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Pohle _____
(Return to WM, 623-SS)

March 25, 1987

009/PM/NWC.006
RS-NMS-85-009
Communication No. 143

U.S. Nuclear Regulatory Commission
Division of Waste Management
Geotechnical Branch
MS 623-SS
Washington, DC 20555

Attention: Mr. Jeff Pohle, Project Officer
Technical Assistance in Hydrogeology - Project B (RS-NMS-85-009)

Re: Trip Report - Hydrogeology Planning for SCP Preparation, Silver Spring,
March 17-19, 1987

Dear Mr. Pohle:

This letter comprises Nuclear Waste Consultants' (NWC) trip report for the NRC's planning meeting with hydrogeology contractors for FY 87 and FY 88 preparations for reviews of the DOE Site Characterization Plans. NWC was represented by Mark Logsdon, Project Manager for the current contract and Vice President of the corporation. Williams and Associates was represented by Dr. Roy Williams throughout the planning sessions. The principal NRC Staff involved included Dr. Tilak Verma, Acting Section Leader, Mr. J Pohle, NRC Project Officer, Dr. R. Codell, Senior Hydraulic Engineer, and Messrs. W. Ford, F. Ross, and N. Coleman, the site leads for the three site teams. At various times, additional NRC staff and management participated in portions of the meetings.

The general agenda for the meeting (with the NRC session leaders) included:

- o Introductory and background material, 3/17 - J. Pohle, T. Verma
- o Preparation for review of NNWSI SCP, 3/17 - W. Ford
- o Preparation for review of SRPO SCP, 3/18 - F. Ross
- o Preparation for review of BWIP SCP, 3/19 - N. Coleman
- o Topical Reports on Uncertainty/Revisions to GWT Technical Position, 3/19 - J. Pohle, R. Codell
- o Wrap-up, 3/19 - T. Verma

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The following material summarizes my understanding of the general direction that was presented by Mssrs. Pohle and Verma and discussed by the whole group:

- o DOE's Site Characterization Plans (SCP's) will include specific testing to address information needs that have been identified from the DOE Issue Hierarchy/Resolution Strategy process (including their Performance Allocation exercises).
- o It is not anticipated that the SCP's will include any attempts to reach regulatory findings, nor that the NRC Staff's comments would be framed in terms of regulatory findings. Rather, the goals of the NRC's review process will be to ensure that, to the maximum extent practicable, the DOE plans address all the information needs that exist with respect to NRC's regulatory requirements and that the technologies and specific tests proposed by the Department are likely to produce the information needed - including the information needed to assess uncertainties in conceptualizations, models, computations and data that are significant to regulatory decisions.
- o In order to meet these NRC goals, the Staff considers that it ought to prepare in advance its independent assessment (including rationale in terms of Part 60 and detailed technical support) of the data needs at each site and its own assessment of technologies, testing methods and instrumentation available to obtain that necessary information. Clearly, data needs must be identified before one can rationally assess methodologies for obtaining information.
- o The NRC Staff will prepare all positions on data needs, testing methodologies and uncertainty. The role of the Technical Assistance contractors for hydrogeology will be to develop specific evaluations of matters of technical concern, with respect to both data needs and methodologies for collecting and evaluating data. The contractor contributions, together with the Staff's own technical efforts, will be compiled by the NRC Staff into comprehensive staff technical positions.
- o Specific technical evaluations may be proposed by either the contractors or the staff. In either case, a technical proposal shall be prepared by the contractor and evaluated by the staff in the context of overall contractual and programmatic needs before detailed evaluations begin.

- o The data needs and technology assessments are part of the existing, overall technical assistance framework of reviewing DOE work, developing Staff capabilities, and identifying and implementing quantitative tools for NRC use. These efforts do not represent a change in scope of the currently required work.

Following presentation of these principles, the discussions moved on to specific matters pertinent to generic and site-specific studies. Mark-ups of the three site-specific outlines are attached for the record. It is my opinion that the site-specific discussions for NNWSI and SRPO and the ideas for generic, topical reports were particularly well organized and integrated with the general framework set out by Messrs. Verma and Pohle. The site leads and contractors discussed the status of scheduled and proposed work for FY 87 and identified additional technical concerns that needed evaluation before the Staff could prepare their Data Needs Assessments. The discussions included topics that cannot be completed by the end of FY 87, such as testing methodologies for unsaturated, fractured rock, isotopic and related hydrochemical tools for site characterization, data needs for assessing the scales at which hydrogeologic conditions and processes must be investigated, and approaches to evaluating parameter-estimation techniques.

At this time, there are several specific matters for each site on which NWC subcontractors are to prepare Task Descriptive Summaries for consideration by the NRC Staff. In addition, there are several matters on which the Staff will initiate action. Furthermore, assignments and schedules related to the Topical Reports on Uncertainty were clarified, pending written confirmation from the NRC Project Officer. In order for the NRC Project Officer to establish the balance and flow of work in preparation for the SCP's in FY 87 and FY 88, in light of other NRC programmatic initiatives, the Task Descriptive Summaries will be submitted by contractors and evaluated by the NRC Staff over the next few months. I anticipate meeting with the key technical and managerial people from our subcontractor organizations in the next two weeks to begin our portion of the planning process.

March 20, 1987

If you have any questions about this trip report, particularly if I have incorrectly stated positions of the NRC Staff as they apply to this planning exercise, please contact me immediately.

Respectfully submitted,
NUCLEAR WASTE CONSULTANTS, INC.

Mark J. Logsdon

Mark J. Logsdon, Project Manager

ATT: Annotated Site Outlines

cc: US NRC - Director, NMSS (ATTN PSB)
DWM (ATTN Division Director)
Mary Little, Contract Administrator
MMGT (ATTN Branch Chief)

cc: L. Davis, MWL
M. Galloway, TTI
J. Minier, DBS

Logsdon
NWL
3/17/87

Inspiration

*new material discussed
no outline
rwl
3/19/87*

PRODUCT LIST

- 1 -

PRE-SCP HIGH-LEVEL HYDROLOGY TASKS

BWIP (FY87)

Task Objectives

Activities/Products

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Ongoing Review of DOE Program <ol style="list-style-type: none"> a. Review DOE Documents and Reports b. Evaluate DOE Conceptual Models c. NRC/DOE Interactions d. Quality Assurance
 2. Develop Staff Capability <ol style="list-style-type: none"> a. Develop Conceptual Models b. Identify and Develop Codes for NRC Use c. Quality Assurance <ol style="list-style-type: none"> 1. Staff 2. Contractors
 3. Identify Information Needs <ol style="list-style-type: none"> a. Identify Significant Conditions and Processes Via Performance Based Sensitivity Studies b. Evaluate Significant Testing Methodologies and Procedures c. Characterize Data Needs/ Testing Methodology/ Instrumentation vs. Uncertainty
 4. Develop Staff Reports <ol style="list-style-type: none"> a. Data Needs Assessment (NRC staff lead) b. Develop Report on Testing Methods and Instrumentation c. Performance Assessment: Internal Assessments of Site Groundwater Travel Time - Uncertainty Evaluation <ol style="list-style-type: none"> 1) Regional hydrology 2) Pasco Basin hydrology 3) RRL scale | <p>Reviews of documents supporting DOE's SCP's</p>
<p>Workshops and Data Reviews</p>
<p>Assessments prepared by all three contractors (FY86)</p>
<p>QA polycys being implemented
Preliminary QA plans developed</p>
<p>Report on adequacy of currently available testing technology, esp. re: eff. porosity</p> |
|--|---|

PRODUCT LIST

- 2 -

REPORTS

1. Analysis of Flow Interior Heterogeneity: Ground Water Travel Time
2. Analysis of Flow Interior Heterogeneity: Cumulative Flux
3. Eval. of Residual Thermal Effects
4. Relationship of Hydrodynamic Dispersion to Compliance with Overall EPA Release Standards
5. Analysis of Drilling Response at the Hanford Site
6. Use of Hydraulic Head for Evaluating Groundwater Flow in a Variable Density System: Simple Analytical Evaluation (Marinelli)
7. A One-Dimensional Numerical Model for Analysis of Steady-State, Variable-Density Groundwater Flow (Marinelli)
8. Analysis of Drilling Response at the Hanford Site: Analysis (Basse)
9. BWIP Groundwater Levels: Will Further Stabilization Significantly Reduce Uncertainty? (Galloway)
10. Effects of Geothermal Heat and Salinity on Pre-Emplacement Heads (Marinelli) ***
11. Tracer Test Evaluation (Galloway and Marinelli) ***
12. Effect of Repository Heat on Groundwater Flux (Marinelli) ***
13. Lumped Parameters (Brown) ***
14. Development of Groundwater Conceptual Flow Models for the BWIP Site (+ update) (Terra Therma, Inc.)
15. Topical Report on Categories of Uncertainty in Groundwater Travel Time Estimation (W&A) ***
16. Hydrochemical Distinctness of Groundwaters in the Vicinity of the BWIP Site (W&A) ***
17. Numerical Modeling of Groundwater Flow Systems in the Vicinity of the RRL, Hanford Site, Washington (NRC contractors & staff) ***

REVIEWS

- NWC
1/8/86 Review of Draft Test Plan for Multiple-Well Hydraulic Testing of Selected Hydrogeologic Units at the RRL-2 Site (SD-BWI-TP-040)
- W&A Effective Porosities of Basalt: A Technical Basis for Values Used in Preliminary Performance Assessments (Loo)
- W&A Integrity Testing Plans for Selected Hanford Site Monitoring Wells
- W&A Preliminary Evaluation of Piezo. Responses at DC-19,20,22 During Construction of DC-23W
- NWC &
W&A Groundwater Drawdown as a Factor in Long-Term Repository Performance Assessment ***

Proposed Evaluations

- W&A Simulation of Hydrogeologic Response to Testing
- W&A Evaluation of Groundwater Model Geometry
- W&A Verify Hydrogeologic Test Data Analysis and Interpretation
- W&A Evaluation of Testing Methodologies in Low Hydraulic Conductivity Materials
- W&A Investigating the Sensitivity of Predicted Ground Water Travel Times to the Distribution of Effective Porosity and the Distribution of Transmissivity
- W&A Hydrochemical Related Topics *statistical distributions*
- W&A Statistical and Geostatistical Related Topics
- W&A Development of a Conceptual Hydrogeologic Model (validity of expert systems approach)

*** In Preparation

Logsdon
Nuel
3/17/87

HLW SCP TASKS

TASKS FOR SCP PREPARATION-NNWSI

1 - A.M.

TASKS-OBJECTIVES

ACTIVITIES/PRODUCTS

2. ONGOING REVIEW OF DOE PROGRAM

- a. REVIEW DOE DOCUMENTS AND REPORTS
- b. EVALUATE DOE CONCEPTUAL MODELS

(P) Conceptual model updates and alternatives.
 => Data Base updates

- c. NRC/DOE INTERACTIONS

3. DEVELOP STAFF CAPABILITY

- a. DEVELOP CONCEPTUAL MODELS

- * Conceptual Models of Groundwater Flow
- * NNWSI Conceptual Model Evaluation Report
- * Penetration and Resistance of Water in a Single Planar Fracture Affected by Air Flow in the Matrix
- * Unsaturated Zone Fracture Flow Models
- * Analyses of Observed Flow Between Test Wells USW G-1 and USW UZ-1
- * Update of Conceptual Ground Water Flow Model
- * Theoretical Description of Steady, Downward flow in Layered, Fractured Unsaturated Porous Media
- * ~~Range and Distributions of Effective Porosity~~
- * Importance of Boundary Conditions
- * Overview of Recharge Estimates
- * The Use of Environmental Tracers for the Estimation of Recharge
- * Analysis of Data Available for the Evaluation of Flow and Transport at Yucca Mt.
- * Capillary Barrier Effects at hydrogeologic unit interfaces in the Unsaturated zone at Yucca Mt.

needs definition

~~Range and Distributions of Effective Porosity~~

*? Non-Isothermal Liquid and Vapor Transport Within the unsaturated Zone at Yucca Mt.

UFA

(P) Investigate the effect of increased precipitation on recharge (is there an empirical relationship between recharge and infiltration) (WRA #71).

Potential for perched water

(P) Effect of perched water tables.

on Rep. Part

(P) The composition of the ground water along flow paths to the accessible environment.

(P) Identify geohydrologic barriers for characterization.

engineers

(P) Identify the type of unsaturated testing in the waste package area that should be conducted in support of waste package and radionuclide transport.

Implement
b. IDENTIFY & DEVELOP CODES FOR NRC USE

Computer programs

*? The Analysis of Unsaturated Flow and Transport at Yucca Mt with a Stochastic Model

*?? A Two-Dimensional (Vertical) Unsaturated Flow Model of Yucca Mt.

*?? A Two-Dimensional (Vertical) Unsaturated Transport Model of Yucca Mt.

*?? A Two-Dimensional (Horizontal) Saturated Flow Model of the Yucca Mt. Region

*?? A Two-Dimensional (Horizontal) Saturated Transport Model of the Yucca Mt. Region

(P) Is the ground water system under steady state or non steady state conditions?

(P) Definition of ground water model validation. Need for ground water model validation.

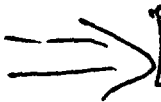
no!

3. IDENTIFY INFORMATION NEEDS

a. IDENTIFY SIGNIFICANT CONDITIONS AND PROCESSES VIA PERFORMANCE BASED SENSITIVITY STUDIES

- * Travel Time Calculations, Yucca Mountain, Nevada Mini-Report #2
- * Estimates of Cumulative Radioactive Flux at Yucca Mountain
- * Penetration and Resistance of Water in a Single Planar Fracture Affected by Air Flow in the Matrix
- * Travel Time Calculations, Yucca Mt., Nevada Mini Report #1
- * Categories of Uncertainty for Groundwater Travel Time
- (P) Effect of Repository Heat on Ground Water Flux
- *? A Summary of Fracture Distribution and Connectivity: Implications for Yucca Mountain
- (P) What is the Significance of vapor movements.

Ornstein



b. EVALUATE SIGNIFICANT TESTING METHODOLOGIES AND PROCEDURES

What parameters are needed

- (P) Develop ^{field} experimental data in support of unsaturated fractured rock water flow.
- (P) Sources of uncertainty in ground water travel times.
- (P) Investigate the resistance to air flow between matrix and fractures.
- (P) Infiltration data needs; now and in the future.
- (P) Report on testing of the unsaturated zone.
- (P) Report on testing of the saturated zone.

already done by all

low priority

c. CHARACTERIZE DATA NEEDS, TESTING METHODOLOGY, AND INSTRUMENTATION VS UNCERTAINTY

Contractor Dept
input to staffs

5. DEVELOP STAFF REPORTS

- a. DEVELOP DATA NEEDS ASSESSMENT
- b. DEVELOP REPORT ON TESTING METHODS AND INSTRUMENTATION

HLW SCP TASKS

- 4 -

- * mini-report
- *? proposed mini-report by technical assistance contractor due 5/87
- *?? proposed mini-report by technical assistance contractor may be due 11/87
- (P) proposed mini-report

Logsdon
NWC
3/19/89

TASKS FOR SCP PREPARATION-NNWSI

TASKS-OBJECTIVES

ACTIVITIES/PRODUCTS

P

1. PROJECT MANAGEMENT

2. ONGOING REVIEW OF DOE PROGRAM

a. REVIEW DOE DOCUMENTS AND REPORTS

b. EVALUATE DOE CONCEPTUAL MODELS

- (P) Conceptual model updates and alternatives. (P)
- (P) Data inventory and management (P)
- (P) Semiannual data inventory transfer to NRC (P)

c. NRC/DOE INTERACTIONS

3. DEVELOP STAFF CAPABILITY

a. DEVELOP CONCEPTUAL MODELS

- * Conceptual Models of Groundwater Flow
- * NNWSI Conceptual Model Evaluation Report
- * Penetration and Resistance of Water in a Single Planer Fracture Affected by Air Flow in the Matrix
- * Unsaturated Zone Fracture Flow Models
- * Analyses of Observed Flow Between Test Wells USW G-1 and USW UZ-1
- * Update of Conceptual Ground Water Flow Model
- * Theoretical Description of Steady, Downward flow in Layered, Fractured Unsaturated Porous Media
- *? Overview of Recharge Estimates
- *? The Use of Environmental Tracers for the Estimation of Recharge
- *? Analysis of Data Available for the Evaluation of Flow and Transport at Yucca Mt.

- *? Capillary Barrier Effects at hydrogeologic unit interfaces in the Unsaturated zone at Yucca Mt.
- *? Non-Isothermal Liquid and Vapor Transport Within the unsaturated Zone at Yucca Mt.
- (P) Investigate the effect of increased precipitation on recharge (is there an empirical relationship between recharge and infiltration) (W&A #71). Roy
- (P) Effect of perched water tables on repository performance and data needs. Frank
- (P) Hydrology information needed in support of waste package. Bill
- (P) Effect of Boundary Conditions with respect to solute transport Mark
- (P) Effect of heterogeneity on Unsaturated flow Mark

b. ADAPT CODES FOR NRC USE TO INVESTIGATE SPECIFIC PERFORMANCE ASSESSMENT AND DATA NEEDS

- *? The Analysis of Unsaturated Flow and Transport at Yucca Mt with a Stochastic Model
- (P) Synthetic data base studies - Day
- (P) Geologic relationship to correlation factor - Roy
- (P) A Two-Dimensional (Vertical) Unsaturated Flow Model of Yucca Mt.
- (P) A Two-Dimensional (Vertical) Unsaturated Transport Model of Yucca Mt. } Mark
- (P) A Two-Dimensional (Horizontal) Saturated Flow Model of the Yucca Mt. Region
- (P) A Two-Dimensional (Horizontal) Saturated Transport Model of the Yucca Mt. Region

4. IDENTIFY INFORMATION NEEDS

a. IDENTIFY SIGNIFICANT CONDITIONS AND PROCESSES VIA PERFORMANCE BASED SENSITIVITY STUDIES

- * Travel Time Calculations, Yucca Mountain, Nevada Mini-Report #2
- * Estimates of Cumulative Radioactive Flux at Yucca Mountain
- * Penetration and Resistance of Water in a Single Planer Fracture Affected by Air Flow in the Matrix
- * Travel Time Calculations, Yucca Mt., Nevada Mini Report #1
- * Categories of Uncertainty for Groundwater Travel Time
- *? A Summary of Fracture Distribution and Connectivity: Implications for Yucca Mountain
- (P) What is the significance of vapor phase transport to the repository? *mark*
- (P) Effect of Repository Heat on Ground Water Flux *- B:4*

b. EVALUATE SIGNIFICANT TESTING METHODOLOGIES AND PROCEDURES

- (P) Scale effects when applying field data to models. *- Jeff*
- (P) Infiltration methodologies *- ~~Jeff~~ Jeff*
- (P) Report on testing the unsaturated zone. *- Bill*

c. CHARACTERIZE DATA NEEDS, TESTING METHODOLOGY, AND INSTRUMENTATION VS UNCERTAINTY

6. DEVELOP STAFF REPORTS

a. DEVELOP DATA NEEDS ASSESSMENT

b. DEVELOP REPORT ON TESTING METHODS AND INSTRUMENTATION

- * mini-report
- *? proposed mini-report by technical assistance contractor due 5/87
- (P) proposed mini-report

Logsdon
Niel
7/17/87

OUTLINE FOR SRP-SCP PREPARATION TASKS IN HYDROLOGY

- I. Ongoing Review of DOE-SRP Program**
 - A. Review of DOE-SRP Documents (50 document reviews)**
 - B. Evaluate DOE-SRP Conceptual Models (6/86)**
 - C. NRC/DOE Interactions**

- II. Develop Staff Capability With Respect to Models and Codes**
 - A. Develop Simple Conceptual Models for NRC Independent Analyses**
 - B. Identify/Develop Codes for NRC Use**

- III. Identify Information Needs and Testing Methodologies**
 - A. Identify Significant Conditions/Processes Via Performance Based Sensitivity Studies**
 - B. Collate List of Technical Concerns/Issues (11/86)**
 - 1. Hydraulic Parameters for Units Important to G.W.T.T. Calculations, Radionuclide Transport, and ESF Design**
 - a. Permeability**
 - 1) anisotropy**
 - 2) fracture permeability**
 - 3) spatial variability/scale**
 - b. Hydraulic gradient**
 - 1) head distributions**
 - 2) vertical/horizontal gradients**
 - 3) spatial variability**
 - c. Effective Porosity**
 - 1) total vs. effective**
 - 2) fracture vs. matrix**
 - 3) spatial variability/scale**
 - d. Numerical Methods of Parameter Estimation/Analysis of Hydraulic Test Data**

2. Framework

a. Hydrostratigraphic Units

- 1) identification of units most important to G.W.T.T. and transport
- 2) interconnection between Ogallala and Dockum aquifers

b. Boundaries

- 1) locations
- 2) nature
- 3) sensitivity of local boundaries to choice of regional boundaries in numerical simulations

c. Structure

- 1) location of structures
- 2) hydrologic characterization of structures

d. Fluid Density/Thermal Effects

e. Hydrochemical Data Evaluation to Support Physical Flow Models

- 1) noble gases
- 2) stable isotopes
- 3) geochemical facies

strong emphasis

C. Review/Evaluate Test Plans/Procedures

1. WIPP Hydrologic Tests (PROSPER 3/87)

a. Hydraulic tests

b. tracer tests ←

2. SRP Site Study Plans (SSP's)

a. shallow hydronests (Papadopulos)

b. deep hydronests (Papadopulos)

c. ESF monitor well tests (Papadopulos)

**D. Evaluate Performance Based Information Needs, Testing Methodologies,
and Instrumentation In Terms of Uncertainty**

- 1. Categorize Areas of Uncertainty**
- 2. Evaluate Methods to Quantify and Reduce Uncertainty**
- 3. Evaluate Methods to Express Uncertainty**

IV. Develop Staff Reports

- A. Develop Data Needs Assessment**
- B. Develop Report On Testing Methods/Procedures**