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MEMORANDUM TO: Paul Hildenbrand, BWIP Project Manager
Operations Branch
Division of High-Level Waste Management

FROM: Jim Warner
Geology/Geophysics Section
Technical Review Branch
Division of High-Level Waste Management

SUBJECT: REPORT ON APPENDIX 7 VISIT TO HANFORD

Introduction and Purpose of Trip:

During the week of 05/11/87 - 05/15/87, a review of BWIP-related on-site geotechnical data was conducted by representatives of the Council of Energy Resources Tribe (CERT), the Yakima Indian Nation, the State of Washington, the State of Oregon, and the NRC. This data, which is an on-site working file that is currently stored in two trailers adjacent to the site of the planned exploratory shaft at Hanford (near RRL-2), consists primarily of drilling records, geologic logs, geophysical logs, borehole completion/history reports, core photographs, and limited hydrologic data. The purpose of this Appendix 7 was to identify geologic/hydrologic conditions that could potentially be adversive to the performance of the repository, to gather further information related to previously identified issues, and to catalog geotechnical information that NRC-BWIP staff should acquire prior to the upcoming geology data review and the SCP review. The accomplishments of this trip include:

- the identification of geotechnical items (zones of circulation loss during drilling, open fractures, tectonic breccia zones, dissolved gas in the basalt section groundwater, and coal) that are relevant to reviewing the SCP, and ultimately, to assessing the performance of a repository in the Cohassett Flow. This information is available in the form of reviewers' notes that can be obtained from Jim Warner. These notes, which were transmitted to the DOE by Bob Cook (NRC BWIP-OR), are briefly summarized in the section of this report that is entitled 'Results'.

- the clarification of questions concerning (a) previously-identified issues (How was the 50' tectonic fracture zone in the Cohassett Flow in DC-19C [non-cored hole] defined ?) (b) the data base (Why is the borehole report for RRL-6B more complete than the borehole report for DC-6 ?)

- the identification of critical data that is available to RHO-BWIP, but has yet to be included in the NRC-BWIP data base. This information will be requested of the DOE (example: NRC has an incomplete set of well reports, geophysical well logs, and shift reports of operations from the primary deep stratigraphic wells at Hanford. A complete set is necessary for us to fulfill our review responsibilities).

Participants:

Bob Cook (NRC BWIP-OR) and Abdul Alkezweeny (CERT) originally requested this Appendix 7 after completing a preliminary overview of the on-site data. The primary reviewers were Pat McGee (EWA, Inc.-Consultants to the Yakima Indian Nation), Curtis Canard (CERT), and Jim Warner (NRC). Keith Stoffel (Washington State Geological Survey) and Ralph Patt (State of Oregon) were present on 05/14/87. Mike Parsons (RHO/BWIP-Repository Licensing) facilitated data retrieval and Darwin Marjaniemi (DOE) was present as an observer. Bill Price (RHO-BWIP) and Greg McLellan (RHO-BWIP) periodically checked in to answer questions and make sure things were running smoothly.

Appendix 7 Protocol:

The reviewers were located in the MO-346 trailer (adjacent to the ES drilling rig) and provided with an index (indexed by well name) of the data that could be accessed during the review. Staff who are interested in looking at the index or obtaining a copy should contact Jim Warner. Mike Parsons (RHO-BWIP Repository Licensing) was responsible for retrieving the requested data and transmitting questions and answers between the reviewers and appropriate RHO-BWIP personnel. This review was not a forum for discussing data

interpretations; thus, questions were primarily limited to those concerning the BWIP data base (data types, data acquisition procedures, etc.)

Geotechnical Data:

The on-site geotechnical data consists of various drilling records (shift reports of operations, mud reports, borehole deviation surveys, contract information, cementing histories, etc.), geologic logs, geophysical logs, borehole completion/history reports, core photographs, and Rockwell-internal and Rockwell-to-DOE letters concerning technical items (dissolved gas in the groundwater within the basalt section, testing recommendations, etc.) (see data index).

Bill Price (RHO-BWIP) emphasized that this data represents only a portion of the BWIP geotechnical data base. For example, basalt whole rock/trace element geochemical and geophysical (excluding geophysical logs) data were for the most part not included in the data index. Thus, staff should request information (including the on-site data of interest during this Appendix 7) through the Basalt Records Management Center, which is the official source of BWIP-related data.

Based on this Appendix 7 visit, the types of data and level of investigation associated with Hanford wells seems to be quite variable. This appears to be a result of the following:

(1) Wells at Hanford were drilled to fulfill a variety of data needs; thus, they vary in depth, drilling fluids used, and sampling program (chips, core, hydrologic testing, in-situ stress testing, gas monitoring). For instance, boreholes DC-32 and DC-33 (multilevel piezometer holes) will be drilled without mud for the pre-ES hydrology tests as non-cored, large diameter holes. This will be done to avoid disturbing the hydrologic conditions within the flows and to allow for the emplacement of several piezometers. In contrast, RRL-2A was core-drilled with mud and was

utilized for geologic, geochemical, hydrologic, and rock mechanics studies.

(2) The procedures and personnel involved with analyzing a given type of hole (stratigraphic, hydrologic) have changed throughout the history of the Hanford site characterization process. This is exemplified by three examples:

(a) More recent borehole reports (i.e. Borehole RRL-6 Report; SD-BWI-TI-167; Rockwell, 1983) summarize drilling operations, coring operations, geologic and geophysical logging/interpretations, hydrologic testing, and rock mechanics testing. These reports are extremely informative. For older core holes (i.e. DC-2, DC-6, DC-8), it is necessary to utilize several sources of information (hole history [Fenix and Scisson, Inc. Reports], core geologic logs, geophysical logs, and shift reports of operations) to attempt to find the types of data contained in the newer borehole reports.

(b) The geophysical logging program at BWIP has utilized several contractors including: Washington State University, PNL, Gearhart, Birdwell, and Schlumberger. These logs are of variable calibration and quality, which can lead to correlation uncertainty.

(c) Geochemical techniques for basalt flow identification either have not been applied to all of the core holes, or else the data is presented within different types of reports. The stratigraphic correlation charts in SD-BWI-DP-035 (Landon, 1985) show down-hole MgO and TiO_2 wt. % plots adjacent to the geophysical and stratigraphic logs for coreholes RRL-2A, RRL-14, RRL-6B, and DC-16A. MgO and TiO_2 wt. % plots are not included in the stratigraphic correlation charts for coreholes DC-8, DC-12, DC-14, DH-4, DH-5, McGee, DC-2, DC-6, DC-15, and DDH-3; however, this data must exist for some of the above holes

as evidenced by the geologic log for DC-6 (Rockwell, 1983), which exhibits major oxide wt. % data adjacent to the core description.

Results:

Each of the reviewers generated notes that can be obtained from Jim Warner. A summary of noteworthy features and drilling conditions that were identified during the Appendix 7 is given by well name below. Refer to the original Appendix 7 notes or talk to Jim Warner if more information is required. The significance of the noteworthy features and drilling conditions will be assessed after related data is acquired and HLTR geology staff discuss these items with RHO-BWIP personnel during the upcoming geology data review.

Lost Circulation Zones: DC-1, RRL-6B, DC-3, RRL-17, RRL-2A, DC-20C, DC-12, DC-4, DC-23W, DC-6,

Open or Partially Open Fractures: RRL-6B, RRL-2A, McGee, DC-12, DC-6, DC-16, DH-27

Tectonic Fractures, Tectonic Breccia, or Slickensides: DH-27, DC-16, McGee, RRL-6B, RRL-2A, DDH-3, DC-19C, DC-6, DC-14, DC-15, DC-7/8, DC-4

Artesian Flow (during drilling): DC-6, McGee, DB-11, DC-5

Coal: McGee, RSH-1

Dissolved Gas: RRL-2A, DC-19C, DC-16, DB-15, DC-12, DB-15, McGee

Other Activities:

Greg McLellan (Manager-ES/NSTF Drilling Tech Group) took the Appendix 7 participants on a tour of the exploratory shaft (ES) drilling rig and explained the reverse circulation (drilling fluids down the annulus and up through the drill string) method that will be used to sink the ES. Also, Jim Warner independently visited key outcrops along the Saddle Mountains, Umtanum Ridge, Gable Butte, and Rattlesnake Mountain Anticlines.

Conclusions and Recommendations:

This Appendix 7 has increased HLTR geology staff's awareness of the types and quality of geotechnical data available to RHO-BWIP personnel. A request for borehole reports, shift reports of operations, geologic logs, and geophysical logs (those not already acquired by the NRC) from the following deep stratigraphic holes should be forwarded to the DOE: DC-2, DC-3, DC-4, DC-5, DC-6, DC-7, DC-8, DC-12, DC-14, DC-15, DC-16A, DC-19C, DC-20C, DC-22, DC-23W, RRL-2A, RRL-6B, RRL-14, RRL-17, DH-4, DH-5, DDH-3, and McGee. In addition, the significance of the above geologic and hydrologic items (see 'Results') should be assessed by NRC staff following an evaluation of the data and discussions with RHO-BWIP personnel during the upcoming geology data review. These activities will enable us to provide constructive guidance concerning the pre-ES hydrology test plans and will be applicable to our review of the SCP.

ORIGINAL SIGNED BY

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Division of High-Level Waste Management

OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

MEMORANDUM FOR: Paul Hildenbrand, BWIP Project Manager
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