affected by random drilling. However, even though hydrocarbon potential is admittedly very low, some variability in potential and in expected exploration trends can be agreed upon, and this factor can thus be used as a discriminator.

DOE and its contractors have not yet completed their detailed evaluation of the hydrocarbon resource potential of the Palo Duro Basin. However, DOE continues to believe that the locations being considered have little potential for commercial production of oil or gas, particulary considering the potential in surrounding basins or at the edge of this basin where conditions for the generation and entrapment of hydrocarbons are more likely to occur. This opinion, which DOE believes is held by most geologists, will not preclude speculation, leasing, and wildcat drilling by others. Thus, there will always

be potential for deep drilling at a repository site and DOE is developing land control procedures designed to prohibit drilling within a certain distance of the underground facilities of a repository. Plans are also being made for warning future generations of the existence of a repository and the dangers of deep drilling or mining at the repository site.

DOE believes greater potential for hydrocarbon exploration should exist in the northeastern portion of the Deaf Smith location and in the eastern and western portions of the Swisher location. DOE recognizes that leases exist outside these areas and that drilling has occurred recently just east of the site in Deaf Smith County. The Taylor No. 1 and Black No. 1 wells shown in Figure 3-16 of the final report were drilled to basement and were dry holes, consistent with the program's expectations. In addition to avoiding areas with greater hydrocarbon resource potential, DOE avoided areas where existing boreholes penetrate the host rock.

One commenter stated that DOE should use data from the Texaco borehole on the west edge of the Swisher County site. The Texaco boreholes to the east and west of the Swisher County site were drilled as stratigraphic test wells in the early 1960s. Texas law requires only that plugging records be submitted to the state for this type of exploration boring. No geologic or hydrologic data are currently publicly available for these boreholes.

In its Location Recommendation Report (ONWI, 1983, page 63), DOE recognized that areas with producing or abandoned oil fields would most likely be the first to be further explored and exploited for hydrocarbons. A screening specification was adopted to eliminate those locations from siting consideration. As a result, the Palo Duro locations, within which smaller sites are located, were selected over other potential locations in part because of the absence of or lack of proximity to existing/abandoned oil and gas fields (ONWI, 1983, pages 74-75). The available data and analysis did not merit more specific elimination based on projected exploration trends at that time.

3.5 GEOHYDROLOGY/GEOCHEMISTRY

3.5.1 Saturated Thickness of the Ogallala

3.5.1.1 Comments

Many commenters stated that the saturated thicknesses indicated in Figure 3-13 of the report are incorrect and that the source for the data should be identified. (Related comments and questions about projected water yields are answered in Section 3.5.2, "Projection of Future Water Yields and Rate of Ogallala Depletion".)

3.5.1.2 Response

Figure 3-13 of the draft report was taken from Figures 15 and 27 of BMI/ONWI-524 (SWEC, 1984). That report was prepared by Stone & Webster Engineering Corporation (SWEC) using data received from the Texas Department of Water Resources (TDWR). Figure 3-13 in each volume compares quite well with the figures on pages 168 and 477 in Volume 3 of the TDWR Report LP-173 (Knowles et al, 1982) although the contouring is different. The Deaf Smith map also compares well with a recent map published by the High Plains Underground Water Conservation District No. 1 (Wyatt et al). DOE recognizes that actual values on a local scale may be slightly different since the maps prepared by SWEC and the TDWR contour regional values and may obscure locally thick or thin saturated thicknesses. These regional maps are therefore not best used for describing a specific small site area. The reviewers are correct that ranges of saturated thicknesses should have been provided when describing the site.

Based on the "regional data" presently available, the recent saturated thickness of the Ogallala at the new Deaf Smith site is estimated to range from about 50 feet in the northwestern quadrant to approximately 130 feet in the southeastern quadrant. The recent saturated thickness of the Ogallala at the new Swisher site is estimated to range from less than 20 feet in the northwest quadrant to slightly greater than 50 feet in the eastern portion.

3.5.2 Projection of Future Water Yields and Rate of Ogallala Depletion

3.5.2.1 Comments

Many comments were received concerning the data and the manner in which projected well yields from the Ogallala aquifer were discussed in the report. The comments generally were:

-- Information for projected yields was developed in the 1970s and is based on water consumption rates using less efficient irrigation methods and in the absence of conservation efforts. Newer projections should be used.

-- The report incorrectly assumes wells producing less than 100 gallons per minute (gpm) are not capable of supporting irrigated agriculture. Many farmers are irrigating lands now with wells that aren't producing 100 gpm. Other water sources such as the Santa Rosa can be used to irrigate. DOE obscures the fact that highly productive and irrigable farmland will be taken out of production.

-- The boundary between more-preferred and less-preferred areas from this standpoint must be realistic, relevant, and consistent with developing federal regulations. The choice of year in conjunction with 100 gpm hints at manipulation.

3.5.2.2 Response

Discussion of projected water yields and rates of depletion stems from DOE's goal of minimizing the potential for future water-use conflicts. DOE desires to minimize the conflict between removing land for waste isolation purposes and using it for normal agricultural purposes. Regardless of the absolute value or quantity of water available, it is an objective of the report to identify sites with relatively less potential for supporting irrigated agriculture in a geohydrologic setting. As stated in Section 3.5.4, "Santa Rosa Aquifer", too little is known about the distribution of productive sands in the Dockum Group rocks to predict future depletion or use patterns. In contrast, much is known about the recent Ogallala saturated thickness and past use and depletion rates. The draft site identification report used projections of future well yields in the Ogallala made by the Texas Department of Water Resources (TDWR) in the late 1970s (Wyatt et al, 1977, for Deaf Smith County, Bell and Morrison, 1980, for Swisher County). The final report has been revised, in light of review comments, to use more recent projections

published by the TDWR in Report LP-173 (Knowles et al, 1982). Knowles et al do not project well yields in the year 2020, but provide regional projections of saturated thicknesses of the Ogallala in the years 2000 and 2030. Generalizations regarding the correlation between saturated thickness and projected well yields have been made by Wyatt et al (1977) and Bell and Morrison (1980). For the purposes of predicting land areas relatively less favorable for irrigated agriculture, projected saturated thickness maps are as useful as projected well yield maps. It should be noted that, while values differ, trends indicating where the Ogallala resource is relatively more attractive remain the same regardless of whether the old data or new data and techniques for mapping are used.

The main result of using these newer data, however, is that the proposed site in Deaf Smith County has been changed in the final report. The revised approach resulted in a less restrictive boundary for more-preferred and less-preferred areas for this discriminator; additional land areas were available for consideration and lower priority discriminators resulted in identification of a site two miles east of the area identified in the draft report. The proposed site in Swisher county was not affected by this consideration of newer data. The final report uses newer projections of future saturated thickness of the Ogallala that incorporate water use management and conservation practices. Projections were made by the TDWR (1982) based upon saturated thickness values obtained as recently as 1980.

The draft report stated that "areas with projected yields of less than 100 gallons per minute (gpm) are projected to be unable to support irrigated agriculture". The "100 gpm" is thought to generally approximate a saturated thickness of 20 feet (see Bell and Morrison, 1980, or Wyatt et al, 1977). The TDWR (Knowles et al, 1982, p. 97) stated that "it is difficult to obtain sufficient water for irrigation by wells where the saturated thickness is not greater than 20 feet". DOE understands that irrigation can and does occur in areas with less than 20 feet of saturated thickness of the Ogallala and at rates of less than 100 gpm. Irrigation also occurs using water produced from the Dockum (Santa Rosa) aquifer. Nevertheless, DOE's goal is to distinguish between those areas more capable and those less capable of supporting irrigated agriculture. The statement quoted in the first line of this paragraph has been deleted from the report.

The boundary between more-preferred and less-preferred areas for siting was selected at a contour value of 60 feet of saturated thickness of the Ogallala in the year 2030. This value was selected, not based on a federal regulation, but as a realistic and conservative compromise in identifying the relatively less-preferred areas for future irrigated agriculture within any one geohydrologic setting. The TDWR (Knowles et al, 1982, p. 97) states: "Generally, well yields are not a limiting factor on irrigation if saturated thickness is 100 feet (30 m) or greater." Selection of a value (60 feet) less than 100 feet is a conservative approach to identifying areas where irrigated agriculture can occur without significant restriction. This is not to say that irrigated agriculture cannot or will not occur in areas containing less than 60 feet of saturated thickness, rather that they will likely be less suitable areas for irrigation.

There is no attempt by DOE to select values or dates in a manipulative manner to obtain a particular desired result. DOE has used the data available in an objective manner. The selected value for the descriptor is not overly restrictive. It does not affect site identification in Swisher County because no area there has projected saturated thickness of greater than 60 feet in the year 2030. In Deaf Smith County, between one-third and one-half the location area is considered less preferred for this factor.

3.5.3 Ogallala Aquifer (General Concerns)

3.5.3.1 Comments

Several general comments were made about the potential for contaminating the Ogallala aquifer. Concern was also expressed that too much is unknown about the Ogallala. One commenter asked why the report (page 61 of the draft Volume I) discusses radionuclides in water if they are to be isolated in the salt beds. In reacting to page 53 of the draft of Volume I, this commenter also asked if radionuclides in water would seek an equilibrium as salts and sugars do.

One commenter was concerned that "routine radioactive releases" could affect the Ogallala aquifer. In particular, the commenter was concerned that the waste could contaminate the aquifer as it is lowered into the repository.

3.5.3.2 Response

DOE shares the commenters' concerns about protecting water resources such as the Ogallala aquifer. The aquifer has been the topic of many studies (Table 3-1), several of which have been conducted for DOE. The repository system itself is being designed and would be operated to prevent contamination of surface water or ground water. It is not within the scope of this report to describe systems for protecting the aquifer in detail. DOE has described these precautions at numerous public meetings and in numerous reports (DOE, 1984a, pp. A-50 to A-56, and pp. A-33 to A-35; DOE, 1984b). (See also the response to comments about ground-water flow direction in Section 3.5.8 of this document.)

DOE recognizes that there are unresolved hydrological issues. It is necessary to narrow to a specific site to resolve these issues. The purpose of the site identification reports is not to qualify or disqualify any proposed sites, but to use the available data to identify more-preferred sites.

While DOE does not expect radionuclides to escape the salt repository horizon during the thousands of years of concern, it has begun evaluating the potential effects of radionuclide migration via the "most likely" pathways should a breach of the repository occur. NWTS-33(2) (DOE, 1981) requires that consideration be given to interactions between radionuclides and ground water.

Subpart 191.15 of the proposed EPA regulations (40 Code of Federal Regulations 191), which DOE must comply with, also relates to long-term protection of ground water:

> "Disposal systems for spent nuclear fuel or high-level or transuranic radioactive wastes shall be designed to provide a reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the disposal system shall not increase the radionuclide concentrations of any major source of ground water or any sole source aquifer by more than:
>
> (a) 15 picocuries per liter of alpha-emitting radionuclides; or
>
> (b) The combined concentrations of radionuclides that emit either beta or gamma radiation that would produce an annual dose equivalent to the total body or any internal organ greater than 4 millirems per year if the individual continuously consumed 2 liters per day of drinking water from such a source of ground water."

Table 1

Resources for Information on the Ogallala Aquifer

The following references have been consulted by Battelle's Office of Nuclear Waste Isolation as part of studies to acquire data for the U.S. Department of Energy in the Permian Basin to identify potential repository sites.

Alexander, W. H., 1961. Geology and Groundwater Resources of the Northern High Plains of Texas, Progress Report 1, Texas Board of Water Engineers Bulletin 6109, 33 pp.

Baker, E. T., Jr., A. T. Long, Jr., R. D. Reeves, and L. A. Wood, 1963. Reconnaissance Investigation of the Groundwater Resources of the Red River, Sulphur River, and Cypress Creek Basins, Texas, Texas Water Commission Bulletin 6306.

Bassett, R. L., M. E. Bentley, and W. W. Simpkins, 1981. "Regional Ground Water Flow in the Panhandle of Texas - A Conceptual Model", Geology and Geohydrology of the Palo Duro Basin, Texas Panhandle; a Report on the Progress of Nuclear Waste Isolation Feasibility Studies (1980), Geological Circular 81-3, Texas Bureau of Economic Geology, pp. 102-107.

Bell, A. E., and S. Morrison, 1980. Analytical Study of the Ogallala Aquifer in Swisher County, Texas, Texas Department of Water Resources Report 249, 64 pp.

Bell, A. E., and S. Morrison, 1980. Analytical Study of the Ogallala Aquifer in Randall County, Texas, Texas Department of Water Resources Report 250, 64 pp.

Bell, A. E., and S. Morrison, 1980. Analytical Study of the Ogallala Aquifer in Armstrong County, Texas, Texas Department of Water Resources Report 251, 64 pp.

Bell, A. E., and S. Morrison, 1976. Analytical Study of the Ogallala Aquifer in Lamb County, Texas, Report 204, Texas Water Development Board.

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Bell, A. E., and S. Morrison, 1976. Analytical Study of the Ogallala Aquifer in Bailey County, Texas, Report 207, Texas Water Development Board.

Bell, A. E., and S. Morrison, 1976. Analytical Study of the Ogallala Aquifer in Floyd County, Texas, Report 211, Texas Water Development Board.

Bell, A. E., and S. Morrison, 1976. Analytical Study of the Ogallala Aquifer in Briscoe County, Texas, Report 212, Texas Water Development Board.

Bell, A. E., and S. Morrison, 1976. Analytical Study of the Ogallala Aquifer in Deaf Smith County, Texas, Report 213, Texas Water Development Board.

Brune, G., 1970. "How Much Underground Water Storage Capacity Does Texas Have?", American Water Resources Association Bulletin, Vol. 6, No. 4.

Budnik, R. T., and D. Smith, 1982. "Regional Stratigraphic Framework of the Texas Panhandle", in Gustavson, et al, Geology and Geohydrology of the Palo Duro Basin, Texas Panhandle, Geological Circular 82-7, prepared for U.S. Department of Energy by Bureau of Economic Geology, The University of Texas at Austin, Austin, TX.

Cronin, J. G., 1969. Groundwater in the Ogallala Formation in the Southern High Plains of Texas and New Mexico, U.S. Geological Survey Hydrologic Investigations Atlas HA-330.

Cronin, J. G., 1964. Summary of the Occurrence and Development of Ground Water in the Southern High Plains of Texas, Geological Survey Water Supply Paper 1693, U.S. Government Printing Office.

Cronin, J. G., and L. C. Wells, 1963. Geology and Groundwater Resources of Hale County, Texas, Water Supply Paper 1539-U, U.S. Geological Survey.

Cronin, J. G., 1961. A Summary of the Occurrence and Development of Groundwater in the Southern High Plains of Texas, Bulletin 6107, Texas Board of Water Engineers, 1044 pp.

Dutton, A. R., 1983. "Regional Ground-Water Flow System of the San Andres Formation", in Gustavson, et al, Geology and Geohydrology of the Palo Duro Basin, Texas Panhandle, Annual Report for 1982, Geological Circular 83-0, draft, prepared for U.S. Department of Energy by Bureau of Economic Geology, The University of Texas at Austin, Austin, TX.

Gould, C. N., 1907. The Geology and Water Resources of the Western Portion of the Panhandle of Texas, Water-Supply Paper 191, U.S. Geological Survey.

Gould, C. N., 1906. The Geology and Water Resources of the Eastern Portion of the Panhandle of Texas, Water-Supply Paper 154, U.S. Geological Survey.

Gustavson, T. C., R. L. Bassett, R. J. Finley, A. G. Goldstein, C. R. Handford, J. H. McGowen, M. W. Presley, R. W. Baumgardner, Jr., M. E. Bentley, S. P. Dutton, J. A. Griffin, A. D. Hoadley, R. C. Howard, D. A. McGookey, K. A. McGillis, D. P. Palmer, P. J. Ramondetta, E. Roedder, W. W. Simpkins, and W. D. Wiggins, 1981. Geology and Geohydrology of the Palo Duro Basin, Texas Panhandle: A Report on the Progress of Nuclear Waste Isolation Feasibility Studies (1980), Geological Circular 81-3, Texas Bureau of Economic Geology.

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Many precautions will be taken to ensure that the waste does not contaminate either the surface or the aquifer as it is lowered into the repository. First, waste shipped to a repository would be in a solid, leach-resistant form. Following receipt of each waste shipment, each shipping cask is inspected for surface condition and contamination level. The casks and vehicle will then be moved through the cask cleaning and decontamination area. At the receiving and handling facility, the waste will be removed from the cask and either placed in temporary storage or directly into the packaging hot cells. Depending on the form of waste, additional operations may be performed to ensure proper packaging. Spent fuel pins will be placed in a waste package liner; high level waste will already be in canisters. [Remote handled trans-uranic waste (TRU) will be inspected without repackaging and passed through the hot cell to the transfer cask station while contact-handled TRU will proceed directly to the waste shaft hoist cage.] Spent fuel and high-level waste will be placed inside the thick-walled overpack, and the overpack lid installed. At the inspection station prior to lowering into the repository, the waste packages will be inspected for leakage, surface contamination, and record verification. The repository shafts will be lined with several layers of concrete and/or steel, with special seals installed at aquifers such as the Ogallala. Thus, as the waste package is lowered past water-bearing strata penetrated by the repository waste shaft, there will be little opportunity for radiological contamination of the aquifer.

One of the major favorable characteristics of salt as a repository host rock is its isolation from flowing ground water. Existing data on the Palo Duro Basin indicate that any radionuclides leached from the repository following closure will flow downward, towards the deep, saline aquifers beneath the salt formations (see Section 3.5.8 on ground-water flow in this response document).

3.5.4 Santa Rosa Aquifer

3.5.4.1 Comments

Questions and comments concerning the Santa Rosa or Dockum Group were generally of one of the following types:

-- "The Santa Rosa was not even mentioned in the text."

-- "DOE should mention that the Santa Rosa contains fresh water (at levels dipping to the southeast) and is a significant resource. The Santa Rosa should have been a descriptor in the site identification process."

-- "The Dockum Group is not hydrologically connected (to the Ogallala) throughout all of Swisher County; therefore, it should be discussed separately."

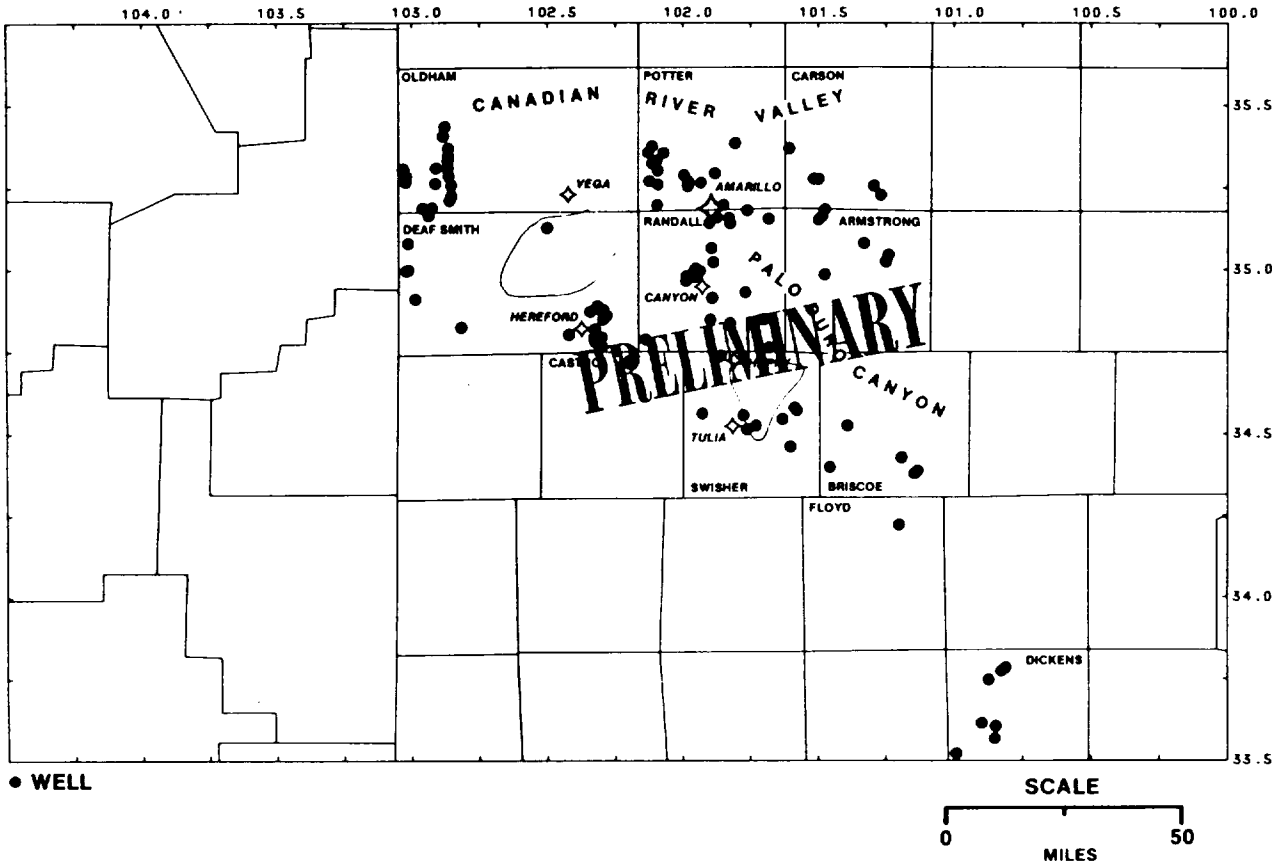
-- "What about the prolific well the Richardsons or others have in the Santa Rosa?"

3.5.4.2 Response

The draft report did repeatedly refer to a Dockum aquifer (the Santa Rosa) or potential water-bearing units in the Dockum Group. (These references occurred on pages 43, 62, 83, 89, and Figure 3-7 of the Deaf Smith report and pages 39, 60, 80, 83 and Figure 3-7 of the Swisher report.) The discussion of previous exploration/exploitation of resources (Section 3.6.1 of the report) notes that "water-bearing units of the Dockum Group have also been locally developed". The terms "Santa Rosa" or "Santa Rosa sandstone", being locally familiar terms, have been used parenthetically in the revised report whenever the Dockum aquifers are discussed.

The description of the Dockum Group (Santa Rosa) aquifer has been improved in the final report (page 29, Volume 1, and page 30, Volume 2). Reference is made to a High Plains Underground Water Conservation District No. 1 report. DOE has acknowledged that water-bearing units in the Dockum Group are potentially important resources. Their use is not in conflict with safe isolation of radioactive waste because wells into the Dockum would not reach the salt units that provide a barrier to radionuclide release. If the Santa Rosa had been used as a descriptor, the result would have been the same because the sparse data base available does not permit showing variation across the locations; this means the descriptor would not have been selected as a discriminator. Figure 3-1 shows that few wells exist in the locations that are completed only in the Dockum. Had enough data been available, it might have been possible to use the saturated thickness of the Santa Rosa as a discriminator in the site identification process. Section 3.9.2.5 of the

LOCATIONS OF NON-COMINGLED DOCKUM WELLS



Notes:

Outlines of locations are approximate.

Wells are those that are completed in the Dockum Group only.

Source: Stone & Webster Engineering Corp.

Figure 3-1. Data Base for Dockum Group Studies

final report, discussing potential water use conflicts, notes that while the Dockum Group will be developed, data do not exist to allow its consideration in narrowing to sites within the locations.

Greater and separate discussion of the Dockum Group has been provided in the final report. The Dockum Group does not appear to be hydrologically connected with the Ogallala throughout Swisher County. Therefore, they must be treated separately when analyses of drawdown, recharge, inflow to shaft, chemical compositions, etc., are made. Also, since the heads in the Dockum aquifer are lower than the Ogallala water levels, the downward flow potential gradient across the salt (host rock) to the Wolfcamp is not as great as had been originally estimated. Investigations are ongoing, but the amount of data available precludes detailed analysis at this time.

Wells on the Richardson Seed Farm property and at selected other locations are very good wells. However, as reported to the Texas Nuclear Waste Programs Office by the TDWR, many landowners have not had this success. Some wells deteriorated in both quality and yield after continued use. DOE and others have little chance (given the sparse exploration base) of accurately predicting where the good or bad wells in the Santa Rosa might occur in the locations. Therefore, sites have been identified without screening on the basis of projected yields from the Santa Rosa.

3.5.5 Dissolution

3.5.5.1 Comments

The statement that "dissolution of shallow salts is of concern only from the standpoint of construction and maintenance of shafts" was questioned because of the significance of dissolution. Another commenter stated that DOE must specifically demonstrate that dissolution at the site is not occurring or is not a significant problem, noting that evidence of dissolution was found at DOE boreholes and that the statement that dissolution "may be occurring at very slow rates today" (page 67 of the draft report) was not adequate.

3.5.5.2 Response

DOE recognizes that dissolution concerns are important for any proposed nuclear waste site in salt, but is convinced by available information that natural dissolution of shallow salt beds (approximately 1,200 feet shallower

than the proposed repository horizon), if occurring at all, is a very slow process that will have no direct effect on long-term isolation of nuclear waste at a Palo Duro site. Very conservative assumptions in Appendix B of the report show that approximately two feet of the shallowest salt might be expected to dissolve during the next 10,000 years. What is yet to be demonstrated is that DOE can design shaft seals which are effective in prohibiting seepage of water through a shallow, possibly brecciated, salt dissolution zone at a proposed site. Investigation and confirmation that this can be done must occur during site characterization. Considerable additional discussion of dissolution will be in the environmental assessments being prepared for sites in Texas. DOE agrees that it will be necessary to "specifically demonstrate that dissolution at the site is not occurring or is not a problem". It is not possible to begin site-specific analysis until a site is designated upon which to focus investigations.

3.5.6 Saline Aquifers and Brines

3.5.6.1 Comments

Several comments were made about saline aquifers and brines. One commenter asked why consideration was given only to solubilities and retardation in nonpotable aquifers. Another asked if the Pennsylvanian and Wolfcamp system brines should be considered in calculating the lifetime of the waste package. Other questions were asked concerning the meaning of chemical amounts stated on page 70 of the draft report and the type of brine that would affect the waste package.

3.5.6.2 Response

Consideration was given primarily to solubilities and retardation in nonpotable aquifers because the aquifers nearest the proposed repository horizon are nonpotable due to their high total dissolved solid content. These aquifers would be the first to receive radionuclides in the unlikely event of any escape from the repository itself. Thus, in order to address the question of solubilities and retardation in ground water [as required by the NWTS performance criteria (DOE, 1981)], aquifers that are the "most likely" to receive radionuclides under worst-case conditions have been analyzed.

Brines that are present in the host salt as fluid inclusions and in interbedded clays/mudstones are those that are immediately available to affect the lifetime of the waste package. Brines from the Pennsylvanian and Wolfcampian systems are not expected to reach the waste package due to the expected absence of pathways. Should they reach the waste package, they would be less corrosive than the natural brines in the salt because of their lower magnesium content. Thus, the use of the high magnesium composition for the brines in the host salt is conservative (i.e., it will predict the shorter waste package lifetimes).

The chemical compositions on page 70 in the draft report are given in milligrams (mg) per liter (l). This is the amount (weight) of a chemical element in solution per volume of fluid.

All types of brine will corrode the waste package if they contact it. The amount of brine that could migrate from the host salt to the waste package is less than the amount considered necessary to breach the waste package. In this case, only the amount, not the type of brine migrating to the waste package is the important factor. The brines located in the deep Pennsylvanian and Wolfcamp brine aquifers, which are about one-half mile below the candidate host salt bed, are not expected to enter the repository.

3.5.7 Alibates Anhydrite-Dolomite Transition Zone

3.5.7.1 Comments

One commenter pointed out that the "character of strata between host rock and overlying aquifers" was not selected as a discriminator because the exact location of the anhydrite-dolomite transition zone in the Alibates formation was undetermined; yet data is apparently sufficient to identify strata and the existence of an anhydrite-dolomite transition.

3.5.7.2 Response

The relatively sparse data base (few wells) in the Deaf Smith and Swisher locations make it impossible to locate the position of the change in Alibates lithology. Further, the even greater lack of core has precluded testing which might possibly indicate that a preference for one lithology exists. DOE has only indicated that if data were available, it might be possible to use the

descriptor, "character of strata between host rock and overlying aquifers", as a discriminator.

3.5.8 Ground-Water Flow Direction and Rates

3.5.8.1 Comments

The following concerns about ground-water flow direction were expressed:

-- The water could not be "dammed up" underground.

-- A person who owns land east and southeast of the site said he was in danger because water would flow toward his land from the repository, according to page 45 of Volume II of the draft report.

-- "All previous leaks have seeped upwards", so the potential for flow is not downward as stated on pages 59 and 60 of Volume II of the draft report. This commenter was concerned that if the "leak" were upwards, to the Ogallala, that the Ogallala would be unusable throughout several states.

-- The water could emerge at the Esteline springs and could contaminate the Colorado River.

-- The local variations in permeability and hydraulic conductivity (discussed on pages 45 and 53, Volume II, of the draft report) could disqualify a site under the NRC's travel time standards, according to one commenter. The commenter noted that even if the natural gradient is downward as stated in the report, the emplacement of hot spent fuel could change the natural flow system.

-- One commenter confused the San Andres formation with the San Andreas fault and expressed concern that there was intrusion of water from the Ogallala into the Wolfcamp.

-- The use of other models for ground-water flow rates in the Wolfcamp was suggested.

-- One commenter charged that calculations of Wolfcamp flow rates came from an unavailable document and another said that Ogallala and Santa Rosa flow rates were not mentioned.

3.5.8.2 Response

DOE recognizes that radioactive materials will migrate if they are dissolved in ground water. For this reason, DOE is searching for a site with geologic characteristics that can be predicted to prevent this from happening.

An advantage of salt is its characteristically dry nature. DOE is trying to find sites in dry stable rock formations that would keep the radionuclides from entering the ground-water flow system. Sites are being sought that have potential for keeping the waste away from the environment even in the unexpected event that radionuclides did enter the ground-water system. Redundant barriers would be in place at a repository more than 2,000 feet underground so that if one failed, another would provide isolation of the waste. For example, DOE is planning engineered barriers, such as the waste package, which would contain the waste during its "hottest" period, for the first 300 to 1,000 years. At the Texas sites, ground-water flow directions and travel times are such that even if the waste could escape, its travel time is so long that radioactivity would have decayed below regulated levels before reaching the human environment. Travel time in the deep aquifer system in the Panhandle has been calculated to be approximately one mile in one million years. (Ground-water flow rates are discussed in Sections 3.2.1 and 3.2.2 of the report.)

Danger of contamination of the Ogallala from surface spills is very low for two important reasons. First, the waste will be in a solid form not readily leached or dissolved for transport to the Ogallala water. Secondly, the ground-water table for the Ogallala is well below the surface and soil conditions are such that seepage and recharge to the Ogallala is very slow. Any spill that might occur at the surface should be easily cleaned up by excavating and removing a few inches of soil for proper disposal.

Contamination of Ogallala during transport of waste through shaft to the repository horizon will be precluded because the shaft will be lined with steel and concrete and special seal systems will be installed. The waste will be in solid form, which also reduces the opportunity for a sudden release of contaminants.

Even if the waste could escape all the barriers once it is emplaced in the repository and enter the ground-water flow system, the potential for flow is downward into deep nonpotable aquifers, not upward to the Ogallala and the human environment. All brine heads in the lower San Andres unit 4 dolomite are below the base of the Ogallala. If, for some reason, there was a connection between the Ogallala and the lower San Andres unit 4 dolomite or deeper aquifers, flow would be downward to the deeper aquifers. DOE does not know to

which "previous leaks" the commenter is referring when stating that "previous leaks" have been upward.

As stated in the report, flow of the Ogallala is southeastward. Some water from the Ogallala and Dockum aquifers may percolate through transmissive dolomite/anhydrite beds of the Blaine formation and discharge into springs in the Rolling Plains (Simpkins and Fogg, 1982); however, much of the water from these springs is probably locally derived from recharge of shallow aquifers in the vicinity (Krietler and Bassett, 1983). It is therefore theoretically possible for Ogallala or Dockum water to reach the Rolling Plains area and discharge into springs. Further analysis would be required to predict what contamination would be possible. As mentioned in the preceding paragraphs, contamination of the Ogallala is unlikely. If, however, contamination were to occur, the extent of it would be dependent upon the nature of the radionuclides responsible and the extent and rate of natural dilution. Contamination would be primarily in a down gradient direction at very slow speeds, along preferred flow channels. There can be no connection to other states since the Ogallala of the southern High Plains is isolated from the northern High Plains by the Canadian River Valley.

Local variation in porosity and hydraulic conductivity are to be expected in both vertical and horizontal directions due to repeated trangression and regression of shelf margins responsible for carbonate buildup and shifting channels of streams depositing granite wash sands. Such variability is not unusual, but can only be characterized with dense drilling patterns. There is no reason to expect a proposed site in the Palo Duro Basin to be disqualified under ground-water travel time standards of the NRC. In fact, preliminary models indicate the NRC's standards will be exceeded by very wide margins.

The San Andreas Fault occurs in California; no similar feature exists anywhere near the Palo Duro Basin.

The concern about disruption of natural flow systems due to emplacement of spent fuel was alluded to on page 57 (Volume 1) and discussed in more detail in Appendix A of the draft report. There was a concern over possible communication between the upper and lower aquifer units. The text of the final report page 33 (Volume 1) was revised to more clearly distinguish between conditions observed at the Mansfield No 1. borehole and those observed at the J. Friemel No. 1. It is not possible, in the absence of

site-specific data, to definitely state that no vertical communication between shallow and deep aquifers exists at the identified site. Potentiometric data for the area suggest, however, that such communication is not occurring. There is no evidence of faulting in the sites' vicinity which would cause DOE to expect hydrologic communication between aquifers.

In response to the comment about using other models for Wolfcamp groundwater flow, DOE has used flow rates from a computer model it believes conservatively represents actual conditions. Flow rates calculated from various models have been quite similar. Recent interpretations are that permeabilities used in this and other early models were too high; thus, calculated flow rates are likely to be even smaller than reported in the report. The environmental assessments being prepared for the Palo Duro sites will provide much more detail than the report. The calculation of Wolfcamp flow rates in the report came from a contactor's report (BMI/ONWI-504) to the Battelle Memorial Institute (INTERA, 1984), which is publicly available, including at public libraries in the Panhandle. Documentation of the selection of parameters for modeling and use in calculation of flow rates is provided in that report.

Discussion of flow rates in the Ogallala and Santa Rosa is not important to the actual process of site narrowing. Radionuclides are not expected to reach these aquifers, as previously explained; if they did, their lateral movement would be quite rapid almost anywhere in the southern High Plains. The TDWR reports that the rate of ground-water movement is on the order of 7 inches (18 cm) per day (Knowles et al, 1982). Rate of flow in the Santa Rosa has not been reported, but can be assumed to be in the same general range.

3.5.9 Effects on Waste Package

3.5.9.1 Comment

A commenter pointed out that page 70 of the draft report states that "the waste package lifetime is dependent in large part upon the chemical and thermal environments in the repository and the materials chosen for use in the waste package"; yet the report also states that information on the character of the host salt, the chemical/thermal effects, and the radiation effects are not available, not perceived as having significant differences across the location, and not selected as discriminators.

3.5.9.2 Response

Waste package lifetime will be affected by the chemical and thermal conditions which occur in a repository. The expected brine compositions were given in the report; the thermal conditions will be dependent upon the type, age, and spacing of waste in the repository. Projections for thermal temperatures indicate that waste package surfaces would reach a maximum of approximately 480 F, and that would be only for a period of a few years. DOE can use these preliminary (expected) conditions to model waste package corrosion and predict lifetime. DOE does not now have specific data to carefully model change such as dehydration or hydration reactions, brine migration, etc., at various areas in the location; thus it cannot show variability across the location and use this factor to discriminate. DOE expects, however, based on its current knowledge of the uniformity of the salt bed composition, that very little variability actually exists over the area being considered.

3.5.10 San Andres Hydraulic Head

3.5.10.1 Comment

One commenter pointed out that in the September-October 1983 issue of Ground Water, the hydraulic head of the San Andres is established as near or above the land surface in the study location.

3.5.10.2 Response

The article referred to was prepared as a result of an investigation performed by a contractor to DOE. DOE reviewed and commented on a draft version of the report and provided authorization for publication of the version in Ground Water. DOE has repeatedly discussed this formation in its technical reports and a considerable amount of testing has occurred, as reported in well completion reports and pump testing/sampling reports. The reviewer is correct that equivalent fresh water heads in the San Andres approach surface elevation. However, brine heads computed for the formation are always below the base of the Ogallala. Testing to date confirms that a water bearing reservoir does exist, at least locally; fluid recovery levels have been on the order of a couple of barrels per week. Additional testing of this formation will occur

if a site is recommended for characterization. Before a repository would be licensed in the Texas Panhandle, DOE would have to show that the occurrence and possible flow of fluid in this formation is compatible with waste isolation. Further discussion of this formation in the report is not warranted because data are too sparse to show or predict variability that might cause preference of one site over another within the location.

3.5.11 Unexpected Conditions

3.5.11.1 Comments

Because the phrase "under expected conditions" is used in the report when discussing hydrologic issues, two commenters said that unexpected conditions should also be examined.

3.5.11.2 Response

The use of the phrase "under expected conditions" may be unfortunate because many unexpected events were actually discussed or analyzed in the report. In the case of ground-water flow, radionuclides will be isolated in the host salt beyond the point at which they represent a hazard; however, the "most likely" (unexpected) radionuclide release and flow conditions were evaluated. Analysis of possible site locations using expected conditions or the "most likely" conditions should an unexpected release occur is the only reasonable approach available to DOE in the site identification process.

3.6 GEOLOGY

3.6.1 Salt Depth

3.6.1.1 Comments

Several comments were made regarding the optimum depth for a repository, the depth-to-host-rock descriptor, and the depth to the host rock in Swisher County. Some commenters stated that the rationale for selection of the San Andres unit 4 should be included.

3.6.1.2 Response

The selection of the 2,700-foot contour to approximately bisect the location was an error in the draft report. The final report uses a 2,650-foot contour. This is the primary reason that the identified site in Swisher County is one mile farther north and east than it was in the draft report. While it is true that, from a constructibility standpoint, shallower depths may be more preferred for siting, there is no easily identifiable optimum or maximum depth below which a repository could not be placed.

The rationale for the identification of the lower San Andres unit 4 in Swisher County and in units 4 or 5 in Deaf Smith county is provided in the Location Recommendation Report (LRR) (ONWI, 1983). Essentially, these are the only units which met the specification for thickness and quality used in the area screening phase.

While a decision has been made to focus all design and analysis efforts on the unit 4 salt in Deaf Smith County, the unit 5 salt has not been dropped as a possible host rock. Unit 4 is preferred over unit 5 simply because its greater thickness allows for more options in selecting a suitable level for a mine opening, and theoretically provides greater initial primary containment of waste.

3.6.2 Salt Thickness

3.6.2.1 Comments

The information on salt thickness in the report was criticized and apparent discrepancies were discussed by several commenters. One questioned the quality (purity) of the San Andres unit 4 salt.

3.6.2.2 Response

Various maps depicting salt thickness in the Palo Duro Basin have appeared in documents published during the past few years. In each case a slightly different approach has been used in defining what constitutes a salt bed. There is no one "right" definition. The Texas Bureau of Economic Geology (TBEG) has mapped cumulative salt thickness within a given informally defined unit, regardless of the nature or thickness of interbeds within that salt unit. For example, Figure 3-5 of Volume 2 illustrates interbeds or zones of major impurities within the lower San Andres unit 4 salt for the Grabbe No. 1 well. Discounting the anhydrite zones, the salt bed at the Grabbe well is considered approximately 170 feet thick using the TBEG method. This is the value and approach which resulted in Figure 4-7 of the LRR (ONWI, 1983).

Stone & Webster Engineering Corporation (SWEC) devised a method of mapping salt bed thickness that takes into account the relative quality of the salt bed. Their approach was to look at any 10-foot interval within the salt-bearing unit and judge (based on geophysical log response) whether that interval was of the quality to be included in the calculation of salt bed thickness. For example, at the Grabbe No. 1 well in Figure 3-5 of Volume 2, if the two anhydrite zones in the middle of the unit are considered one interbed of greater than 10 feet in thickness, the salt unit is effectively considered two separate salt beds. This is what occurred in early mapping of the unit 4 salt in Swisher County. This salt unit was mapped as two separate salt beds at the Zeeck and Grabbe wells, with the thicker of the two beds being illustrated on maps in the draft Area Geological Characterization Report (SWEC, 1983b) and in Major Salt Beds of the Palo Duro and Dalhart Basins (SWEC, 1983a). Review of the original data and these maps has resulted in a revised and more consistent interpretation that does not separate the unit at the Grabbe well into two salt beds. The revised interpretation appears in the report.

The "major" or "thick" salt bed approach to mapping was devised to readily identify sites within a large study area that have higher quality salt of greater thickness. Once sites are identified, this mapping approach is no longer necessary. The actual thickness of the entire salt-bearing interval and the nature and position of interbed material must be mapped. It should

also be noted that these differences in salt thickness on various maps occurred only in Swisher County where anhydrite interbeds happened to be of thicknesses which necessitated dividing the salt unit into two salt beds.

Just as there is no absolute optimal depth for siting a repository, there is no absolute optimal salt thickness or quality. The thickness and quality must be great enough to accommodate the underground workings and to accept the thermal and mechanical stress placed on the system during mining and after emplacement of waste, while maintaining its integrity as a primary containment and barrier to radionuclide migration. Because numerous underground designs and various waste material characteristics are possible, it is only prudent to conservatively select a thickness which provides adequate flexibility (options) in design and waste form to assure waste isolation.

Justification for the 125-foot specification was provided in the LRR (ONWI, 1983). The SWEC "major or thick salt bed" maps (in the site identification report), which include a quality consideration, result in a more conservative approach to identification of appropriate salt bed thicknesses than the net-salt thickness maps (TBEG) that were used in the LRR. The quality of the host salt remains a concern and will be a focus of numerous detailed investigations if a Palo Duro site is recommended for further characterization. DOE is satisfied, however, that the proposed host salt is of an appropriate thickness and at suitable depth to warrant further site-specific study. It is not the purpose of the site narrowing document to address these subjects in detail.

3.6.3 Interbeds and Anhydritic Zones

3.6.3.1 Comments

A few commenters expressed concern about the presence of interbeds and anhydritic zones and indicated that the presence of interbeds should be considered a discriminator. One stated that data on anhydritic zones in the lower San Andres unit 4 in Swisher County should be included in the report. Another was concerned that avoiding the anhydrite interbed zones would cause the repository to be located deeper than 2,500 feet. A description of the method by which geophysical logs were used to interpret interbeds and poor quality salt was requested.

3.6.3.2 Response

DOE recognizes that the Palo Duro Basin salts contain interbeds which must be characterized and understood in order to properly design a waste repository at one of the identified sites. The presence of interbeds was a descriptor, but not a discriminator because the density of well data precluded showing variability across the location.

No physical property data were available on the three anhydritic zones in the lower San Andres unit 4 salt in Swisher County. If a Swisher County site is recommended for further characterization, extensive in situ studies (conducted in the actual repository location) and laboratory testing of these zones will be conducted to determine both hydrologic and mechanical properties.

It is true that a repository opening could be placed near the bottom of the salt interval if necessary to avoid anhydritic zones. However, from an engineering standpoint there is no maximum depth that would preclude such an action.

The method used to interpret geophysical logs and define salt quality and thickness is described in Major Salt Beds of the Palo Duro and Dalhart Basins, Texas (SWEC, 1983a). (See also Sections 2.2.21, 2.2.22, and 3.6.2 of this document.)

3.6.4 Adding Geologic Descriptors/Discriminators

3.6.4.1 Comments

One commenter suggested that descriptors and discriminators be reassessed to assure that they collectively will fully characterize the sites for their suitability as a repository. Another commenter suggested including information on faults in and above the Permian section as a discriminator. A third commenter pointed out confusion over the identification of geologic descriptors and the objectives of the site characterization process.

3.6.4.2 Response

The logic diagram and text have been revised in the final report to more clearly indicate the differences between the use of descriptors in this site narrowing process and their use in the site characterization process. The

purpose of this report is not to fully demonstrate that the proposed host rock can permanently isolate waste. If the site is approved for characterization, DOE will conduct numerous investigations that will ultimately demonstrate the site's suitability or unsuitability for a repository. Field tests will be designed to verify laboratory modeling. Results of these studies will be reported in the site characterization plans, safety analysis report, environmental report, and, eventually, the environmental impact statement.

DOE contractors have found existing data on faults in and above the Permian section speculative and unverifiable. This factor will be the subject of more study if a Texas site is selected for site characterization.

3.6.5 Porosity

3.6.5.1 Comment

Two commenters stated that the source for Figures 3-29 and 3-29a indicates that actual porosity values are unknown, and that, therefore, use of this data is inappropriate.

3.6.5.2 Response

The subject illustration has been used to indicate where porous reservoir rock potentially exists. Actual porosity values are relatively unimportant. Wolfcampion hydrocarbon fairways, as defined by TBEG, occur where total organic carbon exceeding 0.5 percent coincides with porous carbonates. This occurs only in the northeastern portion of the Swisher County location, which was avoided in siting.

3.6.6 Effects on Salt

3.6.6.1 Comment

One commenter asked if DOE knows what effects fractures, radiation, and chemical/thermal phenomena will have on the salt.

3.6.6.2 Response

Numerous investigations have been undertaken to evaluate these phenomena. Studies have been conducted on the amount of gamma-ray energy formed in salt in a repository to determine whether release of the stored mechanical energy could rupture the surrounding rock. These studies show that, should such a release occur, the mechanical energy would be practically negligible. The resulting crevices and cracks, if they occur, would disappear as the salt reconsolidates.

The phenomenon of radiation damage to salt is reasonably well understood. The damage, including loss of sodium and chlorine, change in pH of brine inclusions, and alteration of the mechanical properties of rock salt, varies from one location to another. Site-specific evaluations will not be possible until in situ investigations are under way at sites selected for detailed site characterization.

Tests have been designed and conducted to study temperature and stresses generated by nuclear waste, brine migration, and chemical changes caused by the heat of the waste. DOE is conducting joint studies with the German government in a salt dome in Germany using electric heaters and a radioactive source to simulate nuclear waste.

Table 3-2 lists references to representative research on the effects of heat, radiation, and pressure on salt structures.

Table 3-2

SELECTED REFERENCES TO RESEARCH ON EFFECTS OF HEAT, RADIATION, AND PRESSURE ON SALT

Jenks, G. H., 1979. Effects of Temperature, Temperature Gradients, Stress, and Irradiation on Migration of Brine Inclusions in a Salt Repository, ONRL-5526, prepared for Office of Nuclear Waste Isolation by Oak Ridge National Laboratory, Union Carbide Corporation, Oak Ridge, TN.

Jenks, G. H., and C. D. Bopp, 1977. Storage and Release of Radiation Energy in Salt in Radioactive Waste Repositories, ORNL-5058, prepared by Oak Ridge National Laboratory, Union Carbide Corporation, Oak Ridge, TN.

Jenks, G. H., and H. C. Claiborne, 1981. Brine Migration and Its Implications in the Geologic Disposal of Nuclear Waste, ORNL-5818, prepared for U.S. Department of Energy by Oak Ridge National Laboratory, Union Carbide Corporation, Oak Ridge, TN.

Krause, Wayne B., 1983. Avery Island Brine Migration Tests: Installation, Operations, Data Collection, and Analysis, ONWI-190(4), prepared by RE/SPEC Inc. for Office of Nuclear Waste Isolation, Battelle Memorial Institute, Columbus, OH.

Levy, P. W., J. M. Loman, K. J. Swyler, and R. W. Klaffky, 1981. Radiation Damage Studies on Synthetic NaCl Crystals and Natural Rock Salt for Radioactive Waste Disposal Applications, in "The Technology of High-Level Nuclear Waste Disposal", P. L. Hofmann (ed.) DOE/TIC-4261, Vol. I, U.S. Department of Energy Technical Information Division, Oak Ridge, TN.

Panno, S. V., 1982. Chemical Changes in Radiation Damaged Natural Rock Salt: Preliminary Results, BNL-NUREG-32523, informal report prepared for U.S. Nuclear Regulatory Commission by Brookhaven National Laboratory, Upton, NY.

3.7 ENVIRONMENTAL PROTECTION

3.7.1 Cultural and Historical Resources

3.7.1.1 Comments

Several commenters had concerns about archaeological and historical resources in the area. Two stated that there was strong potential that a significant number of cultural resources existed, particularly associated with playas and water sources. One commenter recommended that the National Historic Preservation Act of 1966 and the Archeological Resources Protection Act of 1979 be referenced. A commenter also pointed out that a property listed on or eligible for listing on the National Register of Historic Places is not necessarily of national significance; three levels of significance are recognized--local, state, and national.

3.7.1.2 Response

Surveys of cultural resources literature and records conducted for DOE agree that there are both historic and prehistoric properties in the general area of the study locations. Before any land-disturbing activities could be conducted for site characterization, cultural resource surveys would be performed. Survey plans would first be coordinated with the state historic preservation officer.

A draft report entitled Cultural Resources: Deaf Smith and Swisher County Location, Texas (NUS, 1984c) provides:

- A discussion of relevant legislation such as the National Historic Preservation Act of 1966 and the Archeological Resources Protection Act of 1979. DOE will comply with these regulations prior to and during site characterization activities.
- A discussion of the importance of playas and other water sources as areas where there are historic and archaeological resources.

The National Historic Preservation Act of 1966 does recognize local, state, and national levels of significance. The draft report was in error in only discussing the national level of significance. This error, however, does not affect how DOE will determine if a site is on or eligible for the National Register. This site identification report recognizes that there are historical and archaeological resources in the study locations. It also recognizes that the La Plata site in Deaf Smith County and several sites and structures

in Tulia in Swisher County have statewide recognition. However, there are no sites that have been nominated (on any level) for the National Register within the study locations or subsequently identified nine-square-mile sites in Deaf Smith or Swisher counties.

3.7.2 Ecological Habitats, Migration Routes, and Endangered Species

3.7.2.1 Comments

Some commenters pointed out that the Texas Panhandle is an important part of the central flyway for migrating waterfowl and others criticized the statement that "the abundant cropland in and around the location can also provide feeding areas for migrating waterfowl". One commenter stated that golden and bald eagles are present each winter. Another commenter identified the horned toad as an endangered species.

3.7.2.2 Response

The report acknowledges the value of playa lakes as waterfowl habitats. (Section 3.9.1.3 of the final report discusses importance of the playas to wildlife.) The intent of the statement that "the abundant cropland in and around the location can also provide feeding areas for migrating waterfowl" was misconstrued. Migrating waterfowl often eat waste grain after crops have been harvested and may at times become a pest by consuming unharvested crops. The intent was to show that, in addition to waterfowl habitats in the form of playas, crops are a source of food. (It was not intended to suggest that farmers in the area should raise crops primarily to feed waterfowl.) Only after detailed ecosystem studies will DOE be able to fully evaluate the value of a specific playa or rangeland area to determine measures required to protect that habitat from the adverse effects of repository development.

Because ecological habitats are a limited resource, this discriminator did receive a high priority in the site selection process. Large areas (associated with the North Palo Duro Creek) north of the potential Deaf Smith site were avoided because they are a valued habitat, as shown in the map of valued ecosystems (Figure 3-36 in the report). However, there is no nine-square-mile area without some potential ecological conflict. By minimizing

these areas, there is a greater possibility of planning development of a repository so there is no significant adverse effect on the area's ecology.

Section 3.9.1.3, "Ecological Habitat", has been expanded to include a more thorough discussion of threatened and endangered species. This includes the addition of a discussion of the Texas horned lizard (also known as the horned toad), a state protected species. The information on threatened and endangered species is based predominantly on a review of published literature, aerial photographs and limited field surveys. These studies were primarily intended to identify habitats and prepare preliminary lists of species that may be present. Information is currently not available on the specific occurrence of a species within a specific habitat. At this time we do not know if the Texas horned lizard can be found within the proposed sites. Information on this and other species can only be determined as a result of detailed site characterization studies.

3.7.3 Prime Farmland

3.7.3.1 Comments

A large number of commenters pointed out the value of prime farmland, particularly that which lies above a major aquifer.

3.7.3.2 Response

DOE recognizes that prime farmland is a major and important land use. Section 3.9.2.1 of the final version of the report states:

> "Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, fiber, forage and other agricultural crops."

The percentage of prime farmland taken out of production relative to the amount in the location's county was not intended in the report as a rationalization of the project. It was to put the land requirement in perspective for people living in the area. DOE realizes that prime farmland is a limited resource and is subject to a number of pressures (including projects such as highways or schools).

DOE activities involving prime farmland are guided by the Farmland Protection Policy Act of 1981. This act is discussed in Section 3.2.1 of this document.

3.7.4 Compatible Land Uses

3.7.4.1 Comment

One commenter asked if industrial and commercial operations in the nine-square-mile sites could be assured that they would be outside of the controlled area.

3.7.4.2 Response

Industrial and commercial operations within the nine-square-mile sites have no assurance at this time that the facility will be designed or located to avoid disrupting their operations. The exact size of the controlled area will be determined in greater detail by using data obtained during site characterization and in accordance with NRC regulations. At the Deaf Smith or Swisher county sites, the controlled area may include most or all of the nine-square-mile site or could possibly extend beyond the nine-square-mile site.* However, current estimates based on ground-water travel times indicate that the controlled area would not extend beyond the nine-square-mile site.

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* Under present NRC regulations, this controlled area could extend to as much as 6.2 miles in any direction from the underground operations area, potentially encompassing thousands of acres. However, the controlled area need not be this large if the EPA standards for radioactive releases to the accessible environment can be met in a shorter distance (proposed Title 40, Code of Federal Regulations, Part 191). The size of the controlled area at a given site will depend on the rate of ground-water flow and other site characteristics and will be established on a site-specific basis after completion of site characterization studies to ensure that releases to the accessible environment will not exceed those permitted by the EPA.

3.7.5 Land Ownership

3.7.5.1 Comments

One commenter stated that there was no justification for excluding land ownership as a discriminator. Another commenter objected to the statement that future ownership could not be predicted by past history because it is "common knowledge that history repeats itself". The commentor expressed a concern that DOE may intend "to put a stop to the chain of family ownership by rights of inheritance".

3.7.5.2 Response

The prime consideration in evaluating land ownership is whether or not land is already owned by the federal government. Virtually all of the land in the two locations is privately owned. For that reason, land ownership would not be useful for discriminating among possible sites within a location.

3.7.6 Water Use Conflicts

3.7.6.1 Comments

A few commenters were concerned about users of water in the area being affected by pumping of water for the repository. Some wondered what water source the repository could use if the Ogallala was already being depleted in some areas.

3.7.6.2 Response

As explained in Sections 3.5.1 and 3.5.2 of this response document, consideration was given to the saturated thickness and rate of depletion of the Ogallala. In addition to the Ogallala, other water resources for the repository could include municipal wastewater, the Dockum (Santa Rosa) aquifer, and desalinization of brackish or saline aquifers. These would be investigated during site characterization studies.

Where water wells are spaced relatively close together, pumping of one well will cause a drawdown in the others. The drawdown in pumping wells caused by withdrawal from other pumped wells is referred to as interference (Heath, 1983). The impact of ground-water withdrawal during the construction and operation phases was analyzed for Deaf Smith and Swisher counties with a ground-water model developed by Prickett and Lonnquist (1971). For the purpose of this analysis, the well was assumed to be at the center of the nine-square-mile site and all repository water was withdrawn from the Ogallala aquifer. The assumptions used in this analysis were derived from Knowles et al (1982). However, the repository operation would consume less water than irrigation of a comparable area of land (see Section 3.2.2 of Volumes 1 and 2 of the report).

3.7.7 Long-Term Health and Safety

3.7.7.1 Comment

One commenter was concerned about the difference between operational performance and long-term performance in terms of health and safety.

3.7.7.2 Response

A primary purpose of the civilian radioactive waste management program is to protect the public health and safety from the hazards posed by disposal of high-level radioactive waste in a repository. All discriminators relate to that purpose. Standards set in the proposed Title 40, Code of Federal Regulations Part 191, require that isolation of radioactive waste material from the accessible environment be ensured for 10,000 years. This has been used as a measure of long-term performance. Any human intrusion of the repository horizon within a controlled area [which is not expected to exceed a radius of 6.2 miles from the disposal area (see Section 3.7.4 of this document)], would be considered a breach of long-term performance integrity. DOE has determined that the greatest risk of human intrusion would be from exploration for oil or gas. As a result, the screening process sought to eliminate from further consideration those areas that: (1) overlie Pennsylvanian shelf-edge carbonates, which are possible reservoir rock; (2) are areas of richer

source rock; (3) contain areas of greater present-day oil and gas leasing; and (4) are near existing hydrocarbon production. By siting away from such areas, long-term risks to populations are reduced significantly. (See also Section 3.4 of this document.)

Operational performance standards, as set by the EPA's proposed Title 40, Code of Federal Regulations Part 191, limit the maximum public doses during the operational phase to 25 millirem* to the whole body, 75 millirem to the thyroid, and 25 millirem to any other organ. Analysis of the effects of routine radiological releases potentially occurring during repository operations indicates that the maximally exposed individual would receive less than 0.0028 millirem. This is also significantly less than the average 95 millirem per year received from natural background radiation in the Texas Panhandle locations (NUS, 1984a).

Modeling results indicate that during repository construction no member of the public is likely to receive an annual whole-body dose greater than 0.0045 millirem. This radioactive material results in any mining operation, including construction of a repository, from the release of isotopes of radon gas, lead, and bismuth during excavation and mining of soil, rock, and to a lesser extent, salt. Though roughly twice as great as radioactive releases expected from repository operation, releases during construction are not the result of handling and emplacing radioactive waste nor are they significant relative to background sources. (See the responses in Sections 3.9.4 and 3.9.6 of this document.)

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* A rem (roentgen equivalent in man) is a measurement of the effects on human tissue from a dose of radiation. A millirem is one-thousandth of a rem.

3.8 SURFACE CHARACTERISTICS

3.8.1 Flood Areas and Surface Impoundments

3.8.1.1 Comments

One commenter noted that approximately the same areas were included for ecological habitats, cultural resources, and flood-prone areas. The commenter argued that probable maximum flood areas should be ranked higher because they would then include areas affected by other discriminators. Another commenter suggested examining surface impoundments more carefully if the Ogallala would be as depleted as projected, necessitating new surface impoundments to provide drinking water.

3.8.1.2 Response

DOE is aware that approximately the same land areas are important as ecological habitats, cultural resources, and flood-prone areas. However it was necessary to consider each discriminator individually in determining priorities.

In selecting a site for a waste repository, the primary concern regarding surface impoundments is the potential adverse effect on the facility. A reservoir upstream could fail and flood the site or backwater from a downstream facility could inundate the site. Another concern would be some change in the subsurface hydrologic character of the area due to a major surface impoundment. The topographic character of the Deaf Smith and Swisher locations and upstream areas is such that construction of a large reservoir hazardous to the repository is very unlikely.

3.8.2 Tornadoes

3.8.2.1 Comment

Two commenters expressed concern that the effects of tornadoes were not adequately addressed. In particular, the use of incidence statistics was criticized, and effects on surface facilities and transportation casks were questioned.

3.8.2.2 Response

Information on the characteristics of tornadoes for the period 1950 through 1978 was obtained from the National Severe Storms Forecast Center in Kansas City, Missouri. According to the information obtained, 229 tornadoes were observed over the 29-year period in the 25,900 km^2 (10,000-square-mile) area encompassing Deaf Smith and Swisher counties. This represents about eight tornadoes per year. The intensity of the tornadoes seldom exceeded a Fujita-Pearson F value of 2, which is characterized by wind speeds of about 50 to 70 meters per second (113 to 157 mph) and considerable structural damage. Most of the tornadoes recorded have F values of either 0 or 1. These are characterized by wind speeds ranging from 18 to 50 meters per second (40 to 112 mph) and light to moderate structural damage (NUS, 1984b, p. 22). Sufficient information was recorded for 197 of these tornadoes to permit several probabilistic calculations. According to these data, a tornado can be expected to strike a point within the screened area about once every 7,400 years (NUS, 1984b, p. 22).

The containment building at a repository (called the waste handling and packaging facility--WHPF) would be designed to withstand a very severe tornado without releasing radioactive material. The containment buildings for existing nuclear power plants which must also meet NRC regulations, are routinely built to withstand very severe tornadoes. The effects of a tornado on other components of a repository surface facility will be evaluated during site studies. Conceptual designs for the WHPF specify tornado and earthquake resistant sections of the building, with walls and roofs constructed of 1.5-foot reinforced concrete. The central part of the WHPF, primarily under the hot cells, would be founded on an approximately 5-foot thick reinforced concrete mat. Once a specific site has been selected and the site-specific final design is complete, the actual size of these structural components will be specified. The design will be reviewed by the NRC as part of the licensing process.

Waste being transported by rail or truck will be in canisters that provide radiation shielding, as well as physical protection to the solid waste. This issue will be addressed in the environmental assessments and will continue to be studied specific to the three sites selected for site

characterization. This evaluation will include the potential risk associated with tornadoes.

3.8.3 Wind Speed

3.8.3.1 Comments

The use of Amarillo National Weather Service data in calculating the relative risk factor was questioned. One commenter believed that location-specific data should have been used. Another commenter said that wind travels in a northeasterly direction and would threaten Amarillo if an accident occurred. Others questioned the use of average wind speed, stating that extreme winds should be considered.

3.8.3.2 Response

To use the model in this report for estimating the relative population risk, three types of meteorological data are required: 1) average wind speed, 2) distribution of wind direction, and 3) stability classes (i.e. a measure of air quality diffusion characteristics). The nearest source of this information is the Amarillo National Weather Service (NWS) station approximately 28 miles east of the Deaf Smith location and 32 miles north of the Swisher location.

Because the topography between Amarillo and these locations is flat, the NWS station data is believed to be representative of the location and the candidate sites. A partial confirmation of the comparability of Amarillo to the sites is provided by meteological data from Vega, Tulia, Hereford, Canyon, Dimmit, and Silverton. Although these data are limited to temperature and precipitation, they show the relative similarity of these factors and comparable factors in Amarillo. Onsite meteorological data for a population risk analysis will only be available after the construction of a meteorological tower and a year of monitoring.

For the proposed Deaf Smith site, the wind blows from the west or west-southwest toward Amarillo twelve percent of the time. For the proposed Swisher site, the wind blows from the south or south-southeast toward Amarillo twenty-six percent of the time (NUS, 1984b, p. 35).

Following is a breakdown of wind speeds for the Amarillo area:

Wind Speed (mph)	Percent Occurence
0 to 1.00	1.0
1.01 to 3.50	0.6
3.51 to 7.50	11.7
7.51 to 12.50	31.8
12.51 to 18.50	37.1
18.51 to 24.0	12.3
24.0 or greater	5.4

Source: Amarillo National Weather Service Station Period of Record 1/1/76 to 12/31/80 (DOC, 1981a)

Two factors argue against performing a worst case analysis instead of using average wind speed:

- The relative risk factor is based on normal operational emissions on a year-round basis, 24 hours per day. A worst-case analysis would require that the diffusion model be run using a relatively low wind speed and very stable (i.e. stagnated) diffusion conditions. These conditions are very rare and such analysis would be more appropriate for a worst case analysis of the radiation exposure from an accident.
- The relative risk factor is used to divide each location into approximately two equal sections for the purpose of site selection. This division of the location and the relative shape of the division should not change even if a worst case analysis were performed.

The consideration of tornadoes is discussed in the preceding Section 3.8.2.

3.8.4 Transportation

3.8.4.1 Comments

Many commenters had concerns about the impact of constructing new roads or railroads to the site. They were concerned about the relative significance

of cost differences for various parts of the locations and the ranking of transportation considerations (proximity to railroads and highways). One questioned whether the priority 3 discriminators were relevant to convenience rather than safety. A commenter questioned the fact that proximity to highways and railroads was ranked above land use conflicts. Other commenters did not understand how apparent conflicts between discriminators could be resolved--such as the need to site a repository near roads and railroads to reduce disturbances from new construction versus the need to site the repository more than a mile away from the road for aesthetic reasons or to reduce risk presented by transporting non-radioactive-waste-related hazardous materials (e.g., chlorine gas to a water treatment facility). One commenter asked that DOE discuss the impact on landowners outside the site of acquiring land for rights-of-way. Other commenters asked about the condition of the existing railroad track.

3.8.4.2 Response

DOE recognizes that construction of a new road and railroad spur to the site would have impacts on adjacent property owners. The proximate transportation installations discriminator was not selected as a matter of making transportation links convenient, but because new railway and highway corridors could disrupt farming operations, natural areas, transportation patterns, and communities if not properly planned. The descriptor was identified as a means of reducing potential disturbance caused by road and railroad construction. Section 3.9.2.4 of the report states that each ten miles of new track may disturb 0.4 square mile (1 square kilometer) of land.

Differential cost impacts were not the reasons for selecting the proximate transportation installations discriminator. Compared to the range of potential socioeconomic effects of this project, the differential cost impacts from one potential site to another as the result of building an additional railroad and/or highway are not significant. (These potential socioeconomic impacts include potential effects of repository construction and operation related to labor force, housing, services, local government, community land-use patterns, population changes, etc.)

It is not clear in the question about the ranking of proximity to highways and railroads what the commenter meant by "land-use"; for example, ecological habitat is a land use that is a priority 1 discriminator. (See Chapter 5 for more information on the screening methodology.)

It is important to note that apparent conflict between discriminators is one reason for the need to prioritize the discriminators for the screening process.

Assigning a higher priority (priority 3) to the proximity of roads and railroads in order to reduce disturbances from new construction, indicates that this is thought to be a more important consideration than aesthetics (priority 5) and the hazards of transportation (priority 6). Despite the lower priority, none of these factors will be ignored during site characterization if the decision is made to proceed with those studies at a Texas site.

The impacts on landowners of acquiring land for rights-of-way will be discussed in the environmental assessment for each site. Transportation-related issues will also be discussed in the environmental assessments, and in the safety analysis report and environmental report that DOE will prepare for the NRC as part of the license application. At this time, a repository access route has not been identified for either candidate site.

Since a repository would not begin receiving waste until at least 1998, the current condition of the existing track is less important than the existence of rail rights-of-way.

3.8.5 Commercial and Industrial Installations

3.8.5.1 Comments

Commenters questioned the treatment of the industrial and commercial installations descriptor because it was not selected as a discriminator. Some cited the draft report's failure to mention Richardson Seed Company and Roll-a-Cone by name. Concern was expressed that the businesses could suffer even if located outside the control zone. It was noted that five of the nine sections in the originally identified Deaf Smith site are operated by Richardson Seed Company and that this operation should have been considered in the site identification process. One commenter claimed that 90 to 95 percent of the world's production of sorghum seed grain is within a 125-mile radius of Plainview, Texas, and that the Richardson Seed operation is a unique facility.

3.8.5.2 Response

The final draft of the report treats the industrial and commercial installations descriptor as a discriminator using logic steps 1, 2, 3, 5, and 6. This reflects two considerations:

(1) No determination has been made of what surface land uses would be allowed within the controlled area of the repository. (This determination will be made by the NRC as a part of construction authorization for the repository, as discussed earlier in this document.)

(2) As much flexibility as possible should be allowed in siting the surface facilities.

Industrial or commercial installations that are located on adjacent land and that could continue operations without significant impact to or from the repository were given lower priority as discriminators. Higher priority was not given to commercial surface facilities since it was assumed that any such facility could be moved if it were located within site boundaries. If any facility within the controlled area is required to relocate, federal regulations allow for compensation.

Commercial and industrial facilities outside of the controlled area would probably not be adversely affected by repository operation. The perception of risk is less quantifiable and business may be adversely affected despite assurances of the safety of the facility (see Section 3.9.2 of this document).

In preparing the February draft site report, it was decided not to identify any individual landowner or operation by name. As a "capital intensive operation", the location of the Richardson Seed Company was mapped on Figure 3-33 of Volume 1 of the February, 1984, draft as a "seed storage and small feedlot". Roll-a-Cone was mapped on Figure 3-33 of Volume 2 of the draft report as a "farm implement manufacturer".

In the revised report, the only portion of the Richardson Seed Company that remains within the site is in the northwestern-most section of this site. Most of the Richardson Seed Company, particularly the storage and processing facility, is now located outside the Deaf Smith site. However, the change of site in Deaf Smith County is based principally on consideration of more recent data on projected saturated thickness of the Ogallala aquifer (see Section 3.5.1 of this document). The proposed repository surface facility is projected to be located in the east central section of the nine-square-mile site. The distance between the two facilities is greater than one mile. Whereas DOE has stated that certain land uses may not be permitted in the controlled area, this controlled area has not been completely delineated, nor is it certain at this time whether all activities currently being conducted

within the surface area of the nine sections would be discontinued or allowed to continue. This determination will be made as part of the repository construction authorization by the NRC. Future investigations and discussions with landowners would be conducted to determine conflicting versus compatible land uses.

Maps indicate that there is obviously a large amount of sorghum seed production in the Texas Panhandle. According to estimates by an agricultural economist with Battelle Memorial Institute (who consulted with state, regional, and local experts), approximately 44,000 acres in the Texas Panhandle are devoted to sorghum seed production. Therefore, the production of sorghum seed by the Richardson Seed Company does not represent a unique operation within the Panhandle. Many of the features that are vital to the Richardson's operations are not incompatible with repository operation.

Due to reevaluation of the salt depth factor, the site in Swisher County no longer includes the Roll-a-Cone facility (see response in Section 3.6.1, "Salt Depth", in this document).

3.8.6 Gas and Transmission Lines

3.8.6.1 Comment

One commenter noted that the report did not show gas pipelines and transmission lines present in the site. DOE shows that there are no gas pipelines or transmission lines running through the site, when, in fact, there are gas lines and power lines in the site area.

3.8.6.2 Response

Only those gas lines with a diameter of four inches or larger and power lines of 69 kV or larger were mapped. Power or gas lines smaller than these, for example power lines or gas lines that run to individual homes or farmsteads, were not mapped.

3.9 SOCIOECONOMIC IMPACTS, DEMOGRAPHY

3.9.1 Impacts on Communities

3.9.1.1 Comments

Many commenters felt that insufficient attention was given to socioeconomic issues and that socioeconomic impacts should have been discriminating factors. In reaction to the statement in Section 3.10 of the draft report that "the magnitude of impacts on a specific community cannot be reliably determined until site characterization is complete", commenters noted that a detailed socioeconomic impact assessment should be done for communities prior to site characterization. It was argued that the magnitude of project impacts will vary between communities even though Section 3.10 stated that the same communities would be affected regardless of which part of the location is selected. Amarillo, for example, is capable of absorbing a population influx much more easily than Vega or Happy. Commenters said that there will be major differences among communities, regarding impacts on government services and social networks.

3.9.1.2 Response

Detailed socioeconomic impact analyses depend heavily on the location of a project site. Population size and distance from the project site influence (1) the number of new people moving to the area as a result of project employment demands, (2) the location of new residents, and (3) community service, fiscal, and social impacts as a result of new residents in communities near the site. A community's ability to absorb new population will vary as indicated by the commenters. It is the purpose of this document to find a site so that detailed impact analyses can be conducted if the site is selected for characterization. For the purpose of this siting document, it was necessary to consider a range of possible sites within the location. There would be some limited variation in the magnitude of impacts to specific communities when different sites within the location are considered. However, the same communities would be affected regardless of which site (within a Deaf Smith/Swisher location) is selected. The numbers of new workers and their families moving to the region cannot be differentiated when different sites within the location are considered. Thus, while it is important to determine impacts to specific communities after a site is selected, at this stage in the siting process, regional socioeconomic changes are not discriminating.

3.9.2 Effects on Agricultural Market

3.9.2.1 Comments

In reacting to the fact that "proximate industrial and commercial installations" was not selected as a discriminator, some commenters claimed that food processors in the area--such as Frito Lay, Arrowhead Mills, and Holly Sugar--have stated that a repository would hinder or eliminate their industries. Commenters also claimed that consumers' perceptions about products from the area would be ruined.

3.9.2.2 Response

While the perceived effects of a repository on the area's agricultural economy are important in the overall siting process, data do not exist which could be used for discriminating one part of a location from another for this factor. Therefore, it was not useful as a discriminator for narrowing to a nine-square mile site at each Texas location. Because the problem is one of perceived risk and product identification, it is a difficult subject to evaluate.

In its letter which discusses this issue, Frito Lay Corporation stated that if its sales were adversely affected by the presence of the repository, they would be forced to go elsewhere for its agricultural products. This is very different from the commenter's statement that "... Frito Lay ... (has) stated that a repository would severly hinder their business if not completely eliminate (it)". Arrowhead Mills, a local producer of health foods and natural food products, has expressed grave concern regarding the potential adverse effects of a repository on its image and sales.

3.9.3 Socioeconomic Impact Criteria

3.9.3.1 Comment

A commenter stated that the two criteria for socioeconomic impacts do not seem of equal importance. The second criterion seems to be a subset of the first.

3.9.3.2 Response

The first criterion ("the site shall be located so that adverse social and/or economic impacts resulting from repository construction and operation can be accommodated by mitigation or compensation strategies") encompasses a variety of impacts. Effects on population, economy, community service, fiscal, and social structure are considered to be part of this criterion. The second criterion addresses transportation and utility considerations ("the site shall be located so that adequate access and utility capability required for the repository either exists or can be provided without unacceptable impact on affected communities") and could be considered a subset of the first criterion. Many socioeconomic indicators were considered when these criteria were evaluated, including labor force, housing, services, local government, land-use patterns, population, railroads, highways, and utility lines. Each of these factors was evaluated separately in order to determine whether or not there were discriminating characteristics.

3.9.4 Population Risk Discriminator

3.9.4.1 Comments

Several commenters were concerned about consideration of the population risk discriminator. Some felt it indicated that DOE believes that the people in both locations are not important or that future generations are considered more important than the existing population. Commenters were also concerned that the population risk from transportation considerations was not selected as a discriminator. Another commenter noted that Amarillo and Canyon were not mentioned although they are closer to the northeastern portion of the location than Hereford. Because "health and safety" was not listed as a discriminator or descriptor, one commenter thought it was not considered. One commenter stated that there was no reason given for selecting the ten points shown in Figure 3-35, "Relative Radiological Risk from Routine Operations", and noted that none of the points was in the site area.

3.9.4.2 Response

Section 112(a) of the Nuclear Waste Policy Act of 1982 (NWPA) requires the siting guidelines to disqualify a site from consideration if any surface facility of the repository would be located (1) in a highly populated area or (2) adjacent to an area 1-mile-by-1-mile having a population of not less than

1,000 individuals. DOE must consider whether a potential site is in an area of low population density with minimal risks to populations. Deaf Smith County has an average population density of 14.1 persons per square mile. This is well below the national average of 64.0 persons per square mile, based on U.S. Department of Commerce statistics. Excluding Hereford, which is not within the location, rural population density drops to about 3.5 persons per square mile. Swisher County has a population density of 10.8 persons per square mile. Although Tulia is partially within the location, NWPA and program criteria would eliminate Tulia from siting consideration. The rural population density of the rest of the location would be approximately 3.6 persons per square mile. In no way does consideration of these factors (as required by the NWPA) mean that DOE considers area residents "unimportant". In fact, a primary purpose of the program is to protect public health and safety, including that of Panhandle residents, from the hazards posed by disposal of high-level radioactive waste in a repository.

Coupling the low population density with the variables considered in determining risk to the population from routine releases results in areas with relatively low risk. Not only would siting a repository in this low-risk area provide additional protection to the general population, but the low numbers of people potentially affected by routine releases would mean that very few people would likely be adversely affected by such releases, low expected doses notwithstanding.

The comment that the existing population is less important than future generations is addressed in the response to the comment about long-term health and safety (see Section 3.7.7 of this document). The comment is also an expression of concern that DOE does not adequately consider (1) penetrating and sealing an aquifer and the region's dependence on that aquifer and (2) potential releases of radionuclides from natural events such as tornadoes or floods, sabotage, or surface accidents. With the exception of potential accidents that result in risks to the population (as part of the demography descriptors), factors such as the presence of an overlying aquifer and extreme meteorological phenomena were not considered discriminators since all areas within the location could expect similar conditions. On the other hand, areas identified by the Corps of Engineers' HEC-2 model as being susceptible to inundation during a probable maximum flood would be avoided in selecting

potential sites. This approach results in the estimation of a floodplain area that is conservatively large relative to established weather records for the region.

As stated in the report, risk to population from transportation of waste to any potential site in the location is not significantly dependent upon site location. The purpose of selecting discriminators was to select factors which do show variation within the location. Since access to any potential site within the location is expected to be by the same major route, only the population present within the location boundary would be important in siting. It was also pointed out that the total population within the location is a very small fraction of the total number of people involved in any transportation route for waste to the Texas Panhandle. Determination and evaluation of routes outside of the location were beyond the scope of the report.

Although not specifically mentioned, the populations of both Amarillo and Canyon were considered in the analyses performed to determine population risk. Although a descriptor specifically called "health and safety" is not used, many descriptors are discussed and evaluated in terms of health and safety. The discriminator for long-term performance is a health and safety criterion, as well as such descriptors as presence of interbeds, gassy conditions, extreme meteorological phenomena, and population risk. In fact, a primary objective of DOE's civilian radioactive waste management program is to protect the public health and safety from the hazards posed by disposal of highly radioactive waste in a repository. The ten points in Figure 3-35 were chosen to provide an adequate number of risk values to establish the relative pattern of risk across the entire location. The points were chosen and analysis completed in order to provide input to the identification process. The fact that a point does not lie within the identified site has no impact on the identification process.

3.9.5 Population Statistics

3.9.5.1 Comments

A number of commenters challenged the validity of population statistics used in calculating population risk. These criticisms were based on anticipated population changes and the fact that seasonal and permanent work force population is far in excess of the average population density used in calcu-

lations. Two commenters were concerned that use of a population density criterion meant that DOE was not concerned about the welfare and safety of people in the vicinity. One commenter questioned the fact that Hereford was not included when calculating the rural population density for Deaf Smith County. Another claimed that population density does not decrease continuously toward the east.

3.9.5.2 Response

The population density estimates for the region were based on 1980 U.S. Census Bureau data. How this information was handled in the calculations of relative population risk is explained in Appendix C of the report. According to 1983 projections by the Texas Department of Water Resources (NUS, 1984d, pp. 12-18), the 12-county Texas area included in the relative population risk analysis will grow 13 percent during the 1980s and 10 percent during the 1990s. Projected population growth will be considered in the environmental assessments and future analyses required by the Nuclear Regulatory Commission.

The population risk factor is based on normal releases resulting from year-round 24-hour-per-day operation of the facility. Based on an average work year of 2,000 hours, the local work force of Roll-A-Cone and Richardson Seed Company will be near the site less than 25 percent of the time. This would reduce the effective population for both operations by a factor of four for the purposes of the risk calculation. A seasonal work force would have to be reduced by a larger factor to account for the relatively short period they are employed. Even if these nonpermanent populations were considered, they would not have significant influence on the outcome of the calculations. This is because the total population of the fourteen-county area used in performing these calculations is 351,728 (DOE, 1981b).

DOE is required by the Nuclear Waste Policy Act to consider population density in the siting of nuclear waste repositories (see response in Section 3.9.4). A primary purpose of the national civilian radioactive waste management program is to protect the public health and safety from the hazards posed by disposal of high-level radioactive waste in a repository. Every reasonable precaution will be taken and DOE will comply with federal safety standards and regulations.

Hereford was not included in the determination of the Deaf Smith County rural population density because it is not a rural area. It was included in

the estimate of population risk and will continue to be in the evaluation of the social, economic, environmental, and health factors.

3.9.6 Definition of "Acceptable" Radiation Risks

3.9.6.1 Comments

Several commenters asked what was meant by an "acceptable" level of risk of radiation exposure. One commenter referred to the phrase "some radiological exposure may be necessary to achieve long-term isolation" (see page 136 of Volume I of the draft report and page 134 of Volume II) as an example of DOE's alleged intent to use any means to keep the repository in operation. Others asked what is considered a routine release of radiation. One pointed out that the preferred area still contains points which have dosage estimates that are double those in other portions of the location.

3.9.6.2 Response

The NRC implements environmental radiation standards developed by the U.S. Environmental Protection Agency. DOE must comply with those standards. The proposed EPA standards were published in 1982 (EPA, 1982).

These proposed standards limit public doses during repository operations to:

25 rem whole body
75 rem thyroid
25 rem any organ.

In order to put this information in perspective, it is necessary to be able to relate these figures to naturally occurring radiation from cosmic rays, terrestrial curves, fallout and low levels of radiation found in food, water, and air. On an average annual basis, individuals in Deaf Smith and Swisher counties would receive about 95 millirems from these sources (NUS, 1984a). With information on average background radiation exposure and population data, it is possible to estimate the total annual population dose. For example, in Deaf Smith County, the annual population dose to the 217,000 people who lived within 50 miles of the center of the site in 1980 was 20,100 person-rem (sum of doses received by individuals who are located in a particular area of interest). Even the maximum doses expected under accident conditions are very small in comparison with the proposed regulations limiting

public doses published in the proposed EPA regulations (Title 40, Code of Federal Regulations, Part 191).

The radionuclides expected to be released during construction of a repository before waste arrives and during operation of a repository are shown in Tables 3-3 and 3-4, respectively. All radionuclides released during construction would be naturally occurring radon and its decay products. Radon occurs naturally in the earth; when the earth is mined, radon is released. This is true for conventional mines as well as for a repository. The total emissions expected from mining 39 million metric tons of salt over the eight-year repository construction period are shown in Table 3-3.

Radionuclide emissions from operation of a repository are listed in Table 3-4. Releases during operation are possible because of the possibility of damage to pins of spent fuel within casks arriving at the repository and from handling incidents prior to sealing of the spent fuel in air-tight packages. Samples taken from casks will detect damaged fuel pins before casks are opened in the waste handling building. When a cask containing damaged fuel pins is opened, venting will be required because of volatile radionuclides. For handling incidents, the volatiles would also be vented from within the waste handling building's hot cells. Calculations indicate that as many as six such pin failures may occur at the repository each year. The venting of the volatile radionuclides from these six possible pin failures is the basis for the release values presented in Table 3-4. The repository is expected to be in operation for approximately 26 years. It is important to emphasize that routine venting of gases in spent fuel pins is not planned. The only venting that will occur will be in the case of damaged fuel pins and it will be controlled to limits allowed by the EPA (EPA, 1982). If only solidified high-level waste is to be disposed of in the repository, there would be no such venting.

Measures can be taken to reduce the emissions from venting of damaged spent fuel pins. In this case, the emissions would be even lower than those stated in Table 3-4. The resulting collected radioactive material after further processing would be disposed of in the repository and would be an extremely small quantity of the total repository inventory.

To put these radionuclide emissions in perspective, it is possible to compare them to the amount of radiation received from naturally occurring

Table 3-3. Construction Radionuclide Emissions

Radionuclide	Total Release (Curies)	Release Rate (Curies per Second)
Radon-220	0.0074	0.000000000029
Radon-222	0.01	0.00000000004
Lead-210	0.00000088	0.0000000000000035
Lead-212	0.000011	0.000000000000044
Lead-214	0.01	0.00000000004
Bismuth-210	0.01	0.00000000004

SOURCE: ONWI, 1984.

Table 3-4. Operational Radionuclide Emissions

Radionuclide	Annual Release (Curies)	Release Rate (Curies per Second)
Hydrogen-3 (Tritium)	0.03	0.00000000095
Carbon-14	0.00024	0.0000000000076
Krypton-85	18.0	0.00000057
Iodine-129	0.00003	0.00000000000095

SOURCE: ONWI, 1984.

sources. If converted to doses of radiation to the maximum-exposed individual, the emissions for the repository construction period of eight years are anticipated to be approximately 0.0045 percent of the natural background radiation exposure rate. The possible repository operation-related emission rates are predicted to add less than 3/10 of one percent (0.28 percent) of the natural background rate. Therefore, when combined, the construction and operation emissions are approximately equivalent to one-fourth to one-third of one percent of the natural background radiation exposure rate.

Analysis of the effects of routine radiological releases during operation was conducted for spent fuel (impacts associated with the high-level waste and other radioactive materials are expected to be similar or lower). The maximum individual dose is estimated to be 0.00017 millirem per year to the whole body of a child, 0.076 millirem per year to the thyroid of an adult, and 0.0031 millirem per year to the skin of a child. These doses are well below the annual limits given in the proposed EPA regulations (Title 40, Code of Federal Regulations, Part 191), of 25 millirem to the whole body, 75 millirem to the thyroid, and 25 millirem to any other organ.

Using the model developed by the Committee on the Biological Effects of Ionizing Radiation (BEIR) of the National Academy of Sciences (BEIR, 1980), the radiation-induced health effects that might occur to the general public living within 50 miles of the repository in the year 2010 have been calculatd to be 0.000000092 excess cancer fatalities and 0.0000000078 genetic disorders.

The two-fold difference between the preferred area and other portions of the locations is not particularly significant because the dose to the maximum exposed individual is so much lower than EPA's proposed limit of 25 millirem to the whole body and the 95 millirem per year received from natural background radiation (NUS, 1984a).

4 MISCELLANEOUS COMMENTS

4.1 EDITORIAL COMMENTS

4.1.1 Comments

"In the Deaf Smith County volume, Figure 1-1 fails to show FM 2587 extending through the identified site. The mistake is repeated on Figure 4-6. Interestingly, Figure 3-34, the map showing pipelines and roads, does depict the true placement of FM 2587. These comments are made to indicate the sloppiness and inaccuracy found throughout these reports and previous ones as well."

Page 6. Figure 1-1 does not show that FM 2587 continues through the identified site area. The road also is omitted from Figures 3-31 and 4-6."

Response

These figures have been corrected in the final report.

4.1.2 Comment

"Page 22. What are 'services'?"

Response

"Services", in this context, means community services that are provided by local governments or other institutions. These may include services such as public transportation, schools, health care facilities, and garbage collection. The phrase has been changed to "community services" in the final report.

4.1.3 Comment

"Page 33 -- The continuing sloppiness and inaccuracy of DOE's documents is readily apparent when overlaying Figure 3-17, page 69, regarding borehole locations onto Figure 3-2a. None of the borehole locations coincide on the two figures, the J. Friemel well 'moves' about a mile and the Woodford #1 well is inside the location in Figure 3-17 to outside the location on Figure 3-2a."

Response

Distortions are the result of the duplication process. Figures 3-17 and 3-2a of Volume I have been corrected in the final report.

4.1.4 Comment

"Page 33 -- Figure 3-2a is not consistent with Figure 3-36 of the draft AGCR nor with Figure 4-8 of the LRR, so DOE must explain the discrepancies and why this 'new' version is more accurate than the previous ones. DOE must also explain why these discrepancies occur."

Response

Figure 3-2a in final report has been revised and more closely approximates Figure 4-8 of the LRR.

4.1.5 Comment

"Figures 3-25, 3-26, 3-27, 3-28, and 3-30 have been omitted from the manuscript."

Response

We were unaware that any copies of ONWI-531 were missing figures. We apologize for the incident and hope that it did not affect any other reviewers' copies.

4.1.6 Comment

Several commenters noted that, due to poor reproduction quality, Figures 3-33, 3-36, and 3-38 were poorly labeled and that the legends needed to be improved.

Response

These figures have been upgraded graphically in the final report.

4.1.7 Comment

"Page 133 -- Regarding the actual size of the site area, refer to the comments on page 14 above. In the next to last line of the text, it should read: 'the objective of this overlay/....'/"

Response

This typographical error has been corrected in the final report.

4.1.8 Comment

"The entire report is repeated and contradictory. It could have been made in a few short pages, thus costing the taxpayers considerable less."

Response

DOE does not believe the report is contradictory. DOE also does not believe that the information could have been presented in a "few short pages". Any attempt to do so could have severely impaired the reader's ability to understand the process, rationale, and results of the site identification. Repetition was an attempt to aid the reader, instead of forcing the reader to refer to earlier chapters or other documents.

4.1.9 Comment

"18/(2.24) What does the statement consideration is given to the extent of subsurfaces data mean?"

Response

In the final report this section was revised to read: "The location of existing wells is considered in the evaluation. Additional information is developed from seismic data and the geologic literature."

4.1.10 Comment

"Figure 3-27a--'Counter Interval' should be 'Contour Interval'. Once again, well control data have 'moved' over a mile."

Response

Figure 3-27a does not appear in the final report.

4.1.11 Comment

"A. The Swisher County earthquake map (Volume 2, p. 79) should be extended to the south."

Response

The map does not need to extend further south for the purposes of this report. A similar map in the Area Geological Characterization Report (Figure 5-1) indicates that no earthquake activity has been reported for the area immediately south of Swisher County.

4.1.12 Comment

Section 4.3.2, Site Geohydrology, p. 149. Following the last line on the page, some comment should be made regarding the Dockum Group. Data from Fink, 1963 (High Plains Underground Water Conservation District No. 1, Rpt. 163) suggests that ground-water flow within the Dockum Group is also east-southeast (Figure 2, Rept. 163).

Response

Reference to the suggested ground-water flow direction and to the Fink, 1963, report is made on page 29 of the final report.

4.2 LACK OF NOTICE PRIOR TO MEETINGS

Comment

A few commenters stated that property owners within the nine-square-mile sites were given inadequate notice of the meetings held on March 20 and 21 to explain the site identification.

Response

Two sets of meetings were held in the vicinity of the nine-square-mile sites to explain the site identification. The first set of meetings, March 20 and 21, was scheduled principally to inform people who owned property or lived within the nine-square-mile sites that the report designated their property. This immediate notification was done as a courtesy to these people, so they could have the information first-hand before public dissemination of the report. DOE felt it was important that affected landowners not learn of the site designation first through media coverage, and that they should have an opportunity to have their immediate questions answered. The timing made the two-day notice necessary, and DOE regrets the inconvenience this caused people in the communities. Early copies of the report were made available, and property owners, as well as the media and public, were briefed on its contents.

DOE also explained that public meetings would be held later after people had an opportunity to review the report. These two public meetings, information exchanges, were held May 1 and 3 in Vega and Tulia to discuss the site identification report in detail. The format, locations, and dates for those meetings were planned in cooperation with local leaders who attended a planning session on April 3.

DOE believes that, although property owners received short notice of the March meetings, it was important to discuss the draft report's contents with site owners and residents prior to its release.

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House, A. G.	1.2.2*
Johnson, J.	1.2.2*
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Kleuskens, Helen	1.2.2*, 3.2.2
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Liebowiz, Marty	1.2.2*
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McBride, Justin	1.2.2*
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McGavoch, F. L.	1.2.2*
McGinnis, Jenny	1.2.2*
Miller, Lula	1.2.2*
Mitchell, Frances	1.2.2*
Nevins, Melissa	1.2.2*
Northcott, Betty	1.2.2*
Raymond, Brenda	1.2.2*
Raymond, Steve	1.2.2*
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Richardson, Donald	1.2.2*, 3.1.2, 3.5.1, 3.5.2, 3.5.4, 3.9.4, 3.9.6
Richardson, Jeanette	1.2.2*
Richardson, Wayne	1.2.2*, 3.1.2, 3.5.1, 3.5.2, 3.5.4, 3.9.4
Roberts, Juanita	1.2.2*
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Seth, John	1.2.2*, 3.9.4
Slaton, Nina	1.2.2*
Sluder, Lena	1.2.2*
Smith, Donald	1.2.2*, 3.1.2, 3.3.1, 3.5.2, 3.5.8, 3.5.10, 3.6.2
Spaw, Steve	1.2.2*
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Vineyard, James	1.2.2*
White, Philip	1.2.2*
Womack, Tommy	1.2.2*
Woods, Elizabeth	1.2.2*

List of Organizations, Businesses, and Government Agencies That Submitted Comments

Names of individuals who presented comments are in parentheses. These can be found in the preceding index of commenters.

Agriculture Stabilization & Conservation Service
Deaf Smith County (Fuston)

Agriculture, Texas Dept. of, Dist. 1 (Lamb, Gibson)

Agriculture, Commissioner of (Hightower)

Air Control Board, Texas (Spaw)

Central Plains Regional Hospital (Woods)

4-H Club (Nivens, Logan, Fletscher)

General Land Office (Mauro)

Governor, Office of the Texas (Frishman)

Health, Department of, Deaf Smith County (Revell)

Health, Texas Department of (Bernstein)

Hector & Associates (see POWER, STAND)

High Plains Water Conservation District (Smith)

Historical Commission, Texas (Herrington)

House, (of Representatives) Speaker of the (Texas) (Lewis)

J. N. Montgomery Farms (McClurg)

League of Women Voters of Texas (Keever)

Legislative Council, Texas (Kuykendall)

Northwest Texas Clergy and Laity Concerned (Converse)

POWER, STAND (Formby, Hector, Hancock, Kleuskens)
see Hector & Assoc.

Roll-A-Cone (Wylie Byrd)

Richardson Seed Farm (Richardson, Auckerman)

Senate, Texas (Doggett)

STAND (Hancock, Hector, Delbert Devin)
See Hector & Assoc.

Soil and Water Conservation Board, Texas State (Davis)

Swisher County Commission, Precinct 2
(Johnson, McGavoch, Vineyard, Boggs)

Texas Advisory Commission on Intergovernmental
Relations (Reed)

Texas Wheat Producers Assoc. (Harmon,
Johnson, McGavoch, Boggs, Vineyard)

Tulia Industrial Board of Directors (Anderson)

Tulia Chamber of Commerce (Anderson)

Tulia Creek Soil & Water Conservation District
(Chenowith, Burelsmith, Devin, Hodges, Herring)

U.S. Representative, Texas 19th Dist. (Ruiz, Hance)

Water Resources, Texas Department of (Knowles)

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