

To: R. Browning



Department of Energy

Yucca Mountain Project Office
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WBS 1.2.5.2.2
QA: N/A

DEC 13 1990

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**U.S. DEPARTMENT OF ENERGY (DOE) RESPONSES TO COMMENTS IN THE STATE OF NEVADA'S
MAY 30, 1989, LETTER ON THE EXPLORATORY SHAFT FACILITY (ESF)**

Enclosed are responses to comments on the ESF received by letter dated May 30, 1989, from the State of Nevada. Enclosure 1 provides responses to those comments which followed DOE's request for early comments applicable to the ESF during the formal site characterization plan comment period. The comment package was divided into 58 comments, which are identified in Enclosure 2. Further explanation of how the comments and responses are presented can be found in the forward to Enclosure 1.

DOE appreciates the comments by the State of Nevada and the opportunity to further explain those aspects of the ESF and the Site Characterization Plan commented upon. Responses identify any actions that are planned, or have already been taken to address the comments. Many of the concerns raised are addressed further in the Technical Assessment Review (TAR) Record Memorandum for "Geologic and Geophysical Evidence Pertaining to Structural Geology in the Vicinity of the Proposed Exploratory Shaft," and the TAR Record Memorandum for the Title I Design Acceptability Analysis. The ESF Alternatives Study, which was begun in February 1989, will also provide additional documentation bearing upon concerns raised in these comments.

If you should have any further questions or need of clarification, please contact David C. Dobson (702) 794-7940 or FTS 544-7940.

Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization
Project Office

RSED:TWB-538

Enclosures: *on shelf in JACKET*

- 1. DOE Responses
- 2. Individual Comments Identified in
May 30, 1989, Letter

RECEIVED

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NUCLEAR WASTE PROJECT OFFICE

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Robert R. Loux

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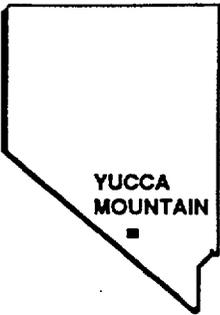
cc w/encls:

J. W. Bartlett, HQ (RW-1) FORS
S. J. Brocoum, HQ (RW-22) FORS
S. G. Van Camp, HQ (RW-20) FORS
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U.S. DEPARTMENT OF ENERGY

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YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

RESPONSES TO STATE OF NEVADA LETTER ON THE SITE CHARACTERIZATION PLAN/ EXPLORATORY SHAFT FACILITY

DECEMBER 1990

UNITED STATES DEPARTMENT OF ENERGY



102.7

U.S DEPARTMENT OF ENERGY'S COMMENT RESPONSES FOR THE PRELIMINARY
COMMENTS RECEIVED FROM THE STATE OF NEVADA

The State of Nevada submitted preliminary comments on the Site Characterization Plan in a letter dated May 30, 1989. The U.S Department of Energy first renumbered the pages contained in the letter received from the State of Nevada and identified individual comments within the letter. The comments were then enumerated from the aggregate package that was submitted and the total number of comments was 58. A copy of the enumerated comment package is provided under separate enclosure for cross reference. Each comment number is marked in the margin of the page and the page number is marked in the upper right hand corner of the page. Where multiple comments occur on one page, each is bracketed by horizontal lines.

For each comment, the DOE response package provides a description of the comment, followed by the response to the comment. Each comment was either furnished an individual response, or cross-referenced to a response addressing comments pertaining to the same overall theme.

U.S. DEPARTMENT OF ENERGY RESPONSES TO THE PRELIMINARY
COMMENTS RECEIVED FROM THE STATE OF NEVADA
ON THE SITE CHARACTERIZATION PLAN

COMMENT 1

The attached Preliminary Comments on the ESF describe Nevada's critical concerns over both the selected location of the ESF at Yucca Mountain and some aspects of the ESF Design at its current level of development. The summary conclusion that arises from the attached comments and concerns is that the DOE should not proceed with the initiation of site characterization and ESF construction until certain fundamental ESF site location and design issues are resolved. Without such advance reconsideration and resolution, the potential consequences are twofold; first, that DOE's activities associated with ESF construction will preclude the future collection of data critical to a determination of Yucca Mountain sit suitability, and second, that DOE's ESF construction activities will compromise the capability of the site to safely isolate waste, should it be developed as a repository.

RESPONSE:

The Yucca Mountain Site Characterization Project Office is currently conducting a study to evaluate and identify a defensible basis for the design and construction of the Exploratory Shaft Facility (ESF) at the Yucca Mountain site. This study, the ESF Alternatives Study, would

- 1) Identify all applicable regulatory and nonregulatory requirements relating to repository and ESF design and construction.
- 2) Identify comments and concerns raised by the U.S. Nuclear Regulatory Agency (NRC), the Nuclear Waste Technical Review Board (NWTRB), State of Nevada, and the DOE during review of the Site Characterization Plan.
- 3) Identify all repository access configurations and ESF configurations and construction methods considered in the past.
- 4) Develop new repository access configurations and ESF configuration and construction methods to address comments and concerns raised by the NRC, NWTRB, State of Nevada, and U.S. Department of Energy.
- 5) Develop evaluation methodology.
- 6) Evaluate all historic and new repository and ESF options.
- 7) Select the preferred ESF configuration and construction method.
- 8) Revise the applicable design requirements documents before re-commencement of design.

29-Nov-1990

This study is intended to resolve all NRC performance-assessment-related objections and concerns, address NWTRB recommendations, and resolve appropriate concerns of the State of Nevada and local agencies before ESF construction is started.

STATE OF NEVADA PRELIMINARY COMMENTS
ON THE SITE CHARACTERIZATION PLAN

COMMENT 2

The ESF location at Coyote Wash was initially selected by DOE in mid-1982, with the selection process documented in a Sandia Report (SAND84-1003). The selection of this location was recently reviewed by the DOE, in December 1988, with that analysis, the Exploratory Shaft Location Documentation report, confirming the earlier location decision. Nevada's review has revealed that neither the original Sandia Report nor the recent review by DOE acknowledges a 1982 United States Geological Survey report (USGS Open File Report 82-182) which contains strong evidence of a fault intersecting the selected ESF site, possibly between the two proposed exploratory shafts. The Location Documentation Report claims to have reviewed certain cited post-1982 reports of geophysical data relevant to the selected ESF site, with the conclusion that no adverse subsurface structures appear to be present at the selected Coyote Wash ESF site. However, the resistivity survey data document in the 1982 U.S.G.S. report, and later summarized in a 1984 U.S.G.S. report were not included in the DOE's recent review even though the work was performed for the Yucca Mountain Project.

The known existence of a fault at the Coyote Wash ESF site would result in the disqualification of this proposed ESF site according to the criteria established in the 1982 Sandia ESF site screening report for setback from adverse subsurface geologic structures. Furthermore, placing the ESF in a fault-disturbed area casts into great question the representativeness of any site characterization data collected from the ESF. It also renders the ESF vulnerable to potential severe flooding from surface water infiltration along a preferred pathway, or from intersection of a perched groundwater zone during shaft or drift construction.

RESPONSE:

The U.S. Department of Energy (DOE) response to this comment is documented in the Technical Assessment Review (TAR), "Geologic and Geophysical Evidence Pertaining to the Structural Geology in the Vicinity of the Proposed Exploratory Shaft" (DOE, 1990).

In 1978, a slingram survey of the Yucca Mountain area indicated a conductive zone underlying Drill Hole Wash (Flanigan, 1981). This zone was inferred to be a possible zone of significant faulting and fracturing based on comparison of the survey results over known faults (Smith and Ross, 1982). Because of the possibility of a significant fault in the repository block, additional studies were performed to evaluate the structure under Drill Hole Wash in 1979. The resistivity and induced polarization study of Smith and Ross (1982) was one of these studies. The Smith and Ross report inferred from resistivity contrasts that faulting may have dropped the area of Drill Hole Wash with respect to the ridges on either side (Spengler and Rosenbaum, 1980). In order to test this interpretation, a series of drillholes (UE25a-4, -5, -6, -7) was completed in 1979 and 1980 in the area of Drill Hole Wash (Spengler and Rosenbaum, 1980). The results from these drillholes showed no evidence of vertical offsets, but Spengler and Rosenbaum (1980) inferred possible strike-slip movement on the basis of paleomagnetic and foliation trends. Other studies, such as the mapping by Scott and Bonk

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(1984), were completed during the 1979-1982 period and were also used to evaluate the Drill Hole Wash area (Scott et al. 1984) and concluded that Drill Hole Wash and other washes to the northeast were probably underlain by right-lateral strike-slip faults.

In addition to the fault/fracture zone inferred in Drill Hole Wash, Smith and Ross (1982) inferred the presence of a minor normal fault in Coyote Wash (Figure 1). This inferred fault was located about 400 meters (1,300 feet) east of Ghost Dance fault and was inferred to be downthrown to the east.

In March, 1982, a working group was organized by the Yucca Mountain Site Characterization Project Office to evaluate exploratory shaft (ES) construction methods and to conduct a screening of potential ES sites. Procedures were developed by the working group and approved on April 28, 1982 (Bertram, 1984). At this time, the working group became the Ad Hoc Technical Overview Contractor (TOC) Committee at the request of the NNWSI Project Technical Integration Group (TIG). A draft report on the ES selection was completed by the committee on June 7, 1982.

Because of the uncertainty at that time about structures in Drill Hole Wash, the Ad Hoc TOC Committee generated a selection criterion that established a set-back distance of 308 meters (1,000 feet) from Drill Hole Wash. The set-back was established to account for the possibility of bedrock fractures extending westward from Drill Hole Wash. In selecting the shaft location, it was desired that the shaft be far enough away from Drill Hole Wash (<308 meters (1,000 feet)) that the shaft and drifts would have a low likelihood of encountering fractures associated with the repository block bounding structure. At the same time, it was considered desirable to be within a distance (<616 meters (2,000 feet)) that would permit horizontal drilling from the ES to intersect the Drill Hole Wash structures. A similar criterion was generated for other "potentially adverse structures" where it was considered desirable to be within 308 to 616 meters of these structures. Sites having subsurface facilities closer than 30.8 meters (100 feet) to a potentially adverse structure were to be excluded (Stephenson, 1982).

USGS Open File Report 84-792 (USGS, 1984) is a compilation and interpretation of geologic data on the Yucca Mountain region acquired before January 1, 1983. The report was used as a source in the preparation of the geologic descriptions of Yucca Mountain for the Environmental Assessment (EA) (DOE, 1986) and the Site Characterization Plan (SCP). Figure 32 of the Open File Report shows a map of "Faults and (or) fractures at Yucca Mountain interpreted from electrical resistivity data." The text of the Open File Report does not give any additional information on the source of this interpretation. The same figure was also duplicated in the SCP as Figure 1-40. This figure shows a fault in Coyote Wash at the location where a fault was inferred by Smith and Ross (1982), but also shows the fault extending much farther to the south than Smith and Ross indicated.

The Open File Report figure is apparently based on an unpublished interpretive map of published and unpublished electrical resistivity data compiled by D.B. Hoover. This unpublished map indicates that the location of the northern end of this longer fault cutting Coyote Wash is based on the interpretation of Smith and Ross (1982). Hoover used a dashed line to connect the inferred fault in Coyote Wash with another fault inferred to cross unpublished resistivity line YM10 at a point about 7,500 ft south of

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Coyote Wash (Figure 2). The location of the inferred fault cutting line YM10 coincides with a fault mapped by Lipman and McKay (1965), which trends to the northeast of the hypothesized connection between the inferred resistivity faults and terminates near Whale Back Ridge (Figure 2). However, in the figure that appears in the Open File Report (USGS 1984) and the SCP, the dashed line connecting the two inferred fault segments has been replaced by a solid line (Figure 3). This appears to represent a drafting error in the preparation of the published figure since other dashed lines shown on the unpublished version of the map were generally deleted from the published map.

Use of the term "potentially adverse" in Bertram (1984) and in the TAR is not the same as the use of the term in 10 CFR Part 60. In 10 CFR Part 60, the term "potentially adverse" is used solely in the context of those things or conditions that "may compromise the ability of the geologic repository to meet the performance objectives relating to isolation of the waste" (10 CFR 60.122(a)(2)). Use of this term in Bertram (1984) is more generic, because it refers to any condition which may affect the design or construction of the Exploratory Shaft Facility (ESF), including but not necessarily restricted to those aspects that would affect "waste isolation" in the repository. Thus, the use of the term "potentially adverse" in Bertram (1984) and in this report does not automatically infer that waste isolation may be compromised.

A map identifying potentially adverse structures was prepared using a preliminary version of the Scott and Bonk (1984) map as a source (Spengler, oral communication). The only potentially adverse structure identified on this map in the Coyote Wash area was the Ghost Dance fault (Figure 4). One Ad Hoc TOC committee member was aware of the report by Smith and Ross, but was of the opinion that the Scott and Bonk mapping was more reliable because topographic effects may have affected the resistivity/IP survey and the interpretation of Smith and Ross was not confirmed by the drilling program in Drill Hole Wash. Also, the main concern at the time was to identify significant throughgoing structures; apparently minor features, such as the fault inferred by Smith and Ross (1982) in Coyote Wash, were not considered in shaft selection because they had no mapped extent. Therefore, the faults shown in the Smith and Ross (1982) report in Coyote Wash were not considered to be potentially adverse structures.

Five preferred site areas for the exploratory shaft location were identified by the Ad Hoc TOC Committee largely on the basis of the location of potentially adverse structures and topography (Bertram, 1984). The area in Coyote Wash was evaluated as having the highest ranking of the five site areas; thus it was the unanimous recommendation of the committee that the shaft be located on the western side of the Coyote Wash area at 766000N and 563300E (Bertram, 1984). The committee recognized the potential need for minor relocation resulting from architectural/engineering design considerations, but advised caution in making such changes because of the small size of the preferred area (Bertram, 1984). The recommendation of Coyote Wash as the preferred site was approved by the TIG, the Yucca Mountain Site Characterization Project Office, and DOE Headquarters (DOE/HQ) between June 14 and August 11, 1982. A reanalysis of the ESF siting process up to the present is contained in the TAR cited at the beginning of this response (DOE, 1990).

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The assertion that placing the ESF in a "fault disturbed area" renders it vulnerable to "potential flooding from surface water infiltration along a preferred pathway or from intersection of a perched groundwater zone during shaft or drift construction" is hypothetical at the present time. Studies to be carried out during site characterization that bear upon the concerns expressed are part of Study Plan 8.3.1.2.2.4 "Characterization of Yucca Mountain percolation in the unsaturated zone -- exploratory shaft facility study."

REFERENCES

- Bertram, S.G., 1984. NNWSI Exploratory Shaft Site and Construction Method Recommendation Report, SAND84-1003, Sandia National Laboratories, Albuquerque, NM.
- DOE (U.S. Department of Energy), 1986. Environmental Assessment, Yucca Mountain Site, Nevada Research and Development Area, Nevada, DOE/RW-0073, 3 vols., U.S. Department of Energy, Washington, D.C.
- DOE (U.S. Department of Energy), 1990. Geologic and Geophysical Evidence Pertaining to the Structural Geology in the Vicinity of the Proposed Exploratory Shaft, Technical Assessment Review, YMP/90-2, U.S. Department of Energy, Las Vegas, NV.
- Flanigan, V.J., 1981. A Slingram Survey at Yucca Mountain on the Nevada Test Site, Open File Report USGS-OFR-81-980, U.S. Geological Survey, 38 p.
- Lipman, P.W., and E.J. McKay, 1964. Geology of the Topopah Spring SW Quadrangle, Nye County, Nevada, Technical Letter NTS-72 (February 25, 1964), U.S. Geological Survey, 8 p.
- Scott, R.B., G.D. Bath, V.J. Flanigan, D.B. Hoover, J.G. Rosenbaum, and R.W. Spengler, 1984. Geological and Geophysical Evidence of Structures in the Northwest-Trending Washes, Yucca Mountain, Southern Nevada, and Their Possible Significance to a Nuclear Waste Repository in the Unsaturated Zone, Open File Report USGS-OFR-84-567, U.S. Geological Survey.
- Scott, R.B., and J. Bonk, 1984. Preliminary Geologic Map of Yucca Mountain Nye County, Nevada with Geologic Section, Open File Report USGS-OFR-84-494, U.S. Geological Survey. [HQS.880517.1443]
- Smith, C., and H.P. Ross, 1982. Interpretation of Resistivity and Induced Polarization Profiles with Severe Topographic Effects, Yucca Mountain Area, Nevada Test Site, Nevada, Open File Report USGS-OFR-82-182 with introduction by D.B. Hoover, U.S. Geological Survey.
- Spengler, R.W., and J.G. Rosenbaum, 1980. Preliminary Interpretations of Geologic Results Obtained from Boreholes UE25a-4, -5, -6, -7, Yucca Mountain, Nevada Test Site, Open File Report USGS-OFR-80-929, U.S. Geological Survey, 33 p.

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REFERENCES

S.P. 8.3.1.2.2.4, Characterization of Yucca Mountain Percolation in the Unsaturated Zone -- Exploratory Shaft Facility Study, Site Characterization Plan, 1988.

USGS (U.S. Geological Survey), 1984. A Summary of Geological Studies through January 1, 1983, of a Potential High-Level Radioactive Waste Repository Site at Yucca Mountain, Southern Nye County, Nevada, Open File Report USGS-OFR-84-792, U.S. Geological Survey.

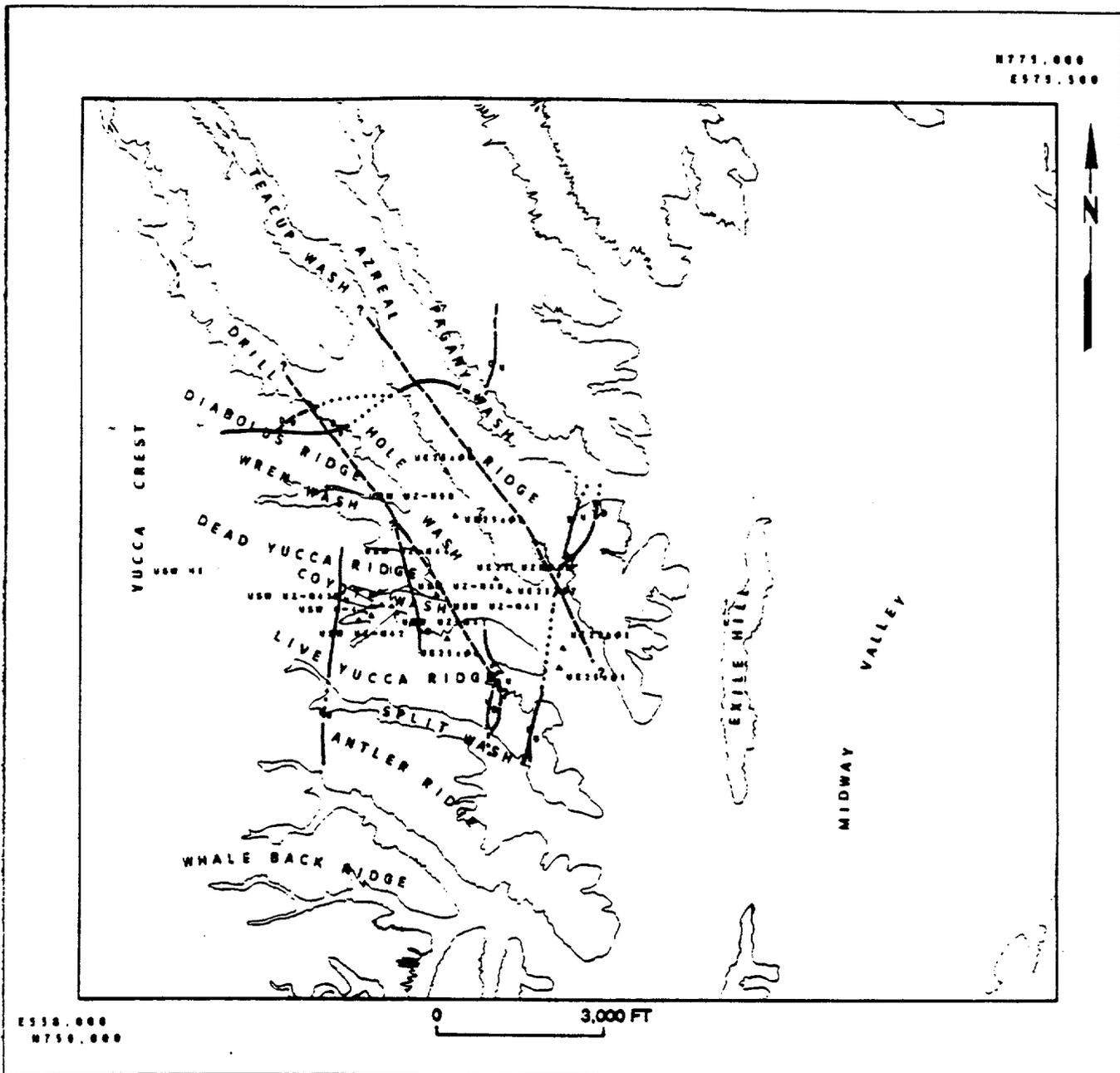
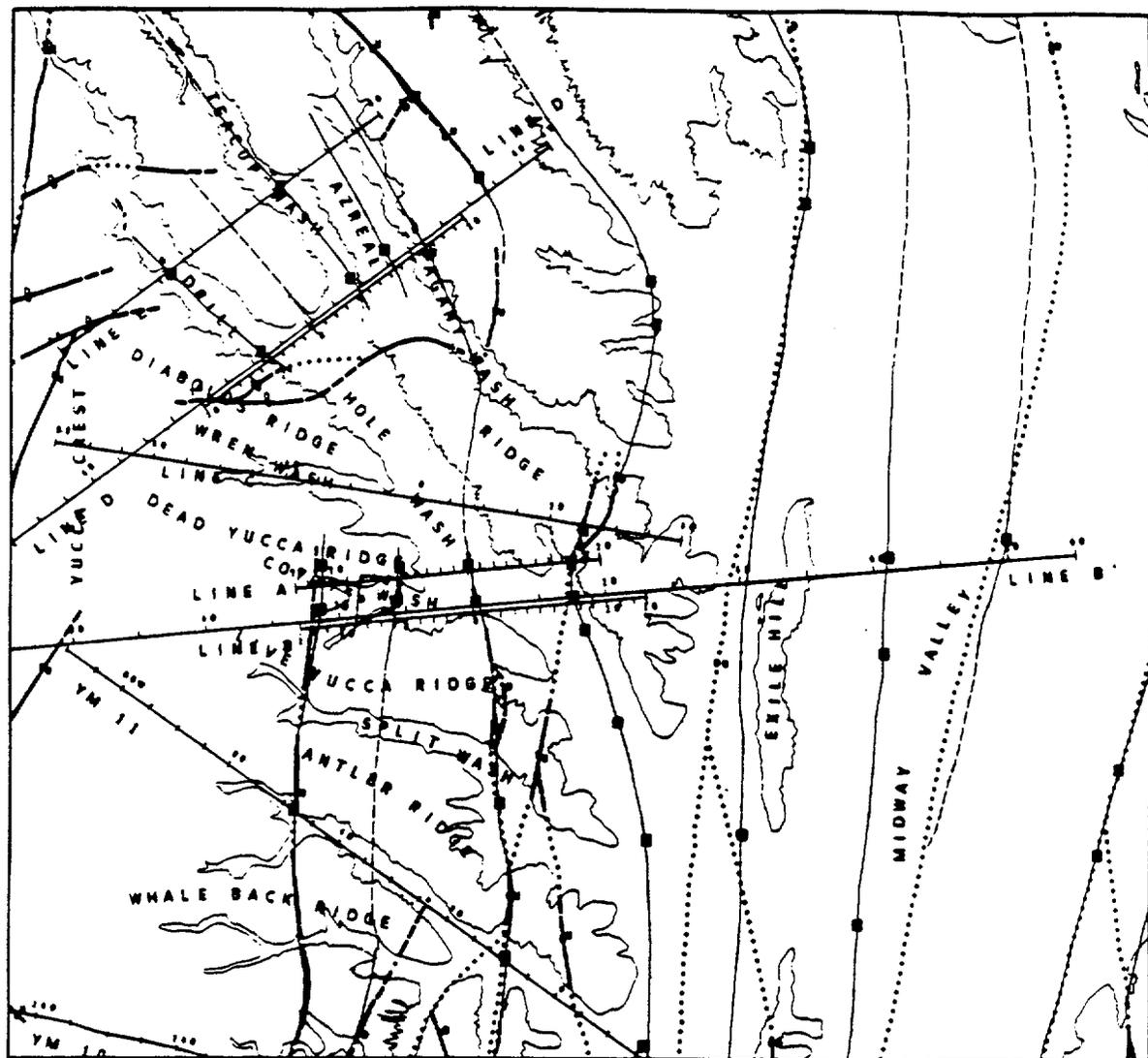


Figure 1. Inferred faults in the Coyote Wash area as interpreted by Smith and Ross (1982).

N775.000
E875.000



E150.000
N750.000

0 2,500 FT

EXPLANATION

—●— FAULT MAPPED BY LIPMAN AND MCKAY (1965)

—●— LOCATION OF RESISTIVITY LINE
YM 11

—●— FAULT INFERRED FROM RESISTIVITY DATA BY HOOVER

□ AREA RECOMMENDED BY BERTRAM (1964) WITH ORIGINAL SHAFT LOCATIONS (OPEN CIRCLES) AND REVISED SHAFT LOCATIONS (SOLID CIRCLES)

Figure 2. Faults interpreted from resistivity data by Hoover, mapped faults shown by Lipman and McKay (1965), locations of resistivity lines.

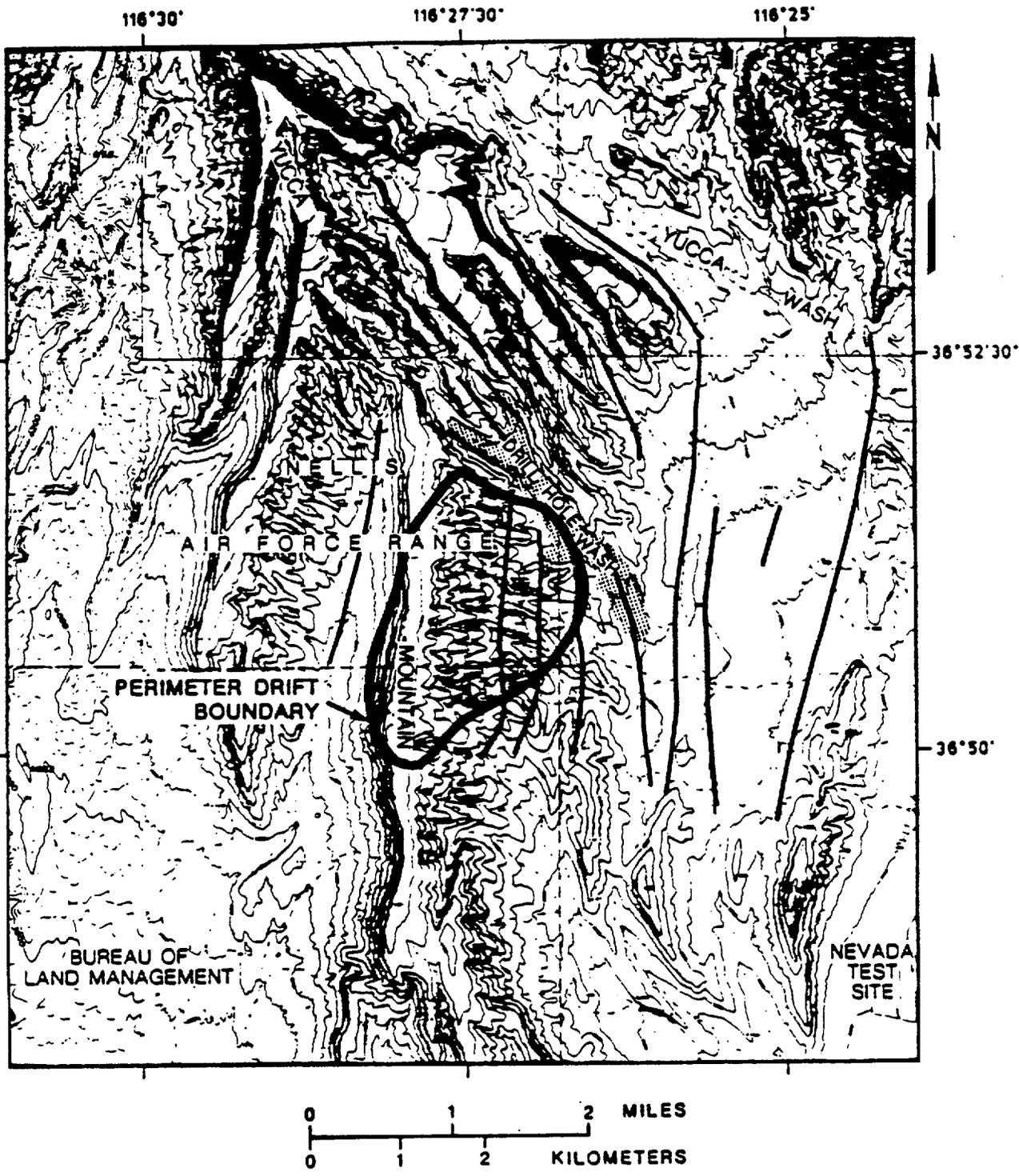
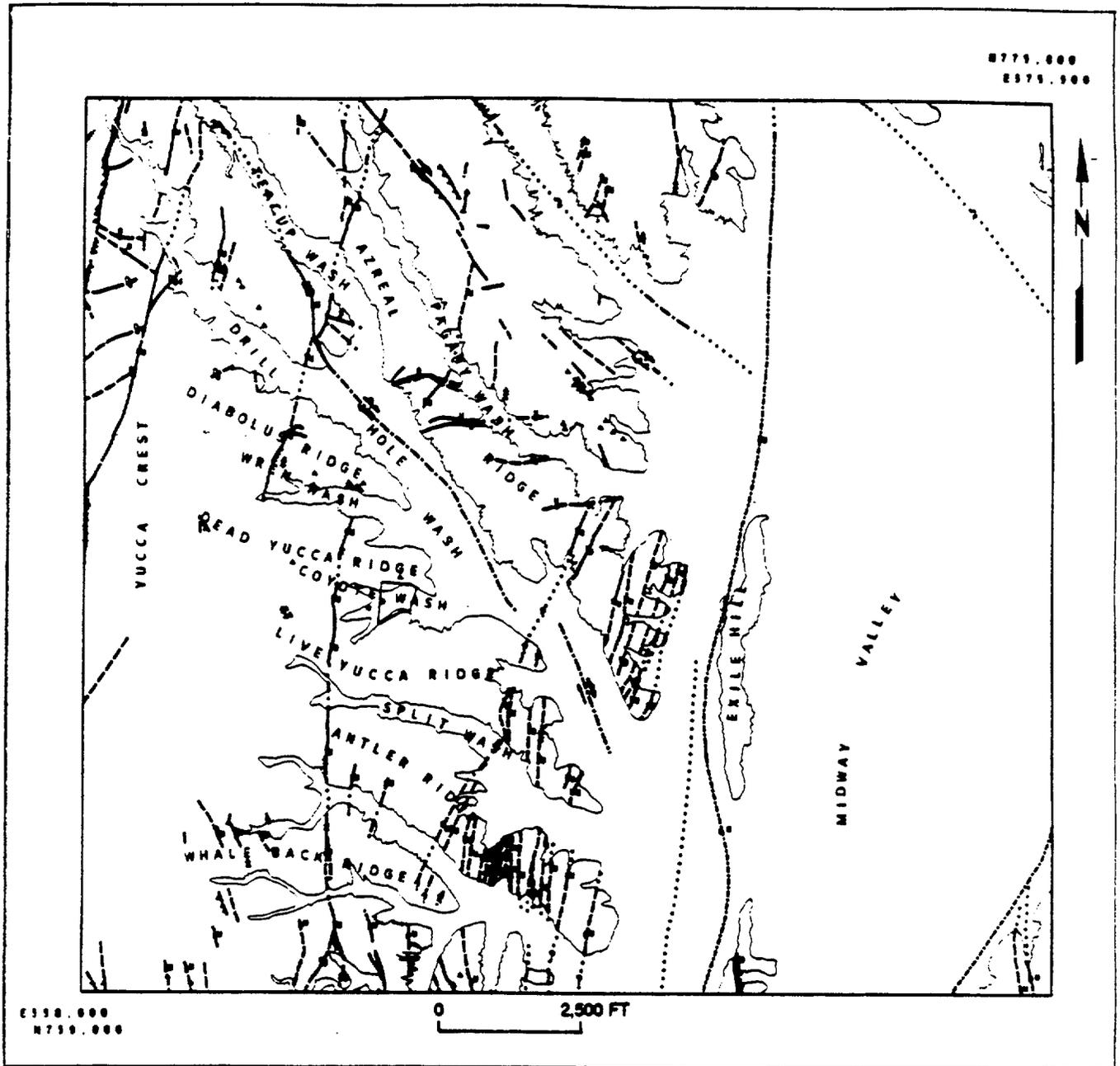


Figure 3. Faults interpreted from electrical resistivity data as shown on Figure 32 of U. S. Geological Survey Open File Report 84-792 and in SCP Figure 1-40.



EXPLANATION

- | | | | |
|--|---|--|---|
| | <p>SITING AREA AND SHAFT LOCATION RECOMMENDED BY BERTRAM (1984)</p> | | <p>TECTONIC BRECCIA, NOT ASSOCIATED WITH PLANAR DISCONTINUITIES</p> |
| | <p>FAULT, LOCATION INDICATED BY SURFACE MAPPING</p> | | <p>FAULT, LOCATION INDICATED BY ELECTROMAGNETIC SURVEYS</p> |
| | | | <p>FAULT, LOCATION INDICATED BY AEROMAGNETIC SURVEYS</p> |

Figure 4. Location of faults shown by Scott and Bonk (1984) and siting area and shaft locations recommended by Bertram (1984).

STATE OF NEVADA PRELIMINARY COMMENTS
ON THE SITE CHARACTERIZATION PLAN

COMMENT 3

Aside from concerns about flooding of the ESF related to the probable fault as described above, the location of the two shaft openings at the proposed ESF in Coyote Wash is such that there is significant concern over potential surface water flooding of the ESF surface facility, the shafts, and underground drifts. The SCP acknowledges in numerous disclaimers that flood level predictions regarding washes in and around the Yucca Mountain area are speculative at best, and that there is essentially no site specific flood data for Coyote Wash. In addition, as Nevada has commented to DOE previously, the effect of proposed ESF surface modifications and structures on flood heights and velocities has not been adequately analyzed, primarily due to a lack of site specific information. The consequences of flooding the ESF as a result of the lack of adequate shaft collar elevation and adequate surface flood protection structures, aside from the obvious risks to personnel, are such that the ESF may be rendered useless for collection of necessary in situ site characterization data, and the abandoned damaged ESF itself may adversely impact the site's waste isolation capabilities.

RESPONSE:

Regarding shaft location with respect to flood-associated in-filling, this issue was previously raised by the NRC to DOE in 1985. The specific concern was the possibility that run-off along Coyote Wash could occur over the ESF location, eventually resulting in erosion of alluvium around the shaft collar. It was stated that this situation could lead to eventual higher influx of run-off into the sealed shaft.

Comments were made at the Title I 50% Design Review and changes in the ESF surface layout were resolved to provide additional assurance that surface flooding would not enter the shafts.

In response to these NRC concerns, DOE made recommendations in 1986 for new shaft locations that took into account two important considerations. The shaft should be located out of any main natural drainage and the shaft should be collared in solid competent material. The shaft locations in the SCP, allow the shaft collar to be set in rock rather than alluvium, and effectively mitigate any flood in-flow threat to the ESF caused by eroding alluvium. Until additional surface data on rate of in-fill in the Wash can be collected or modeled, this move, agreed upon by the NRC and the State of Nevada in 1987, appears to be adequate. In addition, an analysis with respect to the potential for flooding and the ESF location was conducted by Fernandez et al. (1988).

The ESF Alternatives study, discussed in the response to Comment 1, will identify all repository access configurations and ESF configurations and construction methods considered in the past. The purpose of the study is to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada, and DOE. The data, and uncertainties in that data, that pertain to the potential for flooding and probable maximum flood is part of this study.

STATE OF NEVADA PRELIMINARY COMMENTS
ON THE SITE CHARACTERIZATION PLAN

REFERENCES

Fernandez, J.A., T.E. Hinkebein, and J.B. Case, 1988. Selected Analyses to Evaluate the Effect of the Exploratory Shafts on Repository Performance at Yucca Mountain, SAND85-0598, Sandia National Laboratories, Albuquerque, NM.

STATE OF NEVADA PRELIMINARY COMMENTS
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COMMENT 4

From the design standpoint, the SCP and associated documents do not provide plans for sealing, or otherwise isolating from the remainder of the repository block, a failed shaft in the ESF, whether resulting from flooding or other causes, in order to assure that it will not adversely impact the waste isolation performance of a repository. This matter stands as one of the many unresolved design problems, which also include inadequate evaluation of environmental impacts of construction of the ESF.

RESPONSE:

The U.S. Department of Energy (DOE) did not include any plans for the sealing of "failed" exploratory shafts in the Site Characterization Plan (SCP) for the following reasons:

1. The current Exploratory Shaft Facility (ESF) design requirements documents require that certain permanent structures, systems, and components of the ESF be designed and constructed using the same criteria, standards, and quality assurance levels as required for the repository. The permanent items are shaft liners, ground support, underground openings, and operational seals.
2. In the unlikely event of a shaft "failure," either by flooding or by a permanent component not performing its intended function, the shaft would not be sealed and isolated from the remainder of the repository block without performing a full recovery of the affected area(s).
3. These recovery efforts are standard industry practice and are conducted in such a way that the affected areas or components in question are restored to their original condition. However, if DOE decides it would not be prudent to continue to use these affected areas, they would be backfilled and sealed in accordance with the decommissioning and closure strategies identified in the current design requirements documents and Section 8.7 of the SCP.

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COMMENT 5

An additional design issue involves the placement of planned boreholes associated with the ESF. Because of the known lack of quality borehole data at the proposed ESF site for use in shaft design, DOE has planned to drill at least two multipurpose boreholes on the ESF pad at Coyote Wash. The data from these boreholes will be necessary for further shaft design, yet if these holes are drilled as planned, and the DOE's criteria for distance to be maintained between boreholes and shafts at the ESF are honored, there is insufficient space to complete both activities. If some degree of borehole deviation during drilling is assumed (a realistic assumption), not only will the spacing criteria be violated, but there is a possibility that the shafts will intersect the previously drilled boreholes. With reference to the possibility of a proposed third multipurpose borehole, implementing the plan would result in the borehole intersecting a planned ESF drift at the underground test horizon. Further, the surface location of this hole would coincide with the planned location of the hoist house for the No. 2 exploratory shaft. In sum, the design and layout of the ESF cannot accommodate all the planned excavations and proposed construction while continuing to comply with the spacing criteria established by DOE for the ESF underground facility. The spacing criteria have their bases in assuring safety and preserving the ability to collect needed site characterization data that is representative of the site's undisturbed geohydrologic conditions.

The above comments constitute a set of fundamental concerns regarding the DOE's plans for developing and constructing an exploratory shaft facility at Yucca Mountain. Accompanying the attached State of Nevada Preliminary Comments are three letters in which we have previously detailed for DOE a number of the same concerns which are discussed in this letter and attached comments. It is Nevada's position that, without substantial resolution of these matters, it is both unsafe and imprudent to initiate site characterization and ESF activities at the Yucca Mountain site.

RESPONSE:

These boreholes would be drilled using state-of-the-art drilling and logging techniques and the deviations would be controlled such that the stated tolerances are not exceeded. Following results of the ESF Alternatives Study, new layouts for the ESF may be necessary which may or may not leave the multipurpose borehole activity unaltered from the plan identified in the SCP. These criteria are discussed in the SCP Section 8.4.2, page 8.4.2-14. This discussion noted that a 28' radius curve should be maintained around the shaft and the MPBHs to ensure isolation of these elements from each other. The SCP also noted that the descriptions of the tasks are current concepts which would be reviewed and revised as necessary in the future.

STATE OF NEVADA PRELIMINARY COMMENTS
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COMMENT 6

The State of Nevada has strongly warned the Department of Energy to reevaluate its plan to sink two exploratory shafts at Yucca Mountain because an earthquake fault intersecting the shaft site could render it useless for further studies and unsafe for storing nuclear waste.

In preliminary comments released today, the State Nuclear Waste Project Office revealed that the DOE ignored one of its own reports solicited from the United States Geological Survey which indicates a fault intersects the selected exploratory shaft (ESF) location.

As part of its scheme to determine whether Yucca Mountain can safely isolate deadly, high-level nuclear waste for 10,000 years, the DOE plans to sink two 12-foot wide, 1,050-foot deep shafts about 90 miles northwest of Las Vegas.

Besides possibly compromising Yucca Mountain's ability to safely store nuclear waste, the State said that unless fundamental design and location problems for the ESF are resolved, drilling could discredit vital information that must be collected to determine Yucca Mountain's suitability.

The State's preliminary comments came in response to the DOE's site characterization plan, an unwieldy, 6,300-page document which outlines the DOE's study of Yucca Mountain as the nation's first nuclear waste dump. Final comments are scheduled for release in late summer.

RESPONSE:

The author of the comment is not explicit about which U.S. Department of Energy (DOE) report was solicited from the USGS, but claims that the report shows a fault in the vicinity of the proposed ESF location. In February of this year, the DOE completed a thorough investigation of the fault inferred in Coyote Wash by Smith and Ross (1982). This investigation came as a result of an NRC inquiry on geophysically inferred faults reported in the SCP, in particular, the Smith and Ross (1982) analysis. The Technical Assessment Review (TAR) Review Record Memorandum (RRM) titled "Geologic and Geophysical Evidence Pertaining to Structural Geology in the Vicinity of the Proposed Exploratory Shaft", Rev. 0, was issued by the DOE on 1/10/90. That report directly considers the issue of faulting in the vicinity of the proposed ESF, and more specifically the mining and waste management implications of faults that may intersect the ESF. It also summarizes the findings of the TAR Team (DOE, 1990).

In short, the TAR Team found that the available data did not support a finding for a significant fault in the proximity of the ESF, but because of the inherent limitations of the geophysical methods used by Smith and Ross, the Team found that there was a possibility that a relatively small fault could be present at depth in the vicinity of the proposed repository. In addition to planned work such as drilling and logging the multipurpose boreholes and mapping the ESF surface excavations, the TAR Team recommended conducting several activities to increase knowledge of subsurface conditions at the shaft locations. These activities include: new seismic reflection

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and geoelectrical soundings; new dipole-dipole and Slingram surveys, clearing talus from the slopes to map the area between ES-1 and ES-2 with greater certainty prior to any excavation, and drilling and logging, to ESF depth, two centerline boreholes at the shaft locations (DOE, 1990-, Section 7.2).

For further information on this matter, see the response to Comment 2.

REFERENCES

DOE (U.S. Department of Energy), 1990. Geologic and Geophysical Evidence Pertaining to the Structural Geology in the Vicinity of the Proposed Exploratory Shaft, Technical Assessment Review, YMP/90-2, U.S. Department of Energy, Las Vegas, NV.

Smith, C., and H.P. Ross, 1982. Interpretation of Resistivity and Induced Polarization Profiles with Severe Topographic Effects, Yucca Mountain Area, Nevada Test Site, Nevada, Open File Report USGS-OFR-82-182 with introduction by D.B. Hoover, U.S. Geological Survey.

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COMMENT 7

Bob Loux, executive director of the State Nuclear Waste Project Office, said in a letter to the DOE that if drilling on a known earthquake fault proceeds, it will likely encounter perched water that could severely flood the shafts, taint the ESF and cast great doubts on the entire project.

RESPONSE:

See the response to Comments 2 and 3.

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COMMENT 8

He further asserted that based on DOE's own criteria for safety and data preservation, the ESF site cannot accommodate the numerous additional boreholes the DOE plans to drill near the shafts.

Loux said that "without substantial resolution of these matters, it is both unsafe and imprudent to proceed" with site characterization and the ESF."

RESPONSE:

See the response to Comment 5.

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COMMENT 9

"I am very disappointed by the fact that the DOE has once again ignored its own scientists in the critical stages of the decision-making process," said Governor Miller.

"The Secretary assured us at our May 22nd meeting that this would be a scientific and technical process. I have asked that Secretary Watkins personally review and reconsider this decision.

"This would be the third instance in the past two years of the DOE ignoring its own scientists and contractors to satisfy a timetable at the expense of scientific data.

"If Secretary Watkins lets this decision stand, it would seriously undermine the credibility of his stated desire to change a repository program so it is based on scientific facts, not politics."

The two other instances the Governor referred to were the DOE disregarding a study of one of its own scientists, Jerry Szymanski, who suggested the site might easily be disqualified on scientific grounds, and a "disaster" warning issued by 16 USGS hydrologists. In Aug. 5, 1987, and Aug. 17, 1988, memo, they expressed great concern about the scientific merits of DOE's study, and in the latter memo said that "in subjugating the technical program to satisfy DOE political objectives, we may succeed in making the program comply with regulations, while being scientifically indefensible."

RESPONSE:

The U.S. Department of Energy (DOE) has reviewed Mr. Szymanski's ideas, which were presented in a November 1987 draft manuscript by J.S. Szymanski, "Conceptual Considerations of the Death Valley Groundwater System with Special Emphasis on the Adequacy of this System to Accomodate a High-level Nuclear Waste Repository". A report that compiled the comments of 24 project scientists was released on July 26, 1989, entitled, "Review of a Conceptual Model and Evidence for Tectonic Control of the Ground-water System in the Vicinity of Yucca Mountain, Nevada".

Briefly, Szymanski's hypothesis is that the water table under Yucca Mountain could undergo large variations in elevation over time periods of thousands of years or less in response to changes in stress in the rocks caused by earthquake activity. The principal evidence cited for this hypothesis is the presence of calcite-silica veins in fracture zones at Yucca Mountain, which Szymanski believes were deposited by rising hot groundwater from deep in the earth. To date, no studies conducted by other scientists have supported this theory; on the other hand, existing studies do not positively disprove the Szymanski hypothesis.

Both the manuscript and the review report referenced above focus on work relevant to several studies and activities presented in the Site Characterization Plan (SCP) Investigation on postclosure tectonics found in Section 8.3.1.8 of the SCP. The reviewers concluded, though not unanimously, that (1) the tectonic processes and geomechanical models that Mr. Szymanski proposed dominantly influence the hydrologic system are described with insufficient rigor for testing or further analysis; (2) although the stress

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and geothermal heterogeneities in the Earth's shallow crust probably influence the hydrologic system, the magnitude and duration of the effects proposed in the manuscript are highly unlikely; (3) the geologic and hydrologic field data claimed to support Szymanski's hypothesis are more readily and consistently explained by traditionally accepted geologic and hydrologic processes, particularly when supplemented by other available evidence; (4) Szymanski's recommendations for testing his hypothesis lack valid diagnostic criteria. In other words, if the recommended testing was carried out, the results would not demonstrate the validity of the Szymanski hypothesis. The review also recommends some additions and modifications to existing plans that have not yet been fully evaluated for possible incorporation into the DOE's program of study for the site.

DOE conducted a workshop in April 1988; with DOE scientists, scientists independent of the project, including university professors who are experts in the origin of calcite-silica deposits, and technical staff from the Nuclear Regulatory Commission, determined that the vein deposits at Yucca Mountain have the characteristics of "pedogenic calcrete," commonly known as caliché.

In July 1989, the Yucca Mountain Site Characterization Project Office released a final report by Szymanski entitled, "Conceptual Considerations of the Yucca Mountain Groundwater System with Special Emphasis on the Adequacy of this System to Accomodate a High-level Nuclear Waste Repository." Concepts and processes described in the final report will be reviewed by the National Academy of Sciences (NAS), and another review panel. The DOE anticipates that the results of the NAS review will provide significant additional evidence bearing upon the feasibility and likelihood of the mechanism proposed by Szymanski.

REFERENCES

- Szymanski, J. S., 1989. "Conceptual Considerations of the Yucca Mountain Groundwater System with Special Emphasis on the Adequacy of this System to Accomodate a High-level Nuclear Waste Repository." Internal report, Yucca Mountain Project Office, U.S. Department of Energy, Las Vegas NV.

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COMMENT 10

The proposed ESF site is located in Coyote Wash in the northeastern corner of the repository block. Coyote Wash is a narrow wash lying on U.S. Air Force land just west of the NTS boundary. Nearby Drill hole USW G-4 was drilled in Coyote Wash after the site was selected.

According to Sandia Report SAND84-1003 by Bertram, the site was selected in April and May of 1982. In a matter of only a few weeks the selection procedure was developed, screening done, and Coyote Wash selected. Drill hole USW G-4 was not started until August of 1982, so the nearest available drill hole data at the time of ESF site selection was from USW H-1, 3300 feet to the east. See letter of 09/22/1988, Loux to Gertz.

Concern: The ESF site was hastily selected based on drill hole data of questionable applicability.

RESPONSE:

The Sandia Report is a description of a process that used the best available data at the time the shafts were first sited in Coyote Wash. Those decisions have been reviewed and the locations were adjusted in 1987 to satisfy more recent interpretations of geologic data. The ESF Alternatives study is now underway to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada, and DOE. This study is being carried out using a QA program that fulfills the requirements of 10CFR60 Subpart G, and the results will be available for review by the State of Nevada.

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COMMENT 11

Of the criteria used for screening of the five preferred sites considered, heavy emphasis was placed on setback from the repository block boundary and avoidance of adverse geologic conditions. As is pointed out below, the Coyote Wash site may well exhibit adverse geologic conditions.

The proposed repository block contains roughly 1520 acres. During the selection of the ESF site the following areas were summarily eliminated from consideration:

1. a) 500-ft wide buffer area east of Solitario Canyon Fault.
b) 1000-ft wide buffer area south of Drill Hole Wash.
c) 2000-ft wide buffer area along east side of block.
d) All land south of a line 4000 ft north of USW H-3.

This eliminated 633 acres, or 42 percent of the repository block

2. All lands less than 1000 ft, but not more than 2000 ft from adverse geologic structure as identified by the USGS. This eliminated another 812 acres of another 53 percent of the original block.

3. Areas identified as being "steep slopes." This eliminated another 52 acres of the block.

The remaining 23 acres, or 1.5 percent of the original repository block fell into five potentially suitable ESF sites from which the Coyote Wash was selected. However, in the published site rankings, Coyote Wash either tied or was out-ranked by other potential ESF sites in 8 of the 12 subcriteria applied to compare the five sites.

The recent DAA review of the Bertram Report evaluated only the five candidate sites identified by Bertram. It would seem prudent in any review of the site selection to reevaluate the entire repository block for alternate sites.

Concern: Unrealistic and arbitrary criteria were used in screening, and 98 percent of the proposed repository block was eliminated without objective consideration.

RESPONSE:

See the response to Comment 10.

COMMENT 12

The Site Characterization Plan, U.S.G.S. Water Investigations report 83-4001 by Squires and Young, and other reports referenced in the SCP all contain numerous disclaimers that flooding predictions regarding the washes in and around Yucca Mountain are speculative at best. Historical records on streamflow, rainfall, runoff, recharge, flash floods, storms, infiltration, and debris movement range from sparse to nonexistent. Essentially no such data exist for Coyote Wash. The probable maximum flood configurations shown on project maps are based on generalized, regional data (Bullard, 1986) and do not appear to reflect how the proposed structures in Coyote Wash may impact future flood characteristics.

Separately, a visual inspection of the configuration of the lower drainage channel of Coyote Wash suggests that a change in slope which corresponds approximately with the proposed shaft collar elevation may be the erosional remnant of the highest flood runoff. That level is many feet above the maximum flood calculated by Bullard for Coyote Wash. See attached letters of 09/19/88, Loux to Gertz and letter of 03/31/89 Loux to Valentine in which these matters are discussed in greater detail.

It must be recognized that even partial flooding of the ESF during the construction and testing period could have serious consequences. In addition to the risk of personnel injury or loss of life, flood waters would infiltrate the shaft and drift walls. This would render highly questionable the results of tests conducted to characterize hydrologic features of the rock mass such as groundwater travel times. The current ESF plans call for drifts to slope downward to pump installations. In the event of an exploratory drift intersecting a sizeable perched water reservoir or being flooded from the surface via the shafts, the pumping system may be engulfed or otherwise become inoperative. Such an event would likely render the ESF useless for further testing, and could affect the waste isolation capability of the proposed repository horizon.

The DAA (page 3-7) states that, "... significant concentrations of infiltration are more likely to occur in drainage channels, along ridge crests, and in localized depressions." This raises the question of why the ESF is proposed to be located at the mouth of a wash.

Based on the preliminary information provided, the 10-foot wide drainage channel around the north side of the main ESF pad appears to be inadequate for containing or diverting the slope and main pad runoff during a maximum flood. Although the shaft collars are elevated one foot above grade to avoid direct flow of surface water into the shafts, the blast fractured nature of the collar rock and the possibility of deterioration of collar construction materials during the 100-year life, require that surface water diversion be ample to avoid infiltration into the shaft.

Concern: The ESF site was selected without adequate flood potential data in the shaft collar areas, and ESF design has proceeded without sufficient evaluation of possible impacts to site characterization objectives resulting from ESF flooding.

RESPONSE:

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The ESF is being designed to protect against flooding and a Floodplain/Wetlands Assessment is being prepared to evaluate impacts from constructing in a floodplain. The ESF Alternatives study, discussed in the response to Comment 1, will identify all repository access configurations and ESF configurations and construction methods considered in the past. The purpose of the study is to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada, and DOE. The data, and uncertainties in that data, that pertain to the potential for flooding and probable maximum flood is part of this study.

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COMMENT 13

The underground test area of the ESF will cover about 15 acres, and the drifting to the projected fault locations will expose about 3 more acres, providing a total of 18 acres of underground excavations. Thus, of the 1520 acre repository block, a little over 1 percent of the underground area will be available to be characterized at the ESF. While the proposed location and configuration should give some insight into the faults in the area, hydrologic characteristics and in situ rock properties of the remaining 99 percent of the block will remain unknown.

Multiple intersections of adverse geologic structures (i.e. faults) should be planned to assure representativeness. The SCP is silent on plans to evaluate unknown adverse geologic features which may be present within the repository block.

Concern: The location and extent of the planned underground ESF severely limit the extent to which the collected data are representative of the entire repository block.

RESPONSE:

An ongoing activity (ESF Alternatives Study) to consider alternate designs and locations for an exploratory shaft facility includes recognition of concerns about representativeness of data from ESF openings. Data for the three dimensional characterization of the repository block are not limited to those available from the ESF shafts and drifts. Additional data will be provided by surface studies, drill cores, and geophysical investigations. The objective is to combine data sources so that the characterization of the repository block will be representative enough while preserving the waste isolation capabilities of the site.

COMMENT 14

Major faults at Yucca Mountain have been mapped, described and discussed for several years; indeed, they form the boundaries of the proposed repository block, with the Solitario fault on the west, the suspected Drill Hole Wash fracture zone on the north, the Imbricate faults on the east, and the Abandoned Wash fault on the southeast.

DOE documents to date have described the repository block as relatively free of faults with the exception of the Ghost Dance Fault which trends north-south just west of the proposed ESF site. The SCP on page 1-128 acknowledges that the Ghost Dance Fault has as much as 38m of vertical offset and an accompanying breccia zone as wide as 20m. Characterization may give further insight into the significance of this fault to waste isolation.

Of particular importance to the ESF is another possible fault lying parallel to and east of the Ghost Dance Fault. The unnamed fault identified by resistivity geophysical methods is discussed in USGS OFR 82-182 by Smith and Ross. Plate V of that report maps this fault 400m east of the Ghost Dance. Plotting the ES-1 and ES-2 shaft locations on plate V we find that the proposed fault lies between the proposed shafts. Smith and Ross (page 11) describe the block between the unnamed fault and the Ghost Dance Fault as a horst, and suggest (on page 16) that this horst may be a spur of the main fracture zone that underlies Drill Hole Wash.

Verification of the presence of this unnamed fault is supported by the geophysical identification by Smith and Ross of another fault subsequently mapped by Scott and Bonk as the Ghost Dance Fault.

This fault is also shown on Fig 1-40 on page 1-121 of the SCP and in USGS OFR 84-792 on Fig 3 and discussed on page 50. This fault is not discussed in the SCP, but is described in the USGS report as a fault with at least 5m of displacement.

Reviewing the Bertram siting criteria (page 56) regarding setbacks we find two requirements: (1) "ES sites that would have subsurface facilities closer than 100 feet to a potentially adverse structure would be excluded." Either ES-1, ES-2, or the test drifts may well fall within 100 feet of (or intercept) the unnamed fault; (2) "The shaft should be located far enough from potentially adverse structures within the block so that there would be a low likelihood that the shaft itself and the drifts would encounter fractures associated with those structures." "...A 1000-foot setback distance was judged to be sufficient to place the shaft outside the zones of fracturing associated with the structures." The Smith and Ross report (OFR 82-182) identifying the fault is dated "October, 1979" and therefore was available for the Bertram team in 1982.

Concern: Using the two setback requirements for potentially adverse structures developed by Bertram, the Coyote Wash site should have been excluded on both counts. The presence and extent of the fault identified at Coyote Wash must be confirmed and its potential impact on the ESF evaluated before the Coyote Wash ESF site can be considered acceptable.

RESPONSE:

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The U.S. Department of Energy response to Comment 2, and the support documentation cited in it, addresses this concern.

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COMMENT 15

The DAA adopted the potential ESF sites of the Bertram Siting report and only reviewed faults at the Coyote Wash site interpreted from the geophysical data based on magnetic and gravity surveys. The resistivity surveys used by Smith and Ross to delineate the unnamed fault were not referenced and apparently ignored by the DAA analysis.

Concern: Confirmation of the ESF site selection by the DAA has ignored existing information regarding adverse structures at the Coyote Wash ESF site and makes questionable the objectivity of the DAA analysis.

RESPONSE:

The Design Acceptability Analysis (DAA) did not evaluate the currently proposed location for the ESF in relation to a postulated "resistivity fault" (Smith and Ross, 1982), since (1) the anomaly is not unambiguously recognizable as a fault due to lack of surface expression, (2) there exists the possibility of alternative explanations for the origin of the resistivity anomaly, and (3) even if the DAA did assume a fault, it is not a through-going structure of significant mappable extent that could be considered a "potentially adverse condition". See also the response to Comment 2, and the Technical Assessment Review, "Geologic and Geophysical Evidence Pertaining to Structural Geology in the Vicinity of the Proposed Exploratory Shaft" (DOE, 1990).

DOE (U.S. Department of Energy), (1990). Geologic and Geophysical Evidence Pertaining to Structural Geology in the Vicinity of the Proposed Exploratory Shaft, Technical Assessment Review, YMP/90-2, Las Vegas, Nevada.

Smith, C., and H.P. Ross, 1982. Interpretation of Resistivity and Induced Polarization Profiles with Severe Topographic Effects, Yucca Mountain Area, Nevada Test Site, Nevada, Open File Report USGS-OFR-82-182 with introduction by D.B. Hoover, U.S. Geological Survey.

COMMENT 16

The Design Acceptability Analysis (DAA) of the Technical Acceptability Review (TAR) (page 3) contains, without basis, an underlying assumption that any ESF location in the northeast part of the repository block will provide groundwater travel times from the repository horizon to the water table in excess of 10,000 years. This concept is presently speculative and may prove erroneous given the suspected highly fractured nature of the host rock in the Coyote Wash ESF area.

It is likely that the unnamed fault delineated by Smith and Ross resistivity surveys is accompanied by a water-bearing fracture zone or even a perched water reservoir on one side of the fault. This could place any excavations near or through the fault area at risk from flooding due to perched water or rapid infiltration through the fracture zone.

Resistivity surveys identify structural anomalies by measuring differences in resistance within the rock mass. Usually a change in resistance indicates a change in water characteristics, either in water volume or in dissolved solids. The data from core holes on Yucca Mountain indicate a reasonably constant value for dissolved solids; therefore, anomalies identified by resistivity surveys would support a change in water content in the zone.

Concern: The selected ESF subsurface test area appears to lie in a highly fractured zone that could lead to water inflow and stability problems and may not provide data representative of the repository block.

RESPONSE:

The comment appears to misunderstand a statement made on page 3-1 of Chapter 3 and also on page 4-6 of Appendix J of the DAA (DOE, 1990). The comment states that the DAA contains, "an underlying assumption that any ESF location in the northeast part of the repository block will provide groundwater travel times (GWTTs) from the repository horizon to the water table in excess of 10,000 years". The DAA states, "Significant differences [in the waste isolation potential of alternative ESF locations relative to GWTT] might also exist if current or future local concentrations of large flux are caused by subsurface lateral diversion of spatially variable pulses of surface infiltration. In either of these cases, locations toward the northeast [of the repository block] would be more likely to have groundwater flow times to the water table less than the period of regulatory concern (10,000 yr) in the local zones of flux concentration."

Regarding the perched water, the potential for perched water bodies in the vicinity of the ESF location cannot be ruled out on the basis of currently available information. It is unlikely that large perched water bodies exist, because they have not been encountered in drilling at the site performed to date. Some of these holes have been drilled close to the proposed ESF locations, for example USW G-4. Some minor apparently perched water zones have been penetrated in past site drilling, for example USW H-1. The categories of site characterization data to be collected to address the possibility of perched water at the site are listed in Site Characterization Plan (SCP) Table 8.3.5.17-15, which also references the SCP studies and

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activities that discuss the collection of the data.

SCP Activity 8.3.1.2.2.4.7, Perched water test in the Exploratory Shaft Facility, is designed to detect and estimate properties of any perched water zones in the part of the unsaturated zone penetrated by the Exploratory Shaft. This evaluation is needed to understand the geohydrologic conditions causing accumulation of perched water, the implication of such a zone on flux, flow paths, travel time, and on whether perched water is a transient or permanent feature.

Before shaft sinking, any significant amount of perched water near the ESF will have been detected by the multipurpose boreholes (MPBH) (SCP Activity 8.3.1.2.2.4.9, Multipurpose-borehole testing near the Exploratory Shaft Facility). If perched water is detected, the activity allows for full preparation for sample collection and testing in the shaft. If perched water is not detected with the MPBH activity, the shaft walls will still require visual inspection for indications of infiltration possibly due to perched water.

One explanation for a resistivity anomaly could indeed be the presence of zones of greater water saturation in the unsaturated zone.

See also the DOE response to Comment 18 regarding surface infiltration pulses and lateral diversion in the unsaturated zone.

DOE (U.S. Department of Energy), 1990. Geologic and Geophysical Evidence Pertaining to Structural Geology in the Vicinity of the Proposed Exploratory Shaft, Technical Assessment Review, YMP/90-2, Las Vegas, NV.

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COMMENT 17

Concern: Movement in the near-term along the unnamed fault between the exploratory shafts could damage or disable the common hoist house and/or hoist foundations; damage or rupture buried service utilities (water, sewer, electrical, compressed air, and communications) lines in the main ESF pad; misalign conveyance guides in the shaft; damage or rupture the shaft liners and utilities in the shafts.

RESPONSE:

The seismic design of the exploratory shafts (ES), as currently configured, has been analyzed in relation to potential earthquakes and underground nuclear explosions (UNEs) in Subramanian et al. (1989). Although directly intended for design of ES shaft liners, this design basis analysis is also appropriate for seismic design of other surface structures, shafts, and other underground structures that do not affect public radiological health and safety. The report is an evaluation to determine the functions the shafts must perform during the preclosure period of the repository facilities.

Recommendations in the report include design basis parameters for both natural earthquakes that may possibly occur at or near the ES and repository site and for UNEs. The evaluation of faulting potential at the ES site and vicinity indicates that the annual probability of faulting in excess of 5 cm is less than 1 in 10,000. This analysis would be unaffected by a postulated "resistivity" fault in the location shown by Smith and Ross (1982), if it is indeed a fault. Based on this evaluation together with the results of studies to support the ES conceptual design, the report recommended that faulting effects need not be considered in the design of the ES. A failure of the ES would not affect public radiological health and safety, and the ES need only be designed to adequately provide for worker safety.

See also the response to Comment 2.

Smith, C., and H.P. Ross, 1982. Interpretation of Resistivity and Induced Polarization Profiles with Severe Topographic Effects, Yucca Mountain Area, Nevada Test Site, Nevada, Open File Report USGS-OFR-82-182 with introduction by D.B. Hoover, U.S. Geological Survey.

Subramanian, C.V., et al. 1989. Exploratory Shaft Seismic Design Basis Working Group Report, SAND88-1203, Sandia National Laboratory, NM.

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COMMENT 18

Concern: The unnamed fault bisecting Coyote Wash, the main ESF pad and the underground test drifts will provide a pathway for surface water in Coyote Wash to enter the underground facility.

RESPONSE:

Free water flowing into or out of a shaft must necessarily result from conditions that cause local saturation of the rock. Appendix J, pp. 2-8, of the Design Acceptability Analysis (DAA) (DOE, 1990) describes two possible methods by which water may be concentrated locally to cause water to flow into the shaft: (1) concentrations by infiltration pulses and (2) concentration by lateral diversion. Although a number of numerical models have been proposed to address the flow of water, these models are based on assumptions and data requiring field verification. Further, the hydraulic properties are unknown for any fault near the exploratory shafts, so that predictions of performance, based on calculations using these models, would contain many uncertainties that will not be resolved until appropriate hydrologic data is collected during site characterization.

Surface water from precipitation events and surface hydrologic channeling has been modeled using simulated faulted/fractured rock with a wide range of rock hydrologic properties. In all cases studied, the faulted/fractured region does not conduct water for the large distances that might be considered to cause deteriorated performance. Rather, the unsaturated matrix absorbs excess water from fractures so that the zone of saturation is limited to tens of feet from the ground surface. Consequently, the small quantity of water that might enter one of the shafts as a result of intersections with faults or fractures is several orders of magnitude less than the drainage capacity of the exploratory shaft facility (ESF).

Lateral diversion of water in the dipping bedded units of Yucca Mountain has been projected to occur when the flux rate exceeds some minimum value. This minimum value depends strongly on the hydrologic properties of the bedded units as well as those of the faulted zone. However, at the low flux rates projected for Yucca Mountain (approximately 0.1 mm/year based on comparisons with ambient saturation data), modeling efforts to date indicate that either (1) no flow will occur in faulted regions, or (2) flow that does occur will have very negative potentials that will not cross the seepage face at the shaft wall. At higher flux rates (0.5 mm/yr), a small amount of water could enter the shaft; however, the volume of water is much less than the drainage capacity of the ESF so that no performance impacts are expected.

Further detailed information regarding surface channeling and lateral diversion can be found in the Technical Assessment Review (DOE, 1989).

See also the response to Comment 2.

DOE (U.S. Department of Energy), 1990. Geologic and Geophysical Evidence Pertaining to Structural Geology in the Vicinity of the Proposed Exploratory Shaft, Technical Assessment Review, YMP/90-2, Las Vegas, NV.

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COMMENT 19

The SCP (page 1-209) discusses the effect on the repository block of underground nuclear weapons testing (UNEs) at the Nevada Test Site. Surface rupture and minor movements on faults have been observed locally at Yucca Flat and Pahute Mesa, current test shot areas. Mid Valley and buckboard Mesa, both of which are closer to Yucca Mountain than current test areas, are potential sites for future weapons tests.

Concern: That future UNEs located at Mid Valley or Buckboard Mesa could trigger fault slippage movement at the ESF site.

RESPONSE:

Potential impacts of ground motion induced by underground nuclear explosions (UNEs) are the focus of planned work described in the Site Characterization Plan (SCP). SCP Study 8.3.1.17.3.2 (Underground Nuclear Explosion Sources), considers ground motion from UNE sources and, using data from this and other SCP studies, Study 8.3.1.17.2.1 (Faulting Potential at the Repository), assesses the potential for fault offsets at the surface facilities site and within the repository block.

The U.S. Department of Energy response to Comment 17 further discusses the seismic design of the exploratory shafts in relation to potential earthquakes and UNEs.

COMMENT 20

On page 3-68, Fig 3-26, the Integrated Data System (IDS) Block Diagram shows input from "Calico Hills Experiments." In the text on the following pages there is no mention of this experiment. The Title I design does not show the shafts sunk to the Calico Hills horizon. However, the SCP (page 6-179) states that, "Four shafts and two ramps are proposed to penetrate the underground horizon at Yucca Mountain. Only the exploratory shaft is planned to extend below the repository horizon into the zeolitized tuff of the Calico Hills." This is inconsistent with our understanding of the current ESF project, but if the Calico Hills formation is to be penetrated, major revisions in the design must be made to accommodate the additional shaft depth, hoisting system, etc.

If characterization of the Calico Hills from the exploratory shaft is not presently contemplated, then what studies does DOE plan to adequately characterize this unit that will not compromise site integrity, since the Calico Hills tuff is considered to be the primary natural barrier to radionuclide transport.

Concern: That a future decision to deepen the exploratory shafts will compromise the safety and structural integrity of the planned test area.

RESPONSE:

As a result of NRC Objection 2 on the SCP/CD, DOE agreed to conduct a study of the risks and benefits of alternative methods of characterizing the Calico Hills unit. DOE is currently conducting a study of alternative exploratory shaft and ramp configurations and construction methods. The results of this study are being integrated with an analysis of the risk/benefit of excavating into the Calico Hills unit to conduct in situ tests. It is possible, as a result of these studies, that the exploratory shafts would be relocated.

In addition, DOE presented a revised process for controlling the ESF design at a meeting with the NRC and the State of Nevada in July 1989. The NRC indicated that the revised process appeared to be adequate and it has been incorporated into DOE administrative procedures.

COMMENT 21

We find no contingency plans for sealing the underground ESF if one of the exploratory drifts encounters a structural hydrologic feature that condemns the ESF and renders it unfit to be part of a possible repository.

Concern: There are no plans to isolate a failed ESF to assure the integrity and performance of the remainder of the repository block.

RESPONSE:

Concepts for sealing exploratory drifts against major underground flows are given in Chapter 6 of the SCP. The specific section is 6.2.8.6 on pages 6-185 and 6-186. Drawings for the concepts are given in Figure 6-83 on page 6-189. The repository is located in an unsaturated zone, and these flows would most likely be discrete. Drifts with large inflows would be isolated by grouting and drifts with small inflows would be controlled by small dams and drains.

Any ESF failure due to structural features such as faults, fractures, or excessive stressed or broken ground should be accommodated and controlled through standard mining practices for ground control. See also the response to Comment 4.

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COMMENT 22

The Title I Design Summary Report and the TAR Review Record Memorandum list comments generated by reviewers of Title I design. Of the 1172 comments presented, 478 (41 percent) were deferred to Title II, assuming that any problems in Title I would be solved during title II Design. NWPO understands that DOE proposes a phased approach to construction of the ESF.

Concern: Unresolved conceptual problems from ESF Title I design remain unaddressed as Title II Design continues.

RESPONSE:

The changes resulting from recommendations in the ESF Alternative Study will address or circumvent many of the open items noted in the Title I Design Reviews. Since major changes to the configuration of the ESF could result, resolution of many of those problems may not be necessary. Those that are still outstanding will be resolved during Title II Design Reviews. Title II Design has not begun, contrary to the assertion in the comment.

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COMMENT 23

Title I Design gave little consideration to environmental issues and possible ESF impacts upon the environment. This deficiency may be partly due to there being inadequate environmental baseline data prior to commencing design work. Items such as sewage, chemical and industrial wastes, air emissions, mine wastewater and concrete batch plant emission shave not been fully quantified to accommodate mitigation in the design. No consideration has been given in Title I Design for reclamation of the ESF, if the site proves unsuitable.

In a similar manner, during the site selection process, the environmental criteria, "surface disturbance," "reclamation," "archaeological," and "effluents and emissions" received the lowest weightings. As a group, these four items constituted only 15 percent of the total consideration. (Bertram Report, pg 78)

Concern: In addition to inadequate consideration being given to environmental issues in the site selection, design of the ESF continues without appropriate regard for possible environmental impacts related to the facility.

RESPONSE:

The U.S. Department of Energy believes environmental impacts of the Exploratory Shaft Facility (ESF) are being given adequate consideration. The Site Characterization Plan only describes the activities to be conducted to determine the suitability of the Yucca Mountain site for a repository (geologic conditions and parameters) and thus does not address the environmental impacts of the ESF or the repository. Environmental impacts are addressed in other programs and documents. An environmental assessment was prepared (DOE, 1986), an environmental monitoring and mitigation program has been established (DOE, 1988), and a Floodplain/Wetlands Assessment is being conducted.

DOE (U.S. Department of Energy), 1986. Final Environmental Assessment: Yucca Mountain Site, Nevada Research and Development Area, Nevada, DOE/RW-0073, Washington, D.C.

DOE (U.S. Department of Energy), 1988. Environmental Monitoring and Mitigation Plan for Site Characterization, DOE/RW-0208, Oak Ridge, TN.

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COMMENT 24

The SCP states (page 8.3.1.2-310) that, "The two multi-purpose boreholes will be located such that they do not penetrate within a distance of two shaft or drift diameters, as appropriate, of any underground opening." Using the drift widths shown on F&S drawing FS-GA-0162 Rev B from title I Design drawings, the boreholes MP-1 and MP-2 as located on SCP page 8.3.1.2-311 cannot meet the setback requirements. In fact, there appears no location in either of the designated pillars that can meet the standoff criteria.

The SCP (page 8.3.1.2-312) states that a third multipurpose borehole may be drilled midway between ES-1 and ES-2. Again applying the "Two drift diameter standoff" rule, there is no ground between the shafts that can qualify. Further if this third hole was drilled plumb, it would intersect the north-south drift south of the demonstration breakout drift. This same hole would collar in the drum pit of ES-2 hoist in the surface hoist house.

It is also likely that these boreholes will deviate horizontally as they are drilled. USW G-4 deviated 26 feet to the southwest at 1000 feet of depth and 48 feet at 1250 feet of depth. (See Fig 3 of USGS OFR 84-789). This anticipated deviation must also be considered in locating boreholes and setting standoff requirements.

Concern: Consideration must be given to deviation and standoff requirements and possible borehole deviation in locating future boreholes around the ESF and failure to do so may compromise drift and shaft integrity.

RESPONSE:

The U.S. Department of Energy is reconsidering the role and location of multi-purpose boreholes in connection with the ESF Alternatives Study. Integral to the reconsiderations are the questions of appropriate standoff distances, reasonable target areas for boreholes at depth, and the potential for horizontal deviation of vertical boreholes. See also the response to Comment 5.

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COMMENT 25

Some TAR Committee members that reviewed the DAA as well as many of the DAA reviewers are members of the various organizations contracted and funded by DOE. This group determined that all of the NRC concerns were "judged to be adequately addressed in the Title I design." At least five reviewers or committee members participated in either ESF site screenings or Title I design, thus their independence is questioned. The intent of the TAR would have been better suited to have an independent, unbiased team perform the TAR.

Concern: Title II Design is proceeding because of the endorsement of Title I Design by a group not entirely independent.

RESPONSE:

The overall ESF design is currently being reviewed through efforts on the ESF Alternatives Study. This study is being performed at the YMPO and will comply with 10 CFR 60 Subpart G QA requirements. The study will consider all relevant NRC requirements and concerns raised by NRC and others in arriving at an optimum layout for the ESF which could be integrated with the future repository. Based on the results of this study and depending on how significant the changes proposed, the decision on whether to continue with ESF Title II design or start all over again with Title I design (especially for those items impacting future repository design) would be made. It is expected that all necessary design control measures would be satisfied. See also the response to Comment 1.

The U.S. Department of Energy believes that the standard of independence for Technical Assessment Review (TAR) team members that was established for the review of ESF Title I design was appropriate and that the standard was met.

The procedure that governs the TAR process, QMP-02-08, specifies that it is the responsibility of the TAR chairperson to establish minimum qualifications for review team members, including independence, to accomplish the scope and purpose of the review. In this case, the standard for sufficient independence that was established by the chairperson was that review team members must not have been principal contributors to the ESF Title I design or the Exploratory Shaft Design Requirements document that was used as the basis for the ESF Title I design.

The intent of the TAR chairperson in establishing this standard was to exclude from the review any persons whose contribution to the Title I design was substantial enough to create a sense of ownership of the design and, hence, a temptation to defend it, while not excluding from the review persons who were knowledgeable of the Title-I-design history, assumptions, and requirements, simply because they had some peripheral or minor involvement with the design effort. In the judgment of the TAR chairperson, none of the review team members had sufficient prior involvement with the Title I design to feel that they were reviewing their own work. Furthermore, the Department believes that the quality of the review would have suffered had the team comprised only people who had no prior connection with, and knowledge of, the ESF Title I design.

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COMMENT 26

Page 2-60 of the DAA discusses several of the known potential problems with repository performance as related to structural failure within the ESF. With this acknowledgment that ESF failure could jeopardize repository performance, retrieval, etc., prudence would demand that ample, reliable data pertaining to rock strength and other characteristics be available before proceeding with detail design.

Concern: The ESF design is based on unsubstantiated rock properties which may lead to failure in the ESF and have future impacts on the repository.

RESPONSE:

The comment expresses concern that the ESF design is based on insubstantial rock properties and that this would ultimately lead to ESF failure and ultimate future performance impacts. This is unwarranted and the comment considered failure modes in section 2.6.1.1 of the DAA that are not specifically addressed and is taken out of context.

Section 2.6.1.1 discusses the 10 CFR 60 requirements not specifically addressed in the DAA but would be addressed along with other requirements in Title II ESF Design. The DAA position is that the Title I ESF Design, construction, and testing activities are unlikely to impact repository operations or affect compliance with 10 CFR 60.

In short, the possible scenarios considered in 2.6.1.1 were to address the influence of ESF on the repository requirements outlined in 60.111, not to estimate the likelihood of occurrence of these events nor suggest that uncertain rock properties or possible tectonic events would necessarily lead to these scenario outcomes. It is one purpose of the ESF to carefully measure rock properties that are pertinent to waste isolation. To the extent that the design of the ESF is dependent on a priori detailed knowledge of rock properties, rock properties are based on the best available information.

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COMMENT 27

On page 8.5-48 of the SCP there is a listing of Site Characterization Study Plans. Fourteen programs are listed which incorporate 106 study plans. While SCP Chapter 8 contains brief descriptions of the study plans, the detail here is not sufficient to evaluate procedures and equipment involved. More important, it is difficult, if not impossible, to determine the interface impacts of each study on concurrent studies or on the simultaneous development of the ESF.

Concern: Detailed study plans will be developed too late to be used in the design process to insure test-to-test and test-to-ESF construction compatibility.

DOE (U.S. Department of Energy) 1986. PMF Study, Memorandum:
Bullard to Head, Flood Section.

DOE (U.S. Department of Energy) 1988. Yucca Mountain Project Exploratory Shaft Facility title I 100 Percent Technical Assessment Review,
YMP/88-19A.

DOE (U.S. Department of Energy) 1989. Exploratory Shaft Facility (ESF) Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Locations, YMP/89-3.

DOE (U.S. Department of Energy) 1988. Site Characterization Plan,
DOE/RW-0199.

Loux, R.R., 1988. Letter from Robert Loux (NWPO) to Carl Gertz (DOE) regarding flooding at the ESF site.

Loux, R.R., 1988. Letter from Robert Loux (NWPO) to Carl Gertz (DOE) regarding ESF site selection.

Loux, R.R., 1989. Letter from Robert Loux (NWPO) to Deborah Valentine (DOE) regarding determination of floodplain for Site Characterization.

Smith, C., and H.P. Ross, 1982. Interpretation of Resistivity and Induced Polarization Profiles with Severe topographic Effects, Yucca Mountain Area, Nevada Test Site, Nevada, USGS-OFR-82-182, Open-File Report, U.S. Geological Survey.

Squires, R.R., and R.L. Young, 1984. Flood Potential of Fortymile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada, USGS-WRI-83-4001, Water Resources Investigations Report, U.S. Geological Survey.

USGS (U.S. Geological Survey) (Comp.), 1984. A Summary of Geological Studies Through January 1, 1983 of a Potential High-Level Radioactive Waste Repository Site at Yucca Mountain, Southern Nye County, Nevada, USGS-OFR-84-792, Open-File Report, U.S. Geological Survey.

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RESPONSE:

Interface impacts between studies and Exploratory Shaft Facility (ESF) design are the subject of ongoing and continuing review. Although the descriptions of studies are relatively brief in the Site Characterization Plan, the level of thought behind those studies and their interrelations was generally more mature in detail than space permitted. These details are presented in study plans. More than half of the 106 study plans have been written and are in review at the U.S. Department of Energy (DOE), and thus available for the design process, if required. Study Plans for experiments in the ES have been approved and are in review at the U.S. Nuclear Regulatory Commission. DOE recognizes, however, that studies must and will change as site characterization proceeds. The use of the best available knowledge followed by continuing review is the only appropriate way to ensure maximum compatibility between conduct of studies and ESF design and construction.

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COMMENT 28

During the past 5 years this office has observed with keen interest as the conceptual and preliminary designs for the Exploratory Shaft Facility evolved. While a few of our concerns regarding the planning, as expressed in my letter of 5/31/88, have been alleviated, most are still in limbo awaiting resolution in subsequent design processes or at some future discussion or review. This letter will discuss our continuing concern involving the location of the exploratory shafts and their related surface facilities.

In the early conceptual plans, the exploratory shaft collars were located close to midstream in Coyote Wash. At a DOE/NRC/State meeting held April 14 and 15, 1987, to discuss proposed changes to the ESF, DOE announced that the conceptual plans were being revised to relocate the shaft collars 440 feet to the northeast. The stated motivation for the relocation was NRC Staff concerns that the original locations were sited in the alluvial fill of Coyote Wash. The new location was said to minimize the likelihood of collar erosion because the shafts would now be collared in hard rock outside the flow channel of Coyote Wash.

At the ESF Title I 50 Percent Design Review meeting held in May of this year, the NRC Staff continued to express concerns related to collar erosion and possible shaft flooding resulting from flood flows in the adjacent Coyote Wash. It appeared that the shift to hardrock and retreat from the center of the wash did not entirely allay the NRC concerns.

The ESF Title One Design Review is currently nearing completion. Reviewing the latest release of Title I plans relating to the surface facilities in the subject area, we note minor revision in the drainage plans for the Coyote Wash channels that are culverted under the road connecting the ESF pad and drill hole G-4 pad. This situation is in the State's view a bottleneck and will be addressed in future correspondence.

Of major concern with the ESF Design is the analyses and references used to develop the Probable Maximum Flood (PMF) levels. We note that the prime reference for the PMF predictions is a USGS Water-Resources Investigations report, #83-4001, Flood Potential of Fortymile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada. This report was prepared by Squires and Young. However, in reviewing the Consultation Draft of the Site Characterization Plan, Chapter 3, we get the impression that the DOE has little confidence in the flood prediction studies done to date.

Note the following excerpts from your Draft SCP:

Page 3-8. Regarding runoff: "--scanty data available for the region---". Later: "Quantitative data on rainfall, runoff, and evaporation for the area are not yet adequate to determine rainfall-runoff-recharge relations for individual storms, seasons, or years. Therefore, only general knowledge of runoff parameters is available.---- models can't be calibrated until more field data become available."

Page 3-12. Regarding streamflow at Yucca Mountain: "----almost no streamflow data have been collected."

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Regarding floods: "Flood analyses at Yucca Mountain are needed to provide flood data for design and performance considerations."

Page 3-13. Regarding future flooding: "Confidence in predictions of future flooding is lessened because of the sparse historical data, quantitative or qualitative, on streamflow or flooding throughout the region surrounding Yucca Mountain."

Page 3-14. Regarding long term flood predictions: "Predictions are especially difficult for drainages with minimal stream-flow records, such as those in the hydrologic study area."

Page 3-16. Regarding calculating probably maximum flood: "The sparse streamflow records, the availability of only minimal precipitation and storm data, and the absence of data on infiltration-runoff characteristics for the drainage basins in the Yucca Mountain area requires that many speculations and assumptions would be needed to calculate the magnitude of probable maximum floods in complex drainages the size of Forty mile and Topopah washes. Also, the lack of storm and runoff data throughout the hydrologic study area prevents checking the validity of the various assumptions used."

Page 3-17. Regarding the drainage basins of Busted butte Wash and Drill Hole Wash: "The regional maximum flood would inundate all central flat-fan areas in these two watersheds."

Page 3-19. Regarding erosion: "The extent of erosion and sediment movement caused by flood flow in Fortymile Wash and its tributaries that drain Yucca Mountain is not known quantitatively."

Regarding flood and debris hazard: "The sparseness of the historic data base on surface water hydrology, including the movement of both water and debris inhibits accurate prediction of flood and debris hazards for the immediate future. Likewise, a deficient understanding of the paleoclimates and the past geomorphic processes limits the ability to predict climatic changes and their probable effects on flood-and-debris-hazards potential over the next several thousands of years."

Page 3-20. Regarding hazard potential: "The minimal data on stream flow and insufficient knowledge of geomorphic parameters make predictions of flood and debris hazards very speculative."

In looking at the overall Yucca Mountain Project, we view the determination of the PMF or other major hydrologic event as major design uncertainties. Without substantiated hydrologic data on a given site, it is impossible to obtain a PMF at that particular site. Since it is clearly acknowledge in

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both the CD-SCP and the CDR that no site specific data exist for the Coyote Wash area, it becomes a question of conservatism as to the determination of the PMF.

The problem is that the design depends on the PMF determination and the PMF determination is likewise dependent upon the design. PMF is determined by considering hydrologic data, which is sparse, and the planned structures in the wash that will cause backwater effects, damming, etc. In a relatively narrow wash, such as Coyote Wash, the peak level of the PMF is highly dependent on the existence of such obstructions.

In order to insure that the ESF shafts will be safe and free from the damage due to major hydrologic events, it is critical to place the shafts in a position and at an elevation that the engineering and scientific community as a whole agree as safe from the PMF. At their current locations, the shafts certainly do not meet this standard.

We certainly concur with the discussion contained in the Draft SCP: flood prediction at Yucca Mountain is indeed very speculative. Our obvious question is, therefore, how can you confidently site the ESF shafts that will technically be an integral part of the licensed repository in Coyote Wash considering the unfounded, admittedly deficient condition of the potential flood data? We might further point out that the other proposed shafts, the ramps and the surface facilities described in the CDR all may have a similar problem.

RESPONSE:

U.S. Department of Energy (DOE) first responded to these concerns in a letter from Carl Gertz to Robert Loux dated November 27, 1989. The ESF Alternatives study, discussed in the response to Comment 1, will identify all repository access configurations and ESF configurations and construction methods considered in the past. The purpose of the study is to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada and DOE. The data, and uncertainties in that data, that pertain to the potential for flooding and probable maximum flood is part of this study.

DOE (U.S. Department of Energy), 1989. Consultation Draft of the Site Characterization Plan, DOE/RW-160, Washington, D.C.

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COMMENT 29

At the July, 1988 DOE/NRC/State meeting in Rockville, MD, regarding NRC concerns about the Exploratory Shaft Facility (ESF), Joe Tillerson of Sandia gave a presentation that responded to NRC Objection No. 4, "Shaft Locations." Part of this presentation was a bit of history that attempted to defend the reasoning behind the selection of the present ESF shaft locations. Mr. Tillerson cited two references: (1) "detailed discussion with NRC in 8/85 meeting" and (2) "Selection process documented in SAND84-1003." The purpose of this letter is to discuss the latter.

SAND84-1003, NNWSI EXPLORATORY SHAFT SITE AND CONSTRUCTION METHOD RECOMMENDATION REPORT, was authored by Sharla G. Bertram on Sandia's Seabed Programs Division, and published in August of 1984. The abstract claims that the report documents the evaluation of alternate construction methods and the screening of potential exploratory shaft sites. The report concludes by recommending a vertical shaft, conventionally mined, in a dry canyon known as Coyote Wash.

What we find incredible is the brief, just three month, duration of this effort and the lack of documented data upon which to compare alternatives as a basis for the selections. In fairness, we are aware that much has changed since these recommendations were made in the spring of 1982; however, unfortunately the results of this hasty, unreferenced evaluation survive and continue to be perpetuated by DOE.

According to the report, on March 29, 1982, a few months prior to passage of "The Nuclear Waste Policy Act," a working group was formed to develop procedures for evaluating ESF construction methods and screening sites. Thirty days later, on April 28th, the procedures were completed, approved by the senior project officers of all participating contractors in the NNWSI, and the working group became the Ad Hoc TOC Committee. Their task was to refine criteria and implement the methodology. They were further charged with recommending the preferred construction method by May 10 and recommending the preferred site by June 1. This schedule allowed 11 calendar days (6 working days) to select a construction method and generously allowed 33 calendar days (22 working days) to select a site. The method recommendation was presented and unanimously approved on May 12, two days late. No exact date is mentioned for the presentation of the site recommendation, but the report implies the work was completed in June.

On August 22, 1982 Drill Hole USW G-4 was started in Coyote Wash. Note that the shaft site was selected before G-4 was even started and therefore the evaluation criteria that addressed underground fractures, vertical thickness of units, and underground adverse conditions had to be based on the existing drill hole data from G-1, H-1, H-4, and UE25a-1, the latter being the closest to the selected site, being 3300 feet to the east. The Committee stated that it used the most current information available; most data, including that from USGS, was preliminary and unpublished; and that the information was incorporated into the report without reference. Perhaps the rushed schedule was prompted by the stated assumption that shaft construction would begin March 31, 1983.

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Before recommending a construction method, the committee considered 12 alternatives. Five of these were evaluated using merit analysis. Two of the five called for shafts extending through the Calico Hills Unit into the Bullfrog and Tram Units. Though somewhat unsophisticated and general in nature, the process seems to have resulted in the Committee somehow stumbling onto perhaps the best construction method.

The Committee next selected four categories of screening criteria for site selection: 1) Scientific, 2) Engineering, 3) Environmental, and 4) Nontechnical.

From this point the Committee proceeded to screen alternate repository block areas using boundary setbacks, and distance to potentially adverse geologic structures to develop acceptable areas for siting. In addition, all areas of steep slopes or adverse topography were eliminated. From this screening emerged five preferred areas: two on Yucca Ridge and three located in washes on the eastern flank of Yucca Mountain.

It should be noted here that perhaps the greatest flaw in the selection process was in the logic applied to this screening that selected the five preferred sites. Heavy emphasis was placed on two factors: setback from the repository boundaries and avoidance of adverse geologic structures.

In an effort to center the ESF on the block and insure typical representation, the following buffer criteria were applied and the border areas of the block were eliminated:

1. A 500 foot wide strip along the west side of the block, thus avoiding Solitario Canyon Fault zone.
2. A 1000 foot wide strip along the north side of the block, thus avoiding possible drill Hole Wash faulting.
3. A 2000 foot wide strip along the eastern side of the block, thus avoiding the imbricate faults.
4. All land lying south of a line 4000 feet north of H3, thus avoiding the numerous faults suspected in Abandoned Wash.

This exercise eliminated 633 acres (42 percent) of the 1520 acre block and left 887 acres as acceptable. If roughly 40 percent of the block is unsatisfactory for the ESF, the question arises: should the block even be considered for a repository?

Next, to avoid adverse geologic structures as identified by USGS, all lands less than 1000 feet and more than 2000 feet from an adverse structure were eliminated. The intent here seemed to be to maintain a 1000 foot buffer for safety but stay within a maximum of 2000 feet distance so that underground horizontal drilling to the structure could be accomplished. These criteria eliminated another 812 acres leaving 75 acceptable acres.

Finally, of the remaining 75 acres, 52 acres of steep slopes (term undefined)

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were eliminated. This left 23 acres of 1.5 percent of the original 1520 acre block that the committee considered acceptable for an ESF site. These 23 acres were divided among 5 sites, three in washes and two on the ridge top.

Perhaps it made sense to avoid the perimeter boundary of the block and seek a central location. However, a program mandated to characterize the repository block, including its structures, should not have eliminated so much area in an effort to avoid the very geologic structures that were to be investigated. Sinking a shaft near a fault zone is not uncommon, using existing technology. further, there is no assurance that the two ESF shafts or the Men & Materials and Exhaust shafts won't intercept currently unknown faults during sinking, however it seems assured that the proposed ramps will intersect several fault zones as they are driven. In addition, structures that were so carefully shunned in the screening were not all proven, many being only suspected by USGS, based on surface work.

In reviewing the maps that define the various areas discussed above, it is apparent that the nebulous "steep slope" factor was employed in to eliminate a 30 acre tract lying in the center of the block in the area of Antler Ridge. Construction of a road and the required utilities would have been comparatively more difficult here, but by no means restrictive.

The "Nontechnical Category" was discarded because all five sites were considered equal in this category. The remaining parameters were each assigned a weight, with flash flooding, reclamation and surface disturbance at the bottom of the list each with a maximum of 3.0 percent of the total score. Heading the list as most important to the site selection was "subsurface facilities located in good rock" at 16.5 percent of 5.5 times more important than flash flooding.

There then followed in the report a brief discussion of the pros and cons of each of the five sites. The two ridge top sites were suspect because building a mud pit for drilling effluents would be difficult; the muck piles would have to be at the heads of washes making reclamation difficult; a large area would have to be disturbed to gather enough material for the pads and berms; the long access road would require more control over off-road driving of heavy equipment; more road paving would be required; lack of topsoil would require hauling in topsoil for reclamation which would be dissimilar soil to that originally removed; and finally, vegetation recovery would be impeded by wind and water erosion. Needless to say, the ridge-top sites finished a distant 4th and 5th in the ranking.

The first of the wash-bottom sites was said to require some paving of the existing road. All other factors paralleled, but were rated slightly inferior to Coyote Wash. This site was ranked a close second.

The other runner-up wash-bottom site apparently was a throw-away early on. It was located in a "narrow, constricted, and steep wash." The report stated that flash flooding threatened to destroy mud pits, and wash away contained effluents and the muck pile. (We feel similar characteristics exist in Coyote Wash). Overhanging rock cliffs would have to be removed for safety during site preparation, and would be impossible to replace at reclamation. This site was ranked third.

The unanimous winner was, of course, the Coyote Wash site described as, "in a

broad, open wash" providing "suitable areas for mud pit or muck pile construction without flash flood problems." The clincher was that road construction would be required for only a short distance. It is interesting to note that even with the skewed ratings, Coyote Wash was tied or outranked in 8 of the 12 subcriteria applied to compare the 5 sites.

It is also noteworthy that the question of adequate available pad area was never addressed. In the recent Title I ESF Design Reviews, crowding of the facilities on the pad has been a recurring issue.

In the intervening years, as repository requirements and configurations were changed, as the NRC and State of Nevada repeatedly were critical of the Coyote Wash ESF location, and as the planned ESF was enlarged from one shaft to two and shaft depths changed, we saw no attempt to revisit the 1982 ESF selection decision. We therefore strongly recommend that the ESF Site selection decision be reviewed now, in the context of the existing information and consistent with the status of site characterization planning. We further recommend that, unlike the 1982 process, appropriate quality assurance procedures be applied to the evaluation and any resultant decisions and conclusions.

RESPONSE:

U.S Department of Energy (DOE) first responded to these concerns in a letter from Carl Gertz to Robert Loux dated November 27, 1989. The ESF Alternatives study, discussed in the response to Comment 1, will identify all repository access configurations and ESF configurations and construction methods considered in the past. The purpose of the study is to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada and DOE. This study is being carried out using a QA program that fulfills the requirements of 10 CFR 60 Subpart G, and the results will be available for the State's review.

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COMMENT 30

It has come to the attention of the Nevada Agency for Nuclear Projects, Nuclear Waste Project Office, and the subject Federal Register of DOE's Determination of Floodplains/Wetlands Involvement was published on February 9, 1989. We discovered this notice in March 1989, and in fact, have never received direct notification of its publication from the U.S. Department of Energy despite the fact that Yucca Mountain, Nevada, is named in the Nuclear Waste Policy Amendments Act of 1987, as the location of DOE's high-level nuclear waste candidate repository site characterization activities. Federal regulations for Compliance with Floodplains/Wetlands Environmental Review Requirements state, at 10 CFR Part 1022.14(b), that "DOE shall take appropriate steps to inform Federal, State, and local agencies and persons or groups known to be interested in or affected by the proposed floodplains/wetlands action." In view of the DOE's apparent oversight in providing direct notification of the subject determination of the State of Nevada, please provide this office with a description of the "appropriate steps" taken by DOE for notification of this determination, and a list of those agencies, persons, or groups (if any) that were individually informed of the DOE's February 9, 1989, determination.

RESPONSE:

Publication of a notice in the Federal Register served as notification to the State of Nevada and other interested parties. No agencies, persons or groups were individually notified.

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COMMENT 31

In reviewing the subject FR Notice, its cited references, and additional information that is available from the DOE, it is apparent that these documents do not provide adequate and complete descriptions of the proposed specific actions and their locations for comprehensive analysis, nor do they provide adequate information on the delineations of the floodplains/wetlands and their natural environmental and ecological characteristics that are likely to be affected.

RESPONSE:

The intent of a Federal Register Notice is not to provide detailed information on the assessment, but to provide a notice of proposed activities in a floodplain. The specifics of the proposed action will be addressed in a Floodplains/Wetlands Assessment. When the Assessment is available, DOE will issue an announcement in the Federal Register and also notify the State of Nevada.

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COMMENT 32

Although the subject FR Notice makes specific reference to Site Characterization activities as the proposed actions, it is unclear, based upon cited references, whether the Determination is also intended to refer to repository surface facilities, should such facilities be constructed. This matter should be clarified.

RESPONSE:

The determination applies only to site characterization activities and does not include repository surface facilities because the Yucca Mountain site has not, as yet, been recommended for development as a repository. Should such facilities be constructed, a separate flood plain/wetlands review will be conducted.

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COMMENT 33

Specific comparisons of alternative sites considered for proposed actions in floodplains/wetlands have not been discovered in the referenced materials, or other available information.

RESPONSE:

Alternative sites will be presented in the Floodplains/Wetlands Assessment. Initially, five sites were identified as suitable for the Exploratory Shaft Facility (ESF). The final site was selected on the basis of four site selection criteria: scientific (e.g., favorable rock conditions), engineering (e.g., flooding), nontechnical (e.g., land use constraints), and environmental (Bertram, 1984).

The ESF Alternatives study, discussed in the response to Comment 1, will identify all repository access configurations and ESF configurations and construction methods considered in the past. The purpose of the study is to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada, and DOE. This study is being carried out using a QA program that fulfills the requirements of 10 CFR 60 Subpart G, and the results will be available for review by the State.

REFERENCES

Bertram, S.G., 1984. NNWSI Exploratory Shaft Site and Construction Method Recommendation Report, SAND84-1003, Sandia National Laboratories, Albuquerque, NM.

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COMMENT 34

There is no specific discussion regarding the applicability and compliance requirements of Section 404 of the Clean Water Act relative to the proposed actions. Additional information should be provided regarding this matter.

RESPONSE:

The Floodplains/Wetlands Assessment will discuss the applicability of the Clean Water Act Section 404 Permit. The U.S. Department of Energy (DOE) has asked the Army Corps of Engineers for a determination concerning the applicability of the 404 Permit. The Army Corps of Engineers has granted DOE a Section 404 Permit, as required by the Clean Water Act, under its Nationwide Permit (33 CFR Part 330.5).

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COMMENT 35

The referenced materials and other available information are insufficient to permit calculations of the affects of structures proposed to be located in floodplains/wetlands on resultant flood heights and velocities.

RESPONSE:

The Floodplains/Wetlands Assessment will provide information on construction activities in the floodplain. Most of the facilities will be located outside of the 100-year floodplain. Proposed structures such as roads, culverts, borrow areas, screening plant, and channels have been designed for protection from erosion, scouring, and debris loading and transportation. Due to the extreme volume of flow from a probable maximum precipitation event, culverts and roadways will be designed so that they do not back water to more than a 2-meter (6-foot) depth to prevent flash flooding produced by retention dams.

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COMMENT 36

Given the general lack of sufficient, and traditionally available, information to evaluate the proposed floodplains/wetlands actions relative to the requirements of 10 CFR Part 1022 and the relevant executive orders, I am requesting that the Floodplains/Wetlands Assessment, required to be prepared by DOE (10 CFR Part 1022.12), be issued in draft form for review and comment, prior to DOE's issuance of its statement of findings as required by 10 CFR Part 1022.15. This will enable Nevada to undertake a comprehensive evaluation of the proposed actions with respect to the requirements of 10 CFR Part 1022 and provide substantive comment to DOE in a timely and constructive manner. This request is in accord with the intent of the regulation, as well as that of the Nevada's assigned review and oversight role pursuant to the Nuclear Waste Policy Act.

RESPONSE:

The U.S. Department of Energy is preparing the Floodplain/Wetlands Assessment (FWA) in accordance with 10 CFR Part 1022. A draft FWA will be provided to the State of Nevada. The opportunity for review and comment on the FWA is set forth in 10 CFR Part 1022.

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COMMENT 37

Referring to the ESF Title I design, engineering drawings and design narrative do not describe the relationship between hydrologic events expected for the site and the region and the design of the facilities. Other literature presents several storm hydrographs for the Yucca Mountain area which relate to expected precipitation at the site in a general way. How these areal data affect the flood boundaries illustrated within the design drawings is not clear. Such data, if site-specific, also relate to expected flood elevations, volumes, and velocities.

Originally, the Squires and Young Report (USGS Water Resources Investigations Report 83-4001, 1984) was to be the major tool by which the ESF location was justified and other ESF improvements were designed. The current site plans for the ESF conflict with the drawings within the Squires and Young Report in terms of flood boundaries. These differences may prove to be justified, but without specific data and calculations any alteration of the originally established flood boundaries cannot be accepted.

RESPONSE:

The Exploratory Shaft Facility (ESF) design, as required by the design constraints in the exploratory shaft facility Subsystem Design Requirements Document (SDRD) for Title II (DOE, 1990), incorporates design features to protect the facility against credible hydrologic events, such as flooding.

The ESF Alternatives study, discussed in the response to Comment 1, will identify all repository access configurations and ESF configurations and construction methods considered in the past. The purpose of the study is to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada, and DOE. The data, and uncertainties in that data, that pertain to the potential for flooding and probable maximum flood is part of this study.

DOE (U.S. Department of Energy), 1990. Exploratory Shaft Facility (ESF) Subsystem Design and Requirements Document (SDRD) for Title II, YMP/CM-0006, Las Vegas NV.

COMMENT 38

Throughout the ESF Title I drawings, channels, roads, culverts, and even buildings are depicted that may prove to have an adverse impact on the hydraulic characteristics of the washes in the area. For example, on Sheet C39, three 36-inch culverts are to be placed underneath H Road. Further up the wash, H Road enters the 100-year floodplain (see Sheet C45 B). This illustrates that the wash does carry some significant flows as would be expected, but the impacts of placing the three culverts downstream have not been addressed, as is evident by the information presented. It is one thing to simply ensure that all pad and roadway elevations are above the 100-year Floodplain; but of concern is the impact that improvements downstream, which may not be in the floodplain, may have on the upstream improvements as a result of backwater effects.

RESPONSE:

The effects of a 100-year flood were considered in the design of the proposed structures (i.e., roads, culverts, channels, etc.). Minimum side slopes of 2:1 are used on all ditches and channels. Culvert design incorporates corrugated metal pipes with concrete headwall and tailwall. Rip rap protection, added to both the side slopes and bottoms of channels is placed a minimum distance of 9.8 meters (30 feet) upstream and 16.4 (50 feet) downstream of the culvert.

The possible impact of heavy water flows being backed up by blockages in the culverts under a road was discussed at the 50% Design Review and was resolved by lowering the elevation of the road so that water would not build up above the shaft collars.

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COMMENT 39

Another concern that should be addressed is the affect of flood water velocities. Although the ESF site improvements proposed within the 100-year Floodplain may be safe as far as elevation is concerned, the scour potential of flood events in the Yucca Mountain area is enormous. The borrow pit proposed is to be constructed as a channel within the floodway and the muck storage pad is to be placed adjacent to the channel at a bend. Scour at the bend not only can realign the channel, but can undermine the access road and muck storage area.

RESPONSE:

Information on potential flood water velocities from Squires and Young (1984) will be used as a basis to prepare the Floodplains/Wetlands Assessment and was used as input to Title I Design to protect against scouring, erosion, and debris loading and transportation. In addition, protection and control of erosion would be provided by reduced channel gradient, structures at abrupt changes in gradient, and entrance of water course branches, drop spillways, energy dissipaters, and rip rap protection at key points. See also the response to Comment 3.

The ESF Alternatives study, discussed in the response to Comment 1, will identify all repository access configurations and ESF configurations and construction methods considered in the past. The purpose of the study is to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada, and the U.S. Department Energy. The data, and uncertainties in that data, that pertain to the potential for flooding and probable maximum flood is part of this study.

Squires, R.R., and R.L. Young, 1984. Flood Potential of Fortymile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada, USGS-WRI-83-4001, Water-Resources Investigations Report, U.S. Geological Survey.

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COMMENT 40

The ESF site improvements to the floodplain should be designed based on the expected flood conditions, and then the flood elevations recomputed based on improvements with the floodways. From a review of the available literature, there is nothing to justify the 100-year and PMF (500-year) boundaries presented. It is likely the boundaries could be altered dramatically by the proposed improvements.

RESPONSE:

Section 3.2 in the Site Characterization Plan contains a detailed discussion of the flood history and potential for future flooding in the Yucca Mountain area and was modified from Squires and Young (1984). Squires and Young used a method that allows reliability evaluation based on nearby flood data. Title II Design will incorporate flood and erosion control procedures based on site-specific flood elevation analyses.

The ESF Alternatives study, discussed in the response to Comment 1, will identify all repository access configurations and ESF configurations and construction methods considered in the past. The purpose of the study is to perform a documented, detailed analysis of ESF/repository access configurations and construction methods in response to comments raised by the NRC, the NWTRB, the State of Nevada, and U.S. Department of Energy. The data, and uncertainties in that data, that pertain to the potential for flooding and probable maximum flood is part of this study.

REFERENCES

Squires, R.R., and R.L. Young, 1984. Flood Potential of Fortymile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada, USGS-WRI-83-4001, Water-Resources Investigations Report, U.S. Geological Survey.

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COMMENT 41

For the repository surface facilities site, no information is provided in the literature to evaluate the affects of sheet flooding on the proposed site or what floodplain modifications will be made to the site for site characterization activities and how such modifications might impact flood elevations.

RESPONSE:

Potential impacts due to sheet flooding on the repository surface facilities site will be evaluated as part of the site characterization program, for example Study Plan 8.3.1.2.1.2 (Characterization of Runoff and Streamflow), and results will be used as input to the engineering design for the repository. See also the response to Comment 44.

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COMMENT 42

The probability of flood damage to the structures located in the floodplain should not be discounted. Thus, it is deemed critical that a study be initiated to evaluate the impact of such a hydrological event on the performance of the proposed repository. Specifically, the study should outline the damage assessment in the event of surface support facilities' inundation on the total operation and performance of the repository.

RESPONSE:

Refer to responses for Comments 41 and 44.

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COMMENT 43

The proposed borrow pit channel and the smaller channel below the ESF equipment storage area, both appear to outfall into the natural drainage ways. These drainage ways appear to parallel and flow across the main haul road. As an alternative, the road could be built up above its natural grade, as appropriate, to keep it out of the 100-year Floodplain, and a culvert crossing constructed (station 366-50?) to control the flow across the roadway.

RESPONSE:

The proposed borrow pit is designed to become part of the natural drainage way. The main access road is designed to enter the floodplain only one time, at the lower end of the borrow area. No culverts are planned at this crossing. If flooding occurs, the water would be allowed to flow over the road. Culverts are planned where the access road crosses over the wash below the main exploratory shaft facility pad. The design of the proposed borrow area and access road incorporates protective measures against erosion, scouring, and debris loading and transportation. See also comment 40.

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COMMENT 44

On a project of this magnitude, where the consequences of failure are catastrophic, the elemental design cannot be based on an inadequate data base. A thorough investigation of all design parameters must be carried out, and all pertinent information gathering tools should be utilized to construct and build a sound data base for project-specific aerial distribution of rainfall, rainfall ground infiltration, and magnitude of stream channel losses. There should be a concerted effort to initiate a program to systematically collect long-term flood data within the project perimeter, so that more relevant rainfall-runoff models for the ESF site and the repository surface facility site can be studied.

RESPONSE:

The importance of the need for long-term flood data was identified in the Site Characterization Plan (SCP). SCP Section 3.2.1.1, Ongoing and Future Studies of Flood and Debris Hazard Potentials, addresses the plans to improve the surface-hydrologic data base at Yucca Mountain and the surrounding areas. Also, future plans for investigations of, and data collection for, potential flood and debris hazards are described in SCP Section 8.3.1.5.2.

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COMMENT 45

For the ESF site, it is not clear what provisions have been made to contain spills and contaminants from flowing or being carried by storm water runoff into the floodplain from the compressor, generator building, and substation area.

RESPONSE:

Field contractors are required to adopt specific waste minimization, handling, accumulation, manifesting, and disposal practices that comply with Federal law and the State hazardous waste program. Details of these practices will be presented in the Hazardous Materials Management and Handling Program, which is in preparation.

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COMMENT 46

The proposed measures of rerouting segments of several dry washes around critical facilities and straightening banks along several wash segments to "avoid adverse effects related to the location of surface facilities in the floodplain" do not address the effects of observed extensive erosion and deposition patterns characteristics of neighboring floodplains noted during field surveys. Erosion of, or deposition in channels and floodplains would be significant in the Yucca Mountain area during a 100-year flood event and could be severe during the 500-year and regional maximum floods. Ephemeral-channel systems generally undergo significant changes in depth, width, alignment, and stability with time, particularly during floods of long recurrence interval.

RESPONSE:

On the basis of studies by Squires and Young (1984) and Bullard (1986) flood magnitudes and erosion effects were determined. The proposed control measures have considered the erosion and scouring potential of the various floods. The new channel, a deepening of the existing channel, makes the new proposed floodplain narrower. The major "rerouting" of the proposed channel is located at the north end of the borrow area. Rip rap would be used to further reduce the potential of erosion. This new channel is designed to control potential floodwaters flowing through the exploratory shaft facility area while still not significantly changing the floodplain below the planned activities. See also the response to Comments 38 and 40.

REFERENCES

- Bullard, K.L., 1986. PMF (Probable Maximum Flood) Study for Nevada Nuclear Waste Storage Investigations Project, GR-87-8, U.S. Department of the Interior, Bureau of Reclamation, Washington, D.C.
- Squires, R.R., and R.L. Young, 1984. Flood Potential of Fortymile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada, USGS-WRI-83-4001, Water-Resources Investigations Report, U.S. Geological Survey.

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COMMENT 47

For the ESF site, considering the significant modifications proposed to be constructed in the floodway (not just the floodplain), it would seem appropriate to include the results of a backwater analysis (HEC-2) conducted on the site in the floodplain assessment. Such an analysis might assist determination of whether the improvements proposed have a positive or negative impact during flood occurrences.

RESPONSE:

Section 3.2.2, Flood Protection, in the Site Characterization Plan discusses proposed flood analyses. A preliminary analysis of the probable maximum flood (PMF) was done based on a study by Bullard (1986). The primary purpose was to evaluate the feasibility of locating the shaft and its supporting complex in such a rugged area. The Corps of Engineers' HEC-1 methodology for estimating PMF and HEC-2 methodology for conducting backwater analyses are being used to prepare the Floodplain/Wetlands Assessment. Title II surface facility design will be based on PMF flows and levels, determined in accordance with ANSI/ANS 2.8-1981, which incorporates HEC-1 and HEC-2 analyses.

REFERENCES

Bullard, K.L., 1986. PMF (Probable Maximum Flood) Study for Nevada Nuclear Waste Storage Investigations Project, GR-87-8, U.S. Department of the Interior, Bureau of Reclamation, Washington, D.C.

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COMMENT 48

For the ESF Title I Design, data were not issued in the Title I Design Report to allow review of specifications on "fill" areas, such as allowable materials, compaction requirements, compaction techniques, and final acceptance criteria. These are necessary considerations when considering effects of storm water.

RESPONSE:

Fill specifications are discussed in the ESF Title I Summary Report, Chapter 6, Design Aspects. In the design, all pads are constructed in a similar manner. Excavation is below grade approximately 21 ± 7 centimeters (9 ± 3 inches). Type II material is placed in two lifts, which are not greater in depth than 14 ± 2 centimeters (6 ± 1 inch) and are compacted to 95 percent at optimum moisture.

In fill subgrade, after removal of topsoil, the surface is compacted to 95 percent and select material from the borrow pit is brought in and mixed by alternate loading and blading with blasted rock if available.

The depth of base coarse is determined by California Bearing Ratio (CBR) and is a type II material in 14 ± 2 centimeters (6 inch ± 1 inch) lifts compacted to 95 percent at optimum moisture.

Several methods have been considered and are used to protect side slopes from erosion, depending on the fill characteristics. Ditches adjacent to berms and built on fill are concrete lined if velocities are greater than 1.3 meters (4 feet) per second. Runoff is collected in catch basins and piped down slopes where concrete grouted rip-rap is used for erosion control. Side slopes are sprayed with soil stabilizer and compacted and trimmed with side rolling during their construction.

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COMMENT 49

ESF Title I Design drawings (DWR C-37) locate a buried fuel tank in a floodway and possibly the floodplain. The buried fuel tank for emergency generators must comply with Section 601 of the 1984 RCRA Amendments (Public Law 48-616), which provides requirements on buried fuel tanks for the protection of the environment, which were not addressed in the drawings issued.

RESPONSE:

The proposed buried fuel tank for the emergency generators is located outside of the 100-year floodplain. RCRA requirements for underground storage tanks (USTs) are addressed in the Title I Summary Report in Chapter 4, Environmental Aspects, under Section 4.5 Hazardous and Solid Wastes. All USTs will be designed, operated, and monitored as required under RCRA Subtitle I and the State of Nevada UST program.

REFERENCES

U.S. Department of Energy (DOE), 1988. Yucca Mountain Project Exploratory Shaft Facility Title I Design Summary Report, YMP/88-02, U.S. Department of Energy, Nevada Operations Office, Yucca Mountain Project Office, Las Vegas, NV.

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COMMENT 50

According to ESF Title I Design drawing C-41, the leach field and sediment lagoon appear to be within the maximum regional floodplain boundary. If so, alternative locations should be considered, or precautions taken to minimize impacts.

RESPONSE:

Both the sewage system and leach field lagoon are outside of the 100-year floodplain. Final design of both systems will be in compliance with applicable Federal, State, and local regulations.

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COMMENT 51

A borrow pit is proposed (for a reason that is unclear although it is assumed to be for site pad volumetrics) to be constructed in the form of a channel. This channel within the 100-Year Floodplain may prove to have high impacts on the ESF activities. High velocities within the channel can erode the southwestern face of the channel, causing destruction of the access roads and other facilities within Drill Hole Wash.

RESPONSE:

The borrow area is being designed to provide a channel to control potential runoff and protect against flooding, as well as to provide fill materials for the Exploratory Shaft Facility (ESF). The channel is designed to control a 100-year flood. Minimum side slopes will be 2:1. Rip rap will be used to reduce floodwater damage to the channel.

Very few facilities will be located in the wash. Most of the ESF is outside of the 100-year floodplain. The access road through the lower end of the wash is designed to allow water to flow over it. Because of its simple design and construction, the screening plant should not be significantly affected by floodwaters.

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COMMENT 52

How will DOE meet the requirement in 10 CFR 1022.12(a) (3) to address "alternative sites, actions, and no action" with respect to the Exploratory Shaft Facility. This is a crucial point of concern regarding the proposed location of the two shafts in the critical action (500-year) floodplain where, in accord with 10 CFR 1022 "even a slight chance of flooding would be too great." The Agency for Nuclear Projects as well as the Nuclear Regulatory Commission have discussed flooding hazards relative to the current shaft location with DOE in the past. In September 1988, the Agency issued a letter report to the DOE (R. Loux to C. Gertz, September 22, 1988) which documented the State's concerns with the process of exploratory shaft site selection used by the DOE. The report also discussed the concerns with respect to the flood hazard at the "preferred site location." From a review of the DOE selection process (Title I Exploratory Shaft Site and Construction Method Recommendation Report, SAND 84-1003), the criteria used to compare sites and the alternative locations considered did not address impacts to flood plains as contemplated by 10 CFR 1022.

RESPONSE:

In February 1989, U.S. Department of Energy (DOE) published notification in the Federal Register of their intention to prepare a Floodplain/Wetlands Assessment to address the impacts of Yucca Mountain Site Characterization Project Office activities in the floodplain, pursuant to 10 CFR Part 1022. This assessment will address alternative sites, actions and no action relative to the floodplain. It is important to note that the shafts are currently located out of the Probable Maximum Flood (PMF) event.

In addition, an engineering activity has been initiated to undertake an evaluation of the ESF Title I design and construction concepts and the ESF/repository interfaces, addressing comments by the U.S. Nuclear Regulatory Commission (NRC) staff, the State of Nevada, and suggestions from the NWTRB. This activity was identified as the ESF Alternative Configuration Study (ESF ACS).

An evaluation to satisfy the 10 CFR 60.21 (c) (1) (ii) (D) requirement to perform a comparative evaluation of several possible alternatives to the major design features during the design process will be undertaken as part of the ESF ACS. DOE has committed to provide the flexibility to allow the ESF to become part of the repository design and subsequent license application. All other 10 CFR Part 60 requirements have been reviewed, and those requirements considered to be major discriminators between the 34 options were identified, and are included in the evaluation process.

The scope of the ESF ACS includes the identification and evaluation of potential alternative locations and construction methods for the ESF and repository accesses, the identification and evaluation of the potential locations of underground facilities, and the selection of a preferred ESF configuration and construction method(s), which will accommodate the identified site characterization testing needs. This is to be accomplished by examining a number of ESF design options wherein the alternative features and attributes of the ESF design are varied and evaluated against the appropriate design requirements to identify those options that best meet the

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design requirements. This preferred option will be used as a basis for subsequent Title II design efforts. As part of the selection process for the preferred option, a comparative evaluation of these design features will be conducted, taking into account test requirements, performance and impact assessments, preclosure health and safety, environmental protection, and cost and schedule aspects.

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COMMENT 53

Will a single floodplain assessment conducted in accord with 10 CFR 1022 address all affected floodplains at Yucca Mountain or will there be more than one such assessment that addresses different locations, proposed actions, and floodplains anticipated to be involved throughout the course of site characterization?

RESPONSE:

More than one floodplain and wetland assessment may be necessary to address all site characterization activities. The majority of the work taking place on the floodplain will involve exploratory shaft facility activities. Some of the surface-based investigations will be conducted in other drainages.

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COMMENT 54

It is noted that the DOE Environmental Regulatory Compliance Plan (DOE/RW-0177, January 1988) for the Yucca Mountain Project states with respect to compliance with floodplain regulations that, "It is likely, however, that because no maps exist showing areas of flooding along those small washes, compliance with (10 CFR 1022) for these remote activities will not be required." The Agency would appreciate receiving from DOE an inventory of and maps for all the proposed floodplain actions at Yucca Mountain with an indication as to DOE's determination on an individual basis regarding the applicability of the regulations.

RESPONSE:

It should be noted that the Environmental Compliance Plan (DOE, 1989), Revision 1 for the Yucca Mountain Site Characterization Project Office no longer includes this statement. The Floodplain/Wetlands Assessment will include maps showing the applicable floodplains and planned Project facilities for the site characterization program.

DOE (U.S. Department of Energy), 1989. (Revision 2) Environmental Regulatory Compliance Plan, DOE/RW-0209, Oak Ridge, TN.

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COMMENT 55

It would be appreciated if DOE could provide the Agency with a study plan for the floodplain assessment that describes the field studies to be undertaken, the analyses to be conducted, the alternative sites to be evaluated to avoid harm to floodplains, and the steps to be considered for minimizing floodplain damage, and for following-up of the action to verify that implementation of the selected alternative and any adopted mitigation measures proceed as described in the assessment.

RESPONSE:

The U.S. Department of Energy does not plan on preparing a study plan for preparing the Floodplain/Wetlands Assessment because it is not required by 10 CFR 1022. Flooding potential studies are part of site characterization. Study Plan 8.3.1.16.1.1 (Characterization of Flood Potential and Debris Hazard at the Yucca Mountain Site), is a part of this study program.

DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.16.1.1, Characterization of Flood Potential and Debris, Yucca Mountain Project Office, Las Vegas, NV.

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COMMENT 56

Will the DOE Environmental Field Activity Plans (EFAPs) be revised to include field studies needed for the 10 CFR 1022 Floodplain Assessment? For example, the current ecosystems EFAP (DOE/NV-10576-14, August 1988) does not address comprehensive surveys of biota in floodplains. This consideration is important in light of some of the earlier work performed at Yucca Mountain for the DOE statutory environmental assessment which noted that unique assemblages of plants occur in floodplains and nowhere else at the site. No details on the nature of this floodplain vegetation were provided. The assessment currently being planned by DOE should resolve that deficiency in information. The Agency's preliminary evaluation of this matter indicates that locations within the base (100-year) floodplains, e.g., the 50, 25, and 10-year floodplains frequently provide restricted favorable habitat for flora that is limited only to those specific floodplain areas by virtue of the unique soils and moisture conditions that occur there. Additionally, areas adjacent to floodplains often are underlain by shallow hardpans that have been eroded away in the floodplain itself. For this reason the desert tortoise and other important burrowing animals seek out floodplains for their burrows. The Agency's view is that field studies to be conducted by DOE in support of the floodplain assessment should address these and related issues.

RESPONSE:

The U.S. Department of Energy does not plan to revise the Environmental Field Activity Plans to address information needed for the Floodplains/Wetlands Assessment (FWA). However, the Department will revise the EFAPs to collect appropriate data for the EIS. Information needed to prepare a FWA has been collected. A biological assessment regarding the desert tortoise has been submitted to the U.S. Fish & Wildlife Service (USF&WS) (DOE, 1989), this document considered impacts to the desert tortoise and its habitat, both in and out of the floodplain. Prior to any surface disturbing activity, a pre-activity survey is conducted which reviews various environmental disciplines and is then used to provide guidance for environmental protection during the activity. As part of this process, recommendations are made to preserve areas of favorable habitat and unique assemblages of plants. The Yucca Mountain Site Characterization Project Office evaluated its responsibilities under the Endangered Species Act of 1973, as amended, through consultations with the USF&WS. On February 2, 1990, the USF&WS issued an opinion that the proposed site characterization activities would not jeopardize the desert tortoise.

U.S. Department of Energy (DOE), 1989. Biological Assessment of the Effects of Site Characterization Activities on the Endangered Desert Tortoise, U.S. Department of Energy, Yucca Mountain Project Office, Las Vegas, NV.

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COMMENT 57

Will the DOE Environmental Monitoring and Mitigation Plan (DOE/RW-0208, December 1988) be revised to reflect the follow-up procedures required by 10 CFR 1022.17 that will be evaluated and selected in the course of conducting the flood assessment? If not, where in the various pieces of the DOE environmental program plan will such measures be described in detail? Does DOE perhaps intend to issue a separate piece of its environmental program plan specifically to address floodplain actions and compliance procedures in light of the fact that the presently existing 15-plus pieces do not mention environmental measures associated with 10 CFR 1022?

RESPONSE:

The Environmental Monitoring and Mitigation Plan (EMMP) will be revised as necessary during site characterization and subsequent phases of the program. The format for revising the EMMP is through the issuance of EMMP progress reports. Any follow-up procedure required by 10 CFR 1022.17 for proposed activities in the floodplain will be addressed in the EMMP progress reports.

U.S. Department of Energy's environmental program will continue to monitor and, if necessary, mitigate impacts to floodplains in the same manner it has with all environmental disciplines.

DOE (U.S. Department of Energy), 1988. Environmental Monitoring and Mitigation Plan, DOE/RW-0208, Oak Ridge, TN.

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COMMENT 58

Current DOE plans available to this Agency do not address the collection of soils information. 10 CFR 1022 requires that soil conditions in the floodplains be considered as part of the floodplain assessment. What soil studies are proposed for the floodplain assessment.

RESPONSE:

The U.S. Department of Energy regulation concerning Floodplains/Wetlands (10 CFR 1022.11(c)) applies to the determination of wetlands. As part of the determination of wetlands, the regulation recommends using, as appropriate, Soil Conservation Service Local Identification Maps. However, it has been determined through consultation with the U.S. Fish and Wildlife Service that wetlands do not exist in the Yucca Mountain site area.

The regulation does not require that soil conditions in the floodplain be considered as part of the assessment. However, in support of reclamation activities in and out of the floodplain, DOE is conducting a soil survey as part of the Environmental Field Activity Plan for Soils.

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15	16	GPHY
16	16	GPHY
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STATE OF NEVADA PRELIMINARY COMMENTS

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AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE

Capitol Complex
Carson City, Nevada 89710
(702) 885-3744

May 30, 1989

Carl Gertz
Project Manager
Yucca Mountain Project Office
United States Department of Energy
Post Office Box 98518
Las Vegas, Nevada 89193-8518

ACTION _____
CC: Powell
CC: [Redacted]
CC: OC
CC: Wolcott
CC: Robison
CC: Udeh/Beidy - Sac
CC: Smith/Conson - HQ
CC: West - CEA
CC: Behrman
CC: _____

REC'D IN WMFO

6/1/89

Dear Mr. Gertz:

RE: STATE OF NEVADA PRELIMINARY COMMENTS ON THE SITE CHARACTERIZATION PLAN FOR THE YUCCA MOUNTAIN CANDIDATE HIGH-LEVEL NUCLEAR WASTE REPOSITORY SITE

The Nevada Agency for Nuclear Projects, Nuclear Waste Project Office, has completed its preliminary review of the exploratory shaft facility (ESF) components of the U.S. Department of Energy Site Characterization Plan for the Yucca Mountain candidate nuclear waste repository site. This preliminary review included portions of the DOE's Technical Assessment Review Design Acceptability Analysis and Exploratory Shaft Location Documentation Report, as well as numerous relevant references.

In accord with the DOE's request (FR / Vol. 53 No.251 / Dec. 20, 1988 / Pa. 53057, as modified on March 20, 1989) these preliminary comments focus on issues related to the start of the exploratory shaft facility, and are being submitted within the DOE's announced public review and comment period for the Site Characterization Plan (SCP). As the DOE has been notified, the balance of the State of Nevada's technical comments on the SCP will be forwarded to DOE not later than September 1, 1989.

The attached Preliminary Comments on the ESF describe Nevada's critical concerns over both the selected location of the ESF at Yucca Mountain and some aspects of the ESF Design at its current level of development. The summary conclusion that arises from the attached comments and concerns is that the DOE should not proceed with the initiation of site characterization and ESF

1

1 construction until certain fundamental ESF site location and design issues are resolved. Without such advance reconsideration and resolution, the potential consequences are twofold; first, that DOE's activities associated with ESF construction will preclude the future collection of data critical to a determination of Yucca Mountain site suitability, and second, that DOE's ESF construction activities will compromise the capability of the site to safely isolate waste, should it be developed as a repository.

2 The ESF location at Coyote Wash, was initially selected by DOE in mid-1982, with the selection process documented in a Sandia Report (SAND84-1003). The selection of this location was recently reviewed by the DOE, in December 1988, with that analysis, the Exploratory Shaft Location Documentation Report, confirming the earlier location decision. Nevada's review has revealed that neither the original Sandia Report nor the recent review by DOE acknowledges a 1982 United States Geological Survey report (USGS Open File Report 82-182) which contains strong evidence of a fault intersecting the selected ESF site, possibly between the two proposed exploratory shafts. The Location Documentation Report claims to have reviewed certain cited post-1982 reports of geophysical data relevant to the selected ESF site, with the conclusion that no adverse subsurface structures appear to be present at the selected Coyote Wash ESF site. However, the resistivity survey data documented in the 1982 U.S.G.S. report, and later summarized in a 1984 U.S.G.S. report were not included in the DOE's recent review even though the work was performed for the Yucca Mountain Project.

The known existence of a fault at the Coyote Wash ESF site would result in the disqualification of this proposed ESF site according to the criteria established in the 1982 Sandia ESF site screening report for setback from adverse subsurface geologic structures. Furthermore, placing the ESF in a fault-disturbed area casts into great question the representativeness of any site characterization data collected from the ESF. It also renders the ESF vulnerable to potential severe flooding from surface water infiltration along a preferred pathway, or from intersection of a perched groundwater zone during shaft or drift construction.

3 Aside from concerns about flooding of the ESF related to the probable fault as described above, the location of the two shaft openings at the proposed ESF in Coyote Wash is such that there is significant concern over potential surface water flooding of the ESF surface facility, the shafts, and underground drifts. The SCP acknowledges in numerous disclaimers that flood level predictions regarding washes in and around the Yucca Mountain area are speculative at best, and that there is essentially no site specific flood data for Coyote Wash. In addition, as Nevada has commented to DOE previously, the effect of proposed ESF surface modifications and structures on flood heights and velocities has

3 not been adequately analyzed, primarily due to a lack of site specific information. The consequences of flooding the ESF as a result of the lack of adequate shaft collar elevation and adequate surface flood protection structures, aside from the obvious risks to personnel, are such that the ESF may be rendered useless for collection of necessary in-situ site characterization data, and the abandoned damaged ESF itself may adversely impact the site's waste isolation capabilities.

4 From the design standpoint, the SCP and associated documents do not provide plans for sealing, or otherwise isolating from the remainder of the repository block, a failed shaft in the ESF, whether resulting from flooding or other causes, in order to assure that it will not adversely impact the waste isolation performance of a repository. This matter stands as one of the many unresolved design problems, which also include inadequate evaluation of environmental impacts of construction of the ESF.

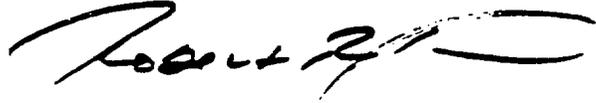
5 An additional design issue involves the placement of planned boreholes associated with the ESF. Because of the known lack of quality borehole data at the proposed ESF site for use in shaft design, DOE has planned to drill at least two multipurpose boreholes on the ESF pad at Coyote Wash. The data from these boreholes will be necessary for further shaft design, yet if these holes are drilled as planned, and the DOE's criteria for distance to be maintained between boreholes and shafts at the ESF are honored, there is insufficient space to complete both activities. If some degree of borehole deviation during drilling is assumed (a realistic assumption), not only will the spacing criteria be violated, but there is a possibility that the shafts will intersect the previously drilled boreholes. With reference to the possibility of a proposed third multipurpose borehole, implementing the plan would result in the borehole intersecting a planned ESF drift at the underground test horizon. Further, the surface location of this hole would coincide with the planned location of the hoist house for the No. 2 exploratory shaft. In sum, the design and layout of the ESF cannot accommodate all the planned excavations and proposed construction while continuing to comply with the spacing criteria established by DOE for the ESF underground facility. The spacing criteria have their bases in assuring safety and preserving the ability to collect needed site characterization data that is representative of the site's undisturbed geohydrologic conditions.

The above comments constitute a set of fundamental concerns regarding the DOE's plans for developing and constructing an exploratory shaft facility at Yucca Mountain. Accompanying the attached State of Nevada Preliminary Comments are three letters in which we have previously detailed for DOE a number of the same concerns which are discussed in this letter and attached comments. It is Nevada's position that, without substantial resolution of these matters, it is both unsafe and imprudent to initiate site

characterization and ESF activities at the Yucca Mountain site.

If you have questions or comments regarding our concerns stated in this letter and the accompanying preliminary comment document please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert R. Loux", with a large, sweeping flourish extending to the right.

Robert R. Loux
Executive Director

RRL:cs
attachment



**AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE**

Capital Complex
Carson City, Nevada 89710
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FOR IMMEDIATE RELEASE

May 31, 1989

Contact:
Robert R. Loux
Executive Director
Nuclear Waste Project Office
(702) 885-3744

The State of Nevada has strongly warned the Department of Energy to reevaluate its plan to sink two exploratory shafts at Yucca Mountain because an earthquake fault intersecting the shaft site could render it useless for further studies and unsafe for storing nuclear waste.

6 In preliminary comments released today, the State Nuclear Waste Project Office revealed that the DOE ignored one of its own reports solicited from the United States Geological Survey which indicates a fault intersects the selected exploratory shaft facility (ESF) location.

(more)

NWPO/2-2-2

As part of its scheme to determine whether Yucca Mountain can safely isolate deadly, high-level nuclear waste for 10,000 years, the DOE plans to sink two 12-foot wide, 1,050-foot deep shafts about 90 miles northwest of Las Vegas.

6 Besides possibly compromising Yucca Mountain's ability to safely store nuclear waste, the State said that unless fundamental design and location problems for the ESF are resolved, drilling could discredit vital information that must be collected to determine Yucca Mountain's suitability.

The State's preliminary comments came in response to the DOE's site characterization plan, an unwieldy, 6,300-page document which outlines the DOE's study of Yucca Mountain as the nation's first nuclear waste dump. Final comments are scheduled for release in late summer.

7 Bob Loux, executive director of the State Nuclear Waste Project Office, said in a letter to the DOE that if drilling on a known earthquake fault proceeds, it will likely encounter perched water that could severely flood the shafts, taint the ESF and cast great doubts on the entire project.

8 He further asserted that based on DOE's own criteria for safety and data preservation, the ESF site cannot accommodate the numerous additional boreholes the DOE plans to drill near the shafts.

(more)

NWPO/3-3-

Loux said that "without substantial resolution of these matters, it is both unsafe and imprudent to proceed" with site characterization and the ESF.

"I am very disappointed by the fact that the DOE has once again ignored its own scientists in the critical stages of the decision-making process," said Governor Miller.

"The Secretary assured us at our May 22nd meeting that this would be a scientific and technical process. I have asked that Secretary Watkins personally review and reconsider this decision.

"This would be the third instance in the past two years of the DOE ignoring its own scientists and contractors to satisfy a timetable at the expense of scientific data.

"If Secretary Watkins lets this decision stand, it would seriously undermine the credibility of his stated desire to change a repository program so it is based on scientific facts, not politics."

The two other instances the Governor referred to were the DOE disregarding a study of one of its own scientists, Jerry Szymanski, who suggested the site might easily be disqualified on scientific grounds, and a "disaster" warning issued by 16 USGS hydrologists. In Aug. 5, 1987, and Aug. 17, 1988, memo, they expressed great concern about the

(more)

NWPO/4-4-4

scientific merits of DOE's study, and in the latter memo said that "in subjugating the technical program to satisfy DOE political objectives, we may succeed in making the program comply with regulations, while being scientifically indefensible."

(Attached are copies of the Nuclear Waste Project Office's cover letter to Carl Gertz, DOE's project manager on the Yucca Mountain project, background information, and the preliminary comments.)

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STATE OF NEVADA
AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE

PRELIMINARY COMMENTS

REGARDING

THE

PROPOSED YUCCA MOUNTAIN
EXPLORATORY SHAFT FACILITY

MAY, 1989

INTRODUCTION

During the past several years, the State of Nevada has participated in the Exploratory Shaft Facility (ESF) program as part of its mandated oversight of the DOE high-level nuclear waste management and disposal program. From information gathered at meetings and field trips and from the review of the Site Characterization Plan (SCP), the Design Acceptability Analysis (DAA) and many other documents produced by DOE and its contractors, the State of Nevada has formulated a preliminary list of concerns regarding the ESF.

Our preliminary concerns are related to two aspects of the ESF: 1) the location of the ESF; 2) the ESF design.

1. LOCATION

A. SITE SELECTION

The proposed ESF site is located in Coyote Wash in the northeastern corner of the repository block. Coyote Wash is a narrow wash lying on U.S. Air Force land just west of the NTS boundary. Nearby Drill hole USW G-4 was drilled in Coyote wash after the site was selected.

According to Sandia Report SAND84-1003 by Bertram, the site was selected in April and May of 1982. In a matter of only a few weeks the selection procedure was developed, screening done, and Coyote Wash selected. Drill hole USW G-4 was not started until August of 1982, so the nearest available drill hole data at the time of ESF site selection was from USW H-1, 3300 feet to the east. See letter of 09/22/1988, Loux to Gertz.

Concern: The ESF site was hastily selected based on drill hole data of questionable applicability.

Of the criteria used for screening of the five preferred sites considered, heavy emphasis was placed on setback from the repository block boundary and avoidance of adverse geologic conditions. As is pointed out below, the Coyote Wash site may well exhibit adverse geologic conditions.

The proposed repository block contains roughly 1520 acres. During the selection of the ESF site the following areas were summarily eliminated from consideration:

1. a) 500' wide buffer area east of Solitario Canyon Fault
- b) 1000' wide buffer area south of Drill Hole Wash
- c) 2000' wide buffer area along east side of block
- d) All land south of a line 4000 feet north of USW H-3

This eliminated 633 acres, or 42% of the repository block.
 2. All lands less than 1000', but not more than 2000' from adverse geologic structure as identified by the USGS. This eliminated another 812 acres or another 53% of the original block.
 3. Areas identified as being "steep slopes". This eliminated another 52 acres of the block.

11 The remaining 23 acres, or 1.5% of the original repository block fell into five potentially suitable ESF sites from which the Coyote Wash was selected. However, in the published site rankings, Coyote Wash either tied or was out-ranked by other potential ESF sites in 8 of the 12 subcriteria applied to compare the five sites.

The recent DAA review of the Bertram Report evaluated only the five candidate sites identified by Bertram. It would seem prudent in any review of the site selection to re-evaluate the entire repository block for alternate sites.

Concern: Unrealistic and arbitrary criteria were used in screening, and 98% of the proposed repository block was eliminated without objective consideration.

B. FLOODING.

12 The Site Characterization Plan, U.S.G.S. Water Investigations report 83-4001 by Squires and Young, and other reports referenced in the SCP all contain numerous disclaimers that flooding predictions regarding the washes in and around Yucca Mountain are speculative at best. Historical records on streamflow, rainfall, runoff, recharge, flash floods, storms, infiltration, and debris movement range from sparse to nonexistent. Essentially no such data exist for Coyote Wash. The probable maximum flood configurations shown on project maps are based on generalized, regional data (Bullard, 1986) and do not appear to reflect how the proposed structures in Coyote Wash may impact future flood characteristics.

Separately, a visual inspection of the configuration of the lower drainage channel of Coyote Wash suggests that a change in slope which corresponds approximately with the proposed shaft collar elevation may be the erosional remnant of the highest flood runoff. That level is many feet above the maximum flood calculated by Bullard for Coyote Wash. See attached letters of 09/19/88, Loux to Gertz and letter of 03/19/89 Loux to Valentine in which these matters are discussed in greater detail.

It must be recognized that even partial flooding of the ESF during the construction and testing period could have serious consequences. In addition to the risk of personnel injury or loss of life, flood waters would infiltrate the shaft and drift walls. This would render highly questionable the results of tests conducted to characterize hydrologic features of the rock mass such as groundwater travel times. The current ESF plans call for drifts to slope downward to pump installations. In the event of an exploratory drift intersecting a sizeable perched water reservoir or being flooded from the surface via the shafts, the pumping system may be engulfed or otherwise become inoperative. Such an event would likely render the ESF useless for further testing, and could affect the waste isolation capability of the proposed repository horizon.

12

The DAA (page 3-7) states that, ". . . significant concentrations of infiltration are more likely to occur in drainage channels, along ridge crests, and in localized depressions." This raises the question of why the ESF is proposed to be located at the mouth of a wash.

Based on the preliminary information provided, the 10 foot wide drainage channel around the north side of the main ESF pad appears to be inadequate for containing or diverting the slope and main pad runoff during a maximum flood. Although the shaft collars are elevated one foot above grade to avoid direct flow of surface water into the shafts, the blast fractured nature of the collar rock and the possibility of deterioration of collar construction materials during the 100 year life, require that surface water diversion be ample to avoid infiltration into the shaft.

Concern: The ESF site was selected without adequate flood potential data in the shaft collar areas, and ESF design has proceeded without sufficient evaluation of possible impacts to site characterization objectives resulting from ESF flooding.

C. REPRESENTATIVENESS.

The underground test area of the ESF will cover about 15 acres, and the drifting to the projected fault locations will expose about 3 more acres, providing a total of 18 acres of underground excavations. Thus, of the 1520 acre repository block, a little over 1% of the underground area will be available to be characterized at the ESF. While the proposed location and configuration should give some insight into the faults in the area, hydrologic characteristics and in situ rock properties of the remaining 99% of the block will remain unknown.

13

Multiple intersections of adverse geologic structures (i.e. faults) should be planned to assure representativeness. The SCP is silent on plans to evaluate unknown adverse geologic features which may be present within the repository block.

13

Concern: The location and extent of the planned underground ESF severely limit the extent to which the collected data are representative of the in entire repository block.

D. FAULTS

Major faults at Yucca Mountain have been mapped, described and discussed for several years; indeed, they form the boundaries of the proposed repository block, with the Solitario fault on the west, the suspected Drill Hole Wash fracture zone on the north, the Imbricate faults on the east, and the Abandoned Wash fault on the southeast.

DOE documents to date have described the repository block as relatively free of faults with the exception of the Ghost Dance Fault which trends north-south just west of the proposed ESF site. The SCP on page 1-128 acknowledges that the Ghost Dance Fault has as much as 38m of vertical offset and an accompanying breccia zone as wide as 20m. Characterization may give further insight into the significance of this fault to waste isolation.

14

Of particular importance to the ESF is another possible fault lying parallel to and east of the Ghost Dance Fault. This un-named fault identified by resistivity geophysical methods is discussed in USGS OFR 82-182 by Smith and Ross. Plate V of that report maps this fault 400m east of the Ghost Dance. Plotting the ES-1 and ES-2 shaft locations on plate V we find that the proposed fault lies between the proposed shafts. Smith and Ross (page 11) describe the block between the un-named fault and the Ghost Dance Fault as a horst, and suggest (on page 16) that this horst may be a spur of the main fracture zone that underlies Drill Hole Wash.

Verification of the presence of this un-named fault is supported by the geophysical identification by Smith and Ross of another fault subsequently mapped by Scott and Bonk as the Ghost Dance fault.

This fault is also shown on Fig 1-40 on page 1-121 of the SCP and in USGS OFR 84-792 on Fig 3 and discussed on page 50. This fault is not discussed in the SCP, but is described in the USGS report as a fault with at least 5m of displacement.

DECEMBER 1988

116°30'

116°27'30"

116°25'

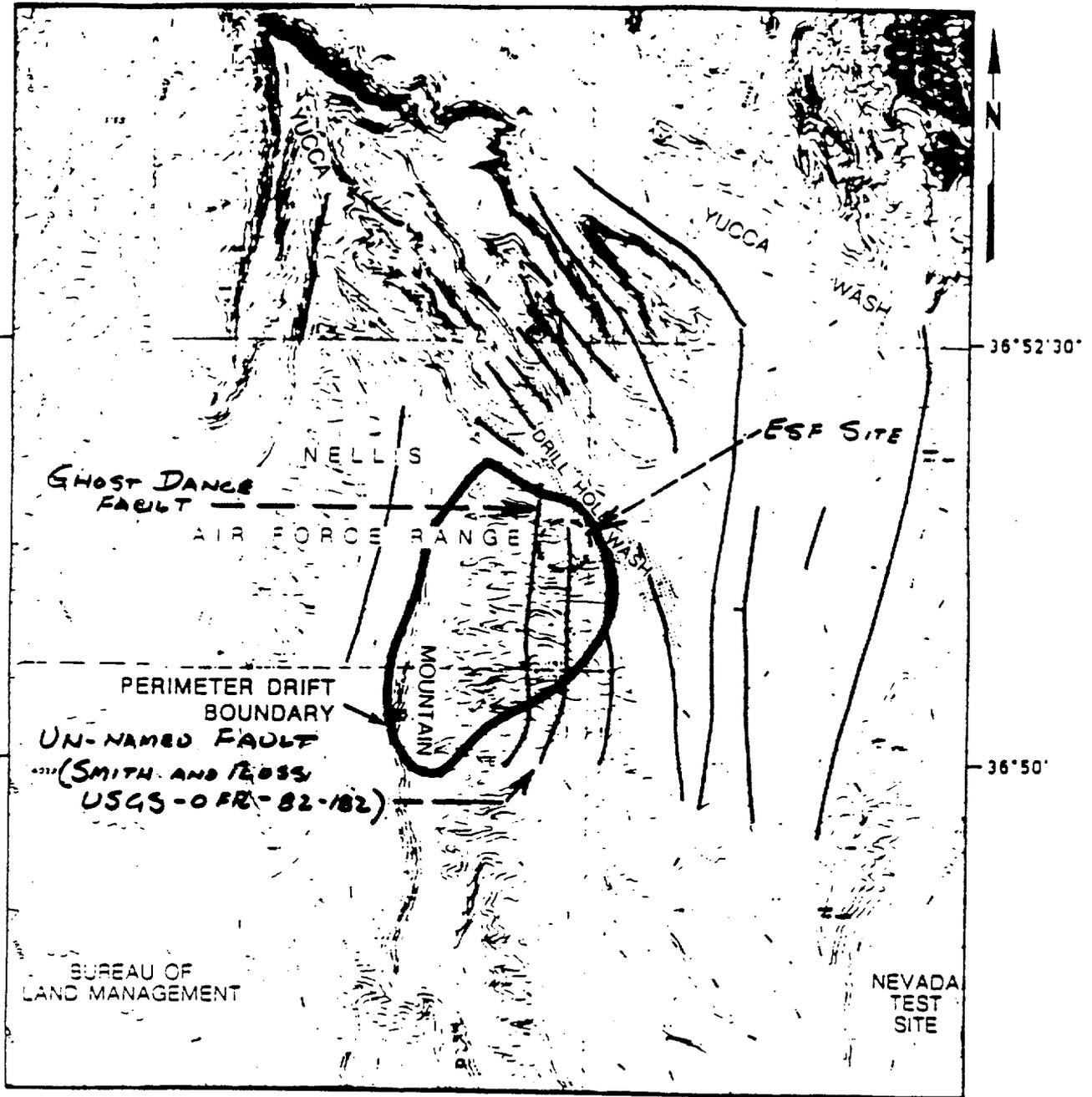


Figure 1-40. Faults and fractures at Yucca Mountain interpreted from electrical resistivity data. Stippling shows zone of inferred fracturing and faulting along Drill Hole Wash; fault trends appear to change abruptly across this zone. Modified from USGS (1984).

MODIFIED FROM DOE SITE CHARACTERIZATION PLAN

14 Reviewing the Bertram siting criteria (page 56) regarding setbacks we find two requirements: (1) "ES sites that would have subsurface facilities closer than 100 feet to a potentially adverse structure would be excluded." Either ES-1, ES-2, or the test drifts may well fall within 100 feet of (or intercept) the un-named fault; (2) "The shaft should be located far enough from potentially adverse structures within the block so that there would be a low likelihood that the shaft itself and the drifts would encounter fractures associated with those structures." ". . . A 1000-foot setback distance was judged to be sufficient to place the shaft outside the zones of fracturing associated with the structures." The Smith and Ross report (OFR 82-182) identifying the fault is dated "October, 1979" and therefore was available for the Bertram team in 1982.

Concern: Using the two setback requirements for potentially adverse structures developed by Bertram, the Coyote Wash site should have been excluded on both counts. The presence and extent of the fault identified at Coyote Wash must be confirmed and its potential impact on the ESF evaluated before the Coyote Wash ESF site can be considered acceptable.

15 The DAA adopted the potential ESF sites of the Bertram Siting report and only reviewed faults at the Coyote Wash site interpreted from the geophysical data based on magnetic and gravity surveys. The resistivity surveys used by Smith and Ross to delineate the un-named fault were not referenced and apparently ignored by the DAA analysis.

Concern: Confirmation of the ESF site selection by the DAA has ignored existing information regarding adverse structures at the Coyote Wash ESF site and makes questionable the objectivity of the DAA analysis.

16 The Design Acceptability Analysis (DAA) of the Technical Acceptability Review (TAR) (page 3) contains, without basis, an underlying assumption that any ESF location in the northeast part of the repository block will provide groundwater travel times from the repository horizon to the water table in excess of 10,000 years. This concept is presently speculative and may prove erroneous given the suspected highly fractured nature of the host rock in the Coyote Wash ESF area.

It is likely that the un-named fault delineated by Smith and Ross resistivity surveys is accompanied by a water-bearing fracture zone or even a perched water reservoir on one side of the fault. This could place any excavations near or through the fault area at risk from flooding due to perched water or rapid infiltration through the fracture zone.

Resistivity surveys identify structural anomalies by measuring differences in resistance within the rock mass. Usually a change in resistance indicates a change in water characteristics, either in water volume or in dissolved solids. The data from core holes on Yucca Mountain indicate a reasonably constant value for dissolved solids; therefore, anomalies identified by resistivity surveys would support a change in water content in the zone.

16

Concern: The selected ESF subsurface test area appears to lie in a highly fractured zone that could lead to water inflow and stability problems and may not provide data representative of the repository block.

Concern: Movement in the near-term along the un-named fault between the exploratory shafts could damage or disable the common hoist house and/or hoist foundations; damage or rupture buried service utilities (water, sewer, electrical, compressed air, and communications) lines in the main ESF pad; misalign conveyance guides in the shaft; damage or rupture the shaft liners and utilities in the shafts.

17

Concern: The un-named fault bisecting Coyote Wash, the main ESF pad and the underground test drifts will provide a pathway for surface water in Coyote Wash to enter the underground facility.

18

The SCP (page 1-209) discusses the effect on the repository block of underground nuclear weapons testing (UNEs) at the Nevada Test Site. Surface rupture and minor movements on faults have been observed locally at Yucca Flat and Pahute Mesa, current test shot areas. Mid Valley and Buckboard Mesa, both of which are closer to Yucca Mountain than current test areas, are potential sites for future weapons tests.

19

19

Concern: That future UNEs located at Mid Valley or Buckboard Mesa could trigger fault slippage movement at the ESF site.

2. DESIGN

A. INADEQUATE PLANNING

20

On page 3-68, Fig 3-26, the Integrated Data System (IDS) Block Diagram shows input from "Calico Hills Experiments". In the text on the following pages there is no mention of this experiment. The Title I design does not show the shafts sunk to the Calico Hills horizon. However, the SCP (page 6-179) states that, "Four shafts and two ramps are proposed to penetrate the underground horizon at Yucca Mountain. Only the exploratory shaft is planned to extend below the repository horizon into the zeolitized tuff of the Calico Hills." This is inconsistent with our understanding of the current ESF project, but if the Calico Hills formation is to be penetrated, major revisions in the design must be made to accommodate the additional shaft depth, hoisting system, etc.

If characterization of the Calico Hills from the exploratory shaft is not presently contemplated, then what studies does DOE plan to adequately characterize this unit that will not compromise site integrity, since the Calico Hills tuff is considered to be the primary natural barrier to radionuclide transport.

Concern: That a future decision to deepen the exploratory shafts will compromise the safety and structural integrity of the planned test area.

We find no contingency plans for sealing the underground ESF if one of the exploratory drifts encounters a structural or hydrologic feature that condemns the ESF and renders it unfit to be part of a possible repository.

21

Concern: There are no plans to isolate a failed ESF to assure the integrity and performance of the remainder of the repository block.

22

The Title I Design Summary Report and the TAR Review Record Memorandum list comments generated by reviewers of Title I design. Of the 1172 comments presented, 478 (41%) were deferred to Title II, assuming that any problems in Title I would be solved during Title II Design. NWPO understands that DOE proposes a phased approach to construction of the ESF.

22

Concern: Unresolved conceptual problems from ESF Title I design remain unaddressed as Title II Design continues.

23

Title I Design gave little consideration to environmental issues and possible ESF impacts upon the environment. This deficiency may be partly due to there being inadequate environmental baseline data prior to commencing design work. Items such as sewage, chemical and industrial wastes, air emissions, mine wastewater and concrete batch plant emissions have not been fully quantified to accommodate mitigation in the design. No consideration has been given in Title I Design for reclamation of the ESF, if the site proves unsuitable.

In a similar manner, during the site selection process, the environmental criteria, "surface disturbance", "reclamation", "archaeological", and "effluents and emissions" received the lowest weightings. As a group, these four items constituted only 15% of the total consideration. (Bertram Report, pg. 78)

Concern: In addition to inadequate consideration being given to environmental issues in the site selection, design of the ESF continues without appropriate regard for possible environmental impacts related to the facility.

24

The SCP states (page 8.3.1.2-310) that, "The two multipurpose boreholes will be located such that they do not penetrate within a distance of two shaft or drift diameters, as appropriate, of any underground opening." Using the drift widths shown on F&S drawing FS-GA-0162 Rev B from Title I Design drawings, the boreholes MP-1 and MP-2 as located on SCP page 8.3.1.2-311 cannot meet the setback requirements. In fact, there appears no location in either of the designated pillars that can meet the standoff criteria.

The SCP (page 8.3.1.2-312) states that a third multipurpose borehole may be drilled midway between ES-1 and ES-2. Again applying the "Two drift diameter standoff" rule, there is no ground between the shafts that can qualify. Further if this third hole were drilled plumb, it would intersect the north-south drift south of the demonstration breakout drift. This same hole would collar in the drum pit of ES-2 hoist in the surface hoist house.

24 It is also likely that these boreholes will deviate horizontally as they are drilled. USW G-4 deviated 26 feet to the southwest at 1000 feet of depth and 48 feet at 1250 feet of depth. (See Fig 3 of USGS OFR 84-789). This anticipated deviation must also be considered in locating boreholes and setting standoff requirements.

Concern: Consideration must be given to deviation and standoff requirements and possible borehole deviation in locating future boreholes around the ESF and failure to do so may compromise drift and shaft integrity.

25 Some TAR Committee members that reviewed the DAA as well as many of the DAA reviewers are members of the various organizations contracted and funded by DOE. This group determined that all of the NRC concerns were "judged to be adequately addressed in the Title I design." At least five reviewers or committee members participated in either ESF site screenings or Title I design, thus their independence is questioned. The intent of the TAR would have been better suited to have an independent, unbiased team perform the TAR.

Concern: Title II Design is proceeding because of the endorsement of Title I Design by a group not entirely independent.

26 Page 2-60 of the DAA discusses several of the known potential problems with repository performance as related to structural failure within the ESF. With this acknowledgment that ESF failure could jeopardize repository performance, retrieval, etc., prudence would demand that ample, reliable data pertaining to rock strength and other characteristics be available before proceeding with detail design.

Concern: The ESF design is based on unsubstantiated rock properties which may lead to failure in the ESF and have future impacts on the repository.

27 On page 8.5-48 of the SCP there is a listing of Site Characterization Study Plans. Fourteen programs are listed which incorporate 106 study plans. While SCP Chapter 8 contains brief descriptions of the study plans, the detail here is not sufficient to evaluate procedures and equipment involved. More important, it is difficult, if not impossible, to determine the interface impacts of each study on concurrent studies or on the simultaneous development of the ESF.

Concern: Detailed study plans will be developed too late to be used in the design process to insure test-to-test and test-to-ESF construction compatibility.

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- Loux, R.R., 1988. Letter from Robert Loux (NWPO) to Carl Gertz (DOE) regarding ESF site selection.
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LETTER
LOUX TO GERTZ

09/19/88

REGARDING ESF SITE FLOODING



AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE

Capitol Complex
Carson City, Nevada 89710
(702) 885-3744

September 19, 1988

Mr. Carl P. Gertz, Project Manager
Yucca Mountain Project Office
U.S. Department of Energy
Nevada Operations Office
Phase 2, Suite 200
101 Convention Center Drive
Las Vegas, NV 89109

SUBJECT: ESF Locations

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Dear Mr. Gertz:

During the past 5 years this office has observed with keen interest as the conceptual and preliminary designs for the Exploratory Shaft Facility evolved. While a few of our concerns regarding the planning, as expressed in my letter of 5/31/88, have been alleviated, most are still in limbo awaiting resolution in subsequent design processes or at some future discussion or review. This letter will discuss our continuing concern involving the location of the exploratory shafts and their related surface facilities.

In the early conceptual plans, the exploratory shaft collars were located close to midstream in Coyote Wash. At a DOE/ NRC/ State meeting held April 14 and 15, 1987 to discuss proposed changes to the ESF, DOE announced that the conceptual plans were being revised to relocate the shaft collars 440 feet to the northeast. The stated motivation for the relocation was NRC Staff concerns that the original locations were sited in the alluvial fill of Coyote Wash. The new location was said to minimize the likelihood of collar erosion because the shafts would now be collared in hard rock outside the flow channel of Coyote Wash.

At the ESF Title I 50 Percent Design Review meeting held in May of this year, the NRC Staff continued to express concerns related to collar erosion and possible shaft flooding resulting from flood flows in the adjacent Coyote Wash. It appeared that the shift to hardrock and retreat from the center of the wash did not entirely allay the NRC concerns.

The ESF Title One Design Review is currently nearing completion. Reviewing the latest release of Title I plans relating to the surface facilities in the subject area, we note minor revisions in the drainage plans for the Coyote Wash channels that are culverted under the road connecting the ESF pad and drill hole G-4 pad. This situation is in the State's view a bottleneck and will be addressed in future correspondence.

Of major concern with the ESF Design is the analyses and references used to develop the Probable Maximum Flood (PMF) levels. We note that the prime reference for the PMF predictions is a USGS Water-Resources Investigations report, #83-4001, Flood Potential of Fortymile Wash and Its Principal Southwestern Tributaries, Nevada Test Site, Southern Nevada. This report was prepared by Squires and Young. However, in reviewing the Consultation Draft of the Site Characterization Plan, Chapter 3, we get the impression that the DOE has little confidence in the flood prediction studies done to date.

Note the following excerpts from your Draft SCP:

Page 3-8. Regarding runoff: "--scanty data available for the region---". Later: "Quantitative data on rainfall, runoff, and evaporation for the area are not yet adequate to determine rainfall-runoff-recharge relations for individual storms, seasons, or years. Therefore, only general knowledge of runoff parameters is available.----- models can't be calibrated until more field data become available."

Page 3-12. Regarding streamflow at Yucca Mountain: "--- almost no streamflow data have been collected."

Regarding floods: "Flood analyses at Yucca Mountain are needed to provide flood data for design and performance considerations."

Page 3-13. Regarding future flooding: "Confidence in predictions of future flooding is lessened because of the sparse historical data, quantitative or qualitative, on streamflow or flooding throughout the region surrounding Yucca Mountain."

Page 3-14. Regarding long term flood predictions: "Predictions are especially difficult for drainages with minimal stream-flow records, such as those in the hydrologic study area."

Page 3-16. Regarding calculating probable maximum flood: "The sparse streamflow records, the availability of only minimal precipitation and storm data, and the absence of data on infiltration-runoff

characteristics for the drainage basins in the Yucca Mountain area requires that many speculations and assumptions would be needed to calculate the magnitude of probable maximum floods in complex drainages the size of Forty mile and Topopah washes. Also, the lack of storm and runoff data throughout the hydrologic study area prevents checking the validity of the various assumptions used."

Page 3-17. Regarding the drainage basins of Busted Butte Wash and Drill Hole Wash: "The regional maximum flood would inundate all central flat-fan areas in these two watersheds."

Page 3-19. Regarding erosion: "The extent of erosion and sediment movement caused by flood flow in Fortymile Wash and its tributaries that drain Yucca Mountain is not known quantitatively."

Regarding flood and debris hazard: "The sparseness of the historic data base on surface water hydrology, including the movement of both water and debris inhibits accurate prediction of flood and debris hazards for the immediate future. Likewise, a deficient understanding of the paleoclimates and the past geomorphic processes limits the ability to predict climatic changes and their probable effects on flood-and-debris-hazards potential over the next several thousands of years."

Page 3-20. Regarding hazard potential: "The minimal data on stream flow and insufficient knowledge of geomorphic parameters make predictions of flood and debris hazards very speculative."

In looking at the overall Yucca Mountain Project, we view the determination of the PMF or other major hydrologic event as major design uncertainties. Without substantiated hydrologic data on a given site, it is impossible to obtain a PMF at that particular site. Since it is clearly acknowledged in both the CD-SCP and the CDR that no site specific data exist for the Coyote Wash area, it becomes a question of conservatism as to the determination of the PMF.

The problem is that the design depends on the PMF determination and the PMF determination is likewise dependent upon the design. PMF is determined by considering hydrologic data, which is sparse, and the planned structures in the wash that will cause backwater effects, damming, etc. In a relatively narrow wash, such as Coyote Wash, the peak level of the PMF is

highly dependent on the existence of such obstructions.

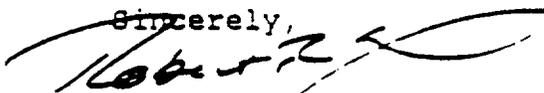
In order to insure that the ESF shafts will be safe and free from the damage due to major hydrologic events, it is critical to place the shafts in a position and at an elevation that the engineering and scientific community as a whole agree as safe from the PMF. At their current locations, the shafts certainly do not meet this standard.

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We certainly concur with the discussion contained in the Draft SCP: flood prediction at Yucca Mountain is indeed very speculative. Our obvious question is, therefore, how can you confidently site the ESF shafts that will technically be an integral part of the licensed repository in Coyote Wash considering the unfounded, admittedly deficient condition of the potential flood data? We might further point out that the other proposed shafts, the ramps and the surface facilities described in the CDR all may have a similar problem.

This office is prepared to discuss our concerns regarding the ESF location with your staff at any time.

Sincerely,



Robert R. Loux
Executive Director

RRL/jrg

cc: Robert Browning, NRC

LETTER
LOUX TO GERTZ

09/22/88

REGARDING SITE SELECTION



AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE

Capitol Complex
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September 22, 1988

Mr. Carl P. Gertz, Project Manager
Yucca Mountain Project Office
U.S. Department of Energy
Nevada Operations Office
Phase 2, Suite 200
101 Convention Center Drive
Las Vegas, NV 89109

Dear Mr. Gertz:

At the July, 1988 DOE/NRC/State meeting in Rockville, MD, regarding NRC concerns about the Exploratory Shaft Facility (ESF), Joe Tillerson of Sandia gave a presentation that responded to NRC Objection No. 4, "Shaft Locations". Part of this presentation was a bit of history that attempted to defend the reasoning behind the selection of the present ESF shaft locations. Mr Tillerson cited two references: (1) "Detailed discussion with NRC in 8/85 meeting" and (2) "Selection process documented in SAND84-1003". The purpose of this letter is to discuss the latter.

29

SAND84-1003, NNWSI EXPLORATORY SHAFT SITE AND CONSTRUCTION METHOD RECOMMENDATION REPORT, was authored by Sharla G. Bertram of Sandia's Seabed Programs Division, and published in August of 1984. The abstract claims that the report documents the evaluation of alternate construction methods and the screening of potential exploratory shaft sites. The report concludes by recommending a vertical shaft, conventionally mined, in a dry canyon known as Coyote Wash.

What we find incredible is the brief, just three month, duration of this effort and the lack of documented data upon which to compare alternatives as a basis for the the selections. In fairness, we are aware that much has changed since these recommendations were made in the spring of 1982; however, unfortunately the results of this hasty, unreferenced evaluation survive and continue to be perpetuated by DOE.

According to the report, on March 29, 1982, a few months prior to passage of "The Nuclear Waste Policy Act", a working group was formed to develop procedures for evaluating ESF construction methods and screening sites. Thirty days later, on April 28th, the procedures were completed, approved by the senior project officers of all participating contractors in the NNWSI, and the working group became the AD Hoc TOC Committee. Their task was to refine criteria and implement the methodology. They were further charged with recommending the preferred construction method by May 10 and recommending the preferred site by June 1. This schedule allowed 11 calendar days (6 working days) to select a construction method and generously allowed 33 calendar days (22 working days) to select a site. The method recommendation was presented and unanimously approved on May 12, two days late. No exact date is mentioned for the presentation of the site recommendation, but the report implies the work was completed in June.

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On August 22, 1982 Drill Hole USW G-4 was started in Coyote Wash. Note that the shaft site was selected before G-4 was even started and therefore the evaluation criteria that addressed underground fractures, vertical thickness of units, and underground adverse conditions had to be based on the existing drill hole data from G-1, H-1, H-4, and UE25a-1, the latter being the closest to the selected site, being 3300 feet to the east. The Committee stated that it used the most current information available; most data, including that from USGS, was preliminary and unpublished; and that the information was incorporated into the report without reference. Perhaps the rushed schedule was prompted by the stated assumption that shaft construction would begin March 31, 1983.

Before recommending a construction method, the committee considered 12 alternatives. Five of these were evaluated using merit analysis. Two of the five called for shafts extending through the Calico Hills Unit into the Bullfrog and Tram Units. Though somewhat unsophisticated and general in nature, the process seems to have resulted in the Committee somehow stumbling onto perhaps the best construction method.

The Committee next selected four categories of screening criteria for site selection: 1) Scientific, 2) Engineering, 3) Environmental, and 4) Nontechnical.

From this point the Committee proceeded to screen alternate repository block areas using boundary setbacks, and distance to potentially adverse geologic structures to develop acceptable areas for siting. In addition, all areas of steep slopes or adverse topography were eliminated. From this screening emerged five preferred areas: two on Yucca Ridge and three located in washes on the eastern flank of Yucca Mountain.

It should be noted here that perhaps the greatest flaw in the selection process was in the logic applied to this screening that selected the five preferred sites. Heavy emphasis was placed on two factors: setback from the repository boundaries and avoidance of adverse geologic structures.

In an effort to center the ESF on the block and insure typical representation, the following buffer criteria were applied and the border areas of the block were eliminated:

1. A 500 foot wide strip along the west side of the block, thus avoiding Solitario Canyon Fault zone.
2. A 1000 foot wide strip along the north side of the block, thus avoiding possible Drill Hole Wash faulting.
3. A 2000 foot wide strip along the eastern side of the block, thus avoiding the imbricate faults.
4. All land lying south of a line 4000 feet north of H3, thus avoiding the numerous faults suspected in Abandoned Wash.

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This exercise eliminated 633 acres (42%) of the 1520 acre block and left 887 acres as acceptable. If roughly 40 % of the block is unsatisfactory for the ESF, the question arises: should the block even be considered for a repository?.

Next, to avoid adverse geologic structures as identified by USGS, all lands less than 1000 feet and more than 2000 feet from an adverse structure were eliminated. The intent here seemed to be to maintain a 1000 foot buffer for safety but stay within a maximum of 2000 feet distance so that underground horizontal drilling to the structure could be accomplished. These criteria eliminated another 812 acres leaving 75 acceptable acres.

Finally, of the remaining 75 acres, 52 acres of steep slopes (term undefined) were eliminated. This left 23 acres or 1.5% of the original 1520 acre block that the Committee considered acceptable for an ESF site. These 23 acres were divided among 5 sites, three in washes and two on the ridge top.

Perhaps it made sense to avoid the perimeter boundary of the block and seek a central location. However, a program mandated to characterize the repository block, including its structures, should not have eliminated so much area in an effort to avoid the very geologic structures that were to be investigated. Sinking a shaft near a fault zone is not uncommon, using existing technology. Further, there is no assurance that the two ESF shafts or the Men & Materials and Exhaust shafts won't intercept currently unknown faults during sinking, however it seems assured that the proposed ramps will intersect several fault zones as they are driven. In addition, structures that were so carefully shunned in the screening were not all proven, many being only suspected by USGS, based on surface work.

In reviewing the maps that define the various areas discussed above, it is apparent that the nebulous "steep slope" factor was employed in to eliminate a 30 acre tract lying in the center of the block in the area of Antler Ridge. Construction of a road and the required utilities would have been comparatively more difficult here, but by no means restrictive.

The "Nontechnical Category" was discarded because all five sites were considered equal in this category. The remaining parameters were each assigned a weight, with flash flooding, reclamation and surface disturbance at the bottom of the list each with a maximum of 3.0% of the total score. Heading the list as most important to the site selection was "subsurface facilities located in good rock" at 16.5 % or 5.5 times more important than flash flooding.

29 There then followed in the report a brief discussion of the pro's and cons of each of the five sites. The two ridge top sites were suspect because building a mud pit for drilling effluents would be difficult; the muck piles would have to be at the heads of washes making reclamation difficult; a large area would have to be disturbed to gather enough material for the pads and berms; the long access road would require more control over off-road driving of heavy equipment; more road paving would be required; lack of topsoil would require hauling in topsoil for reclamation which would be dissimilar soil to that originally removed; and finally, vegetation recovery would be impeded by wind and water erosion. Needless to say, the ridge-top sites finished a distant 4th and 5th in the ranking.

The first of the wash-bottom sites was said to require some paving of the existing road. All other factors paralleled, but were rated slightly inferior to Coyote Wash. This site was ranked a close second.

The other runner-up wash-bottom site apparently was a throw-away early on. It was located in a "narrow, constricted, and steep wash". The report stated that flash flooding threatened to destroy mud pits, and wash away contained effluents and the muck pile. (We feel similar characteristics exist in Coyote Wash). Overhanging rock cliffs would have to be removed for safety during site preparation, and would be impossible to replace at reclamation. This site was ranked third.

The unanimous winner was, of course, the Coyote Wash site described as, "in a broad, open wash " providing "suitable areas for mud pit or muck pile construction without flash flood problems." The clincher was that road construction would be required for only a short distance. It is interesting to note that even with the skewed ratings, Coyote Wash was tied or outranked in 8 of the 12 subcriteria applied to compare the 5 sites.

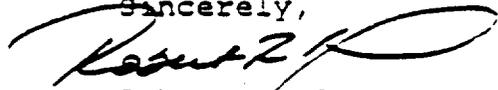
It is also noteworthy that the question of adequate available pad area was never addressed. In the recent Title I ESF Design Reviews, crowding of the facilities on the pad has been a recurring issue.

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In the intervening years, as repository requirements and configurations were changed, as the NRC and State of Nevada repeatedly were critical of the Coyote Wash ESF location, and as the planned ESF was enlarged from one shaft to two and shaft depths changed, we saw no attempt to revisit the 1982 ESF selection decision. We therefore strongly recommend that the ESF Site selection decision be reviewed now, in the context of the existing information and consistent with the status of site characterization planning. We further recommend that, unlike the 1982 process, appropriate quality assurance procedures be applied to the evaluation and any resultant decisions and conclusions.

I look forward to hearing from you on this matter, and if you have any questions, please feel free to contact me.

Sincerely,



Robert R. Loux
Executive Director

RRL/jrg

cc: Robert Browning, NRC

LETTER
LOUX TO VALENTINE

03/31/89

REGARDING FLOOD PLAIN DETERMINATION



**AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE**

Capitol Complex
Carson City, Nevada 89710
(702) 885-3744

March 31, 1989

Ms. Deborah Valentine
United States Department of Energy
Office of Civilian Radioactive Waste Management
Mail Stop 7F-079, RW-333
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Ms. Valentine:

RE: Determination of Floodplain/Wetlands Involvement for Site
Characterization at Yucca Mountain, Nevada (FR Vol.54, No.
26 / Thursday, February 9, 1989, p. 6818).

It has come to the attention of the Nevada Agency for Nuclear Projects, Nuclear Waste Project Office, that the subject Federal Register Notice of DOE's Determination of Floodplain/Wetlands Involvement was published on February 9, 1989. We discovered this Notice in March, 1989, and in fact, have never received direct notification of its publication from the U.S. Department of Energy despite the fact that Yucca Mountain, Nevada, is named in the Nuclear Waste Policy Amendments Act of 1987 as the location of the DOE's high-level nuclear waste candidate repository site characterization activities. Federal regulations for Compliance with Floodplain/Wetlands Environmental Review Requirements state, at 10 CFR Part 1022.14(b), that "DOE shall take appropriate steps to inform Federal, State, and local agencies and persons or groups known to be interested in or affected by the proposed floodplain/wetlands action." In view of the DOE's apparent oversight in providing direct notification of the subject Determination to the State of Nevada, please provide this Office with a description of the "appropriate steps" taken by DOE for notification of this Determination, and a list of those agencies, person, or groups (if any) that were individually informed of the DOE's February 9, 1989, Determination.

The Agency for Nuclear Projects has reviewed the subject FR Notice in accord with its duties as assigned by Nevada Statute and we are providing the following general observations and comments on the proposed action for consideration by the

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Department of Energy. Additional specific comments are attached to this letter, and are intended to be incorporated as a portion of the comments of the State of Nevada.

31 1. In reviewing the subject FR Notice, its cited references, and additional information that is available from the DOE, it is apparent that these documents do not provide adequate and complete descriptions of the proposed specific actions and their locations for comprehensive analysis, nor do they provide adequate information on the delineations of the floodplains/wetlands and their natural environmental and ecological characteristics that are likely to be affected.

32 2. Although the subject FR Notice makes specific reference to Site Characterization activities as the proposed actions, it is unclear, based upon the cited references, whether the Determination is also intended to refer to repository surface facilities, should such facilities be constructed. This matter should be clarified.

33 3. Specific comparisons of alternative sites considered for proposed actions in floodplains/wetlands have not been discovered in the referenced materials, or other available information.

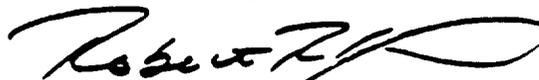
34 4. There is no specific discussion regarding the applicability and compliance requirements of Section 404 of the Clean Water Act relative to the proposed actions. Additional information should be provided regarding this matter.

35 5. The referenced materials and other available information are insufficient to permit calculations of the affects of structures proposed to be located in floodplains/wetlands on resultant flood heights and velocities.

36 Given the general lack of sufficient, and traditionally available, information to evaluate the proposed floodplain/wetlands actions relative to the requirements of 10 CFR part 1022 and the relevant Executive Orders, I am requesting that the Floodplain/Wetlands Assessment, required to be prepared by DOE (10 CFR Part 1022.12), be issued in draft form for review and comment, prior to DOE's issuance of its Statement of Findings as required by 10 CFR Part 1022.15. This will enable Nevada to undertake a comprehensive evaluation of the proposed actions with respect to the requirements of 10 CFR Part 1022 and provide substantive comment to DOE in a timely and constructive manner. This request is in accord with the intent of the Regulation, as well as that of the Nevada's assigned review and oversight role pursuant to the Nuclear Waste Policy Act.

I look forward to the DOE's consideration of the comments and observations contained in this letter and its attachment. I also am awaiting your response to my above information request, and my request that a draft Floodplain/Wetlands Assessment be issued for review and comment.

Sincerely,



Robert R. Loux
Executive Director

RRL/SAF/sjc

Attachment

ATTACHMENT
 NEVADA AGENCY FOR NUCLEAR PROJECTS
 SPECIFIC COMMENTS
 ON
 DETERMINATION OF FLOODPLAIN/WETLANDS INVOLVEMENT FOR
 SITE CHARACTERIZATION AT YUCCA MOUNTAIN

Facility Locations

37 The Nevada Agency for Nuclear Projects has reviewed plans and documents available for the design of the exploratory shaft facility and the repository surface facilities, focusing specifically on modifications to floodplains as required by 10 CFR 1022. Plans and documents reviewed included the Site Characterization Plan for Yucca Mountain, December 1988; Exploratory Shaft Facility Title I Design, December 21, 1988; and Site Characterization Plan - Conceptual Design Report, September 1987. Taken apart or together, these plans and documents provide insufficient information to ascertain the impacts of any flood event on the facilities proposed within the washes and the floodplains for either the ESF site or the repository surface facility site, and any alternative locations or designs which might minimize impacts to the washes and floodplains.

1. Referring to the ESF Title I Design, engineering drawings and design narrative do not describe the relationship between hydrologic events expected for the site and the region and the design of the facilities. Other literature presents several storm hydrographs for the Yucca Mountain area which relate to expected precipitation at the site in a general way. How these areal data affect the flood boundaries illustrated within the design drawings is not clear. Such data, if site-specific, also relate to expected flood elevations, volumes, and velocities.

Originally, the Squires and Young Report (USGS Water Resources Investigations Report 83-4001, 1984) was to be the major tool by which the ESF location was justified and other ESF improvements were designed. The current site plans for the ESF conflict with the drawings within the Squires and Young Report in terms of flood boundaries. These differences may prove to be justified, but without specific data and calculations any alteration of the originally established flood boundaries cannot be accepted.

-
2. Throughout the ESF Title I drawings, channels, roads, culverts, and even buildings are depicted that may prove to have an adverse impact on the hydraulic characteristics of

38 the washes in the area. For example, on sheet C39, three 36-inch culverts are to be placed underneath H Road. Further up the wash, H Road enters the 100-Year Floodplain (see sheet C45 B). This illustrates that the wash does carry some significant flows as would be expected, but the impacts of placing the three culverts downstream have not been addressed, as is evident by the information presented. It is one thing to simply insure that all pad and roadway elevations are above the 100-Year Floodplain; but of concern is the impact that improvements downstream, which may not be in the floodplain, may have on the upstream improvements as a result of backwater effects.

39 3. Another concern that should be addressed is the affect of flood water velocities. Although the ESF site improvements proposed within the 100-Year Floodplain may be safe as far as elevation is concerned, the scour potential of flood events in the Yucca Mountain area is enormous. The borrow pit proposed is to be constructed as a channel within the floodway and the muck storage pad is to be placed adjacent to the channel at a bend. Scour at the bend not only can realign the channel, but can undermine the access road and muck storage area.

40 4. The ESF site improvements to the floodplain should be designed based on the expected flood conditions, and then the flood elevations recomputed based upon improvements within the floodways. From a review of the available literature, there is nothing to justify the 100-Year and PMF (500-Year) boundaries presented. It is likely the boundaries could be altered dramatically by the proposed improvements.

41 5. For the repository surface facilities site, no information is provided in the literature to evaluate the affects of sheet flooding on the proposed site or what floodplain modifications will be made to the site for site characterization activities and how such modifications might impact flood elevations.

42 6. The probability of flood damage to the structures located in the floodplain should not be discounted. Thus, it is deemed critical that a study be initiated to evaluate the impact of such a hydrological event on the performance of the proposed repository. Specifically, the study should outline the damage assessment in the event of surface support facilities' inundation on the total operation and performance of the repository.

43 7. The proposed barrow pit channel and the smaller channel below the ESF equipment storage area, both appear to outfall into the natural drainage ways. These drainage ways appear

- 43 to parallel and flow across the main haul road. As an alternative, the road could be built up above its natural grade, as appropriate, to keep it out of the 100-Year Floodplain, and a culvert crossing constructed (station 366+50?) to control the flow across the roadway.
-
- 44 8. On a project of this magnitude, where the consequences of failure are catastrophic, the elemental design cannot be based on an inadequate data base. A thorough investigation of all design parameters must be carried out, and all pertinent information gathering tools should be utilized to construct and build a sound data base for project-specific aerial distribution of rainfall, rainfall ground infiltration, and magnitude of stream channel losses. There should be a concerted effort to initiate a program to systematically collect long-term flood data within the project perimeter, so that more relevant rainfall-runoff models for the ESF site and the repository surface facility site can be studied.
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- 45 9. For the ESF site, it is not clear what provisions have been made to contain spills and contaminants from flowing or being carried by storm water runoff into the floodplain from the compressor, generator building, and substation area.
-
- 46 10. The proposed measures of rerouting segments of several dry washes around critical facilities and straightening banks along several wash segments to "avoid adverse effects related to the location of surface facilities in the floodplain" do not address the effects of observed extensive erosion and deposition patterns characteristics of neighboring floodplains noted during field surveys. Erosion of, or deposition in channels and floodplains would be significant in the Yucca Mountain area during a 100-year flood event and could be severe during the 500-year and regional maximum floods. Ephemeral-channel systems generally undergo significant changes in depth, width, alignment, and stability with time, particularly during floods of long recurrence interval.
-
- 47 11. For the ESF site, considering the significant modifications proposed to be constructed in the floodway (not just the floodplain), it would seem appropriate to include the results of a backwater analysis (HEC-2) conducted on the site in the floodplain assessment. Such an analysis might assist determination of whether the improvements proposed have a positive or negative impact during flood occurrences.
-
- 48 12. For the ESF Title I Design, data were not issued in the Title I Design Report to allow review of specifications on "fill" areas such as allowable materials, compaction requirements, compactions techniques, and final acceptance

- 48 criteria. These are necessary considerations when considering effects of storm water.
-
- 49 13. ESF Title I Design drawings (DWR C-37) locate a buried fuel tank in a floodway and possibly the floodplain. The buried fuel tank for emergency generators must comply with Section 601 of the 1984 RCRA Amendments (Public Law 48-616), which provides requirements on buried fuel tanks for the protection of the environment, which were not addressed in the drawings issued.
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- 50 14. According to ESF Title I Design drawing C-41, the leach field and sediment lagoon appear to be within the maximum regional floodplain boundary. If so, alternative locations should be considered, or precautions taken to minimize impacts.
-
- 51 15. A borrow pit is proposed (for a reason that is unclear-although it is assumed to be for site pad volumetrics) to be constructed in the form of a channel. This channel within the 100-Year Floodplain may prove to have high impacts on the ESF activities. High velocities within the channel can erode the southwestern face of the channel, causing destruction of the access roads and other facilities within Drill Hole Wash.
-
- 52 16. How will DOE meet the requirement in 10 CFR 1022.12 (a)(3) to address "alternative sites, actions, and no action" with respect to the Exploratory Shaft Facility. This is a crucial point of concern regarding the proposed location of the two shafts in the critical action (500-year) floodplain where, in accord with 10 CFR 1022 "even a slight chance of flooding would be too great." The Agency for Nuclear Projects as well as the Nuclear Regulatory Commission have discussed flooding hazards relative to the current shaft location with DOE in the past. In September 1988, the Agency issued a letter report to the DOE (R. Loux to C. Gertz, September 22, 1988) which documented the State's concerns with the process of exploratory shaft site selection used by the DOE. The report also discussed the concerns with respect to the flood hazard at the "preferred site location". From a review of the DOE selection process (NNWSI Exploratory Shaft Site and Construction Method Recommendation Report, SAND 84-1003), the criteria used to compare sites and the alternative locations considered did not address impacts to floodplains as contemplated by 10 CFR 1022.

Environmental Concerns

53 The Nevada Agency for Nuclear Projects reviewed the actions contemplated for floodplains in the Yucca Mountain area and the possible impacts on the environment of those floodplains. A site-specific literature base does not exist. Regional information is minimal and of little value in analyzing the floodplain environmental and ecological conditions and the impacts the proposed actions might present. In the absence of necessary environmental and ecological information, a series of questions are presented which should be addressed in the floodplain assessment.

1. Will a single floodplain assessment conducted in accord with 10 CFR 1022 address all affected floodplains at Yucca Mountain or will there be more than one such assessment that addresses different locations, proposed actions, and floodplains anticipated to be involved throughout the course of site characterization?

- 54 2. It is noted that the DOE Environmental Regulatory Compliance Plan (DOE/RW-0177, January 1988) for the Yucca Mountain Project states with respect to compliance with floodplain regulations that, "It is likely, however, that because no maps exist showing areas of flooding along those small washes, compliance with (10 CFR 1022) for these remote activities will not be required." The Agency would appreciate receiving from DOE an inventory of and maps for all the proposed floodplain actions at Yucca Mountain with an indication as to DOE's determination on an individual basis regarding the applicability of the regulations.

- 55 3. It would be appreciated if DOE could provide the Agency with a study plan for the floodplain assessment that describes the field studies to be undertaken, the analyses to be conducted, the alternative sites to be evaluated to avoid harm to floodplains, and the steps to be considered for minimizing floodplain damage, and for following-up of the action to verify that implementation of the selected alternative and any adopted mitigation measures proceed as described in the assessment.

- 56 4. Will the DOE Environmental Field Activity Plans (EFAPs) be revised to include field studies needed for the 10 CFR 1022 Floodplain Assessment? For example, the current ecosystems EFAP (DOE/NV-10576-14, August 1988) does not address comprehensive surveys of biota in floodplains. This consideration is important in light of some of the earlier work performed at Yucca Mountain for the DOE statutory environmental assessment which noted that unique assemblages of plants occur in floodplains and nowhere else at the site. No details on the nature of this floodplain

vegetation were provided. The assessment currently being planned by DOE should resolve that deficiency in information. The Agency's preliminary evaluation of this matter indicates that locations within the base (100-year) floodplains, e.g., the 50, 25, and 10-year floodplains frequently provide restricted favorable habitat for flora that is limited only to those specific floodplain areas by virtue of the unique soil and moisture conditions that occur there. Additionally, areas adjacent to floodplains often are underlain by shallow hardpans that have been eroded away in the floodplain itself. For this reason the desert tortoise and other important burrowing animals seek out floodplains for their burrows. The Agency's view is that field studies to be conducted by DOE in support of the floodplain assessment should address these and related issues.

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5. Will the DOE Environmental Monitoring and Mitigation Plan (DOE/RW-0208, December 1988) be revised to reflect the follow-up procedures required by 10 CFR 1022.17 that will be evaluated and selected in the course of conducting the flood assessment. If not, where in the various pieces of the DOE environmental program plan will such measures be described in detail? Does DOE perhaps intend to issue a separate piece of its environmental program plan specifically to address floodplain actions and compliance procedures in light of the fact that the presently existing 15-plus pieces do not mention environmental measures associated with 10 CFR 1022?

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6. Current DOE plans available to this Agency do not address the collection of soils information. 10 CFR 1022 requires that soil conditions in the floodplains be considered as part of the floodplain assessment. What soil studies are proposed for the floodplain assessment.

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