



Department of Energy

Nevada Operations Office

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WM-11(2)



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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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WM Project 11

Docket No.

PDR

DEC 26 1986

Distribution:

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CLOSURE OF OPEN ITEMS AND STATUS OF COMMITMENTS FROM THE NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS (NNWSI) PROJECT/NUCLEAR REGULATORY COMMISSION (NRC) MEETING OF AUGUST 27-28, 1985

Reference letter, Donald L. Vieth to John J. Linehan, dated June 2, 1986 (Enclosure I).

As stated in Enclosure II and Table I to the referenced letter, the NNWSI Project indicated that discussion on Open Items 10 and 11 would be initiated by August 1, 1986. This letter documents the current status of these items. The "Open Items" and "Responses" as they appeared in Enclosure II are repeated.

Open Item 10

[Open Item] 10. Need to review Section 60.21(c) to determine the NRC's expectations regarding the information of fracture characteristics to be obtained from the exploratory shaft.

RESPONSE

o Open Item 10: The NNWSI Project will initiate a discussion with the NRC on this item by August 1, 1986.

Discussion and Status of Open Item 10

10 CFR 60.21(c)(1)(i)(A) requires detailed information on "the orientation, distribution, aperture infilling and origin of fractures, discontinuities, and heterogeneities."

This information is required in the context of subsurface conditions which might affect geological repository operations area design and performance. In particular, the presence and characteristics of potential pathways that may allow transport of radionuclides by water or gases to the accessible environment must be identified.

The following discussion presents the views of a spectrum of the Project's earth scientists as to their interpretation of the requirements for information which would lead to a thorough description of the nature of the subsurface

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fractures, discontinuities, and heterogeneities at Yucca Mountain. It is not entirely clear to us that all of the information discussed below is necessary to satisfy the basic requirements outlined in 10 CFR 60.21(c), to define the subsurface isolation characteristics of the Yucca Mountain site. Since the subject of fractures, discontinuities, and heterogeneities represents a substantial portion of our test program, the NNWSI Project needs to clearly understand the scientific basis of the NRC requirements as they relate to the Yucca Mountain site. We propose that the following discussion serve as the basis for a future interaction with the NRC on this topic.

At Yucca Mountain fracture networks change with stratigraphic level and with lithologic (in part mechanical) character of the strata. Mapping the vertical sequence of fractures and the lithologic character within the exploratory shaft is an important part of the definition of variables that affect isolation. Because the abundance and patterns of the nearly vertical fractures at Yucca Mountain change also laterally, mapping within drifts and lateral boreholes from the drifts is also a vital part of the characterization, particularly within the waste-emplacement horizon.

In addition, isolation is a function of the degree of retardation of radio-nuclides by sorption along fractures or by diffusion, into the rock matrix. Two factors that control the degree of retardation by sorption include the quantity and types of sorptive minerals that coat fractures and occur within matrices. Mapping in the shaft, drifts, and lateral drill holes along with mineralogic studies will provide the means to evaluate these retardation factors.

The containment of nuclear waste by engineered barriers and the retrievability of waste packages depend to a large degree on the stability of mined openings and the tectonic stability of Yucca Mountain. An evaluation of containment and retrievability at Yucca Mountain requires an understanding of the relationships between the tectonic environment, the mechanical properties of rocks, and the design of mined openings. Geologic data collected during mapping in the shaft, drifts, and lateral drill holes will contribute to an understanding of the tectonic environment and mechanical properties of the rock.

Shaft-wall mapping of fractures is the principal opportunity in the NNWSI Project site characterization program to study the characteristics and vertical continuity of fractures at depth. The purposes of shaft-wall mapping are to (1) describe the geologic medium in which the repository will operate; (2) provide the geologic framework by which hydrologic test results in the fractured rock of the shaft can be evaluated; (3) provide the framework by which geomechanical test results can determine the stability of underground excavations; (4) provide the framework by which geochemical and mineralogical test results can be used to determine the near-field retardation capacity of the rocks; and (5) calibrate seismic signals with fracture parameters. This last purpose is designed to quantify vertical seismic profile fracture-detection surveys planned within the repository block.

Performance

In both saturated and unsaturated zones, fractures provide an important means of transporting water or gas to, through, and from the repository. Fractures provide the only potential paths of rapid flow.

In the unsaturated zone at Yucca Mountain, understanding of hydrologic behavior is still conceptual as expressed by Montazer and Wilson (1984). Localized fracture flow probably will occur during heavy precipitation and beneath runoff channels. The depth to which fracture flow will persist is still in question. Among the factors influencing it are the intensity and duration of the infiltration event, the persistence of the fractures through the various lithologies, the ambient degree of under saturation of the rock matrix along fractures, and perhaps fracture-wall coatings. Altered walls of fractures and coatings of secondary minerals precipitated from aqueous solutions within fractures are characteristic in the upper part of the unsaturated zone. These observations suggest that in the past, fractures have transmitted fluids and have been the most active sites of chemical interaction in the unsaturated zone. It should be noted that preliminary indications suggest that the densely welded tuff of the Topopah Spring Member of the Paintbrush Tuff at the proposed repository horizon have neither of the features mentioned above. Together with the high degree of undersaturation of the Topopah Spring matrix, this may indicate that downward-moving water is absorbed into the matrix, or that it has been diverted laterally to major structural pathways before reaching the Topopah Spring. The NNWSI Project intends to evaluate these possibilities by observations during construction of the Exploratory Shaft Facility and by in-situ tests of matrix versus fracture flow. In addition to the role that fractures play in movement of water in the unsaturated zone of Yucca Mountain, they also provide a possible means of release of radionuclide gases from the repository to the surface.

In the saturated zone at well J-13, about 6 km east of the southern portion of Yucca Mountain, the fractured, densely welded Topopah Spring Member exhibited hydraulic conductivities 3 to 8 orders of magnitude greater than those of the unfractured matrix (Winograd and Thordarson, 1975). Hydraulic tests of deeper tuffs beneath Yucca Mountain also result in hydraulic conductivities that are orders of magnitude greater than those of the matrices indicating that fracture flow is operating in the saturated zone. Rates of 365 meters per year have been calculated for fracture flow between two wells several kilometers east of the repository area (DOE, 1986).

Design

A combination of fracture data with results of geomechanical tests can address a number of subsurface facility design concerns. Among these design concerns are the environment and retrievability of the waste package, the effect of mined openings on the stability of a fractured rock mass, and the effects of lithologic variations. Structural and lithostratigraphic features that could possibly limit the boundaries of the repository block affect the flexibility of design. In addition, the extent of adverse structural or lithologic features, if any, within the repository block could define an unusable part of the block.

John J. Linehan

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Past tectonic rates and future probabilities of tectonic events, principally rates of faulting, have been difficult to interpret from investigations at the surface of Yucca Mountain. This difficulty is largely due to the general absence of offsets related to faulting in young material that can be reliably dated. Preservation of fracture-filling material that can be dated is far greater in the subsurface than at the surface. Thus, dating of samples obtained from faults and other fractures encountered in the shaft will contribute to determination of tectonic rates. Study of geometry of lineations on fault slickensides, if found in the shaft, will be used to estimate the paleostress environment (Angelier, 1979).

As discussed in the introduction to this Open Item, the NNWSI Project will propose, at a later date, a meeting with the NRC on this topic. It is the NNWSI Project's goal to develop its testing programs with a full understanding of the NRC requirements and related scientific bases. At the present time, a scientific study of fractures, discontinuities, and heterogeneities, as discussed above, may not be necessary to assess the isolation characteristics and performance of Yucca Mountain.

References for Open Item 10

Angelier, J., 1979. "Determination of the Mean Principal Directions of Stresses for a Given Fault Population," Tectonophysics, Vol. 56, pp. T17-T26.

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

Montazer, P., and W. E. Wilson, 1984. Conceptual Hydrologic Model of Flow in the Unsaturated Zone, Yucca Mountain, Nevada, USGS-WRI-84-4345, Water-Resources Investigations Report, U.S. Geological Survey, Lakewood, CO.

Winograd, I. J., and W. Thordarson, 1975. Hydrogeologic and Hydrochemical Framework, South-Central Great Basin, Nevada-California, and Special Reference to the Nevada Test Site, Professional Paper 7 12-C, U.S. Geological Survey, Washington, D.C., pp. C1-C126.

Open Item 11. The NRC staff [member] who is concerned about the fact that the second exploratory shaft was located outside of the preferred area, needs to more thoroughly explain his logic as to why this is a significant point. Is it an issue related to validity of testing data or radiological health and safety?

RESPONSE

o Open Item 11: The NNWSI Project will initiate a discussion with the NRC on this item by August 1, 1986.

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Discussion and Status of Open Item 11

In August 1985, the NRC reviewed SAND84-1003, and asked the following question:

Proposed ES-1 is located 50 feet east of the western boundary of DOE's preferred area identified in SAND84-1003 report. However, proposed ES-2 is located 260 feet west of ES-1 and would be outside the preferred area. How does location of the ES-2 rating compare with the rating of DOE's preferred area?

This question became Open Item 11 in the summary of the ESF design and construction meeting (see Enclosure II to the enclosed letter from D. L. Vieth to J. L. Linehan, Exploratory Shaft Design and Construction Response...and Status of Commitments Resulting from...Meeting of August 27-18, 1985").

Although SAND84-1003, NNWSI Project Exploratory Shaft Site and Construction Method Recommendation Report, discusses in detail the criteria for the selection of the preferred area for exploratory shaft (ES-1) siting, there is no similar discussion of criteria for the selection of the emergency egress shaft (ES-2) location. It must be remembered that the purpose of defining a preferred area was to establish a location for the underground facility that would be within exploratory range of subsurface geologic features. The lack of uniformity of the surface topography also became a practical consideration in siting the location of the shafts. Consequently, the designation of the preferred area represented general guidelines for locating the shaft (ES-1) to provide the passageway to get underground for the purposes of conducting the exploratory activities. The fact that ES-2 falls outside of the "designated" preferred area has no known practical or long-term waste isolation significance.

The siting of Shaft ES-2 is based on California mining regulations that require a minimum of 100 ft. of separation between escape openings, and on the geotechnical rule of thumb that adjacent shafts should be separated by 15 to 20 shaft diameters in order to avoid disturbance of one shaft due to blasting in the adjacent shaft.

The placement of ES-2, therefore, is based on the application of standard mine safety requirements and is not related to the conduct of the site characterization activities that will take place in ES-1. In fact, the placement of ES-2 outside the boundary of the repository underground facility minimizes the impact of the shaft on both site characterization testing and on the repository's isolation integrity. We believe this Open Item to be closed.

Please address any questions on these topics to Jerry S. Szymanski at FTS 575-1503.


Donald L. Vieth, Director
Waste Management Project Office

WMPO:JSS-1772

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Enclosure:
As stated

cc w/encl:

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Enclosure I

Responses to NRC's April 14, 1983, request to NNWSI Project, "Information Considered Necessary Regarding Exploratory Shaft Construction and Sealing."

(These responses are an update of the NNWSI Project's June 7, 1985,
transmittal to NRC.)

I. Shaft and Seal Design Considerations

- a) Provide an analysis of the potential effects of construction of the exploratory shaft on long-term sealing capabilities of the rock mass and identify factors that determine the nature and extent of such effects
- b) Describe how the selected excavation technique and shaft design accounts for limitations and uncertainties in long term sealing considerations
- c) Provide design specifications for the shaft construction and show how they deal with the factors affecting sealing
- d) Describe the seal design and materials
- e) Discuss the selected locations of any planned explorations or testing to be performed along the length of the shaft. Include discussion of data on sealing characteristics to be gathered and the limitations and uncertainties associated with the data.
- f) Provide drilling history and results of geotechnical testing from the principal borehole, G-4

Response:

- a) The preliminary performance analysis study (Letter Report, Hunter to Oakley, 7/2/85) will be revised and transmitted to the NRC by October 3, 1986. The revised study will address the NRC concerns expressed at the August 27-28, 1985, meeting and in the November 25, 1985, letter. See Agreements 2, 3, and 4 of Enclosure III.
- b and c) The design specifications and acceptance criteria for shaft construction including construction controls, test blasting and overbreak control will be provided to the NRC when available. The plan for finalizing the specifications, criteria and controls is to develop the technical information necessary to implement revised blasting specifications. This will allow the development of technically defensible controlled blasting specifications, in the event they are determined to be necessary, to meet operational or postclosure radiological safety and isolation requirements based on

the results of the revised performance analysis study (see I.(a) above). This will involve gathering available technical literature and review to form a firm technical foundation of knowledge. A first step will be to review information concerning the blast damage zone. A second step is to attempt to gather performance data from blasting at G-tunnel at the Nevada Test Site (this blasting is required for other needs and obtaining blast damage data would be a secondary objective). Opportunities will be available in FY 86 and FY 87 to obtain this data. Coincident with these efforts, informal communication with mining professionals will continue.

Different blasting specifications can be incorporated easily into ESF construction plans at any time until actual construction bids are requested.

The date for complete closure on this item depends on the resolution of need for controlled blasting which will be based on the results of the revised performance analysis study.

This item will be a subject of discussion at the second meeting on ESF Design and construction.

- d) The shaft seal design concepts and materials are described in the Repository Sealing Concepts Report, SAND 83-1778. Further development in this area depends on the results of the revised performance analysis study as well as numerous other planned studies that will be reported in the SCP Conceptual Design Report, Advance Conceptual Design studies report, the License Application design report, etc. Further discussion with NRC on the subject of sealing will occur at the meeting on the NNWSI Project repository design. This meeting has not yet been scheduled.
- e) This information will be contained in the "NNWSI Exploratory Shaft Test Plan" and will be discussed with NRC at a meeting on that Plan which is yet to be scheduled. A summary of test plans was presented in the June 7, 1985, transmittal to the NRC and the pertinent parts of that summary are repeated here.

"Eight tests are planned to start ES construction. One of the eight, shaft-wall mapping, photographing, and hand specimen sampling, will be conducted routinely following each blast round as the ES-1 is being sunk. ...large-block sampling for porewater analysis, ³⁶Cl age dating, and geomechanical testing, will follow selected blasting rounds at 15 to 30 locations in the shaft. ...unsaturated-zone water sampling [will also be conducted]... The remaining tests initiated during ES construction will be at predetermined depths... These tests include (1) vertical and lateral coring to confirm adequacy of geologic and hydrologic conditions before breakout at the 158-m (520-ft) level, the 366-m (1200-ft) level, and the shaft bottom at 451-m (1480-ft); (2) the tests performed in the upper and lower demonstration breakout rooms (DARS) to assess constructibility and stability of repository-sized drifts; (3) shaft convergence tests, between the 158-m (520-ft) and 366-m (1200-ft) breakouts, and (4)

permeability tests also at the 158-m and 366-m levels."

"Most of the tests will be conducted at the 365-m (1200-ft) level in drifts located off the lower DRR. However, a few tests will also be performed in the upper DRR, in a drill room at the bottom of the ES-1, and through the ES-1 shaft liner at selected depths.

"It is currently planned to perform hydrologic tests at the interface of the Calico Hills and the Topopah Spring units and within the upper few meters of the Calico Hills unit. The purpose of these tests are (1) to investigate whether significant, sustained water flow in fractures is possible between the Topopah Spring and the Calico Hills units and within the zeolitized tuff of Calico Hills and (2) to obtain bulk hydrologic and geochemical properties for water flow within the Calico Hills unit...

"The data collected in these tests will be used in the final design and construction of the shaft seals, which will be emplaced during [closure.] Of particular significance to seal design and construction will be the extent and nature of the overbreak surrounding the shaft, and the extent of faulting, fracturing, and water producing zones..."

- f) The information requested is contained in the report, "Stratigraphic and Structural Characteristics of Volcanic Rocks in Borehole USW-G4," USGS-OFR-84-789 and the report "Uniaxial and Triaxial Compression Test Series on Topopah Spring Tuff from USW G-4, Yucca Mountain, Nevada", SAND84-1011. The latter report was transmitted to you on March 4, 1986, completing the response to this request.

II. Construction Plans and Procedures

- a) Identify the acceptance criteria for construction of the exploratory shaft
- b) Identify procedures used to minimize damage to the rock mass penetrated
- c) Identify liner construction and placement technique. Include such information as: liner type, liner material testing and placement of liner. This information needs to be fully considered in application of any permanent sealing program.

Response:

- a) Specific acceptance criteria for the ES are still being developed and will be incorporated into drawings and specifications. It is the NNWSI Project position that these criteria and their implementing construction controls need be no more strict than those required for short term stability. Therefore, these criteria will be representative of good quality, conventional shaft construction practices. Normal Title III inspections will verify compliance and quality assurance surveillance will provide additional

documentation. This item is closed.

- b) Short-term stability and safety requirements suggest that the use of excavation procedures transmitted to NRC as Enclosure A to Reference 2 will be adequate. These procedures limit the damage to the penetrated rock mass to reasonable levels. Note that some damage to the penetrated rock mass will occur due to stress relief even if no blasting were used. In view of the insignificant impact of the potential damage on the long-term repository performance, no special requirements have been identified. This item is closed.
- c) The NNWSI Project approach to construction and placement of the liner was transmitted to NRC as Enclosure B of Reference 2. The construction methods will not preclude the removal of the liner, if in the future it is determined to be necessary to emplace sealing components. This item is closed.

III. Sealing or Grouting Plans and Procedures

- a) Describe how the seals are expected to perform in sealing the exploratory shaft. Describe tests done, both laboratory and field, to determine their long-term durability and their compatibility, both chemical and physical, to the host rock environment.
- b) Describe the placement methods.
- c) Describe remedial methods to be used if sealing methods are not adequate.

Response:

- a, b and c) This question is believed to be related to seals planned for installation during construction of the ES. As identified in the August 27-28, 1985, meeting, such seals are not planned for an ES at Yucca Mountain since all construction is above the water table. Plans for monitoring potential vadose water inflow will be discussed in the ESTP. These items should, therefore, be considered closed.

Future discussions of postclosure performance of seals emplaced prior to closure (not during ES construction) will be held with NRC on a basis much broader than for the ES alone.

Remedial methods for seals intended to function during postclosure are not planned. Design philosophy will emphasize conservative assumptions and redundancy to preclude necessity for remedial measures.

IV. Construction Testing and Inspection Plans and Procedures

- a) Describe test and inspection procedures to be used during excavation (e.g., plumbness of hole, rock mass disturbance etc.) to determine acceptability of the shaft as constructed.
- b) Describe test and inspection procedures to be used during shaft liner construction. Include information such as grout injection

rates, grout bond logs, thermal measurements of grout during curing, and liner instrumentation to be used.

- c) Describe test and inspection procedures to be used after sealing of the shaft to assess the results of the sealing effort in controlling adverse effects. Include information such as grout strength tests, visual identification of seal conditions, records of water inflow, assessment of seal bond to host rock, and logging of drill holes.
- d) Describe plans to document the above construction activities.

Response:

- a) Test and inspection procedures utilized during ES construction, other than site characterization, will be developed based on the acceptance criteria developed during the Title II design (See Response IIa, above). It is anticipated that the Title II design will be complete by September, 1986. The Project will discuss the acceptance criteria which form the bases for the procedures in the second ESF design and construction meeting.
- b) This information request appears to be based on the blind bored shaft concept presented in LA-9179-MS. As the exploratory shaft is planned to be conventionally sunk, a grouted steel liner is no longer proposed. Pressure cells are planned to be installed in the concrete liner as part of the shaft convergence testing. This item is closed.
- c) This question is believed to be related to seals planned for installation during construction of ES. Such seals are not planned for ES at Yucca Mountain since all construction is above the water table. Test and inspection procedures are therefore not required. This item is closed.

Test and inspection procedures for use during construction of the shaft seals intended for postclosure are not required at this time.

- d) The documentation of construction activities will be in the Title III summary reports. The format of these reports is to be determined but the reports will contain as a minimum: 1) summaries of construction inspection reports; 2) materials testing reports; 3) change order records; and 4) as-built drawings. These reports should be available about six months after completion of construction. This item is closed.

V. Plans and Procedures for Gathering Specific Information Related to Site Characterization

- a) Describe test plans and procedures used to obtain adequate data on site characteristics that can be measured either directly or indirectly during construction of the exploratory shaft. For example:
 - o Geologic mapping and rock mass characterization of the shaft

IV b)	Liner test and inspection procedures	See Table I
IV c)	Seal test and inspection methods	See Table I

Since these items are covered under open information requests or are related to sealing issues much broader than ES concerns, this item is closed.

22. A decision (and the implications of such a decision) on whether the DOE will remove the liner at permanent closure or use it as part of the long term sealing system has not been determined.

RESPONSE

- o Open Item 22: The decision has not yet been made by the NNWSI Project.
23. A discussion of sealing materials and placement method and timing for exploratory boreholes from the ES will be provided in a future meeting on repository design.

RESPONSE

- o Open Item 23: This item cannot be closed until the Project meets with NRC on this subject (sealing). This meeting has not yet been scheduled.
24. The testing program to characterize perched water zones will be discussed at the ESTP meeting.

RESPONSE

- o Open Item 24: This item cannot be closed until the Project meets with the NRC on exploratory shaft testing. This meeting has not yet been scheduled.
25. The design specifications and acceptance criteria for the shaft construction including construction controls, test blasting, and overbreak control will be provided to the NRC when available.

RESPONSE

- o Open Item 25: The design specifications and acceptance criteria for the shaft construction including construction controls, test blasting, and overbreak control will be provided to the NRC when available.

The plan for responding to this Open Item is to develop the technical information necessary to implement revised blasting specifications. This will allow the development of technically defensible controlled blasting specifications in the event they are determined to be necessary to meet operational or postclosure radiological safety and isolation requirements based on the results of the revised performance analysis study (see Enclosure I, Item 1a). This will involve gathering available technical literature and performing sufficient review to form a firm technical foundation of knowledge. A first step on this will be to review information concerning the blast damage zone. A second step is to attempt to gather performance data from blasting at G-tunnel at the Nevada Test Site (this blasting is required for other needs and obtaining blast damage data would be a secondary objective). Opportunities will be available in FY 86 and FY 87 to obtain this data. Coincident with these effects, informal communication with mining professionals will continue.

The date for complete closure on this item depends on the resolution of need which will be based on the results of the revised performance analysis study.

Substitutions of different blasting specifications can be incorporated easily into ESF construction plans at any time until actual construction bids are requested.

This item will be discussed at the second meeting on ESF Design and Construction.

26. The NRC will provide guidance on the key parameters that should be considered in determining the representativeness of the ESF.

RESPONSE

- o Open Item 26: Guidance is being developed by NRC on this subject. Note that NUREG/CR 4161 has been published on this subject for basalt.

27. DOE's plans on the characterization of lithophysal zones and on plans for demonstrating horizontal emplacement and exploration holes will be discussed in a future meeting on repository design.

RESPONSE

- o Open Item 27: This item cannot be closed until the Project meets with the NRC on exploratory shaft testing. This meeting has not yet been scheduled.

28. Has DOE/OGR made a decision that the use of radioactive materials in the site characterization program will not be considered in the future?

RESPONSE

- o Open Item 28: This item cannot be closed until the Project meets with NRC on exploratory shaft testing. This meeting has not yet been scheduled.

ENCLOSURE II

STATUS OF OPEN ITEMS RESULTING FROM
THE DOE/NRC MEETING
AUGUST 27-28, 1985

1. DOE would like copies of Ted Johnson's analysis that indicated the 1/2" run-off from the E.S. Drainage Area could result in a 4 order of magnitude increase of water into the ES over the SNL 500-year floor scenario.

RESPONSE

- o Open item 1: The NRC Analyses "Review of Flooding Analyses, Exploratory Shaft Performance Analysis Study, NNWSI," was transmitted to D. L. Vieth by letter from J. J. Linehan, April 21, 1986. Closed.
2. DOE would like a copy of the report on in situ stress measurement at NTS referenced by David Conover.
 19. The NRC will provide the DOE with the U.S. Bureau of Mines reference related to horizontal stress of southern Nevada rocks.

RESPONSE

- o Open Items 2 and 19: The USBRM reference is: "In Situ Testing Determination of Stress in Rocks," Mining Engineering, pp. 51-58, August 1962, per NRC. Closed.
3. DOE would like specific details on the areas of landslides at Yucca Mountain referenced by John Trapp.

RESPONSE

- o Open Item 3: In a letter of December 3, 1985, (Linehan to Vieth) the following information was referenced in response to this Open Item:

Scott, R. R. and Ronk, J. "1984 Open File Report 84-494, page 8, Preliminary Geologic Map of Yucca Mountain, Nye County, Nevada with Geologic Sections"

Scott, R. R. referred to these slide areas during the 9/84 Geology Data Review in Nevada.
4. NRC [is to provide its] position on the 1 part per 100,000 release limit as an instantaneous differential or an integral over a year.

15. The NRC is to furnish the DOE with the information as to whether NRC's 10^{-5} /yr release rate applies on a discrete year-by-year basis or a continuous rate basis.

o Open Items 4 and 15 are NRC's responsibility.

5. Need to establish an authoritative set of references on the subject of rock damage around openings in the earth.

RESPONSE

o Open Item 5: A report on the zone of modified permeability ("damage zone") around openings is being prepared and will contain a bibliography developed by IT Corporation supplemented by additional references developed by Van Eeckhout. This report will be transmitted to NRC by 10/3/86. This item will be closed by that transmittal.

6. Need to establish a common approach to evaluating the magnitude of the damage around openings.

18. The DOE will provide the NRC with the data (e.g., RQD's stresses, hydraulic conductivities) used to get the results presented during the DOE presentation on damage zone model for tuff.

RESPONSE

o Open Item 6 and 18: Due to the importance of having a well defined damage zone model, we have initiated additional efforts that will refine that model. All information used to develop the damage zone model will be included in this report. This item should be left open until the report is transmitted to you. Our anticipated date of transmittal is July 1, 1986. The common approach to evaluating the magnitude of the damaged zone should be an agenda item for the second meeting on exploratory shaft design and construction.

7. Need to establish the properties of characteristics that can be used in the evaluation of "representativeness." A method for analyzing the data also needs to be established.

12. During the DOE presentation on the rationale for selection of the site for the exploratory shaft, the DOE stated that the site chosen is representative of the repository block but indicated that discussion of the question of representativeness would be deferred. The NRC staff agrees that this should be an agenda item for a future meeting.

RESPONSE

- o Open Items 7 and 12: A determination needs to be made as to which properties or characteristics, capable of being measured from the surface, need to be evaluated as a basis for determining representativeness. This subject should be an agenda item for the Exploratory Shaft Design and Construction second meeting.
8. Need to structure the Open Items in a manner that will allow the April 1983 NRC Letter (Coplan to Vieth) to be closed out.

RESPONSE

- o Open Item 8: This transmittal includes the structure which relates the Open Items to the April 1983 letter (see Table I). Closed.
9. NRC final comments on the Draft Performance Assessment on the Exploratory Shaft.

RESPONSE

- o Open Item 9: The November 25, 1985, letter from Linehan to Vieth provided these comments. Closed.
10. Need to review section 60.21(c) to determine NRC's expectations regarding the information of fracture characteristics to be obtained from the exploratory shaft.

RESPONSE

- o Open Item 10: NNWSI Project will initiate a discussion with NRC on this item by August 1, 1986.
11. NRC staff [member] concerned about the fact that the second exploratory shaft was located outside of the preferred area, needs to more thoroughly explain his logic as to why this is a significant point. Is it an issue related to validity of testing data or radiological health and safety?

RESPONSE

- o Open Item 11: NNWSI Project will initiate a discussion with NRC on this item by August 1, 1986.

12. See 7, above.

13. The DOE will provide to the NRC the Keystone Document 6310/85/1, Recommended Matrix and Rock Mass Bulk, Mechanical, and Thermal Properties for Thermomechanical Stratigraphy of Yucca Mountain, Version 1, October 1984, related to selection of the repository horizon.

RESPONSE

- o Open Item 13: A copy of the Keystone Document, "Recommended Matrix and Rock Mass Bulk, Mechanical, and Thermal Properties for Thermomechanical Stratigraphy of Yucca Mountain," was transmitted to you on March 4, 1986. Closed.

14. The DOE delineated the underground layout of the exploratory shaft and drifts and stated that underground testing considerations heavily influenced the layout. The NRC cannot assess the adequacy of the planned tests and hence the testing layout until the test plans are provided prior to the NNWSI/NRC ESTP meeting.

RESPONSE

- o Open Item 14: This item cannot be closed until the Project meets with the NRC on exploratory shaft testing. This meeting has not yet been scheduled.

15. See 4, above.

16. The DOE will furnish the NRC with the document which contains recent information on thickness of the Calico Hills.

RESPONSE

- o Open Item 15: A copy of SAND85-1076, "A Three Dimensional Model of Reference Thermal/Mechanical and Hydrological Stratigraphy of Yucca Mountain, Southern Nevada," was transmitted to you on March 4, 1986. This report contains the basic information on the stratigraphy that was used to construct the three-dimensional model that currently is being used by SNL in design studies. Contained in this report are the data on the Calico Hills unit that was requested by the NRC.

In this report the NRC will find discussions on the presence of zeolites within Yucca Mountain, as well as the methodology used to create the three-dimensional model. It must be emphasized that we occasionally revise the model as our understanding of Yucca Mountain increases. The reference information base will include the three-dimensional model and it is that model which forms the basis for our calculations. Closed.

17. The DOE will send the NRC copies of the viewgraphs used in the DOE's presentation of the damaged zone model for tuff.

RESPONSE

- o Open Item 17: A copy of the viewgraphs presented on the damage zone model during the subject meeting was transmitted to NRC on March 11, 1986. This item is closed.

18. See 6, above.

19. See 2, above.

20. DOE will provide NRC with information relating to testing performed in/on samples obtained from USW G-4 in addition to that presented in USGS-OFR-84-789.

RESPONSE

- o Open Item 20: The report SAND84-1101, "Uniaxial and Triaxial Compression Test Series on Topopah Springs Tuff from US G-4, Yucca Mountain, Nevada," was transmitted to you on March 4, 1986. Closed.

21. NRC requests that DOE identify the schedule for providing the items identified in DOE's response of June 7, 1985 as being under development.

RESPONSE

Information Item	Subject	Schedule
III a)	Design requirements for ES seals	See Table I
III b)	Seal placement methods	See Table I
	ES construction test and inspection activities	See Table I

walls

- o Measurements of rates and quantities of groundwater inflow and collection of groundwater samples for testing
- o Measurements of overbreakage during blasting
- o Rock mechanics testing of samples obtained during drill and blast operations

Response:

- a) The plans for gathering data during construction of the exploratory shaft are contained in the NNWSI Project "Exploratory Shaft Test Plan" (ESTP). Detailed test and measurement procedures have not yet been completed. The ESTP will be discussed at a meeting with NRC on that subject. The meeting has not yet been scheduled.

VI. Quality Assurance (QA)

Administrative Procedures

- a) Identify the line of responsibility for implementing QA procedures down to and including the Construction Contractor "... (10 CFR 50 Appendix B. Criteria I requires that 'organizations performing quality assurance functions shall report to a management level such that this required authority and organizational freedom, including sufficient independence from cost and schedule when opposed to safety consideration, are provided.)..."
- b) Identify the procedures to be used by the Quality Assurance organization for implementing and monitoring the QA program for exploratory shaft design, construction and testing.

Response:

- a) The line of responsibility was described in the June 7, 1985, transmittal to the NRC and discussed at the August meeting. The description from the June 7 transmittal is reproduced here for completeness. This response is completed.

"The line of responsibility starts with DOE/HQ, which has mandated to DOE/NV that quality practices will conform to ANSI/ASME NQA-1-1983. DOE/NV has in turn written and issued NVO-196-17, entitled Nevada Nuclear Waste Storage Investigations Quality Assurance Plan, which conforms to ANSI-ASME NQA-1-1983. NVO-196-17 requires that each organization participating in the NNWSI Project write a Quality Assurance Program Plan plus write (or cite) detailed procedures for all items or activities judged to be Quality Level I or II. Reynolds Electrical and Engineering Co. (REECo) will be the construction contractor for the ESF; however, the shaft sinking and underground drifting will be performed by a subcontractor. Therefore, the line of responsibility flows from DOE/HQ to DOE/NV to participating

organizations and, in the case of REECo, on to the shaft sinking subcontractor. Quality assurance procedures for the Level I and II shaft sinking and drift mining activities will be either written or adopted from such professional societies as ASME, IEEE, AIME, ASCE, etc. These procedures will be part of the subcontract.

- b) The QA procedures for exploratory shaft construction and testing will be completed prior to the start of shaft construction. The anticipated start of construction is May, 1987. Identification of these procedures will be transmitted to the NRC by March, 1987. (NRC VI R-1, this response is complete). The Quality Level assigned to exploratory shaft construction and to data collection during construction will be based in part on the revised performance analysis study and will be a topic of discussion at a meeting with the NRC yet to be scheduled (NRC VI R-2 and NRC VI R-3).



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JUN 02 1986

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Repository Projects Branch
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EXPLORATORY SHAFT DESIGN AND CONSTRUCTION - RESPONSE TO INFORMATION REQUEST FROM THE NUCLEAR REGULATORY COMMISSION (NRC), APRIL 14, 1983, AND STATUS OF COMMITMENTS RESULTING FROM NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS (NNWSI) PROJECT/NRC MEETING OF AUGUST 27-28, 1985

- References:
- (1) Letter, Seth M. Coplan to Dr. Donald L. Vieth, dated April 14, 1983
 - (2) Letter, Dr. Donald L. Vieth to John J. Linehan, dated June 7, 1985
 - (3) NNWSI/NRC Meeting Summary, Observations, Agreements and Open Items, dated August 27-28, 1985
 - (4) Letter, John J. Linehan to Dr. Donald L. Vieth, dated November 25, 1985
 - (5) Letter, T. O. Hunter (Sandia) to D. T. Oakley (Los Alamos), "Performance Analysis Studies to be Used in Determining Quality Assurance Levels for the Exploratory Shaft Design and Construction Activities," July 2, 1985 (Transmitted to NRC by letter, D. L. Vieth to J. J. Linehan, July 15, 1985)

The purpose of this letter is to provide a further response to NRC's letter of April 14, 1983, requesting information on the exploratory shaft construction and sealing (Reference 1) and to provide the status of the Agreements and Open Items which resulted from the NNWSI Project/NRC meeting on the same subject held on August 27 and 28, 1985 (Reference 3). The participants of this meeting discussed a preliminary response (Reference 2) to your initial information request. In addition, this letter considers the formal comments of NRC on the NNWSI Project preliminary response (Reference 4).

In the NNWSI Project's June 7, 1985, letter and supporting reference documents, and the U.S. Department of Energy's (DOE) Project presentations at the August 27-28 meeting with NRC, DOE presented its preliminary conclusion that the ability of the repository to meet NRC regulations is not significantly affected either by the degree of rock damage which can be anticipated near the exploratory shaft (ES) using planned excavation methods or by the quality of the liner.

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ENCLOSURE I

JUN 02 1986

John J. Linehan

-2-

This conclusion was based on the results of a performance analysis (Reference 5) study done by the Project. The proposed construction controls evolved from this conclusion. In addition, the Project stated that testing and exploration to be performed are described in the "Exploratory Shaft Test Plan" which is not yet available for NRC review. The Project did not address several of NRC's requests for information since the information requested has not yet been developed. The construction of a second exploratory shaft was not explicitly addressed in the study, although the conclusions for the first shaft apply equally to the second shaft.

It should be noted that the scope of the performance analysis study (Reference 5) is to provide a basis for the determination of the quality levels to be applied to the exploratory shaft design and construction. The study, therefore, is limited to consideration of rock damage during construction, the role of the shaft liner, and the role of the shaft internals.

Enclosure 1, NNWSI Project responses to NRC's April 14, 1983, request for "Information Necessary Regarding Exploratory Shaft Construction and Sealing" updates the Project's preliminary responses of June 7, 1985 (Reference 2) and will be utilized by the Project as the basis for tracking and documenting further development of information on the subjects.

Enclosure 2, Status of Open Items resulting from the NNWSI Project/NRC meeting on August 27-28, 1985, correlates the Open Items with the subject of Enclosure 1.

The Agreements resulting from the August 27-28 meeting are discussed in Enclosure 3, "Status of Agreements." No further tracking of these items appears to be necessary.

Table 1 of this letter shows the correlation of information requests and Open Items of the August 1985 meeting and summarizes the status of each information item. The Open Items will be tracked using Table 1.

In summary, the NNWSI Project will revise its performance analysis study (Reference 5) considering the NRC's comments. Conclusions which result from the revision will be the basis for the NNWSI Project Exploratory Shaft Facility Quality Assurance Program and construction controls. The conclusions of the revised study and the Project's plans for design and construction will be discussed at a second meeting between the Project and NRC, to be held later this year. The NNWSI Project Exploratory Shaft Test Plan (ESTP) will be transmitted to NRC and will be the subject of an NNWSI Project/NRC technical meeting which will also be scheduled for later this year.

If you have questions on this subject, please contact J. Szymanski at FTS 575-1503.



Donald L. Vieth, Director
Waste Management Project Office

WMPO:JSS-1161

ENCLOSURE III

AGREEMENTS FROM AUGUST 1985 MEETING

1. The DOE has proposed construction methods for the two exploratory shafts (ES-1, drill and blast, ES-2, raise bored) in the DOE letters dated June 7, 1985 from D. Vieth to J. Linehan entitled, "Comments on the NNWSI Exploratory Shaft Conceptual Design Report (SA-9179-MS)." The NRC has no objection to the use of the proposed construction methods, provided that they [the shafts] are properly constructed and controlled with an adequate quality assurance program. This position is taken considering both information gathering and final site sealing objectives. This is further based on specific information related to these objectives made available to staff over the past several years and the discussion in this meeting.
 - 2.* The calculations in the performance analysis document based upon a 12-foot shaft diameter and a 6-foot damaged rock zone will be redone utilizing the full excavated diameter of the exploratory shaft.
 - 3.* In the performance analysis it is assumed that the fuel cladding breaches linearly from year 300 to year 10,000. The DOE will recalculate using a more conservative scenario in which all cladding has been breached 1,000 years after the container has failed. This is in accord with the work presented by Lawrence Livermore National Laboratory at the NNWSI Project/NRC Waste Package meeting in July, 1985.
 - 4.* The uncertainties in dissolution rates of spent fuel should be clearly recognized in the performance analysis document. In its present form the performance analysis gives the impression that such uncertainties do not exist.
 - 5.** The NRC agrees to provide written comments on the DOE response to the NRC letter and the Performance Analysis report within 30 days.
- * Refer to Enclosure I, Responses ... Item I.a will consider these statements.
- ** Refer to Enclosure II, Status of Open Items.... This commitment is similar to Open Item 9.

TABLE I
CORRELATION OF INFORMATION REQUESTS AND OPEN ITEMS
OF AUGUST 1985 MEETING

INFORMATION REQUEST (4/14/83)		OPEN ITEMS FROM 8/27-28/85 MEETING	INFORMATION/ OPEN ITEM STATUS	REMARKS
I.	a	*	open	revised analysis to NRC by 10/3/86
	b	6	open	report on model to NRC by 7/1/86
		17	closed	viewgraphs transmitted to NRC on 3/11/86 ✓
		18	open	ESF Design and Construction second meeting
	c	25	open	depends on results of I.a
	d	23	open	repository design meeting on sealing shafts & boreholes
	e	14, 24, 28	open	ESTP meeting
	f	20	closed	SAND 84-1011 transmitted to NRC on 3/4/86 ✓
II.	a	*	closed	Enclosure I, letter to J. J. Linehan from D. L. Vieth 6/2/86.
	b	*	closed	" " "
	c	22	closed	Enclosure B, letter to J. J. Linehan from D. L. Vieth June 7, 1985
III.	a	21	closed	seals will not be installed during ES construction
	b	21	closed	" " "
	c	*	closed	" " "
IV.	a	21	open	ESF Design and Construction second meeting
	b	21	closed	Enclosure I, letter to J. J. Linehan from D. L. Vieth 6/2/86.
	c	21	closed	" " "
	d	*	closed	" " "
V.	a	*	open	ESTP meeting

* No Open Item correlates with Information Request.

TABLE I (Cont'd)

CORRELATION OF INFORMATION REQUESTS AND OPEN ITEMS
OF AUGUST 1985 MEETING

<u>INFORMATION REQUEST (4/14/83)</u>		<u>OPEN ITEMS FROM 8/27-28/85 MEETING</u>	<u>INFORMATION/ OPEN ITEM STATUS</u>	<u>REMARKS</u>
VI. a	b	*	closed	at 8/27-28/85 Meeting
		*	closed	VI-R-1 of NRC's 11/25/85 letter; Enclosure I, letter to J. J. Linehan from D. L. Vieth 6/2/86.
			open	VI-R-2 and 3; ES Design and Construction second meeting
			open	VI-R-4; ESF Design and Construction second meeting (these two Open Items depend on results of I.a. above)
None**		1	open	NRC analysis transmitted to DOE by letter of 4/2/86
None		2, 19	closed	USRM reference is "In Situ Testing Determination of Stress in Rocks" <u>Mining Engineering</u> , pp. 51-58, August 1962 per NRC
None		3	closed	Letter from NRC of 12/3/85
None		4, 15	open	NRC response needed
None		5	open	Report with bibliography to be transmitted to NRC by 10/3/86
None		7,12	open	NNWSI Project position on representativeness to be discussed at ESF Design and Construction second meeting
None		8	closed	letter to J. J. Linehan from D. L. Vieth 6/2/86.
None		9	closed	by transmittal of NRC's 11/25/85 letter
None		10	open	NNWSI Project to initiate discussion by 8/1/86
None		11	open	NNWSI Project to initiate discussion by 8/1/86

TABLE I (Cont'd)

CORRELATION OF INFORMATION REQUESTS AND OPEN ITEMS
OF AUGUST 1985 MEETING

<u>INFORMATION REQUEST (4/14/83)</u>	<u>OPEN ITEMS FROM 8/27-28/85 MEETING</u>	<u>INFORMATION/ OPEN ITEM STATUS</u>	<u>REMARKS</u>
None	13	closed	Keystone document transmitted ✓ to NRC on 3/4/86
None	16	closed	SAND 85-1076 transmitted to ✓ NRC on 3/4/86
None	21	closed	considered under other items
None	27	open	Repository Design Meeting

** No Information Requests correlates with Open Item

JUN 6 2 1983

Enclosures:

1. Responses to NRC's April 14, 1983 request to NNWSI Project.
2. Status of Open Items resulting from the August 27-28 meeting.
3. Status of Agreements
4. Table 1

cc w/encl:

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J. P. Knight, DOE/HQ (RW-24), FORS
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