See folder for just the copy of the cover of this document.

J. Pearring from K. Wahi

Comments on the Swisher County Site Draft EA



| Comment Number | Comment |
|---|---|
| 3.1 | **Section 3.2.3.2 Site Specific Stratigraphy Page 3-26, Relatively little flexibility in locating repository depth**<br><br>The repository host rock thickness is estimated to be between 36 m (120 ft) and 42 m (140 ft) near the site. This is substantially less than for the Davis Canyon (DC) or Lavender Canyon (LC) site where it is approximately 200 ft. The EA's for DC and LC sites claim that a 200 ft thick host rock allows considerable (~ 100 ft) flexibility. By comparison, a 120-140 ft thick host rock only permits 20-40 ft flexibility which may not be sufficient. |
| 3.2 | **Section 3.2.6.1 Geomechanical Properties Page 3-56 to 3-59, Rock quality weak based on strength classification**<br><br>The mean compressive strength, which is the only value reported for the Lower San Andres Unit 4 salt, is 22 MPa. This value would rate the rock as "weak" according to the Deere & Miller (1966) Classification. |

3.3 Section 3.2.6.1 Geomechanical Properties
Page 3-60 and 3-62,
Questionable application of creep data in preliminary design

The vast differences (more than an order of magnitude) in the reported creep rates of salt from different sites, as shown in Figure 3-33, raises serious questions about the utility of generic creep test data in preliminary design applications. Differences in the experimental procedures may partially account for the reported disparity in the creep rates. Until the spread becomes narrower, only site-specific data should be used for design.

3.4 Section 3.2.6.1 Geomechanical Properties
Page 3-63,
Available data insufficient (even contradictory) to support consistency and predictability of lithologies

Statements in the first paragraph under subsection 3.2.6.1.2, Lithostratigraphic Characterization, regarding the consistency and predictability of lithologies are in contradiction with data from the Zeeck No. 1, Harmon No. 1, and Federal No. 1 Grabbe wells. On page 3-35 it is stated that, "A 6-meter (20 foot) layer of anhydrite overlies the carbonates in the Harmon and grabbe wells but is not present in the Zeeck well."

3.5 <u>Section 3.2.6.1 Geochemical Properties Pages 3-63, 3-64, 3-71 and 3-72, Missing figure and table make verification difficult</u>

Figure 3-34 is illegible which makes it difficult to see the correlation between the Zeeck and Harmon wells.

Table 3-8 has no data which, again, makes the intercomparison and interpolation among the three wells difficult.

3.6 <u>Section 3.4.3.4 Severe Weather</u>
<u>Page 3-196,</u>
<u>Improper data base used to establish maximum rainfall</u>

The stated maximum 24-hour rainfall of 16.5 cm is noted to have been exceeded on several occasions in the area. The text suggests that this may be an artifact of the larger areal data bases and the specific data periods used to develop these parameters. Why not use the appropriate areal data base and the specific periods that <u>would</u> result in a conservative estimate of the rainfall parameter?

3.7 <u>Section 3.4.3.4 Severe Weather</u>
<u>Pages 3-196 and 3-197,</u>
<u>Fastest mile wind underestimated?</u>

Why is the fastest wind speed exclusive of tornado related wind speeds? The 85 miles per hour value given for the fastest wind speed is substantially lower than either the upper limit of Fujita Pearson F value of 1 (112 mph) or the entire range for F value of 2 (113-157 mph). Tornadoes of such intensity apparently do occur in the area.

| Comment Number | Comment |
| --- | --- |
| 4.1 | <u>Section 4.1.1 Field Studies</u><br><u>Page 4-8,</u><br><u>Inadequate documentation on the nature of borehole backfill</u><br><br>The backfilling of boreholes is mentioned in the first paragraph. Given the long-term performance requirements, should the site become a repository location, what specifications are envisioned for the backfill material in these exploratory boreholes? |
| 4.2 | <u>Section 4.1.1.2 Engineering Design Studies</u><br><u>Page 4-21,</u><br><u>Insufficient description of EDBH activities</u><br><br>The discussion on the EDBH (4.1.1.2.2) is very limited considering the impor tant function it has in the design and construction of the exploratory shaft. What is the diameter of the hole? What specific geotechnical data will be |

obtained and how will it be plugged if it does not lie within the perimeter of the exploratory shaft?

4.3 <u>Section 4.1.2 Exploratory Shaft (ES)</u>
<u>Page 4-23</u>,
<u>Distance to highway not provided</u>

In paragraph 3, the access road is stated as being 1.6 km long, presumably the distance to the nearest two-lane hard-surfaced state or county road. Does this county road connect to a highway? What is <u>that</u> distance?

4.4 <u>Section 4.1.2.2 Construction</u>
<u>Page 4-36,</u>
<u>Lack of justification for the size selection of sediment detention pond</u>

Paragraph 3, what is the basis for sizing the sediment detention basins to provide a 1-hour retention period for a 13-cm rainfall in a 24-hr period?

4.5 <u>Section 4.1.2.3 Testing</u>
<u>Page 4-49,</u>
<u>Inadequate number and insufficient types of at-depth tests</u>

Only three basic tests are planned for the at-depth in-situ testing activity. No tests are mentioned that would determine the in-situ moduli, strength, potential anisotropy or variability in the geomechanical properties over the repository dimensions. Apparently, no tests are planned related to demonstration of retrievability. A more complete discussion is recommended.

| Comment Number | Comment |
| --- | --- |
| 4.6 | <u>Section 4.3.2 Alternate Exploratory Shaft Construction</u><br><u>Pages 4-134 to 4-137,</u><br><u>Inadequate consideration of important issues in comparing shaft sinking methods</u><br><br>The drill-and-blast and large-hole-drilling (LHD) methods are stated as being roughly equivalent in terms of their environment inmpact. The decision to select the LHD method appears to have been based primarily on its anticipated shorter construction time. However, the opportunity to gather geologic and geotechnical data during shaft construction is sacrificed when using the LHD method. Considering the purpose and scope of the exploratory shaft facility, the additional data that could be obtained when using the drill-and-blast technique would constitute a major advantage in terms of site characterization. |

| <u>Comment Number</u> | <u>Comment</u> |
| --- | --- |
| 5.1 | <u>Section 5.1.1.3 Repository Shafts and Ventilation System</u><br><u>Page 5-13,</u><br><u>Future utility of the Exploratory Shaft</u><br><br>Possible utility of the exploratory shaft (ES) as one of the five proposed |

shafts is not addressed. There appears to be no reason why the ES cannot be modified to become one of the repository shafts.

5.2 Section 5.1.1.4 Repository Subsurface Facilities
Page 5-15,
Inadequate discussion of passageway design

Five horizontal passageways are planned for various functions. The cross-section of these passageways is given as approximately 9m (wide) x 5m (high). The extraction ratios in the vicinity of these passageways are not given but are important to stability. Further, the planned 5m height may not be adequate for the spent fuel containers.

5.3 Section 5.1.2.1 Construction Schedule and Personnel
Page 5-18,
Shaft completion schedule unclear

It is unclear whether it will take 39 months to construct the service shaft alone or all five shafts. Figure 5-6 (p. 5-19) only names the service shaft under "Shafts and Facilities Develop ment," and yet the schedule chart on the same figure shows the beginning of waste emplacement as an activity after seven years. If the waste shaft is not completed at that time, how can emplacement begin?

5.4 <u>Section 5.1.2.4 Shafts and Facilities Development</u>
<u>Page 5-26,</u>
<u>Incomplete consideration of shaft linings</u>

What lining (if any) would be used for the salt strata? After the concrete lining is cast to a given horizon, wouldn't subsequent drill-and-blast operations jeopardize the integrity of the liner already in place?

5.5 <u>Section 5.1.2.5 Underground Development</u>
<u>Page 5-29,</u>
<u>Lack of supporting data for estimates in Table 5-4</u>

It is not clear what portions of the shafts contribute to the estimated 485,000 tons of excavation during construction (Table 5-4). No information is provided on how the amount of re-excavation (scaling) was estimated. Presumably, one needs a good estimate of the expected closure during operation. Since the creep deformation is difficult to quantify, it would be equally difficult to quantify the necessary amount of scaling.

5.6 <u>Section 5.1.3.3 Retrievability</u>
<u>Pages 5-34 and 5-35,</u>
<u>Cursory treatment of licensing issue</u>

The discussion on Retrievability is extremely cursory. No information is provided on whether sufficient technology exists to carry out a safe retrieval option or whether new technology would have to be developed. How would the packages be located if rooms have been backfilled? Is the design of retrieval equipment flexible enough to allow retrieval of tilted packages?

| Comment Number | Comment |
|---|---|
| 5.7 | <u>Section 5.1.4.2 Subsurface Activities Page 5-36, Lack of data on plug seals for isolation of shafts from storage rooms</u><br><br>In an extremely limited discussion, the use of plug seals is mentioned as a way to isolate the shafts from the waste storage rooms. What are the dimensions of the seals? What materials are used in their construction? What performance specifications are imposed in their design? |

| Comment Number | Comment |
|---|---|
| 6.1 | <u>Section 6.2.1.4 Meteorology, Guideline 960.5-2-3, Page 6-33 and 6-38, Internal inconsistency in finding potentially adverse conditions 960.5-2-3(c)(1) and (2)</u><br><br>In Table 6-5, the two potentially adverse conditions are not found. This contradicts the statement on p. 6-38 |

which says that, "Potentially adverse conditions as defined above do exist for the Swisher site." The discussion on p. 6-38 following the quoted statement (on p. 6-38) supports the finding of one of the two potentially adverse conditions.

6.2 <u>Section 6.2.1.4 Meteorology</u>
<u>Page 6-34,</u>
<u>Contradictory statements regarding atmospheric conditions</u>

The second paragraph under the heading, "<u>Atmospheric Transport and Diffusion Conditions</u>," has two sentences that contradict each other. One sentence claims that, ". . . neutral conditions are predominant in the area (D Stability), especially during summer months, . . ." The next sentence says that, "In the summer (June to August), unstable conditions (A, B, and C Stabilities) increase."

6.3 <u>Section 6.2.1.8 Transportation, Guideline 960.5-2-7,</u>
<u>Page 6-80,</u>
<u>Acceptability of non-radiological risk</u>

The repository lifetime risks from the transport of waste to the site is estimated to be 14. Is this an acceptable level of risk?

6.4 **Section 6.2.1.8 Transportation, Page 6-81 Information lacking on weight limits**

The weight capacities or weight limits of the access route and other highways to be used for transportation are not addressed. The existing limits may be too low and may require upgrading that is not planned for.

6.5 **Section 6.2.1.8 Transportation Pages 6-74 and 6-82, Internally inconsistent data on construction of new railroad that impacts cost estimates**

In the analysis of favorable conditions, Table 6-9 shows that the second favorable condition (960.5-2-7(b)(2)) is not found, which is consistent with the text on p. 6-82. However, whereas the table shows that 6.4 km of railroad would be required to reach the AT&SF mainline, construction of 42 km of railroad is necessary according to the last paragraph on p. 6-82.

6.6 **Section 6.2.1.8 Transportation Page 6-83, Questionable finding of favorable condition 960.5-2-7(b)(3)**

Access to the nearest railroad system is 10.3 km according to the text for analysis of the third favorable condition.

This distance is not in agreement with either of the numbers (6.4km and 42km) mentioned in the previous item. If the correct distance is 42 km, then the finding of a favorable condition is in error.

6.7 <u>Section 6.2.1.8 Transportation</u>
<u>Pages 6-76 and 6-89,</u>
<u>Internally inconsistent data and findings of 960.5-2-7(c)(1)</u>

An inconsistency exists between the findings stated in Table 6.9 and p. 6-89 regarding Potentially adverse Condition (1). The table shows the condition as not found, whereas the text on p. 6-89 states that a potentially adverse condition exists. Further, the cost in comparison to other sites (using the same $3.5 million figure for estimated cost) is stated as "less than at many of the other sites" in the table and as "greater than at several of the other sites" in the text on p. 6-89!

6.8 <u>Section 6.2.1.8 Transportation</u>
<u>Pages 6-89 and 6-90,</u>
<u>Unsupported non-finding of adverse condition 960.5-2-7(c)(4)</u>

According to DOE's analysis, Potentially Adverse Condition (4) is "not found." This determination does not appear to be valid because the risk to public health and safety (deaths) estimated for the

Swisher site is equal to or higher than four other salt sites, only Davis Canyon and Lavender Canyon sites have risks higher than Swisher County site.

6.9 <u>Section 6.3.1.1 Geohydrology</u>
<u>Page 6-123,</u>
<u>Location of nearest aquifer below repository uncertain</u>

It is not obvious from figures in Chapter 3 that the upper Wolfcamp is the nearest aquifer below the repository. The travel time might be substantially shorter if another aquifer exists between the repository horizon and the upper Wolfcamp.

6.10 <u>Section 6.3.1.1 Geohydrology</u>
<u>Pages 6-125 and 6-127,</u>
<u>Deletion of certain favorable conditions in revised guidelines</u>

Favorable conditions 960.4-2-1(b)(4) and (7), as they appear in the draft EA, have been eliminated from the siting guidelines (revised May 14, 1984).

6.11 <u>Section 6.3.1.1 Geohydrology</u>
<u>Page 6-128,</u>
<u>Inadequate analysis of adverse condition, 960.4-2-1(c)(3)</u>

The analysis of Potentially Adverse Condition (3) is incomplete and inadequate. Dissolution effects and brine pockets are likely to be present. The present data base is inadequate to presume their absence. Recommend that the conclusion regarding this condition be modified to reflect these uncertainties. The claims that faults can be accommodated in basinal models is unsupported.

6.12 <u>Section 6.3.1.1 Geohydrology</u>
<u>Page 129,</u>
<u>Erroneous conclusion regarding favorable conditions</u>

Subsection 6.3.1.1.6 (<u>Conclusion</u>) incorrectly states that the site complies with <u>all</u> favorable conditions listed in the Geohydrology Guideline. Specifically, Favorable condition 960.4-2-1(b)(2)is not found.

6.13 <u>Section 6.3.1.3 Rock Characteristics</u>
<u>Pages 6-141 and 6-146,</u>
<u>Internally inconsistent finding of 960.4-2-3(c)(2)</u>

Table 6-16 on p. 6-141 shows that Potentially Adverse Condition (2) is not found. However, the first paragraph on p. 6-146 contradicts that finding. The analysis evaluates the increase in the assumed porosity due to dehydration of clay minerals and finds that the resultant "decrease in saturation may result in delamination of clay-rich interbeds and an overall weakening of the rock mass." This would suggest that a potentially adverse condition does exist.

6.14 <u>Section 6.3.1.3 Rock Characteristics Pages 6-144 and 6-145, Lack of justification for selecting a point value of creep strain rate</u>

Large uncertainties are associated with the first three assumptions on p. 6-144, as is pointed out in the EA. However, Assumption #7 assumes a point value (0.085 per million seconds) for a creep strain rate for the repository host rock. No justification or reference is given for this choice. A more appropriate choice would be a range of values that reflects the uncertainty in the creep data as well as the inherent uncertainties of other assumptions.

6.15 <u>Section 6.3.1.3 Rock Characteristics Pages 6-147 and 6-148, Finding of Favorable Condition 960.4-2-3(b)(2) not supported by the data presented</u>

Whereas rock salt is known to have a high thermal conductivity, the value quoted for Permian salt (1.5-2.4 W/mK) is not particularly high. Likewise, the coefficient of thermal expansion for salt is relatively high compared to most other rocks. Paragraph 1 on p. 6-148, in spite of stating a correct numerical value, would have the reader believe that salt has a low thermal expansion coefficient. It is difficult to justify the finding of Favorable condition (2) given that: 1) the thermal conductivity of permian salt is not high, 2) coefficient of thermal expansion is high, and 3) the healing and sealing of fractures induced by construction is probably offset by potential microcracking in the drift walls (as observed at the WIPP facility).

6.16 <u>Section 6.3.1.3 Rock Characteristics Page 6-148, Assessment of rock strength not supported by data</u>

Last paragraph on this page states, "Rock strengths and elastic moduli are sufficiently high . . ." This assessment is not supported by the data given in Table 3-2, which would classify the strength of the Palo Duro salt as weak to moderate according to the Deere and Miller classification.

6.17 <u>Section 6.3.3.2 Rock Characteristics, Preclosure Guideline 960.5-2-9 Page 6-209, Internally inconsistent data on thickness of host salt sequence</u>

The salt horizon in the lower San Andres Unit 4 is stated as being "more than 48 meters (160 feet) thick at the site, . .

." in paragraph 3 of p. 6-209. This contradicts statements made in other chapters of the document. For example, on p. 3-26, the bottom paragraph says that, "The host salt sequence is between 36 meters (120 feet) to 42 meters (140 feet) thick near the site." If the statement on p. 3-26 is correct, then not only is the claim made on p. 6-209 wrong, but the degree of flexibility in selecting the repository horizon within that salt unit is much more restricted and the finding of Favorable Condition 960.5-2-9(b)(1) may be significantly diluted.

6.18 Section 6.3.3.4 Tectonics
Pages 6-222 and 6-223,
Misplaced paragraph(?)

The bottom paragraph on p. 6-222 apparently belongs to an EA for a domed salt site. The discussion given is irrelevant to bedded salt. Suggest that the paragraph be deleted.

6.19 Section 6.4.2.1 Performance of Engineered Barriers
Pages 6-246,6-250, and 6-252,
Contradictory conclusions regarding impact of brine on waste package performance

In the first paragraph on p. 6-246, the statement is made that, "Section 6.4.2.1.3 shows that waste package performance depends more on brine migration than on any uncertainty in expected thermal conditions (see Jansen, 1984)." However, a contradictory statement appears in the second paragraph on p. 6-252 when it is stated, "Jansen (1984) and Section 6.4.2.1.3 show that these differences in the accumulated brine do not significantly impact the performance of the waste package." A clarification is needed regarding these statements.

The quantities of accumulated brine indicated in the second paragraph on p. 6-252 disagree with those shown in Figure 6.4.2.1-5 (p. 6-250). It appears that the numbers on p. 6-252 are in error; 0.17 should be 0.86, and 0.086 should be 0.45 cubic meter.

6.20 <u>Section 6.4.2.1 Performance of Engineered Barriers</u>
<u>Page 6-256,</u>
<u>Inadequate analysis of the impact of corrosion by-product (hydrogen)</u>

Item 2 (<u>Brine Flow Rate</u>) alludes to 271 cubic meters of hydrogen gas per centimeter of steel overpack thickness dissolved. Where does this gas go? Large pressure build-ups are conceivable given that the permeability of salt is low and there are no large gaps or cavities to accommodate the corrosion by-products. Recommend that DOE address this potentially adverse situation.

6.21 <u>Section 6.4.2.1 Performance of Engineered Barriers</u>

<u>Page 6-265,</u>

<u>Uncertain data utilized to arrive at relatively deterministic conclusions</u>

Using relatively uncertain point values of corrosion rates, the claim is made that corrosion stops indefinitely after 2.3 cm of the 5.0 cm corrosion allowance for CHLW and 1.3 cm of the 2.5 cm allowance for SFPWR. Yet applying all of the available brine to roughly 50% of the overpack surface, failure may be expected in approximately 220 years using the same corrosion rates. It is unlikely that corrosion will occur uniformly across the package surface. The approach used does not appear to be sufficiently conservative. The margin of safety is too small given the large uncertainties in the corrosion rate data and in the assumed manner in which corrosion would occur.

6.22 <u>Section 6.4.2.1 Performance of Engineered Barriers</u>

<u>Page 6-269,</u>

<u>Questionable assumption of uniform corrosion</u>

Paragraph 3 points out that the effect of gas evolution from the corrosion process on the package integrity has not yet been considered. It is possible that the presence of hydrogen gas may alter the mode and/or rate of corrosion such that the assumption of uniform corrosion at specified rates is not conservative.

6.23 Section 6.4.2.1 Performance of Engineered Barriers
Page 6-275,
Over-reliance on limited solubility limit data

In summarizing the performance of engineered barriers, reliance is placed on the solubility limits of various radionuclide elements to limit the release at the package to within EPA limits. How reliable are these solubility limits? Has their dependence of temperature been measured or even considered?

6.24 Section 6.4.2.2 Performance of Shaft Seals
Page 6-276,
Simplifying assumptions may preclude adverse findings with regard to increased ground water flow

In evaluating the performance of shaft seals, preliminary analyses by INTERA (1984) and Gureghian et al. (1983) are shown to result in very small groundwater flow around and through the shaft-seal system. We note that the analysis by Gureghian et al. made simplifying assumptions that may have precluded adverse findings. Salt dissolution due to intruding water was ignored and it was assumed that the disturbed zone around the shaft perimeter is negligible. Both of these effects would tend to increase the ground-water flux.

for J. Pearring
from K. Wahi

Deaf Smith Site

| Comment Number | Comment |
|---|---|
| 3.1 | Section 3.2.6.1 Geomechanical Properties<br>Page 3-62,<br>Applicability of creep data to<br>preliminary design<br><br>No creep data were obtained by Pfeifle (1983) for cycle 4 salt in the vicinity of the Deaf Smith site. The only cycle 4 salt creep data are from the No. 1 Rexwhite in Randall County (approximately 80 km away) and No. 1 Grabbe well in Swisher Country (roughly 120 km away). Given the large spread in the creep rate data for salt from different locations, the applicability of these data for site-specific preliminary design is questioned. |
| 3.2 | Section 3.2.6.1 Geomechanical Properties<br>Pages 3-64 and 3-65<br>Illegible figure depicting stratigraphic<br>profile between wells<br><br>Figure 3-31 has been reduced to a degree where is is impossible to read. Statements in text regarding consistency and predictability of stratigraphy cannot be confirmed. |

3.3 <u>Section 3.2.6.2 Thermal Properties</u>

<u>Pages 3-75 through 3-77,</u>

<u>Poor correlation between thermal conductivity data</u>

Whereas the other thermal properties for the Permian salt are in fairly good agreement with the "typical values" reported in Table 3-11, the thermal conductivity shows relatively large variations. The average conductivity value measured at 100°C is 3.15 W/mK (with a range of 2.05 to 3.67), but the "typical value" at 100°C is 5.28 W/mK (Gevantman, 1981). This discrepancy needs explanation. A majority of the predictions (to date) of thermal response for a salt repository have used typical rather than site-specific data. Caution must be exercised when predicted maximum temperatures are used to evaluate the potential for phenomena such as thermal cracking.

3.4 <u>Section 3.2.7.1 Geochemical Properties of Host Rock</u>

<u>Page 3-78,</u>

<u>Lack of solubility data and effects of geochemistry on rock properties</u>

No solubility data are provided in this discussion. Neither is there a mention of changes in mechanical properties due to geochemical effects.

3.5 Section 3.4.3.4 Severe Weather
Pages 3-196 to 3-197,
Improper data base used to establish maximum rainfall

The stated maximum 24-hour rainfall of 16.5 cm is noted to have been exceeded on several occasions in the area. The text suggests that this may be an artifact of the larger areal data bases and the specific data periods used to develop these parameters. Why not use the appropriate areal data base and the specific periods that would result in a conservative estimate of the rainfall parameter?

| Comment Number | Comment |
|---|---|
| 4.1 | Section 4.1.1 Field Studies<br>Pages 4-2 and 4-3,<br>No plans for hydrofracturing tests to measure in-situ stresses |

Table 4-1 summarizes the various field test activities. There is, however, no mention of hydrofracture testing in any of the numerous boreholes that will be drilled.

4.2 <u>Section 4.1.1.1 Basic Geologic and Hydrologic Studies</u>
<u>Page 4-21,</u>
<u>Search techniques not thorough</u>

Searching for boreholes is planned by walking the site with hand-carried geophysical tools, etc. A more productive approach might be to seek the cooperation of oil companies and local governments in providing records of exploration activities.

4.3 <u>Section 4.1.2.2 Construction</u>
<u>Pages 4-31 to 4-39,</u>
<u>Long-term performance of seals not addressed</u>

Placement of polymer seals at various horizons is described in a limited fashion. No performance requirements, particularly for the long-term performance, are discussed. Will the performance of these seals be monitored in any way?

4.4 <u>Section 4.1.2.3 Testing</u>
<u>Pages 4-48 and 4-49,</u>
<u>Inadequate number and insufficient types of at-depth tests</u>

Only three basic tests are planned for the at-depth in-situ testing activity. No tests are mentioned that would determine the in-situ moduli, strength, potential anisotropy or variability in the geomechanical properties over the repository dimensions. Apparently, no tests are planned related to demonstration of retrievability. A more complete discussion is recommended.

4.5 Section 4.3.2 Alternate Exploratory Shaft Construction
Pages 4-134 to 4-137,
Inadequate consideration of important issues in comparing shaft sinking methods

The drill-and-blast and large-hole-drilling (LHD) methods are stated as being roughly equivalent in terms of their environment impact. The decision to select the LHD method appears to have been based primarily on its anticipated shorter construction time. However, the opportunity to gather geologic and geotechnical data during shaft construction is sacrificed when using the LHD method. Considering the purpose and scope of the exploratory shaft facility, the additional data that could be obtained when using the drill-and-blast technique would constitute a major advantage in terms of site characterization.

| Comment Number | Comment |
|---|---|
| 4.6 | Section 4.3.2 Alternate Exploratory Shaft Construction<br>Page 4-136,<br>Larger finished ES diameter for drill-and-blast alternative more useful<br><br>The finished ES diameter for the drill-and-blast method is 12 feet versus 10 feet for the LHD method. The larger inside diameter will, no doubt, provide more flexibility and larger capacities for a number of activities. |

| Comment Number | Comment |
|---|---|
| 5.1 | Section 5.1.1.3 Repository Shafts and Ventilation System<br>Page 5-15,<br>Height of passageways too small?<br><br>The corridor for waste transport (as well as other passageways) will be 5 m high. This height may not be sufficient for the transport of spent fuel canisters in the vertical position. |
| 5.2 | Section 5.1.2.3 Onsite Development<br>Pages 5-24 and 5 25,<br>Lack of information on disposition of non-salt excavated materials<br><br>Whereas salt stockpiles are described in adequate detail, no information or plan is discussed for the disposition or storage of non-salt rock/soil excavated during shaft construction. |

5.3 **<u>Section 5.1.2.5 Underground Development</u>**

**<u>Pages 5-27 and 5-29,</u>**

**<u>Lack of basis for estimating re-excavation quantities</u>**

Table 5-4, among other data, lists the quantity of re-excavation (scaling) necessary to maintain geometry of the openings. How was this estimated? Given the uncertainty in estimating the creep deformation, the reported quantity of re-excavation must be regarded as a guess.

5.4 **<u>Section 5.1.3.3 Retrievability</u>**

**<u>Page 5-34,</u>**

**<u>Inadequate discussion of a licensing issue</u>**

The discussion on Retrievability is extremely cursory. No information is provided on whether sufficient technology exists to carry out a safe retrieval option or whether new technology would have to be developed. How would the packages be located if rooms have been backfilled? Is the design of retrieval equipment flexible enough to allow retrieval of tilted packages?

5.5 **<u>Section 5.1.4.2 Subsurface Activities</u>**

**<u>Page 5-36,</u>**

**<u>Inadequate description of backfill materials</u>**

After backfilling a shaft with salt to the top of the salt formation, the backfilling of the remaining non-salt strata is planned by filling "further with impermeable materials and seals, ..." What are these impermeable materials? Would the liner be first removed? Will there be an attempt to make the backfill compatible with the surrounding rock?

| Comment Number | Comment |
|---|---|
| 6.1 | Section 6.2.1.4 Meteorology<br>Pages 6-33, 6-38, and 6-39,<br>Internally inconsistent conclusions regarding potentially adverse condition<br><br>Table 6-5 (p. 6-33) shows Potentially Adverse Conditions 960.5-2-3(c)(1) and (2) as "not found." However, the analysis on pages 6-38 and 6-39 does not support the above finding. In fact, the conclusion on p. 6-38 states that "potentially adverse conditions defined previously do exist for the Deaf Smith site." |
| 6.2 | Section 6.2.1.8 Transportation<br>Page 6-80,<br>Impact of land-acquisition costs not considered<br><br>In the discussion for the Qualifying Condition, the cost data presented do not include land acquisition. Whereas this in itself may not disqualify the site, intercomparison of sites from a cost perspective must include such costs |

because they can be substantial. Not doing so might give this site an unfair advantage over another.

6.3 <u>Section 6.2.1.8 Transportation</u>
<u>Page 6-87,</u>
<u>Estimated cost shown on this page incorrect</u>

The discussion for the first potentially adverse condition includes an estimated rail line construction cost of $3.6 million. This number should be $18.6 million. Table 6-11 on p. 6-86 does show the correct figure.

6.4 <u>Section 6.2.1.8 Transportation</u>
<u>Pages 6-88,</u>
<u>Unsupported non-finding of adverse condition 960.5-2-7(c)(4)</u>

According to DOE's analysis, Potentially Adverse Condition (4) is "not found." This determination does not appear to be valid because the risk to public health and safety (deaths) estimated for the Swisher site is equal to or higher than four other salt sites, only Davis Canyon and Lavender Canyon sites have risks higher than Swisher County site.

6.5 Section 6.2.1.8 Transportation
Pages 6-76 and 6-88
Internally inconsistent finding regarding Potentially Adverse Condition 960.5-2-7(c)(3)

In Table 6.9 (p. 6-76), the third potentially adverse condition associated with "Transportation" is listed as being "found." The start of the analysis on p. 6-88 under Highway and Railroad Upgrading, however, states the same condition as "not found." The remainder of the analysis on p. 6-88 seems to support the finding of the table, i.e., potentially adverse condition is found

6.6 Section 6.3.1.1 Geohydrology
Page 6-128,
Inadequate analysis of adverse condition, 960.4-2-1(c)(3)

The analysis of Potentially Adverse Condition (3) is incomplete and inadequate. Dissolution effects and brine pockets are likely to be present. The present data base is inadequate to presume their absence. Recommend that the conclusion regarding this condition be modified to reflect these uncertainties. The claims that faults can be accommodated in basinal models is unsupported.

6.7 **Section 6.3.1.1 Geohydrology**
**Page 129,**
**Erroneous conclusion regarding favorable conditions**

Subsection 6.3.1.1.6 (Conclusion) incorrectly states that the site complies with all favorable conditions listed in the Geohydrology Guideline. Specifically, Favorable condition 960.4-2-1(b)(2)is not found.

6.8 **Section 6.3.1.3 Rock Characteristics**
**Page 6-145,**
**Questionable assumption with respect to creep strain rates**

Large uncertainties are associated with the first three assumptions on p. 6-144, as is pointed out in the EA. However, Assumption #7 assumes a point value (0.085 per million seconds) for a creep strain rate for the repository host rock. No justification or reference is given for this choice. A more appropriate choice would be a range of values that reflects the uncertainty in the creep data as well as the inherent uncertainties of other assumptions.

6.9 **Section 6.3.1.3 Rock Characteristics**
**Pages 6-145,**
**Internally inconsistent finding of 960.4-2-3(c)(2)**

Table 6-16 on p. 6-141 shows that Potentially Adverse Condition (2) is not found. However, the last paragraph on p. 6-145 contradicts that finding. The analysis evaluates the increase in the assumed porosity due to dehydration of clay minerals and finds that the resultant "decrease in saturation may result in delamination of clay-rich interbeds and an overall weakening of the rock mass." This would suggest that a potentially adverse condition does exist.

6.10 <u>Section 6.3.1.3 Rock Characteristics Pages 6-147 and 6-148, Improper interpretation of data in finding favorable condition</u>

Core tests on Palo Duro salt indicate a thermal conductivity range of 1.5 to 2.5 W/mK. This range does not represent a particularly high thermal conductivity, considering generic values for salt with a range of 3 to 5 W/mK (Roy et al., 1981). The discussion tends to minimize the effect of thermal expansion by quoting total expansion, instead of emphasizing the fact that rock salt has a coefficient of expansion that is much higher than that for other rock types under consideration. These two factors, when properly considered, would lower the confidence in the favorable finding of 960.4-2-3(b)(2). See Comment 3.3 for a more detailed analysis.

6.11 Section 6.3.1.3 Rock Characteristics
Pages 6-149 and 6-150
Unsupported non-finding of Potentially Adverse Condition 960.4-2-3(c)(2)

See Comment 6.9 of this review.

6.12 Section 6.4.2.1 Performance of Engineered Barriers
Pages 6-245, 6-249, and 6-252
Contradictory statements regarding importance of brine migration; errors in reported values of accumulated brine

In the second paragraph on p. 6-245, the statement is made that, "Section 6.4.2.1.3 shows that waste package performance depends more on brine migration than on any uncertainty in expected thermal conditions (see Jansen, 1984)." However, a contradictory statement appears at the end of first paragraph on p. 6-252 when it is stated, "Jansen (1984) and Section 6.4.2.1.3 show that these differences in the accumulated brine do not significantly impact the performance of the waste package." A clarification is needed regarding these statements.

The quantities of accumulated brine indicated in the first paragraph on p. 6-252 disagree with those shown in Figure 6.4.2.1-5 (p. 6-249). It appears that the numbers on p. 6-252 are in error; 0.17 should be 0.86, and 0.086 should be 0.45 cubic meter.

6.13 Section 6.4.2.1 Performance of Engineered Barriers
Page 6-254,
Inadequate analysis of the impact of corrosion by-product (hydrogen)

Item 2 (Brine Flow Rate) alludes to 271 cubic meters of hydrogen gas per centimeter of steel overpack thickness dissolved. Where does this gas go? Large pressure build-ups are conceivable given that the permeability of salt is low and there are no large gaps or cavities to accommodate the corrosion by-products. Recommend that DOE address this potentially adverse situation.

6.14 Section 6.4.2.1 Performance of Engineered Barriers
Pages 6-263 and 6-267,
Uncertain data utilized to arrive at relatively deterministic conclusions

Using relatively uncertain point values of corrosion rates, the claim is made that corrosion stops indefinitely after 2.3 cm of the 5.0 cm corrosion allowance for CHLW and 1.3 cm of the 2.5 cm allowance for SFPWR. Yet applying all of the available brine to roughly 50% of the overpack surface, failure may be expected in approximately 220 years using the same corrosion rates. It is unlikely that corrosion will occur uniformly across the package surface. The approach used does not appear to be sufficiently conservative. The margin of safety is too small given the large uncertainties in the corrosion rate data and in the assumed manner in which corrosion would occur.

6.15 Section 6.4.2.1 Performance of Engineered Barriers
Page 6-270,
Questionable assumption of uniform corrosion

Paragraph 1 points out that the effect of gas evolution from the corrosion process on the package integrity has not yet been considered. It is possible that the presence of hydrogen gas may alter the mode and/or rate of corrosion such that the assumption of uniform corrosion at specified rates is not conservative.

6.16 Section 6.4.2.1 Performance of Engineered Barriers
Page 6-278,
Over-reliance on limited solubility limit data

In summarizing the performance of engineered barriers, reliance is placed on the solubility limits of various radionuclide elements to limit the release at the package to within EPA limits. How reliable are these solubility limits? Has their dependence of temperature been measured or even considered?

6.17 Section 6.4.2.2 Performance of Shaft Seals

Page 6-279,

Simplifying assumptions may preclude adverse findings with regard to increased ground water flow

In evaluating the performance of shaft seals, preliminary analyses by INTERA (1984) and Gureghian et al. (1983) are shown to result in very small ground-water flow around and through the shaft-seal system. We note that the analysis by Gureghian et al. made simplifying assumptions that may have precluded adverse findings. Salt dissolution due to intruding water was ignored and it was assumed that the disturbed zone around the shaft perimeter is negligible. Both of these effects would tend to increase the ground-water flux.

For John Buckley (from K. Wali)

General Remarks on the Draft EA

1. There are many sections that contain a note saying that it would be revised extensively or it is being written. The [illegible] of those sections is [illegible] limitation.

2. [illegible]
it appears [illegible] should [illegible]
to be [illegible]).

3. Only [illegible] technology [illegible]
to determine [illegible]
No structural or thermo-mechanical [illegible]
have been discussed in any detail. No [illegible]
techniques or [illegible] described [illegible]
design [illegible] application

4. Unlike the [illegible] EA's, this EA does not ~~[illegible]~~ summarize in [illegible]
[illegible] determination [illegible]
[illegible]
[illegible] disqualifying [illegible]. In most
[illegible] done [illegible]
[illegible]. In many [illegible] the

[illegible] stated [illegible] with any [illegible] confidence.

ii. Problems associated with high [illegible] stresses have not received appropriate attention in this document.

Nirex Comments on the Draft Longlands EA

| Comment Number | Comment |
| --- | --- |
| 2.1 | Chapter 2 Summary<br>P. 2-vii,<br>Misleading statement regarding the thickness of candidate horizon<br><br>Since the [illegible] [illegible] to [illegible] [illegible] intersection of a [illegible], it is misleading to state that [illegible] of the candidate horizon is [illegible] [illegible] the [illegible] [illegible] thick [illegible] [illegible] thickness of the [illegible] flow is [illegible] (~~[illegible]~~ [illegible] ~~the~~ RFL-2 (Wintergill [illegible]). |
| 2.2 | Section 2.2.4.1 [illegible] Alternative to the R.[illegible]<br>Page 2.12,<br>[illegible] description of in-situ [illegible] data<br>A range [illegible] given [illegible] the ratio of [illegible] to vertical [illegible] for [illegible] RFL-2. However, the depth |

(or [illegible]) at which these measurements were obtained is not given. In-situ stress should be an important consideration in the selection of a preferred horizon. Yet, a preliminary selection has been already made, although in-situ stress was not determined for all candidate [illegible]

2.3 Section 2.2.4.3 Application of expert judgement to the candidate repository horizons:

Page 2-67,

[illegible] candidate horizon suitable

The [illegible] thickness data from [illegible]-2 do not support the assertion on page [illegible] that, "all [illegible] candidate horizons identified through this study are considered to be suitable candidate repository horizons." The [illegible] [illegible] 4 [illegible] especially if the [illegible] ~~to~~ utilize the vertical emplacement concept. [illegible] [illegible] of [illegible] 25.5 [illegible]

[illegible] 4

[illegible]

Rock Characteristics Disqualifying Analysis

Page 2-74,

Anticipated [illegible] contingent uncertain construction method

The second paragraph [illegible] ... b[illegible] ... [illegible] predicted [illegible] blind hole drilling [illegible] excavation. [illegible] with [illegible] its [illegible] ... [illegible] the [illegible] ... [illegible] commitment [illegible] not [illegible] made to use this [illegible] method of construction. It [illegible] turn out that this [illegible] in basalt. So, if the [illegible] method of [illegible] has to be used ([illegible]) [illegible] the [illegible] to [illegible] possible?

| Comment Number | Comment |
| --- | --- |
| 3.1 | Section 3.2.2.7 [illegible] Alignment<br>Page 3-34.<br>Zone of [illegible] not shown on Figure 3-12<br>[illegible]<br>[illegible]<br>[illegible]<br>not [illegible] number of other features<br>[illegible] the<br>paragraph can [illegible]<br>Figure [illegible]<br>[illegible]<br>[illegible]<br>has been left out inadvertently! |

[illegible] Number | Comment

4.1 Section 4.1.2 Exploratory Shaft

Pages 4-8 and 4-9.

Inadequate documentation of ES activities

A note is included in this [illegible] ... [illegible] of the method to [illegible]. However [illegible] it is [illegible] design of the [illegible] will not [illegible].

Figure 4-2 is blank therefore the overall conceptual arrangement cannot be commented on.

4.2 Section 4.1.2.1 Construction

Page 4-8.

No justification for [illegible] or no damage to host rock

Regardless of method of construction, it is naive to expect that little or no [illegible] host rock will occur beyond [illegible] perimeter [illegible]. Except [illegible]

[illegible] there is no basis [illegible] (presently) to justify the assumption that [illegible] will cause any [illegible] (the [illegible]) the surrounding [illegible]. Specifically, given the [illegible] horizontal [illegible] characteristic of the Hanford site [illegible] [illegible] [illegible].

4.3 Section 4.1.2.1 Construction

Page 4-1.

[illegible] of ES [illegible]

A finished diameter [illegible] 6 feet is planned for the first exploratory shaft. This diameter is too small to carry out the [illegible] exploratory [illegible] and [illegible] use the shaft [illegible] 5 [illegible].

4.4 Section 4.1.2.1 Construction

Page 4-8 and 4-11,

Unclear discussion of drill [illegible] [illegible] [illegible] and [illegible]

It is not [illegible] enough to say that in the [illegible]: "[illegible] the [illegible] [illegible] will be [illegible] conditioned with [illegible] circulation material ...". How will this be done? What would be the source of such material?

Section [illegible]

Page [illegible].

No discussion on [illegible] of seals at [illegible] aquifer

There is no mention of [illegible] of [illegible] placement of [illegible] any [illegible] aquifer. [illegible] the revised write-up [illegible] address this important part of [illegible] construction. Grouting along [illegible] of the aquifers.

Section 4.1.2.1 Construction

Page 4-11,

[illegible]

[illegible]

There [illegible] steps [illegible] taken to [illegible] [illegible]

[illegible] ground, [illegible] wells [illegible] from [illegible] with the [illegible] rock [illegible] will [illegible] impossible [illegible].

4.7 [illegible] 4.1.2.2 [illegible]

[illegible] 21.

[illegible]

[illegible]

[illegible] sity [illegible] thermal [illegible] site [illegible].

4.8 Section 4.1.2.2 In-situ [illegible] Tests

Page 4-1 [illegible]

Test pl[illegible] de[illegible] a [illegible]

C[illegible] -hole [illegible] included [illegible] the [illegible] p[illegible]

However, no [illegible] exist to demonstrate the [illegible] and [illegible] of [illegible] package [illegible] conditions.

2.0 Section [illegible] Alternative [illegible] Activity [illegible]

[illegible]

A [illegible] for the [illegible] method. [illegible]

[illegible] this [illegible] may [illegible] be [illegible]. [illegible] BWIP [illegible] it [illegible] ?

11.10

[illegible] A[illegible]

Page[illegible] and [illegible]

Inadequate disposal [illegible] of bird [illegible]

Practically no disadvantages are pointed out for the selected shaft [illegible] A [illegible]

[illegible] ~~the~~ better [illegible] the [illegible] is lost with this method. Another disadvantage [illegible] the adverse environmental [illegible] pumps [illegible]

| Comment Number | Comment |
| --- | --- |
| 5.1 | Section 5.1.1 [illegible] Phasing<br>[illegible] 5-2 to 5-6.<br>[illegible] should [illegible] conceptual design [illegible]<br>The [illegible] city, the [illegible] [illegible] to [illegible] [illegible] [illegible] given. It [illegible] not [illegible] in [illegible] detail [illegible] design. |
| 5.2 | Section 5.1.2 Description of Existing Conceptual Design<br>Page 5-6.<br>[illegible]<br>Figure [illegible] the [illegible] the [illegible] pipe [illegible] the [illegible]. [illegible] no information is given [illegible] design. Do the [illegible] exist today [illegible] [illegible] [illegible] |

Would a change in the emplacement scheme require major [illegible] changes in the transportation? How many will be [illegible], etc.?

5.3

<u>Section 5.1.2 Description of Existing Conceptual Design</u>

[illegible]

The description of the conceptual emplacement process [illegible] the placement [illegible]

[illegible]

[illegible] . The [illegible]

[illegible] in this case. A [illegible] plan needs to be [illegible] anticipated [illegible] under the adverse [illegible] conditions. [illegible]

[illegible] What [illegible] the [illegible]

5.4 [illegible]

[illegible] 5-20,

[illegible]

A [illegible] given [illegible] would be [illegible] will [illegible] be [illegible] as [illegible] pin placed [illegible] No dis[illegible] various [illegible] [illegible]. The [illegible] pass[illegible] the staple will be [illegible]. Will [illegible] shall be [illegible] the [illegible] design [illegible] 70,00[illegible] MTHM ?

5.5 Section 5.1.3 [illegible]

Studies

[illegible]

[illegible]

[illegible]

Accord[illegible] "[illegible]" [illegible]

[illegible]. The [illegible] shaft [illegible] [illegible] for the repository is 12-ft [illegible] diameter. [illegible] [illegible] a 14-ft [illegible] for operational [illegible]. This [illegible] significantly [illegible] than the planned ^long^ shafts [illegible] the [illegible]

[illegible]

[illegible] not [illegible]

[illegible].

5.6 Section 5.1.3 [illegible]

[illegible]

[illegible] for [illegible]

[illegible]-hole [illegible]

al[illegible]

The p[illegible]

[illegible] the large [illegible]

for all [illegible] the repository shafts. The [illegible] planned construction method for repository shafts in salt media is the conventional drill-and-blast. Why ~~are the~~ is the [illegible] plan different? especially ~~t~~ since [illegible] large-hole drilling limits the size of the [illegible] [illegible] [illegible] to a considerable extent?

5.7 Section 5.1.3 Ongoing Engineering Studies

Page 5-24,

Insufficient discussion of equipment & limitations.

N[illegible] [illegible] the criteria that [illegible] optimize the waste emplacement configuration. Aside from stating that [illegible] horizontal [illegible] offers [illegible] advantages over long holes, the nature of the advantages is not addressed. How will these horizontal holes be drilled? Can such "openings" be maintained long enough without collapse?

| Comment Number | Comment |
| --- | --- |
| 6.1 | Section 6.3.1.1 Geohydrology<br>Pages 6-43 and 6-44,<br>Distance to accessible environment not necessarily 10 km<br>It is not certain whether the distance to the accessible environment will be a [illegible] value [illegible].<br>If quantification of ground-water travel times is not possible ~~(as stated)~~ at this time (as stated), then there is even a greater uncertainty [illegible] —<br>year criterion for a shorter distance to the accessible environment. |
| 6.2 | Section 6.3.1.1 Geohydrology<br>Pages 6-113 to 6-116,<br>No conclusions on Favorable Conditions 960.4-2-1(b)(1), (2), and (3)<br>Inspite of a reasonably long discussion on the three favorable conditions for geohydrology, no conclusions are offered with respect to their finding [illegible].<br>The general impression one |

gets from the discussion is that each of these conditions has considerable uncertainty associated with it.

6.3 Section 6.3.1.1 Geohydrology Pages 6-46 and 6-47, Inadequate representation of hydrologic effects due to glaciation

Table 6-2 outlines possible hydrologic effects of potential geologic or climatologic processes. The stress loading can also cause opening of vertical fractures and thus cause an increase in the near surface vertical permeability. In addition, the elastic rebound upon unloading (i.e., when the glacier retreats) can give rise to transient tensile stresses that could cause an increased permeability.

6.4 Section 6.3.1.1 Geohydrology Page 6-48, Effective thickness range not consistent with effective porosity range

The effective thickness for the McCoy Canyon flow top is estimated to range between $2 \times 10^{-3}$ m to $3 \times 10^{-3}$ m.

However, the effective porosity range is given as between 1.0 and 0.01 percent, a two orders-of-magnitude spread.

It is noted that a more recent version of the Siting Guidelines has deleted Favorable Condition (4) as it existed previously ~~for~~ and has combined it with Favorable Condition (5) from before. The "old" Favorable Condition (7) has also been deleted in the revised version.

6-57 <u>Section 6.3.1.1 Geohydrology</u>

<u>Pages 6-57 and 6-58,</u>

<u>Discrepancies in the flow direction and path lengths unexplained</u>

Of the first three studies cited that evaluate potential flow path and travel time, two indicate a northward flow path (12 to 16 km) to the Columbia river with different estimates of travel time. The third study showed a ground-water flow path of 60 km to the southeast. The near reversal of predicted flow direction needs to be explained. Which one is more credible ?

6.6 Section 6.3.1.1 Geohydrology

Page 6-61,

Test to determine effect of drilling mud not mentioned in Section 4.1

The outline of planned field testing given on p. 6-61 includes tests to determine the effect of drilling mud on hydraulic test results. However, there is no mention ~~or discussion~~ of such tests in the more detailed discussion on testing in Section 4.1.

6.7 Section 6.3.1.3 Rock Characteristics

Pages 6-2[illegible] to 6-25,

Lack of consistency between text and data

The statement in paragraph [illegible] on page 6-2[illegible] regarding the thermal expansion coefficient of Columbia River Basalt Group is not supported by the data in the tables. In general, the thermal expansion coefficient of basalt is comparable to other rocks such as tuff and granite. It is an order of magnitude lower than that of salt. So the assertion that basalt has a "high thermal expansion" property is incorrect. Therefore, most of the discussion on page 6-82 is [illegible] or irrelevant.

The thermal property [illegible] Table 6-6 need to be qualified as to whether the samples were dry, wet, or saturated.

6.8 Section 6.3.1.3 Rock Characteristics, Page 6-84.

Assertions regarding certain material behavior without basis

The second paragraph on page [illegible] contains a statement that the ductility of a material generally becomes more noticeable at higher temperatures and pressures. Whereas this is true for temperature it is not the case with higher pressures. The yield strength of rocks typically increases with pressure up to a point, and [illegible] a problem.

The third paragraph states that; "Interaction between the host rock, ground water, and elevated temperature may improve the isolation characteristics of the host rock." Whereas [illegible] mineralization (due to [illegible] [illegible]) [illegible] [illegible] [illegible] [illegible] [illegible] potentially [illegible] processes that ~~[illegible]~~ could [illegible] [illegible] the isolation characteristics have not been mentioned. For example, thermal cracking [illegible] [illegible] with temperature, increased solubility [illegible] certain radionuclides etc. [illegible] [illegible] in the present context.

6.9 [illegible] 6.3.1.3 Rock Characteristics

Page 6-92.

Lack of reference(s) for the [illegible] behavior and numerical values

Paragraph 2 on [illegible] [illegible] analyzes the progressive roof failure based on [illegible] [illegible] assumed bulking behavior and assigns numerical values to the bulking [illegible] might be expected. However, no references are given that would support the assumption and [illegible] analysis presented.

6.10 <u>Section 6.3.1.3 Rock Characteristics</u>

<u>Page [illegible]</u>

[illegible]

The [illegible] paragraph [illegible] states that "dehydration is only expected to occur in the [illegible] [illegible] portion of the disturbed rock zone [illegible]". No studies or data are cited to support this speculation. One should expect dehydration to occur wherever the hydraulic pressure is low enough and temperature high enough which could be the case within the blast damage zone.

6.11 <u>Section 6.3.1.3 Rock Characteristics</u>

<u>Page 6-91,</u>

<u>[illegible]</u>

<u>assessment studies</u>

In [illegible] the conclusion [illegible] the qualifying condition, [illegible] credit to the "favorable results of long-term thermal-hydrological performance assessment studies." What are these studies? What favorable results did they have? No document or report is referenced.

6.12 Section 6.3.1.7 Tectonics

Page 6-[illegible],

No supporting evidence for the claim that mines are not damaged by certain earthquakes

Studies, reports, case histories need to be cited to back up this statement!" Empirical data indicate that mines and mined tunnels are not adversely affected by earthquakes large enough to cause damage (often severe) to surface buildings and facilities.

6.13 Section 6.3.1.7 Tectonics

Page 6-[illegible].

Determination of adverse condition 960.4-2-7(c)(4) internally inconsistent

The fact that "seismic activity

within the Columbia Plateau occurs less frequently and at lower magnitudes than in other areas of the "Pacific Northwest" would seem to imply that a potentially adverse condition does not exist. The document, however, reports that "this potentially [illegible] condition [illegible]."

Sec[illegible] 5.[illegible].2

6.14 ^ [illegible] Ch[illegible] ([illegible]) Pages 6-136 [illegible] 6-139, Internally inconsistent [illegible] of rock quality

The [illegible] paragraph [illegible] 6-1[illegible] [illegible] the following [illegible]: "Using the 'Q' System, the rock mass quality of the Cohassett flow dense interior [illegible] classified as 'very poor' to '[illegible]'." This [illegible] by [illegible] statement on page [illegible] that states, "However, the [illegible] rock mass in the dense interior is not the type of rock commonly associated with long-term ground control problems as in the [illegible] of shales, evaporites, and other rocks with [illegible] rock mass quality [illegible]." Moreover, without the experience in having deep underground mines in basalt, how can anything be said about the ground control problems in basalt?

6.15 Section 6.3.3.2 Rock Characteristics (960.5-2-9)

Page 6-148

Control of water inflow pathways to be altered by construction method not currently planned

Item # 1 ... "Water inflow under high pressure", states that grouting, freezing, or dewatering can be used to seal or control inflow from high water producing areas during construction of shafts by drill-and-blast methods. Elsewhere in the document, only the large-hole drilling method is included in the construction plans.

6.16 Section 6.3.3.2 Hydrology

Page 6-152,

Lack of specific example(s) in underground openings in environment similar to basalt

The discussion under 'Evaluation process' claims that, "A number of underground openings ...

been constructed in [illegible] media and are operating under comparable stress field and hydrologic conditions estimated for the [illegible] repository location." Specific examples are needed to support this assertion. Also the degree of support and [illegible] [illegible] [illegible].

6.17 <u>Section 6.3.3.3 H[illegible]</u>

<u>Page [illegible]</u>

<u>Estimated water usage [illegible]</u>

The [illegible] minute [illegible] rather high. [illegible] roughly a million gallons per day during repository construction operations, and surface facility support. What are the [illegible] impacts of such large quantities of water being used [illegible] decades?

6.18 <u>Section 6.3.3.3 Hydrology</u>

<u>Page [illegible]</u>

<u>Inadequate discussion of seal emplacement</u>

at aquifer horizons

The discussion for the analysis of the potentially adverse condition suggests that the same cement grout would be used to seal off the aquifers as that used to fill the annulus between the casing and rock. The sealing of aquifers is likely to require special measures or different kinds of seals. Although the salt EA's mention chemical seals, it is not clear whether the basalt site plans the use of similar technology. The last statement of the third paragraph (section 6.3.3.3.4) mentions that zones of water inflow during repository construction can be detected and grouted off in advance of tunneling. It is not clear how the detection would be made and whether, after grouting, such zones would not be tunnelled any further.

6.19 Section 6.3.3.4 Tectonics

Pages 6-155 and 6-157,

Internally inconsistent statements regarding presence of active faults

On p. 6-155, under the discussion of the Evaluation process of the Qualifying condition (960.5-2-11(a)), Paragraph 4 states that, "Tectonically active faults do not appear to be present in the reference repository location based on ~~the~~ existing data and interpretations." This is contradicted on p. 6-157 by the finding of Potentially Adverse Condition 960.5-2-11(c)(1) and other data under subsection 6.3.3.4.4.

6.2 [illegible]

Section 6.3.4.1 Preclosure Ease and Cost of Construction, Operation and Closure (960.5-1(a)(3)).
Pages 6-158 to 6-160,
Questionable interpretation of cost data; requirements may be in excess of reasonably available technology
[illegible] is used [illegible] the [illegible] of [illegible] site [illegible] it has a much higher cost estimate than any of the other sites. It [illegible] that [illegible] the cost estimates of [illegible] and [illegible]

[illegible] the same.

The [illegible] paragraph under section 6.2.4.1.2 [illegible] "Studies [illegible] underway to determine technology requirements to [illegible] stable [illegible]" [illegible] [illegible] [illegible] is adequate?

[illegible] Section [illegible] Description of [illegible] Analysis Methodology

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Data required for probabilistic analysis [illegible]

A methodology is [illegible] described in the document for [illegible] analysis. Assigning [illegible] probability distributions to [illegible] involves having a large data base. Assuming that sufficient data exist for the [illegible], probability of event (or scenarios) is still needed. The [illegible] of [illegible] data have not been defined, [illegible] point values of probability may not suffice; probability distributions for specific events may [illegible] to be generated. What [illegible] the plans and methods to obtain [illegible] the necessary probability data?