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'87 MAR 20 A10:48

16 March 1987

David Tiktinsky - SS623
U.S. Nuclear Regulatory Commission
Division of Waste Management
Washington, D.C. 20555

"NRC Technical Assistance
for Design Reviews"
Contract No. NRC-02-85-002
FIN D1016

Dear David:

Enclosed is Itasca's trip report for the 12 March 1987 meeting to discuss the review outline for the SRP Site Technical Position on In-Situ Testing. Included as part of this trip report is the draft outline for this point paper which has incorporated the comments brought forth at the meeting. Please call me if you have any questions.

Sincerely,

Laura Lang for RDH

Roger D. Hart
Project Manager

cc: J. Greeves, Engineering Branch
Office of the Director, NMSS
E. Wiggins, Division of Contracts
DWM Document Control Room

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ITASCA TRIP REPORT

DATES: 12 March 1987

LOCATION: U.S. Nuclear Regulatory Commission (Silver Spring, Maryland)

PURPOSE: Review Outline for SRP Site Technical position on In-Situ Testing

ATTENDEES: R. Hart and L. Lorig

PREPARED BY: R. Hart

SUMMARY

The purpose of this meeting was to discuss the point paper on in-site testing at the Deaf Smith site. The meeting was attended by NRC technical staff reviewing the BWIP, NNWSI and SRP programs. The meeting was conducted by N. Tanious.

The draft outline was presented by L. Lorig. The outline follows the same format as that used for the BWIP in-situ test point paper. The presentation focused on two major sections of the paper: the "Requirements Document" for Deaf Smith and the "Justification for Testing".

Following the presentation, discussion was opened to general comments by the NRC staff. The comments were noted and will be addressed in preparation of the paper. They are summarized in the following section. Based on these comments, the outline has been revised and is attached.

During the discussion, J. Pearring presented notes from a meeting he attended on "SCP Issues Hierarchy and Performance Allocation" (3-4 March 1987). He identified points from this meeting which are related to the present point paper. In particular, he discussed the present DOE strategy for resolving information needs with the testing program. The strategy involves identifying the following conditions for each parameter: parameter goal, current confidence, needed confidence, and expected value. These conditions will then drive the testing required for each site.

After the review of the point paper outline was completed, an informal discussion was held on off-site salt programs. R. Hart and L. Lorig presented possible review topics to N. Tanious and J. Pearring. A decision was made to conduct a review of pertinent documents related to the WIPP in-situ testing program. This review will focus on test plans, pre-test analysis, post-test observations, and current understanding. The results of this review will be presented in a summary document and will provide a basis for comparison to the SRP testing program. It is estimated that between five and ten documents will be reviewed; this will require between four and six person-weeks of effort. The documents to be reviewed will be recommended by R. Hart and K. Wahi.

Specific Comments

The following comments were noted for consideration in the SRP in-situ testing point paper.

1. The paper should cover the 15 aspects related to the rationale for in-situ testing which were identified in the "Generic Technical Position on In Situ Testing During Site Characterization for High-Level Nuclear Waste Repositories" dated December 1985.

2. Both temperature and stress distribution around the waste package should be evaluated in the analyses.

3. When investigating the sensitivity of parameters, care should be taken to consider the time of comparison in the analyses.

4. The investigation of heterogeneity in the bedded salt mass is difficult to conduct as a scoping analysis in terms of random distribution of properties because of the present lack of understanding of the in-situ conditions. This analysis will not be conducted at present but will be considered for later study.

5. The presence of interbeds is considered an important topic for investigation by analysis for this study. J. Peschel suggested that Itasca review the experience of interbed movement at the WIPP test program.

6. J. Pearring suggested that the paper should recognize the current terminology used by DOE for the in-situ testing program. Documents from the "Issues Hierarchy" meeting be attended were provided as a resource.

7. The paper should attempt to identify the current Deaf Smith repository design concept in developing the test plan strategy. Because this concept has not been released by DOE, it may be necessary to evaluate the information made available at SRPO through an Appendix 7 site visit before progressing too far with the test plan strategy.

8. The analyses conducted to justify a test plan are considerable. For the present point paper, some judgement will be necessary to define a priority for performing these analyses. This priority will recognize which analyses are most critical for development of the test plan strategy.

9. Several editorial changes were identified for the outline. These have been made.

Respectfully submitted,

Lee Ferry for RDH

Roger D. Hart
Project Manager

attach.
rdh/ks

DRAFT OUTLINE

POINT PAPER ON IN-SITU TESTING AT DEAF SMITH

I. INTRODUCTION

Objective: to provide a brief description of the site and conceptual design in order to acquaint readers with the reasons for in-situ testing at Deaf Smith

A. Site Description

B. Conceptual Design

C. Present SRP Plans for Underground Testing

II. "REQUIREMENTS DOCUMENT" FOR DEAF SMITH

Objective: (1) to identify and discuss the most crucial rock mechanics/design issues facing a high-level waste repository at Deaf Smith; and (2) to identify and discuss information needed to resolve crucial design issues

A. Crucial Rock Mechanics/Design Issues (Regulatory Requirements)

1. Waste Retrievability [10CFR60.111(b), 60.133(c)]

2. Decommissioning and Sealing (10CFR60.134)

3. Disturbance [10CFR60.133(a),(e)(2),(f) and (i)]

4. Thermomechanical Loading of Waste Package [10CFR60.135(a)]

5. Design Performance (10CFR60.131)

B. Required Studies

There is considerable overlap between the issues in terms of data needs. In essence, the information needed to address each of the crucial rock mechanics/design issues is the information needed to perform the following studies.

1. Closure Rate Analyses of Rooms, Boreholes, Emplacement Holes, and Shafts at Ambient and Post-Emplacement Temperatures (These studies should also include analyses accounting for backfill interaction and emplacement configuration.)

2. Studies of Excavation and Thermally-Induced "Damage" and Extent of Disturbance to Rock Mass Surrounding Rooms, Boreholes, Emplacement Holes, and Shafts

3. Waste Package/Repository Thermal Impact Study

4. Waste Package Retrievability Study

5. Seal System and Shaft Lining Study

C. <u>Broad Areas of Rock Mechanics/Design Information Needs for Deaf Smith</u>

1. Procedure for Identifying Information Needs

   a. Use of Need in Issue Resolution

      1. information need for resolution by <u>demonstration method</u>

      2. information need for resolution by <u>empirical analysis method</u>

      3. information need for resolution by <u>numerical/analytical analysis method</u>

   b. Condition for Information Needs

      1. It must be required to address the licensing issues set out in 10CFR60.

      2. It must be inadequately known at present.

      3. It must be obtainable at a level that will significantly reduce uncertainty in the relevant regulatory decision.

2. Geomechanical Information Needs for Deaf Smith

   a. Geotechnical Description of Host Rock Mass

      1. description of host rock mass heterogeneity

      2. effects of host rock mass heterogeneity

      3. in-situ stresses

      4. strength and deformability (creep)

      5. thermomechanical properties

   b. Construction of the Repository

      1. freeze-thaw response of rock mass

      2. seal material properties

      3. backfill material properties

   c. Closure Rate of Repository Excavations

      1. shaft convergence

      2. underground opening convergence

      3. emplacement holes convergence

      4. deformation around openings

   d. Predictability of Rock Mass Response

      The confidence level for the ability to predict pre- and post-closure rock mass response using numerical models must be established.

III. JUSTIFICATION FOR TESTING

Objective: to provide preliminary analyses of various test strategies and anticipated repository conditions which indicate the relative importance of information needs

A. Parameter Studies of Repository Performance Objectives

1. Establish base case which represents the current estimate of in-situ conditions. From the base case, some input parameters are varied over a range of uncertainty. Effects of constitutive model choice can also be examined. The purposes of this study include the following.

   a. determination of which phenomena (parameters) are important

   b. determination of time scales of importance

2. Typical scales of studies are:

   a. canister-scale studies — analyses of borehole and surrounding rock mass to approximately 5-hole diameters

   b. room-scale studies — analysis of a series of equally-spaced rooms and the region of influence of these rooms (5 diameters); the details of the borehole are ignored and the heat source is represented as a planar source

   c. repository-scale studies — analysis of the far field around the repository; at this scale, the geometry of the emplacement rooms is ignored and canisters are modeled as point or line heat sources

3. Relative importance of phenomena and time scales analyzed in these studies will be assessed based on engineering judgement.

B. Studies to Assess Effects of Heterogeneity

1. Discrete Inhomogeneity (e.g., mudstone or anhydrite interbed)

   Objective: to assess the importance of discrete inhomogeneity for room- and canister-scale analysis

2. Irregular masses of chaotic mudstone/salt mixtures or anhydrite

   From an established base case, determine the effect of random distribution of properties

   Objective: to assess the effects of various averaging assumptions (i.e., arithmetic mean, geometric mean, harmonic mean) concerning thermal conductivity, elastic properties, etc.

C. Studies to Compare Results of Accelerated Room-Scale Testing

Accelerated heating has been proposed for the Room-Scale Heater Test (Golder, 1985). The authors state that "This accelerated heating of the test area will induce a deformational response which is typical of that which will occur over the operational life of the repository." The validity of this assumption will be checked by numerical analysis.

D. Preliminary Prioritization of Information Needs

IV. TEST STRATEGY

Note: The content of this section will follow Sections 8.3.2 and 8.3.3 of the Annotated Outline.

Objective: (1) to provide rational (strategy) for resolving information needs; and (2) to describe how the results of particular tests or experiments can be used to resolve specific information needs.

A. Repository Program (8.3.2)

1. Overview (8.3.2.1)

   a. assessment of present SRP test plan

   b. strategy for resolution of information needs through in-situ testing

   c. representativeness of in-situ testing in salt

      - heterogeneity of rock mass
      - scale effects
      - number of tests
      - test duration

2. Verification or Measurement of Host Rock Environment (8.3.2.2)

   a. construction monitoring

   b. geotechnical characterization

   c. in-situ stress measurement

3. Coupled Interactive Tests (8.3.2.3)

   validity of accelerated room-scale heater test

4. Design Optimization Activities and Tests (8.3.2.4)

   a. emplacement hole drilling

   b. waste package retrieval

5. Repository Modeling (8.3.2.5)

   An approach for verifying and validating repository models for predicting pre- and post-closure rock mass response is discussed.

B. Seal System Program (8.3.3)

1. Overview (8.3.3.1)

a. objectives of seal system program

i. demonstrate that the site characterization will provide for the acquisition of all data necessary to demonstrate compliance with 10CFR60, particularly 10CFR60.134

ii. demonstrate that site characterization activities do not induce irreversible effects that could significantly complicate permanent closure/sealing or could reduce permanent closure/sealing performance or reliability

iii. demonstrate that site characterization activities will not cause a substantial risk of repository flooding during operation

b. review of present SRP seal system program

c. strategy for resolution of information needs through seal system program

2. Seal System Environment (8.3.3.2)

a. physical enviroment

- temperature
- deformations to which seals are likely to be or might be subjected subsequent to emplacement
- stresses/heads (stresses applied to enclosed seals—e.g., as a result of continuing rock deformation)

b. chemical environment

c. hydrologic environment

d. construction influence parameters

3. Seal System Components and Interaction Tests (8.3.3.3)

   This section will discuss the following.

   a. seal system component tests, including component-environment interaction testing

   b. correlation between design/performance requirements and tests

4. Seal System Design Optimization (8.3.3.4)

5. Seal System Modeling (8.3.3.5)

   This section will describe planned modeling and code development studies associated with seal system development, utilization, verification, and validation for those tests and studies requiring data from site characterization. In principle, this could be an extremely broad aspect of the program—in essence, a minature version of the repository modeling program. Examples include the following.

   a. thermomechanical interaction modeling

   b. flow modeling

COST BREAK-OUT

Labor

R. Hart	12 hrs @ $24.04/hr	$ 288.48
L. Lorig	10 hrs @ $21.15/hr	211.50
	TOTAL LABOR	$ 499.98

Actual Expenses

Travel

Airfare (Mpls-WDC-Mpls)	
Hart	$ 149.00
Lorig	98.34
Miscellaneous Travel Expenses	
Lorig (car rental, parking)	$ 57.89

Lodging

Hart (1 night @ $68.20/night)	$ 68.20
Lorig (1 night @ $68.20/night)	68.20

Meals

Hart	$ 19.00
Lorig	13.50
TOTAL EXPENSES:	$ 474.13