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SEP 18 1985

Dr. Donald L. Vieth, Director
Waste Management Project Office
U.S. Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, NV 89114-4105

Dear Dr. Vieth:

Enclosed are two typed sets of the meeting notes for the NNWSI Project/NRC Exploratory Shaft Design Meeting held in Silver Spring August 27-28, 1985. Please sign both copies as the NRC signatories have already done and return one to me. Also enclosed is a copy of the original, partly handwritten notes signed by the NRC and NNWSI representatives at the meeting.

If you have any questions about the notes, please do not hesitate to contact King Stablein (FTS 427-4611).

Sincerely,

John J. Linehan, Section Leader
Repository Projects Branch
Division of Waste Management

Enclosures: As stated

cc: M. Gora, SAIC (w/o enclosure)

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PDR WASTE PDR
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OFC :WMRP:ec :WMRP : : : : :
NAME :KStablein :JL Linehan : : : : :
DATE :9/17/85 :9/17/85 : : : : :
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NRC-NNWSI PROJECT EXPLORATORY SHAFT DESIGN/CONSTRUCTION MEETING SUMMARY
August 27-28, 1985

Willste Building
Silver Spring, Maryland

Attendees

A list of attendees and their organizational affiliations is attached as Enclosure 1.

Background/Facts

An agenda is attached as Enclosure 2. Copies of the viewgraphs used in the NNWSI presentations and responses, and in the NRC presentations are attached as Enclosures 3 and 4, respectively.

Observations

The NRC had the following observations:

1. The location of the proposed exploratory shaft was stated by the DOE to be approximately 1,000 feet from the Ghost Dance Fault. If this fault is active, ground motion associated with movement along this fault could threaten stability of the shaft and thus adversely affect integrity of the repository. The DOE should include data gathering related to determination of the potential for seismic activity along the Ghost Dance Fault in its site characterization plans.
2. The NRC recommends that the DOE provide early insight to the NRC into proposed testing during exploratory shaft construction and in the shaft so that potential concerns can be identified in time for the DOE to factor them into its planning for site characterization.
3. At this time the NRC cannot accept the conclusion in the Performance Analysis document that construction of the Exploratory Shaft facility will not affect the ability of the site to meet public health and safety

performance requirements. Specifically, the NRC raised many points on the DOE Performance Analysis including the following:

- a. A total systems analysis should be done, including, but not limited to, the effects of all ramps and shafts on the volume of water coming in contact with the waste packages even though these shafts, ramps, and entrances may be in other drainage areas than the exploratory shaft. In general, anticipated processes and events that must be considered in any evaluation of compliance with 10 CFR 60 performance objectives need to be considered;
- b. A range of scenarios that might increase flood volumes due to lesser storm events (e.g., 20-year floods, annual floods) should be considered; it is possible for the volume of water to be several orders of magnitude greater than that estimated in the performance analysis due to total runoff over a 10,000-year period;
- c. Scenarios that consider water escaping up the shaft(s) and ramps should be considered to determine whether they are credible events;
- d. The DOE considers the impoundment of water near the exploratory shaft to be a highly conservative condition and an unanticipated process. The NRC staff considers that an equivalent to this impoundment could be achieved by an anticipated process, namely erosion, subsidence, and channelization at the surface, causing runoff to move along a preferred path directly toward the ES area. Inasmuch as erosion, slumping, landsliding, and debris movement may be seen in many places on and about Yucca Mountain, the DOE should show why such events should not be considered anticipated events in the performance analysis document.
- e. Given uncertainty about parameters included in assessments of performance in terms of 10 CFR 60 performance objectives, any analysis should be essentially a sensitivity study which recognizes these uncertainties. For example,
 - (i) Sensitivity analyses of various flood parameters to the total flood volume should be included;

- (ii) Sensitivity analyses of parameters important to the results such as damaged rock thickness need to accompany and support the narrow numerical ranges considered for those parameters;
 - (iii) Waste form performance parameters should be considered.
4. On the basis of information presently available to the staff and considering each of the aspects that are important to waste isolation and safety, the NRC staff has no reason to believe that formations other than the Topopah Spring (TS) formation are clearly superior. Uncertainties exist with respect to the site and the TS formation which will have to be investigated during site characterization and, as a consequence, a position cannot now be taken on horizon suitability.
 5. The scenario that considered that water flowing from fault zones underground could not flow to the ES based on the long term performance of the emplaced dams and/or drains does not consider the implications of failure of those features. If these engineered barriers are considered in future evaluations, expected performance over 10,000 years should be addressed.
 6. The value of hydraulic conductivity 10^{-5} cm/sec used in the performance analysis document appears nonconservative when viewed in light of the DOE's statement that 10,000 barrels of drilling fluid were lost down G-4 during the drilling of that hole.
 7. The NRC questions DOE's estimate of the percentage of water within the repository that will contact the waste packages. In particular, the possible convective effect of decay heat on the water should be considered.
 8. There appears to be a discrepancy between the thickness of the Calico Hills presented in the performance analysis document and that determined by the NRC from the DOE literature. The NRC review of the data indicates that the Calico Hills may be substantially thinner at the exploratory shaft location than stated in the performance analysis document. This is important to the performance analysis in that the DOE assumes a thickness of 150 m for the Calico Hills unit as a bounding value.

9. During the various DOE presentations the term Calico Hills was apparently used to designate at least three different entities: a geological unit; a geohydrological unit; a thermomechanical unit. The DOE should establish consistency in the use of the term Calico Hills.
10. The NRC has some concern about the penetration of the exploratory shaft into the Calico Hills because it may have an adverse effect on the ability of that unit to retard radionuclides. Heated water that has contacted the waste may enter the Calico Hills via the exploratory shaft and react with the zeolites. Temperatures need be only 80-100 degrees C for reactions to occur (or less depending on the composition of the groundwater leaving the waste). This may compromise the sorptive capacity of that unit. Further, if the ES shaft-bottom is used as a sump, the impact of water flows during the construction and operational periods should be considered.
11. NRC identified that both ES-1 and ES-2 must be considered in response to the NRC letter of April 14, 1983.
12. NRC has particular interest in getting a better understanding of DOE specifications for construction of the shaft (i.e., control of blasting) and specifications for liner construction. A followup meeting is necessary after NRC staff have had an opportunity to review them, possibly in Las Vegas.
13. One of the principal objectives of the meeting was to discuss the quality levels to be applied to items and activities associated with the exploratory shaft. There are three primary areas which were discussed in the meeting, and the staff observations on each are presented below.
 - o Regarding construction of the ES, DOE has conducted performance analyses of the ES demonstrating that rock damage associated with construction activities will not be a factor in meeting the NRC and EPA criteria. As a result, DOE has taken the position that construction activities do not need to be classified as Level I QA. Level I is defined in the NNWSI QA Plan (NVO-196-17) and prescribes that the NRC QA requirements in Subpart G of Part 60 be utilized. Level I also involves NRC review to assure that the requirements of Part 60 are being met. During the meeting, the NRC staff identified a number of concerns with the analyses presented, which are

identified elsewhere in this report. In addition, in their June 7, 1985 letter to the NRC staff, the DOE indicated that the conclusions presented (including those related to quality levels), were based on preliminary data and unverified assumptions. The staff therefore cannot agree at this time that Level II is an appropriate classification. Either DOE should resolve the concerns and reduce uncertainties in the analyses so that there is adequate confidence that the classification is correct, or should assume for the time being that shaft construction is Level I.

During the meeting the DOE representatives indicated that the actual QA measures applied to specific construction activities could be identical whether they were classified as Level I or II and need not necessarily be elaborate. The principal difference in this case could be the NRC review of Level I activities. The staff agreed with this statement about the amount of QA which may need to be applied, and is ready to review the specific approaches DOE selects for assuring quality if Level I is required. This should be the subject of a follow-up meeting.

- o Data collection during construction (although not explicitly addressed in the DOE submittals) -- it was indicated during the meeting that data collection activities conducted during construction of the shaft would fall under the Level I QA requirements.
 - o Design -- a number of specific items/systems and their associated quality levels were identified by the DOE in their June 7, 1985 letter to the staff. Based on the information provided, the staff does not agree with the classification of the liner and rock structure and support (both of which are influenced by the performance analysis). In addition, additional information is needed on the dewatering system to justify its classification.
14. The NRC recommends that the damaged zone analysis should be extended into the portion of the ES that penetrates the Calico Hills.
 15. The NRC recommends that if seals are determined to be needed for long term isolation, then the DOE should investigate degradation mechanisms that affect performance.

16. The NRC recommends that the DOE investigate and provide detail (including caliper logs from bored shafts) on shaft sinking experience in welded tuff in the vicinity of Yucca Mountain.

The NNWSI had the following observations:

1. The Exploratory Shaft Design Workshop, with specific objectives and a clear focus, has been an effective means of communicating and understanding similar and divergent viewpoints. The NNWSI project objectives for the workshop were basically achieved.
2. The specific comments regarding the Performance Assessment for the exploratory shaft were presented in a constructive manner. DOE will revise the analysis considering alternative (realistic and bonding) scenarios. DOE will also add a sensitivity analysis to the Performance Assessment.
3. The comments provided by NRC regarding the specification of quality levels were valuable. The open discussion of the technical basis, in the context of radiological health and safety, of the NRC staff's position was beneficial to the DOE participants and is essential in reaching a common viewpoint in a timely fashion.
4. NRC staff and DOE staff have different viewpoints on determining whether a construction activity will affect radiological health and safety. The logic used by both organizations to arrive at their conclusions needs to be better defined.
5. NRC staff is concerned about the potential pathway created by the exploratory shaft for introduction of water into the repository. There appeared to be no significant argument put forward by NRC for a scenario in which water contaminated with radionuclides moves upward through the shaft to the surface.
6. NRC staff holds strong views about the potential impact of construction-induced rock damage around the exploratory shaft. It is not clear that NRC staff's views on the impact of such damage are supported by any calculations related to radiological health and safety. It is also not

clear which research on this issue represents the authoritative technical basis for evaluating this phenomena.

7. The NRC staff did not have any significant comments on the proposed horizon in the Topopah Spring for the repository.
8. The NRC staff did not have significant comments on the choice of conventional mining as a construction method, for the exploratory shaft, over the use of large hole drilling.
9. The NRC staff raised an issue about the exploratory shaft location within the context of the representativeness of the testing area. Before this issue can be resolved, both NRC staff and DOE staff must decide which properties or characteristics, capable of being measured from the surface, need to be evaluated as a basis for determining representativeness.
10. NRC is concerned about the DOE/NNWSI project perception of requirements for Level I quality assurance. While details of documentation requirements are not yet defined, NRC staff expressed a view that it will not be "onerous." This situation needs to be formally clarified in view of the potentially conflicting implications from ANSI-N45.2 and NQA-1.
11. Several points of confusion arose as a result of poor use of words. It is important to minimize these difficulties by effective use of a common lexicon.
12. The draft comments on the Performance Assessment were helpful in understanding the areas of NRC concern. However, many of the points were presented in a cryptic notation. In order to assure that the comments are properly addressed, the final comments should be adequately expressed.
13. The workshop idea as discussed in March was viewed as a small group. Interest in these working sessions has grown with a concomitant increase in attendees. If these meetings are to be conducted efficiently while meeting the requirements of the observers, better physical facilities and equipment are required.
14. The Nevada representative misinterpreted Tom Merson's comments on controlled blasting. Position was that we will tighten up specification

but will not promise something that will not buy us anything. We need to determine what constitutes a successful method.

The State of Nevada had the following observations:

Many of the State's initial comments and concerns about the NNWSI exploratory shaft design and the materials provided to the State on the subject were addressed during the meeting discussion. We desire to further emphasize two points noted during the meeting.

1. It seems premature in the exploratory shaft performance analysis to conclude that the presented event scenarios can be categorized as unanticipated events. In our view there is insufficient evidence to support such a conclusion.
2. We fully support the view expressed by Tom Merson, LANL, that an overall goal of the NNWSI exploratory shaft design and construction effort is to minimize the damage zone and overbreak during excavation. Such a goal will help achieve public confidence that NNWSI is committed to insuring public health and safety and protecting the environment.

Agreements

1. The DOE has proposed construction methods for the two exploratory shafts (ES-1, drill and blast, ES-2, raised 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 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 redo the calculations 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 Laboratory at the NNWSI Project/NRC Waste Package meeting in July, 1985.
4. The uncertainties in dissolution rates of spent fuel need to 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.

Open Items

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 flood scenario.
2. DOE would like a copy of the report on in situ stress measurement at NTS referenced by David Conover.
3. DOE would like specific details on the areas of landslides at Yucca Mountain referenced by John Trapp.
4. NRC position on the 1 part per 100,000 release limit as an instantaneous differential or an integral over a year.
5. Need to establish an authoritative set of references on the subject of rock damage around openings in the earth.
6. Need to establish a common approach to evaluating the magnitude of the damage around openings.

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.
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.
9. NRC final comments on the Draft Performance Assessment on the Exploratory Shaft.
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.
11. NRC staff 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?
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.
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.
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.
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.

16. The DOE will furnish the NRC with the document which contains recent information on thickness of the Calico Hills.
17. The DOE will send the NRC copies of the viewgraphs used in the DOE's presentation of the damaged zone model for tuff.
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 damaged zone model for tuff.
19. The NRC will provide the DOE with the U.S. Bureau of Mines reference related to horizontal stress of southern Nevada rocks.
20. DOE will provide NRC with information relating to testing performed in/or on samples obtained from USW G-4 in addition to that presented in USGS-OFR-84-789.
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.
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.
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.
24. The testing program to characterize perched water zones will be discussed at the ESTP meeting.
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.
26. The NRC will provide guidance on the key parameters that should be considered in determining the representativeness of the ESF.

- 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.
- 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?

Donald L. Vieth, Director
Waste Management Project Office
DOE/NV
August 28, 1985

DOE Comment:

(Original signed with accompanying note: "These notes were signed as a basis for completing the requirements for the meeting. Time constraints due to travel requirements prohibited finalization of comments at this time. Supplemental points will be submitted.")

Newton K. Stablein

Newton K. Stablein
Division of Waste Management
US NRC
August 28, 1985

Ray John T. Greeves

John T. Greeves
Division of Waste Management
US NRC
August 28, 1985

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OBSERVATIONS BY DOE/NNWSI PROJECT

1. THE EXPLORATORY SHAFT DESIGN WORKSHOP, WITH SPECIFIC OBJECTIVES AND A CLEAR FOCUS, HAS BEEN AN EFFECTIVE MEANS OF COMMUNICATING AND UNDERSTANDING SIMILAR AND DIVERGENT VIEW POINTS. THE NNWSI PROJECT OBJECTIVES FOR THE WORKSHOP WERE BASICALLY ACHIEVED.
7. THE NRC STAFF DID NOT HAVE ANY SIGNIFICANT COMMENTS ON THE PROPOSED HORIZON IN THE TOPPAH SPRING FOR THE REPOSITORY.
- B. THE NRC STAFF DID NOT HAVE SIGNIFICANT COMMENT ON THE CHOICE OF ^{CONVENTIONAL} MINING AS A CONSTRUCTION METHOD, FOR THE EXPLORATORY SHAFT, OVER THE USE OF LARGE HOLE DRILLING.
9. THE NRC STAFF RAISED AN ISSUE ABOUT THE REPRESENTATIVENESS OF THE TESTING AREA. BEFORE THIS ISSUE CAN BE RESOLVED BOTH NRC STAFF AND DOE STAFF MUST DECIDE WHICH PROPERTIES OR CHARACTERISTICS, CAPABLE OF BEING MEASURED FROM THE SURFACE, NEED TO BE EVALUATED AS A BASIS FOR DETERMINING REPRESENTATIVENESS.
4. NRC STAFF AND DOE STAFF HAVE DIFFERENT VIEWPOINTS ON DETERMINING WHETHER A CONSTRUCTION ACTIVITY WILL AFFECT RADIOLOGICAL HEALTH AND SAFETY. THE LOGIC USED BY BOTH ORGANIZATIONS TO ARRIVE AT THEIR CONCLUSIONS NEEDS TO BE BETTER DEFINED.

6. NRC STAFF HAS STRONG VIEWS ABOUT THE POTENTIAL IMPACT

OF CONSTRUCTION INDUCED ROCK DAMAGE AROUND THE EXPLORATORY SHAFT. IT IS NOT CLEAR THAT NRC STAFF'S VIEWS ON THE RELATED IMPACTS OF SUCH DAMAGE ARE SUPPORTED BY ANY CALCULATIONS, TO RADIOLOGICAL HEALTH AND SAFETY. IT IS ALSO NOT CLEAR WHICH RESEARCH ON THIS ISSUE REPRESENTS THE AUTHORITY'S TECHNICAL BASIS FOR EVALUATING THIS PHENOMENON.

5. NRC STAFF IS CONCERNED ABOUT THE POTENTIAL PATHWAY CREATED BY THE EXPLORATORY SHAFT FOR INTRODUCTION OF WATER INTO THE REPOSITORY. THERE APPEARED TO BE NO SIGNIFICANT ARGUMENT PUT FORWARD BY NRC FOR A SCENARIO IN WHICH WATER CONTAMINATED WITH RADIONUCLIDES MOVES UPWARD THROUGH THE SHAFT TO THE SURFACE.

2. THE SPECIFIC COMMENTS REGARDING THE PERFORMANCE ASSESSMENT FOR THE EXPLORATORY SHAFT WERE PRESENTED IN A CONSTRUCTIVE MANNER, (REALISTIC AND BOUNDING) DOE WILL REVISE THE ANALYSIS CONSIDERING ALTERNATIVE SCENARIOS. DOE WILL ALSO ADD A SENSITIVITY ANALYSIS TO THE PERFORMANCE ASSESSMENT.

3. THE COMMENTS PROVIDED BY NRC REGARDING THE SPECIFICATION OF QUALITY LEVELS WAS VALUABLE. THE OPEN DISCUSSION OF THE TECHNICAL BASIS, IN THE CONTEXT OF RADIOLOGICAL HEALTH AND SAFETY, OF THE NRC STAFF'S POSITION WAS BENEFICIAL TO THE DOE PARTICIPANTS AND ESSENTIAL IN REACHING A COMMON VIEWPOINT IN A TIMELY FASHION.

10. NRC IS CONCERNED ABOUT THE DOE/NNWSI PROJECT PERCEPTION OF REQUIREMENTS FOR LEVEL I QUALITY ASSURANCE. WHILE DETAILS OF DOCUMENTATION REQUIREMENTS ARE NOT YET DEFINED, NRC STAFF EXPRESSED VIEW THAT IT WILL NOT BE "ONEROUS". THIS SITUATION NEEDS TO BE FORMALLY CLARIFIED IN VIEW OF THE POTENTIALLY CONFLICTING IMPLICATIONS FROM ANSI-N45.2 AND NQA-1

11. SEVERAL POINTS OF CONFUSION AROSE AS A RESULT OF POOR USE OF WORDS. IT IS IMPORTANT TO MINIMIZE THESE DIFFICULTIES BY EFFECTIVE USE OF A COMMON DICTIONARY.

12. THE NEVADA REPRESENTATIVE MISINTERPRETED TOM MERRONS COMMENTS ON CONTROLLED BLASING. POSITION WAS THAT WE WILL ~~NOT~~ PROMISE SOMETHING THAT WILL NOT BUY US ANYTHING. WE NEED TO DETERMINE WHAT CONSTITUTES A SUCCESSFUL METHOD.

13. THE WORKSHOP IDEA AS DISCUSSED IN MARCH WAS VIEWED AS A SMALL GROUP. INTEREST IN THESE WORKING SESSIONS HAS GROWN WITH A CONCOMITANT INCREASE IN ATTENDEES. IF THESE MEETINGS ARE TO BE CONDUCTED EFFICIENTLY WHILE MEETING THE REQUIREMENTS OF THE OBSERVERS, BETTER PHYSICAL FACILITIES AND EQUIPMENT ARE REQUIRED.

14. THE DRAFT COMMENTS ON THE PERFORMANCE ASSESSMENT WERE HELPFUL IN UNDERSTANDING THE AREAS OF NRC CONCERN. HOWEVER, MANY OF THE POINTS WERE PRESENTED IN A CRYPTIC MANNER. IN ORDER TO ASSURE THAT THE COMMENTS ARE PROPERLY ADDRESSED, THE FINAL COMMENTS

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8/29/85

SHOULD BE ADEQUATELY EXPRESSED.

OPEN ITEMS

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1. DOE WOULD LIKE COPIES OF TED JOHNSON'S ANALYSIS THAT INDICATED THE $\frac{1}{2}$ " 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 FLOOD SCENARIO.
2. DOE WOULD LIKE A COPY OF THE REPORT ON IN SITU STRESS MEASUREMENTS AT NTS REFERENCED BY DAVID CONOVER.
3. DOE WOULD LIKE SPECIFIC DETAILS ON THE AREAS OF LANDSLIDES AT YUCCA MOUNTAIN REFERENCED BY JOHN TRAPP.
4. NRC POSITION ON THE 1 PART PER 100,000 RELEASE LIMIT AS AN INSTANTANEOUS DIFFERENTIAL OR AN INTEGRAL OVER A YEAR.
5. NEED TO ESTABLISH AN AUTHORITY SET OF REFERENCES ON THE SUBJECT OF ROCK DAMAGE AROUND OPENINGS IN THE EARTH.
6. NEED TO ESTABLISH A COMMON APPROACH TO EVALUATING THE MAGNITUDE OF THE DAMAGE AROUND OPENINGS.
7. NEED TO ESTABLISH THE PROPERTIES OR CHARACTERISTICS THAT CAN BE USED IN THE EVALUATION OF "REPRESENTATIVENESS".
A METHOD FOR ANALYZING THE DATA ALSO NEEDS TO BE ESTABLISHED.
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.

9. NRC FINAL COMMENTS ON THE DRAFT PERFORMANCE ASSESSMENT ON THE EXPLORATORY SHAFT

10. NEED TO REVISION SECTION 6.21(C) TO DETERMINE WRC'S EXPECTATIONS REGARDING THE INFORMATION OF FRACTURE CHARACTERISTICS TO BE OBTAINED FROM THE EXPLORATORY SHAFT

11. NRC STAFF 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 RELATION TO VALIDITY OF TESTING DATA? RADIOLOGICAL HEALTH AND SAFETY.

12.



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8/28/85

DRAFT MEETING NOTES FOR THE NNWSI/NRC EXPLORATORY SHAFT DESIGN MEETING

Observations

1. The location of the proposed exploratory shaft was stated by the DOE to be approximately 1,000 feet from the Ghost Dance Fault. If this fault is active, ground motion associated with movement along this fault could threaten stability of the shaft and thus adversely affect integrity of the repository. The DOE should include data gathering related to determination of the potential for seismic activity along the Ghost Dance Fault in its site characterization plans.

2. The NRC recommends that the DOE provide early insight to the NRC into proposed testing during exploratory shaft construction and in the shaft so that potential concerns can be identified in time for the DOE to factor them into its planning for site characterization.

3. At this time the NRC cannot accept the conclusion in the Performance Analysis document that construction of the Exploratory Shaft facility will not affect the ability of the site to meet public health and safety performance requirements. Specifically, the NRC raised the following points on the DOE Performance Analysis including *many*:

a. A total systems analysis should be done, including, but not limited to, the effects of all ramps and shafts on the volume of water coming in contact with the waste packages. In general, anticipated processes and events that must be considered in any evaluation of compliance with 10 CFR 60 performance objectives need to be considered *even though these shafts, ramps, and entrances may be in other drainage basins than the exploratory shaft.*

b. A range of scenarios that might increase flood volumes due to lesser storm events (e.g., 20-year floods, annual floods) should be considered; it is possible for the volume of water to be *several* orders of magnitude greater than that estimated in the performance analysis due to *continuous* total runoff over a 10,000-year period;

* c. Scenarios that consider water escaping up the shaft(s) and ramps *should be* ~~to be considered in addition to the scenarios of water going down the shaft presented in the performance analysis document;~~ *to determine whether they are credible events;*

d. The DOE considers the impoundment of water near the exploratory shaft to be a highly conservative condition and an unanticipated process. The NRC staff considers that an equivalent to this impoundment could be achieved by an anticipated process, namely erosion, subsidence, and channelization at the

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surface, causing runoff to move along a preferred path directly toward the ES area. Inasmuch as erosion slumping, landsliding and debris movement may be seen in many places on and about Yucca Mountain, the DOE should show why such events should not be considered anticipated events in the performance analysis document.

e. Given uncertainty about parameters included in assessments of performance in terms of 10 CFR 60 performance objectives, any analysis should be essentially a sensitivity study which recognizes these uncertainties. For example,

- (i) Sensitivity analyses of various flood parameters to the total flood volume should be included;
- (ii) Sensitivity analyses of parameters important to the results such as damaged rock thickness need to accompany and support the narrow numerical ranges considered for those parameters.
- (iii) Waste form performance parameters should be considered.

4. On the basis of information presently available to the staff and considering each of the aspects that are important to waste isolation and safety, the NRC staff has no reason to believe that formations other than the Topopah Spring (T.S.) formation are clearly superior. Uncertainties exist with respect to the site and the T.S formation which will have to be investigated during site characterization and, as a consequence, a ~~portion~~ ^{position} cannot now be taken on horizon suitability.

5. The scenario that considered that water flowing from fault zones underground could not flow to the ES based on the long term performance of the emplaced dams does not consider the implications of failure of those dams. ^{ARE ON DAMS} Furthermore, ~~the NRC believes that the underground dams proposed to imposed water originating from the Ghost Dance Fault to the exploratory shaft are unlikely to last 10,000 years.~~ ^{ENGINEER BARRICA} If these dams are considered in future evaluation, expected performance over 10000 years should be addressed. A more acceptable approach may be to consider excavations for containment of water infiltration when reliances on natural conditions of the site

6. The ~~one~~ value of hydraulic conductivity 10-5 cm/sec used in the performance analysis document appears nonconservative when viewed in light of the DOE's statement that 10,000 barrels of drilling fluid were lost down G-4 during the drilling of that hole.

7. The NRC questions DOE's estimate of the percentage of water within the repository that will contact the waste packages. In particular, the possible convective effect of decay heat on the water should be considered.

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8/28/85

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review of the

8. There appears to be a discrepancy between the thickness of the Calico Hills presented in the performance analysis document and that determined by the NRC from the DOE literature. The NRC data indicate that the Calico Hills may be substantially thinner at the exploratory shaft location than stated in the performance analysis document. This is important to the performance analysis in that the DOE assumes a thickness of 150 m for the Calico Hills' unit as a bounding value.

9. During the various DOE presentations the term Calico Hills was apparently used to designate at least three different entities: a geological unit; a geohydrological unit; a thermomechanical unit. The DOE should establish consistency in the use of the term Calico Hills.

10. The NRC has some concern about the penetration of the exploratory shaft into the Calico Hills because it may have an adverse effect on the ability of that unit to retard radionuclides. Heated water that has contacted the waste may enter the Calico Hills via the exploratory shaft and react with the zeolites. Temperatures need be only 80-100 degrees C for reactions to occur (or less depending on the composition of the groundwater leaving the waste). This may compromise the sorptive capacity of that unit. Further, if the ES shaft - bottom is used as a sump, the impact of water flows during the construction and operational periods should be considered.

NKS
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Agreements

1. The DOE has proposed construction methods for the two exploratory shafts (ES-1, drill and blast, ES-2, raised 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 (LA-9179-MS)". The NRC has no objection to the use of the proposed construction methods, provided that they 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 redo the calculations 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 Laboratory at the NNWSI Project/NRC Waste Package meeting in July, 1985.
4. The uncertainties in dissolution rates of spent fuel need to 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.

Open Items

1. 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.
2. The DOE will provide to the NRC the Keystone Document ~~(insert title)~~ and Rock related to selection of the repository horizon.
3. 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.
4. 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.

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 and Rock
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 Version 1,
 October, 1988

5. The DOE will furnish the NRC with the document entitled _____ which contains recent information on thickness of the Calico Hills.
6. The DOE will send the NRC copies of the viewgraphs used in the DOE's presentation of the damaged zone model for tuff.
7. The DOE will provide the NRC with the data (eg., RQD's, stresses, hydraulic conductivities) used to get the results presented during the DOE presentation on damaged zone model for tuff.
8. The NRC will provide the DOE with the US Bureau of Mines reference related to horizontal stress of southern Nevada rocks.

9. D.O.E. WILL PROVIDE NRC WITH INFORMATION RELATING TO TESTING PERFORMED IN/ON ON SAMPLES OBTAINED FROM USW-G4 IN ADDITION TO THAT ~~WAS~~ PRESENTED IN USGS-OFR-84-989

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- ob NRC identified that both ES-1 and ES-2 must be considered in response to the NRC letter of April 14, 1983.
- Open NRC requests that DOE identify the schedule for providing the items identified in DOE's response of June 7, 1985 as being under development.
- ob NRC has particular interest in getting a better understanding of DOE specifications for construction of the shaft (i.e. control of blasting) and specifications for liner construction. A followup meeting is necessary after NRC staff have had an opportunity to review them possibly in Las Vegas.

NRC QA OBSERVATIONS

- 1. One of the principal objectives of the meeting was to discuss the quality levels to be applied to items and activities associated with the exploratory shaft. There are three primary areas which were discussed in the meeting and the staff observations on each are presented below.

Re: ^e

- o Construction of the ES-DOE has conducted performance analyses of the ES demonstrating that rock damage associated with construction activities will not be a factor in meeting the NRC and EPA criteria. As a result, DOE has taken the position that construction activities do not need to be classified as Level I QA. Level I is defined in the NNWSI QA Plan (NVO-196-17) and prescribes that the NRC QA requirements in Subpart G of Part 60 be utilized. Level I also involves NRC review to assure that the requirements of Part 60 are being met. During the meeting, the NRC staff identified a number of concerns with the analyses presented, which are identified elsewhere in this report. In addition, in their June 7, 1985 letter to the NRC staff, the DOE indicated that the conclusions presented (including those related to quality levels), were based on preliminary data and unverified assumptions. The staff therefore cannot agree at this time that Level II is an appropriate classification. Either DOE should resolve the concerns and reduce uncertainties in the analyses so that there is adequate confidence that the classification is correct, or should assume for the time being that shaft construction is Level I.

During the meeting the DOE representatives indicated that the actual QA measures applied to specific construction activities could be identical whether they were classified as Level I or II and need not necessarily be elaborate. The principal difference in this case could be the NRC review of Level I activities. The staff agrees with this statement about the amount of QA which may need to be applied, and is ready to review the specific approaches DOE selects for assuring quality if Level I is required. This should be the subject of a follow-up meeting.

- o Data collection during construction-although not explicitly addressed in the DOE submittals, it was indicated during the meeting that data collection activities conducted during construction of the shaft would fall under the Level I QA requirements.

- o Design—a number of specific items/systems and their associated quality levels were identified by the DOE in their June 7, 1985 letter to the staff. Based on the information provided, the staff does not agree with the classification of the liner and rock structure and support (both of which are influenced ~~or~~ by the performance analysis). In addition, additional information is needed on the dewatering system to justify its classification.

Donald L. Keech

These notes were signed as a basis for completing the requirements for the meeting. Time constraints due to travel requirements prohibited finalization of comments at this time. Supplemental points will be submitted

8/28/85

Newton K. Stabile

8/28/85

John D. Brewer

8/28/85

Observations

NRC obs.
open item

①

1) ~~DOE will extend~~ the damaged zone analysis ^{should be extended} ~~to~~ the portion of the ES that penetrates the Calico Hills.

open item

①

2) ~~Provide~~ ^(and the implications of such a decision) 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.

open item

②

3) A discussion of sealing materials and placement method and timing for exploratory borings from the ES will be provided in a future meeting on repository design.

open item

③

4) The ^{testing} ~~sealing~~ program to characterize perched water zones will be discussed at the ESTP meeting.

NRC obs.

②

5) ^{the NRC recommends that,} IF seals are determined to be needed for long term isolation, then ~~deprecate~~ the DOE ^{should} ~~will~~ investigate degradation mechanisms that affect performance.

open item

④

6) the DESIGN specifications, ^{and acceptance criteria} ~~for~~ for the shaft construction ~~and DOE will~~ including construction controls, ^{test blasting} and overbreak control will be provided to the NRC when available.

NRC obs.

③

7) The NRC recommended that the DOE investigate and provide data ^{including copper lined shafts} on shaft sinking experience in welded ~~full~~ ~~on~~ in the vicinity of Yucca Mountain

open item 8) - The NRC will provide guidance on the key parameters that should be considered in determining ~~the~~ the representativeness of the ESF.

8

open item 9) DOE's plans on the characterization of Lithophysical zones and ^{the plans for} demonstrating horizontal emplacement ^{and transportation} will be discussed in a future meeting on repository design.

9

~~10) NRC recommends that QA levels apply to the liner, rock support and possibly the venting system should be upgraded to Quality Level 2.~~

~~11) NRC recommends that blasting controls and data collection be considered level 1.~~

Q.A.

open item 12) Has DOE/OPR made a decision that the use of radioactive material in the ~~ESF~~ site characterization program will ~~be considered?~~ not be considered in the future?

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