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NUCLEAR REGULATORY COMMISSION

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101.  
PDR-1  
LPDR WM-10(2)

Mr. James Knight  
Director, Licensing and Regulatory Division  
Office of Geologic Repositories  
U.S. Department of Energy  
RW-20  
Washington, DC 20585

Dear Mr. Knight:

This letter is in response to DOE's request dated June 26, 1987 for NRC review and comment on the revised package of documents related to the restart of constructing piezometer facilities for DC-23, 24, 25, 32, and 33. In a July 27, 1987 conference call with DOE-Headquarters, DOE-BWIP, and Westinghouse staffs, to clarify the scope of the restart package, DOE requested the NRC review of the restart package be limited to only the drilling and initial geophysical logging of wells DC-24, 25, 32, and 33. In subsequent telephone conversations with DOE-Headquarters, DOE requested that NRC comments focus on only that part of the program up to and including drilling of borehole DC-24 to the full depth, but not including final installation of the piezometer itself. However, since this final clarification was received at the end of our review and since the sequence of drilling proposed in the package requires drilling to a specific depth or stratigraphic horizon, logging this zone, installing casing to the bottom of this zone, cementing the casing in place and drilling through the bottom of the casing to a new horizon at which time the procedure is repeated, we have provided comments on drilling, logging, and piezometer location. Furthermore, drilling, logging, and casing are considered by the NRC staff to be associated activities of critical importance, as much of the geologic information can only be obtained while the borehole is drilled. After the casing has been placed there will be no possibility of getting new information or checking the information obtained.

In this review of the restart package, the NRC staff has identified items that should be resolved prior to proceeding with wells DC-24, 25, 32, and 33. We are concerned that some of the types of concerns identified may be indicative of an ineffective QA program and inadequate program control. As discussed in more detail below and in specific comments which are enclosed, the main concerns identified are in regard to the scope of the restart package, the incomplete nature of the restart package, the use of draft documents, inconsistencies in the documents, the Quality Assurance program and Quality Level assignments.

The restart package did not contain an overview that clearly laid out the scope of the overall work and define how the individual documents fit together into an integrated program for drilling and geophysical logging. This matter was discussed in conference calls with DOE - Headquarters, DOE-BWIP and Westinghouse staff where the NRC was informed that the restart package represented the documents necessary to take all four well through drilling and initial geophysical logging and that DOE Letter No. R87-2380 in the restart package presented the overview. Subsequent NRC re-review of this document indicated that this document did not contain the requested information.

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As discussed in a July 27, 1987 telephone call, a significant number of documents which the NRC staff consider relevant to the review were not provided. This conclusion is based primarily on a comparison of the documents received in the restart package versus the Technical Operating Procedures listed in SD-BWI-TP-045. A list of these documents is provided in Enclosure 1. It appears that prerequisite documents not in place when work begins will be integrated with completed work once the documents are completed. In addition, the DOE restart package contained draft documents, and documents that specifically stated "Not to cite or quote". Also our review indicated inconsistencies (e.g., locations for DC-32 and 33) among the various documents which further indicate the draft nature of some documents.

With regard to quality assurance, a number of QA documents which apply to this work are currently under review by NRC and NRC has identified outstanding issues to DOE. It is possible that some of these issues may not apply directly to the drilling of DC-24/25. However, each issue should be addressed and a determination made as to its effect on drilling. In addition, there are a number of quality assurance comments in Enclosure 2 as well as technical comments in other enclosures that directly relate to quality. We therefore have reservations about the effectiveness and implementation of QA for the activities described in the restart package since based on our review we can not conclude that there is good assurance that the QA is adequate. This could also be an issue in a licensing hearing in that DOE proceeded to collect data without an acceptable program. The NRC staff position is that no new work needed to support licensing findings should be initiated without proper quality assurance controls in place. Finally, with regards to the quality level assignments, in this document the Quality Evaluation Board has assigned a QA level 3 to borehole geologic logs. One of the considerations is that the information on logs will not be used in site characterization. The NRC does not agree with this assignment because the data gained from the geologic logs are the basis for several level 1 activities (see Enclosure 2).

In response to your request to separate out comments related to initial drilling and logging from subsequent activities, comments related to the drilling and initial geophysical logging of wells DC-24, 25, 32, and 33 are provided in Enclosure 3 and comments related to activities that go beyond drilling and initial logging are provided in Enclosure 4.

If you have any questions regarding the above comments or would like to set up a meeting or conference call to discuss our concerns, please contact me or Sandra L. Wastler of my staff at FTS 427-4780.



John J. Linehan, Section Leader  
Projects Section  
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Enclosures:  
As stated

ENCLOSURE 1

Comparison of the documents received in the restart package versus those documents listed in the attachment to June 26, 1987 cover letter entitled Specific Documents Required For Drilling and Borehole Geophysical Logging and the Technical Operating Procedures listed in SD-BWI-TP-045 indicate that a significant number of documents relevant to the review were not provided.

The following generic technical operating procedures and letters relevant to the drilling and initial geophysical logging of DC-24,25,32,and 33 were not received and should be provided:

LTR No. R85-4159  
LTR No. R86-0310  
DT-ES-102  
DT-ES-106  
DT-ES-122  
DT-ES-405  
AT-ES-203  
GT-ES-104  
GT-ES-105  
GT-ES-302  
GT-ES-304  
GT-ES-309  
GT-ES-311  
GT-ES-312  
GT-ES-316  
GT-ES-323

BER-1987-005  
BER-1987-006  
HT-ES-203  
HT-ES-209  
HT-ES-211  
HT-ES-213  
HT-ES-214  
HT-ES-214  
HT-ES-226  
LO-TL-006  
LO-TL-033  
LO-TL-126  
LO-TL-138  
GM-ES-500  
GT-ES-313  
GT-ES-322  
DT-ES-404

QUALITY ASSURANCE COMMENTS ON BWIP  
RESTART PACKAGE

1. Based upon our limited review, it appears that DOE-BWIP has developed a system of Quality Assurance procedures which may be overly complex. The specifications, HS-BC-0001 through HS-BC-0008 and the accompanying drawings are very clear, well written documents. From these documents it is very easy to understand how the boreholes and piezometers will be constructed, the procedures which will be used and the acceptance criteria which will be utilized by BWIP. A large amount of the same information is also presented in SD-BWI-SP-057, SD-BW-TN-010, SD-BWI-TP-045 and FI-DC-241. However, in these documents the information is never presented as clearly and concisely as it is presented in the above specifications. In general, what is clear in one set of documents is not clear in another. There are no central stand-alone documents, there is considerable cross-reference to other documents and the hierarchy of documents is unclear. There appears to be no reason why the information has to be presented more than once. We would recommend that duplication of this type of instructions and procedures be minimized since the possibility exists that conflicting instructions will result if the basic information is not duplicated exactly.
  - a. According to the section on "PURPOSE" in FI-DC-241, this is the procedure which controls the drilling of DC-24CX, however it does not reference HS-BC-0001, the "specification for borehole drilling/construction, CX piezometer facilities". FI-DC-241 is a very general document which leaves in question exactly what is expected, whereas HS-BC-0001 contains very specific requirements which are sometimes stated differently. For example, 6.2.1.1 of FI-DC-241 requires that "Maximum allowable change in deviation between two consecutive measurements is 1 degree and no more than 5 degrees total deviation at any point in the borehole" while 3.2.2.3. of HS-BC-0001 requires that "indicated inclination for any single measurement shall not exceed 5 degrees from vertical, and the change in indicated inclination between two consecutive measurements shall not exceed 1 degree. In addition, the completed borehole shall be such that the absolute deviation from the hole centerline of the surface entry point of the hole centerline of any other measurement point (8.1) in the hole does not exceed 5 degrees from the vertical". Which document is the controlling document for the drilling operations and exactly what specification will be the controlling specification?
  - b. SD-BWI-TN-010 specifies that a location for DC-32CX which is different than the location specified in the specifications and SD-BWI-TP-045. The difference in location is greater than the

difference allowed in SD-BWI-TN-010. Where is this borehole to be drilled?

- c. The Quality Assurance standing of the various documents is in question. The TOPs have an approval sheet which requires a sign off by a Quality Assurance representative, however this sign off has been completed for certain documents such as TOP GT-ES-301 but listed as N/A for HT-ES-200. The approval sheet for the specifications is an entirely different list. Are the specifications a quality assurance document? Do the drilling contractors bid against the specifications and work against the specifications but for quality assurance are judged against the TOPs? Which document controls the work?
- d. The Study Plans, Test Plans, Test and Operations Procedures and Specifications continually repeat and restate much of the same material. As such if there is a change in one document all other documents must be changed. As stated in 4 above, the location of SC-32CX is stated different in different documents but in addition the location of DC-33CX is shown differently in the specifications than it is in the hydrology study plan. Which locations are correct and how many documents will have to be changed to assure that the locations shown and listed are the correct ones?

2. SD-BWI-AP-031; QUALITY EVALUATION BOARD LEVEL ASSIGNMENTS, EXPEDITED SPECIAL CASE FOR RESTART OF BOREHOLES DC-23, 24, 25, 32 AND 3.

Comment 1, pages 153-158, Section 3.3.7, Item 7, BHL-003-07; Materials Item Analysis.

In this section the Quality Evaluation Board has assigned a QA level of 3 to procurement of materials such as piezometer tubing, screens, filter sand and the like. The logic which is used is that these materials do not need to be level 1 materials as verification, testing, and calibration will demonstrate that these materials meet the required standards. For example, under section 3.3.3., the testing of the tubing is listed as a level 1 activity even though in section 3.3.7 the tubing is listed as level 3. The staff agrees that standard industrial tubing is of satisfactory quality for performing the assigned tests and that inspection and testing of this material is necessary to assure the tubing meets the required standards. The staff is unsure as to which procedure will be the basis for assuring documentation that the tubing is of sufficient quality to meet the intended purpose. By listing the material in two sections with conflicting QA levels assigned there is the possibility that improper procedures for documentation will be followed. The staff would recommend that the tubing just be listed in one section, for example section 3.3.3, and state that industrial grade material is sufficient and that this will be inspected and tested to assure that it meets project specifications. A similar example is the case of filter sand. This is also listed as a level 3 material while in section 3.3.4, where filter pack placement for

piezometers is discussed as a level 1 activity, it states that improper specifications of the sand pack may allow the cement to enter the lower levels of the sand pack and possibly plug the piezometer screen or test interval and in section 4.0 of HS-BC-0003 very specific specifications are presented for the sand and gravel. Again the staff agrees that standard industrial materials are sufficient to meet the quality standard for the intended purpose, but is unsure of where the BWIP staff will document that the material has been tested and inspected to assure that it is of sufficient quality. By discussing the sand in section 3.3.7 as level 3, and in section 3.3.4 as needing proper characteristics to assure the successful completion of the level 1 activity the possibility exists of confusion and lack of traceable documentation to assure the licensability of the required information.

Comment 3, pages 174-180, Section 3.4.3, Item 3, BHL-004-3;; Borehole Geologic Logs Item Analysis.

In this section the Quality Evaluation has assigned a QA level 3 to Borehole geologic logs. One of the considerations is that the "information on the logs will not be used in site characterization". The staff does not agree with this assignment for the following reasons:

- a. In section 3.2.8 the drill cuttings that form the basis for this log are listed as a permanent record and given a level 1 assignment.
  - b. In SD-BWI-SP-035, STRATIGRAPHIC STUDY PLAN, DRAFT C, it is stated that the geologic logs are one of the basis for determining the stratigraphy of the site, a level 1 activity.
  - c. Documentation of the behavior of the drill rig and logging of the cutting samples in the field are integral parts of preparation of the field log. Even without a QA program, standard industry practice requires that accurate field logs be prepared as they are an information source which has been used in court to document the in-situ conditions.
  - d. Logging activities, including field logging, chip sample logging, core logging and electrical logging, must be conducted as an integrated program. By attempting to separate out various components as various levels ignores the fact that one of the resultant products from this activity is the description of the stratigraphy and structure. Applying different handling methods for various similar portions of data which will be used as information sources to determine the stratigraphy and structure may lead to information conflicts which may invalidate larger portions of the program.
4. Page 13, paragraph 2.2 provides a list of items and QA level assignments. Several of the items are classified as level 3 items. The DOE should provide the basis for the level 3 assignments.

5. Based on the information presented in the description on pages 6-11 it is difficult to fully understand the methodology on the classification used on the "Matrix of Interactions chart, e.g., pages 15, 31, etc. It is also difficult to understand what the QAL's mean on the grading Chart List" e.g., pages 16, 26, etc.

NRC COMMENTS ON BWIP RESTART PACKAGE  
RELATED TO DRILLING AND INITIAL GEOPHYSICAL  
LOGGING OF WELLS DC-24, 25, 32, AND 33

1. Test Data Collection Specifications--Drilling, Logging, and Piezometer Installation, Boreholes DC-23GR, DC-24CX, DC-25CX, DC-32CX, and DC-33CX. SD-BWI-TN-010

Pages 28, paragraph 1: It is noted that groundwater pressures will be monitored at the cluster well sites and recorded hourly during drilling, logging, and piezometer installation activities at the proposed cluster sites. It is suggested that the data be recorded more frequently to provide a better record of any hydrologic perturbation that may be caused by these activities.

2. FI-DC-241; Borehole DC-24CX Drilling Activities.

Comment 1, page 3, Section 4.3.1.2.

Within this section it states that the Test Coordinator will receive training as determined by the RM and DD manager. There is no description of the type of training, the frequency of training or the like. The same general statement is presented in other sections such as 4.3.2.2, 4.3.3.2, and 4.3.4.2., however, in these later section specifics are presented on the TOPs which will form the basis for training. More specifics on training requirements are needed.

Comment 2, page 5, Section 4.4.1.

This section states that the site geologist may act as witness for geophysical logging runs in place of the geophysical Logging BTLR while in section 4.4.2 it states that the Geophysical Logging BTLR may act as witness for geophysical logging runs in place of the Site Geologist. For this specific activity the confusion appears to be cleared up in SD-BWI-TP-045, where it states that the Site Geologist has this responsibility and the Geophysical Logging BTLR may witness for the Site Geologist however, in GT-ES-301, the Geophysical Logging BTLR is to witness the geophysical logging operations. In this last document it may just be that BWIP intends that the Geophysics Logging BTLR can witness calibration and the Site Geologist has primary responsibility in the field but the question of who is in charge of what is very unclear.

Comment 3, pages 20-21, Section 5.7.

This section contains forms that verify that people have received training applicable to their duties without listing what is applicable or providing a space to list what training they have received which was determined to be applicable. Verification without a basis for the verification is meaningless.

Comment 4, page 21, Section 5.8.

This section requires that a survey point be surveyed to the nearest 2nd order survey point with no mention of the accuracy that the survey itself must obtain. Are there procedures for surveying and requirements of survey accuracy?

comment 5, page 22-23, Section 6.1.

In this section specifications are listed which appear to be incomplete. For example:

- a. Are there any specifications or requirements for the type of mud to be used?
- b. Are there any other requirements for the casing except that it is to be 30 inch OD butt welded?
- c. After the casing is cut into 20 foot sections is there any requirement that it be rewelded?
- d. Is there any other requirement on the cement except it be ASTM type 2?

The specifications listed in HS-BC-0001 through HS-BC-0008 contain many specifics about these activities which present much clearer instructions as to what is expected. However, these specifications are not contained in FI-DC-241 which appears to be the controlling document. Which documents are the controlling documents? How do the documents fit together?

Comment 6, page 23, Section 6.1.1.

Section 5.8 states that a 0.0 ft. point is established implying measuring accuracy to the nearest tenth of a foot while this section requires measurement to the nearest, .01. What accuracy for elevation is required? What is the relationship of the survey point listed in section 5.8 to the elevation of the ground surface and the kelly bushing elevation? What is the relationship of these data points to the

groundlevel datum referenced in sections 6.1 of DT-ES-320 or the baseline reference logs described in section 3.1.1 of HS-BC-0001?

Comment 7, page 24, Section 6.2.1.1

This section states that single shot deviation surveys will be performed every 100 ft. (plus or minus 20 ft.) but gives no specifications or procedures on how this survey will be conducted. Is this a procedure which has not been completed?

Comment 8, page 24, Section 6.2.1.1.

This section states that the borehole deviation will be no more than 1 degree between any two consecutive measurements or more than 5 degrees overall. The section goes on to state that if this requirement is not met an Interim Problem Report (IPR) will be filed. According to PMPM 7-119, an IPR is a means of documenting a suspected problem and when a problem is clearly a nonconformity an NCR is to be generated without the initiation of an IPR.

If 5 degrees is the maximum allowable deviation and the borehole is past this point there is a real problem not just a suspected problem. Work should either be stopped or a procedure should be in place to bring the borehole back into tolerance. Based on the proposed criteria, if the borehole can not be brought back into tolerance the borehole should be rejected. This is a procedural problem which needs to be corrected.

Comment 9, page 4, Section 4.3.2

In this section a BTLR is required to meet the requirements of an authorized preparer as stated in DT-ES-103. In section 4.4.3 there are not specific requirements stated for the geophysical logging BTLR, however, it would seem that all BTLRs would have to have the same basic qualifications. In DT-ES-103 an authorized preparer is required to have 5 years of drilling related training, while in section 4.3 of GT-ES-301 a geophysical logging BTLR is only required to have 4 years. Is this a mistake or is there an inconsistency in the qualifications need for various personnel.

3. GT-ES-325; Hardware Configuration Control and Software Change for Geophysical Logging

Comment 1, page 18, Section 6.5.2.

Within this section under paragraph 4, the Geological Testing Group Manager is to write an internal letter to the file which states a recognition of the risk of using the required software for geophysical logging software before completion of the final internal development

review. This letter is to state, among other things, that it is recognized that acceptance testing has not been completed, that it is recognized that final technical review has not been completed, and that the software is not eligible for the production library. We understand this letter to mean that the BWIP geologic testing group manager recognizes that they can not at the present time meet the requirements of quality assurance for these procedures. How does the BWIP staff expect the NRC staff to agree that the necessary quality controls are in place to ensure that the drilling work performed will be sufficiently pedigreed for potential licensing actions if the procedures which are to be followed are documentation by the BWIP staff that these are not met? The NRC staff position is that no additional new work need for licensing should be initiated without proper quality assurance controls in place.

4. SD-BWI-TN-010; Test Data Collection Specifications-Drilling, Logging, and Piezometer Installation, Boreholes DC-23GR, DC-24CX, DC-25CX, DC-30 and DC-33CX

Comment 1, page 26, Section 3.3.2.1.

Collecting samples at five-foot intervals might result in the Vanta interbed and Levering flow not being observed or sampled. Both of these units are strategically located in the stratigraphic sequence. The NRC staff suggests that samples be collected at smaller intervals when approaching these units.

Comment 2, page 42, Section 3.4.4, 2nd paragraph.

This paragraph indicates that some of the logging measurements will require comparison with core analysis data and that previously cored boreholes will be used for comparison. The NRC staff questions when this comparison will be performed as sequencing these studies prior to drilling and logging of the CX series boreholes would improve the utility of the information gained.

Comment 3, page 54, Section 3.5, last sentence.

The importance of knowing what unit and structure is being tested suggests that a formal technical review of the stratigraphic and intraflow structure interpretations should be required prior to setting the piezometers.

Comment 4, page 36, Table 3.4.1.

Provide the rationale for not running the types of geophysical logs mentioned in Table 3.4.1 for the full lengths of the open boreholes. For example, running the diameter between depths of 0-1500 feet will provide valuable additional information in this interval. Similarly, running borehole

television, acoustic, and full waveform televiwers along the total length of the boreholes will provide a means of investigating problems encountered during drilling, such as hole caving and spalling and will provide compressional waveform velocity data about the formations.

Also it is suggested that an additional technique, borehole gravity, not mentioned in Table 3.4.1, be considered in the down hole investigations. Borehole gravity can be used as a spot check for density measurements acquired through other means such as the compensated gamma-gamma bulk density technique.

NRC COMMENTS ON BWIP RESTART PACKAGE RELATED TO ACTIVITIES  
BEYOND DRILLING AND INITIAL GEOPHYSICAL LOGGING OF DC-24 AND DC-25

HYDROLOGY

1. During the April 1987 NRC/DOE meeting on pre-exploratory shaft (ES) hydrologic testing, the DOE noted (Summary meeting notes, April 9, 1987, Attachment 2) that the basis for locating the DC-32 and -33 facilities would be provided to NRC prior to pre-test interaction. Our review of the documents in the restart package has not shown that they contain specific criteria for siting these wells. A general discussion of wellsite selection for these and other wells is given on pages 10-13 of SD-BWI-TN-010. Locations for facilities DC-32 and -33 are shown in the Site Groundwater Study Plan, so it appears that siting of the wells has been accomplished. The only criterion that DOE has previously identified for siting the wells is to construct them at intermediate locations between the RRL-2 cluster and the established cluster wellsites DC-19, -20, and -22. Other criteria that have been used by the DOE should be provided.
2. Documents previously received from the DOE have raised possible questions about the integrity of piezometers at the Hanford Site (Rockwell International Internal letter from L. Connell to G. Jackson re: Internal Problem Reports, 2/26/87). The staff is aware that some initial testing of piezometers is currently underway at the site. In the summary meeting notes from the April 1987 meeting on pre-ES testing, the NRC staff noted that the status of grout permeability and piezometer performance remains open until the program of piezometer integrity testing is satisfactorily completed.
3. Hydraulic Head Monitoring for DC-24CX, DC-25CX, DC-32CX, and DC-33CX, GM-ES-110  
Pages 10 and 11: Discussions regarding the Steel Tape Method for head measurements do not refer to calibration of the steel tape. This should be included because of the potential problem of tape "stretch" that can be encountered when making repeated measurements over long periods using the same measuring tape.
4. Entry, Transmittal and Verification of Piezometric, Barometric Data and Calibration Coefficients, HI-ES-700

Pages 2 and 3, section 6.1: Under the section entitled "Water Level Data"

it is recommended that an additional entry be made to show the date of the most recent calibration of the steel measuring tape. This may take the form of a correction factor to be applied to the data collected from that time until the date of the next calibration check.

Pages 8 and 9, section 6.4: This section relates to calibration coefficients for downhole pressure probes. It is recommended that a "drift factor" be included to show the actual variation in the probe readout from the time of installation. It may be useful to provide this in a summary chart format to facilitate review of past trends in drift of a given transducer.

5. Site Groundwater Study Plan, SC-BWI-SP-057

Page 17, Figure 3: Locations of the planned cluster wellsites DC-32 and -33 are shown in this figure. DC-33 is shown to be sited about 1.5 km southeast of DC-32. These locations appear to be inconsistent with the coordinates of these wellsites as shown on the Site Plan, drawing number H-6-4301 (release date 6/19/87).

Page 48, last paragraph: It is stated that "Verification of piezometer integrity will be demonstrated in the post-ES phase with the testing of selected multiple-level piezometers," and that "The integrity of piezometer tubes will be tested in the pre-ES timeframe." Does this mean that the integrity testing now being performed at the Hanford site is restricted to tests of piezometer tubes and does not include cement seals? Concerns about the effectiveness of piezometer integrity in wells built during the pre-ES period should be resolved prior to the initiation of LHS testing. It is emphasized that the NRC staff considers the topic of piezometer integrity to be a major issue at Hanford, and one which should be addressed by the DOE.

6. Test Data Collection Specifications--Drilling, Logging and Piezometer Installation, Boreholes DC-23GR, DC-24CX, DC-25CX, DC-32CX and DC-33CX, SD-BWI-TN-010

Page 57, paragraph 2: It is stated that, upon completion, each piezometer shall be tested for integrity, including the "efficacy of seals" and "tubing leaks." This seems appropriate, but is inconsistent with statements in the Site Groundwater Study Plan which imply that piezometer integrity will be demonstrated in the post-ES phase of testing. Which is correct, pre-ES or post-ES demonstration of integrity? This comment specifically refers to wellsites DC-23, -24, -25, -32, and -33.

Page 57, paragraph 3: "Qualification testing methods" are referred to in the discussion about integrity testing of piezometer seals. No detailed references are given to identify sources of the appropriate testing methods.

Page 58, paragraph 1: It is stated that "Fluid temperature logs shall be run in piezometer tubes in accordance with approved TOP's ..." This is confusing because the TOP's are not identified. The TOP's should be clearly cross-referenced by the DOE.

### GEOCHEMISTRY

7. The DOE indicates that procedures describing their methodology to identify stratigraphic units have not yet been developed. Since the intent of the drilling restart program is to place piezometers within the flow tops of seven basalt flows, we consider accurate stratigraphic identification and correlation to be essential to the proper placement of the piezometers. In the eventual determination of whether data collected from this restart program will be adequate for licensing, the resolution of the stratigraphic identification methodology will be of prime importance. It appears that the DOE is prepared to begin piezometer installation in the absence of formally established criteria to assure proper stratigraphic location of the piezometers. Thus it appears that the geochemical information would be backfitted to confirm whether the piezometers have been located properly.
8. It is not clear from the review of the restart package documents the extent to which the proposed drilling and sampling program has been integrated with the sampling needs of other investigations, and vice versa. The NRC staff suggests that the DOE stress the integration of the hydrology drilling program with other disciplines (for example, mineralogy/petrology, hydrochemistry, rock mechanics) if possible. The integration of sampling programs could reduce the impacts of drilling and sampling programs on site performance (as per 10CFR60.15(d)).
9. Descriptions of the geochemical analyses that will be used in identifying and correlating the rock units are found in the BWIP documents included in the restart package (i.e., SD-BWI-SP-035, Stratigraphy Study Plan; SD-BWI-SP-057, Site Groundwater Study Plan; SD-BWI-TN-010, Test Data Collection Specifications - Boreholes DC-32GR, DC-24CX, DC-25CX, DC-32CX, and DC-33CX). Some of the geochemical methods suggested for use in identification and correlation include rock chemistry and discriminate analysis of rock chemistry data, hydrochemistry, and rock age dating. The NRC staff agrees that geochemical methods can provide information that will be useful in the identification and correlation of rock units. Documents specific to the restart program (such as Request for Extended Special Case Restart Drilling and Piezometer Installation for Boreholes DC-23, 24, 25, 32, and 33) however, discuss only the use of rock chemistry data. This discussion does not provide sufficient detail for the NRC staff to determine whether this single approach will provide distinctive chemical data that can be used in the identification and correlation of

rock units. In addition, it is not clear from the restart documents that geochemical methods other than rock chemistry will be used in correlations. The NRC staff considers that a combination of geochemical methods (rock mineralogy/petrology, hydrochemistry data used in conjunction with interpretive chemical computer codes, isotopic dating techniques) will provide data that could be useful in the identification and correlation of rock units.

10. The restart package documents state that rock samples for chemical analyses will be collected as (drilling fluid) chip samples. The documents do not address how accurately the depth from which a particular rock chip originated can be determined. The DOE should determine the accuracy of such depth determinations, and consider how inaccuracy in this sampling technique could affect stratigraphic correlations using geochemical data. The NRC staff considers that more accurate discrimination of depth (if required) could be obtained by using alternative sampling methods. Such alternative methods could include coring and then reaming out the hole to accommodate piezometer installation, combining rotary drilling with coring or sidewall coring (the use of sidewall coring is currently being planned in paleomagnetism investigations).

#### GEOLOGY - GEOPHYSICS

11. The NRC staff considers that attempts to characterize intraflow structures but not tectonic structures (i.e., breccia zones) will not provide the needed data for characterization of the rock-mass. Specifically, SD-BWI-TN-010 (page 39) indicates that the Intraflow Structure Study Plan will be used to provide data needed to define the rock-mass characteristics of boreholes. Tectonic features are equally important in defining rock-mass characteristics, but they will not be addressed. The staff believes that not addressing tectonic structures unjustifiably deemphasizes the possible presence of structural features in the Controlled Area Study Zone (CASZ).
12. There is no indication that BWIP intends to test for methane in the holes to be drilled. The NRC staff considers the potential for hydrocarbon resources in the vicinity of the CASZ is unresolved and suggests that testing for methane be performed.
13. The NRC staff considers that without a more detailed program for basalt flow identification than is planned, BWIP may not precisely know which interval they are testing. For example RHO-BWI-SA-344 (page B-2) indicates that. "Although the Wanapum Basalt was frequently penetrated by boreholes, certain chemical and physical factors thwarted confident identification of the Wanapum basalt flows." This report also indicates that multiple vesicular zones occur within individual basalt flows. While geophysical logs helped in two holes, this report suggests that differentiating flows in the Wanapum may not be possible in rotary holes.

**14. SD-BWI-SP-035; Stratigraphic Study Plan, Draft 2**

Comment 1, page 9, Table 3 and page 29, Section 3.1.1, 2nd paragraph.

The goal for the identification of flows (excluding the Cohasset flow) is given as + 1 unit (flow?). If geotechnical investigations are based on an inaccurately defined stratigraphy, the results will not be meaningful input to performance assessment. Positive identification of the primary isolation zone flows should be accomplished for all boreholes and shafts in the CASZ.

Comment 2, page 27, Section 3.1.1.1.

Paragraph 1 discusses the importance of the borehole magnetometer and the natural gamma log for primary identification of basalt flows. A useful addition to this section (or a related study plan) would be a description of the confidence that can be placed in correlating the potassium-40 content of flows with the natural gamma log response. The NRC staff has not seen documentation of this method as applied to Columbia River Basalt flow correlations.

Comment 3, page 27, Section 3.1.1.2.

This section describes the general approach used to identify basalt flows in the Pasco Basin; however, no comprehensive procedure that describes the integration of geologic/geophysical/geochemical data as applied by the BWIP is referenced. Development of a flow identification procedure would allow the BWIP geology group to clearly state how flow identification is performed and enable outside persons to easily evaluate the validity of this portion of the project.

Comment 4, page 13, Figure 1.

Outcrop patterns as well as maps in other publications suggest that the structure between the Rattlesnake Hills and the Yakima Ridge anticline should be a syncline rather than an anticline.

Comment 5, page 25, Section 3.1.1.1.

RHO-BWI-ST-14 (page 4-17) suggests that the flows in the upper part of the Sentinel Bluffs Sequence are differentiated based on their chromium contents and paleomagnetic signature. If trace element analyses will not be done on samples from these holes and paleomagnetic surveys cannot be performed on rotary holes, how will these flows be differentiated?

Comment 6, page 28, Table 6.

This table does not convey the information necessary to identify specific units and should be revised. RHO-BWI-ST-4 has tables that actually define the characteristics of the various flows. Does this table indicate that the on site geologist will have to refer to the references to determine which flow he has drilled through?

Comment 7, pages 32 and 33, Sections 3.1.2.1 and 3.1.3.1.

The FEA indicates that a precisely logged hole in the RRL currently allows the uncertainty of the basalt-sediment contact to be reduced to an estimated 8 meters (p. C.5-124). This suggests that locating internal boundary contacts within  $\pm 1$  m is not possible.

15. GT-ES-314; Field Set Up, Calibration, and Operation of the CNT Porosity, CDT and GR Tool Str.

Page 8, Section 5.2.

This section states that the calibration requirements for the thermometer are for calibration to the following points: 40°, 75° and 120° F. Is there any relationship between this thermometer and the thermometer referenced in section 5.2 of GT-ES-306 which is to be calibrated to 45°, 75°, 105°, 135°, 165° and 195° F? It would seem that thermometers which are to calibrate geophysical test equipment, which requires temperature calibration at the lands surface should be the same calibration standards, and if these are the requirements for the geophysical crew it would seem most logical that only one thermometer be used, along with only one calibration standard.

16. SD-BWI-SP-036; Intraflow Structure Study Plan

This section, by reference to the "Physical Rock Properties Characterization Study Plan", discusses plans to rerun geophysical logs in previously drilled holes. In light of poor calibration and standardization practices in the past, these activities will be very useful. However, the plans are not discussed in detail and the referenced document was not transmitted to the NRC. NRC staff would like to see details concerning the extent and timing of plans to rerun geophysical logs at Hanford.

Comment 2, page 20, Section 3.1.2., paragraph 2 and page 25, Section 3.1.3. paragraph 2.

On page 20, the discussion states that shallow top-of-basalt wells will be drilled around boreholes RRL-17, RRL-18, and RRL-19 "aid in reducing uncertainties in positions of bottom of flow top and top of flow bottom in the Cohasset flow at these locations...". On page 25, it is further explained that the top-of-basalt surface will be used as a datum from

which to project to depth (thereby reducing one level of uncertainty above the Cohasset flow). However, as stated on page 25, the elevation of the top of the basalt may have been controlled by several processes (post-Columbia River Basalt time erosion, nondeposition of post-Cohasset time flows) that have had no influence on the elevation of the Cohasset flow. The NRC staff questions the validity of using top-of-basalt elevations to reduce the uncertainty associated with interpolating the depth to the Cohasset when no Cohasset-level well control exists.

Comment 3, page 65, Section 4.0, Paragraph 3.

This section describes intraflow structure study-related deliverable products for the first year of site characterization. It does not specify if or the extent to which this information will be used for pre-ES hydrologic test activities. A concise description of how and when the intraflow structure study data will be used (with respect to hydrologic testing) would be a useful addition to this section.

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