See pocket for encl.

NUCLEAR WASTE CONSULTANTS INC.
8341 So. Sangre de Cristo Rd., Suite 6
Littleton, Colorado 80127
(303) 973-7495

January 31, 1986

009/2.1/TTI.001
RS-NMS-85-009
Communication No. 20/0, 11, 16

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: **BWIP Site Familiarization Report, Subtask 2.1**

Dear Mr. Pohle:

This cover letter transmits to the NRC staff the Site Familiarization Subtask Report for BWIP, Subtask 2.1 of Contract No. RS-NMS-85-009. This report has been prepared by the Mssrs. Mike Galloway and Fred Marinelli of Terra Therma, Inc., the site team for BWIP, under subcontract to Nuclear Waste Consultants. The report has received a management and technical review by Mark Logsdon and Adrian Brown of Nuclear Waste Consultants.

Nuclear Waste Consultants calls to your attention three specific technical matters concerning the hydrology of the site that have been raised by Terra Therma in their review of the site data and of conceptual models of the hydrogeology in the BWIP literature. These technical matters include:

1. The status of piezometric baseline conditions and the general question of the hydraulic gradients in the Pasco Basin.

2. The degree of vertical hydraulic communication across the dense interiors of basalt flows.

3. The degree of lateral hydraulic continuity within the flow system.

Terra Therma and Nuclear Waste Consultants continue to consider that the performance of a multiple-well aquifer test that is designed to stress the flow system on a scale appropriate to assessment of repository performance is a key matter for a realistic characterization of the flow system and of the likely hydraulic performance of a repository in the Pasco Basin.

Based on our review of the BWIP literature and the work of other NRC consultants under previous contracts, Nuclear Waste Consultants considers that work on the geologic framework of the hydrologic system provides a useful initial step in formulating and evaluating conceptual models of the site. It is our intention that this work should be pursued under subsequent subtasks for BWIP, as Mr. Galloway indicates in his leter report (p. 4-5). However, we concur with Terra Therma that these are first, "pre-analytical" steps with respect to the scope of Project B. There are specifically hydrologic aspects

2736

of the conceptual models proposed to date by DOE (and others, including the NRC staff) that need to be addressed in a timely fashion, also. We consider that these quantitative matters and other, similar concerns that will continue to be raised, can be profitably analyzed starting at an early time in the program, in keeping with our understanding of the intent of the Statement of Work.

The Statement of Work for all three tasks calls for comment on the NRC staff's hydrologic issues. Terra Therma has commented briefly in this report, per the SOW. Nuclear Waste Consultants and its subcontractors will be preparing a letter report to the NRC staff concerning the proposed NNWSI Issue Hierarchy. It is our intention to broaden the scope of that letter report to address related matters that arise in the NRC's issues.

The submission of this letter report meets the contractual deliverable for Subtask 2.1 of Contract Number RS-NMS-85-009 and completes the BWIP Site Familiarization subtask.

If you have any questions concerning this report or related matters, please contact me immediately.

Respectfully submitted,
NUCLEAR WASTE CONSULTANTS, INC.

Mark J. Logsdon

Mark J. Logsdon, Project Manager

Att: BWIP Site Familiarization Report, Subtask 2.1

cc: US NRC - Director, NMSS (ATTN: PSB)
DWM (ATTN: Division Director) - 2
Barry Bromberg, Contract Administrator
WMGT (ATTN: Branch Chief)

bc: M. Galloway, TTI
R. Knowlton, DBS
L. Davis, WWL

TERRA THERMA, INC.

WATER CONSULTANTS AND ENGINEERS

8341 S. Sangre de Cristo Rd., Suite 6, Littleton, CO 80127 (303) 973-7492

January 30, 1986

Nuclear Waste Consultants, Inc.
8341 S. Sangre de Cristo Road
Littleton, Colorado 80127

Att: Mark Logsdon, Project Manager

Re: Site Familiarization Report, Subtask 2.1

Dear Mr. Logsdon:

This document constitutes the letter report required in our subcontract to Nuclear Waste Consultants for Subtask 2.1, Site Familiarization. This letter provides a summary of the BWIP bibliographic data base, recommendations regarding BWIP STP 1.0, and comments on the Geotrans approach to data presentation as it relates to BWIP.

Background

Nuclear Waste Consultants, Inc, (NWC) was awarded NRC project (RS-NMS-85-009) entitled "Technical Assistance in Hydrogeology - Project B - Analysis" on September 28, 1985. Terra Therma, Inc. (TTI) is subcontracted to NWC for review of hydrogeologic investigations of the Basalt Waste Isolation Project (BWIP). The TTI team, Michael Galloway (Project Manager) and Adrian Brown (Technical Director), attended the project kickoff meeting in Silver Spring, Md. on October 22-25, 1985. As discussed in the October travel report, we were introduced to the NRC project officers and staff personnel and the Project A team of Williams and Associates.

The project managers of the three media teams were specifically requested to review an NRC bibliography for each site and provide a list of documents which may be of interest. Approximately 144 documents were requested by the TTI team, of which 114 have been received. The outstanding documents are listed in Attachment A.

Shortly after the project kickoff meeting, the TTI team was asked to prepare for a DOE - NRC Hydrology Workshop to be held in Richland, Washington in early December, 1985. Preparing for this meeting required that the team accelerate the site familiarization process and begin to use the bibliographic data base which was under development. As most team members are reasonably familiar with the BWIP site from past projects, the team was able to quickly review the DOE test plan and develop technical positions and comments. Also, the data base was tested under actual use conditions, resulting in a more usable product.

Document Data Base

In order to manage the large number of hydrogeology-related BWIP documents and ensure the library's usability, a computerized data base has been created. Attachment B presents the total BWIP listings in our library to date. There are 339 BWIP documents in the data base at the present time. Presently, documents can be identified and the full citation retrieved by using complete or partial titles, author's name, document number, or subject. The ability to use partial or incomplete information has been particularly important for locating references for which we are not familiar.

Figure 1 presents a short review form which is being used to catalogue information derived from informal reviews or readings of documents. This catalogued information will be useful throughout the life of the project, specifically for formal reviews and short-fused data needs.

Site Familiarization

Our current familiarization and understanding of the BWIP hydrogeology has been derived from numerous documents, including the following:

DOE, Draft Environmental Assessment: Reference Repository Location, Hanford Site, Washington (84/12)
DOE/RW-0017 NWC #: 1295

NRC, BWIP Site Technical Position No. 1.1: Hydrologic Testing Strategy for the Basalt Waste Isolation Project (83/12) NWC #: 1053

Stone, R., Test Plan for Multiple-Well Hydraulic Testing of Selected Hydrogeologic Units at the RRL-2 Site, Basalt Waste Isolation Project, Reference Repository Location (85/11)
SD-BWI-TP-040 NWC #: 1122

Stone, R., Strategy and Preliminary Plans for Large-Scale Hydraulic Stress Testing of Selected Hydrogeologic Units at the RRL-2 Location (84/10)
NWC #: 1048

DOE, Site Characterization Report for the Basalt Waste Isolation Project Volumes I-III (82/11)
DOE/RL 82-3 NWC #: 1297

NRC, Site Chraacterization Analysis of the Site Characterization Report for the Basalt Waste Isolation Project, Hanford Washington Site, 2 Volumes (83/03)
NUREG-0960 NWC #: 1294

FIGURE 1

SHORT-FORM DOCUMENT REVIEWS FOR NRC

1.0 INTRODUCTORY MATERIAL

A. CITATION:

B. REVIEWER: DATE:

2.0 SUMMARY OF DOCUMENT

3.0 MAJOR REVIEW CONCLUSIONS

4.0 SIGNIFICANCE TO WASTE MANAGEMENT PROGRAM

5.0 DETAILED REVIEW

A. DOE DATA:

B. RATING OF DATA:

C. DOE CONCLUSIONS:

D. RATING OF CONCLUSIONS:

E. PROBLEMS, DEFICIENCIES, LIMITATIONS:

6.0 RECOMMENDATIONS

Gephart, R.E., Hydrologic Studies Within the Columbia Plateau, Washington: An Integration of Current Knowledge (79/10)
RHO-BWI-ST-5 NWC #: 1307

RHO, Exploratory Shaft Test Plan, Exploratory Shaft Test Program, 2 Volumes (83/11)
SD-BWI-TP-007 NWC #: 1072

BWIP Test Interval Reports

Water Level Data Reports

Although our original intent in reviewing these documents was to develop an overview of the project hydrogeology, our attention quickly focused on the relationship between the hydrogeology and the pending BWIP stress testing.

General Comments

The stratigraphy of the thick basalt sequence of the Pasco Basin has been fairly well defined by studies of the radioactive waste storage project. However, the hydrostratigraphy of the basin as it relates to relative permeability of the units and probable groundwater flow directions is not well defined. The very small vertical and horizontal hydraulic gradients have made it very difficult to identify groundwater flow directions within the precision of available measurement techniques. There is also an unresolved contradiction within the DOE conceptual model that assumes an apparent lack of hydraulic interconnection of the flow tops due to the low permeability flow interiors, yet there appears to be no significant hydraulic gradient, either vertically or horizontally over thousands of feet. Recent hydrographs from wells in various flow margins show rapid reponse to drilling activities despite being separated by dense flow interiors, suggesting that the "regional" interconnection of the basalt units must be considered in developing a performance assessment of the site.

At this point in the project, a key matter for resolution is the performance of a multi-well aquifer test which will sufficiently stress the entire hydrogeologic system. Several BWIP-related documents indicate that one of the primary concerns is that the numerous single well low-stress tests have not sufficiently defined the degree of interconnection between the flow margins and interiors. Therefore, the methodology, performance, and interpretability of a multi-well stress test are critical in developing an assessment which realistically characterizes the system. If significant interconnection is identified by LHS Testing, it will then be neccessary to determine if hydraulic communication occurs uniformly throughout the flow interiors or along isolated high permeability features.

Issues

STP 1.0, "Hydrology Issues For the Basalt Waste Isolation Project" was reviewed as required by the Statement of Work for Subtask 2.1. We have reviewed the document and have provided comments listed below.

The issues, as presented in this document, are sufficiently broad so as to incorporate any hydrogeologic concerns we might have in developing a respository in this medium. However, for the "issues" to be useful to the NRC staff, we would like to see the development of a mechanism for determining when a given issue has been sufficiently resolved in order to address the concerns of the staff. It is our understanding that licensing issues can only be resolved by the Atomic Safety and Licensing Board. Conceivably, the issues document could be reduced to merely a checklist, keeping track of the voluminous material submitted by DOE, but providing no indication as to when or if an issue is actually resolved. If the issues document is not to be a checklist, how can it be used? A final comment or suggestion is that given BWIP's present stage of investigation, would it not be possible to provide an additional tier of comments which are specific to the current understanding of the BWIP site. For example, the following issue could be added under 1.1.3 Mathematical modeling: To what extent can the fractured media at the BWIP site be modeled mathematically as a porous media? A series of detailed issues of this nature would not necessarily be a permanent part of the issues document, but could rather be used to better define specific problems or concerns.

Data Presentation

Graphical or pictoral representation of various types of geological data is the classical approach to both site analysis and data presentation. The use of computer-based analytical methods during the last decade has allowed more data to be handled more accurately (or consistantly) within shorter periods of time. However, the exclusive use of computers for data handling and analyses can effectively disconnect the geologist, hydrogeologist, etc. from the hands-on experience with the actual data. During the mechanical manipulation of data, particularly in a graphical or pictoral sense, an understanding of the "system" often develops. Hand drawn contouring, for example, requires an interactive participation of the individual which usually results in a more thorough understanding of a groundwater flow system with all its subtleties, and probably results in a more realistic, albeit more idiosyncratic, depiction of the system.

In the specific case of BWIP, graphical or pictoral representations of the data should be used as pre-modeling analyses of the system. However, it may be necessary to adapt classical techniques such as structure and isopachous contour maps to the specific needs of this site. For example, structure and isopachous contour maps may be more revealing if based on hydrostratigraphic units rather than stratigraphic units. Diagrams resulting from a graphical or

pictoral analysis of the site can be used to develop initial conceptual models of the system which can be used to guide (or check) the development of analytical/numerical models.

We propose to use the available data to construct various graphical or pictoral representations of the BWIP site as an early phase of the numerical studies under the present contract(Subtasks 2.2, 2.4 and 2.5). The exact number and types of maps to be used will depend upon the site data and availability of high quality base maps, which we do not have at this time.

Summary

The Site Familiarization subtask has been successfully completed. The TTI team has developed a basic understanding of the BWIP site hydrogeology and is in a good position to respond to formal reviews and future meetings. The readiness of the bibliographic data base will greatly assist us in future tasks.

If you have any questions or we can provide any additional information regarding subtask 2.1, please do not hesitate to contact us.

Sincerely,
TERRA THERMA, INC.

Michael Galloway

Michael Galloway
Project Manager