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MEMORANDUM FOR: Malcolm R. Knapp, Acting Chief
Geotechnical Branch
Division of Waste Management

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FROM: Neil M. Coleman
Geotechnical Branch
Division of Waste Management

SUBJECT: SITE VISIT REPORT: BWIP/NRC WORKSHOP ON UNDERGROUND
TEST PLAN (NOVEMBER 29 - DECEMBER 2, 1983)

This memorandum summarizes my observations made on the above mentioned site visit. It begins with a short review of the workshop, continues with a brief description of major topics of discussion, and ends with general observations. The summary meeting notes of this workshop are attached.

I. Workshop and Travel Program

My activities during the workshop were as follows:

- (1) Sunday, November 27th. Travel to Seattle.
- (2) Monday, November 28th. Preliminary meeting of NRC staff attendees and contractors at Nendels Inn. Major questions about engineering and hydrogeologic aspects of the In-Situ Test Plan were identified and discussed in preparation for the workshop. Travel to Richland.
- (3) Tuesday, November 29th through Thursday, December 1. Please refer to the agenda (Attachment 1) listed in the summary meeting notes. Meetings held in Vernita Room of Hanford House.
- (4) Friday, December 2nd. Technical wrap-up. Management wrap-up. Preparation and signing of final meeting notes. Final discussion comments at Rockwell Hanford. Travel to Seattle.
- (5) Saturday, December 3rd. Travel to Washington, D.C.

II. Outline of Major Topics of Discussion (Hydrogeology)

A. As presented, the In-Situ Test Plan fails to adequately address

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thermal-hydrogeologic-mechanical-chemical (THMC) coupling effects. This was the point of greatest discussion and contention.

- B. Standard analytical techniques may not be appropriate to analyze the proposed hydrogeologic tests in the drift. Also, the possibility of cross-test interference has not been addressed. The rationale for these tests needs to be more clearly defined.
- C. The potential effects of matrix diffusion on tracer movement should be considered.
- D. The rationale for the need to test the Cohasset flow interior has been defined.
- E. How does the in-situ hydrogeologic testing fit into the framework of the entire groundwater testing program?
- F. If the host horizon is to be considered a barrier by DOE/Rockwell, NRC recommends that containment performance under conditions equivalent to post-closure must be evaluated.

III. General Observations

- A. The USGS representatives had only several very minor comments to make about the proceedings.
- B. Representatives of the Yakima Indian Nation declined to make any closing statements.
- C. In general, DOE/Rockwell expressed an open and cooperative attitude with regard to NRC comments and questions.

ORIGINAL SIGNED BY
 Neil M. Coleman
 Geotechnical Branch
 Division of Waste Management

Attachment:
Summary Meeting Notes

OFC : *VM&T* : : : : : : :
 NAME : *NColeman:dm* : : : : : : :
 DATE : *12/16/83* : : : : : : :

SUMMARY MEETING NOTES
BWIP/NRC WORKSHOP ON UNDERGROUND TEST PLAN
Richland, Washington
November 29-December 2, 1983

Objectives: See Attachment 1

Agenda: See Attachment 1

Attendees: See Attachment 1 and 2

Developments:

The workshop centered on preliminary comments by Nuclear Regulatory Commission (NRC) on the Draft Exploratory Shaft (ES) Test Plan (2 volumes) SD-BWI-TP-007, dated November 9, 1983. The comments were directed toward the suitability of the test plan in satisfying licensing information needs, in the event that the Basalt Waste Isolation Project (BWIP) site is submitted to the NRC for licensing.

These summary notes provide general comments presented at the meeting by NRC and by BWIP, as well as a list of open items. Additional comments by NRC appear in Attachment 3. Attachment 4 presents material prepared by Department of Energy (DOE) and related to the underground test plan that was discussed during the meeting. Attachment 5 is a "Test Logic Diagram" presented by the NRC as an illustrative example of logic useful for structuring the Test Plan. Attachment 6 provides a table of questions on coupled behavior that was presented by NRC for discussion.

NRC General Comments:

1. If a construction authorization application is submitted for the BWIP, that application must be complete and fully supported by the data and analysis necessary for a licensing decision on whether the site and design comply with the performance objectives and criteria contained in 10 CFR 60. Fundamental test results for the construction application findings must be in place at the time of license application.

2. The draft ES Test Plan is inadequate in expressing the application of test data to modeling and performance assessment. We suggest that the report should set out a clear connection between the site performance issues and the remaining information needed to address them. This requires:

- a. A discussion of the performance issues, and the way in which they have been identified.
- b. A discussion of the proposed investigation approach to obtaining the required information.
- c. A discussion of the way in which the results of these investigations will be used to address the site performance issues.

The report should, therefore, provide more complete material on "justifications of need for additional data and proper selection of tests" and "identification of data applications to modeling and performance assessment" (SD-BWI-TP-007, Volume I, page 2).

3. A critical part of the site characterization effort is the development of an understanding of the coupled thermal-mechanical-hydrologic-geochemical behavior of the repository host rock. Nuclear Regulatory Commission has expressed this view several times in the past twelve months (SCA, 1983; DOE, Headquarters, 1983; Advisory Committee on Reactor Safety, 1983). It is necessary for the test plan to include a description of how the information collected will address this issue, or what other kind of information will be used to address this question.
4. During the workshop there were a number of topics (e.g., retrievability, sealing and waste package testing) on which DOE and NRC do not have agreement about whether testing is required prior to License Application. Basalt Waste Isolation Project identified that

these tests could be put off until after License Application (Attachment 4, Section 17.2.8, page 17.2-29). Each of these topics needs to be addressed on its own merits. The NRC has serious concerns about putting off tests that could be needed to support a License Application.

Nuclear Regulatory Commission noted that Subpart F - Performance Confirmation Program, Section 10 CFR 60.140 general requirements, includes provisions for determining subsurface conditions and changes assumed in the licensing review and for obtaining data to confirm functional performance of natural and engineered systems. Section 60.140 requires that the performance confirmation program be started during site characterization and continue through permanent closure and that it include in situ experimentation and monitoring as is appropriate.

5. The workshop did not explicitly include discussion of tests involving performance objectives for the engineered systems. We consider such testing could influence the in situ testing currently planned by the DOE. This matter will be considered at the design and waste package workshop early in 1984.
6. We are pleased to see that BWIP is investigating ways to enhance the amount of time available for in situ testing (e.g., contingency for a second shaft).
7. While progress is being made in making site characterization information available to NRC and other interested parties, this effort needs continued project attention. All such data must be made available as soon as possible.

8. We recommend that two additional objectives be added to Table 3-1. These are:
 - a. Control any adverse radiological, safety-related effects from shaft construction; Reference: 10 CFR 60.11 (a) (6) (iii).
 - b. Perform preliminary characterization of the RRL block.

BWIP General Comments:

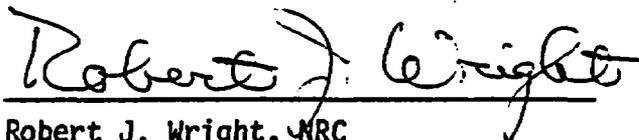
1. A data needs assessment should be provided for each item to establish necessary and sufficient conditions. The assessments would consider data use in performance assessment and design.
2. Basalt Waste Isolation Project logic for the site characterization program and the relationship of the ES to the other program elements needs to be explained.
3. Allocation of tests to Phase II and Design Confirmation must be based on rationale developed from future dialogue with the NRC.
4. The NRC concern relative to tests which impact the Nuclear Waste Terminal Storage (NWTs) program, such as the coupled (thermal/mechanical/hydrologic/geochemical) test, isolation sealing, retrievability and backfill capabilities will be referred to DOE, Headquarters for coordination of an overall NWTs program approach.
5. The attached updated BWIP responses to previous Draft Site Characterization Analysis comments will be incorporated into the next revision of the "disposition tables."

Open Items:

1. The NRC will provide written, follow-up comments on the Underground Test Plan by the end of January 1984.
2. A technical assistance report on retrieval alternatives, completed for NRC, will be provided to the DOE shortly.
3. The DOE was requested to provide NRC with information on six case histories of mining through rock showing discing in exploratory boreholes.
4. The DOE will provide NRC with hydrological test interval reports that have been developed after July 1982.



O. L. Olson, DOE-RL
December 2, 1983



Robert J. Wright, NRC
December 2, 1983

11/29/83
REVISED
AGENDA
DOE/NRC MEETING ON
EXPLORATORY SHAFT AND UNDERGROUND TESTING
BASALT WASTE ISOLATION PROJECT

Date: November 29 to December 2, 1983

Place: Richland, Washington, Hanford House

Purpose: To discuss resolution of previous NRC concerns regarding underground testing portions of the Site Characterization Report and NRC's preliminary comments on the draft Exploratory Shaft In Situ Test Plan.

Objectives:

- (1) To discuss NRC comments regarding underground testing raised in the Draft Site Characterization Analysis.
- (2) To discuss approaches to resolve previously noted areas of disagreement.
- (3) To receive and discuss NRC's preliminary comments arising from a recent review of the draft Exploratory Shaft Test Plan.

Participants:

DOE: P. Boileau, V. Der, J. Mecca, C. Newton, P. Saget, D. Squires, J. N. Fiore

DOE Consultants: J. Bartlett, Z. Bieniawski, W. Hustrulid, J. Smith

NRC: N. M. Coleman, L. Doyle, P. K. Dutta, J. Greeves, M. S. Nataraja, C. Russell, C. Westbrook, R. J. Wright, E. Zurflueh

NRC Consultants: A. Brown, J. Daeman, D. Galster, L. Ganano, L. Mundell, V. Rajaram, J. Rowe, M. Serbousek, K. Wahi, R. Williams, G. Winter

Rockwell: R. J. Bielefeld, H. B. Dietz, R. E. Gephart, K. A. Hadley, J. F. Marron, W. M. McCabe, T. M. Wintczak

USGS: P. Stevens, A. LaSalla

Other
Attendees:

State of Washington: D. Provost

Yakima Indian Nation: J. Hovis, L. Lehman

NNWSI: D. Nelson, W. Myers

MK: B. R. Bush, J. J. Keating, S. Iedema, F. C.
Larvie

ONWI: M. H. Farzin, L. B. Myers

Weston: V. Montenyohi, N. Saidman

NOVEMBER 29, 1983

- 8:00 DOE Introduction
- 8:15 NRC Introduction
- 8:30 BWIP overview of Exploratory Shaft In Situ Test Plan:
- Preparation process and schedule, including current status and revisions planned to accommodate comments received from the Overview Committee and others.
 - Methodology for resolving open, workshop, and "agreed" items resulting from BWIP's dispositioning of NRC comments on underground testing raised in the Draft Site Characterization Analysis.
 - Test Plan's responsiveness to open, workshop, and "agreed" items.
- 11:20 NRC/BWIP discussion of thermal coupled effects
- 12:00 Lunch
- 1:00 Discuss NRC's preliminary comments on draft In Situ Test Plan
- Geology
 - Hydrology

NOVEMBER 30, 1983

- 8:00 Continue discussion of NRC's preliminary comments
- Geology
 - Hydrology
- 12:00 Lunch
- 1:00 Continue discussion of NRC's preliminary comments
- Geomechanics
 - Constructibility

DECEMBER 1, 1983

- 8:00 Continue discussion of NRC's preliminary comments
- Geomechanics
 - Constructibility

12:00 Lunch
1:00 NRC caucus/BWIP caucus
3:00 BWIP present disagreements and agreements
3:30 NRC present disagreements and agreements
4:00 BWIP/NRC develop list of disagreements and agreements

DECEMBER 2, 1983

8:00 Technical wrap-up
10:00 Management wrap-up
11:00 Preparation of meeting notes

NUCLEAR REGULATORY COMMISSION
PRELIMINARY COMMENTS PROVIDED DURING
THE WORKSHOP

GEOMECHANICS

1. The Department of Energy (DOE) should provide in the Exploratory Shaft (ES) Test Plan the rationale for the development of data needs that are essential for site characterization, the repository design and performance assessment. The revised ES Test Plan document should provide justification for the proposed tests in terms of necessary and sufficient data for the License Application (LA).
2. Sensitivity analyses should be conducted to determine the relative importance of the design parameters and the needed levels of accuracy and confidence in the proposed tests.
3. A glossary should be provided in the ES Test Plan. A detailed discussion should be provided to clearly define, for example, the following: a) rock mass strength; b) failure; c) failure criteria; d) excessive deformation; e) overstressing; f) stability; g) stability criteria. Time effects should be considered explicitly in each discussion.
4. The revised Test Plan document should contain discussions on the manner in which data from the Near-Surface Test Facility (NSTF) and ES will be integrated and extrapolated to the reference repository location (RRL) block.
5. Details on the ongoing tests on packing material should be provided to the Nuclear Regulatory Commission (NRC) when available. If a decision is made to take credit for the packing in meeting the release rate criteria, the NRC recommends that tests on packing be considered in the ES Test Plan. This should be discussed in the February Waste Package meeting.

6. Objectives of ES-Phase I (ES-I) should be expanded to include:
 - a) control of any adverse effects during ES activities; and
 - b) preliminary characterization of the RRL block. The disturbed rock zone along the shaft and drifts needs to be addressed in terms of isolation performance.

7. A list of tests that are considered to be design confirmation tests should be provided by the Basalt Waste Isolation Project (BWIP). The rationale behind such thinking should be discussed in the revised Test Plan document.

8. Retrievability demonstration tests are considered important by the NRC, especially if the horizontal emplacement concept is chosen in the final BWIP design. The NRC recommends consideration of retrieval demonstration for the horizontal concept in the ES. This should be discussed in the planned January 1984 Design workshop.

9. The ES Test Plan does not explicitly address coupled thermal effects (interaction among thermal, mechanical, hydrological and chemical effects). Information is needed on the effects of heat, deformation and stress on hydrological properties as part of site characterization.

9. NRC believes that for correlation, the same suite of logs should be run in all holes in the underground facility, vertical or horizontal. NRC is concerned about the adequacy of using only single point resistivity tests in the exploratory shaft boreholes.

REPOSITORY BLOCK SCALE

IN SITU TEST FACILITY SCALE

LABORATORY SCALE

EXPLORATORY BOREHOLE STUDIES

MATERIAL TEST IN SITU

LABORATORY MATERIAL TESTS

material properties

material properties

material properties

material phenom. behavior

MATERIAL-MASS PROPERTY CORRELATIONS
ROCK MASS PHENOM. MODELS/CODES

prediction

ROCK MASS TESTS IN SITU

rock mass properties in situ

rock mass site characteristics

REPOSITORY DESIGN MODELS
STRUCTURAL PHENOM. MODELS/CODES

prediction

STRUCTURAL TESTS IN SITU

structural response

performance prediction

repository design

FOR CONSTRUCTION

repository performance

performance conformation

ROCK MATERIAL

ROCK MASS

ENGINEERING STRUCTURE

test/experiment/construction data
design/analysis facility

TEST LOGIC DIAGRAM (NRC/LPG)

ROLE OF SITE CHARACTERIZATION STUDIES IN REPOSITORY PERFORMANCE ASSESSMENT

ATTACHMENT-6
THMC QUESTIONS

1. What is the overall DOE strategy on addressing the THMC coupling issue?
2. What are DOE's plans to develop an integrated THMC interaction model?
3. For what specific problems are there simplified approaches that can be used to bound the interaction effects?
4. How will the models of individual phenomena be combined?
5. How does DOE plan to evaluate the importance of the THMC interaction effects and the consequences on long term waste isolation and containment?
6. What in situ test plan is being proposed by DOE specifically to address the THMC interactions?
7. How much of the in situ testing will be completed during the prelicense application stage and how much of it will continue after license application?
8. Will the physical and chemical phenomenological processes of THMC interaction be adequately understood before LA/permanent closure?
9. Is site-specific testing needed and if so what kind of site-specific data are required and with what reliability should they be measured and for how long?
10. Could the repository design circumvent foreseeable uncertainties that might result from a lack of thorough understanding of the THMC coupling phenomena?

HYDROLOGY

1. The standard analytical techniques described on Page 3-45, Volume II, may not be appropriate to analyze proposed borehole tests. The Department of Energy should consider alternate analytic and numeric methods.
2. Potential interference effects caused by the concurrent tests and by the presence of the drifts and shaft will be considered in test design.
3. The Department of Energy should consider alternate borehole configurations for the cluster tests (e.g., parallel sets of holes in a horizontal planar configuration for specifically testing vertical hydraulic conductivity).
4. The alternative of (examining rock obtained from cores) in the tracer test area (in order) to evaluate tracer movement should be considered.
5. The potential effects of matrix diffusion on tracer movement should be considered.
6. The Department of Energy should be more specific about the directional property of the term "hydraulic conductivity" as used in the text of the test plan.
7. The rationale for the need to test the Cohasset interior, as expressed in the workshop, is understood to be:
 - isolation potential
 - generic information for extrapolation to other flow interiors
 - constructibility
8. The hydrologic character of the repository horizon depends on the stages of the repository:
 - pre-excavation
 - post-excavation, pre-closure
 - post-closureIf the host horizon is to be considered a barrier by DOE, NRC recommends that containment performance in the third stage must be evaluated.

GEOLOGY

1. Geologic mapping should be objective. The plan is not clear on this point because it mentions "objective" and "subjective" surveys (page 2-2). All data from the drifts should be recorded without interpretation. Procedures for geologists to have constant access to the working face of drifts are needed. Water for cleaning walls is also needed to get early data on the wall conditions, such as discontinuities and evidence of stress release to base decisions on types of ground support.
2. The contingency plan on page 2-46 of Volume II indicates that thickness of the interior of the candidate horizon flow is crucial to siting a repository. However, it also seems that discontinuities or lateral changes in flow properties could also represent unfavorable conditions. An analysis of such factors by use of all available data showing "dense interior" variations should be included in the plan.
3. Use of wireline drilling equipment should be considered. BWIP is presently testing best methods of drilling (standard versus wireline) in NSTF.
4. BWIP should consider coring of all borings in shaft walls unless heavy water flows are encountered.
5. Basic mapping scales for underground drifts should be 1 inch map equals 1 foot in drifts.
6. Use of pilot core holes at least 20-30 m ahead of all working faces should be written into the test plan to make predictions of drift conditions and to establish correlation between core logs and face maps.
7. The rationale for the orientation of the underground facility should be provided in the test plan.
8. Generic or interpretative terms in mapping of discontinuities in drift mapping should not be used as a substitute for accurate description.

DOE/NRC WORKSHOP

Attendees

<u>Name</u>	<u>Representing</u>	<u>Name</u>	<u>Representing</u>
Karl A. Hadley	Rockwell	Tom McLaughlin	Rockwell
John F. Marron	Rockwell	F. C. Larvie	M-K
Tom M. Wintczak	Rockwell	Carl Newton	DOE
Brad R. Bush	M-K	Harry Babad	Rockwell
John J. Keating	M-K	W. Martin McCabe	Rockwell
Lynn B. Myers	ONWI	Chris Bohr	Rockwell
R. P. Saget	DOE	Victor Der	DOE-HQ
D. J. Squires	DOE-RL	Phil Long	Rockwell
H. B. Dietz	Rockwell	James B. Hovis	YIN
Bill Hustrulid	CSM/DOE	Dean Nelson	LANL
W. A. Herber	Rockwell	Wes Myers	LANL
Stuart Iedema	M-K	Ron Arnett	Rockwell
L. T. Murphy	Rockwell	Kunsoo Kim	Rockwell
Larry Fitch	Rockwell	Peter Stevens	USGS
Roy Gephart	Rockwell	Roy E. William	NRC
Vic Montenyohl	Weston	Catherine Russell	NRC
M. Saidman	Weston	Kristin Westbrook	NRC
J. N. Fiore	DOE/NV	B.C.K. Moravek	Rockwell
Robert Wright	NRC	F. R. Cook	NRC
F. L. Doyle	NRC	M. O. Serbousek	USBM
Emma Zurflueh	NRC	R. J. Bielefeld	Rockwell
John Greeves	NRC	J. H. LaRue	Rockwell
Jank Daemen	NRC	S. M. Baker	Rockwell
Lou Gowano	Golder/NRC	S. R. Strait	Rockwell
Adrian Brown	NRC	Don Prouost	Weston
V. Rajabram	NRC	Richard W. Galster	NRC
Gerry Winter	NRC	Hassan Farzin	ONWI
Kris Walin	NRC	Lawrence A. White	Weston
Neil Coleman	NRC	George C. Evans	Rockwell
Peyush Dutta	NRC	R. T. Wilde	Rockwell
Jerry Rowe	Golder/NRC	A. M. LaSala, Jr.	USGS
M. S. Nataraja (Raj)	NRC	P. L. Boileau	DOE
Ed Ash	Rockwell	J. E. Mecca	DOE
Dick Bieniawski	DOE	A. M. Tallman	Rockwell
Linda Lehman	YIN	R. T. Wilde	Rockwell
Jan Partricio	Rockwell	J. T. Baxter	Rockwell
John Bartlett	DOE	G. S. Hunt	Rockwell
Jay L. Smith	DOE		

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MEMORANDUM FOR: John T. Greeves, Acting Chief
Engineering Branch
Division of Waste Management

THRU: Philip S. Justus, Section Leader
Geochemistry Section
Geotechnical Branch
Division of Waste Management

FROM: David Brooks
Geotechnical Branch
Division of Waste Management

SUBJECT: NRC - RHO/BWIP GEOCHEMISTRY WORKSHOP

A geochemistry workshop will be held January 9-13, 1984 at Hanford Washington (a preliminary agenda is attached). Since the nearfield environment of waste packages will be discussed, you are invited to send representatives to attend and participate in the workshop. In addition, your review of the attached agenda would be appreciated. Please discuss your plans and agenda comments with me and Bob Wright by C.O.B. Wednesday, December 21, 1983.

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David Brooks
Geotechnical Branch
Division of Waste Management

Attachment:
As Stated

Encl. already in file - POR.

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