

AUG 1 1990

TARREVIEW/CJ

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THRU: Ronald L. Ballard, Chief  
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FROM: Keith I. McConnell, Geologist  
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Geosciences and Systems Performance Branch, HLWM

SUBJECT: RESULTS OF THE GEOLOGY-GEOPHYSICS SECTION'S REVIEW OF  
DOE'S TECHNICAL ASSESSMENT REVIEW, REVIEW RECORD MEMORANDUM  
RELATED TO GEOLOGIC AND GEOPHYSICAL EVIDENCE PERTAINING TO  
STRUCTURAL GEOLOGY IN THE VICINITY OF THE PROPOSED  
EXPLORATORY SHAFTS (TAR)

SUMMARY:

The Geology-Geophysics Section has completed the focused review of the TAR. The review consisted of two parts, a review of the TAR submitted by the DOE and a field review (June 13, 1990) of the evidence supporting conclusions made in the TAR.

We conclude that the TAR satisfactorily addresses several of the bases and recommendations contained in Site Characterization Analysis (SCA) Comment 127, but does not provide a complete basis for closing-out the open-item. We consider that two additional steps are necessary to close-out Comment 127:

- 1) Confirmation that procedures are in place to assure that critical data will not be overlooked in future design efforts and that recommendations made in the TAR are resolved in a timely matter.
- 2) The recommendations made in the TAR for use of the multipurpose boreholes in the assessment of faulting at the ES locations and the mapping of excavations created for the surface facilities at the ES need to be implemented.

DOE's ongoing Shaft Alternatives Study may result in shaft locations and/or configurations different from those on which the TAR was based. However, SCA Comment 127 is in large part process-related and applicable to any shaft or ramp site. Therefore, the DOE should respond to SCA Comment 127 irrespective of the shaft locations/configurations.

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REVIEW CRITERIA:

As requested in your note dated March 7, 1990, the Geology/Geophysics performed a focused review of the DOE's Technical Assessment Review, Review Record Memorandum on the "Geologic and Geophysical Evidence Pertaining to Structural Geology in the Vicinity of the Proposed Exploratory Shaft" (TAR). We used as limits to our review the criteria stated in your note, that is:

- \* Is the information in the report adequate to resolve Comment 127?
- \* If not, what more needs to be done, or wherein is the report inadequate?

Since the review was focused on the information in the TAR that might serve to close-out SCA Comment 127, we have not provided you with comments on other aspects of the report.

REVIEW APPROACH:

Comment #127 was separated into nine points that DOE would need to satisfactorily address in order for the staff to consider Comment #127 closed. The nine points are listed below along with the Geology-Geophysics Section's (GGS) position on each point. The GGS positions are the result of a section meeting held on this topic 03/27/90.

In addition, a field review of evidence supporting conclusions made in the TAR was conducted on June 13, 1990. The field review addressed DOE's evidence to support the conclusion reached in the TAR that faulting was not a significant factor in the present locations of the exploratory shafts. Geology-Geophysics Section staff members attending the field review were Abou-Bakr Ibrahim, Philip Justus, and myself.

REVIEW RESULTS:

1) Has documentation been provided to support the conclusion in the DAA that faulting is a nondiscriminating factor in the decision on shaft location? (Comment #127, Basis 1)

GGS Position: No. While the apparent absence of a large breccia zone appears to support the conclusion that a fault of significance to the repository is not present near the exploratory shafts, other field evidence related to faulting appears highly subjective and non-confirmatory. Therefore, the question as to whether faulting is a nondiscriminating factor in the decision on shaft location is still open. However, planned activities referred to in the TAR to map the area in detail during pad construction should clarify any concerns related to faulting in the vicinity of the exploratory shafts.

2) Has documentation been provided to indicate that the recommendations in the Bertram (1984) report were addressed? (Comment #127, Basis 2)

GGs Position: Yes. All recommendations in the Bertram report appear to have been addressed by the TAR. However, regarding implementation of a geophysical evaluation (recommendation #2) which could have ranged from a literature review to collection and interpretation of new data, only a literature review was conducted.

3) Given that the TAR acknowledges that no data other than that presented in the Bertram report was used in assessing the new shafts sites, has documentation been provided that shows sufficient data are available to judge whether the new shaft locations are on, or adjacent to a significant fault? (Comment #127, Basis 3)

GGs Position: No. We consider that data presented in the TAR do not resolve the issue about the presence of a significant fault. Specifically, the geophysical and fracture data presented in the TAR do not appear to be conclusive. The possible connection of a structural feature in the ES area with a larger scale fault to the south having significant displacement has not been resolved. In addition, no information on the possible presence of a strike-slip fault in the vicinity of the ES was provided in the TAR. We consider that the planned activities referred to in the TAR need to be implemented to resolve this concern.

4) Has a reevaluation of the fracture data provided an adequate basis for assuring that a major adverse structural feature does not exist in the vicinity of the shafts? (Comment #127, Bases 4 & 6)

GGs Position: No. After a field review of the evidence, we consider that the data presented in the TAR on fractures is not conclusive and does not provide an adequate basis for assuring that a major adverse structural feature is not present. We consider that the planned activities referred to in the TAR need to be implemented to resolve this concern.

5) Has a reevaluation of the geophysical data provided an adequate basis for assuring that a major adverse structural feature does not exist in the vicinity of the shafts? (Comment #127, Basis 5)

GGs Position: No. We consider that the planned activities referred to in the TAR need to be carried out to resolve this concern. However, in light of the significance of the shaft(s) as major repository design features, we also consider it to be prudent to implement the recommendations made in the TAR for additional geophysical testing and detailed mapping.

6) Has the design control process been reevaluated to assess why key information was apparently overlooked and are there procedures in place to assure that key information and recommendations are not overlooked in the future? (Comment #127, Recommendation 1)

GGs Position: No. We do not consider that the data presented in the TAR alone resolve this concern. Specifically, while recommendations are made in the TAR

to address this concern, no procedures are documented in the TAR which assure that key information and recommendations will not be overlooked in the future. The Quality Assurance Section may need to follow-up on this concern. We also consider that the recommendations concerning data management made in the TAR should be completed.

7) Have apparent conflicts between the design criteria in Bertram (1984) and the possible presence of a fault near the shaft locations been resolved? (Comment #127, Recommendation 2)

GGG Position: Yes. We consider that the data presented in the TAR has satisfactorily addressed the apparent conflict between design criteria in Bertram (1984) and the possible presence of a fault near the shaft locations.

8) Have the present shaft locations been reevaluated based on an assessment of available technical data? (Comment #127, Recommendation 3)

GGG Position: Yes. We consider that the TAR has adequately reevaluated the present shaft locations in light of available data.

9) Are the recommendations for future testing adequate for resolving the concern about the possible presence of adverse structural features in the area of the shafts? (Comment #127, Recommendation 4)

GGG Position: Yes. We consider that the planned activities in the TAR for future testing, if carried out, are adequate to address the concern about the possible presence of an adverse structural feature in the vicinity of the shafts. However, we would recommend to DOE that it consider high resolution seismic reflection surveys, VSP, tomography, and the use of carefully located angled boreholes to aid in fault detection.

#### RECOMMENDATIONS FOR CLOSING COMMENT #127:

1) Confirm that procedures are in place to assure that critical data will not be overlooked in future design efforts and that recommendations made in the TAR are resolved in a timely matter.

2) Complete the planned activities referred to in the TAR for use of the multipurpose boreholes in the assessment of faulting at the ES locations and the mapping of excavations created for the surface facilities at the ES.

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Enclosure:  
Site Characterization  
Analysis Comment #127

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Date:	7/19/90	: 7/19/90	: 7/19/90	: 8/1/90

implemented within the SCP and SCP/CDR should be reevaluated, particularly considering the reliability of the input data.

- Section 6.1.5 of the SCP states that only the waste "container" and not the waste form is on the proposed Q-list of items important to waste isolation; however, the analyses appear to rely on the waste form in performance allocation. If this is the case, the waste form (or at least the glass waste form) should be on the Q-list.
- The Q-list should include significant items such as the "design" to preclude criticality, or another means should be provided to identify such items requiring 10 CFR 50 Appendix B QA controls which do not fit the definition of Q-list or quality activities list items.
- The NRC staff suggests that DOE should start by making a list of all engineered items and barriers associated with handling and isolating high-level waste. Items could then be removed from this list as reliable data and suitable analyses show that a low-level of, or no, QA is required for such items. What remains on the list would, at any given time, be the "Q-list."

## REFERENCES

10 CFR Part 60, Subpart G and 10 CFR Part 50, Appendix B.

H. R. MacDougall, L. W. Scully, and J. R. Tillerson (Compilers). Site Characterization Plan Conceptual Design Report. Sandia National Laboratories, SAN84-2641, September 1987.

### 4.2.2 DAA Comments

Section: Design Acceptability Analysis, Chapter 3:  
Assessment of Alternative Shaft Locations

#### COMMENT 127

The process used to integrate all available technical data into decisions regarding shaft location appears to have been inadequate because an apparent lack of data integration raised concerns about the suitability of shaft locations and about a process that has resulted in a possible violation of the criteria specified in the Design Acceptability Analysis (DAA) for set-back distances from faults.

#### BASIS

- The Design Acceptability Analysis cites Bertram (1984) as the basis for decisions regarding shaft set-back distance from faults and concludes that "...all five shaft locations are more than 100 feet from the nearest faults and this factor is nondiscriminating. . ." (DAA, p. 3-7). The DAA states that "Thus, consideration in this report of fault locations as a surrogate for performance essentially adopts the use of the same characteristic by Bertram" and "Because Bertram (1984) excluded all areas within 100 feet of faults, all five alternative locations compared by Bertram are in an acceptable zone" (DAA, pps. 2-26, 2-29). However, the Bertram (1984) report, while publishing the results of siting activities conducted in early 1982, does not include the results of recommended activities to determine the presence of potentially adverse structures near the shaft locations. Therefore, the Bertram (1984) report does not support the conclusion made in the DAA regarding faulting as a factor in shaft location.
- The activities of DOE's shaft related Technical Integration Group conducted in 1982, and reported on by Bertram in 1984, made several recommendations regarding geologic mapping and geophysical evaluations in the vicinity of the preferred shaft locations. Some of the recommended mapping and evaluation was carried out in the two years (1982-1984) preceding publication of the Bertram (1984) report; however, there is no indication in either Bertram (1984) or a subsequent report on shaft location by Gnirk and others (1988) that the results of the geologic mapping and geophysical surveys were ever integrated into the decision on shaft location.
- In 1987, in response to concerns raised by the NRC staff, the locations of the exploratory shafts were moved from the center of Coyote Wash to the rock slope that bounds the wash to the north (Gnirk and others, 1988). There is no indication that data other than that presented in the outdated Bertram (1984) report was used in the decision-making process that led to the determination of the new locations.
- In 1982, the NNWSI Technical Integration Group (TIG) recommended that the sites of the shafts be re-evaluated should the recommended sites contain surface joint densities significantly higher than other sites. The SCP indicates that scientific criteria were used so that the exploratory shaft would not be constructed in areas of fractures associated with structural features (8.4.2-155). The area near the present sites on the northern slope of the wash is said to contain "fracture sets. . .so intense that they are essentially breccias. . ." (Dixon to Vieth, 1982). Based on the recommendations made in 1982, a re-evaluation of the recommended site should have been

conducted to determine the significance of the fracturing near the sites selected in 1987. While the DAA refers to the Dixon to Vieth letter and suggests that the mapping "tends to support the data set used in the original selection. . ." (p. I.6-8), there is no indication that the site selection process included a detailed analysis of these fracture data.

- The TIG also recommended that a geophysical evaluation be made in the washes near Yucca Mountain to explore for structures not exposed at the surface. Many of the geophysical surveys (most are regional studies) cited in the Gnirk and others' (1988) report as addressing the TIG recommendation were completed after the final decision on shaft locations was made (August, 1982). In addition, there is no indication that the results of resistivity surveys suggesting the presence of a fault at the current shaft locations (Smith and Ross, 1982) were considered in the selection of the site.
- There is no indication that the results of the geologic mapping, showing a high degree of fracturing present in rocks near the present shafts sites, were integrated and assessed with the results of the 1982 geophysical survey that suggests the possible presence of a fault in the vicinity of the mapped breccias.

#### RECOMMENDATIONS

- DOE should reconsider whether the design process, which appears to have overlooked key information about the suitability of exploratory shaft locations, is adequate to assure that the shafts will not adversely impact waste isolation.
- DOE should address apparent conflicts between the design criteria specified (i.e., set-back of 100 feet from faults) in Bertram (1984) and Gnirk and others (1988) and the presence of a possible fault near the exploratory shafts as suggested by the geophysical testing (Smith and Ross, 1982).
- The present shaft locations should be re-evaluated based on an assessment of available technical data.
- Consider conducting further tests (e.g., geophysical testing and trenching) in the vicinity of the proposed shafts to verify features and conditions that exist in that area.

#### REFERENCES

Bertram, S., 1984, NNWSI Exploratory shaft site and construction method recommendation report: Sandia National Laboratory, SAND 84-1003, 100 pp.

Dixon to Vieth, 1982, letter: G.L. Dixon (USGS/Las Vegas) to D.L. Vieth (DOE/NV-WMPO), re: "Results of detailed geologic mapping at the five potential exploratory shaft locations on Yucca Mountain," July 16, 1982.

Gnirk, P., Hardin, E., and Voegele, M., 1988, Exploratory shaft location documentation report: U.S. Department of Energy Nevada Operations Office, Las Vegas, Nevada, December 21, 1988, 127 p.

Smith, C., and Ross, H.P., 1982, Interpretation of resistivity and induced polarization profiles with severe topographic effects, Yucca Mountain area, Nevada Test Site, Nevada: U.S. Geological Survey Open-File Report 82-182, 21 p.

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Section: Design Acceptability Analysis

#### COMMENT 128

Several applicable 10 CFR 60 requirements have not been considered in evaluating the acceptability of ESF Title I design.

#### BASIS

The DAA lists fifty-two (52) 10 CFR 60 requirements that are considered in ESF Title I Design Acceptability Analysis (DAA). This list of (52) requirements does not include all applicable 10 CFR 60 requirements. The following requirements are missing from the list and are not considered in the DAA:

- 60.17 Contents of Site Characterization Plan

The ESF will be used to obtain information called for by (a) the SCP, (b) the waste package program, and (c) the repository design. As such, this requirement could potentially affect ESF requirements.

- 60.24(a) Updating of Application and Environmental Report

This section requires various applications (e.g., license application) to be as complete as possible in light of information that is reasonably available at the time of docketing. This requirement is applicable to ESF design because it provides guidance regarding scope and possible sequencing of activities.

- 60.113(a)(2) Performance of Particular Barriers After Permanent Closure—Geologic Setting

This regulation is applicable because the ESF design could impact the location of the disturbed zone boundary.