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Status of Nuclear Regulatory Commission Concerns Pertaining to the Site Characterization Report

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Prepared by (Name and Dept. No.)
BWIP Licensing Department and Staff (B10700)
A. C. Rutz ACRutz
See reverse side for additional approvals

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Abstract

This document represents a recapitulation of the Nuclear Regulatory Commission's (NRC's) comments and concerns pertinent to the Site Characterization Report, including the Basalt Waste Isolation Project (BWIP) dispositions and responses to the NRC comments, as presented in the Draft Site Characterization Analysis. The focus is on the adequacy and sufficiency of BWIP characterization activities from the licensing standpoint. The document further reflects the opinions and clarifications offered at a meeting between NRC, the Department of Energy, and BWIP, June 13-17, 1983, and serves as the vehicle which ensures that NRC concerns will be addressed as site characterization proceeds.

Specific concerns which remain "open" (i.e., unresolved) have been excerpted from the tables, the major issues forming the first table, and the list of all "open" items serving to conclude the document.

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Prepared By: RHO

Used By: DOE

*	Distribution Name	Mail Address
*	R. C. Arnett	1135JAD/1100
*	J. L. Ash	PBB/1100
*	H. Babad	PBB/1100
*	R. G. Baca	1135JAD/1100
*	J. D. Bazemore	PBB/1100
*	M. S. Bensky	1135JAD/1100
*	D. J. Brown	PBB/1100
*	J. A. Caggiano	PBB/1100
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*	R. A. Deju (2)	PBB/1100
*	H. B. Dietz	MO-408/600
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*	G. C. Evans	PBB/1100
*	L. R. Fitch	PBB/1100
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*	E. L. Moore	MO-407/200E
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*	M. F. Nicol	PBB/1100
*	S. M. Price	PBB/1100
	P. J. Reder PR	1135JAD/1100
*	A. C. Rutz	PBB/1100

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- ☐ _____ Program Office
- ☐ _____ Research and Engineering
- ☐ _____ Plant Operations
- ☐ _____ Health, Safety and Environment
- ☒ M. F. Nicol 8/30/83 Quality Assurance
- ☐ _____ Training
- ☒ L. R. Fitch, Manager, Research and Licensing End Function 8/30/83
- ☒ J. H. LaRue, Manager, Licensing End Function
- ☒ D. J. Brown
- ☐ _____
- ☐ _____
- ☐ _____
- ☒ R. A. Deju, Director, BWIP Approval Authority

Additional Approvals:

J. L. Ash, Manager, Engineering Design Department

G. S. Hunt, Manager, Site Department

8/31/83
M. J. Smith, Manager, Engineered Barriers Department

D. A. Turner 8-30-83
D. A. Turner, Manager, Engineering Development Department

R T Wilde 8-30-83
R. T. Wilde, Acting Manager, Project Integration and Performance Assessment Department

* Distribution	Name	Mail Address
*	C. A. Shepard	PBB/1100
*	M. J. Smith	2101M/200E
*	J. C. Sonnichsen	1135JAD/1100
*	A. M. Tallman	PBB/1100
*	D. A. Turner	PBB/1100
*	R. T. Wilde	1135JAD/1100
*	Records Retention (2)	1135JAD/1100
*	W. F. Todish (2)	1135JAD/1100
*	D. J. Squires (DOE) (50)	Fed Bldg/700

FOREWORD

The Basalt Waste Isolation Project (BWIP) is part of the national effort by the U.S. Department of Energy (DOE) to identify a site suitable for a nuclear waste repository. The BWIP's mission is to assess whether or not a nuclear waste repository can be sited in the basalts beneath the Hanford Site. Studies to date on the project are summarized in the BWIP Site Characterization Report (SCR) which was submitted by the DOE to the U.S. Nuclear Regulatory Commission (NRC) in November 1982.

The purpose of the SCR is to provide the status of the preliminary site characterization work and identify the data yet to be obtained for detailed site characterization. The plans for acquiring the needed data during the detailed site characterization phase were also included in the SCR. The SCR focuses on the preliminary geology and hydrology studies and includes some of the initial work in the development of nuclear waste packages and repository-engineering studies. Special emphasis has been placed on the early work in development of performance standards for radionuclide release that will be required of the geologic, waste package, and repository systems.

The NRC reviewed the SCR and submitted their comments to DOE in a document called the Draft Site Characterization Analysis (DSCA) in March 1983. In the DSCA the NRC addresses both the sufficiency of current information in the SCR and adequacy of plans outlined in the SCR. Specifically, the NRC reviewed the BWIP SCR in terms of licensing information needs: (1) does it adequately identify potential licensing issues? (2) does it adequately describe the level of knowledge and uncertainty associated with the results of investigations to date? and, (3) are the proposed investigations adequate to obtain the remaining information needed to address the licensing issues? Comments were made by the NRC on each of the main chapters (Chapters 3 through 10) with specific comments detailed in Appendix B of the DSCA.

In order to systematically respond to the NRC's comments as raised in their DSCA, the DOE produced disposition/response tables. The tables listed each separate concern raised in the DSCA and in a disposition column either identified an agreement with NRC's concern, requested clarification from NRC, or identified disagreement which required further consultation between DOE and NRC. Following the disposition, a narrative response was included to expand on the disposition and/or commit to its resolution at defined points in the next site characterization document, the Site Characterization Plan (SCP). Clarification of issues, modification of some responses, and a process for resolving any open issues in the draft tables were agreed to by the DOE and the NRC during meetings June 13-16, 1983. These meetings were conducted as concurrent, topical sessions in order to provide an item-by-item review of both the NRC's concern and the DOE disposition and response. The goal was to attain concensus, even if it be to declare the concern "open," and to provide a framework of NRC concerns to be addressed in the SCP.

The SCP is required by the Nuclear Waste Policy Act of 1982, which was passed in January 1983, after the submittal of the SCR to the NRC. The Nuclear Waste Policy Act specifies the content of the SCP, which basically includes an update of information in the SCR and adds two chapters; Chapter 20 "Criteria to Assess Suitability of the Site" and Chapter 21 "Decontamination and Decommissioning Plan for the Site." The addition of the SCP also allows for comments on the BWIP SCR to be addressed or included in the SCP.

The following final tables also include the results of the June meetings between the NRC, DOE, and BWIP. Thirty-four major open items are identified and briefly discussed in a narrative form in Table 1. "Open" items are those for which a resolution has not yet been agreed upon by DOE and NRC. The NRC and the DOE have agreed to further consultation between their respective technical representatives to approach resolution on these major items. Nine technical, topical workshops have been proposed to discuss these priority items.

Table II addresses the NRC concerns from the DSCA text, Chapters 1 through 11 (Chapter 11 contains a summary of NRC concerns specified in Chapters 1 through 10.) However, several concerns found elsewhere in these text chapters were not included in Chapter 11 and have therefore been added to Table II. Table III addresses NRC issues as they were organized in the DSCA Appendices A and B. It should be noted that based on further interpretation some dispositions in Table III have changed following the June meetings. In those instances, the original dispostion is parenthetically followed by the revised dispositon. The response shown matches the revised disposition. Table IV is a comprehensive list of all open issues.

It is intended that these tables comprise a tool to systematically approach resolution of the NRC's comments and concerns as site characterization proceeds. They also provide a checklist to ensure that each of the NRC's comments and concerns will be addressed in the SCP.

TABLE I

MAJOR OPEN ITEMS IDENTIFIED AT JUNE 13-17, 1983
MEETING WITH NUCLEAR REGULATORY COMMISSION

TABLE I

HYDROGEOLOGY (1-3)

A description of the Basalt Waste Isolation Project's (BWIP's) program for completing hydrogeologic characterization of the site should be provided. The description should be complete enough that reviewers can assess the appropriateness of the program to resolution of concerns. The descriptions should include the following features:

1. Piezometric Monitoring - The piezometric monitoring program should be described, including location and construction of additional piezometers and the schedule for installation, equilibration, and establishment of a piezometric baseline. Utilization of piezometers to determine the uncertainties in drill and test head data should be described. A consensus should be obtained that a baseline has been established before the site is subjected to major hydraulic disturbances such as large-scale pump testing or Exploratory Shaft construction.

2. Large-Scale Pumping Test - The program for installing additional pumping wells to conduct large-scale hydraulic tests should be described. The description should include location of the wells, construction, and objectives to be met. Objectives to be met include determining the representativeness of data obtained from single and dual-well testing, determination of heterogenities across the reference repository location (RRL), and determination of large-scale (vertical conductivity) values.

3. Utilization of Hydrochemistry Data - The BWIP program for utilizing hydrochemistry data in support of hydraulic flow system determination should be described. The description should include a discussion of how hydrochemistry is used to support conceptual model formulation, a discussion of how hydraulic models can be tested by geochemical modeling, and plans for determining how geochemical factors affect radionuclide retardation.

PERFORMANCE ASSESSMENT (4-10)

4. The BWIP methods for calculating groundwater flow paths and traveltimes, as compared to those used by the U.S. Nuclear Regulatory Commission (NRC) must be discussed with the NRC in order to develop a consensus on methods that are applicable to the geology of the BWIP candidate site and in order to achieve closure on calculations made.

5. The technical bases used by BWIP for judging compliance with the U.S. Environmental Protection Agency (EPA) draft standard, as compared to those of the NRC, need to be discussed with the NRC in order to develop a consensus on quantitative isolation performance assurance requirements, i.e., defining what constitutes a reasonable expectation of compliance with the EPA standard.

TABLE I

6. The specific numerical models (computer codes) that will be used by the BWIP to predict subsystem performance should be described and discussed with the NRC in order to assure that the BWIP understands the NRC's data requirements, capabilities, and limitations.

7. The processes of code verification, benchmarking, and validation being used by the BWIP need to be discussed with the NRC in order to develop test cases applicable to the BWIP candidate site and to elicit agreement on acceptable criteria.

8. The BWIP needs to confer with the NRC on acceptable approaches for calculating the radionuclide source term at the scale of the waste package. Results of such discussions will help determine which specific physical and geochemical processes are of key importance in the basalt environment.

9. The BWIP's process for selection of disruptive scenarios applicable to BWIP's candidate site should be reviewed by the NRC to develop a consensus between BWIP and NRC on scenarios to be considered in pre- and post-closure performance assessments.

10. The BWIP's planned basis for determining the location and exent of the disturbed rock zone must be presented to the NRC. Discussion of the plans with the NRC will help in development of an applicable quantitative definition.

GEOLOGY (11-14)

11. The BWIP needs to present plans to the NRC for geologic and geophysical investigations that will adequately characterize the stratigraphic (primary) and structural (secondary) discontinuities of the basalts within the Cold Creek syncline.

12. The BWIP needs to show the NRC that the planned geologic, geophysical, and surveillance investigations will adequately define the characteristics of near- and far-field seismic events (seismicity).

13. In order to formulate an adequate definition of the nature and rates of tectonic processes, BWIP needs to develop one or more tectonic models consistent with the geologic data.

14. The BWIP needs to expand characterization plans to include a determination of the mineralogy of flow tops and interbeds along potential groundwater flow paths.

TABLE I

GEOCHEMISTRY (15-25)

15. The BWIP needs to expand its presentation to the NRC of plans (testing and analysis) regarding approaches to bounding or limiting the geochemical data requirements for site characterization, experimental assumptions, experimental design, experimental methods, approaches to data analysis, and detailed milestones.

16. The BWIP, as part of its site characterization effort, must develop a sufficient data base to adequately define site redox conditions through time and their effect on radionuclide solubility/sorption. These data are basic to the evaluation of the site isolation capability and to the waste package/repository seal design effort.

17. The BWIP needs to develop a sufficient data base to support the contention that the basalt groundwater and geochemical environment is benign. The NRC feels that this conclusion is premature because of the limited data available, the problems with determining uncontaminated downhole measurements, and outstanding questions on the interpretation of data.

18. The BWIP needs to present to the NRC how they have or intend to extrapolate data for short-term laboratory scale experiments to the prediction of long-term repository behavior. In particular, the uncertainties involved in this extrapolation must be evaluated.

19. The BWIP needs to present to the NRC how they plan to establish the reliability of the thermodynamic data used in geochemical modeling. Because repository conditions will be changing through time and space, the prudent approach includes models to determine solubility under the whole range of possible conditions, and experimentally verifying thermodynamic phase boundaries pertinent to solubility relationships.

20. The BWIP should approach determination of radionuclide solubility from both oversaturation and undersaturation.

21. The BWIP should measure radionuclide solubilities as a function of temperature for critical important solid phases and aqueous species.

22. The BWIP should include in the Site Characterization Plan (SCP) an evaluation of pH buffering couples other than $H_4SiO_4^-$ that are found in the reference BWIP groundwaters (e.g., HCO_3/CO_3, H_2O/OH^-).

23. The BWIP needs to present to the NRC how they have or intend to address the uncertainties associated with radionuclide solubilities and associated geochemical parameters: T, P, redox, pH, groundwater flow, and composition. Until the uncertainties associated with the above parameters are significantly reduced, little confidence can be placed in preliminary quantitative assessment regarding the extent that solubilities of certain radionuclide species have been bounded sufficiently to demonstrate satisfaction of the proposed EPA standard for those nuclides.

TABLE I

24. The BWIP should complete an investigation of the origin of the fluoride in the groundwaters and the control by the host rock. The fluoride levels in Grande Ronde groundwaters may be high enough to increase the canister corrosion rates and actinide solubilities.

25. The discussion BWIP provided on whether radionuclide releases are leach limited or solubility limited should be expanded to support BWIP's solubility limited radionuclide release approach.

WASTE PACKAGE (26-28)

26. The BWIP needs to present to the NRC how they have or intend to develop and implement a reliability program to demonstrate that the waste package satisfies NRC performance criteria and subtier design limits.

27. The BWIP, as part of site characterization, must complete an engineering analysis of failure modes for the life history of the waste package and estimate their contribution toward failure. Results of this analysis should be factored into an assessment to ascertain whether or not the package meets the required criteria with the needed reliability.

28. The details of BWIP plans to predict changes in the chemical environment surrounding the waste package should be expanded. These data are basic to the evaluation of barrier components performance and radionuclide transport.

REPOSITORY DESIGN (29-32)

29. A meeting with the NRC is needed to resolve the extent of underground testing envisioned by NRC versus that envisioned by BWIP.

30. A meeting with the NRC is needed to evaluate the design criteria and design alternates which will be considered in the conceptual design of the seal systems for shafts and underground openings. It is expected that the critical features of the design will be identified.

31. The BWIP, in conjunction with the Architect-Engineer, is currently assessing alternate waste emplacement configurations. The BWIP needs to discuss with the NRC the retrieval criteria that will serve as a basis for evaluating the emplacement alternates.

TABLE I

32. The BWIP needs to define requirements for stable openings before final design for repository openings can be made. The stability requirement can be addressed in terms of maximum allowable deformation of an opening, or maximum allowable stresses around the openings, or a combination of both. The method of analysis and the method of monitoring for design verification need to be discussed with the NRC at an early date.

QUALITY ASSURANCE (33-34)

33. The BWIP must expedite the process for public clearance of manuals, procedures, and other supporting documents, permitting them to be made available to the NRC in a timely manner.

34. A greater level of detail must be included in the SCP regarding quality assurance, especially in regards to the U.S. Department of Energy (DOE) Quality Assurance program.

TABLE II

STATUS OF SPECIFIC ISSUES FROM CHAPTERS 1-11 OF THE DSCA

TABLE II

GROUNDWATER

ITEM REFERENCE: Page xii, paragraph 2

NRC COMMENT: "Uncertainties...on groundwater flow system are inadequately conveyed..."

STATUS: Agreed

BWIP RESPONSE: Comprehensive programmatic planning is underway to identify uncertainties, assess the acceptability of current uncertainties, and reduce them where required. A framework for this planning effort will be given in Chapter 13 of the SCP. Plans will be discussed with the NRC as they are developed.

ITEM REFERENCE: Page xiii and xiv, items 1-4

NRC COMMENT: "Hydraulic data is inadequate to support a defensible conceptual model."

STATUS: Agreed

BWIP RESPONSE: Additional data are required to provide a defensible conceptual model. A discussion of the programs required to obtain the data will be provided in Chapter 13 of the SCP. Details will be provided in appropriate plans. These plans will be discussed with the NRC as they are developed.

ITEM REFERENCE: Page xvi, paragraph 3, items 1 and 2

NRC COMMENT: Item 1. "Large scale...pump tests...on the north and east of the RRL (are required) to adequately establish groundwater flow conditions."

STATUS: Agreed

BWIP RESPONSE: Specific test needs, test designs, and number of required tests should be determined by DC-16 test results. This will be stated in Chapter 13 of the SCP. Additional large scale tests will be conducted. Test plans will be discussed with the NRC as they are developed.

. . . . . .

NRC COMMENT: Item 2. "Head data must be validated by groundwater monitoring techniques."

STATUS: Agreed

TABLE II

GROUNDWATER

BWIP RESPONSE: Detailed plans for this validation will be provided in the groundwater monitoring plan. Additional monitoring wells will be drilled. Plans will be discussed with the NRC as they are developed.

ITEM REFERENCE: Pages xx and xxi

NRC COMMENT: "A careful and clearly documented strategy for data collection and intepretation must be provided."

STATUS: Agreed

BWIP RESPONSE: Chapter 13 of the SCP will contain a framework under which this planning will take place. Programmatic planning documents will provide the necessary detail. These planning documents will be discussed with the NRC as they are developed.

ITEM REFERENCE: Section 3.4.3, page 3-10, last sentence

NRC COMMENT: "Furthermore, the...Carbon-14 relationships." (Need for paleohydrologic and paleoclimatological models.)

STATUS: Open

BWIP RESPONSE: We would like to understand what paleohydrologic and paleoclimatological modeling techniques are being proposed. (NRC will provide written clarification.)

ITEM REFERENCE: Section 3.5, page 3-11, 3-12, items 1-5

NRC COMMENT: Item 1. "Representative Hydraulic Parameter Values" - (Need for state-of-the-art large-scale multiple well pumping tests.)

STATUS: Agreed

BWIP RESPONSE: Large scale pumping tests from DC-16B will be conducted to obtain the required data at a location south of the RRL. Additional clusters of wells, including large-scale pumping holes, will be drilled and tested to provide these data at other locations around the RRL. Plans for these tests will be discussed with the NRC as they are developed.

. . . . . .

TABLE II

GROUNDWATER

NRC COMMENT: Item 2. "External Boundary Conditions" - (Need for long-term measurements of hydraulic heads.)

STATUS: Agreed

BWIP RESPONSE: A network of three piezometric monitoring stations, with nine piezometers at each station, will be installed to provide a baseline for calibrating models as well as other functions. This will be discussed in Chapter 13 of the SCP. These plans will be discussed with the NRC as they are developed. Additionally, findings of the Hydrology Model Task Force will be used in the interpretation.

. . . . . .

NRC COMMENT: Item 3. "Effective Porosity" - (Need for state-of-the-art multiple-well tracer tests.)

STATUS: Agreed

BWIP RESPONSE: One tracer test has been conducted and others are being planned at all multiple well sites. The results of the tracer test and status of future plans will be documented in the SCP. These plans will be discussed with the NRC as they are developed.

. . . . . .

NRC COMMENT: Item 4. "Hydrochemistry." First Bullet. (Integration of data with defensible data on the hydraulic flow system is needed.)

STATUS: Agreed

BWIP RESPONSE: Chapter 13 of the SCP will be modified to provide a framework for better integration. Geochemical modeling will be utilized to support integration. Modeling plans will be discussed with the NRC as they are developed.

. . . . . .

NRC COMMENT: Item 4. Second Bullet. (Matrix diffusion data should be obtained to support transport modeling.)

STATUS: Open

BWIP RESPONSE: Discussions with NRC staff are necessary to understand their recommendations. (The NRC will provide additional written references to clarify the techniques.)

. . . . . .

TABLE II

GROUNDWATER

NRC COMMENT: Item 5. "Alternate Conceptual Models" - (Need for sensitivity studies to test alternative conceptual models.)

STATUS: Agreed

BWIP RESPONSE: Chapter 5 of the SCP will be modified to include alternate conceptual models. The conceptual models selected and the sensitivity studies to test these models will be discussed with the NRC at a future date.

TABLE II

GEOLOGY

ITEM REFERENCE: Section 4.3.2, page 4-4, paragraph 1

NRC COMMENT: "The SCR inappropriately places too much emphasis on the predictive accuracy for total flow thickness..."

STATUS: Agreed

BWIP RESPONSE: The predictability of total flow thickness is important for understanding the site stratigraphy but it is our conclusion that thickness of dense interior is more significant relative to repository construction and performance. The SCP will reflect the importance of understanding the thickness of the dense flow interiors.

ITEM REFERENCE: Section 4.3.2, page 4-5, paragraph 2

NRC COMMENT: "...DOE should consider that the intact volumes of rock...are far more complex in structure than the SCR indicates (see page 3.7-28, paragraph 1)."

STATUS: Agreed

BWIP RESPONSE: The BWIP recognizes that the "relatively intact volumes of bedrock in the RRL are complex in structure." A more balanced treatment will be presented in the SCP.

ITEM REFERENCE: Section 4.3.2, page 4-5, paragraph 2, item 3

NRC COMMENT: "...Uncertainties of geologic structure at depth."

STATUS: Agreed

BWIP RESPONSE: The BWIP agrees that more data are needed on possible structures within the basalt underlying the area in and around the RRL. This information is required for performance assessment and the development of a tectonic model(s). Subsequent discussions with the NRC will be held to discuss the matter of constraining uncertainties.

TABLE II

GEOLOGY

ITEM REFERENCE: Section 4.3.2, page 4-5, paragraph 3

NRC COMMENT: "The extent to which these stratigraphic and structural features adversely influence hydrologic isolation, inflow into drifts, and the stability of openings must be determined."

STATUS: Agreed

BWIP RESPONSE: Such determinations, as will be outlined in the SCP, constitute a significant part of BWIP's work. These plans will be integrated with hydrology and engineering.

ITEM REFERENCE: Section 4.3.3, page 4-6, paragraph 3

NRC COMMENT: "DOE should update their references to include alternate tectonic models while completing their detailed studies."

STATUS: Agreed

BWIP RESPONSE: Additional tectonic models will be presented and discussed in the SCP.

ITEM REFERENCE: Section 4.3.3, page 4-6, paragraph 4

NRC COMMENT: Inconsistencies among tectonic models allow large uncertainties in an understanding of tectonic stability; contradictions include estimates of the rate of deformation, degree to which sub-basalt strata are involved in deformation, location of strain within the basalts. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Additional structural data will be collected (i.e., deformation rates, fault orientation, structural rotation, seismic surveillance, etc.) and be used to constrain existing tectonic models. Detailed data from the Pasco Basin will be used, along with tectonic/structural data from the surrounding area to develop a tectonic model(s) for the site.

TABLE II

GEOLOGY

ITEM REFERENCE: Section 4.3.3, page 4-6, paragraph 4

NRC COMMENT: "The possible presence of low-angle-faulting in the Cold Creek syncline and the distribution of swarm earthquakes suggest continuing strain in the Cold Creek syncline."

STATUS: Agreed

BWIP RESPONSE: Plans for assessing possibilities of low-angle faulting will be addressed in Chapter 13 of the SCP.

ITEM REFERENCE: Section 4.4.1, page 4-7, paragraph 3

NRC COMMENT: "The DOE should include plans to retrieve oriented cores to provide definitive data on the orientation of fractures in he candidate repository horizons."

STATUS: Agreed

BWIP RESPONSE: Orientation of core in the Umtanum flow has been attempted in previous coring operations. However, the only available orientation devices for small diameter core depend on magnetic compasses which are notably unreliable in highly magnetic rocks such as basalt. Data on fracture orientation will also be obtained in the Exploratory Shaft, Phase II. Alternate methods for providing definitive data on the orientation of fractures are being investigated.

ITEM REFERENCE: Section 4.4.1, page 4-7, paragraph 3

NRC COMMENT: The DOE should obtain vertical fracture data by means of deviated cored boreholes. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Data on vertical fractures have been obtained from surface exposures but the applicability of such data to the RRL is questioned. The only way to demonstrate that fracture infilling mineralogy and average widths are not different from those encountered in vertical boreholes is to obtain core from deviated boreholes. This has been done in the Umtanum flow (DC-2A1, DC-2A2). These boreholes are not, however, located in the RRL and moreover the Umtanum may not be the preferred candidate horizon. These cores will be analyzed, and based on the results, a limited number of deviated boreholes may be constructed from existing boreholes in the RRL. These boreholes could well

TABLE II

GEOLOGY

be multipurpose, yielding both structural and hydrologic information in addition to the primary purpose of providing data on vertical fractures. Data on vertical fractures will also be obtained in the Exploratory Shaft, Phase II.

ITEM REFERENCE: Section 4.4.1, page 4-7, paragraph 4

NRC COMMENT: "The NRC staff is concerned with format for data presentation in the SCR. Figure 3.5.1 (SCR, page 3.7-27) does not show all data points used to generate the top-of-basalt contour map..."

STATUS: Agreed

BWIP RESPONSE: Data points will be added to the top-of-basalt contour map in either the SCP or in supplementary maps to be provided to the NRC for review.

. . . . . .

NRC COMMENT: "Figure 3.5.2 (SCR, page 3.7-29) does not distinguish between known and inferred structures."

STATUS: Agreed

BWIP RESPONSE: A distinction between known and inferred structures will be made on Figure 3.7-29 of the SCP.

. . . . . .

NRC COMMENT: "Inconsistencies between text, tables, and figures."

STATUS: Agreed

BWIP RESPONSE: Inconsistencies between tables, text, and figures will be corrected.

. . . . . .

NRC COMMENT: "Schematic or incomplete presentation or data..."

STATUS: Agreed

BWIP RESPONSE: Details will be added by inserting data and/or references to published data in the SCP.

TABLE II

GEOLOGY

ITEM REFERENCE: Section 4.4.2, page 4-8, paragraph 2

NRC COMMENT: "Planned studies of lateral variations of basalt flows extending outside the Pasco Basin, north of Vantage, will be limited in use in the...in the RRL."

STATUS: Agreed

BWIP RESPONSE: The limitations of such "analog" studies are recognized by BWIP. However, we would be remiss if we did not conduct such studies as a cost-effective means of developing an understanding of the kinds of lateral variations that can occur in Grande Ronde Basalt. The utility and applicability of "analog" studies was discussed with the NRC at the April 1983 Geologic Stability Workshop. The BWIP plans to proceed with the lateral variation studies described in the SCR.

ITEM REFERENCE: Section 4.4.2, page 4-8, paragraph 4

NRC COMMENT: "Preliminary confirmation of the adequacy of the internal stratigraphy and structure of the repository horizon will not be addressed until ES-II testing is completed in FY 1986 (SCR, page 17.3-3). Thus, recommended repository horizons will be chosen before DOE has completed preliminary confirmation of these horizons."

STATUS: Agreed

BWIP RESPONSE: The currently available information appears to be adequate to identify a preferred candidate horizon for exploratory shaft breakout. This information, and the process used to identify the preferred horizon, is currently being documented. Details will be provided in RHO-BW-ST-28 P, "Horizon Identification Study."

ITEM REFERENCE: Section 4.4.2, page 4-8, paragraph 4

NRC COMMENT: "...the NRC staff is concerned that the proposed boring program will not adequately define the subsurface geology so that engineering fixes will effectively resolve geologic problems..."

STATUS: Agreed

BWIP STATUS: The BWIP is currently using a combination of geostatistics, observation of surface outcrops and performance assessment, in conjunction with existing borehole data to define the subsurface geology. If

TABLE II

GEOLOGY

geostatistics indicate that the probability of detecting features that would have a significant impact on groundwater inflow is significantly improved by additional boreholes, then they will be recommended. The exact number of boreholes that might be required is not known. Current plans for additional drilling and testing will be presented in Chapter 13 of the SCP and in the ES Test Plan.

ITEM REFERENCE: Section 4.4.2, page 4-8, paragraph 4

NRC COMMENT: "The use of 'state-of-the art' geophysical techniques...in the repository host rock."

STATUS: Agreed

BWIP RESPONSE: State-of-the-art geophysical techniques are being identified for Exploratory Shaft investigations. A phased approach will be used to insure that the applicability of all the more routine methods are thoroughly investigated. All of the geophysical techniques used or planned will be documented in the ES test plan and referenced in the SCP.

ITEM REFERENCE: Section 4.4.2, page 4-8, paragraph 4

NRC COMMENT: "In determining the extent to which there should be additional borehole investigations, from the surface and from the underground facility, a rationale must be presented on the adequacy of these investigations to resolve the uncertainties discussed above."

STATUS: Agreed

BWIP RESPONSE: The fundamental bases for determining the adequacy of knowledge of the site are geostatistics and performance assessment evaluations. Additional borehole investigations will be based on the need to reduce uncertainty as prescribed by geostatistics and performance assessment allocations. The requested rationale will be included in the drilling and testing plan, the ES test plan, and will be referenced in the SCP.

ITEM REFERENCE: Section 4.4.3, page 4-9, paragraph 2

NRC COMMENT: "The SCR does not discuss plans to resolve the recent interpretation of the Yakima anticlines as drag folds at the front of low angle imbricate thrust faults with the tectonic model proposed by Price (1982)."

TABLE II

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STATUS: Agreed

BWIP RESPONSE: Additional field studies are planned to determine the style of deformation of the Yakima folds. During this work, the "drag fold" model will be assessed. Preliminary work completed suggests compatibility of these models. Plans for the field studies will be included in the SCP.

ITEM REFERENCE: Section 4.4.3, page 4-9, paragraph 3

NRC COMMENT: "Although the SCR provides plans for assessment of the continuity of RAW from Rattlesnake Mountain to Wallula Gap, the NRC staff is concerned that the SCR provides no plans to investigate the continuity of RAW from Wallula Gap to the Hite fault."

STATUS: Agreed

BWIP RESPONSE: A phased approach will be used to assess the RAW. Field investigations will concentrate in that portion of the RAW from Rattlesnake Mountain (sic) to Wallula Gap to determine the character and location of the proposed structure. Modeling of a 6.5 earthquake on the structure will be done to determine the impact on a repository. Based upon the results of these studies, additional work will be done southeast of Wallula Gap, toward the Hite fault, as required.

ITEM REFERENCE: Section 4.4.3, page 4-9, paragraph 3

NRC COMMENT: The impact of Rattlesnake-Wallula Alignment (RAW) on the repository should be determined. (General)

STATUS: Agreed

BWIP RESPONSE: The impact of the RAW on the repository will be investigated by means of modeling the effect of a 6.5 earthquake on a repository in the RRL. The results of this modeling will be used to determine the level of additional work required. In addition, mapping along the Rattlesnake Hills, between Snively Basin and the Yakima River, will be completed and ground geophysical surveys will be extended from the RRL to the flanks of Rattlesnake Hills. Based upon the results of these studies, trenching and/or drilling may be utilized to determine the location and age of movement on structures along the RAW. An important part of the assessment of the RAW will be to determine whether or not there are any structures that splay into the RRL. Based on the

TABLE II

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results of these studies, the requirements for field studies south of Wallula Gap will be determined. Plans regarding this concern will be presented in Chapter 13 in the SCP.

ITEM REFERENCE: Section 4.4.3, page 4-9, paragraph 4

NRC COMMENT: "The NRC staff is concerned about reliance on geophysical investigations to define geologic structure in the Pasco Basin."

STATUS: Agreed

BWIP RESPONSE: Verification of interpreted structures, based on geophysical data, will be verified by drilling and/or trenching where such interpreted structures have potential impact on the performance of a repository. Plans for this verification will be presented in Chapter 13 of the SCP.

ITEM REFERENCE: Section 4.4.3, page 4-9, paragraph 5

NRC COMMENT: "The NRC is concerned about the adquacy of plans to evaluate a possible bedrock structure identified through geophysical investigations (N-96 to N-84 linear) and remote sensing (Nancy linear) in close proximity to the RRL."

STATUS: Agreed

BWIP RESPONSE: Geophysical anomalies have been identified and require further investigation to determine their geologic/structural implications. Anomalies will be further investigated by performing detailed ground geophysical surveys. Upon completion of these surveys, those anomalies which are interpreted to have potential structural implication which might affect repository performance or aid in developing a tectonic model for the site may have to be verified with a drilling program. It is not agreed that the Nancy linear can be classified as a structure at this time. The term, N-96 to N-84 linear, is a designation used to describe the northern boundary of the Cold Creek Depression and should not be used to imply that this is a continuous geophysical anomaly. Plans to evaluate these anomalies will be presented in Chapter 13 of the SCP.

TABLE II

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ITEM REFERENCE: Section 4.4.3, page 4-9, paragraph 6

NRC COMMENT: "Two anomalous zones have been identified in borehole DC-1 from 1,210 to 1,222 m and 1,273 to 1,301 m."

STATUS: Agreed

BWIP RESPONSE: Plans will be developed to investigate the nature of these zones. An additional borehole may be needed near DC-1 for this purpose.

ITEM REFERENCE: Section 4.4.3, page 4-10, paragraph 1

NRC COMMENT: "...Develop plans to evaluate the effect of near-field ground motion from micro-earthquakes to determine what influence they may have on seismic design."

STATUS: Agreed

BWIP RESPONSE: The Seismic Surveillance Test Plan provides for data collection to evaluate the near field ground motion from earthquakes; a Seismic Design Task Force has been established to develop seismic design criteria for a repository in basalt.

ITEM REFERENCE: Section 4.5, page 4-10, paragraph 2, items 1, 2, 5, and 6

NRC COMMENT: Item 1. "...details of the work plans for issue resolution are not always provided. DOE should provide the details of work plans as they are developed so that the NRC can evaluate the conclusions."

STATUS: Agreed

BWIP RESPONSE: More detailed work plans will be provided in the SCP or in appropriate test plans which elaborate further on the contents of the SCP. These plans will be appropriately referenced.

. . . . . .

NRC COMMENT: Item 2. "The data are not adequate for a technical reviewer to complete an independent review of conclusions drawn from the data. Schematic or incomplete data presentation would be unacceptable for licensing documents."

TABLE II

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STATUS: Agreed

BWIP RESPONSE: Sufficient data will be included in the SCP, or referenced, to support the conclusion drawn.

. . . . . .

NRC COMMENT: Item 5. "Subsurface structures, such as the Nancy linear, cannot be unequivocally interpreted through the planned geophysical programs. Such structures must be ground truthed to resolve the geophysical interpretation."

STATUS: Agreed

BWIP RESPONSE: See BWIP comment on NRC reference item, page 4-9, paragraph 5.

. . . . . .

NRC COMMENT: Item 6. "...No plans to investigate micro-earthquake triggering mechanisms in the controlled zone."

STATUS: Agreed

BWIP RESPONSE: Such plans are included in the Seismic Surveillance Test Plan. This plan will be referenced in the SCP.

ITEM REFERENCE: Section 5.4.2, page 5-12, paragraph 3

NRC COMMENT: "Plans to characterize the stratigraphy and mineralogy below Grande Ronde Basalt were omitted from the SCR."

STATUS: Open

BWIP RESPONSE: BWIP disagrees with the need to characterize the stratigraphy and mineralogy below the Grande Ronde, thousands of feet below the candidate horizons. This issue needs further clarification. It is BWIP's opinion that obtaining this information would not significantly alter estimates of repository performance. The objectives of such characterization could be met by data from petroleum exploration wells currently being drilled in the vicinity of the Pasco Basin and through geophysical studies. BWIP feels that it is important to understand the stratigraphy below the candidate repository layer but does not feel it is cost-effective and technically justified to drill wells to depths of 10,000 to 15,000 feet to assess the "very deep" stratigraphy. The BWIP would like clarification from the NRC regarding how extensive an investigation program they envision.

TABLE II

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ITEM REFERENCE: Section 5.4.2, page 5-12, paragraph 3

NRC COMMENT: "More information is required to fully characterize the mineralogy of the flow tops and interbeds because these are the zones in which groundwater will spend most of its time."

STATUS: Agreed

BWIP RESPONSE: It is agreed that more information is required to fully characterize the mineralogy along the flow paths. BWIP's approach to this characterization will be presented in Chapter 13 of the SCP. However, further discussion between NRC and BWIP is needed in order to ascertain what level of detail and what methodologies are needed to adequately characterize flow tops and interbeds.

ITEM REFERENCE: Chapter 11, page 11-6, items 2 and 3

NRC COMMENT: Item 2. "DOE has concluded that volcanic activity in the Pasco Basin in the next 10,000 years is very unlikely. This conclusion is based on frequency studies. No consideration has been given to the causes of past volcanism. Studies should consider both causes and frequency of volcanic activity when considering the probability and nature of future volcanism in the Pasco Basin."

STATUS: Open

BWIP RESPONSE: Clarification of this comment is needed from the NRC.

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NRC COMMENT: Item 3. "DOE recognizes that renewed glaciation is a possibility if present cooling trends continue, however unlikely. DOE should use worst-case scenarios to estimate stress changes and their impact on the host flow in the RRL."

STATUS: Agreed

BWIP RESPONSE: The BWIP agrees that such scenarios should be considered. Plans for modeling the effect of renewed glaciation on the host flow will be addressed in the SCP.

TABLE II

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ITEM REFERENCE: Chapter 11, page 11-8, item 9

NRC COMMENT: "Petrology of flow tops and interbeds where groundwater will spend 85 to 90 percent of travel time."

STATUS: Agreed

BWIP RESPONSE: See the BWIP response to NRC reference item, Section 5.4.2, page 5-12, paragraph 3.

ITEM REFERENCE: Chapter 11, page 11-10, item 12

NRC COMMENT: "The groundwater and geochemical environment of the Middle Sentinel Bluffs flow; relation to Umtanum data base."

STATUS: Agreed

BWIP RESPONSE: The currently available data on the groundwater and geochemical environment of the Middle Sentinel Bluffs (Cohassett) flow will be reported in RHO-BW-ST-28 P (Horizon Identification Report).

TABLE II

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ITEM REFERENCE: Chapter 5, page 5-1, paragraph 3

NRC COMMENT: "If the NRC staff has interpreted the SCR correctly, this approach consists of (1) calculations based on theoretical considerations, (2) experimental confirmation of the theoretical estimates, and (3) observations of natural systems that can be used to support extrapolation of experimental results to repository scale and time frame."

STATUS: Agreed

BWIP RESPONSE: The BWIP approach to characterization of site geochemistry and subsequent repository/waste package geochemistry does involve the three elements listed by NRC. These topics are reviewed in Sections 6.5, 5.1.5, 11.4.5, and 6.6 of the SCP.

ITEM REFERENCE: Chapter 5, page 5-2, paragraph 1 (also related items on pages 5-4, 5-10, 5-11, and 5-13)

NRC COMMENT: "Plans for conducting further investigations are not presented in a manner that permits the NRC staff to assess with any degree of confidence whether DOE will provide adequate or timely input to a construction authorization application. For example, the SCR plans are inadequate regarding approaches to bounding or limiting the geochemical data requirements for the site characterization, experimental assumptions, experimental design, experimental methods, approaches to data analysis, and detailed milestones."

STATUS: Agreed

BWIP RESPONSE: A more complete summary of future plans will be included in Chapter 15 of the SCP.

ITEM REFERENCE: Chapter 5, page 5-2, paragraph 4, Section 5.2

NRC COMMENT: "Based on solubility, the maximum possible release rates for all the radionuclides considered will be below the NRC 10^{-2} proposed release rate criterion (NRC, 1981) and the draft cumulative release criterion (EPA, 1981)." "This assertion could mean that adequate performance is ensured by one favorable geochemical condition at the site."

STATUS: Agreed

TABLE II

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BWIP RESPONSE: The BWIP acknowledges that calculated solubility estimates appearing in the SCR did not consider formation of certain complexes and may not result in conservative estimates of fractional release from the waste package.* A reassessment of solubility estimates for many key radionuclides using thermodynamic data appears in Section 6.5.2 of the SCP. Furthermore, a reevaluation of radionuclide release rates from the waste package is discussed in Section 11.4.4 of the SCP.

* Questions related to physicochemical conditions which influence solubility are discussed exhaustively in Section 6.4.3 of the SCP.

ITEM REFERENCE: Chapter 5, page 5-5, paragraph 4, item 4

NRC COMMENT: "The significance of the comparison of solubilities of actinide compounds with maximum permissible concentration is unclear because, for the purposes of licensing a high-level waste repository, the final published rules by NRC (10 CRF Part 60) and EPA (40 CFR Part 191) will apply. Furthermore, the calculation of the ratios of radionuclide solubility/maximum permissible concentration (MPC) presented in SCR Figure 6-15 (page 6.4-4) are nonconservative because they make use of uncorrected MPC data and the solubility values do not account for contributions by all important aqueous species, especially carbonate. For example, the NRC staff made estimates of the adjusted MPCs on the basis of the new International Commission on Radiation Protection (ICRP-30 data, 1979). In every case, the adjusted values are more restrictive by about 1 to 2 orders of magnitude. Thus, this adjustment will raise the solubility MPC radio in SCR Figure 6-15 by 1 to 2 orders of magnitude. Therefore, the MPC values in SCR Figure 6-15 are too high (Appendix U, Part 1).

STATUS: Agreed

BWIP RESPONSE: The discussion on MPC values for radionuclides which appeared in the SCR will be deleted from the SCP. This change derives from the fact that NRC (10 CFR 60) and EPA (40 CFR 191) regulations will apply to releases from the repository rather than 10 CFR 20 regulations.

ITEM REFERENCE: Chapter 5, page 5-6, paragraph 3 and page 5-12, paragraph 4

NRC COMMENT: Sufficient sorption data including solid phase characterization are not available for flowtops and interbeds where groundwater will spend most its time flowing. (paraphrased)

TABLE II

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STATUS: Agreed

BWIP RESPONSE: The BWIP has been conducting sorption experiments on a limited number of flowtop and interbed materials. A more extensive data base is now available on interbeds and will be incorporated in the SCP. Detailed plans for evaluating radionuclide sorption behavior will be referenced in the SCP. (Sorption test plans also will be included in the Barrier Materials Test Plan.)

ITEM REFERENCE: Chapter 5, page 5-6, paragraph 4 (refers to preceeding 8 items)

NRC COMMENT: "Until the uncertainties associated with the above parameters are significantly reduced, little confidence can be placed in the preliminary DOE quantitative assessment that solubilities of certain radionuclide species have been bounded sufficiently to demonstrate satisfaction of the proposed EPA standard for those nuclides."

STATUS: Agreed

BWIP RESPONSE: The BWIP acknowledges that uncertainties in solubility estimates may result from associated uncertainties in many of the parameters listed by the NRC and these effects have been evaluated in the SCP. Specifically, the spectrum of physicochemical conditions in the candidate repository horizons will be discussed in depth in Sections 6.3 and 6.4.3. Estimates of solubilities using thermodynamic data will be addressed in Section 6.5.2 and will incorporate a discussion of sensitivity analyses. The potential effects of radiolysis and colloid transport on radionuclide migration are discussed in Sections 6.4 and 6.5 and plans for further study are outlined in the Barrier Materials Test Plan and Chapter 15 of the SCP.

ITEM REFERENCE: Chapter 5, page 5-8, paragraph 4

NRC COMMENT: "The uncertainties involved in the transferability of information derived from short-term laboratory-scale experiments to the prediction of long-term repository behavior remain to be evaluated."

STATUS: Agreed

TABLE II

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BWIP RESPONSE: A review of the BWIP approach and associated assumptions regarding resolution of this issue is presented in Section 11.4.5 of the SCP. A more comprehensive treatment regarding extrapolation of short-term test data to long-term performance is included in the Barrier Material Test Plan, Appendices F and G.

ITEM REFERENCE: Chapter 5, page 5-9

NRC COMMENT: "In fact, the resolution of geochemical issues is not to be presented by the DOE until FY87 and FY88 (SCR, page 17.3-1 and Table 17-12). The NRC staff does not consider this aspect of DOE's plan to be timely. The progress of each work element that contributes to the resolution of an issue should be published sufficiently early during site characterization and in enough detail to permit the NRC staff and other peer reviewers to provide constructive, timely commentary."

STATUS: Open

BWIP RESPONSE: The BWIP and DOE will publish, in such documents as the SCP, the adopted approach to resolution of geochemical issues for NRC review long before FY 87. In addition, updates on progress on resolving these issues will also be available to NRC in a timely manner for comment on a continuing basis before FY 87. However, final resolution is not required or expected before this FY 87/FY 88 time frame. This interpretation of "resolution" needs further clarification.

ITEM REFERENCE: Chapter 5, page 5-10, paragraph 2, items 6 and 8

NRC COMMENT: Item 6. "The methods of ensuring compatability between BWIP data and data generated by other laboratories trying to simulate the in situ conditions of the basalt repository were not described." "The plans for determining solubilities, speciation, and colloid transport are not detailed enough for the NRC staff to assess whether they are adequate, and timely, for the following reasons:..."

STATUS: Agreed

BWIP RESPONSE: This issue is a key consideration of Chapter 18 of the SCP and fuller description of BWIP's approach to this topic can be found in appropriate BWIP Quality Assurance documents such as the Basalt Operating Procedure, RHO-BWI-MA-4.

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TABLE II

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NRC COMMENT: Item 8. "The use and limits of stability diagrams, computational schemes, or numerical codes required to address solubility, speciation, and colloidal transport in a complex fluid flow regime were not discussed."

STATUS: Agreed

BWIP RESPONSE: A detailed discussion of the methods employed by the BWIP for computing the solubility and speciation of key radionuclides is included in Section 6.5.2 of the SCP and associated references. An empirical approach for evaluating colloidal transport has been adopted by the BWIP. Plans for additional characterization of the effects of colloids are outlined in the Barrier Materials Test Plan.

ITEM REFERENCE: Chapter 5, page 5-12, paragraph 5

NRC COMMENT: More information is required pertaining to mineral distributions within flows, particularly the flowtop and interbeds in order to adequately assess radionuclide migration data (sorption/solubility) and mineral stability in the near field. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The BWIP will incorporate available data related to mineral distribution in the basalt flows in the SCP. Available data related to mineral stability in the near field (including backfill materials) will also be summarized in the SCP. Plans for the near field mineral stability investigation will be included in the Barrier Materials Test Plan and referenced in the SCP.

ITEM REFERENCE: Chapter 5, page 5-13, paragraph 4

NRC COMMENT: "SCR Chapter 12 summarizes transport models to be used in assessing long-term performance. However, it does not specify how various geochemical data will be input to the codes, nor does it specify whether sensitivity analyses will be performed and utilized in the data-gathering program of assessment models.

STATUS: Agreed

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BWIP RESPONSE: The relationship of the geochemical model, as well as other models, to the integrated BWIP performance assessment model will be covered in Chapter 12 of the SCP. The issue of sensitivity analyses regarding the effect of data uncertainty on performance assessment results is also covered in Chapter 12 of the SCP.

ITEM REFERENCE: Chapter 5, page 5-14, paragraph 2, items 1-3

NRC COMMENT: Item 1. "The NRC staff believes that solubility determinations (steady-state condition) should be approached from both oversaturation and under saturation."

STATUS: Open

BWIP RESPONSE: There are serious questions concerning the feasibility of approaching solution equilibrium from undersaturation. The time necessary to achieve equilibrium may be unrealistically long. Identification and synthesis of solid phases required to perform solubility studies from undersaturation may not be possible. The approach to solubility determinations to be used by the BWIP will be documented in the BMTP.

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NRC COMMENT: Item 2. If the BWIP adopts a rigorous thermodynamic approach to determining radionuclide solubilities, then the reliability of the thermodynamic data used in geochemical modeling must be established. Because repository conditions will be changing through time and space, the prudent approach includes measurement of missing thermodynamic constants, using numerical models to determine solubility, including complex formation, under the whole range of possible conditions, and experimentally verifying thermodynamic phase boundaries pertinent to solubility relationships. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The BWIP does not expect to verify the reliability of thermodynamic data and measure missing thermodynamic constants "...especially for the high-temperature conditions expected in the repository." The BWIP recommends that solubility and solid phase relationships be established through testing under repository-specific conditions. Reliability of these tests will be demonstrated by a series of replicate tests, comparison of test results with expected results based on previous laboratory or thermodynamic data, and examination of consistency of results as key experimental parameters (e.g. temperature, radiation field) are systematically varied. These data will serve as direct inputs into geochemical models, rather than relying on extrapolation of a thermodynamic data base and indirect computational prediction of solubility behavior. The direct, site-specific test approach of

TABLE II

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the BWIP safeguards the geochemical modeling effort in cases where steady-state rather than true solubility conditions may be limiting radionuclide concentrations. The effects of heat, pH and Eh solubility will be evaluated parametrically.

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NRC COMMENT: Item 3. Because solubilities are in general a function of temperature, efforts should be directed toward measurements of solubilities as a function of temperature for critically important solid phases and aqueous species.

STATUS: Agreed

BWIP RESPONSE: Preliminary plans have been made to determine solubilities of some key radionuclides at elevated temperatures (>100oC) beginning in FY 1984. Available data and plans will be summarized in the SCP, Chapters 6 and 15, respectively.

ITEM REFERENCE: Chapter 11, page 11-6, item 4

NRC COMMENT: More information is required to adequately define site redox conditions through time and its effect on radionuclide solubility/sorption and the site isolation capability. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: This requires development of in situ Eh monitoring capabilities, extensive characterization of secondary minerals lining fractures and in flow tops, response of radionuclides to redox conditions, and detailed analysis of redox couples in groundwaters. Detailed planning will be incorporated into the Barrier Materials Test Plan.

ITEM REFERENCE: Chapter 11, page 11-7, items 7-11

NRC COMMENT: Item 7. "The NRC is concerned that additional solid materials in the near field and far field be included in radionuclide sorption studies. These include backfill materials, altered basalt, fracture filling materials, flow top, and interbed materials."

STATUS: Agreed

BWIP RESPONSE: The BWIP has supported the evaluation of sorption studies on each of these types of materials. Data are available on radionuclide sorption on interbed and fracture filling materials. Work on these materials is almost

TABLE II

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complete and the BWIP is now directing its effort to complete work on flow top, backfill materials, altered basalt, and basalt from several candidate repository horizons. This additional information and plans will be included in the SCP in Chapters 6 and 15, respectively.

. . . . . .

NRC COMMENT: Item 8. The NRC recommends Kd measurements and isotherm determinations be determined by the batch and flow through methods per Appendix T, SCA. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: BWIP has found very few radionuclide sorption reactions that have linear isotherms. For this reason the BWIP now reports most sorption data in terms of isotherms rather than single distribution coefficients (K_d's). The BWIP is presently supporting column (flow-through) studies to complement the batch experiments. Both approaches to sorption measurements must be used in order to thoroughly determine radionuclide sorption behavior.

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NRC COMMENT: Item 9. Fine grinding. Effect of fines generation by mechanical abrasion during batch Kd measurements on radionuclide sorption behavior. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The effects of vigorous shaking of the solid-groundwater mixtures on sorption during batch sorption measurements by BWIP researchers have been studied. Results of these studies will be presented in Chapter 6 of the SCP.

. . . . . .

NRC COMMENT: Item 10. Rock:water ratio. Effect of mass ratio of rock to groundwater used in the batch Kd experiments on radionuclide sorption. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The groundwater:rock ratios required by batch sorption measurements are much higher than would be observed in basalt formations. The effects of this variable will be considered when comparing the results from batch and column methods. The ratio during column experiments will be more representative of actual field conditions and will be discussed in Section 6.5.3 of the SCP.

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NRC COMMENT: Item 11. Oxidizing conditions versus reducing conditions. Effect of technique used to establish low Eh conditions on radionuclide sorption behavior particularly the use of hydrazine to establish low Eh condition. Relevance of performing system/solubility experiments under oxidizing conditions. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Oxidizing conditions were used in much of the early sorption work on basalt materials because for many radionuclides, the predicted solubilities were greater under oxidizing conditions. It was felt that this would be a conservative estimate of sorption/solubility behavior in a NWRB. BWIP has been concerned with control of Eh during sorption experiments for some time. Two approaches to achieving the very reducing Eh values expected in basalt formations have been examined. First, reducing agents have been added to the groundwater in concentrations great enough to overwhelm other redox couples and thus control Eh. This approach has been used for most sorption experiments at reducing conditions because of its applicability to large numbers of experiments and rapid rate of radionuclide reduction.

The second approach used is to remove oxygen to very low levels in the groundwater-solid system so that naturally-occuring redox couples can control the Eh. This is the preferred method since no extraneous chemicals are added to the system which might interfere with sorption reactions. Further work on this method and future plans will be discussed in Chapter 6 of the SCP.

ITEM REFERENCE: Chapter 11, page 11-8, items 1, 3, 4, 5, 10, and 11

NRC COMMENT: Item 1. Reversibility of sorption reactions on evaluating radionuclide transport. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The reversibility of sorption reactions is an important factor in radionuclide transport in basalt. This has been addressed in recent BWIP studies by measuring desorption isotherms of key radionuclides. Results and evaluations of these studies will be presented in Section 6.5.3 of the SCP.

. . . . . .

NRC COMMENT: Item 3. Effects on sorption of ionic strength changes as the result of dissolution of the waste form, backfill, or host rock fracture filling materials. (paraphrased)

STATUS: Agreed

TABLE II

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BWIP RESPONSE: Effects of ionic strength changes on sorption have been studied by varying the concentrations of major cations in the groundwater (Na^+, K^+, Ca^{2+}, and Mg^{2+}). These changes are important for radionuclides that sorb partly by ion-exchange mechanisms. Results and evaluations of these studies will be summarized in the SCP, Section 6.5.3.

. . . . . .

NRC COMMENT: Item 4. The effects on sorption of colloid formation. Sorption of radionuclides by colloids may lead to erroneously high Kd values, as many colloids are sufficiently small to travel with the groundwater. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Studies of radionuclide sorption and desorption from colloids in groundwater are under way. Competition between mobile colloids and immobile solids in basalt formations for radionuclide sorption is being examined. Colloid transport of radionculides is recognized as a potentially significant mechanism by the BWIP and will be discussed in Chapter 6 of the SCP.

. . . . . .

NRC COMMENT: Item 5. "Large variability of the Kd values."

STATUS: Agreed

BWIP RESPONSE: The wide ranges of Kd values reported in the SCR are due to the non-linearity of respective sorption isotherms and differences in experimental conditions used for the measurements. The ranges are not a result of experimental error or poor precision. The preferred method at present, of reporting sorption data, is by using isotherms for specific experimental conditions. This eliminates the need to present ranges of Kd values. Note: Precision will be discussed in the SCP, Section 6.5.3.

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NRC COMMENT: Item 10. The NRC recommends a more detailed evaluation of radionuclide speciation/complexation behavior, particularly the effect of available ligands on radionuclide sorption behavior. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Experimental and theoretical studies on radionuclide speciation in Grande Ronde groundwater are either in progress or have been completed. These studies indicate that ligands such as OH- and $CO_3^{=}$ which are present in these groundwaters play an important role in complexing many key radionuclides. Planned flow-through sorption experiments also will

provide data on radionuclide speciation effects on sorption. Results and evaluations of completed studies will be presented in Chapter 6 of the SCP. A parametric approach to speciation/complexation behavior will be used. Future plans will be discussed in the SCP, Chapter 15.

. . . . . .

NRC COMMENT: Item 11. The NRC recommends that more emphasis be placed on evaluating the potential for colloid formation and their physical-chemical characteristics as related to radionuclide transport in both the near field and far field. Colloids provide a potential mechanism for radionuclide transport. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The BWIP is aware of the potential importance of colloids as a means of transport of radionculides from a nuclear waste repository. Experimental studies in progress are addressing this issue. Additional plans will be included in the Barrier Materials Test Plan and will be referenced in the SCP.

ITEM REFERENCE: Chapter 11, page 11-9, items 1, 2, and 3

NRC COMMENT: "Mineralogical changes due to heat generated by the repository
- Availability of K as the result of dissolution of basaltic glass at elevated temperatures.
- Dehydration of smectite under reduced water pressure followed by hydration under later saturated conditions."

STATUS: Agreed

BWIP RESPONSE: We agree that potassium concentrations in groundwater do increase at elevated temperatures as demonstrated by hydrothermal experiments in the basalt-bentonite groundwater system at 300°C. However, K concentrations then decrease with time indicating incorporation into an alteration product. Both K bearing zeolite and K feldspars have been observed. In addition, incorporation of K in the bentonite and conversion to illite may occur in fractures if hydrothermal conditions exist at temperatures as high as 300°C over long periods of time. Long term experiments are under way to further understand the rate of conversion of smectite to illite. The Koster van Groos (1981) data were meant only to relate to smectite degradation via dehydration and are, therefore, not misapplied. If saturated fracture environments are characterized by high pressure (hydrostatic to lithostatic) then dehydration will not occur. An evaluation of dehydration on behavior of backfill in a radioactive zone will be performed. Additional information on this subject will be included in the SCP, Chapter 11.

TABLE II

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ITEM REFERENCE: Chapter 11, page 11-9, items 11 and 12

NRC COMMENT: Rock/water interactions. Dissolved silica can act as a pH buffer through the H_4SiO_4/H_3SiO_4 couple. There are, however, additional pH buffering couples that are found in reference BWIP groundwater (e.g., $HCO_3^-/CO_3^=$, H_2O/OH^-) and that should be evaluated.

STATUS: Agreed

BWIP RESPONSE: Recent results from hydrothermal and theoretical studies which are reported in RHO-BWI-ST-38 P illustrate that silicic acid is the dominant pH buffer in Grande Ronde groundwaters at low temperature. At elevated temperatures (100o-300oC) hydroxyl (OH-) and carbonate (CO_3^{2-}) equilibria become important. This will be discussed and evaluated in Chapter 6 of the SCP.

ITEM REFERENCE: Chapter 11, page 11-10, items 1, 2, 3, 6, 7, 8, 9, 10, 11, and 14.

NRC COMMENT: Item 1. Use of baseline geochemical data as a "natural experiment". There should be use of the baseline information which must be gathered during characterization of the prevailing in situ geochemical conditions as a "natural experiment".

STATUS: Open

BWIP RESPONSE: It is not clear if the "natural experiment" refers to "geochemical conditions", "characterization of conditions", or "baseline information". The BWIP will be including in the SCP a discussion of in situ, diagenetic alteration of Columbia River basalts as evidence for expected alteration of basalt after emplacement of nuclear waste. Thus, site characterization data will be used as a "natural analog" for long-term basalt alteration. A discussion of how the natural analog studies will be used to support waste package design will be included in the SCP, Chapter 6. The NRC will provide additional written clarification.

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TABLE II

GEOCHEMISTRY

NRC COMMENT: Item 2. The fluoride levels in Grande Ronde groundwater may be high enough to increase the canister corrosion rates and actinide solubilities. The origin of fluoride in the groundwaters and its control by the host basalt should be investigated. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Recent electron microprobe studies of several Grande Ronde basalt samples have identified at least two phases (apatite and glass) which are relatively enriched in fluoride. In addition, a basalt-deionized water hydrothermal experiment demonstrated the leachability of fluoride. While the specific reaction by which fluoride is incorporated in the groundwater has not been established, a possible source may be through basalt-water interaction. The effects of the high fluoride levels in the groundwater on canister corrosion and actinide solubilities are being studied and will be reported in the SCP.

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NRC COMMENT: Item 3. Experimental data from available literature on montmorillonite suggest that this material may not be stable under expected repository conditions. (paraphrased)

STATUS: Open

BWIP RESPONSE: See the BWIP comment on mineralogical changes due to heat, item reference page 11-9, items 1, 2, and 3. The NRC should provide the referenced literature as the basis for discussion/clarification of this item.

. . . . . .

NRC COMMENT: Item 6. The applicability of the DOE natural analog program, including the evaluation of natural uranium deposits, should be addressed. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The natural analogues discussed in the SCR will be reevaluated in terms of their applicability to the basalt geochemical environment. Because the spatial and temporal variations of geochemical conditions, important parameters that affect the applicability of "natural analog" comparisons, may not be known, it is necessary that such studies must be approached cautiously. The SCP (Chapter 6) will include a discussion of data on Columbia River basalt as a "natural analog" (see comment on use of baseline chemical data as a "natural experiment", reference item page 11-10, item 1). In addition, the fresh water-basalt hydrothermal fields in Iceland will be the subject of a future analog study by the BWIP.

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TABLE II

GEOCHEMISTRY

NRC COMMENT: Items 7 and 8. The possibility of enhanced migration of radionuclides by particulate and colloid transport should be investigated. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The BWIP recognizes the potential importance of colloids and particulates in the transport of radionuclides away from the waste package. Preliminary work is in progress to evaluate the formation of colloids for a variety of key radionuclides in the basalt geochemical system. Further studies which address this issue will be included in the Barrier Materials Test Plan and will be referenced in the SCP.

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NRC COMMENT: Item 9. Radiolysis of groundwater can lead to the formation of oxidizing and reducing solution species, as well as possible complexing agents and species affecting pH. Because all of these factors could affect radionuclide transport, the radiolysis of groundwater should be investigated. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The BWIP agrees that the effects of radiolysis around the waste package may be important in determining the local geochemical environment and the transportation behavior of some radionuclides. Preliminary work on radiolysis is in progress and will be expanded. Plans and available data will be discussed and evaluated in the SCP (Chapter 11).

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NRC COMMENT: Item 10. The basalt-groundwater and geochemical environment is stated to be benign. Because of the limited data available, the problems with determining uncontaminated down-hole measurements, and outstanding questions on the interpretation of data, this statement appears to be premature. (paraphrased)

STATUS: Open

BWIP RESPONSE: This statement in the SCR refers to canister corrosion and is supported by data presented therein. The BWIP is currently expanding and improving its data base. All data and test results to date still confirm this statement. The statement in the SCP will be clarified to assure that the reader is aware that the statement is referring only to canister corrosion.

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TABLE II

GEOCHEMISTRY

NRC COMMENT: Item 11. The plans by the BWIP to define background radiation level, as a result of potential leakage from previous and potential defense waste activities at the Hanford site, should be thoroughly discussed. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Background radiation levels will be addressed as part of the baseline environmental assessment. The EA will be referenced in Chapter 8 of the SCP.

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NRC COMMENT: Item 14. The SCR states that conceptual geochemical models guided by observed and postulated geochemical reaction mechanisms, has been outlined. The status of these models as to their validity and consideration of alternative conceptual models should be evaluated. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The BWIP recognizes certain limitations in the conceptual models as they relate to Eh, radionuclide sorption, and solubility as presented in the SCR. Currently, the BWIP is formulating plans to provide a better understanding of the redox state of the basalt geochemical system and the reactions which control it. Furthermore, significant improvements in estimates of radionuclide solubility and sorption behavior have been achieved. Experimental studies and plans for geochemical modeling of the ambient basalt geochemical system will be discussed in Sections 6.4.3 and 5.1.5, respectively, of the SCP. The relationship of geochemical models to performance assessment will be discussed in Chapter 12 of the SCP.

ITEM REFERENCE: Chapter 11, page 11-11, items 1 and 6

NRC COMMENT: The procedures by which geochemical data are input into the performance assessment models and assessed should be clarified. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Detailed plans to provide information for determining the source terms at the very near-field by means of performance assessment modeling of the waste package will be addressed in the Barrier Materials Test Plan. The relationship of geochemical models to overall system performance assessment will be documented in Chapter 12 of the SCP.

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TABLE II

GEOCHEMISTRY

NRC COMMENT: Item 6. There should be a fuller discussion of whether radionuclide releases are leach limited versus solubility limited. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Experimental studies involving tracer- and fully-loaded waste forms are detailed in the Barrier Materials Test Plan. One goal of these investigations is the evaluation of leach-limited versus solubility limited releases of radionuclides in a flow-through autoclave. This information will be referenced in the SCP, Chapter 11.

TABLE II

REPOSITORY DESIGN

ITEM REFERENCE: Section 6.1, page 6-1, paragraph 4

NRC COMMENT: "A comprehensive conceptual design...is to be submitted to NRC."

STATUS: Agreed

BWIP RESPONSE: Elements of a design description, "Conceptual System Design Description, Nuclear Waste Repository in Basalt," Raymond Kaiser Engineers, Inc./Parson, Brinckerhoff, Quade and Douglas, Inc. (1983) will be presented in Chapter 10 of the SCP. It is noted that this conceptual design is still preliminary and that extensive engineering studies are currently in progress which will be used to upgrade the conceptual design by September 1985.

ITEM REFERENCE: Section 6.1, page 6-1, paragraph 4

NRC COMMENT: "Two candidate horizons...are identified." When will the horizon selection report be delivered?

STATUS: Agreed

BWIP RESPONSE: The BWIP report, RHO-BWI-ST-28, "Repository Horizon Identification Report, Volume I," is scheduled to be released October 1983.

ITEM REFERENCE: Section 6.3.1, page 6-3, paragraph 2

NRC COMMENT: "Conceptual design of openings in the underground facility has not considered the potential variability in important rock properties." Response doesn't seem to be timely. When will this effort be presented to the NRC? "NRC staff considers that a realistic stability analysis...should be performed at an early date."

STATUS: Agreed

BWIP RESPONSE: Engineering studies are planned to be conducted prior to the upgraded conceptual design which will consider the influence of key parameters on the design of the openings. Additional field data from the Exploratory Shaft construction and test program will provide a better understanding of what the potential variability in each of the parameters is. The results of these activities will then be factored into the upgraded conceptual design. A discussion regarding the plans for sensitivity analysis will be included in Section 10.5 of the SCP.

TABLE II

REPOSITORY DESIGN

ITEM REFERENCE: Section 6.3.1, page 6-3, paragraph 3

NRC COMMENT: "Some of the key results of analyses available to the BWIP have not been presented in the SCR or referenced." (Specifically scoping and modeling studies referred to in Section 4.6.4.) When will this cleared report be released? What takes so long?

STATUS: Agreed

BWIP RESPONSE: Details and results of scoping calculations based on empirical methods and two- and three-dimensional numerical modeling studies will be presented in a cleared report and referenced in Section 10.10 of the SCP.

ITEM REFERENCE: Section 6.3.1, page 6-3, paragraph 4

NRC COMMENT: "Single value of rock strength used in the conceptual design corresponds to the strength of intact basalt specimen tested in the laboratory, and not to the rock mass strength, which is affected by the discontinuities (fractures)." This should be part of work element R.1.10.A. How much (testing) will be done before shaft sinking?

STATUS: Agreed

BWIP RESPONSE: Future evaluations of rock mass strength will be based on empirical failure criteria. An initial estimate of a rock mass failure envelope will be established by factoring the laboratory strength results of intact rock to account for the presence of discontinuities in the rock mass. Latter attempts will be made to improve the failure criteria based on results from large diameter triaxial laboratory testing of jointed specimens. In addition, in situ/field testing and observations plus discrete block modeling will be used to help verify or improve the rock mass failure criteria. The methodology and test schedules described above will be included in the SCP.

ITEM REFERENCE: Section 6.3.1, page 6-3, paragraph 4

NRC COMMENT: "The assumptions of linear elastic analysis used in the conceptual design for computing excavation-induced and thermal stresses are not applicable to jointed basalts." "The assumptions...," (The point is "linear elastic analysis" is not realistic.) Will analyses include thermal response?

STATUS: Agreed

TABLE II

REPOSITORY DESIGN

BWIP RESPONSE: The linear elastic analysis has been used as a baseline study for the purpose of conceptual design, and as an initial means of conducting parameter sensitivity studies. A more sophisticated rock mass constitute model will be developed from the results of the Block Test at the Near-Surface Test Facility and load-deformation results from laboratory triaxial testing of intact and jointed specimens for various confinement pressures. In addition, a discrete block model analysis of a jointed columnar basalt is being considered to be used to help establish the load-deformation response of the rock mass for various confinement stresses and rock temperatures. The results of the nonlinear analysis will not be available in time for inclusion in the SCP. However, the BWIP plan described above will be elaborated upon in the SCP.

ITEM REFERENCE: Section 6.3.1, page 6-4, paragraph 3

NRC COMMENT: "Low priorities are given to important activities." (Specifically Work Element R.1.10.A - Sensitivity Studies of Rock Mechanic Parameters.) What is the schedule for work element R.1.10.A? Is it a key work element? The NRC would like to follow it closely.

STATUS: Agreed

BWIP RESPONSE: The importance of a parameter sensitivity study is recognized and this activity will be given higher priority in th future; the priority rating of work element R.1.10.A will be changed to 1 from 2.

ITEM REFERENCE: Section 6.3.1, page 6-4, paragraph 3

NRC COMMENT: "What tests should be performed, how many measurements...how accurate...how...will affect the design?" Key point! i.e., what is the logic behind the test plans? What is the status of this?

STATUS: Agreed

BWIP RESPONSE: A workshop will be held with the NRC to discuss in situ test plans and provide the information now available and approaches that are going to be taken to answer these questions. This is a workshop discussion item. Test plans, with follow up discussions, will provide a portion of this information.

ITEM REFERENCE: Section 6.3.1, page 6-4, paragraph 5

NRC COMMENT: "More details should be provided...describing the methodology that will be used to extend the findings from a limited area to the entire candidate horizon." "More details...describe methodology...used to extend

TABLE II

REPOSITORY DESIGN

finding in the entire horizon." This is a key item. (There are) many comments on the inadequate number of boreholes, the need for inclined boreholes and ACRS comments. How predictable is the geology? Need to explain logic. Any experience? Response should be detailed as possible with identification of limitations.

STATUS: Agreed

BWIP RESPONSE: The variability of laboratory and field data from various boreholes in the RRL will be evaluated in addition to the data to be obtained from the Exploratory Shaft tests. The variability cannot be predicted with a high degree of uncertainty from these data. It should be noted that long horizontal boreholes will be driven ahead of drift development to better anticipate rock mass variability. A detailed discussion of the development of plans to investigate and deal with geologic variability will be included in Chapters 10 and 17.

ITEM REFERENCE: Section 6.3.2, pages 6-5 to 6-6, items 1-6 (General)

NRC COMMENT: Engineered Barriers. Item 1. The viability of the long horizontal borehole concept for waste emplacement is questioned. Specific concerns are as follows: (a) constructibility and stability, (b) ability to emplace backfill with required density and uniformity, (c) performance in waste isolation under a vertical transport scenario, and (d) retrievability. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: A description of current plans for engineering studies to be performed in FY 1983 and 1984 which will investigate alternative waste placement configurations including vertical, short hole horizontal and in-tunnel placement will be added to Section 10.4.3 of the SCP. It will be pointed out that the studies will address stability of openings, constructibility including backfill placement, performance and ease of retrievability. The studies will also identify development requirements and demonstration tests which will supply the required design data to support the license application.

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NRC COMMENT: Item 2. This is a key item and apparently is not understood by BWIP. Backfill placement density on horizontal emplacement is difficult to control...difficult to quantify.

STATUS: Agreed

BWIP RESPONSE: The BWIP agrees that the ability to pneumatically emplace the waste package backfill using the long hole horizontal storage concept needs to be demonstrated. However, the backfill permeability necessary to achieve the

TABLE II

REPOSITORY DESIGN

required waste package backfill functions for an NWRB is approximately three orders of magnitude less than that believed to be achievable by pneumatic emplacement so the emplacement process need not be a precise operation. Should the full-scale backfill emplacement tests now in progress not prove successful or show the process to be difficult to control, the method will be abandoned in favor of other techniques. As data becomes available, results and evaluations will be incorporated in future updates to the SCP (Chapter 11).

. . . . . .

NRC COMMENT: Item 3. Analytical sensitivity studies considering a range of waste emplacement configurations and backfill properties are needed.

STATUS: Agreed

BWIP RESPONSE: Engineering studies that consider a range of waste package configurations are also in progress. The results of these studies will be used to optimize the waste package configuration before proceeding with an advanced conceptual design. As data becomes available, results and evaluations will be incorporated in future updates to the SCP (Chapter 11).

. . . . . .

NRC COMMENT: Item 4. Some credit for retardation by emplacement room backfill may be needed to satisfy the engineered barrier release rate criteria.

STATUS: Agreed

BWIP RESPONSE: The waste package configuration studies now in progress will address the possibility of taking credit for retardation of radionuclides by the emplacement room backfill. Several in-tunnel concepts, for example, are being considered. As data becomes available, results and evaluations will be incorporated in future updates to the SCP (Chapter 11).

. . . . . .

NRC COMMENT: Item 5. Chapter 15, summary narrative 5, page 15.4-4 (conduct trade studies) and work element W.3.6 need further explanation. Results should be provided to NRC at an early date. How many tests, when, where?

STATUS: Agreed

BWIP RESPONSE: The BWIP is currently conducting engineering "trade" studies, and results from those studies relating to the waste package design will be included in future updates of the SCP (Chapter 11). The section of Chapter 15 also will be expanded in the SCP to include more details of planned engineering studies and engineering field tests. However, details of the field tests will be found only in the specific field test plans themselves. Currently, only four field tests are proposed (SD-BWI-TP-017) and preparation

TABLE II

REPOSITORY DESIGN

of detailed test plans for these tests is underway. Additional field/engineering tests may be added to the program if laboratory testing results and the waste package design effort indicate that they are necessary to validate the design.

. . . . . .

NRC RESPONSE: Item 6. How will quality control be provided for fill in horizontal holes?

STATUS: Agreed

BWIP RESPONSE: Quality control for the backfill in bulk form, whether in horizontal or vertical boreholes, will be accomplished by control of process parameters. The inspection techniques will include, as a minimum, monitoring the quantities of basalt and bentonite emplaced per unit volume filled. One objective of the backfilling process tests is to investigate quality control methods for successful emplacement processes.

ITEM REFERENCE: Section 6.3.3, page 6-6, paragraph 2

NRC COMMENT: "...repository room and tunnel backfill is part of the underground facility (part of the engineered barrier system), as defined in 10 CFR 60. Shaft and borehole seals are considered separately in the proposed rule. Work Element R.1.18.D (Identification of performance requirements for sealing boreholes, tunnels, shafts, and rooms) combines room and shaft sealing performance evaluation. These should be considered separately." Note different performance objectives apply to borehole/shaft seal (i.e. to meet EPA standards) and room and drift backfill (i.e., 10-5).

STATUS: Agreed

BWIP RESPONSE: The contents of SCP Section 10.8 and Chapter 14 will be modified to clearly distinguish between sealing within the underground facility and sealing of shafts and boreholes.

ITEM REFERENCE: Section 6.3.3, page 6-6, paragraph 3

NRC COMMENT: "Concerned with delaying laboratory and field testing."

STATUS: Agreed

TABLE II

REPOSITORY DESIGN

BWIP RESPONSE: Some laboratory and field testing are planned in conjunction with preliminary performance assessment work. The scope and nature of these tests will be the subject of a workshop to be held with the NRC.

ITEM REFERENCE: Section 6.3.3, page 6-6, paragraph 3

NRC COMMENT: "Need to understand potential problems with site specific placement techniques delaying lab and field testing could impact repository scheduled."

STATUS: Agreed

BWIP RESPONSE: Some laboratory and field testing are planned in conjunction with preliminary performance assessment work. The scope and nature of these tests will be the subject of future workshop discussions with the NRC.

ITEM REFERENCE: Section 6.3.3, page 6-7, paragraph 1

NRC COMMENT: "Information on possible adverse safety related effects...will be reviewed by the NRC when complete information is submitted...staff considers there to be a sense of urgency about resolving."

STATUS: Agreed

BWIP RESPONSE: The requested information on safety related effects of shaft construction in the bsaalt flows was sent to the NRC in April 1983. This information will also be included in the SCP.

ITEM REFERENCE: Section 6.3.3, page 6-7, paragraph 3

NRC COMMENT: "The staff is concerned about the schedule for development of the shaft and borehole seal design. As noted in SCR Figure 17-9, laboratory and field tests are not scheduled to begin until late in FY 1984. Summary narrative 10 (Repository Seal Design Criteria) in the SCR mentions field and in situ testing but is vague and gives no details of ongoing activities." The point is...concern about the late start in lab and field tests, not just the seal design schedule.

STATUS: Agreed

TABLE II

REPOSITORY DESIGN

BWIP RESPONSE: The schedules in SCP Chapter 17 will be modified to reflect that repository seal design criteria and a shaft seal conceptual design are now planned to be completed September 30, 1983. Schedules for laboratory and field tests are being evaluated and will be included in the SCP.

ITEM REFERENCE: Section 6.3.3, page 6-7, paragraph 3

NRC COMMENT: "No schedule for completion of this work element (R.1.18.D) is provided." "All seal requirements can be met through shaft seals...no tunnel seal required." NRC doesn't understand this.

STATUS: Agreed

BWIP RESPONSE: Section 10.8 will be modified in the SCP to include performance requirements for the entire repository seal system which include sealing the emplacement holes, repository tunnels, shafts, and boreholes.

ITEM REFERENCE: Section 6.3.3, page 6-7, paragraph 4

NRC COMMENT: "The staff is also concerned about the DOE approach to deriving performance requirements for the seal system. As noted in SCR Figure 10-16, the ratio of releases to the EPA limit is set equal to 1. This does not provide a margin of safety to allow for uncertainty in the data or the model used. The SCR notes that this will be used to establish preliminary design criteria, but does not identify how uncertainties in the models and in the input parameters for performance assessment will be addressed."

STATUS: Agreed

BWIP RESPONSE: A new repository performance assessment plan for allocating isolation performance among site, seals, and waste package will be prepared. It is anticipated that a safety factor will be introduced into the formulation for deriving seal system performance requirements. SCP Section 10.8 will be modified to reflect this performance reallocation, and will address the methods used to identify uncertainties.

ITEM REFERENCE: Section 6.3.3, page 6-7, paragraph 5

NRC COMMENT: "A detailed description of the methods and what specific data will be acquired during site characterization is needed (see Chapter 10 of this report for a discussion of the level of detail needed). Specific

statements of the methodology to be employed in determining the need for and the adequacy of such tests as they relate to the performance objectives are not discussed in the SCR." Description of the procedures and data. Note: Procedures can be referenced.

STATUS: Agreed

BWIP RESPONSE: SCP Section 10.8 will refer to detailed descriptions of the procedures and data which must be acquired during site characterization for the purposes of seal development.

ITEM REFERENCE: Section 6.3.3, page 6-7, paragraph 5, item 1

NRC COMMENT: "The DOE sealing program seems to rely heavily on the results of performance assessment failure scenarios with a ratio of releases to the EPA standard equal to 1. These scenarios consider performance from the seal system is necessary. The staff agrees that such an approach is necessary and useful in developing design criteria. Considering the uncertainties involved, however, it should not be the only approach used in determining the design criteria. Minimum design objectives should be developed considering industry sealing experience and preliminary experimental studies." Minimum design objectives should (also) be developed and discussed.

STATUS: Agreed

BWIP RESPONSE: Shaft seal performance modeling independent of site and waste package performance assessment activities, currently in progress, will be included in Section 10.8 of the SCP. This modeling will take into account the results of disturbed rock zone and seal materials studies, which will reflect industry sealing experience. Minimum design objectives (i.e., performance requirements) are being developed and will be discussed in the SCP.

ITEM REFERENCE: Section 6.3.3, page 6-8, paragraph 1, items 2-5

NRC COMMENT: Item 2. "According to SCR Figure 17-9, selection of candidate sealing materials will be delayed until 1984. This is late in the program and forces delays in other work elements, such as selecting, testing and placement techniques, longevity tests, and field tests for seal materials. If there is any slippage in the proposed schedule, the test program may not be adequately completed by license application time. Trade studies under summary narrative 16 in the SCR should be started as soon as possible because of the long lead times involved." What about placement techniques and field tests? The slippage in scheduling could be a problem.

TABLE II

REPOSITORY DESIGN

STATUS: Agreed

BWIP RESPONSE: The schedules in SCP Chapter 17 will be modified to reflect that primary candidate sealing materials have been selected, namely, concrete and mixtures of crushed basalt and bentonite. SCP Chapter 17 will also be modified to reflect plans for laboratory and field testing of materials. Laboratory testing of these materials is in progress.

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NRC COMMENT: Item 3. "The work elements do not identify how the long-term stability of seals (i.e., longevity) will be evaluated so that reasonable assurance of performance can be presented at licensing time. Work Elements R.1.22.D and R.1.23.D do mention simulation of repository operating conditions; however, long-term and accelerated laboratory and field testing are not addressed in the SCR. These concerns should be addressed at an early date." The SCP needs to reference documents used to date, "currently being conducted".

STATUS: Agreed

BWIP RESPONSE: SCP Section 10.8 will be modified to reflect that studies are currently being conducted to identify methodologies for predicting the very long term performance of seal materials based on laboratory testing. The SCP will reference appropriate documentation.

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NRC COMMENT: Item 4. "The effects of reinforcements, such as shaft liners, on long-term sealing are not addressed adequately in the SCR (e.g., will production shaft liners be removed?). The design and use of reinforcement such as shaft liners require assessment from the standpoint of long-term sealing. If left in place, liners may deteriorate and become preferential pathways for nuclide migration." What is the impact of leaving liners in place in other areas?

STATUS: Agreed

BWIP RESPONSE: SCP Section 10.8 will be modified to reflect that current plans call for the removal of the shaft liner in the area where bulkhead seals are to be emplaced. Liner removal in other areas, as well as liner retention, will be evaluated for impact in view of performance objectives.

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TABLE II

REPOSITORY DESIGN

NRC COMMENT: Item 5. "Detailed plans for construction and sealing the exploratory shaft and details of the QA procedures are not presented."

STATUS: Agreed

BWIP RESPONSE: See NRC reference item Section 6.3.3, page 6-8, paragraph 1, item 4. Details of the QA procedures are included in Chapter 18 of the SCP.

ITEM REFERENCE: Section 6.3.4, page 6-8, paragraphs 2 and 3

NCR COMMENT: Additional study of waste retrieval is needed to provide confidence that waste retrieval can be accomplished and to ensure that design features to facilitate retrieval are incorporated. This study is also needed to define any development or demonstration testing that may be warranted, specifically:

- What in situ tests are planned?
- Retrieval work element given low priority.
- Evaluate problems with horizontal emplacement.
- No details regarding scope, number, timing, type of tests, or where?
- Constructability is unproved.
- Stability of horizontal holes in a jointed rock under thermal stresses.
- Equipment and procedures for retrieving waste are yet to be developed.
- Must be reasonable assurance at license application that retrieval of waste is indeed possible.
- Demonstration of (1) drilling, (2) emplacement, and (3) retrieval will build confidence. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: More detailed information will be added to Section 10.7.3 of the SCP identifying current plans for engineering studies in FY 1983 and 1984 to investigate alternate waste retrieval methods and equipment. These studies will also identify requirements for demonstration testing of retrieval operations under simulated repository conditions. Design data from these tests will support the license application. These items will be discussed further at a future NRC workshop.

TABLE II

REPOSITORY DESIGN

ITEM REFERENCE: Section 6.3.5, page 6-10, paragraph 1-4

NRC COMMENT:
- Plan lacks a logical development and rationale for development.
- Identify important design parameters.
- Document their potential variability.
- Identify measuring technique and reliability.
- Provide references to test procedures and QA. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: More detailed information will be added to Section 10.7.3 of the SCP addressing these items. These items will also be discussed further at a future NRC workshop.

ITEM REFERENCE: Section 6.3.5, page 6-10, paragraph 5

NRC COMMENT: Major limitation, lack of plans for (1) full-scale room excavation and (2) large-scale thermal-hydrologic testing in underground facility during Phase II. (paraphrased)

STATUS: Agreed (Open)

BWIP RESPONSE: This topic will be included at a future NRC workshop. Clarification of the type of testing proposed and the method of analysis is needed.

ITEM REFERENCE: Section 6.3.5, page 6-11, paragraph 1

NRC COMMENT:
- Commitment to perform necessary and sufficient testing.
- Difficult to evaluate site characterization in the absence of test plan details.
- There should be a sense of urgency about resolving these concerns.

STATUS: Agreed

BWIP RESPONSE: The schedules in Chapter 17 of the SCP will reflect sufficient time for testing prior to license application.

TABLE II

REPOSITORY DESIGN

ITEM REFERENCE: Section 6.3.5, page 6-12, paragraph 2

NRC COMMENT: "Many tests performed at the NSTF may not be repeated." (Needs explanation.)

STATUS: Agreed

BWIP RESPONSE: An explanation of those tests performed in the NSTF will be provided in the SCP and more details will be given justifying those tests that will not be repeated at depth in the ES-II.

ITEM REFERENCE: Section 6.3.5, page 6-12, paragraph 3

NRC COMMENT: "In summary, the staff finds the vagueness in the test plans and the lack of details for the in situ tests, tight schedules, and the apparent conditional commitments to execute the tests make the evaluation of the proposed site characterization plan difficult. Lack of plans for a full-scale room excavation to demonstrate the stability of repository openings during the Phase II testing is a weakness of the proposed site characterization program at the BWIP.

The NRC staff and DOE need to come to closure on what is an adequate in situ test plan. To do this the NRC staff needs early access to proposed test procedures. It is suggested that draft plans be provided to avoid a situation where plans are locked in and NRC comments will meet great resistance! It is suggested that NUREG/CR-3065 be used as a point of reference.

Detailed plans should be referenced in the SCP."

STATUS: Agreed

BWIP RESPONSE: A paragraph will be added to Section 10.1.1 of the SCP stating that results from in situ tests which serve to characterize the site will be input to the design in time to support the license application. A reference will be made to Chapter 17 of the SCP in situ testing details and plans.

NUREG/CR-3065 will be used as a point of reference in future discussions of test planning. Action is underway to expedite the document clearance process.

Available detailed test plans will be referenced in the SCP.

TABLE II

REPOSITORY DESIGN

ITEM REFERENCE: Section 6, General Comment

NRC COMMENT: Conceptual Design Report required by the NRC.

STATUS: Agreed

BWIP RESPONSE: Action has been taken to expedite the release of the Conceptual System Design Description. It will be furnished to NRC as soon as it becomes available.

ITEM REFERENCE: Section 6, General Comment

NRC COMMENT: Horizon Selection Report required by the NRC.

STATUS: Agreed

BWIP RESPONSE: Action has been taken to expedite the publication and release of the Horizon Identification Report. It will be furnished to NRC as soon as it becomes available.

TABLE II

WASTE PACKAGE

ITEM REFERENCE: Chapter 11, page 11-13 through 11-15, items 1-10

NRC COMMENT: Item 1. Develop and implement a reliability program to demonstrate satisfaction of NRC performance criteria, including identification of pertinent design requirements for reliability of long term post emplacement performance. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Development of an engineering design and reliability analysis plan for waste package is underway. Further discussions with NRC regarding the program they envision will be based on a NRC position paper on waste package reliability. It is expected that reliabilities will be assigned to each waste package component. (paraphrased)

. . . . . .

NRC COMMENT: Item 2. Complete an engineering analysis of known failure modes for the life history of the waste package and estimate their contribution towards failure to satisfy system performance criteria in conjunction with reliability analysis. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The present BWIP engineering analysis plan does not account for all identified failure modes nor does it estimate their contribution towards failures of the waste package. All identified events will be considered. The materials testing effort necessary to support this activity will be detailed in the BWIP BMTP. This plan will be completed when the SCP is issued. A later edition of this plan will tie each of these tests to reliability objectives for the waste package. (paraphrased)

. . . . . .

NRC COMMENT: Item 3. "The NRC suggests that pitting corrosion is a very likely cause for low carbon steel container failure. The effect of pitting corrosion, stress corrosion, cracking and H_2 embrittlement on the integrity of the carbon steel container should be discussed in greater detail and plans for future evaluation of pitting corrosion provided."

STATUS: Agreed

BWIP RESPONSE: In the present draft of the BWIP Barrier Materials Test Plan, preferential corrosive attack of carbon steel is covered in greater detail than in the SCR. The susceptibility, rate, mechanisms, effect of groundwater composition, backfill material, and gamma radiation will be measured on pitting, stress corrosion, cracking and H_2 embrittlement. The SCP will include additional material and appropriately reference the Barriers Materials Test Plan.

. . . . . .

TABLE II

WASTE PACKAGE

NRC COMMENT: Item 4. The possible effect of microbes on canister integrity, backfill stability, and transport of radionuclides should be discussed and plans for evaluating microbial effects on corrosion and backfill stability provided. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: Since microbial activity may affect pH and Eh, the corrosion behavior of carbon steel and behavior of backfill material may be adversely affected if microbes can survive and/or become acclimatized to the thermal and radiation fields near the waste package. These studies are discussed in the Barrier Materials Test Plan. These effects will be measured if found significant under expected repository conditions and if successful test techniques can be developed.

. . . . . .

NRC COMMENT: Item 5. The details of plans to collect data to determine the effect of groundwater residence time (effective groundwater flow rate) on waste form degradation and on transport should be discussed.

STATUS: Agreed

BWIP RESPONSE: These kinds of tests are planned for the flow-through autoclaves and are described in the Barrier Materials Test Plan. This is a key factor in determining whether radionuclide release will be limited by leach rate or by solubility concentrations. They will be referenced in the SCP, Section 11.4.5.

. . . . . .

NRC COMMENT: Item 6. Insufficient details of plans to investigate transport properties of candidate packing material, particularly under hydrothermal conditions and in the presence of a radiation field are presented in the SCR. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: This item is incorrectly referenced in the SCA; should refer to 7.3.3.3.1. Radionuclide transport data needs and testing techniques for backfill are detailed in the Barrier Materials Test Plan. Development of Soret diffusion coefficients is not planned because of the estimated low thermal gradient across the backfill component of the waste package. Degradation mechanisms sensitive to thermal gradents (e.g., convective heat change, diffusion, pitting attack, etc.) will be evaluated. Additional information will be summarized in the SCP, Section 11.4.4.

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TABLE II

WASTE PACKAGE

NRC COMMENT: Item 7. Insufficient details of plans to determine changes in waste form properties such as devitrification, phase separation, radiation effects, etc. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: A large part of the waste package material studies encompass the work to define the behavior of borosilicate glass and spent fuel under hydrothermal conditions expected in the basalt repository. These tests are detailed in the Barrier Materials Test Plan and cover the use of simulated, tracer-doped, and fully radioactive waste forms in the presence of waste package components and basalt. Long term effects of waste aging during containment (dry) will be addressed, i.e. effect of H_2 gas on glass during containment. They will be referenced in the SCP.

. . . . . .

NRC COMMENT: Item 8. No plans to collect data to estimate rate of flow of water through a failed container were presented to the SCR.. Water flow rate is important in determining the conditions of the waste form following canister failure and transport of radionuclides within the waste package. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: No specific reference to this subject was found on the referenced appendices P and R. However, the subject of water flow through breached borosilicate glass containers and fuel cladding is being considered by the BWIP. Experimentally it appears that, due to the low flow rates expected in the repository and through the backfill, quantitative and meaningful data may be difficult to obtain. Planning for such testing is awaiting further analysis and, if feasible, will be incorporated in the Barrier Materials Test Plan. The effect of local convective flow will be addressed in field tests. The status of planning will be covered in the SCP, Chapter 15. This item will be discussed with the NRC at a future workshop.

. . . . . .

NCR COMMENT: Item 9. The details of plans to predict changes in the environment surrounding the waste package should be expanded. These data are basic to the evaluation of barrier components performance and radionuclide transport. Mechanical, thermohydraulic, and chemical changes, as well as radiation effects, need to be addressed with engineering tests of prototype systems to support degradation modeling. (paraphrased)

STATUS: Agreed

TABLE II

WASTE PACKAGE

BWIP RESPONSE: The hydrothermal test equipment used by the BWIP permits sampling of test solutions for analysis during the test runs. Thus, the chemical changes as a function of time and physical conditions are obtained. This data is necessary to verify the performance model. Test results documenting the change in geochemical conditions in the waste package and surrounding disturbed zone will be presented in Section 6.4 of the SCP. Mechanical and radiation testing will be based on potential failure modes. It is expected that the waste package design developed will be sufficiently conservative to obviate the need for characterizing every failure mode in detail.

. . . . . .

NRC COMMENT: Item 10. Description of a plan to demonstrate that mechanical loading is being properly addressed. This effort is to include the effects on canister, backfill (packing material) and waste form. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: A waste package mechanical testing and fabrication testing plan for package material, canister and waste form behavior will be developed as a separate or subtier plan to the Barrier Materials Test Plan. Plans in this area will be summarized in the SCP, Chapter 15.

ITEM REFERENCE: Section 7.3, page 7-9

NRC COMMENT: Waste Form Issue: Borosilicate glass is questioned as an effective release barrier in a NWRB, particularly under hydrothermal conditions. The concern centers about the stability of glass and predicting its long term behavior. The behavior of the waste form under hydrothermal conditions should be emphasized if the waste package container reliability for the selected design life is insufficient to exclude such conditions from the waste form. (paraphrased)

STATUS: Open

BWIP RESPONSE: The BWIP approach has been to not emphasize the waste form leach rate, but the solubility limits to concentrations (and hence release) imposed by radionuclide bearing solids. In this manner, the BWIP follows the fate of radionuclides rather than just the fate of the initial waste form. If testing of an alternate waste form were required, testing of the alternate would effectively double the waste-barrier-rock interaction work currently underway. This requires a DOE decision on development of contingency (alternate) waste forms. This will be the subject of future discussions with the NRC.

TABLE II

WASTE PACKAGE

ITEM REFERENCE: Chapter 7, page 7-12, item 1

NRC COMMENT: Viability of long borehole horizontal waste package emplacement needs to be demonstrated and alternate designs considered prior to selecting a final waste package design. The waste package design selected must be capable of meeting overall reliability objectives established. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: (None) As part of ongoing engineering studies, the BWIP is evaluating several alternate waste package emplacement configurations. The results of these studies will be taken into consideration during the preliminary design phase.

TABLE II

PERFORMANCE ASSESSMENT

ITEM REFERENCE: Section 9.3.1, page 9-7, paragraph 3

NRC COMMENT: "The minimum groundwater travel time issue as stated in the SCR is inconsistent with 10 CFR 60. The SCR states travel times are calculated from 'near the repository' rather than from the disturbed zone to the accessible environment."

STATUS: Agreed

BWIP RESPONSE: Chapter 12, Section 12.1.1 of the SCP will contain a complete and precise restatement of the minimum traveltime criterion.

ITEM REFERENCE: Section 9.3.3, page 9-9, paragraph 1

NRC COMMENT: The SCR should discuss the exact form of the EPA standard (relative to the total amount of radionuclides potentially releasable to the accessible environment in a 10,000-year period) and present a plan for demonstrating compliance with it. (paraphrased)

STATUS: Agreed

BWIP RESPONSE: The probabilistic nature of 40 CFR 191 deals specifically with the nature of releases (reasonably foreseeable versus unlikely). As yet, the EPA proposed regulation does not specify an acceptance probability for determining compliance with Table 2 values. The BWIP performance assessment approach will be to quantify all performance measurements in a probabilistic framework, e.g., cumulative probability versus performance measure. Chapter 12 of the SCP will be revised appropriately.

ITEM REFERENCE: Section 9.3.4, page 9-9, paragraph 3

NRC COMMENT: "No specific issues have been identified by DOE for the time period through permanent closure for either operational safety or retrievability. The NRC staff believes that greater emphasis or priority should be given to these items to achieve consistency with the performance objectives of 10 CFR 60."

STATUS: Agreed

BWIP RESPONSE: The scope of Chapter 12 in the SCR was limited to the issues of 'postclosure' performance. The revised chapter in the SCP will address preclosure performance issues/plans and retrievability issues/plans using available information.

TABLE II

PERFORMANCE ASSESSMENT

ITEM REFERENCE: Section 9.3.5, page 9-9, paragraph 4

NRC COMMENT: Descriptions in the SCR of the performance assessment approaches and methods in use or under development appear to be fragmented and imcompletely described.

STATUS: Agreed

BWIP RESPONSE: Additional detail on the performance assessment approach will be provided in Chapter 12, Section 12.2 of the SCP.

ITEM REFERENCE: Section 9.3.5, page 9-1, paragraph 1

NRC COMMENT: The SCR should have included a detailed discussion of how the subsystem models that might be integrated into system models (SCR Figure 12-3) would be used to address each performance objective.

STATUS: Agreed

BWIP RESPONSE: A detailed description of the performance assessment models and how they are interfaced will be included in Chapter 12, Section 12.3.

ITEM REFERENCE: Section 9.3.6, page 9-11, paragraph 4

NRC COMMENT: The NRC staff would like clear and concise locations and descriptions of the boundaries used for assessments, i.e., accessible environment, disturbed zone, waste package, and engineered barrier system.

STATUS: Agreed

BWIP RESPONSE: Detailed definitions will be included in Chapter 12, Section 12.1 of the SCP.

ITEM REFERENCE: Section 9.3.7, page 9-13, paragraph 3

NRC COMMENT: The methods used for scenario development were not described in adequate detail in the SCR.

STATUS: Agreed

TABLE II

PERFORMANCE ASSESSMENT

BWIP RESPONSE: A detailed discussion on scenario analysis will be included in Chapter 12, Section 12.2 of the SCP.

ITEM REFERENCE: Section 9.3.10, page 9-14, paragraph 5

NRC COMMENT: The NRC staff would like the problem of complete validation, verification and documentation of performance assessment methods to be addressed. This should include numerical models and computer codes.

STATUS: Agreed

BWIP RESPONSE: Technical reports and user's guides are currently being prepared for the major performance analysis models. Documentation for the PORFLO and MAGNUM 3-D codes will be issued this fiscal year. Our current plan is to have all codes documented by the end of FY 1985.

ITEM REFERENCE: Section 9.3.11, page 9-15, paragraph 3

NRC COMMENT: The NRC staff is concerned that the assessment process discussed in the SCR has inadequately identified the types and ranges of data needed to demonstrate compliance with the numerical performance objectives. The NRC is also concerned that the assessment process referenced cannot reconcile the successes and failure of site characterization activities that produce this data.

STATUS: Agreed

BWIP RESPONSE: Second order uncertainty analysis techniques and Monte Carlo simulations will be used in assessing the relationship between 'data uncertainty' and 'predictive uncertainty.' These techniques will be discussed in Chapter 12, Section 12.3 of the SCP.

ITEM REFERENCE: Chapter 11, page 11-3, items 8-10

NRC COMMENT: Item 8. "Numerical models of groundwater flow reported in the SCR."

STATUS: Agreed

BWIP RESPONSE: On-going activities leading to model validation are aimed at resolving any deficiencies noted in current codes and models. Current defects are recognized; BWIP Performance Assessment Plan and related plans and procedures address this issue.

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TABLE II

PERFORMANCE ASSESSMENT

NRC COMMENT: Item 9. "The code PORFLO."

STATUS: Agreed

BWIP RESPONSE: See NRC reference item page 11-3, item 8. User's Guide publication is imminent, and verification/validation of several PORFLO components are in progress.

. . . . . .

NCR COMMENT: Item 10. "The level of confidence in preliminary traveltime calculations."

STATUS: Agreed

BWIP RESPONSE: Stochastic analysis from The Baseline Report will be incorporated into Chapter 5, Section 5.1.8 of the SCP emphasizing on-going efforts.

ITEM REFERENCE: Chapter 11, page 11-4, items 1-4

NRC COMMENT: Item 1. "Quantitative sensitivity studies which show the effects of uncertainty in key parameters (e.g., vertical hydraulic conductivity)."

STATUS: Agreed

BWIP RESPONSE: Two work elements, S.1.28.C and S.1.40.D-SD, will be rewritten to incorporate the use of sensitivity and uncertainty analysis to examine their effect on travel-time calculations.

. . . . . .

NRC COMMENT: Item 2. "Description of plans to determine the probabilities and consequences of natural changes which could affect groundwater flow."

STATUS: Agreed

BWIP RESPONSE: Work elements S.1.41.D, S.1.44.D, S.1.45.D, S.1.46.D, and S.1.48.D will be rewritten to incorporate the current work on the identification and characterization of disruptive scenarios. Both natural and man made events will be reviewed.

. . . . . .

TABLE II

PERFORMANCE ASSESSMENT

NRC COMMENT: Item 3. "Description of plans to determine the probabilities and consequences of human-induced changes (excluding repository - induced changes) that could affect groundwater flow."

STATUS: Agreed

BWIP RESPONSE: Work elements S.1.41.D, S.1.44.D, S.1.45.D, S.1.46.D, and S.1.48.D will be rewritten to incorporate the current work on the identification and characterization of disruptive scenarios. Both natural and man made events will be reviewed.

. . . . . .

NRC COMMENT: Item 4. "Description of plans to determine the probabilities and consequences of repository-induced changes that could affect groundwater flow."

STATUS: Agreed

BWIP RESPONSE: Work elements S.1.41.D, S.1.44.D, S.1.45.D, S.1.46.D, and S.1.48.D will be rewritten to incorporate the current work on the identification and characterization of disruptive scenarios. Both natural and man made events will be reviewed.

ITEM REFERENCE: Chapter 11, page 11-11, items 1, 2, 4, and 5

NRC COMMENT: Item 1. "Geochemical inputs to performance assessment models."

STATUS: Agreed

BWIP RESPONSE: Discussion of current plans for integration of source term (very-near-field) and transport models will be added to Chapters 15 and 16 of the SCP.

. . . . . .

NRC COMMENT: Item 2. "Coupling geochemical models to transport models."

STATUS: Agreed

BWIP RESPONSE: Discussion of current plans for coupling the geochemical and transport models will be addressed in Chapter 15 of the SCP.

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TABLE II

PERFORMANCE ASSESSMENT

NRC COMMENT: Item 4. "Source term (including contributions by the waste package other than radionuclides)."

STATUS: Agreed

BWIP RESPONSE: See NRC reference item page 11-11, item 2.

. . . . . .

NRC COMMENT: Item 5. "Release scenarios."

STATUS: Agreed

BWIP RESPONSE: See NRC reference item page 11-11, item 2.

TABLE II

QUALITY ASSURANCE

ITEM REFERENCE: Chapter 10, page 10-2

NRC COMMENT: Data should be documented and recorded under a full QA program and be made available to all interested parties for inspection at an early date. (paraphrased)

STATUS: Open

BWIP RESPONSE: The system of QA documentation of data collection and recording exists and will be clarified in the SCP. The issue of open availability will be discussed at a future NRC workshop.

ITEM REFERENCE: Chapter 10, page 10-3, items 1 and 2

NRC COMMENT: Item 1. "...implementing functional procedures manuals, the BWIP procedures manual, the Data Package Manuals, and (other Rockwell manuals and documents applicable to the overall QA program should be referenced and identified)."

STATUS: Open

BWIP RESPONSE: Resolution of the DOE document clearance process is required to satisfy this issue. Rockwell's Quality Assurance Program Index references applicable Rockwell manuals.

. . . . . .

NRC COMMENT: Item 2. The SCR does not present adequate details regarding implementation of site characterization plans. Plans should be developed "from identification of general performance objectives and criteria." Also, "few detailed test plans are referenced in the SCR for any of the major test programs mentioned." The planning "must start by considering EPA and NRC criteria." Additionally, "a description of the QA program to be applied to each planned test and a discussion of the limitations and uncertainty in the data" should be provided. The NRC staff recognizes that not all test plans may be needed at this time, however some (plans) should be available for review. (paraphrased)

STATUS: Open

BWIP RESPONSE: Details of the structured test planning program, updated to 10 CFR 60 requirements, will be discussed in the SCP. Resolution of the DOE document clearance process is required to fully satisfy this issue. A description of the QA program applied to each test and discussion of data limitations and uncertainty is contained in the test plans and is not considered appropriate for the SCP.

TABLE II

QUALITY ASSURANCE

ITEM REFERENCE: Chapter 11, page 11-16, items 3 and 4

NRC COMMENT: Item 3. "Methods for reliability analyses should be identified. Implementation of the requirements of DOE-RL Order 5700.2 and DOE Order 6430 involving design control should be identified and documented."

STATUS: Open

BWIP RESPONSE: The BWIP approach is to use confidence levels of waste package/backfill/seals/host rock, etc. This will be clarified in an upcoming workshop with the NRC and addressed in the SCP.

. . . . . .

NRC COMMENT: Item 4. "The effectiveness of the QA program should be addressed in detail. Revisions to the program which were implemented to increase effectiveness should be discussed."

STATUS: Open

BWIP RESPONSE: The NRC was unable to clarify the intent of this comment. This topic will be discussed and clarified in an upcoming workshop with the NRC.

TABLE III

STATUS OF SPECIFIC ISSUES FROM APPENDIX B AND C OF THE DSCA

Note: There are no comments on SCR Chapters 1, 2, 7, 8, 9, and 19.

TABLE III

EXECUTIVE SUMMARY

ITEM REFERENCE: Executive Summary, page 1, paragraph 2, item 5

NRC COMMENT: "Preliminary tests indicate...favor long-term stability."/4, 12

STATUS: Agreed

BWIP RESPONSE: Statement will be modified to more closely reflect the preliminary nature of the data. Additional data will be input into the SCP to substantiate this statement.

ITEM REFERENCE: Executive Summary, page 7, paragraph 4

NRC COMMENT: "The results of the studies...horizons of the Grande Ronde Basalt."/4, 7, 12 -- "The results to this time have suggested just the opposite; Eh would be a particular example."

STATUS: Agreed

BWIP RESPONSE: Statement will be modified to more closely reflect the preliminary nature of the data. Conditions have not been fully established in the Grande Ronde. Independent simulations of the Grande Ronde environment have been made and the data will be discussed.

ITEM REFERENCE: Executive Summary, page 7, paragraph 4

NRC COMMENT: "At the end of the waste containment period...relative to release criteria."/3, 4, 5, 7, 11, 12, 13, 15 -- "This statement is much too strong and glosses over the need for site-specific solubility."

STATUS: Agreed

BWIP RESPONSE: Statement will be re-written to address all mechanisms likely to control radionuclide concentrations in the groundwater.

ITEM REFERENCE: Executive Summary, page 8, paragraph 1

NRC COMMENT: "It was found that...low oxidation potential (Eh)."/3, 5, 6, 7, 12, 15 -- "Basalt water equilibrium has not been demonstrated. The relationship between DO and redox conditions of the water is not so simple."

STATUS: Agreed

TABLE III

EXECUTIVE SUMMARY

BWIP RESPONSE: Statement will be modified to more closely reflect the preliminary nature of the data. Eh conditions in the basalt have not been established. Independent simulations of DO and redox condtions in a basalt environment have been initiated and the preliminary results will be reported.

ITEM REFERENCE: Executive Summary, page 8, paragraph 1

NRC COMMENT: "Under these conditions...iron oxide existing in the basalt."/3, 4, 6, 7, 12

STATUS: Agreed

BWIP RESPONSE: Statement will be modified to more closely reflect the preliminary nature of the data. Additional data will be input into the SCP to substantiate this statement.

ITEM REFERENCE: Executive Summary, page 8, paragraph 1

NRC COMMENT: "Under these reducing conditions...extremely insoluble and thus immobile."/4, 6, 7, 11, 12, 13 -- "Reducing conditions not proven and extremely insoluble is a gross overstatement."

STATUS: Agreed

BWIP RESPONSE: Statement will be re-written to properly qualify the anticipated radionuclide behavior under reducing conditions.

ITEM REFERENCE: Executive Summary, page 11, paragraph 3, items 1 and 3

NRC COMMENT: Item 1. "Solubility of radionuclides...proposed technical criteria."/10, 15 -- "Very dependent on model input assumptions and therefore involves some code 6 and 7 too. Does not prove solubility limits."

STATUS: Agreed

BWIP RESPONSE: Statement will be modified to more closely reflect the preliminary nature of the data. Additional data will be input into the SCP to substantiate this modified statement.

. . . . . .

NRC COMMENT: Item 3. "High-sorptive properties of basalt..., americium."/10, 15 -- "Modeling assumes 'High-sorptive capacity' then the rest may follow; therefore, also includes codes 6 and 7 because of 9 and 11."

TABLE III

EXECUTIVE SUMMARY

STATUS: Agreed

BWIP RESPONSE: Statement will be re-written and the sorption data used in the modeling will be qualified to more closely reflect the available data.

ITEM REFERENCE: Executive Summary, page 12, item 1

NRC COMMENT: "Radioactive release...scenarios."/10, 15 -- "Again assumptions play such a great role that codes 6 and 7 apply in part. Cannot state a fact about an input that is assumed."

STATUS: Agreed

BWIP RESPONSE: Statement will be re-written to properly qualify this conclusion from the predictive modeling, and the preliminary nature of the input data.

ITEM REFERENCE: Executive Summary, page 13, paragraph 2

NRC COMMENT: "A description...in this report."/3, 21

STATUS: Agreed

BWIP RESPONSE: Statement in the executive summary will not be changed. However, some of the work elements are being modified to provide more detail and additional work elements are being added to the project to address NRC concerns. It should be noted that the level of detail required to evaluate the likely level of success in a timely manner is subjective and will be the basis for continued dialogue with the NRC.

ITEM REFERENCE: Executive Summary, page 14, paragraph 1

NRC COMMENT: "The methods to be used...modeling."/3, 21

STATUS: Agreed

BWIP RESPONSE: Statement in the executive summary will not be changed. However, additional information will be given on the methods to be used to obtain the needed data. The level of detail required to evaluate the likely level of success in a timely manner is subjective and will be the basis for continued dialogue with the NRC.

TABLE III

EXECUTIVE SUMMARY

ITEM REFERENCE: Executive Summary, page 14, paragraph 2

NRC COMMENT: "Logic diagrams and schedules...a repository."/3, 21

STATUS: Agreed

BWIP RESPONSE: Statement in the executive summary will not be changed. However, additional detail will be provided on the logic diagrams and schedules to more easily identify the interface between activities. The level of detail required to evaluate the likely level of success in a timely manner is subjective and will be the basis for continued dialogue with the NRC.

TABLE III

CHAPTER 3 (GEOLOGY)

ITEM REFERENCE: Section 3.2.1, page 3.2-1, paragraph 3

NRC COMMENT: "Two slant core holes...through the Umtanum..."/ "This data is not provided."

STATUS: Agreed

BWIP RESPONSE: Data are in Fenix & Scisson, Inc. (1978) and the borehole files. Existing references will be added.

ITEM REFERENCE: Section 3.4.1, page 3.4-1, paragraph 2

NRC COMMENT: "Anticlinal ridges of the Yakima folds were avoided...8-kilometer offset from fold hinge lines..."/1 -- "This statement does not account for Yakima Ridge."

STATUS: Agreed

BWIP RESPONSE: The statement will be changed to account for Yakima Ridge.

ITEM REFERENCE: Section 3.4.2 page 3.4-4, paragraph 3

NRC COMMENT: The SCR states that "less than 50 meters are flood deposits;...Pleistocene catastrophic floods."/5 -- "There is insufficient data to make this statement."

STATUS: Agreed

BWIP RESPONSE: Figure 3-14 shows the thickness limitation in a generalized cross-section. The additional suprabasalt data will be added to the SCP.

ITEM REFERENCE: Section 3.5.4, page 3.5-15, paragraph 4

NRC COMMENT: "It has distinctly...chemical type."/14 -- "See Table 6.1 and Figure 6.3."

STATUS: Agreed

BWIP RESPONSE: This does not disagree with the previous statement. The statement is correct, but Figure 6-3 requires change to reflect TiO_2 for the upper portion of Schwana sequence and/or the upper low Mg flow below the Umtanum.

TABLE III

CHAPTER 3 (GEOLOGY)

ITEM REFERENCE: Section 3.5.4, page 3.5-28, paragraph 2

NRC COMMENT: "The petrographic characteristics...rate for the entablature."/16

STATUS: Agreed

BWIP RESPONSE: The reference to Wood and Long (1981) and Long and Others (1980) (SA-67) will be added.

ITEM REFERENCE: Section 3.5.4, page 3.5-28, paragraph 4

NRC COMMENT: "The SCR states that "considerable continuity (intraflow structures) exists in some flows such as the Umtanum."/1, 5 -- "Borehole RRL-2 and others show great lack of continuity in the Umtanum flow."

STATUS: Agreed

BWIP RESPONSE: The use of the Umtanum flow as an example was inappropriate. The statement will be revised to clarify which flows display considerable continuity.

ITEM REFERENCE: Section 3.5.4, page 3.5-31, paragraph 2

NRC COMMENT: The SCR states that "At the Emerson Nipple section...has a thickness of 40 meters."/6 -- "The thick flow top found in RRL-2, DC-12, and DC-15 indicates that this feature is not anomalous."

STATUS: Agreed

BWIP RESPONSE: The borehole data (e.g., RRL-2, DC-12, DC-15) will be included in the interpretation. The statement "anomalously" thick will be eliminated.

ITEM REFERENCE: Section 3.5.4, page 3.5-32, paragraph 2

NRC COMMENT: "The SCR states that "with additional data from field observations..any given volume of the Umtanum flow could be predicted."/1 -- "With geology as complex as in the basalts, accurate predictions of this kind are very unlikely."

STATUS: Agreed

TABLE III

CHAPTER 3 (GEOLOGY)

BWIP RESPONSE: The paragraph will be reworded to indicate what level of predicton can likely be made. A discussion of predictive accuracy will be made in the SCP.

ITEM REFERENCE: Section 3.5.4, page 3.5-32, paragraph 1

NRC COMMENT: Lines 7-11, "The occurrence of the...host flow itself."/3 -- "Hydrogeologic implications are not adequately covered in Chapter 5 of the SCR."

STATUS: Agreed

BWIP RESPONSE: The occurrence of fanning columns may be difficult to identify in vertical cores. However, such zones, if detected, will be tested hydrologically. Slant cores from the surface or horizontal cores from an exploratory test facility provide the best opportunity to detect such features. Plans for such hydrologic testing (large scale pump tests) will be included in the SCP.

ITEM REFERENCE: Section 3.5.4, page 3.5-32, paragraph 3

NRC COMMENT: Lines 33-36, "These features should...exploratory test facility."/3 -- "Hydrogeologic implications are not adequately covered in Chapter 5 of the SCR."

STATUS: Agreed

BWIP RESPONSE: The hydrogeologic implications of these features will be addressed in the SCP.

ITEM REFERENCE: Section 3.3.5, page 3.5-33, paragraph 5

NRC COMMENT: Lines 35-39, "A vesicular zone...to be interconnected."/3 -- "Hydrogeologic implications are not adequately covered in Chapter 5 of the SCR."

STATUS: Agreed

BWIP RESPONSE: The current hydrologic testing program consistently includes tests across this zone. Chapter 5 will include available data and the direction of further tests. Data from RHO-BWI-ST-28 (Horizon Identification Report) will be included in the SCP.

TABLE III

CHAPTER 3 (GEOLOGY)

ITEM REFERENCE: Section 3.5.4, page 3.5-33, paragraph 1

NRC COMMENT: "The total volume...percent."/7, 10

STATUS: Agreed

BWIP RESPONSE: Data from RHO-BWI-ST-28 (Horizon Identification Report) will be included in the SCP.

ITEM REFERENCE: Section 3.5.4, page 3.5-33, paragraph 1

NRC COMMENT: "The volume of unfilled fractures...percent."/7, 10

STATUS: Agreed

BWIP RESPONSE: Recent review of data indicate that reference to "unfilled" fractures as a percentage is inappropriate; such references will be deleted. These data are discussed in RHO-BWI-ST-28 and plans will be presented in Chapter 13 of the SCP.

ITEM REFERENCE: Section 3.5.4, page 3.5-33, paragraph 1

NRC COMMENT: The SCR states "the great majority of fractures...to assess their hydraulic conductivity."/1, 3, 11, 13, 15 -- "The majority of fracture are vertical or subvertical so would not be considered. Hydrogeologic implications are not adequately covered in Chapter 5 of the SCR."

STATUS: Agreed

BWIP RESPONSE: The statements will be reworded to include data from RHO-BWI-ST-28 (Horizon Identification Report). A statement relative to vertical or near vertical fractures will be added for clarification.

ITEM REFERENCE: Section, 3.5.4, page 3.5-33, paragraph 2

NRC COMMENT: The SCR states "additional exploratory drilling will be needed to confirm this prediction."/3, 12 -- "The plan for two more vertical holes will not yield enough information on fracture filling or distribution of palagonite."

STATUS: Agreed

TABLE III

CHAPTER 3 (GEOLOGY)

BWIP RESPONSE: The statement will be modified to reflect its basis in the existing data base. Information from the ES-II will be added to the data base providing confirmation. ES-II plans will be included or referenced in the SCP.

ITEM REFERENCE: Section 3.5.4, page 3.5-33, paragraph 4

NRC COMMENT: "The interior of the Sentinel Bluffs flow...entablature and colonnade may also exist."/4, 12, 15

STATUS: Agreed

BWIP RESPONSE: The statements will be modified to be descriptive only. Additional data will be supplied from RHO-BWI-ST-28.

ITEM REFERENCE: Section 3.5.4, page 3.5-33, paragraph 5

NRC COMMENT: "This zone occurs...(see Figure 3.22, 3.23, and 3.24)."/3 -- "Zone is not shown on diagrams cited."

STATUS: Agreed

BWIP RESPONSE: The reference to Figure 3-22 will be omitted. The zone is illustrated in Figures 3-23 and 3-24 as a dotted line, as identified in the legend.

ITEM REFERENCE: Section 3.5.4, page 3.5-35, paragraph 1

NRC COMMENT: "Fractures in the Middle Sentinel Bluffs flow...such occurrences are very low."/3, 5, 7, 15, 19 -- "There just isn't enough data to make such a statement."

STATUS: Agreed

BWIP REPONSE: Additional data will be added from RHO-BWI-ST-28.

ITEM REFERENCE: Section 3.5.5, page 3.5-39, paragraph 2

NRC COMMENT: "The dominant rock alteration process...(whole paragraph)."/5, 16 -- "Very loose reasoning is used. In particular equilibrium among basalt glass/fracture filling/groundwater is not proven and the effects of a thermal pulse are not considered."

TABLE III

CHAPTER 3 (GEOLOGY)

STATUS: Agreed

BWIP RESPONSE: Reference to the results of recent hydrothermal experiments will be made in Chapter 6 of the SCP.

ITEM REFERENCE: Section 3.5.6, page 3.5-39, paragraph 2

NRC COMMENT: "The general stratigraphic setting...lithologic factors...location."/5, 12, 15, 16 -- "Knowledge of distribution of (a) flow tops and flow top mineralogy, (b) interbeds and interbed mineralogy, and (c) mesostasis in basalt not well understood."

STATUS: Agreed

BWIP RESPONSE: The general stratigraphy is well known, however, a statement will be added that the intraflow and interbed characteristics are not as well understood with respect to constructibility and performance assessment. Plans for data collection will be presented in the SCP.

ITEM REFERENCE: Section 3.5.6, page 3.5-39, paragraph 2

NRC COMMENT: "Additional detailed...candidate repository horizons..."/21

STATUS: Agreed

BWIP RESPONSE: Plans will be included for additional host flow characterization and data will be added from RHO-BWI-ST-28.

ITEM REFERENCE: Section 3.6.6, page 3.6-20, paragraph 4

NRC COMMENT: "Remote sensing studies...are summarized."/3, 7 -- "No maps are provided."

STATUS: Agreed

BWIP RESPONSE: Because of the volume of maps, it is not practical to include them in the SCP. This information is presented in Sandness and others (1983) and is referenced.

ITEM REFERENCE: Section 3.7.2, page 3.7-2, paragraph 1

NRC COMMENT: The SCR states that "Overall, the folds and strain...predicted in the mechanical model."/6, 11

TABLE III

CHAPTER 3 (GEOLOGY)

STATUS: Agreed

BWIP RESPONSE: Alternatives models will be discussed and evaluated in the SCP.

ITEM REFERENCE: Section 3.7.2, page 3.7-4, paragraph 4

NRC COMMENT: Lines 46-48, "Planned studies...in basalt."/3 -- "Not adequately covered in Chapter 13 of the SCR."

STATUS: Agreed

BWIP RESPONSE: More detailed plans for tectonic breccia and fracture study will be described in Chapter 13. Tectonic breccia zones will be hydrologically tested and the program will be described in Chapter 13 and the Drilling and Testing Plan.

ITEM REFERENCE: Section 3.7.2, page 3.7-8, paragraph 3

NRC COMMENT: "Location of the Silver Dollar fault on Figure 3-48."/ "The Silver Dollar fault is incorrectly located on Figure 3-48."

STATUS: Agreed

BWIP RESPONSE: The location of the Silver Dollar fault is taken from RHO-BWI-ST-4 which was taken from the original mapping by Goff. The text of the SCR is incorrect and will be changed to designate the fault location as the north limb of the Yakima Ridge structure.

ITEM REFERENCE: Section 3.7.2, page 3.7-17, paragraph 4

NRC COMMENT: The SCR states "small fault zones a few centimeters ... taken from many core holes."/7, 15 -- "Which core holes and at what intervals?"

STATUS: Agreed

BWIP RESPONSE: The SCR summarizes the discussion of Moak (1981) in RHO-BWI-ST-14. The data are given in Table 6-2 of RHO-BWI-ST-14. The discussion is on pages 6-1 to 6-8 of RHO-BWI-ST-14. Specific table and discussion pages in RHO-BWI-ST-14 will be updated and added to the SCR.

TABLE III

CHAPTER 3 (GEOLOGY)

ITEM REFERENCE: Section 3.7.2, page 3.7-18, paragraph 5

NRC COMMENT: The SCR states that "these structures have been interpreted as part of a wrench-fault system."/7

STATUS: Agreed

BWIP RESPONSE: The evidence for wrench fault interpretation is given in Swanson and others (1979) and in Anderson (1983). Additional text will be inserted in the SCP to express the evidence, which is largely the geometry of faults and fault-fold relationships. Alternate interpretations will also be considered in the SCP.

ITEM REFERENCE: Section 3.7.2, page 3.7-19, paragraph 4

NRC COMMENT: The SCR states "structural analyses at five locations ... along any one anticline and between different anticlines."/11

STATUS: Agreed

BWIP RESPONSE: The SCR restates the conclusions of Price (1982). Recognition of alternatives and analysis of uncertainties will be presented in the SCP.

ITEM REFERENCE: Section 3.7.2, page 3.7-19, paragraph 4

NRC COMMENT: The SCR states that "the strain is interpreted to be related to the folding process."/12, 15

STATUS: Agreed

BWIP RESPONSE: The observed faulting is related to folding. Additional information will be required to test the hypothesis which was raised later in the WPPSS hearings as to whether the folding is a shallow manifestation of deep seated thrusting along imbricate thrust plates that slip along a decollement.

ITEM REFERENCE: Section 3.7.2, page 3.7-26, paragraph 4

NRC COMMENT: The SCR states "because of the large number of boreholes ... which have been penetrated by a few boreholes."/ "There is little justification in presenting a geologic map based on top-of-rock data."

STATUS: Agreed

TABLE III

CHAPTER 3 (GEOLOGY)

BWIP RESPONSE: Structure contour maps of deeper horizons were constructed using data from boreholes that penetrated those horizons. The top-of-basalt datum was used only to add minor details in preparation of structure contour maps. The SCP will expand on the qualification of top of basalt as a structure datum.

Some clarification will also be added to the SCP as to how the structure contour maps of deeper horizons were prepared. The maps will be updated as data from new boreholes are collected.

ITEM REFERENCE: Section 3.7.2, page 3.7-28, paragraph 1

NRC COMMENT: Lines 1-5. "Based on data ... in Figure 3-52."/3 -- "The hydrogeologic significance of these potential boundaries was inadequately addressed in Chapter 5 and 13 of the SCR."

STATUS: Agreed

BWIP RESPONSE: Worst-case assumptions were made in interpreting geophysical anomalies as structures. These interpretations are being modified with collection of additional data. Additional interpretation of existing and new data will follow. The possible hydrologic significance will be addressed in more detail in Chapter 5 of the SCP. Plans for investigating anomalies will also be presented in Chapter 13 of the SCP.

. . . . . .

NRC COMMENT: Lines 32-33. "Future studies will ... (Chapter 13)."/3 -- "Not adequately covered in Chapter 13 of the SCR."

STATUS: Agreed

BWIP RESPONSE: A study of tectonic breccias and fractures is currently under way. The plan of investigation will be added to Chapter 13 of the SCP.

ITEM REFERENCE: Section 3.7.2, page 3.7-31, paragraph 4

NRC COMMENT: The SCR states that "the pattern of joints described above ... found in the Cold Creek Syncline."/6, 17 -- "DOE has stated that tectonic breccia is found in every borehole in the Cold Creek Syncline that penetrates the Umtanum flow."

TABLE III

CHAPTER 3 (GEOLOGY)

STATUS: Agreed

BWIP RESPONSE: Clarification of the expression "relatively few tectonic joints" will be made in the SCR.

ITEM REFERENCE: Section 3.7.2, page 3.7-32, paragraph 3

NRC COMMENT: The SCR states "the presence of Miocene basalt ... slow enough to permit ductile deformation."/6, 11

STATUS: Agreed

BWIP RESPONSE: The SCR summarizes (briefly) the work of E. Price (1982). (RHO-BWI-SA-138). Additional discussion of deformation models will be added to Chapter 3 of the SCP.

ITEM REFERENCE: Section 3.7.3, page 3.7-35, paragraph 4

NRC COMMENT: The SCR states that "activity in the region since 1979 ... probably was related to eruptive activity."/11 -- "As shown in University of Washington publications, there was a great deal of microseismic activity in and adjacent to the Pasco Basin. This statement does not indicate this fact."

STATUS: Agreed

BWIP RESPONSE: The statement will be changed to refer to earthquakes greater than M=3.

ITEM REFERENCE: Section 3.7.3, page 3.7-35, paragraph 5

NRC COMMENT: The SCR states "the Columbia Plateau is an area of low seismicity. Historic earthquakes ... and have been small."/11 -- "The Pasco Basin and adjacent areas show a great deal of microseismic activity."

STATUS: Agreed

BWIP RESPONSE: Microseismicity is not part of the historical seismicity and is discussed in conjunction with instrumental seismicity.

Moderate historical seismicity is considered by BWIP to represent Modified Mercalli Intensity V-VII earthquakes. Thus, the historic events listed in Table 3-10 are all moderate. Algersmissen's 1969 seismic risk map depicts all of Eastern Washington as "moderate."

TABLE III

CHAPTER 3 (GEOLOGY)

The word "low" will be changed to "moderate" in the referenced statement to reflect the occurrence of many "moderate" events shown in Figure 3-54. Table 3-10 will also reflect these changes.

ITEM REFERENCE: Section 3.7.3, page 3.7-43, Figure 3.56

NRC COMMENT: Figure 3-5. 6/11 -- "Not all microearthquakes are shown. Does not indicate what years are covered."

STATUS: Agreed

BWIP RESPONSE: Figure 3-56 shows earthquakes M=1.5 or greater from 1969 through 1979. Additional figures of all recorded earthquakes M 1 will be added to the SCP.

ITEM REFERENCE: Section 3.7.3, page 3.7-52, paragraph 4

NRC COMMENT: The SCR states that "the permeability effects of swarms ... single large magnitude earthquake."/5, 6, 13, 15 -- "A number of swarms occurring near the repository over time could have a very significant effect on the repository and isolation."

STATUS: Agreed

BWIP RESPONSE: A complete data base and supporting data are being collected at BWIP and will be outlined in the Seismic Surveillance Test Plan to be referenced in the SCP. Additional information on this subject regarding the potential effect of swarms as an initiating disruptive event will be included in the SCP.

ITEM REFERENCE: Section 3.7.3, page 3.7-53, paragraph 4

NRC COMMENT: "An event of this size was assumed ... or unmapped faults."/ "This is not the NRC staff position. A swarm type earthquake was assumed to occur at a hypocentral distance of 3 to 5 k from site (WNP-2)."

STATUS: Agreed

BWIP RESPONSE: The entire sentence will be deleted.

TABLE III

CHAPTER 3 (GEOLOGY)

ITEM REFERENCE: Section 3.5.7, page 3.7-57, paragraph 1

NRC COMMENT: The SCR states "preliminary interpretations indicate that the site meets the criteria for tectonic stability."/15 -- "This conclusion, even if preliminary, is based on insufficient data."

STATUS: Agreed

BWIP RESPONSE: The statement will be changed to reflect more clearly the current level of understanding.

ITEM REFERENCE: Section 3.8.1, page 3.8-1, paragraph 5

NRC COMMENT: The SCR states that, "the frequency, areal distribution ... relieved as earthquakes along geologically mapped faults. Therefore, stress may be relieved in part aseismically."/6 -- "Stress relief resulting in microearthquakes is probably along nonmapped faults."

STATUS: Agreed

BWIP RESPONSE: Earthquakes, however small, indicate fracturing of rock or slip on existing fractures. This statement will be revised in the SCP.

The installation of a borehole network may help delineate any causative structures. Present plans for gathering and processing earthquake data are included in the Seismic Surveillance Test Plan and should address this concern. This plan will be referenced in the SCP.

ITEM REFERENCE: Section 3.8.1, page 3.8-2, paragraph 1

NRC COMMENT: "These results indicate ... criteria for tectonic stability."/5, 6, 7, 13, 15 -- "This conclusion is very premature."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 3.7-57, paragraph 1.

ITEM REFERENCE: Section 3.8.2, page 3.8-3, paragraph 4

NRC COMMENT: The SCR states that "Davis (1981) postulated that ... deformation as the folds begin to lock up."/17 -- "Davis no longer holds this view."

TABLE III

CHAPTER 3 (GEOLOGY)

STATUS: Agreed

BWIP RESPONSE: Davis revised his position in September 1982 after that section of the SCR had been completed. Clarification will be added to Chapter 3 of the SCP. The statement will be revised.

ITEM REFERENCE: Section 3.8.2, page 3.8-5, paragraph 4

NRC COMMENT: Price (1982) showed that the basalts ... reasonable for the Yakima fold system./11, 12

STATUS: Agreed

BWIP RESPONSE: Other hypotheses for Yakima fold development will be presented in the SCP.

ITEM REFERENCE: Section 3.8.2, page 3.8-5, paragraph 5

NRC COMMENT: The SCR states "According to this model ... buttress in the sub-basalt basement."/5.

STATUS: Agreed

BWIP RESPONSE: The statement will be revised. The statement was intended to indicate that the experiment shows one way of producing Yakima-like folds.

ITEM REFERENCE: Section 3.9.2, page 3.9-3, paragraph 1

NRC COMMENT: "Economic evaluation of mineral resources ... is considered too costly to remove."/ "No mention is made of groundwater or of present exploration activity near the Pasco Basin for hydrocarbons."

STATUS: Agreed

BWIP RESPONSE: Groundwater resources are discussed in Chapter 5 of the SCR.

The exploration for hydrocarbons beneath plateau is ongoing and no information is available from oil companies doing exploratory drilling. Public releases indicate that commercial quantities of gas have not been found.

A brief discussion based on recent limited available data and information on drilling activities will be added to the SCP.

TABLE III

CHAPTER 4 (GEOENGINEERING)

ITEM REFERENCE: Section 4.0, page 4.0-1, paragraph 4

NRC COMMENT: "There is a limit to the applicability of the near-surface data... such as stress levels." /19 -- "Site-specific differences are considerably more extensive than stress levels, and include lithology (possible structure), in situ temperature, geological history, water pressure, temperature, chemistry, lateral confinement."

STATUS: Agreed

BWIP RESPONSE: The text will be expanded to include site-specific differences in Section 4.0 of the SCP.

ITEM REFERENCE: Section 4.1.2, page 4.1-2, Table 4-1, page 4.1-3, Table 4-2

NRC COMMENT: "Strength parameters given in Tables 4-1 and 4-2."/19 -- "Specification of a cohesion and angle of internal friction for rock material strength implies a linear relation between shear strength and confining pressure, whereas the relation is generally considered to be curvilinear. The values are appropriate to a particular range of confining pressures and this should be indicated."

STATUS: Agreed

BWIP RESPONSE: Confining pressure ranges will be specified in Tables 4-1 and 4-2 and the basic assumption behind the Coulomb Failure criterion will be included.

ITEM REFERENCE: Section 4.1.3, page 4.1-7, paragraph 1

NRC COMMENT: "A comparison of the basalt... except for the shear strength parameters."/4 -- "Comparison of lab results for Umtanum (Table 4-2) with design assumptions (Table 4-1) in terms of comparison of cohesion intercepts and friction angles is somewhat meaningless. Both sets of strength parameters are approximately consistent with an unconfined compressive strength of 200 MPa, and triaxial compressive strengths differ by only 10%-15% up to confining pressures of 10 MPa. Therefore, for stress zones of interest to design and for all practical purposes, the two strength relations are very similar."

STATUS: Agreed

BWIP RESPONSE: Tables 4-2(a), (b), and (c) will be completely updated using test results obtained from RRL cores. Qualified conclusions will be drawn from the data and included in Section 4.1.3 of the SCP.

TABLE III

CHAPTER 4 (GEOENGINEERING)

ITEM REFERENCE: Section 4.1.3, page 4.1-7, paragraph 1

NRC COMMENT: "of significance is ... uniaxial and triaxial." /3 -- "The considerable scatter in the strength data suggests that design should take this into account, e.g., by using a design strength significantly below the average. The second paragraph on this page confirms the suspicion that extremely optimistic (high) strength values have been used for the conceptual design, even though the third paragraph mitigates this somewhat. This aspect should be analyzed in the exploratory shaft."

STATUS: Agreed

BWIP RESPONSE: The final detailed design will be based on the tunnel stability criteria to be obtained from the Exploratory Shaft Test. A conservative approach will be taken in the upgraded conceptual design with regard to strength values. It should be noted that laboratory measured strength values will be used to estimate the rock mass strength along with geomechanic logging data for use in the upgraded conceptual design. In addition, data to be obtained from the ES test will be utilized to ascertain soundness of the approach. This plan will be further elaborated in Section 4.1.3 of the SCP.

ITEM REFERENCE: Section 4.2.1, page 4.2-1, paragraph 1

NRC COMMENT: "At such a scale ... rock fabric itself."/3, 19 -- "The statement that discontinuities rather than intact rock control rock mass behavior is too general, and is, in fact, inconsistent with the design approach presented in Chapter 10, where rock material strengths are referenced for comparison with the thermo-mechanical stresses. Either discontinuity or rock material strength may dominate rock mass behavior, e.g., discontinuities under low stress conditions, intact material under high stress conditions with favorably oriented structure, but generally both contribute to behavioral response."

STATUS: Agreed

BWIP RESPONSE: The statement will be revised to include the relative importance of rock material strength. The clarification of the design approach with regard to rock material strength will be made in Chapter 10 of the SCP.

TABLE III

CHAPTER 4 (GEOENGINEERING)

ITEM REFERENCE: Section 4.2.1, page, 4.2-1, paragraph 2

NRC COMMENT: "o Strength," "o deformability."/3 -- "Both bullets are extremely narrow in scope. While acceptable for preliminary design, it must be recognized that a realistic description of rock mass strength and deformability is likely to require more comprehensive, complete (e.g., nonlinear time-dependent) material models."

STATUS: Agreed

BWIP RESPONSE: Bullets will be revised to more accurately reflect the complexity of the constitutive behavior of basalt in Section 4.2.1.

ITEM REFERENCE: Section 4.2.2, Page 4.2-2, paragraph 4

NRC COMMENT: "A total of 75 Goodman-Jack ... platen orientations."/9,10 -- "The Goodman-Jack modulus values are very low in comparison with both smaller scale (i.e., laboratory) test results and larger scale (i.e., jointed block) test results. Their usefulness must, therefore, be called into question even as an index test. Although tests were carried out in horizontal holes, there is no discussion of whether it was possible to discern any significant difference between the horizontal and vertical modulus values. Within the horizontal plane, modulus values are inferred to be isotropic. It might be inferred that for a rock mass with predominant subvertical structure, the horizontal modulus would be less than the vertical modulus, but there is little discussion of this."

STATUS: Agreed

BWIP RESPONSE: Limitations of the test method discussed on page 4.2-2 of the SCR regarding platen orientation will be clarified to reflect the fact that Goodman-Jack results showed no significant difference between directions parallel and perpendicular to columnar structure. A discussion will be added to Chapter 4 of the SCP on the low valves from the tests.

ITEM REFERENCE: Section 4.2.3, page 4.2-5, paragraph 4

NRC COMMENT: "The pressure in the flat jacks ... perpendicular to the tunnel."/9,10 -- "The theoretical basis for using borehole stressmeters to infer cancellation stress is shakey. The procedure outlined for establishing the stress distribution in the tunnel sidewall is not very practical; other methods should be considered."

STATUS: Agreed

TABLE III

CHAPTER 4 (GEOENGINEERING)

BWIP RESPONSE: The information regarding stress distribution around the opening was obtained as a by-product of the single slot test. In the ES, overcoring tests will be conducted to obtain information on stress redistribution around the opening. Further details regarding the test method will be included in the Exploratory Shaft Test Plan and Chapter 17 of the SCP.

ITEM REFERENCE: Section 4.2.3, page 4.2-9, paragraph 1

NRC COMMENT: "Although the relaxation technique ... method of stress determination."/9 -- "Do not agree with comments regarding superiority of the flat-jack over borehole inclusion and other techniques as a stress measuring procedure."

STATUS: Agreed

BWIP RESPONSE: Field test results obtained from the NSTF revealed serious short comings of point measurement techniques for stress determination in a closely jointed rock mass. Detailed information on the NSTF test can be found elsewhere*, and will be referenced in the SCP. Brief statements on the relative merits and short-comings of borehole methods and flat jack methods will be included in the SCP to avoid potential disagreements. A discussion on test method validation will be provided in the SCP.

*"In Situ Stress Measurement in a Jointed Basalt: The Suitability of Five Overcoring Techniques," E. C. Gregory, T. A. Rundal, W. M. McCabe, K. Kim, RHO-BWI-SA-262 P.

ITEM REFERENCE: Section 4.2.4, page 4.2-11, paragraph 1

NRC COMMENT: "The tests results obtained ... block test results."/9 -- "Test results of the Goodman-Jack and modified Goodman-Jack are reported. Both yield lower values than that of single-slot flat jack in the jointed block at the NSTF. Can any correlation be established between borehole jack tests and flat jack tests? If not, what is the purpose of using them again at the repository horizon?"

STATUS: Agreed

BWIP RESPONSE: The BWIP plans to conduct a series of field tests to establish the relationship between the borehole jacking test and the flat jack test. If the borehole jacking tests cannot be validated, this method will not be conducted at the repository horizon. No further clarification is deemed necessary at this point. A discussion on test method validation will be included in the SCP.

TABLE III

CHAPTER 4 (GEOENGINEERING)

ITEM REFERENCE: Section 4.2, page 4.2-12

NRC COMMENT: "Tests available to determine ... and field seismic tests."/3 -- "Sonic velocity data from laboratory tests and borehole geophysical logs usually can be related to static values, and an estimate of the in situ elastic modulus obtained. This method should be investigated along with other tests that are available to determine the modulus of elasticity of rock masses."

STATUS: Agreed

BWIP RESPONSE: The BWIP is fully considering the use of the suggested method.

ITEM REFERENCE: Section 4.3.2, page 4.3-2, paragraph 5

NRC COMMENT: "Most fractures had ... and contained secondary minerals."/3 -- "It is stated that core logging has revealed that most of the joints are filled with secondary minerals and are less than 0.5 mm thick. Have the effects of secondary minerals on the fractional properties of joints been thoroughly analyzed?"

STATUS: Agreed

BWIP RESPONSE: Laboratory tests were initiated recently to investigate the effect of joint infilling on fractional properties of rock. It appears unlikely that the test results can be made available for the SCP in time. This information will be reported at a later date.

ITEM REFERENCE: Section 4.3.3, page 4.3-3, paragraph 2

NRC COMMENT: "The samples were initially subjected to ... was again observed."/3 -- "The stage testing technique did not permit assessment of residual friction angles. The peak values show considerable scatter and a description of the corresponding joint roughness in each case would be useful. In addition, no joint stiffness values are reported."

STATUS: Agreed

BWIP RESPONSE: The current data base on joint properties is very limited. No joint stiffness (joint roughness and residual friction angles) data are available presently. As data becomes available, a thorough analysis will be conducted and the results of the analysis will be published.

TABLE III

CHAPTER 4 (GEOENGINEERING)

ITEM REFERENCE: Section 4.3.3, page 4.3-3, paragraph 4

NRC COMMENT: "Results indicate that the friction angle ... This trend seemed to be affected ... However, the use of a single sample ... with additional loading cycles."/14 -- "Most tests show a decreasing joint coefficient of friction, suggesting a non-linear (rather than linear, as on page 4.2-1) strength criterion. (Polishing influence is possible but does seem unlikely in triaxial testing.)"

STATUS: Agreed

BWIP RESPONSE: It is agreed that the decreasing trend in joint coefficient of friction can best be represented by nonlinear failure criterion. However, the lack of quality data (i.e., lack of sufficient data) prohibited us in generating non-linear failure criteria. Clarification will be made in Section 4.3.3 of the SCP.

ITEM REFERENCE: Section 4.4.3, page 4.4-4, paragraph 4, item 3

NRC COMMENT: "The influence of ... understood. Laboratory tests ... this relationship."/3 -- "In addition, the effect of moisture on the thermal properties must be studied."

STATUS: Agreed

BWIP RESPONSE: The suggested study has not been conducted although it was identified in work element R.1.12.B, page 14.3-8 of the SCR. The statement will be modified to include the effect of the moisture on thermal properties.

ITEM REFERENCE: Section 4.5.1, page 4.5-1, paragraph 3, bullet 3

NRC COMMENT: "Very few monitoring instruments ... at elevated temperatures."/3 -- "The heater tests reveal the poor performance of some state-of-the-art instruments at high temperatures. Much effort must be placed in improving the instruments before conducting tests in the exploratory shaft."

STATUS: Agreed

BWIP RESPONSE: The BWIP has been conducting instrument development work since the early stage of the program. Continuing efforts are being made to improve instrument performance in preparation of the ES tests. A brief statement regarding the status of the instrument development program will be included in Section 4.5.1 of the SCP.

TABLE III

CHAPTER 4 (GEOENGINEERING)

ITEM REFERENCE: Section 4.6.4, page 4.6-13, paragraph 2

NRC COMMENT: "Scoping calculations based on ... will not pose a major problem to repository contribution."/4 -- "Although the in situ stress data are limited, very substantial stress levels are inferred at the repository horizon. The predicted stress levels around the opening are high. Rock mass strengths are unknown (the present document refers to design strengths which appear to relate to the rock material strengths). We do not agree that there are sufficient data to draw the conclusion that rock mass strength will not pose a major problem."

STATUS: Agreed

BWIP RESPONSE: A definitive conclusion cannot be made regarding tunnel stability until in situ data on tunnel performance can be obtained from the ES. Further elaboration of BWIP's interpretation on stability will be made in Section 4.6.4 of the SCP.

ITEM REFERENCE: Section 4.7.1, page 4.7-1, paragraph 3

NRC COMMENT: "There seems to be no consensus on the mechanism ... However, it is clear that bursting as well as ... to high concentrations of stress in the vicinity of the opening."/3, 4 -- "The coupled effect of the stress redistribution due to excavation and the thermal stress is not discussed. The rate of application of the thermal shock is an important consideration in thermal spalling. These factors should be considered in analyzing small scale dynamic failure."

STATUS: Agreed

BWIP RESPONSE: The coupled effect of the stress redistribution due to excavation and the thermal stress will be discussed in Section 4.7.1 of the SCP.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.2, page 5.1-4, paragraph 5

NRC COMMENT: "Well WPPSS-3 is listed in Table 5-1, but is now shown on Figure 5.2."/16.

STATUS: Agreed

BWIP RESPONSE: The well location will be added to the map on page 5.1-5, Figure 5-2.

ITEM REFERENCE: Section 5.1.2, page 5.1-7, paragraph 3

NRC COMMENT: Line 22-24, "Groundwater recharge...ground surface."/4 -- "Delete 'principally' to indicate that some uncertainty exists, re: recharge mechanism."

STATUS: Agreed

BWIP RESPONSE: The paragraph will be modified for clarity, it shall discuss other potential recharge mechanisms and use appropriate references.

ITEM REFERENCE: Section 5.1.2, page 5.1-10, paragraph 2

NRC COMMENT: Line 14-19, "The majority of...hydraulic conductivities."/7

STATUS: Agreed

BWIP RESPONSE: This section will be rewritten to more clearly trace the conclusions to the supporting data.

ITEM REFERENCE: Section 5.1.2, page 5.1-10, paragraph 2

NRC COMMENT: Line 19-21, "Data gathered...producers (aquifers)."4, 9 -- "No large scale tests have been run. How limited?"

STATUS: Agreed

BWIP RESPONSE: Supporting data will be presented in the SCP.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.2, page 5.1-10, paragraph 3

NRC COMMENT: Line 30-32, "The confining...sedimentary interbeds."/7 -- "Vertical hydraulic conductivity has not been measured."

STATUS: Agreed

BWIP RESPONSE: The statement will be revised to state "Hydrologic testing of flow interiors (ref. Table 5.5) from surface-based boreholes suggests that the confining...sedimentary interbeds."

ITEM REFERENCE: Section 5.1.2, page 5.1-10, paragraph 5

NRC COMMENT: Line 38, "Most groundwater...low conductivity aquitards."/4, 7 -- "Vertical hydraulic conductivity has not been measured." Move this discussion to the conceptual model section or leave the discussion quantities out.

STATUS: Agreed

BWIP RESPONSE: This statement will be deleted.

ITEM REFERENCE: Section 5.1.2, page 5.1-11, Table 5-3

NRC COMMENT: Table 5-3, "Groundwater hydrochemistry."/5, 7, 15

STATUS: Open

BWIP RESPONSE: The column only claims to portray general groundwater hydrochemistry information. The term "isotopically heavier" will be replaced with "isotopically distinct." The title of the table will be changed or the information will be moved to the conceptual model section.

ITEM REFERENCE: Section 5.1.1, page 5.1-11, Table 5-3

NRC COMMENT: Table 5-3, "Groundwater recharge and discharge areas, second paragraph and third paragraph."/4, 5

STATUS: Agreed

TABLE III

CHAPTER 5 (HYDROLOGY)

BWIP RESPONSE: This is an oversimplification of the conceptual model. A major effort is being performed to assess regional and local groundwater flow patterns using numerical models. The effort involves both internal an external organizations, e.g., the Modeling Task Force. The table will be modified for clarity and to reflect residual uncertainties.

ITEM REFERENCE: Section 5.1.3, page 5.1-12, paragraph 2

NRC COMMENT: Line 6-8, "Recharge areas...ground surface."/5

STATUS: Agreed

BWIP RESPONSE: The sentence will be modified to make it clear that it is a generalization and include the concepts of interbasin flow and the possibility of recharge at locations other than outcrops.

ITEM REFERENCE: Section 5.1.3, page 5.1-27, paragraph 4

NRC COMMENT: Line 37-44, "Within the Saddle...10-5 meters per second."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: The SCR was not intended to comprehensively include all of the data required for an independent assessment. Primary data are on file at the BWIP. Data required for an independent assessment can be provided to NRC.

ITEM REFERENCE: Section 5.1.3, page 5.1-28, Table 5-4

NRC COMMENT: Table 5-4, range of values versus Figure 5-16 range./14

STATUS: Agreed

BWIP RESPONSE: The inconsistency will be eliminated.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.3, page 5.1-31, paragraph 3

NRC COMMENT: Line 19-21, "As shown in Table 5-4, the...and flow tops."/3 --"Primary Data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.3, page 5.1-31, paragraph 3

NRC COMMENT: Line 27-30, "Best estimates...flow interior."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.3, page 5.1-42, paragraph 1

NRC COMMENT: Line 4-7, "Based on...to 10^{-7} meters per second."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.3, page 5.1-42, paragraph 2

NRC COMMENT: Line 17-21, "A best estimate...borehole RRL-2."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.3, paragraph 5.1-42, paragraph 2

NRC COMMENT: Line 29-30, "The equivalent...meters per second."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.3, page 5.1-43, Table 5-6

NRC COMMENT: Table 5-6, "Equivalent hydraulic conductivity (m/s)."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.3, page 5.1-44, paragraph 3

NRC COMMENT: Table lines 10-17, "Equivalent hydraulic conductivity (m/s)."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.3, page 5.1-44, paragraph 5

NRC COMMENT: Line 32-34, "As addressed in...basalt flows."/4, 7, 13 -- "Delete 'conservatively' if the paragraph is used. Also use appropriate references."

STATUS: Agreed

TABLE III

CHAPTER 5 (HYDROLOGY)

BWIP RESPONSE: The subject will be put into perspective in either Chapter 5 or Chapter 12 of the SCP.

ITEM REFERENCE: Section 5.1.3, page 5.1-45, paragraph 3

NRC COMMENT: Line 23-24, "Efforts in...than 2 months)."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data. Plans for large scale stress testing will be included in Chapter 13 of the SCP.

ITEM REFERENCE: Section 5.1.3, page 5.1-45, paragraph 4

NRC COMMENT: Line 28-29, "As noted in...(10^{-3} to 10^{-6})."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.3, page 5.1-46, paragraph 2

NRC COMMENT: Lines 10-21, "Test Results and Other physical data."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.3, page 5.1-45, paragraph 4

NRC COMMENT: Lines 22-29, "The respective...10^{-2} and 10^{-4}."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.4, page 5.1-49, paragraph 1

NRC COMMENT: Lines 1-6, "The water-table...or nonexisting."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.4, page 5.1-49, paragraph 3

NRC COMMENT: Lines 19-24, "Piezometers located...groundwater discharge."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.4, page 5.1-53, paragraph 6

NRC COMMENT: Lines 38-39, "Sufficient head...surface."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

TABLE III

CHAPTER 5 (HYDROLOGY)

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.5, page 5.1-55, paragraph 3

NRC COMMENT: Lines 15-16, "Section 5.1.5.2...in Figure 5-31."/5, 6

STATUS: Agreed

BWIP RESPONSE: Chapters 5 and 13 of the SCP will be modified to reflect a more detailed approach to utilizing hydrochemistry data in flow system interpretation. These plans will be discussed with the NRC as they are developed.

ITEM REFERENCE: Section 5.1.5, page 5.1-57, paragraph 1

NRC COMMENT: Lines 4-7, "Thus, the...the east."/11

STATUS: Agreed

BWIP RESPONSE: Discussions about head gradients in the RRL and the Cold Creek syncline will be modified to address uncertainties and the need for additional data. Any revelant plans will be discussed with the NRC as they are developed.

ITEM REFERENCE: Section 5.1.5, page 5.1-57, paragraph 3

NRC COMMENT: Lines 21-23, "This occurs...ground surface."/5

STATUS: Agreed

BWIP RESPONSE: Additional references will be provided.

. . . . . .

TABLE III

CHAPTER 5 (HYDROLOGY)

NRC COMMENT: Lines 34-36, "The major...dam area."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be deleted or supported by additional information.

ITEM REFERENCE: Section 5.1.4, page 5.1-60, paragraph 1

NRC COMMENT: Lines 1-3, "5.1.4.22 Wanapum Basalt...conditions."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

. . . . . .

NRC COMMENT: Lines 7-9, "Within the Pasco...significance."/4

STATUS: Agreed

BWIP RESPONSE: The statement that the Vantage has no apparent hydrologic significance will be qualified and supported by additional information.

. . . . . .

NRC COMMENT: Lines 22-24, "Within the Hanford Site...(Section 5.1.3.3)."/3 -- "Primary data are not presented in the SCR. Independent assessment requires presentation of all primary data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

. . . . . .

NRC COMMENT: Lines 35-38, "These data...to be southward."/11

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 5.1-57, paragraph 1.

. . . . . .

TABLE III

CHAPTER 5 (HYDROLOGY)

NRC COMMENT: Lines 43-36, "Therefore, even through...repository location."/14

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 5.1-57, paragraph 1.

ITEM REFERENCE: Section 5.1.4, page 5.1-61, paragraph 1

NRC COMMENT: Lines 1-4, "Table 5-8...meter per meter."/3, 11 -- "Compare DC-12 to RRL-2."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 5.1-57, paragraph 1.

. . . . . .

NRC COMMENT: Lines 24-27, "The major discharge...Priest Rapids Dam."/4

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item 5.1-57, paragraph 1.

ITEM REFERENCE: Section 5.1.4, page 5.1-61, paragraph 5

NRC COMMENT: Lines 39-47, "In borehole DC-15...shallow basalt formations."/4

STATUS: Agreed

BWIP RESPONSE: Clarification will be made to the extent that hydrochemical data will be used as a means of corroboration for conceptual evaluations.

ITEM REFERENCE: Section 5.1.4, page 5.1-62, Table 5-8

NRC COMMENT: Table 5-8/11, "apparent gradient" would reflect uncertainties.

TABLE III

CHAPTER 5 (HYDROLOGY)

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 5.1-57, paragraph 1.

ITEM REFERENCE: Section 5.1.4, page 5.1-63, paragraph 2

NRC COMMENT: Lines 12-15, "The predominant...Cold Creek syncline."/1, 11 -- "Compare DC-23 to RRL-2."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 5.1-57, paragraph 1.

ITEM REFERENCE: Section 5.1.4, page 5.1-64, paragraph 1

NRC COMMENT: Lines 7-10, "Principal sources of...Grande Ronde Basalt crops out."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be deleted or supported by additional information.

. . . . . .

NRC COMMENT: Lines 14-12, "Major discharge areas...River Gorge region."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be deleted or supported by additional information.

ITEM REFERENCE: Section 5.1.4, page 5.1-74, paragraph 5

NRC COMMENT: Lines 40-46, "However, it is recognized...these flow interiors."/5, 7 -- "Vertical hydraulic conductivity has not been measured."

TABLE III

CHAPTER 5 (HYDROLOGY)

STATUS: Agreed

BWIP RESPONSE: References to supportive data will be provided in the SCP and the statement qualified.

ITEM REFERENCE: Section 5.1, page 5.1-74, paragraph 1

NRC COMMENT: Lines 9-11, "Hydrochemical data...<+5 percent)."/3 -- "Basis for restrictive criterion?"

STATUS: Open

BWIP RESPONSE: The NRC reference should be 5.1-85. This criterion is equivalent to that used by the USGS (Hem, 1970) for the low TDS waters of the Saddle Mountains and is less restrictive than the USGS criteria for waters of elevated TDS in the Grande Ronde. Less restrictive criteria are used for Grande Ronde water due to the limitations of sampling from deep, small diameter boreholes. The NRC has agreed to provide additional written clarification.

ITEM REFERENCE: Section 5.1.4, page 5.1-83, paragraph 3

NRC COMMENT: "...(i.e., less than approximately 350 milligram per liter)..."/14 -- "Table 5-11 shows maximum TDS = 510."

STATUS: Agreed

BWIP RESPONSE: 500 mg/L is the maximum value observed, however, concentration is generally less than 350 mg/L. The relationship between these two reported figures will be clarified in Chapter 5 of the SCP.

ITEM REFERENCE: Section 5.1.4, page 5.1-85, Table 5-11

NRC COMMENT: Table 5-11./3 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.5, page 5.1-85, Table 5-4

NRC COMMENT: Table 5-4./15, 16 -- "Eh, pH, Temp."

STATUS: Agreed

BWIP RESPONSE: Clarification will be added to identify that no additional supporting data are available.

ITEM REFERENCE: Section 5.1.5, page 5.1-87, Table 15-13

NRC COMMENT: "...(i.e., less than 350 milligrams/liters)..."/14 -- "Table 5-13 shows maximum TDS - 728."

STATUS: Agreed

BWIP RESPONSE: The maximum measures value is 728 mg/L, however, groundwaters of the unconfined system generally have a TDS of 350 mg/L. The relationship between the two reported figures will be clarified in Chapter 5 of the SCP.

ITEM REFERENCE: Section 5.1.5, page 5.1-87

NRC COMMENT: "The wide range in concentration..."/(Gephart, et al., 1979a). "If waste water disposal is controlling groundwater at site, required analyses are irrelevant."

STATUS: Open

BWIP RESPONSE: Discussion with the NRC staff will serve to clarify this item. Clarification will then be added to the SCP distinguishing between the hydrochemistry of natural vs. disturbed groundwater systems.

ITEM REFERENCE: Section 5.1.5, page 5.1-87, Table 5-12

NRC COMMENT: Table 5-12. /3, 10, 15 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data. No V analysis could be important."

TABLE III

CHAPTER 5 (HYDROLOGY)

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.5, page 5.1-88, Table 5-13

NRC COMMENT: Table 5-13/3, 10 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.5, page 5.1-90, Table 5-14

NRC COMMENT: Table 5-14. /3, 10, 16 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of date."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data. References for the data sources are provided in section 5.1.5.1 of the SCR. The NRC staff will confirm whether the required references have been received.

ITEM REFERENCE: Section 5.1.5, page 5.1-95, paragraph 4

NRC COMMENT: Lines 29-38, "Examination of Figure 5-50...chloride concentration."/5, 12 -- "The groundwater flow flow directions are not firmly established."

STATUS: Open

BWIP RESPONSE: The groundwater flow direction is inferred from hydraulic head data (Figure 5-31) and hydrochemical data principally from the Mabton Interbed, therefore, the conclusion is supported. Wording in the SCR will be changed to indicate the appropriate confidence level. Plans for correlating

TABLE III

CHAPTER 5 (HYDROLOGY)

hydrochemical data with hydraulic properties of the groundwater flow system will be discussed in Chapter 13 of the SCP. The NRC staff will provide additional written clarification on their concerns regarding the groundwater flow direction.

ITEM REFERENCE: Section 5.1.5, page 5.11-96, Table 5-16

NRC COMMENT: Table 5-16. /3, 10, 16 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data. Measured versus calculated values should be indicated (silica species)."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data. Measured and calculated values will be segregated in future presentations of hydrochemical data (5.1.5 of the SCP).

ITEM REFERENCE: Section 5.1.5, page 5.1-98, paragraph 2

NRC COMMENT: "Chemical equilibria and mineral saturation...(Truesdell and Jones, 1974; Plummer, et al., 1976)."/3, 10

STATUS: Agreed

BWIP RESPONSE: Chemical equilibria and mineral saturation of Columbia River basalt groundwaters is currently being evaluated in greater detail than was presented in the SCR. Plans for these analyses will be discussed in Chapter 13 of the SCP. These plans will be discussed with the NRC staff as they are developed.

ITEM REFERENCE: Section 5.1.5, page 5.1-98, paragraph 4

NRC COMMENT: "Sulfate reduction proceeds...catalyst for the reaction."/1 -- "Hem (1970, p. 160) also states microbes are needed for reduction."

STATUS: Open

BWIP RESPONSE: The NRC staff has agreed to provide written clarification concerning this topic.

TABLE III

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ITEM REFERENCE: Section 5.1.5, page 5.1-99, Figure. 5-51

NRC COMMENT: Figure 5-51. /10, 16

STATUS: Agreed

BWIP RESPONSE: The figure is a trilinear diagram described by Piper (1944). The borehole location will be presented in Section 5.1.5 of the SCP.

ITEM REFERENCE: Section 5.1.5, page 5.1-100, Figure 5-52

NRC COMMENT: Figure 5-52. /10, 16

STATUS: Agreed

BWIP RESPONSE: The references are given in paragraph 2 on page 5.1-98. The test interval location will be provided in the SCP.

ITEM REFERENCE: Section 5.1.5, page 5.1-102, Figure 5-53

NRC COMMENT: Figure 5-53. /15

STATUS: Open (Agreed)

BWIP RESPONSE: Appropriate data on total dissolved solids will be included in the SCP.

ITEM REFERENCE: Section 5.1.5, page 5.1-103, Table 5-17

NRC COMMENT: Table 5-17. /3, 10, 16 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.5, page 5.1-105, paragraph 3

NRC COMMENT: Lines 24-28, "Within the Saddle...+ CO_3^2."/4 -- "Other alternatives are not considered."

STATUS: Agreed

BWIP RESPONSE: Other alternatives are not discussed. The current program to geochemically model Columbia River basalt groundwaters will address this in detail. Plans for this work will be discussed in Chapter 13 of the SCP. These plans will be discussed with the NRC staff as they are developed.

ITEM REFERENCE: Section 5.1.5, page 5.1-105, paragraph 5

NRC COMMENT: "Future work, including...evaluate this parameter."/3, 9 -- "No, ...as is shown in analysis. Is it to be added?"

STATUS: Agreed

BWIP RESPONSE: Relevant plans to measure Eh will be discussed with the NRC staff as they are developed.

ITEM REFERENCE: Section 5.1.5, page 5.1-105, paragraph 1

NRC COMMENT: "Measured fluid temperature...groundwater flow patterns."/10, 16

STATUS: Agreed

BWIP RESPONSE: This topic will be deleted or supported by additional information.

ITEM REFERENCE: Section 5.1.5, page 5.1-108, paragraph 2

NRC COMMENT: "An environment conducive...bacteria."/14 -- "See p. 5.1-98, paragraph 4."

STATUS: Open

TABLE III

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BWIP RESPONSE: Page 5.1-98 discussed a possible reason for low sulfate in some Mabton waters. Page 5.1-108 indicates that this low sulfate condition is a prerequisite for methanogenic bacteria to thrive. Low sulfate correlates well with the occurrence of methane. The NRC staff will provide additional written clarification on the nature of the conflicting statement.

ITEM REFERENCE: Section 5.1.5, page 5.1-112, Table 5-21

NRC COMMENT: Table 5-21. /3, 10, 16 -- "Primary data are not included in SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27.

ITEM REFERENCE: Section 5.1.5, page 5.1-116, Table 5-23

NRC COMMENT: Table 5-23./3, 10, 16 -- "Primary data are not included in SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the modified response comment to NRC reference item page 5.1-27.

ITEM REFERENCE: Section 5.1.5, page 5.1-116, paragraph 1

NRC COMMENT: "...water is generally saturated with calcite and a silica mineral phase..."/14 -- "Figure 5-58 shows supersaturation for cristobalite."

STATUS: Agreed

BWIP RESPONSE: While this analysis showed the waters to be oversaturated with cristobalite, another silica phase (chalcedony or amorphous silica basaltic glass) is most likely controlling silica concentration. This subject is currently being addressed through a more extensive program of geochemical modeling. The statement will be modified to reflect this. Geochemical plans will be discussed with the NRC staff as they are developed.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.5, page 5.1-118, paragraph 2

NRC COMMENT: "These studies indicate...below ground surface."/4

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 5.1-105, paragraph 1, related to temperature.

ITEM REFERENCE: Section 5.1.5, page 5.1-118, paragraph 6

NRC COMMENT: "Measured Eh values range...reducing conditions may exist."/10, 16

STATUS: Agreed

BWIP RESPONSE: The wording of the sentence reflects the uncertainty in the analytical methods. The statement will be qualified on the basis of referencable data and included in the SCP.

ITEM REFERENCE: Section 5.1.5, page 5.1-118, paragraph 5

NRC COMMENT: Lines 26-28, "Factors contributing...dissolved carbonate dissociation."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be supported by additional information on the Wanapum Basalt.

ITEM REFERENCE: Section 5.1.5, page 5.1-120, Table 5-25

NRC COMMENT: Table 5-25. /9, 10

STATUS: Agreed

BWIP RESPONSE: The Eh measurements were qualified in the paragraph referencing Table 5-25 and in section 5.1.5.2.3. These data are primary data and no reference is available.

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ITEM REFERENCE: Section 5.1.5, page 5.1-121, Table 5-26

NRC COMMENT: Table 5-26./3, 10, 16 -- "Alternative units are suggested."

STATUS: Open

BWIP RESPONSE: The NRC staff will provide additional written clarification on the alternative units suggested and on the methods used to obtain these data.

ITEM REFERENCE: Section 5.1.5, page 5.1-122, paragraph 5

NRC COMMENT: Lines 27-29, "As discussed in...shallower basalt systems."/5

STATUS: Agreed

BWIP RESPONSE: The statement will be changed to indicate that the increase in TDS values as a function of depth suggest longer groundwater residence times in the deeper basalt flows.

ITEM REFERENCE: Section 5.1.5, page 5.1-125, Table 5-28

NRC COMMENT: Table 5-28./3, 10, 16 -- "Primary data are included in the SCR. Presentation of range and mean does not permit independent evaluation of data. Potassium content is significant with respect to montmorillonite altering to illite."

STATUS: Open

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data. The NRC staff will provide written clarification on formation of illite from montmorillonite at the measured potassium content.

ITEM REFERENCE: Section 5.1.5, page 5.1-127, paragraph 5

NRC COMMENT: "...for selected Grande Ronde Basalt groundwaters..."/10 -- "What is the basis of selection and why?"

STATUS: Agreed

TABLE III

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BWIP RESPONSE: This reflects the status of the work at the time the SCR was written. All samples had not been modeled and so they could not be included in the figure. The SCP will contain additional discussion to clarify the status of our geochemical modeling program. These plans will be discussed with the NRC staff as they are developed.

ITEM REFERENCE: Section 5.1.5, page 5.1-129, paragraph 2

NRC COMMENT: "The presence of molybdenum...the detection limit."/5, 16

STATUS: Agreed

BWIP RESPONSE: The wording will be changed to clarify the possible source of molybdenum in the groundwater samples and show the concentrations found in the pipe-joint lubricant. The source of molybdenum will also be discussed in greater detail in Chapter 5 of the SCP.

ITEM REFERENCE: Section 5.1.5, page 5.1-129, Table 5-29

NRC COMMENT: Table 5-29. /3, 10, 16 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.5, page 5.1-131, paragraph 1

NRC COMMENT: Lines 1-5, "Factors contributing...these deep zones."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be qualified to reflect the preliminary nature of the data and the data will be appropriately referenced.

ITEM REFERENCE: Section 5.1.5, page 5.1-131, paragraph 2

NRC COMMENT: Lines 11-16, "The Eh values based...and -0.53 volt."/3, 5, 6, 12, 13 -- "Redox equilibrium is not demonstrated."

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STATUS: Agreed

BWIP RESPONSE: The wording of the statement will be expanded to make its conjectural nature clear. Plans will be presented in Chapter 15 of the SCP on methodology to be used to obtain representative Eh values. These plans will be discussed with the NRC staff as they are developed.

ITEM REFERENCE: Section 5.1.5, page 5.1-131, paragraph 1

NRC COMMENT: "Due to low concentrations...within these deep zones."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be modified to present an hypothesis or supported with additional data and analysis.

ITEM REFERENCE: Section 5.1.5, page 5.1-131, paragraph 2

NRC COMMENT: "..., Eh within Grande Ronde...-0.20 and -0.53 volt./14 -- "Section 11.4 says, -0.43 to -0.53V."

STATUS: Agreed

BWIP RESPONSE: See page 11.4-16 of the SCR. The paragraph discusses measured and theoretical indications of Eh and concludes that the Eh of the Columbia River basalt groundwaters will be between the lower measured values and the value estimated from thermodynamic considerations. The statement will be modified to present a hypothesis or supported with additional data and analysis.

ITEM REFERENCE: Section 5.1.5, page 5.1-132, paragraph 2

NRC COMMENT: "In borehole DC-15,...then found farther east"./9, 10

STATUS: Open

BWIP RESPONSE: Measurement and sampling techniques associated with collection of gas will be discussed with the NRC in a future workshop. The NRC will provide written clarification on this topic.

TABLE III

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ITEM REFERENCE: Section 5.1.5, page 5.1-132, paragraph 1

NRC COMMENT: "Small quantities of dissolved oxygen...presence of dissolved oxygen."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be modified to clearly reflect the reliability of the sampling method and the preliminary nature of current Eh estimates.

ITEM REFERENCE: Section 5.1.5, page 5.1-132, paragraph 3

NRC COMMENT: Lines 26-27, "Changes from one...stratigraphic interval."/5 -- "See Appendix F."

STATUS: Agreed

BWIP RESPONSE: The statement will be modified on hydrochemical changes to support possible conclusions.

ITEM REFERENCE: Section 5.1.5, page 5.1-132, paragraph 4

NRC COMMENT: Lines 37-39, "As discussed by...residence time."/16 -- "Reference refers to deep sedimentary basins."

STATUS: Agreed

BWIP RESPONSE: The reference will be changed to Domenico (1972).

ITEM REFERENCE: Section 5.1.5, page 5.1-132 to 5.1-139

NRC COMMENT: Lines 48 to page 5.1-139, line 3, "By the time...are being reestablished."/5 -- "See Appendix F."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-132, lines 26-27.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.5, page 5.1-139, paragraph 4

NRC COMMENT: Lines 23-28, "The hydrochemical changes...this concept (Chapter 13)."/5 -- "See Appendix F."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1.132, lines 26-27.

ITEM REFERENCE: Section 5.1.6, page 5.1-145, paragraph 1

NRC COMMENT: Lines 11-14, "This process is...continental land mass."/1

STATUS: Agreed

BWIP RESPONSE: The statement will be worded more correctly to reflect this process of isotope depletion.

ITEM REFERENCE: Section 5.1.6, page 5.1-146, paragraph 1

NRC COMMENT: Lines 6-9, "This is not...average groundwaters."/2

STATUS: Agreed

BWIP RESPONSE: The statement will be reworded to better describe the data presented in Figure 5-69.

ITEM REFERENCE: Section 5.1.6, page 5.1-146, paragraph 2

NRC COMMENT: Lines 9-11, "The slope of...versus 8)."/5 -- "Statistical confidence interval for slope required."

STATUS: Agreed (Open)

BWIP RESPONSE: The BWIP would like clarifications from the NRC on the statistical parameter measured.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.6, page 5.1-146, paragraph 3

NRC COMMENT: Lines 22-24, "The significant...formational boundaries."/4 -- "See Appendix F."

STATUS: Agreed

BWIP RESPONSE: The statement will be modified to reflect the fact that it is a preliminary evaluation based on available data.

ITEM REFERENCE: Section 5.1.6, page 5.1-146, paragraph 4

NRC COMMENT: Lines 33-37, "Abrupt changes...would be evident."/6

STATUS: Agreed

BWIP RESPONSE: Chapter 5 of the SCP will discuss the range of conceptual models which will be considered. The alternative conceptual models will be discussed with the NRC staff at a future date.

ITEM REFERENCE: Section 5.1.6, page 5.1-150, paragraph 2

NRC COMMENT: Lines 7-17, "The Saddle Mountains...between basalt formations."/5

STATUS: Agreed

BWIP RESPONSE: Chapter 5 of the SCP will discuss alternate conceptual models to be assessed. These models will be discussed with the NRC staff at a future date.

ITEM REFERENCE: Section 5.1.6, page 5.1-155, paragraph 1

NRC COMMENT: Lines 4-5, "This is due...individual formations."/5

STATUS: Agreed

BWIP RESPONSE: The statement will be deleted.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.6, page 5.1-155, Table 5-35

NRC COMMENT: Table 5-35. /3, 10, 16 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.6, page 5.1-157, Table 5-36

NRC COMMENT: Table 5-36. /3, 10, 16 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

ITEM REFERENCE: Section 5.1.6, page 5.1-158, paragraph 1

NRC COMMENT: Lines 8-10, "This would have the...(Fritz, et al., 1979)."/1 -- "Significant deviations from slope of +8 are known for only arid or semi-arid closed basins and high temperature geothermal systems."

STATUS: Open

BWIP RESPONSE: The Pasco Basin is a semi-arid region with 8 inches of precipitation annually. Local precipitation indicates that significant evaporation occurs. The NRC will provide additional written clarification on this topic.

ITEM REFERENCE: Section 5.1.6, page 5.1-161, paragraph 4

NRC COMMENT: Lines 22-24, "Under reducing conditions...less than about 7."/1

TABLE III

CHAPTER 5 (HYDROLOGY)

STATUS: Agreed

BWIP RESPONSE: The statement will be changed to read "Under reducing condition...greater than about 7."

ITEM REFERENCE: Section 5.1.6, page 5.1-164, paragraph 2

NRC COMMENT: "...it is likely that oxidation of pyrite...basalt groundwater."/5

STATUS: Agreed

BWIP RESPONSE: The statement will be changed to read "...it is possible...based on the high concentrations of pyrite..."

ITEM REFERENCE: Section 5.1.6, page 5.1-167, paragraph 1

NRC COMMENT: "At the time of actual sampling...evaluate sample representativeness."/16

STATUS: Open

BWIP RESPONSE: The sampling procedure will be referenced.

ITEM REFERENCE: Section 5.1.6, page 5.1-168, Equation 5-9

NRC COMMENT: Equation 5-9./1, 16 -- "Equation is incorrect."

STATUS: Agreed

BWIP RESPONSE: Equation 5-9 should read: $T = -\frac{1}{\lambda} \ln \frac{A}{A_o}$

ITEM REFERENCE: Section 5.1.6, page 5.1-169, paragraph 4

NRC COMMENT: Lines 30-32, "With the exception...in age with depth."/3

TABLE III

CHAPTER 5 (HYDROLOGY)

STATUS: Agreed

BWIP RESPONSE: The statement will be expanded and clarified.

ITEM REFERENCE: Section 5.1.6, page 5.1-170, Table 5-42

NRC COMMENT: Table 5-42. /1, 3, 10, 16 -- "Primary data are not presented in the SCR and data are not corrected for effects of methane."

STATUS: Open

BWIP RESPONSE: See the modified response to NRC reference item 5.1-27 regarding primary data. The BWIP would like to discuss correction techniques with the NRC staff to see how they would suggest making the corrections.

ITEM REFERENCE: Section 5.1.6, page 5.1-170, paragraph 1

NRC COMMENT: Lines 6-10, "The general pattern...potentiometric information."/4

STATUS: Open

BWIP RESPONSE: The conjectural nature of the statement will be further clarified. This topic will be discussed with the NRC staff at a future workshop.

ITEM REFERENCE: Section 5.1.6, page 5.1-178, Table 5-43

NRC COMMENT: Table 5-43./3, 10, 16 -- "Primary data are not included in the SCR. Presentation of range and mean does not permit independent evaluation of data."

STATUS: Agreed

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.6, page 5.1-179, paragraph 2

NRC COMMENT: Lines 9-11, "The groundwater in...to the +4 state."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be modified to clearly reflect the fact that it is a hypothesis.

ITEM REFERENCE: Section 5.1.6, page 5.1-180, paragraph 5

NRC COMMENT: Line 36-38, "This would be...overlying groundwater."/5

STATUS: Agreed

BWIP RESPONSE: The statement will be modified to express uncertainty in the hypothesis relating groundwater age to depth.

ITEM REFERENCE: Section 5.1.7, page 5.1-182, paragraph 5

NRC COMMENT: Lines 40-43, "Available hydraulic head...5.1.5 and 5.1.6."/4 -- "The hydrochemical data is not clear cut. See Appendix F."

STATUS: Agreed

BWIP RESPONSE: Alternative hypotheses will be assessed in Chapter 5 of the SCP. These hypotheses will be discussed with the NRC staff in a future workshop.

ITEM REFERENCE: Section 5.1.7, page 5.1-184, paragraph 1

NRC COMMENT: Lines 11--14. "In fact, hydraulic...the Hanford Site."/4

STATUS: Agreed

BWIP RESPONSE: The conceptual model of groundwater flow in the Pasco Basin presented in the SCR is a preliminary interpretation of hydrochemical data. The statements will be modified to emphasize this fact.

. . . . . .

TABLE III

CHAPTER 5 (HYDROLOGY)

NRC COMMENT: Lines 29-40, "Available hydrochemical...on the Hanford Site."/4

STATUS: Agreed

BWIP RESPONSE: This statement will be modified to clarify the preliminary nature of this interpretation of the hydrochemical data.

ITEM REFERENCE: Section 5.1.7, page 5.1-187, paragraph 2

NRC COMMENT: Lines 7-8, "Carbon 14 dates...a corrected age."/1, 3 -- "Data are not corrected for effects of methane."

STATUS: Agreed

BWIP RESPONSE: This topic will be discussed with the NRC staff in a future workshop to see how they would suggest making these corrections.

ITEM REFERENCE: Section 5.1.7, page 5.1-187, paragraph 3

NRC COMMENT: Lines 13-14, "Dissolved gas content...borehole DC-15."/6, 10, 16

STATUS: Agreed

BWIP RESPONSE: The conjectural nature of the statement will be clarified. Alternative hypotheses will be assessed in Chapter 5 of the SCP. These hypotheses will be discussed with the NRC staff in a future workshop.

ITEM REFERENCE: Section 5.1.7, page 5.1-187, paragraph 4

NRC COMMENT: Lines 19-12, "Thus specific ionic...the DC-15 Site."/4

STATUS: Agreed

BWIP RESPONSE: The statement will be modified or deleted.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.9, page 5.1-198, paragraph 5, Bullet 1

NRC COMMENT: Lines 33-38, "Confined Flow Systems...individual aquifers."/5

STATUS: Agreed

BWIP RESPONSE: The conclusions stated will be modified to state that the model presented is one of many which will be considered.

ITEM REFERENCE: Section 5.1.9, page 5.1-202, paragraph 1

NRC COMMENT: Lines 1-6, "Lack of Significant...deformed areas."/5 -- "See Appendix F."

STATUS: Agreed

BWIP RESPONSE: This is one of several interpretations of the conceptual model. This statement will be rewritten to indicate the position.

ITEM REFERENCE: Section 5.1.9, page 5.1-202, paragraph 2

NRC COMMENT: Lines 19-24, "As noted in...south of the Hanford Site."/5

STATUS: Agreed

BWIP RESPONSE: This statement will be modified to reflect that it is one interpretation of the conceptual model.

ITEM REFERENCE: Section 5.1.9, page 5.1-202, paragraph 3

NRC COMMENT: Lines 25-31, "Distinct Groundwater...within the Grande Ronde Basalt."/4, 6 -- "See Appendix F."

STATUS: Agreed

BWIP RESPONSE: See the BWIP comment to NRC reference item page 5.1-198.

TABLE III

CHAPTER 5 (HYDROLOGY)

ITEM REFERENCE: Section 5.1.9, page 5.1-202, paragraph 4

NRC COMMENT: Lines 39-46, "Additionally, hydrochemical...basalt flows."/4, 7 -- "See Appendix F."

STATUS: Agreed

BWIP RESPONSE: See the BWIP comment to NRC reference item page 5.1-198.

ITEM REFERENCE: Section 5.1.9, page 5.1-203

NRC COMMENT: Lines 12-14, "Groundwater Flow...the southeast."/5, 11

STATUS: Agreed

BWIP RESPONSE: See the BWIP comment to NRC reference item page 5.1-198.

ITEM REFERENCE: Section 5.1.9, page 5.1-203, paragraph 3

NRC COMMENT: Lines 24-37, "The overall quantity...undisturbed areas)."/4, 7

STATUS: Agreed

BWIP RESPONSE: See the BWIP comment to NRC reference item page 5.1-198.

ITEM REFERENCE: Section 5.2, page 5.2-1, paragraph 1

NRC COMMENT: "Site Hydrogeologic System" (section)./7 -- "Information in this section is covered by earlier sections of Chapter 5 of the SCR."

STATUS: Agreed

BWIP RESPONSE: Section will be rescoped to avoid duplication from previous sections. This section will discuss our present understanding of the site hydrologic system based on available data. See the modified response to NRC reference item page 5.1-27.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.0, page 6.0-1, paragraph 2

NRC COMMENT: "This baseline information also represents a 'natural experiment' on the long-term effects of low-temperature hydrothermal alteration between groundwater and basalt."/2,4 -- "The baseline information is an input to the study of the BWIP geology and geochemistry."

STATUS: Agreed

BWIP RESPONSE: The statement in the SCR is correct but will be addressed more extensively in Section 6.6 of the SCP to clarify the NRC concerns.

ITEM REFERENCE: Section 6.0, page 6.0-1, paragraph 3

NRC COMMENT: "Unresolved geochemical issues are addressed in Section 6.8."/3.

STATUS: Open

BWIP RESPONSE: Unresolved geochemical issues will be addressed in Chapter 15 of the SCP.

ITEM REFERENCE: Section 6.1.1, page 6.0-1, paragraph 5

NRC COMMENT: "Mineral filling of tectonic features...the cooling joints."/5, 16 -- "These may be important in considering vertical flow paths."

STATUS: Agreed

BWIP RESPONSE: A tectonic breccia and fractures study is underway. It will be included in an expanded form in the SCP, Chapter 5. In particular, those features considered important to radionuclide migration will be investigated.

ITEM REFERENCE: Section 6.1.2, page 6.1-5, paragraph 4

NRC COMMENT: "More than 2,000 major-element analyses have been performed on Grande Ronde Basalt samples."/3, 16 -- "Documentation of methods and results in published reports or in SCR needed for this and all following figures and tables."

STATUS: Agreed

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

BWIP RESPONSE: The data file of major-element analysis is in preparation. These data and the methodologies used to obtain the data will be made available.

ITEM REFERENCE: Section 6.1.2, page 6.1-5, paragraph 5

NRC COMMENT: "Analyses for 21 selected trace elements have been made on more than 400 Grande Ronde Basalt samples."/3, 16

STATUS: Agreed

BWIP RESPONSE: A data file of trace element analyses is in preparation. These data and the methodologies used to obtain them will be made available.

ITEM REFERENCE: Section 6.1.2, page 6.1-6, Table 6-1

NRC COMMENT: Table 6-1. "Major-Element Composition of Grande Ronde Basalt Flows (wt%)."/5, 7, 10, 14, 16 -- "Data in Fig. 6-3 differ from summary data in Table 6-1."

STATUS: Agreed

BWIP RESPONSE: New references will be added to the methodology. The data for low magnesium flows in Table 6-1 and Figure 6-3 will be reconstructed for consistency.

ITEM REFERENCE: Section 6.1.2, page 6.1-7, Figure 6-3

NRC COMMENT: "Figure 6-3. Magnesium Oxide Plotted Versus Titanium Dioxide for Grande Ronde Basalt Chemical Types and Subtypes."/5, 7, 10, 14, 16 -- "Data in Fig. 6-3 differ from summary data in Table 6-1."

STATUS: Agreed

BWIP RESPONSE: See NRC reference Item 6.1-6, Table 6-1.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.1.2, page 6.1-8, Figure 6-4

NRC COMMENT: "Figure 6.4. Magnesium Oxide and Titanium Dioxide Plotted Versus Stratigraphic Depth in Borehole DC-6."/5, 7, 10, 16

STATUS: Agreed

BWIP RESPONSE: The data file is in preparation. These data and the methodologies used to obtain them will be made available.

ITEM REFERENCE: Section 6.1.2, page 6.1-9, Table 6-2

NRC COMMENT: Table 6-2. "Element Compositions of Grande Ronde Basalt Flows Determined by Instrumental Neutron Activation Analysis."/5, 7, 10, 16

STATUS: Agreed

BWIP RESPONSE: See NRC reference item page 6.1-8, Figure 6-4. These data and the methodologies used to obtain them will be made available.

ITEM REFERENCE: Section 6.1.2, page 6.1-10, Figure 6-5

NRC COMMENT: "Figure 6-5. Zirconium and Chromium Plotted Versus Stratigraphic Position in Borehole DC-6."/5, 7, 10, 16

STATUS: Agreed

BWIP RESPONSE: See NRC reference item page 6.1-8, Figure 6-4. These data and the methodologies used to obtain them will be made available.

ITEM REFERENCE: Section 6.1.3, page 6.1-11, paragraph 3

NRC COMMENT: "An extended discussion of this material is presented in Chapter 3."/3

STATUS: Agreed

BWIP RESPONSE: The reference to Chapter 3 was inappropriate. Additional data on Fe^{+2}/Fe^{+3} will be included.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.1.3, page 6.1-12, Table 6-3

NRC COMMENT: "Table 6-3. Petrographic Characteristics of Primary Phases in Grande Ronde Basalt."/7, 10, 14, 16

STATUS: Agreed

BWIP RESPONSE: This chart will be modified to reflect latest data.

ITEM REFERENCE: Section 6.1.3, page 6.1-12, Table 6-4

NRC COMMENT: "Table 6-4. Secondary Minerals Identified in Grande Ronde Basalt, Pasco Basin."/7, 10, 14, 16

STATUS: Agreed

BWIP RESPONSE: The data are from Benson and Teague (1979)*. This reference and other appropriate references will be included in an updated SCP.

* Benson, L.V. and Teague, L.S., 1979, A Study of Rock-Water-Nuclear Waste Interactions in the Pasco Basin, Washington, LBL-9677, Lawrence Berkeley Laboratory, Berkeley, California.

ITEM REFERENCE: Section 6.1.4, page 6.1-15, paragraph 4

NRC COMMENT: "It has been experimentally demonstrated...to buffer pH (Barnes and Sheetz, 1979) and Eh (Jacobs and Apted, 1981)..."/3, 16 -- "Cited references are abstracts and not acceptable documentation. References are not as definite as SCR about pH buffering mechanism."

STATUS: Agreed

BWIP RESPONSE: Acceptable documentation related to this comment is either completed or near completion and an expanded discussion of pH and Eh control will be incorporated into Section 6.4.3 of the SCP.

ITEM REFERENCE: Section 6.1.4, page 6.1-15, paragraph 4

NRC COMMENT: "The mechanism for the control of solution...will help to resolve this question."/3,16 -- "It is well known that two glasses are present in the Umtanum."

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

STATUS: Agreed

BWIP RESPONSE: The statement in the SCR reflects the need for further examination of the products of hydrothermal tests in order to understand solution composition. These tests are in progress and the results will be incorporated into Sections 6.2 and 6.4.3 of the SCP when completed. It is recognized that glass composition and abundance may vary within candidate horizons. These variations are currently being evaluated.

ITEM REFERENCE: Section 6.1, page 6.1-16, paragraph 2

NRC COMMENT: "It may be that the moderate fluoride concentrations...fluorine-bearing mesostasis."/4

STATUS: Agreed

BWIP RESPONSE: Microprobe and hydrothermal studies which address this question currently are in progress. Results from these studies will be incorporated into Sections 6.2 and 6.4.3 in the SCP.

ITEM REFERENCE: Section 6.1.5, page 6.1-20, paragraph 1

NRC COMMENT: "Although such data...porosity of this rock is comparatively small."/1, 4 -- "RRL-2 core showed large open vesicles in Umtanum flow top."

STATUS: Agreed

BWIP RESPONSE: The statement refers to dense interiors. Additional data in ST-28 (Horizon Selection Report) will be reflected in an updated SCP (see item below).

ITEM REFERENCE: Section 6.1.5, page 6.1-20, paragraph 1

NRC COMMENT: "...Grande Ronde Basalt flows is small..."/4

STATUS: Agreed

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

BWIP RESPONSE: Reconsideration of these data and collection of new data indicate that the distinction between filled-unfilled fractures is inappropriate. The SCP will reflect this conclusion.

ITEM REFERENCE: Section 6.1.5, page 6.1-20, paragraph 1

NRC COMMENT: "In addition, the secondary mineral content..."/4, 7

STATUS: Agreed

BWIP RESPONSE: Cross references to new Table 6-6 and Section 6.5.3 (Table 6-4, Section 6.4.2 of the SCR) will be made in the SCP. Furthermore, additional characterization of secondary minerals in the candidate horizons and flow tops currently is in progress or planned and available data will be incorporated into Section 6.2 in the SCP.

ITEM REFERENCE: Section 6.1.5, page 6.1-20, paragraph 2

NRC COMMENT: "A second significant feature..."/4, 15

STATUS: Agreed

BWIP RESPONSE: If fracture fillings are heated to 300oC and water is driven off, then the permeability of the fracture is irrelevant under these conditions because no water flow will occur. Once temperature decreases, clay will reswell when it comes into contact with water as long as irreversible dehydration has not occurred. The data from Koster van Groos, 1981, and subsequent work completed by BWIP (in press) suggest that irreversible dehydration does not occur at 300oC or less. With regard to zeolites, irreversible dehydration may occur at 300oC. We cannot at this time estimate the increase in fracture volume or the effect of such an increase on radionuclide transport or mechanical stability. The analysis needs to be completed. However, given the extremely small volume of rock that will be exposed to high temperatures relative to the repository scale, it is unlikely that dehydration-rehydration scenarios are of great importance in overall repository performance. These experimental data and bases for conclusions drawn will be discussed and documented in Chapter 11, Section 11.4.4 of the SCP.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.1.5, page 6.1-20, paragraph 2

NRC COMMENT: "Experimental evidence indicates...the clay minerals (see Section 6.3)."/5, 7, 16 -- "These pressures are not effective for controlling mineral stability."

STATUS: Open (Agreed)

BWIP RESPONSE: A more detailed discussion of the effects of temperature and pressure on clay mineral degradation (dehydration versus hydrothermal reaction mechanism) will be included in the SCP.

ITEM REFERENCE: Section 6.1.5, page 6.1-21, Figure 6-8

NRC COMMENT: Figure 6-8./4, 6

STATUS: Open (Agreed)

BWIP RESPONSE: A more detailed discussion of fracture filling will be included in the SCP. Figure 6-8 will be deleted.

ITEM REFERENCE: Section 6.1.5, page 6.1-22, paragraph 3

NRC COMMENT: "The fractures generally contain..."/3, 4

STATUS: Open (Agreed)

BWIP RESPONSE: Additional data on fracture and vesical filling will be included in the SCP.

ITEM REFERENCE: Section 6.1.5, page 6.1-22, paragraph 3

NRC COMMENT: "...smectite seems to occur...illite occurs unevenly through the section."/3, 4

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

STATUS: Open (Agreed)

BWIP RESPONSE: The data presented in the SCP on vertical zonation of secondary minerals will be appropriately qualified and referenced.

ITEM REFERENCE: Section 6.1.6, page 6.1-24, paragraph 5

NRC COMMENT: "6.1.6 Composition of Interbeds in the Pasco Basin."/3 -- "This whole section is inadequate to characterize the rocks w.r.t. mineralogy or texture."

STATUS: Agreed

BWIP RESPONSE: Additional interbed and flowtop studies are required to adequately characterize the rock. Data from these studies also support radionuclide transport modeling/assessment.

ITEM REFERENCE: Section 6.1.6, page 6.1-25, paragraph 2

NRC COMMENT: "...(See Section 3.5.4)."/2 -- "Not there."

STATUS: Agreed

BWIP RESPONSE: Change the reference to Section 3.5.4.2.

ITEM REFERENCE: Section 6.2, page 6.2-1, paragraph 2

NRC COMMENT: "...low permeability of the Grande Ronde Basalt flow interiors..."/4

STATUS: Agreed

BWIP RESPONSE: All Grande Ronde groundwater samples collected to date come from either flow tops or flow bottoms. Because of the low hydraulic conductivity of the flow interiors encountered in this formation, currently there are no plans to attempt to collect such samples.

ITEM REFERENCE: Section 6.2.1, page 6.2-1, paragraph 3

NRC COMMENT: "Examination of Table 6-7 indicates...1.7 x 10-2 and 7.4 x 10-3."/3, 14

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

STATUS: Agreed

BWIP RESPONSE: Recent acquisition of hydrochemical data from the candidate horizons within the reference repository location will be incorporated in Sections 5.1.5, 5.1.6, 5.2.3, and 6.3 of the SCP. It is not clear that the data presented in Table 6-7 are in conflict with previous statements in the SCR. The data in Table 6-7 are a subset of the data presented in Table 5-28.

ITEM REFERENCE: Section 6.2.1, page 6.2-1, paragraph 4

NRC COMMENT: "Fluoride is present...along interflow contacts."/3, 4, 14 -- "See 6.1-16, paragraph 2."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.1-16, paragraph 2. Evidence presented in Chapter 5 strongly suggests that the principal groundwater flow is along flow tops and flow bottoms. There is no apparent conflict with previous statements.

ITEM REFERENCE: Section 6.2.1, page 6.2-3, Table 6-7

NRC COMMENT: Table 6-7. /3, 15, 16

STATUS: Agreed

BWIP RESPONSE: The data in this table have been supplemented by a significant number of new analyses. Many of these data will be included in Section 5.1.5 of the SCP. Table 6-7 in the SCR has been replaced by Table 6-10 for the SCP.

ITEM REFERENCE: Section 6.2.2, page 6.2-4, paragraph 1

NRC COMMENT: "The presence of molybdenum...above the detection limit..."/4, 14

STATUS: Agreed

BWIP RESPONSE: This statement will be changed to incorporate new data and to avoid conflict with data from Chapter 5.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.2.2, page 6.2-4, paragraph 1

NRC COMMENT: "Uranium concentrations in groundwater...(1 nanogram per liter)."/3, 7, 11

STATUS: Agreed

BWIP RESPONSE: The statement in the SCR is in error. It will be modified in Section 6.3 of the SCP to be factually correct and consistent with available results in Table 5-43 in Chapter 5. Expansion of this discussion is not warranted.

ITEM REFERENCE: Section 6.2.2, page 6.2-4, Table 6-8

NRC COMMENT: Table 6-8. /14, 16 -- "Ca should Cu."

STATUS: Agreed

BWIP RESPONSE: Table 6-8 contains two errors which will be corrected in Table 6-12 of the SCP. It is a modified version of Table 5-29 in Chapter 5.

ITEM REFERENCE: Section 6.2.3, page 6.2-5, paragraph 3

NRC COMMENT: "The groundwater pH at borehole DC-12...(equal to approximately 9.5)."/4, 7

STATUS: Agreed

BWIP RESPONSE: Appropriate data have been collected and will be incorporated and evaluated in Section 6.4.3 of the SCP.

ITEM REFERENCE: Section 6.2.3, page 6.2-5, paragraph 4

NRC COMMENT: "The Eh, a measure of oxidation potential...range from 0 to -0.21 volt."/1, 3, 11, 14 -- "+0.21 to -0.22 in Table 5-31."

STATUS: Agreed

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

BWIP RESPONSE: Corrections will be incorporated in Section 6.4.3 of the SCP.

ITEM REFERENCE: Section 6.2.3, page 6.2-5, paragraph 4

NRC COMMENT: "Thermodynamic calculations...(Smith et al., 1980; Jacobs and Apted, 1981)."/7, 9, 11, 15 -- "Some of the minerals assumed Eh calculations are not present at all. Based on composite samples."

STATUS: Agreed

BWIP RESPONSE: The BWIP is currently addressing the question of Eh and is formulating a plan to obtain defensible estimates of this parameter. A more comprehensive discussion of Eh is these groundwaters will be included in Section 6.4.3 of the SCP. However, it is important to recognize that in the repository the presence of fresh basalt surfaces in the backfill and disturbed rock zone will provide substantial Eh buffering by iron-bearing primary phases such as magnetite and pyroxene.

ITEM REFERENCE: Section 6.2.3, page 6.2-6, Figure 6-11

NRC COMMENT: Figure 6-11. /16

STATUS: Agreed

BWIP RESPONSE: The figures have been documented and will be referenced in Section 6.3 of the SCP.

ITEM REFERENCE: Section 6.2.3, page 6.2-7, Figure 6-12

NRC COMMENT: Figure 6-12. /16

STATUS: Agreed

BWIP RESPONSE: The figures have been documented and will be referenced in Section 6.3 of the SCP.

ITEM REFERENCE: Section 6.2.4, page 6.2-8

NRC COMMENT: "All of 6.2.4 Dissolved Gas."/4, 14

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

STATUS: Agreed

BWIP RESPONSE: Section 6.2.4 will be replaced with Section 6.3 for the SCP. New data from the RRL will be brought into concurrence with data presented in Section 5.1.5 of Chapter 5 in the SCP.

ITEM REFERENCE: Section 6.2.4, page 6.2-8, paragraph 3

NRC COMMENT: "Eh conditions in the deep basalt zones...dissolved oxygen in formation groundwaters."/1, 3, 4 -- "Not in agreement with measured +.21 Eh and paper on dissolved O_2 in deep groundwater by Winograd and Robertson (Science, Vol. 216, June 11, 1982)."

STATUS: Agreed

BWIP RESPONSE: This discussion will be expanded in Section 6.4.3 of the SCP. Measurements made in BWIP laboratories illustrate the rapid uptake of dissolved oxygen by basalt. Furthermore, direct measurements in free-flowing wells at Hanford have not resulted in detectable levels of dissolved oxygen. Finally, many standard works on geochemistry (e.g., Stumm and Morgan, 1982) suggests that measured Eh values are fraught with problems and likely to be in error. It should be noted that even an Eh of +0.21 volt at pH = 8 to 10 represents dissolved oxygen values below analytical detection limits.

ITEM REFERENCE: Section 6.3.1, page 6.3-1, paragraph 4

NRC COMMENT: "The extent of spent fuel dissolution...oxidized or reduced form."/3

STATUS: Agreed

BWIP RESPONSE: The Barrier Materials Test Plan (SD-BWI-TP-002) contains provisions for experimentally determining the dissolution rate of spent fuel under conditions likely to be encountered in the repository (Section W5.1.5). The SCP will be expanded to reflect the information on the Barrier Materials Test Plan.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.3.1, page 6.3-1, paragraph 4

NRC COMMENT: "Lemoine obtained the uranium solubility...the UO_2 dissolution rate was ..."/3, 7

STATUS: Agreed

BWIP RESPONSE: The Barrier Materials Test Plan (SD-BWI-TP-022) contains provisions for experimentally determining the dissolution rate of spent fuel under conditions likely to be encountered in the repository (Section W5.1.5). The SCP will be expanded to appropriately include information from this test plan.

ITEM REFERENCE: Section 6.3.1, page 6.3-2, paragraph 1

NRC COMMENT: "...higher than when the oxygen fugacity...(Jacobs and Apted, 1981)."/4, 16 -- "Reference improper. What about backfilling effect on pH for example?"

STATUS: Agreed

BWIP RESPONSE: See response to Item 6.3-1, paragraph 4. The SCP will contain an acceptable reference. Hydrothermal tests completed to date support the fact that backfill may lower the pH of the aqueous solution by 0.5 to 1.0 pH units.

ITEM REFERENCE: Section 6.3.1, page 6.3-2, Figure 6-13

NRC COMMENT: Figure 6-13. "Estimated UO_2 solubility...plotted as a thin line."/3. 5 -- "What is basis?"

STATUS: Agreed

BWIP RESPONSE: This figure and discussion have been deleted from the SCP. This figure cannot be supported as being site-specific data.

ITEM REFERENCE: Section 6.3.1, page 6.3-3, paragraph 4

NRC COMMENT: "The large decrease in dissolved...have been conducted to date."/3, 7, 16 -- "Very important point. Needs elaboration in regard to solubility on leach rate limited."

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CHAPTER 6 (GEOCHEMISTRY)

STATUS: Agreed

BWIP RESPONSE: Additional data on the dissolution of borosilicate glass is available in Apted and Myers (1982) and will be incorporated in Section 11.4.5 of the SCP.

ITEM REFERENCE: Section 6.3.1, page 6.3-4, Table 6-10

NRC COMMENT: Table 6-10. /14, 16

STATUS: Agreed

BWIP RESPONSE: This table will be deleted from the SCP.

ITEM REFERENCE: Section 6.3.1, page 6.3-5, paragraph 1

NRC COMMENT: "The shape of the curves suggests...under oxidizing conditions."/3, 6. 7 -- "Could be quite difference with groundwater from Grande Ronde."

STATUS: Agreed

BWIP RESPONSE: The experiments quoted in the SCR were performed using deionized water. Slightly different results were obtained using synthetic groundwater (Apted and Myers, 1982; Jenkins and Holloway, 1983). Identification of secondary alteration phases which contain sodium, uranium, and silicon support the claim that the early dissolution of these components is followed by precipitation. Experiments are currently in progress using technetium-doped borosilicate glass and synthetic groundwater. These experiments will hopefully determine if technetium will be incorporated into secondary phases. The effect of a radiation field on the stability of secondary mineral will be investigated and the results will be incorporated in Section 11.4.5 of the SCP when they become available.

ITEM REFERENCE: Section 6.3.1, page 6.3-5, paragraph 1

NRC COMMENT: "...(similar to those expected in the repository)..."/4, 7

STATUS: Agreed

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

BWIP RESPONSE: This reference has been superceded by more recent theoretical and experimental solubility studies which will be incorporated into Section 6.5.2 of the SCP. Future reference to these data will include more detail of the relevant Eh conditions considered.

ITEM REFERENCE: Section 6.3.1, page 6.3-5, paragraph 4

NRC COMMENT: "At 100°C to 200°,...supercalcines are comparable."/5, 7, 11

STATUS: Agreed

BWIP RESPONSE: Supercalcine is no longer considered a candidate waste form; no further data will be available. Section 6.3.1.3 will be deleted from the SCP.

ITEM REFERENCE: Section 6.3.1, page 6.3-6, Figure 6-14

NRC COMMENT: Figure 6-14. / 16

STATUS: Agreed

BWIP RESPONSE: Figure 6-14 is from Smith et al (1980). The figure represents a compilation of solution composition data extracted from the literature (Turcotte [illegible] ald, 1978/McCarthy and Others, 1978). Data from experiments conducted at different laboratories under the same conditions are in agreement (Westsik and Turcotte, 1978). This figure will not appear in the SCP.

ITEM REFERENCE: Section 6.3.2, page 6.3-9, paragraph 1

NRC COMMENT: "The available experiment evidence...(Koster van Groos, 1981)."/2, 11, 15 -- "Montmorillonite stability seems questionable because of illite being present and being formed in hydrothermal experiments. In addition heating favors dissolution of K-rich basalt glass."

STATUS: Agreed

BWIP RESPONSE: Laboratory data generated after the SCR was written (Wood, 1983) suggests that the conversion of bentonite to illite is not a significant reaction in a benetonite-basalt-groundwater system. The potassium concentration in hydrothermal runs at 300°C first increases and then decreases with time. Examination of hydrothermal solids indicates that a

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

potassium-bearing zeolite is the dominant reaction product. This suggests that a basalt glass to zeolite is the preferred alteration process in this system and that potassium leached from the glass partitions preferentially into the zeolite phase. It is important to note that bentonite stability cannot be estimated from experiments which do not simulate the Hanford basalt environment (RHO-BW-SA-219 P). These data will be summarized in Chapter 11, Section 11.4.4 of the SCP.

ITEM REFERENCE: Section 6.3.2, page 6.3-9, paragraph 1

NRC COMMENT: "..., Weaver (1979) has compiled studies...lesser extent, chlorite."/3

STATUS: Open

BWIP RESPONSE: The discussion by Weaver (1979) is of interest but not directly applicable to the basalt environment. Therefore, no further discussion of these data are warranted.

ITEM REFERENCE: Section 6.3.2, page 6.3-9, paragraph 1

NRC COMMENT: "The low potassium content...(approximately 1.5 weight percent and 5.9 milligrams per..."/7

STATUS: Agreed

BWIP RESPONSE: This statement should reference Tables 6-1 and 6-7 for the source of the data. However, due to the continuing acquisition of additional whole rock and groundwater data, numerical values listed in the tables (and in the above statement) will change somewhat. These changes will be incorporated in the SCP in Chapter 11, Section 11.4.4.

ITEM REFERENCE: Section 6.3.2, page 6.3-10, paragraph 1

NRC COMMENT: "...liter, respectively) and the smecite-dominated...significant degree."/5, 7

STATUS: Agreed

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

BWIP RESPONSE: See the discussion under Item 6.3-9, paragraph 1. In addition to this work, long-term experiments in the basalt-bentonite groundwater system are underway to better determine mineral alterations on a long term basis.

ITEM REFERENCE: Section 6.3.3, page 6.3-11, paragraph 2

NRC COMMENT: "...known to be stable in spent fuel with Hanford basalt and basalt phases."/4, 15 -- "Check reference."

STATUS: Agreed

BWIP RESPONSE: Proper reference is Komarneni, S., Scheetz, B. E., McCarthy, G. J., and Coons, W. E. (1980) "Hydrothermal Interactions of Cesium and Strontium Phases from Spent Unreprocessed Fuel with Basalt Phases and Basalts", RHO-BWI-C-70, Rockwell Hanford Operations, Richland, Washington.

ITEM REFERENCE: Section 6.3.3, page 6.3-11, paragraph 4

NRC COMMENT: "Barnes and Scheetz (1979."/9, 15, 16 -- "Improper reference (abstract)."

STATUS: Agreed

BWIP RESPONSE: This reference will be removed in the SCP. In the revision, Section 6.4.3 will include a detailed discussion of more recent data obtained from basalt-water hydrothermal experiments conducted by the BWIP and its subcontractors.

ITEM REFERENCE: Section 6.3.3, page 6.3-11, paragraph 4

NRC COMMENT: "Other than a very slight decrease...not change significantly."/6, 7, 14

STATUS: Agreed

BWIP RESPONSE: Section 6.4.3 will be revised to include more recent data obtained from basalt-water hydrothermal experiments.

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CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.3.3, page 6.3-12, Table 6-14

NRC COMMENT: Table 6-14. /16

STATUS: Agreed

BWIP RESPONSE: Same reference as found in the response to NRC reference item page 6.3-11, paragraph 2, Komarneni, et al (1980).

ITEM REFERENCE: Section 6.3.3, page 6.3-13, Table 6-15

NRC COMMENT: Table 6-15. /16

STATUS: Agreed

BWIP RESPONSE: Same reference as found in the response to NRC reference item page 6.3-11, paragraph 2, Komarneni, et al (1980).

ITEM REFERENCE: Section 6.3.3, page 6.3-13, paragraph 1

NRC COMMENT: "Barnes and Scheetz (1979)."/15, 16 -- "Improper reference (abstract)."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.3-11, paragraph 4.

ITEM REFERENCE: Section 6.3.3, page 6.3-13, paragraph 1

NRC COMMENT: "These early results suggest...the early thermal period."/3, 5, 9

STATUS: Agreed

BWIP RESPONSE: Recent experiements on the basalt-groundwater system (Apted and Myers, 1982) confirm the presence of the alteration phases nontronite, illite, mordenite, analcime, and clinoptilolite at 300°C, 300 bars.

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CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.4.1, page 6.4-1,

NRC COMMENT: "Section 6.4.1 Radionuclide Solubilities (all)."/3, 4 -- "Complexation must be considered."

STATUS: Agreed

BWIP RESPONSE: The section on Radionuclide Solubilities (6.4.1 in the SCR) will be modified and expanded in the SCP (Section 6.5.2). Modifications will take advantage of recent estimates of key radionuclide solubilities based upon thermodynamic analyses and experimental solubility measurements currently in progress.

ITEM REFERENCE: Section 6.4.1, page 6.4-1, paragraph 3

NRC COMMENT: "...; Giggenbach, 1981)."/15, 16 -- "Reference doesn't really apply to subject discussed."

STATUS: Open

BWIP RESPONSE: See the response to NRC reference item page 6.4-1; the exact pages of Giggenbach are pages 405, 406.

ITEM REFERENCE: Section 6.4.1, page 6.4-2, paragraph 2

NRC COMMENT: "However, the effect of complexing ligands...in these estimates complexation needs."/3, 13 -- "Carbonate effects on consideration."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.4-1.

ITEM REFERENCE: Section 6.4.1, page 6.4-2, paragraph 2

NRC COMMENT: "...reducing conditions expected...containment of uranium."/3, 4, 9

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.4-1.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.4.1, page 6.4-2, paragraph 3

NRC COMMENT: "Under oxidizing conditions, neptunium...solubility estimates."/3, 9, 13 -- "Complexation is important."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.4-1.

ITEM REFERENCE: Section 6.4.1, page 6.4-2, paragraph 4

NRC COMMENT: "...this value does not take...plutonium solubility."/2, 3, 13

STATUS: Agreed

BWIP RESPONSE: The section on Radionuclide Solubilities (6.4.1 in the SCR) will be greatly modified and expanded in the SCP (Section 6.5.2). Modifications will take advantage of recent estimates of key radionuclide solubilities based upon thermodynamic analyses and experimental solubility measurements currently in progress.

ITEM REFERENCE: Section 6.4.1, page 6.4-3, paragraph 1

NRC COMMENT: "Final americium concentrations...less than 10^{-9} mole per liter at pH 10."/3, 9, 19 -- "Not acceptable method of calculating solubilities."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.4-2, paragraph 4.

ITEM REFERENCE: Section 6.4.1, page 6.4-3, paragraph 2

NRC COMMENT: "Groundwater containing uranium...under repository conditions."/3, 6, 7 -- "Oxide assumption not acceptable."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.4-2, paragraph 4.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.4.1, page 6.4-3, paragraph 2

NRC COMMENT: "...to complex or colloid formation."/3

STATUS: Agreed

BWIP RESPONSE: The section of Radionuclide Solubilities (6.4.1 in the SCR) will be greatly modified and expanded in the SCP (Section 6.5.2). Modifications will take advantage of recent estimates of key radionuclide solubilities based upon thermodynamic analyses and experimental solubility measurements currently in progress. In addition, experimental studies which address the importance of colloids in radionuclide transport currently are planned. Results from these studies will be incorporated in this section of the SCP.

ITEM REFERENCE: Section 6.4.1, page 6.4-4, Figure 6-15

NRC COMMENT: Figure 6-15. /11, 14 -- "Am results are several orders of magnitude low."

STATUS: Agreed

BWIP RESPONSE: Within the context of proposed NRC (10 CFR 60) and EPA (40 CRF 191) regulations, Figure 6-15 and the related discussion in the text probably are not applicable. It will be dropped because maximum permissible concentrations of radionuclides based on the quoted analysis are not applicable to NRC and EPA criteria.

ITEM REFERENCE: Section 6.4.1, page 6.4-4, Figure 6-15

NRC COMMENT: "(NRC, 1981)."/ -- "Incorrect reference. MPC rules are in 10 CFR Part 20, not Part 60."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6-4, Figure 6-15.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.4.1, page 6.4-4, Figure 6-15

NRC COMMENT: "Comparison of estimated solubilities for actinide compounds with the maximum permissible concentrations.."/ -- "The relevance of this comparison is questioned because, for licensing, the final published rules by NRC (10 CFR 60) and EPA (40 CFR 191) will apply for long-term performance assessment. Nevertheless, the calculations of radionuclide solubility/MPC presented in Figure 6-15 (page 6.4-4) in the SCR are nonconservate because they make use of uncorrected MPC data and the solubility values do not account for contributions by all important aqueous species, especially carbonate. For example, the NRC staff made estimates of the adjusted MPCs on the basis of the new ICRP-30 data. In every case, the adjusted values are more restrictive by about 1 to 2 orders of magnitude. Thus, this adjustment will raise the solubility to MPC ratio in SCR Figure 6-15 by 1 to 2 of magnitude. Therefore, the MPC values used in SCR Figure 6-15 are too high. (Appendix U)."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6-4, Figure 6-15.

ITEM REFERENCE: Section 6.4.1, page 6.4-5, paragraph 1

NRC COMMENT: "low Eh."/4

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.2.5, paragraph 4. The source term for radionuclide transport to the far field is determined, in part, by redox conditions in the repository. The Eh in this region will likely be controlled to low levels by Fe-bearing primary phases in the crushed basalt of the backfill. However, this statement should refer to the discussion on Eh in Section 6.4.3.

ITEM REFERENCE: Section 6.4.2, page 6.4-5, paragraph 2

NRC COMMENT: "6.4.2 Radionuclide Sorption (all)."/12 -- "Data lacking on portion on secondary minerals in potential flow paths."

STATUS: Agreed

BWIP RESPONSE: Although we do have some data on radionuclide sorption on secondary minerals found in vugs and on the surfaces on altered basalt found in porous flowtops, the BWIP does need more information in this area.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

Additional sorption work has been performed on flow top materials since the SCR was published, and this work is continuing through FY 1987. Detailed planning for this work will be included in the Barrier Materials Test Plan (Chapter 5, Section 5.5.1-Site Materials) and will be referenced in the SCP.

ITEM REFERENCE: Section 6.4.2, page 6.4-5, paragraph 2

NRC COMMENT: "In the basalt environment...sediments above the basalts."/3

STATUS: Agreed

BWIP RESPONSE: Additional information on possible radionuclide sorbants will be included in Section 6.5.3 in the SCP.

ITEM REFERENCE: Section 6.4.2, page 6.4-6, paragraph 2

NRC COMMENT: "Extremely reducing conditions expected."/4, 9

STATUS: Agreed

BWIP RESPONSE: A detailed discussion of expected Eh will be included in Chapter 6 of the SCP.

ITEM REFERENCE: Section 6.4.2, page 6.4-6, paragraph 3

NRC COMMENT: "Groundwater composition effects on the distribution coefficient...large errors..."/3

STATUS: Agreed

BWIP RESPONSE: Table 6-17 gives errors in plutonium distribution coefficients for sorption on basalt for both groundwaters. The large error shown for GR-1 distribution coefficient does not allow comparison of coefficients for GR-1 and GR-2.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.4.2, page 6.4-7, Table 6-16

NRC COMMENT: Table 6-16. /6, 7, 9, 10 -- "Results not relevant for conditions."

STATUS: Open

BWIP RESPONSE: These groundwater compositions were chosen for use in sorption studies because of their compositional differences and because they represent two potentially important groundwaters. Alternative compositions were carefully considered before choosing those being used. The supporting data for choosing these compositions will be given in Section 5.2.3.1.2 of the SCP. The testing and analysis method will be referenced.

ITEM REFERENCE: Section 6.4.2, page 6.4-7, Table 6-17

NRC COMMENT: Table 6-17. /6, 7, 9, 10 -- "Results are not relevant for conditions."

STATUS: Open

BWIP RESPONSE: The supporting data, testing techniques, and analytical methods are given in a reference to be added to Section 6.5 of the SCP. See comments for Table 6-16 for statements on "alternatives not considered," and results not "relevant for conditions."

ITEM REFERENCE: Section 6.4.2, page 6.4-8, paragraph 1

NRC COMMENT: "The decrease in cesium distribution coefficient...at higher temperatures."/3, 4, 14

STATUS: Agreed

BWIP RESPONSE: Data supporting this statement may be found in Salter et al, 1982 (RHO-BWI-LD-48). It is known that K effectively competes for Cs sorption sites; at high temperatures, basalt groundwater reactions result in an increase in K in solution. It is suggested that K may be causing the deviation in Cs sorption observed at higher temperatures. This will be covered in more detail in the SCP.

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CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.4.2, page 6.4-9, Table 6-18

NRC COMMENT: Table 6-18. /5, 16

STATUS: Agreed

BWIP RESPONSE: The appropriate reference will be given for this table in Section 6.4 of the SCP.

ITEM REFERENCE: Section 6.4.2, page 6.4-9, paragraph 1

NRC COMMENT: "Reducing conditions expected for a repository..."/4, 9, 10, 12

STATUS: Agreed

BWIP RESPONSE: The 0.1 M hydrazine used in these experiements may not simulate expected reducing conditions in a repository in basalt. Also, the increased distribution coefficients under reducing conditions may not be due to formation of less soluble species, but due to stronger absorption of reduced species. Additional sorption work under Eh conditions controlled by basalt (without hydrazine) is being performed and will be reported in Section 6.5.3 of the SCP.

ITEM REFERENCE: Section 6.4.2, page 6.4-10, Table 6-19

NRC COMMENT: Table 6-19. /7, 10, 14, 16

STATUS: Agreed

BWIP RESPONSE: The use of Kd values in Tables 6-17, 18, 19 and 20 have been replaced with isotherm models that will be used in radionuclide transport models. Values of Kd are useful for describing radionuclide sorption behavior only when sorption isotherms are linear and sorption reactions are reversible.

ITEM REFERENCE: Section 6.4.2, page 6.4-11, paragraph 3

NRC COMMENT: "It becomes independent or radionuclide...at trace levels."/3, 4, 10

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

STATUS: Agreed

BWIP RESPONSE: This statement is incorrect since sorption depends on radionuclide concentration at all concentration levels. It will be removed from Section 6 of the SCP.

ITEM REFERENCE: Section 6.4.2, page 6.4-11, paragraph 3

NRC COMMENT: "These equations (Table 6-21)...radionuclide retardation factors."/3, 4, 7, 10, 16

STATUS: Agreed

BWIP RESPONSE: The supporting data and analysis methods are given in a reference to be added to Section 6.5 of the SCP.

ITEM REFERENCE: Section 6.4.2, page 6.4-12, Table 6-20

NRC COMMENT: Table 6-20. /7, 10, 14, 16

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.4-12, Table 6-19.

ITEM REFERENCE: Section 6.4.2, page 6.4-13, Table 6-21

NRC COMMENT: Table 6-21. /7, 10, 14, 16

STATUS: Agreed

BWIP RESPONSE: The supporting data and analysis methods are contained in the reference which will be added to Section 6.5 of the SCP.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.5.1, page 6.5-1, paragraph 2

NRC COMMENT: "Thus, although most volcanic glass...repository performance requirements."/7, 11, 14

STATUS: Agreed

BWIP RESPONSE: This discussion will be deleted in the SCP.

ITEM REFERENCE: Section 6.5.1, page 6.5-8, paragraph 4

NRC COMMENT: "...hazards from uranium...uranium ore deposits."/3, 7, 10

STATUS: Agreed

BWIP RESPONSE: The paragraph containing this statement will be deleted from the SCP.

ITEM REFERENCE: Section 6.5.1, page 6.5-10, paragraph 1

NRC COMMENT: "The observations support...life of the repository."/4, 7, 9

STATUS: Agreed

BWIP RESPONSE: Cross reference of this discussion with the appropriate portions of Section 6.4.3 in the SCP will provide justification for this statement.

ITEM REFERENCE: Section 6.5.2, page 6.5-11, paragraph 2

NRC COMMENT: "Preliminary calculations indicate...(see Section 11.4)."/2, 4, 14

STATUS: Agreed

BWIP RESPONSE: Actual calculations have not been included in the SCR, therefore, the statement can be considered unsupported. The previous statement that conflicts with this statement is not specified (need a specific description of conflicting statement). Either calculations or a revision of the statement will be incorporated into this same paragraph in the revision.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.5.2, page 6.5-11, paragraph 4

NRC COMMENT: "Hanford Site, where ambient Eh conditions are also expected to be quite reducing."/4, 14

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.2-5.

ITEM REFERENCE: Section 6.5.2, page 6.5-11

NRC COMMENT: "6.5.2.3 Archaeological Objects and Metal Meteorites. (all)"/3

STATUS: Agreed

BWIP RESPONSE: For the intended purpose of including this material (i.e., simply to point out that metal objects have existed for thousands of years without significant degradation in geologic media), the subject SCR paragraph adequately covers and references the source information. Meteorites are inappropriate analogs and reference to them will be deleted in the SCP.

ITEM REFERENCE: Section 6.5.3, page 6.5-12, paragraph 1

NRC COMMENT: "Limited experimental data...(see Sections 6.3..."/4, 11, 15 -- "Montmorillonite stability is in question."

STATUS: Agreed

BWIP RESPONSE: See the discussion under Item Reference 6.3-9. The expected repository conditions refer to ambient conditions. Alteration of smectite to illite is significant in this case.

ITEM REFERENCE: Section 6.5.3, page 6.5-12, paragraph 1

NRC COMMENT: "The groundwaters in the candidate repository...not be affected."/4, 6, 11, 14 -- "Dissolution of basalt at higher temperatures will add K to water."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.5-12, paragraph 1.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.6, page 6.6-1

NRC COMMENT: "6.6 FIELD TESTS (all)."/^ -- "The discussion is for granite."

STATUS: Agreed

BWIP RESPONSE: Current scoping plans call for extensive field testing of waste package backfill and canister materials under repository conditions at Hanford. Furthermore, these plans include provisions for determining in situ radionuclide migration rates in the basalt geochemical environment. Plans for these field tests will be addressed in the SCP.

ITEM REFERENCE: Section 6.7, page 6.7-1, paragraph 2

NRC COMMENT: "Geologic and hydrologic studies have established...Grande Ronde Basalt."/3, 4, 7, 11, 12, 14

STATUS: Agreed

BWIP RESPONSE: The SCP will contain a substantial increase in the geologic, hydrologic, and geochemical data base for the Grande Ronde and related discussions. These discussions will be contained in Chapter 3 (Section 3.5), Chapter 5 (Sections 5.1.3, 5.1.5, 5.1.6, 5.2.1, and 5.2.3) and Chapter 6 (Sections 6.2, 6.3, and 6.4).

ITEM REFERENCE: Section 6.7, page 6.7-1, paragraph 2

NRC COMMENT: "The indication is...(especially the glass portion of the basalt.)"/4, 7, 12

STATUS: Agreed

BWIP RESPONSE: In the SCP this statement, in its present or modified form, will be backed by a substantial data base and will reflect refinements in the evaluation of these data.

ITEM REFERENCE: Section 6.7, page 6.7-1, paragraph 3

NRC COMMENT: "...results confirm the dominant control...at high temperature."/4, 7, 12

STATUS: Agreed

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

BWIP RESPONSE: A significant increase in the data base from hydrothermal basalt-water systems has been achieved and will be incorporated in Section 6.4 of the SCP. Planned micro-characterization of hydrothermal run products will be included when available and will help elucidate specific mineral-water reactions that occur.

ITEM REFERENCE: Section 6.7, page 6.7-1, paragraph 4

NRC COMMENT: "...hydrothermal studies demonstrate...to isolation criteria."/4, 7, 12 -- "Laboratory studies have not been related to in situ conditions."

STATUS: Agreed

BWIP RESPONSE: Considering the available data base at the time this statement was written, it expresses a premature conclusion. Hydrothermal studies either currently in progress or planned in the Barrier Materials Test Plan (SD-BWI-TP-022): Section W5.1.3, W5.1.4, and W5.1.5) will address this issue directly and will be referenced in the SCP.

ITEM REFERENCE: Section 6.7, page 6.7-2, paragraph 1

NRC COMMENT: "Field investigations of granites...the geochemical program at Hanford."/3, 4. 11 -- "This has to be related to basalt; the geochemistry is quite different."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 6.6-1.

ITEM REFERENCE: Section 6.8, page 6.8-1

NRC COMMENT: "6.8 SUMMARY OF UNRESOLVED ISSUES (all)."/3

STATUS: Open

BWIP RESPONSE: This discussion of unresolved issues is included in Chapter 15. This section in Chapter 6 only identifies where these issues will be discussed in the SCP. References to appropriate test plans will be included in those discussions.

TABLE III

CHAPTER 6 (GEOCHEMISTRY)

ITEM REFERENCE: Section 6.9, page 6.9-1

NRC COMMENT: "6.9 REFERENCES (all)."

STATUS: Agreed

BWIP RESPONSE: The references in the SCP will be expanded to include recent, documented sources of information. In most instances, these were not available at the time the SCR was written.

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

ITEM REFERENCE: Section 10.0, page 10.0-1, paragraph 2

NRC COMMENT: "In the conceptual design, the deeper and more widely ... using the deeper of the candidate flows, ... schedule improvement, and less technologic risk."/3,4 -- "There is no mention of retrievability and barely of containment or isolation. It is suggested that a less deep location would be covered by a deeper location design without even mentioning the containment function."

STATUS: Agreed

BWIP RESPONSE: We agree that the design impacts of alternative candidate basalt flows are inadequately covered. Additional paragraphs on this subject, including mention of retrievability impacts, will be provided in Sections 10.3 and 10.4 of the SCP; based on information recently developed in support of the horizon selection study. The discussion on this subject in the introduction 23 Chapter 10 (page 10.0-1) will be rewritten to be fully supported by the additional information.

We also agree that the containment and isolation of alternative candidate basalt flows should be addressed, but not in Chapter 10. The horizon selection study will be referenced in the SCP for this information.

ITEM REFERENCE: Section 10.2.2, page 10.2-5, paragraph 4

NRC COMMENT: "After the borehole is filled with packages, ... is transferred to the next borehole"/3 -- "There is no discussion of retrievability and its impact on design requirements."

STATUS: Agreed

BWIP RESPONSE: A discussion will be added to this paragraph on page 10.2-5 to explain that canister retrieval would be accomplished using the same equipment as used for canister emplacement and using the same procedure but in reverse sequence.

ITEM REFERENCE: Section 10.3.6, page 10.3-4, paragraph 4

NRC COMMENT: "The conceptual design is based ... of about 58°C. Location of ... use of smaller, shorter shafts."/4 -- "Will location of the repository in the Sentinel Bluffs which is about 200 feet above the Umtanum make that much difference in the heat and hence the ventilation? The difference will only amount to about 5° to 10°F in rock temperature."

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

STATUS: Agreed

BWIP RESPONSE: This paragraph will be rewritten to explain that the rock temperature difference of 12°F between the Umtanum and middle Sentinel Bluffs flows would not justify significant design changes in the ventilaton system capacity or shaft cross-sectional area, but would provide additional design conservatism. An additional description will be provided based on information developed as part of the horizon selection study.

ITEM REFERENCE: Section 10.4.1, page 10.4-4, paragraph 4

NRC COMMENT: "This panel will ... the retrieval period."/6,8 -- "The experimental panel is provided to conduct tests. Many of these tests may be needed prior to License Application (LA), yet the panel comes after the LA."

STATUS: Open

BWIP RESPONSE: This paragraph, and the list of tests to be performed in an experimental panel, will be revised to clarify that the tests envisioned are not intended to provide necessary input to the construction permit or operating license applications, but instead are intended as performance confirmation tests as defined in 10 CFR 60. This topic will be discussed with the NRC staff at future workshops.

ITEM REFERENCE: Section 10.4.2, page 10.4-6, Figure 10-11

NRC COMMENT: Figure 10-11. /14 -- "Why aren't the reaming rooms sized with a 2:1 horizontal to vertical ratio since they are also subjected to a stress field similar to the waste emplacement rooms."

STATUS: Agreed

BWIP RESPONSE: The apparent conflict in tunnel shapes between emplacement rooms and back-reaming access drifts will be eliminated by additional explanation in Section 10.5.1 of the SCP. The elliptical shape is not considered necessary for the back-reaming access drifts because of smaller tunnel cross-sectional area requirements and a reduced need for assured tunnel wall integrity.

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

ITEM REFERENCE: Section 10.5, page 10.5-1, paragraph 1

NRC COMMENT: "The conceptual design ... stress ratio. Current test data ... of 200 to 220 megapascals."/3 -- "A rock stress of 186 MPa together ith a rock strength of 200 MPa provides a safety factor of only 1.08. Hor is this justified? Has consideration been given to the fact that the fractured zone may have a considerably smaller strength than 200 MPa, and a rock stress lower than 186 MPa."

STATUS: Agreed

BWIP RESPONSE: Future evaluations of rock mass strength will not be determined from a single strength value, but from a failure envelope which will be expressed in terms of the major and minor principal stress state. Failure envelopes will be developed from both rock mass peak strength and rock mass residual strength. Incorporating these stress dependent failure envelopes into the constitutive model plus the inclusion of the rock mass nonlinear deformation characteristics into the constitutive model will result in a numerical model more suited for representing the in situ rock mass strength and rock mass deformation behavior. This new nonlinear numerical model will be stress state and stress path dependent resulting in lower rock stresses near excavation boundaries and rock mass strengths dependent upon in situ stress states. Existing BWIP plans for developing the analysis and design methodology for subsurface openings and their support systems are discussed in Section 14.3.1. The rock strength data in Table 10-4 will be updated and expanded using information obtained from RRL cores.

ITEM REFERENCE: Section 10.5, page 10.5-1, paragraph 1

NRC COMMENT: "The conceptual design ... stress ratio. Current test data ... of 200 to 220 megapascals."/7 --"Design strength value is extremely high, in light of the very large standard deviation on strengths given in Tables 4.2(a) and (b), as discussed in the first paragraph of Section 4.1.3."

STATUS: Agreed

BWIP RESPONSE: Laboratory procedure for characterization of intact uniaxial and triaxial test specimens has been improved. Available site specific data for candidate horizons shows better statistical behavior. In particular, estimated strength values for intact Umtanum basalt have increased and they show less statistical spread. See the response to NRC reference item page 10.5-1, paragraph 1 (above).

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

ITEM REFERENCE: Section 10.5, page 10.5-1, paragraph 5

NRC COMMENT: "Time dependent near field phenomena, such as ... and more detailed stress analyses."/3,8 -- "Does not address retrievability, and barely containment."

STATUS: Agreed

BWIP RESPONSE: Stress analysis considerations relative to retrievability and containment will be discussed in Section 10.5 of the SCP. This will be coordinated with discussions in Section 10.7-3 for retrievability and Chapter 12 for containment.

ITEM REFERENCE: Section 10.5, page 10.5-2, Table 10-4

NRC COMMENT: Table 10-4. /14 -- "Rock maximum design temperature is shown to be 500°C rather 300°C shown in Table 10.5."

STATUS: Agreed

BWIP RESPONSE: Consistent values of the basalt maximum design temperature limit will be included in Tables 10-4 and 10-5 of the SCP.

ITEM REFERENCE: Section 10.5.1, page 10.5-3, paragraph 3

NRC COMMENT: "When the horizontal-to-vertical ... at the repository horizon."/7 --"The assumed maximum horizontal stress of 60 MPa is significantly less than several measure values in Table 4.11."

STATUS: Agreed

BWIP RESPONSE: Data in Table 4.11 became available after the architect engineer had completed the design analysis. Future designs will use the best estimates of in situ stress available, with added conservatism as appropriate at the time the designs are accomplished.

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

ITEM REFERENCE: Section 10.5.1, page 10.5-3, paragraph 4

NRC COMMENT: "Using the chosen orientation, ... before any decay of heat from emplaced waste is released into the rock."/10 -- "The assumption of uniform stress around the emplacement room perimeter assumes strictly elastic analysis and doesn't account for blast damage zone which weakens the rock."

STATUS: Agreed

BWIP RESPONSE: Existing BWIP plans to evaluate the extent of the blast damage zone are discussed in Section 14.3.1 of the SCR, Work Element R1.17.D. See also the first comment under NRC item reference page 10.5-1, above.

ITEM REFERENCE: Section 10.5.1, page 10.5-5, paragraph 2

NRC COMMENT: "Further, the placement room ... decay heat is released."/4 -- "The argument for changing the room width to maintain a uniform stress is a highly debatable one. Simplistic elastic analysis might be acceptable for conceptual stability estimates, but is totally inadequate to guide final shape decisions."

STATUS: Agreed

BWIP RESPONSE: See first comment under NRC item reference page 10.5-1 above.

ITEM REFERENCE: Section 10.5.3, page 10.5-9, paragraph 4

NRC COMMENT: "The consequence of nominal ... along rock joints."/3 --"It is of serious concern that not even a very simple estimate was made of the behavior (slip-no slip analysis) of the joints intersecting the opening."

STATUS: Agreed

BWIP RESPONSE: Same as first comment under NRC reference item page 10.5-1, above. The existing BWIP plans will be expanded to include additional detail relative to joint behavior.

ITEM REFERENCE: Section 10.5.3, page 10.5-9, paragraph 4

NRC COMMENT: "The consequence of ... along rock joints./4 -- "Any justification for claiming that the motions along joints will be minor?"

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

STATUS: Agreed

BWIP RESPONSE: Same as first comment under NRC reference item page 10-5.1, above. The existing BWIP Plans will be expanded to include additional detail relative to joint behavior and redistribution.

ITEM REFERENCE: Section 10.5.3, page 10.5-9, paragraph 5

NRC COMMENT: "The proposed rock support ... potential rock motion."/3 -- "How will the grouted bolts react to the elevated temperature?"

STATUS: Agreed

BWIP RESPONSE: A preliminary assessment of the effect of evaluated temperature on roof support components (rockbolts) will be included in Section 10.5.3 of the SCP. Plans for assessing the response of roof support components to elevated temperatures will be included in Section 14.3.1.

ITEM REFERENCE: Section 10.5.3, page 10.5-9, paragraph 5

NRC COMMENT: "The proposed rock support ... potential rock motion."/10 -- "Rock support needs careful study. If the strong basalt can't handle the load, support may not help."

STATUS: Agreed

BWIP RESPONSE: Plans for assessing roof support requirements will be included in Section 14.3.1 of the SCP.

ITEM REFERENCE: Section 10.5.4, page 10.5-9, paragraph 7

NRC COMMENT: "Based on analyses ... in a homogeneous mass. On the other hand ... above the repository."/5 -- "The comment on thermal stress and cracking appears inappropriate for conservative design."

STATUS: Agreed

BWIP RESPONSE: This statement is incorrect and will be revised in Section 10.5.4 of the SCP. Plans for assessing the effect of stratification on basalt thermomechanical response will be included in Section 14.3.1.

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

ITEM REFERENCE: Section 10.6.2, page 10.6-2, paragraph 6

NRC COMMENT: "After a heading has ... behind the face advance."/3 -- "Implies delayed reinforcement and support; hence; larger displacements and possibly greater permeability than if both were required at the face. The latter should not influence construction, given the multiple faces and highly mobile equipment proposed. This aspect should be considered since it has direct implications for containment."

STATUS: Agreed

BWIP RESPONSE: Delayed roof support (rock bolts installed a short distance behind the face advance) could result in larger displacements and possibly greater permeability than immediate roof support (roof bolts installed immediately behind the face advance). The impact of delayed roof support on distrubed rock zone (DRZ) permeability and, therefore, waste isolation performance will be addressed in Section 10.6.2 of the SCP. This discussion will reference an assessment of the impact of the DRZ around repository tunnels will be demonstrated to have a negligible effect on waste isolation performance (Section 12.4.2) for a long horizontal waste storage configuration and a hydraulic driving force that is predominately vertical.

ITEM REFERENCE: Section 10.7.2, page 10.7-2, paragraph 1

NRC COMMENT: "This sequence continues ... height of the room."/1 -- "The filling sequence appears to indicate room heights greater than 10 ft."

STATUS: Agreed

BWIP RESPONSE: The error noted will be corrected by rewriting the paragraph in question for consistency with recent changes in the room backfill emplacement method, as described in the final Conceptual System Design Description (CSDD) document.

ITEM REFERENCE: Section 10.7.2, page 10.7-2, paragraph 1

NRC COMMENT: "To achieve maximum ... next lift is started."/3 -- "Because backfill will be moistened when emplaced, this moisture may turn into high pressure steam that will hamper retrieval. This needs to be discussed."

STATUS: Agreed

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

BWIP RESPONSE: The comment will be resolved by rewriting this paragraph for consistency with the final CSDD. Moistening the backfill during emplacement is no longer intended, but not for the reason identified in the comment. Moisture conversion to steam would not hamper retrieval because room backfilling will not be performed until the retrievability period for that room has been decreed to be over.

ITEM REFERENCE: Section 10.7.3, page 10.7-3, paragraph 7

NRC COMMENT: "Prior to retrieval ... to approximately 27°C."/4 -- "The cooling rates assumed seem very optimistic."

STATUS: Agreed

BWIP RESPONSE: We still support the accuracy of the cooling rate estimates as written. However, the design calculations for room cooling prior to possible waste retrieval will be reviewed, and additional discussion of these calculations will be provided to support the cooling rate estimate.

ITEM REFERENCE: Section 10.7, page 10.7-3, paragraph 1

NRC COMMENT: "Retrieval shall be ... safety performance objectives."/3 -- "Retrieval as discussed is full retrieval which would terminate use of the repository. What about local retrieval due to geologic unsuitability of one room or panel which doesn't affect the suitability of the repository overall?"

STATUS: Agreed

BWIP RESPONSE: The paragraph in question will be revised to include the possibility of waste retrieval from only one room or panel due to localized geologic unsuitability. However, it will also be pointed out that such a condition would more likely be recognized prior to waste emplacement, and that a decision not to emplace waste in such an area would obviate future retrieval.

ITEM REFERENCE: Section 10.7.3, page 10.7-3, paragraph 3

NRC COMMENT: "The approach that will be followed to resolve ... in the decision flow chart (Fig. 10-14). The requirement for the proposed 10 CFR 60 ... has an impact on when backfill will be placed."/3 -- "Potential retrievability difficulties, including overcoring of leaking canisters in horizontal storage holes, and the cooling of backfill should be carefully considered."

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

STATUS: Agreed

BWIP RESPONSE: The comment will be resolved by clarifying in Section 10.7-3 of the SCP, that the design philosophy of deferred backfilling (i.e., until after the retrievability period) applies to canister emplacement holes as well as to rooms and shafts. Thus, the retrievability difficulties recognized by the NRC merit only brief mention as justification for this design philosophy.

ITEM REFERENCE: Section 10.7.3, page 10.7-4, Figure 10.14

NRC COMMENT: Figure 10-14. /3 -- "It is not clear when backfilling will take place."

STATUS: Agreed

BWIP RESPONSE: Figure 10-14 will be redrawn for the SCP and its supporting text will be revised to clarify that the current design philosophy is to perform backfill of placement holes at the end of the caretaker-retrievability phase. Also a statement will be added to the effect that if it is decided during the operational phase to backfill prior to retrievability, then retrievability demonstration testing can be performed in the experimental panel. Current plans are to demonstrate retrievability without backfill.

ITEM REFERENCE: Section 10.8, page 10.8-3, paragraph 4

NRC COMMENT: "The effect of the disturbed ... sensitivity analysis. The results of these studies ... affected by disturbance is required."/3 -- "Very vague and noncommittal. Are large-scale field tests optional?"

STATUS: Agreed

BWIP RESPONSE: Statements will be added to the information presented in the SCR, page 10.8-3, Section 10.8, to reflect the following: Due to inherent difficulty in the analysis, both of the extent and nature of rock mass disturbance and of changes in permeability associated with this disturbance, accurate characterization of the distrubed rock zone will require field testing. In situ rock mechanical and hydrologic field testing to be conducted in the Exploratory Shaft Test Facility will enable an accurate characterization of the distrubed rock zone. Rock mass characterization and any necessary remediation at specific seal sites will be done prior to seal emplacement.

TABLE III

CHAPTER 10 (REPOSITORY DESIGN)

ITEM REFERENCE: Section 10.8.1, page 10.8-5, paragraph 1

NRC COMMENT: "These materials will be tested ... at the repository horizon. Emplacement techniques ... as needed."/3 -- "Where will the referenced shaft seal be demonstrated? Prior to LA?"

STATUS: Open

BWIP RESPONSE: Current plans do not include shaft seal demonstration prior to construction license application. However, the overall seal field testing program is being reevaluated to detrmine the extent of shaft seal testing to be done to support the LA.

ITEM REFERENCE: Section 10.8.1, page 10.8-6, Figure 10-17 and Figure 10-18

NRC COMMENT: Figures 10-17 and 10-18. /3,4 -- "What is the basis of design? Mortar jointed basalt blocks are not justified anywhere. Seal length should be based on joint patterns and conductivity, i.e., on risk of bypass flow."

STATUS: Agreed

BWIP RESPONSE: SCR Figures 10-17 and 10-18 show schematic designs developed during the preconceptual design period. They no longer reflect our planning and will be deleted. A statement will be added to the contents of the SCP Section 10.1, that calculations of seal length to meet flow rate and travel time requirements for radionuclide isolation are based on estimated hydraulic conductivities of seal, disturbed rock zone, and undisturbed host rock materials.

TABLE III

CHAPTER 11 (WASTE PACKAGE)

ITEM REFERENCE: Section 11.2.1, page 11.2-4, paragraph 2

NRC COMMENT: "Preliminary experimental results ... a rapid reaction of groundwater with basalt occurs to establish anoxic conditions soon after repository, sealing, and decommissioning."/4, 7, 9, 10, 12, 16

STATUS: Agreed

BWIP RESPONSE: The latest data on the kinetics of Eh recovery, from hydrothermal testing in rock-water backfill systems will be included in Section 6.4 of the SCP prior to the discussion of the waste-barrier system interactions and will serve to define the actual waste package near-field environment behavior. References will be incorporated as available. Cross reference to the material in Section 6.4 will be added to Chapter 11 to summarize the hydrothermal studies reported earlier. The tables and narratives in work elements WE 1.12.A and WE 2.3.A will be upgraded to clarify the studies that are planned in the area of rock-water and rock-water backfill interactions, making reference to the Barrier Material Test Plan as a source for detailed test planning on the topic of concern.

ITEM REFERENCE: Section 11.2.1, page 11.2-4, paragraph 3

NRC COMMENT: "...the repository will have returned to anoxic conditions..."/4

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Section 11.3 to support this statement.

ITEM REFERENCE: Section 11.2.1, page 11.2-4, paragraph 3

NRC COMMENT: "...highly corrosion resistant overpack is not needed..."/4

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Section 11.3 to support this statement.

TABLE III

CHAPTER 11 (WASTE PACKAGE)

ITEM REFERENCE: Section 11.2.1, page 11.2-4, paragraph 3

NRC COMMENT: "... the benign nature of the basalt groundwater and geochemical environment..."/4

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Section 11.3 to support this statement.

ITEM REFERENCE: Section 11.2.1, page 11.2-4, paragraph 3

NRC COMMENT: "...the buffer also is not necessary..."/4

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Section 11.3 to support this statement.

ITEM REFERENCE: Section 11.2.1, page 11.2-4, paragraph 3

NRC COMMENT: "...the backfill may decrease in importance or may even be eliminated as a component of the waste package for basalt."/4, 5

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Section 11.4 to support this statement.

ITEM REFERENCE: Section 11.2.1, page 11.2-7, paragraph 3

NRC COMMENT: "The site conditions have eliminated the need for a buffer and overpack by providing an environment that canister corrosion..."/4

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Sections 6.4 and 11.3 of the SCP.

TABLE III

CHAPTER 11 (WASTE PACKAGE)

ITEM REFERENCE: Section 11.2.5, page 11.2-10, paragraph 6

NRC COMMENT: "This (sic) groundwater, pH, and extremely anoxic condition simulate...conditions expected in a repository in basalt following decommissioning and a return to conditions controlled by the geology."/1, 4, 6

STATUS: Agreed

BWIP RESPONSE: The text in Section 6.4 will be revised to reflect the results of current testing. Continued testing will treat the environmental conditions as variables to achieve a range of conditions.

ITEM REFERENCE: Section 11.2.5, page 11.2-12, paragraph 2

NRC COMMENT: "Materials ... have been identified ... for chemically modifying the groundwater ..."/2, 4, 15 -- "See page 11.2-1, 1st paragraph which essentially says waste package has not been designed."

STATUS: Agreed

BWIP RESPONSE: No action is required, since the next sentence of the paragraph states that required use of these materials is yet to be determined. Item 11.2-12 and 11.2-10 are not in conflict. The definition of conceptual design will be added.

ITEM REFERENCE: Section 11.2.5, page 11.2-12, paragraph 3

NRC COMMENT: "...backfill materials and additivies have been selected..."/2, 3, 4, 6

STATUS: Agreed

BWIP RESPONSE: The appropriate reference for the backfill material development and selection process will be added.

ITEM REFERENCE: Section 11.2.2, page 11.2-6

NRC COMMENT: All/4, 5, 6, 9, 10

STATUS: Agreed

TABLE III

CHAPTER 11 (WASTE PACKAGE)

BWIP RESPONSE: The text of Section 11.2-6 will be revised to show the current design and development effort. Details of materials can be found in Section W5.1 of the Barrier Materials Test Plan which will be referenced in the SCP. The definition of conceptual design will be added.

ITEM REFERENCE: Section 11.3.1, page 11.3-1, paragraph 2

NRC COMMENT: "Preliminary estimates of long-lived radionuclide solubilities indicate that this assessment (sic) could reduce the design constraints on the waste package..."/3, 4, 5, 9, 10

STATUS: Agreed

BWIP RESPONSE: The sentence will be revised to clarify that the preliminary estimates are not based upon a well-developed data base, testing techniques and analysis methods.

ITEM REFERENCE: Section 11.2.1, page 11.2-4, paragraph 2

NRC COMMENT: "Groundwater will not reach the canister before about 100 years and will have returned to anoxic conditions by that time."/4, 5, 6, 10

STATUS: Agreed

BWIP RESPONSE: The paragraph will be revised to clarify the preliminary nature of the analyses leading to these assertions. Data supporting this statement will be presented in Section 6.4.3 of the SCP.

ITEM REFERENCE: Section 11.3.2, page 11.3-3, paragraph 3

NRC COMMENT: "As will be discussed in Section 11.4,...be uranite (UO_2)."/5, 10 --"It has never been properly demonstrated that the QFM buffer controls Eh."

STATUS: Agreed

BWIP RESPONSE: The paragraph will be deleted.

ITEM REFERENCE: Section 11.3.2, page 11.3-4

NRC COMMENT: All including Figure 11-7./3, 9, 10 -- "According to Figure 11-17 the HM buffer doesn't affect the solubility until 300oC, which is higher than the temperature will be at thermal peak."

TABLE III

CHAPTER 11 (WASTE PACKAGE)

STATUS: Agreed

BWIP RESPONSE: This section of the SCR will be revised and appear as Section 6.4 in the SCP.

ITEM REFERENCE: Section 11.3.2, page 11.3-20, paragraph 7

NRC COMMENT: "The strategy for testing...scientific practices."/4

STATUS: Agreed

BWIP RESPONSE: The sentence will be deleted.

ITEM REFERENCE: Section 11.3.2, page 11.3-28, paragraph 4

NRC COMMENT: "A series of experiments...disposal of nuclear waste."/3, 4, 15

STATUS: Open (Agreed)

BWIP RESPONSE: The discussion of mineral alterations and dehydration will be expanded and more appropriately qualified in the SCP.

ITEM REFERENCE: Section 11.3.2, page 11.3-30, paragraph 1

NRC COMMENT: "This suggests that interlayer water...potential backfill alteration."/10, 16

STATUS: Agreed

BWIP RESPONSE: The BWIP will add clarification to the reasoning supporting the statement.

ITEM REFERENCE: Section 11.3.2, page 11.3-37, paragraph 3

NRC COMMENT: "The continued application...waste package final designs."/3, 21 -- "This is an extensive program that deserves elaboration."

STATUS: Agreed

TABLE III

CHAPTER 11 (WASTE PACKAGE)

BWIP RESPONSE: A cross reference will be made to Chapter 15 of the SCR, where the plans for testing will be updated to yield greater detail.

ITEM REFERENCE: Section 11.3.3, page 11.3-38, paragraph 1

NRC COMMENT: "Important conclusions drawn...disturbed zone of the repository."/5, 9, 10, 15

STATUS: Open

BWIP RESPONSE: The work "conclusions" will be replaced by "inferences."

ITEM REFERENCE: Section 11.4.1, page 11.4-1, paragraph 2

NRC COMMENT: "The composition of the Grande Ronde Basalt...and HCO_3."/5, 14, 16 -- "Previously the groundwater was claimed to have low F- concentration."

STATUS: Agreed

BWIP RESPONSE: None.

ITEM REFERENCE: Section 11.4.1, page 11.4-6, paragraph 2

NRC COMMENT: "Irreversible loss of water...(Deer, et al., 1967)."/10 -- "What, when F- is present?"

STATUS: Open

BWIP RESPONSE: To our knowledge fluoride has no relevance to the irreversible loss of water. If there are known mechanisms involving fluoride which cause an irreversible loss of water below temperatures of 300°C, we would like to discuss this aspect at a future NRC workshop.

ITEM REFERENCE: Section 11.4.1, page 11.4-7, paragraph 2

NRC COMMENT: "The high pH values...(Krauskopf, 1979)."/3 -- "Carbonates are claimed to be important but there is no further discussion of them."

TABLE III

CHAPTER 11 (WASTE PACKAGE)

STATUS: Agreed

BWIP RESPONSE: Section 6.4 of the SCP will discuss the influence of carbonate on pH.

ITEM REFERENCE: Section 11.4.1, page 11.4-7, paragraph 3

NRC COMMENT: Equation (11-2). /10 -- "The reference title implies pH is a result of H_4SiO_4 dissociation only."

STATUS: Agreed

BWIP RESPONSE: Section 6.4 of the SCP will discuss the importance of silicic acid dissociation on pH at ambient temperatures.

ITEM REFERENCE: Section 11.4.1, page 11.4-7, paragraph 5

NRC COMMENT: "The Hanford groundwater...dissociation of silicic acid."/10, 14 --"Previously stated that carbonates were also important."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 11.4-7, paragraph 2.

ITEM REFERENCE: Section 11.4, page 11.4-8, paragraph 4

NRC COMMENT: "Precipitation and hydroloysis...steady-state value."/10, 16

STATUS: Agreed

BWIP RESPONSE: The revised text of Section 6.4 will clarify that the conclusion is the usual interpretation of the observed pH behavior. The reference cited presents that interpretation, and should be an adequate example.

TABLE III

CHAPTER 11 (WASTE PACKAGE)

ITEM REFERENCE: Section 11.4.1, page 11.4-9, paragraph 1

NRC COMMENT: "For instance, pH depression...200°C using seawater."/16

STATUS: Open

BWIP RESPONSE: This discussion relates to Figure 11-24, which contains references on the curves; those for basalt will be added. This statement and action has been deleted from Section 6.4 of the SCP as more applicable site specific data is now available. This information will be included in the SCP.

ITEM REFERENCE: Section 11.4.1, page 11.4-9, paragraph 3

NRC COMMENT: "Barnes and Sheetz (1979)."/16 -- "Improper reference."

STATUS: Agreed

BWIP RESPONSE: The reference will be deleted.

ITEM REFERENCE: Section 11.4.1, page 11.4-10

NRC COMMENT: Equation (11-6). /16

STATUS: Agreed

BWIP RESPONSE: Equation 2.6 will be referenced.

ITEM REFERENCE: Section 11.4, page 11.4-12, paragraph 1

NRC COMMENT: "...(Fig. 11-25 and 11-26), ... ratios are low."/10 -- "What about carbonates."

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 11.4-7, paragraph 2.

TABLE III

CHAPTER 11 (WASTE PACKAGE)

ITEM REFERENCE: Section 11.1.1, page 11.1-4, paragraph 5

NRC COMMENT: "...include the THOREX wastes...metric ton of heavy metal."/16

STATUS: Agreed

BWIP RESPONSE: The paragraph consists of suppositions regarding possible waste streams. A reference will be included for clarity.

ITEM REFERENCE: Section 11.1.1, page 11.1-13, paragraph 3

NRC COMMENT: "...fins 6.4 millimeters thick (Mendel, et al., 1977)."/14 -- "Figure II-1 says 2.4 millimeters."

STATUS: Agreed

BWIP RESPONSE: Figure 11-1 will be corrected to 6.4 millimeters.

ITEM REFERENCE: Section 11.2.1, page 11.2-4, paragraph 3

NRC COMMENT: "Preliminary results of heat transfer...waste package for basalt."/5, 10, 16 -- "The groundwater may be relatively benign, but 1,000 years is a long time. Analysis demonstrating this seems necessary."

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Sections 11.3 and 11.4 of the SCP to support this statement.

ITEM REFERENCE: Section 11.2.2, page 11.2-7, paragraph 3

NRC COMMENT: "The site conditions have eliminated...period of time (Anderson, 1982)."/5 -- "This conclusion about eliminating both buffer and overpack seems premature. It is not clear that backfill will be eliminated also, but this was implied in previous statement of item."

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Sections 11.3 and 11.4 of the SCP to support this statement.

TABLE III

CHAPTER 11 (WASTE PACKAGE)

ITEM REFERENCE: Section 11.2.5, page 11.2-10, paragraph 6

NRC COMMENT: "This groundwater, pH...controlled by the geology."/4

STATUS: Agreed

BWIP RESPONSE: Additional information will be included in Section 6.4 of the SCP to support this statement.

ITEM REFERENCE: Section 11.4.1, page 11.4-16, paragraph 3

NRC COMMENT: "The reducing conditions...radiolysis of water."/4, 16

STATUS: Agreed

BWIP RESPONSE: Paragraph 2 and 3 will be reorganized to place the reference at the proper place.

ITEM REFERENCE: Section 11.4.1, page 11.4-14, paragraph 2

NRC COMMENT: "The equations for ... (Robie, et al., 1978)."/16 -- "This reference is not the correct one."

STATUS: Agreed

BWIP RESPONSE: The revised SCP text will be corrected to show that data came from correct references.

ITEM REFERENCE: Section 11.4.3, page 11.4-21, paragraph 1

NRC COMMENT: "Assuming that at elevated...100°C to 300°C."/16 -- "Boric acid dissociation could be a problem at pH's as low as 6.2 (Herm, 1977)."

STATUS: Agreed

BWIP RESPONSE: Discussion on ambient pH will be presented in Section 6.4 of the SCP. It will stress that it is the basalt rather than the dissolved constituents that controls pH.

TABLE III

CHAPTER 11 (WASTE PACKAGE)

ITEM REFERENCE: Section 11.6, page 11.6-5, paragraph 1

NRC COMMENT: "Under geologic control...varying with temperature."/4 -- "That low an Eh has not been established for the disturbed target horizon."

STATUS: Agreed

BWIP RESPONSE: The text of Section 6.4 of the SCP will be clarified to show that analysis of available data indicate the value cited.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.1, page 12.1-1, paragraph 1

NRC COMMENT: "The SCR states that preemplacement groundwater travel times near the repository must be sufficient to meet NRC criteria."/8 -- "10 CFR 60 states that travel times are evaluated from the disturbed zone to the accessible environment - wording should conform."

STATUS: Agreed

BWIP RESPONSE: The current wording of 10 CFR 60 will be used.

ITEM REFERENCE: Section 12.1, page 12.1-1, paragraph 1

NRC COMMENT: "The SCR states that travel times will be evaluated under anticipated geologic conditions and postulated disruptive conditions."/8 -- "10 CFR 60 requires analysis of preemplacement travel times."

STATUS: Agreed

BWIP RESPONSE: Analysis of preemplacement travel times will be included in the SCP.

ITEM REFERENCE: Section 12.1, page 12.1-1, paragraph 1

NRC COMMENT: "The SCR states that the current technical criteria proposed by the NRC is a minimum groundwater transit time of 1,000 years."/8 -- "10 CFR 60 states that the travel time shall be at least 1,000 years or such other travel time as may be approved or specified by the Commission."

STATUS: Agreed

BWIP RESPONSE: The current wording of 10 CFR 60 will be used.

ITEM REFERENCE: Section 12.1.1, page 12.1-2, paragraph 1

NRC COMMENT: "The SCR states that any potential release will be controlled by the engineered barriers in the underground facility and the primary geologic barrier."/8 -- "10 CFR 60 states that the release rate shall be evaluated at the border of the engineered barriers."

STATUS: Agreed

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

BWIP RESPONSE: The distinction between "release at source" and "release into accessible environment" will be clarified to avoid misunderstandings.

ITEM REFERENCE: Section 12.1.3, page 12.1-3, paragraph 4

NRC COMMENT: "The SCR states that proof of compliance with the technical criteria depends on the reliability of numerical models to predict system performance."/15 -- "The analysis will also depend on empirical studies and expert judgement."

STATUS: Agreed

BWIP RESPONSE: A clarification will be incorporated in the SCP.

ITEM REFERENCE: Section 12.1.3, page 12.1-3, paragraph 4

NRC COMMENT: "The SCR states that the modeling effort will give a reasonable expectation of compliance with the EPA draft regulations."/1 -- "Compliance with the EPA standard and 10 CFR 60 is required. Any determinations on reasonable expectations will be made by the licensing agencies."

STATUS: Agreed

BWIP RESPONSE: The statement will be modified to be more precise.

ITEM REFERENCE: Section 12.2, page 12.2-1, paragraph 1

NRC COMMENT: "The SCR states that the major stages of a long-term performance analysis are identification of release modes and prediction of consequences."/18 -- "The performance analysis will also require determination of the probability of each release scenario."

STATUS: Agreed

BWIP RESPONSE: The SCP will be clarified to include probability estimates and an assessment of residual uncertainty.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.2.1, page 12.2-1, paragraph 3

NRC COMMENT: "The SCR states that the principal applications of long-term performance analysis are twofold: to assist in the design of the engineered facility and to predict the long-term behavior of the repository system."/1 -- "The purpose of these analyses should be threefold. The third function should be to guide testing in the geologic setting."

STATUS: Agreed

BWIP RESPONSE: The SCP will reflect this additional function of performance analysis.

ITEM REFERENCE: Section 12.2.1, page 12.2-2, paragraph 2

NRC COMMENT: "The SCR states that scenarios to be evaluated must be selected on the credibility of the event and the probability of a significant release."/16 -- "The EPA standard defines the scenarios which must be considered as those having the chance of occurring once in 10,000 years."

STATUS: Agreed

BWIP RESPONSE: The scenario discussion in the SCP will be consistent with the EPA requirements.

ITEM REFERENCE: Section 12.2.1, page 12.2-4, paragraph 3

NRC COMMENT: "The SCR discusses the method for scenario selection."/3 -- "The process to assign probabilities to scenarios was not described."

STATUS: Agreed

BWIP RESPONSE: A statement describing the process will be added to address probability value assignments.

ITEM REFERENCE: Section 12.2.1, page 12.2-4, paragraph 4

NRC COMMENT: "The SCR presents a preliminary list of disruptive event scenarios."/15 -- "The list is recognized as preliminary. It is noted that the final scenario set will be determined at licensing."

STATUS: Agreed

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

BWIP RESPONSE: The NRC comment will be incorporated. NRC is emphasizing that additional scenario analysis is needed. Additional statements will be added to reaffirm this. Plans will be discussed in an expanded fashion in Chapter 12 of the SCP.

ITEM REFERENCE: Section 12.2.1, page 12.2-4, paragraph 3

NRC COMMENT: "It (the borehole intrusion scenario) appears to be a subset of the shaft seal failure scenario."/1 -- "Shaft failure is passive flow, borehole intrusion is active."

STATUS: Agreed

BWIP RESPONSE: The statement will be deleted from the SCP.

ITEM REFERENCE: Section 12.2.1, page 12.2-5, paragraph 1

NRC COMMENT: "The nature of the space and time scales virtually precludes the use of physical models for field experiments to predict long-term performance of the repository system."/4, 13 -- "Unretarded tracers may migrate rapidly enough to provide useful information."

STATUS: Agreed

BWIP RESPONSE: A specific computation will be added or the statement will be amended to indicate that the possibility of such tests will be evaluated.

ITEM REFERENCE: Section 12.2.1, page 12.2-5, paragraph 4, 5; page 12.2-7, paragraph 1

NRC COMMENT: "Systematic error in field measurements is listed as one of the major sources of uncertainty in model predictions but a technique for evaluating the associated uncertainty is not presented."/3

STATUS: Agreed

BWIP RESPONSE: A paragraph will be added to explain the technique used for evaluating parameter uncertainty.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.2.1, page 12.2-5, paragraph 2

NRC COMMENT: "The SCR divides the areas to be analyzed into the very near field, the near field, and the far field."/8 -- "The relation of these regions to the disturbed zone should be defined."

STATUS: Agreed

BWIP RESPONSE: A description will be added either in the glossary or in the text. The information will conform to the current 10 CFR 60 rule.

ITEM REFERENCE: Section 12.2.1, page 12.2-7, paragraph 1

NRC COMMENT: "Kriging techniques...will provide a pragmatic approach to developing continuous representations of hydrologic data."/10 -- "Meaningful kriging analysis requires a substantial data base. The BWIP data base may not be extensive enough to warrant use of this technique."

STATUS: Agreed

BWIP RESPONSE: The word "will" will be changed to "may."

ITEM REFERENCE: Section 12.2.1, page 12.2-5 to 7

NRC COMMENT: "The SCR states that uncertainties in interpolation and in conceptual models are comparable in importance to measurement uncertainties as sources of error in performance assessment."/14 -- "On page 13.3-72 the SCR states that data uncertainties dominant."

STATUS: Agreed

BWIP RESPONSE: A clear definition and scope of "conceptual model" is needed and will be added to Chapter 5 and Chapter 12 of the SCP.

ITEM REFERENCE: Section 12.2.1, page 12.2-7, paragraph 2

NRC COMMENT: "The SCR states that a conservative methodology is necessary to compensate for uncertainties."/14 -- "Preliminary modeling has not used a conservative approach to data selection (for example, the choices of K and O on page 12.4-13)."

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: Substantial elements of conservatism will be included. The porosity value on page 12.4-13 is in error. Further clarification on the basis for categorization will be provided.

ITEM REFERENCE: Section 12.3, page 12.3-1-4

NRC COMMENT: "The SCR states that modeling will include heat transport stress-strain, groundwater flow, and radionuclide transport. "/14 -- "Chapter 5 discusses plans for hydrochemical modeling on page 5.1-139. The relation to the transport modeling and the codes to be used is not discussed."

STATUS: Agreed

BWIP RESPONSE: A sentence will be added to address source term modeling.

ITEM REFERENCE: Section 12.3.1, page 12.3-4, paragraph 4, Bullet 2

NRC COMMENT: "Sorption of the dissolved...linear isotherm."/1, 14 -- "See Section 6.5.2.2."

STATUS: Agreed

BWIP RESPONSE: A statement will be added to Section 6.4.2.2 to indicate that constant and conservative K_d's are a reasonable alternative to precise linear isotherms.

ITEM REFERENCE: Section 12.3.1, page 12,3-4, paragraph 6

NRC COMMENT: "The SCR states that a mathematical model has been developed which describes the transport of any radionuclides in fractures porous media."/7 -- "No plans are presented for gathering data on the existence of dual porosity in basalt. No data are presented to identify the need for a dual porosity model."

STATUS: Agreed

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

BWIP RESPONSE: There are no firm plans for the use of the FECTRA model. It may be utilized to estimate the magnitude of the matrix diffusion effects. A comment will be added to note that although the code exists, its use will depend on the extent of its future need.

ITEM REFERENCE: Section 12.3.2, page 12.3-6, Table 12.2

NRC COMMENT: "The SCR presents a table of codes to be used for repository performance."/14 -- "This list of codes differs from the codes discussed in the plans on page 13.3-59, 69."

STATUS: Agreed

BWIP RESPONSE: This list presented in Chapter 12 includes a brief discussion of codes that have been used in previous studies by Rockwell or others and codes that may be used in performance assessment. The discussion in Chapter 12 will be modified to conform to the plans Chapter (16).

ITEM REFERENCE: Section 12.3.2, page 12.3-7, paragraph 3

NRC COMMENT: "The SCR states that the ANSYS computer code will be used in the analysis."/10 -- "The difficulties of benchmarking a proprietary code are not discussed."

STATUS: Agreed

BWIP RESPONSE: No firm decision has been made to use this code for performance assessment. The discussion of ANSYS will be deleted.

ITEM REFERENCE: Section 12.3.2, page 12.3-6 to 12

NRC COMMENT: "The SCR describes the various codes to be used in performance assessment."/3 -- "The section contains little information on the specific uses of the various codes."

STATUS: Agreed

BWIP RESPONSE: Some additional detail will be added to Section 12. Full detail will be added in future documents. For those which will be used to reach conclusions, full documentation is needed.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.3.2, page 12.3-13, paragraph 4

NRC COMMENT: "The SCR states that the codes can be integrated to produce a system model."/3 -- "The section contains no discussion of the type or amount of coupling planned. All modeling results are based on the use of single codes without coupling."

STATUS: Agreed

BWIP RESPONSE: Clarifying statements will be added to Section 12. Full details will be provided in future documentation. Plans for this will be addressed in the SCP. These plans will be discussed with the NRC staff as they are developed.

ITEM REFERENCE: Section 12.3.3, page 12.3-15, paragraph 1

NRC COMMENT: "The SCR states that the different codes are in various stages of verification and benchmarking."/3 -- "There is no discussion of the specific number or type of problems being used."

STATUS: Agreed

BWIP RESPONSE: A brief discussion of the scope of verification and benchmarking will be added to Chapter 12. Full status on a code-by-code basis will be provided in future documentation. Plans to accomplish this will be addressed in the SCP. These plans will be discussed with the NRC staff as they are developed.

ITEM REFERENCE: Section 12.3.3, page 12.3-15, paragraph 4

NRC COMMENT: "The SCR states that the process of demonstrating that a computer code adequately represents physical reality is termed validation."/3 -- "No other mention of validation is included in Chapter 12. The plans for validation do not show how the proposed exercises will contribute to showing the equations to be correct."

STATUS: Agreed

BWIP RESPONSE: An expanded discussion conforming to the current 10 CFR 60 rule will be added to Section 12. Full status on a code-by-code basis will be provided in future documentation. Plans to accomplish this will be addressed in the SCP. These plans will be discussed with the NRC staff as they are developed.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.1, page 12.4-1, paragraph 2

NRC COMMENT: Lines 23-26, "In spite of...exceeding 10,000 years."/3, 6, 12, 13

STATUS: Agreed

BWIP RESPONSE: The scope of our document did not provide for detailed discussions and explanations of these studies. The references may be examined for detail.

Alternative conceptual models were considered because each of the independent studies considered a different conceptual model and somewhat different properties. A discussion of alternatives will be included in the SCP.

A detailed site characterization is clearly justified.

Certain aspects may be nonconservative in the disruptive scenario analyses. The conservative factors are believed to far outweight the limited nonconservative factors in the pre-waste emplacement analyses. Additional data and further analysis is clearly needed. This topic will be discussed with the NRC staff during a future workshop.

ITEM REFERENCE: Section 12.4.1, page 12.4-3, paragraph 7

NRC COMMENT: "*(Detailed comments about early modeling efforts are not included.)*" Lines 39-40, "The total travel...to be 33,000 years."/6, 13

STATUS: Agreed

BWIP RESPONSE: Discussions of obsolete analyses will be deleted from future revisions.

Only a single alternative was considered in this particular study. The set of studies taken as a group considered several alternatives. Additional alternatives will be considered in the SCP.

Substantial conservation was incorporated into the study. Some factors (e.g., effective porosity) may be nonconservative. Clarification in the SCP will address this concern.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.1, page 12.4-3, paragraph 4

NRC COMMENT: "The vertical hydraulic conductivity of Layer 2 also included the intervening basalt layers."/13

STATUS: Agreed

BWIP RESPONSE: A discussion of this analysis will be deleted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-3, paragraphs 5 and 6

NRC COMMENT: "Model Calibration."/3

STATUS: Agreed

BWIP RESPONSE: This information was not provided to DOE or Rockwell. The subcontractor was requested to provide this information, but was unable to comply due to staff changes. Further explanation or detail is not possible. Any discussion of this obsolete study will be deleted.

ITEM REFERENCE: Section 12.4.1, page 12.4-3, paragraph 6

NRC COMMENT: "Assumed values of thickness and porosity shown in Table 12-4."/3 "Combination is nonconservative, as well as porosities."

STATUS: Agreed

BWIP RESPONSE: Any discussion of this obsolete study will be deleted.

ITEM REFERENCE: Section 12.4.1, page 12.4-5, paragraph 3

NRC COMMENT: "This composite vertical hydraulic conductivity was used in the calibration of the groundwater travel time."/3

STATUS: Agreed

BWIP RESPONSE: The discussion of this study will be deleted.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.1, page 12.4-7, paragraph 3

NRC COMMENT: "A composite vertical hydraulic conductivity was calculated using undisturbed rock properties, the aggregate cross-sectional areas of the five shafts, the vertical hydraulic conductivity of the degraded shaft material, and the area of a 4000 x 4000 m grid block (planar dimension)."/13

STATUS: Agreed

BWIP RESPONSE: See the response to NRC reference item page 12.4-5. It should be noted that the shaft and fault analyses are disruptive scenarios and not estimates of pre-waste emplacement groundwater traveltimes. The discussion of this analysis will be deleted.

ITEM REFERENCE: Section 12.4.1, page 12.4-6, paragraph 4

NRC COMMENT: Lines 31-32, "The traveltime...comparison purposes."/13

STATUS: Agreed

BWIP RESPONSE: It is not clear how nonconservative the overall analysis results are in light of the fact that a higher vertical conductivity in the actual fault or shaft areas would produce a lower head gradient. It is agreed that the approach used in these scenarios was inadequate for the reasons noted by the NRC. The discussion of the scenarios will be deleted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-7

NRC COMMENT: Line 1-bottom, "...12.4.1.1.2.2 Assumptions...to 100,000 years."/3

STATUS: Agreed

BWIP RESPONSE: This was a very preliminary analysis and was presented as such. The discussion of this study will be deleted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-7, paragraph 1

NRC COMMENT: "The initial ratios of horizontal-to-vertical hydraulic conductivities were determined for each layer by compositing the estimated conductivities of dense basalt, interflow, and interbed materials."/13

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Open

BWIP RESPONSE: The basis for the nonconservative categorization code needs clarification. In this analysis, vertical movement from the repository horizon to the Mabton Interbed was assumed (a highly conservative assumption). The normal limitations of using composite layers for traveltime calculations do not apply for that portion of the flowpath. The traveltime in the Mabton Interbed was estimated using best estimates of the horizontal hydraulic conductivity for the Mabton. No credit was taken for the vertical flowpath from the Mabton to the river. The NRC staff will provide further written clarification on this topic.

ITEM REFERENCE: Section 12.4.1, page 12.4-7, paragraph 1

NRC COMMENT: "Values of porosity assumed for traveltime calulations."/2

STATUS: Agreed

BWIP RESPONSE: The range of traveltimes is indicative of the magnitude of predictive uncertainty. This study was very preliminary and references to it will be deleted in future revisions of the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-7, paragraph 3

NRC COMMENT: "The model computed absolute heads that were larger than measured in the deep basalts underlying Hanford. This was attributed in part to the existence of some structural features that were not well defined and were, therefore, not included in the model."/6, 13

STATUS: Agreed

BWIP RESPONSE: Code 6. A discussion of alternatives will be added to the SCP. The influence of a possible hydrologic barrier to the west of the reference repository location appeared at the time to be a feature influencing the hydrologic regime in the RRL. Lack of definition of this possible feature was considered to be a major deficiency in simulating heads in the Cold Creek Syncline and the RRL areas. No reasonable amount of parameter adjustment or range of boundary conditions would account for a 500 foot head drop in less than 3 kilometers without proper accounting for a specific barrier. This aspect will be addressed in future studies.

BWIP RESPONSE: Code 13. The analysis was acknowledged to be deficient due to lack of definition of the structural features. These will be added to the SCP.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.1, page 12.4-8

NRC COMMENT: Line 1-bottom, "12.4.1.1.3 Pacific...of the Hanford Site."/3

STATUS: Agreed

BWIP RESPONSE: The objective in discussing the various far-field studies was to present a factual summary. Value judgements and criticisms of these studies were excluded from the SCR descriptions. Further details will be provided in Chapter 12 of the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-9, Table 12-5

NRC COMMENT: "Classifications of conservatism of assumptions."/3, 4

STATUS: Agreed

BWIP RESPONSE: No additional information was available in the reference.

ITEM REFERENCE: Section 12.4.1, page 12.4-13, paragraph 1, 13-18

NRC COMMENT: "The surface fluxes for the upper boundary elements lying below recharge areas were assumed to be proportional to annual rainfall."/2 -- "Pressures which the model calculates in these recharge areas should be checked to confirm that the fixed inflow rates are realistic."

STATUS: Agreed

BWIP RESPONSE: The heads calculated by the model are presented in the reference. The rainfall input was simulated in this case through the volumetric source term into the upper layer. This aspect will be further clarified in the SCP revisions of Chapter 12.

ITEM REFERENCE: Section 12.4.1, page 12.4-13, paragraph 1, Item 8

NRC COMMENT: "The SCR states that the hydraulic conductivity in the Cold Creek Syncline is representative of the Pasco Basin and that conductivities are uniform throughout each layer."/14 -- "The assumption is not consistent with the conclusions on page 5.1-20 which states that structural elements such as the Gable Mountain-Gable Butte Anticline may alter the conductivity and flow in the region."

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: The modeling analysis summarized in this section was preliminary and completed more than a year before Chapter 5 of the SCR was prepared. It is recognized that anticlines may alter rock properties. The degree of such alteration is not certain but is being addressed in current modeling studies. Information which makes assumptions which are not consistent with other portions of the SCP will be reviewed.

ITEM REFERENCE: Section 12.4.1, page 12.4-13, paragraph 1, Item 6

NRC COMMENT: "The SCR states that the hydraulic conductivity for the model layers can be represented by compositing the hydraulic conductivity of the individual layers."/13 -- "Compositing of different hydraulic character can result in increased travel times and limited vertical flow. These factors in addition to flow rate must be considered when compositing layers."

STATUS: Agreed

BWIP RESPONSE: As stated in the SCR and the technical reference, the nonconservative features of compositing hydraulic conductivity were recognized and compensated for in the analysis. The effects of compositing the effective porosity were not addressed. This may introduce some nonconservatism in the analysis. Future updates of Chapter 12 will address the effect of compositing the material properties upon effective porosity, flow path and traveltime. This particular study was not specifically designed to be conservative.

ITEM REFERENCE: Section 12.4.1, page 12.4-13, paragraph 1, Item 4

NRC COMMENT: Lines 19-21. "The horizontal...variations."/4 -- "The NRC staff notes the assumptions."

STATUS: Agreed (Open)

BWIP RESPONSE: The BWIP is unclear on why this statement was interpreted to be an assertion of fact. This topic will be discussed with the NRC staff during future workshops.

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TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

NRC COMMENT: Lines 22-23. "The hydraulic...vertical plane."/4 -- "The NRC staff notes the assumptions."

STATUS: Agreed

BWIP RESPONSE: Again, this is not an assertion of fact but a reasonable assumption. The assumption of vertical anisotropy in the dense basalts is considered very conservative (factor of 100). It was selected because of the vertical orientations of fractures in the colonnade portions of the dense basalt flows. The alternative to isotropy had been assumed, it would also have been necessary to assume an anisotropy ratio and orientation without supporting information. This topic will be discussed with the NRC staff during future workshops.

ITEM REFERENCE: Section 12.4.1, page 12.4-13, paragraph 1, Item 8

NRC COMMENT: Lines 31-33, "The hydraulic conductivity values in...as a whole."/4 -- "The NRC staff notes the assumptions."

STATUS: Agreed (Open)

BWIP RESPONSE: This statement was presented as an assumption. It is unclear as to why the NRC interpreted this to be an assertion of fact. This topic will be discussed with the NRC staff during future workshops.

. . . . . .

NRC COMMENT: Lines 38-40. "The model composite...per second."/13 -- "Noted page 12.4-14."

STATUS: Agreed

BWIP RESPONSE: As noted previously, the nonconservatism in hydraulic conductivity was compensated for in the analysis. The mild nonconservatism introduced by the compositing process on effective porosity will be addressed in the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-13, paragraph 1, Item 9

NRC COMMENT: "The SCR states that the effective porosity of the Grande Ronde Basalt assumed to be 1%."/13, 14 -- "The range of porosity values reported in the SCR (Page 4.1-46) is 10^{-2} - 10^{-4}. The value chosen in Chapter 12 is the high end of the range."

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: This is a typographical error in the SCR. The correct value is 0.1%. The original error was in the report by Arnett, et al. (1981). This will be corrected in the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-13, paragraph 2

NRC COMMENT: "The SCR states that PATH was used to calculate streamlines."/10 -- "The method for calculating the streamlines is not discussed. The method used may be a nonconservative method of calculating streamlines for fractured media."

STATUS: Agreed

BWIP RESPONSE: The PATH -3D model was used, not the PATH model. The method is discussed in additional detail in the reference. The basalt system at the far-field scale was assumed to be a continuum. Arnett, et al. should be examined for this information.

ITEM REFERENCE: Section 12.4.2, page 12.4-14, Table 12-6

NRC COMMENT: Table 12-6. /13

STATUS: Agreed

BWIP RESPONSE: The basis for the overall categorization code is not clear. The conservative and nonconservative nature of modeling analysis will be discussed in the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-15, paragraph 3

NRC COMMENT: "The SCR states that for travel time calculations a horizontal conductivity of 10^{-7} m/s is used."/ -- "The value chosen for the flow contact is not conservative. Chapter 5 (page 5.1-37-39) reports that the Umtanum flow top has a value of 10^{-5} m/sec while other Grande Ronde layers have values as high as 10^{-3} m/sec."

STATUS: Agreed (Open)

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

BWIP RESPONSE: The comment appears to suggest that extreme values of local hydraulic conductivity should be used. The mean value of hydraulic conductivity is on the order of 10^{-7} m/s. The BWIP would like clarification of the basis for using single print extreme data for travel time calculations without evidence of extensive areal correlation. Recent statistical studies of horizontal conductivities in the Grande Ronde Flow tops support a mean value of 10^{-7} m/s. This point will be addressed in some detail in the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-15, paragraph 1

NRC COMMENT: "Reasonable adjustments in the values of the boundary conditions were made to obtain a match with the head data within the model boundaries. For the Wanapum and Grande Ronde Basalts, emphasis was placed on adjusting boundary conditions to approximate the head measurements in boreholes DC-13, -14, and -15."/10 -- "Normally, material properties are adjusted."

STATUS: Open

BWIP RESPONSE: Text should correctly read DC-12, -14, and -15. In this analysis, the boundary conditions and locations of the effective boundaries for the RRL were considered to be particularly uncertain. Using the initial set of boundary conditions, even extreme ratios of hydraulic conductivity were unsatisfactory in matching heads. Unless the boundary conditions are satisfactorily known, adjusting material property values can produce misleading results. The analysis summarized in this section of the SCR emphasized that point. The modeling taskforce has agreed to the uncertainty in the boundary conditions and the need to first define boundary conditions. A discussion of boundary conditions and material properties will be added to the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-15

NRC COMMENT: "The SCR states that in the study of Arnett, et al., it was assumed that flow occurs in 1% of the Grande Ronde basalt."/16 -- "The original reference gives 0.1% for this figure."

STATUS: Agreed

BWIP RESPONSE: There are two typographical errors in the original reference. The effective porosity used should read 0.1% and the effective interval used should have read 1%. The SCR is correct in this sentence. The reference should be corrected.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.1, page 12.4-15, paragraph 2

NRC COMMENT: Lines 17-19. "The groundwater was...Wallula (Figure 12-8)."/6, 15, 13 -- "Input gradient and subsequent direction of travel are not consistent with data."

STATUS: Agreed

BWIP RESPONSE: Code 6. The purpose of the preliminary study summarized was not to evaluate a variety of alternative concepts. Taken as one of several preliminary studies several alternatives have been considered. Careful consideration of reasonable alternatives is necessary and additional studies are planned. A discussion of alternatives will be added to the SCP.

. . . . . .

NRC COMMENT: Lines 17-19. "The groundwater was...Wallula (Figure 12-8)."/6, 15, 13 -- "Input gradient and subsequent direction of travel are not consistent with data."

STATUS: Agreed

BWIP RESPONSE: Code 15. Only the data available at the time were used.

. . . . . .

NRC COMMENT: "Input gradient and subsequent direction of travel are not consistent with data."

STATUS: Agreed (Open)

BWIP RESPONSE: Code 13. A discussion of conservatism/nonconservatism will be included in the SCP. The RRL data were not available at the time of this study. Such a flow direction is consistent with the RRL data. It is not the only flow direction than can be interpreted from current data, however, and alternative conceptual models are being developed. Specific and detailed reasons for this categorization code are needed. These topics will be discussed with the NRC staff during future workshops.

. . . . . .

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

NRC COMMENT: Lines 31-32. "After reduction...than 100,000 years."/3, 13

STATUS: Agreed (Open)

BWIP RESPONSE: The intent was to present a summary in the SCR. Specific detail is available in the reference. Specific and detailed reasons for categorization codes are needed. This topic will be discussed with the NRC staff during future workshops.

ITEM REFERENCE: Section 12.4.1, Figure 12-8

NRC COMMENT: Figure 12-8. /6, 15, 13 -- "Forced gradient and subsequent direction of travel are not consistent with data (see comments Chapter 5 of SCR)."

STATUS: Agreed (Open)

BWIP RESPONSE: Code 6. The particular study being summarized did not consider alternatives. Several alternatives were considered when the set of studies summarized in Section 12.4 are examined. A discussion of alternatives will be included in the SCP.

BWIP RESPONSE: Code 15. The flow direction is consistent with data. The discussion on conceptual models will be expanded in the SCP.

BWIP RESPONSE: Code 13. Both horizontal and vertical gradients in the analysis were much higher than gradients calculated from recent head data. Specific and detailed reasons for the categorization code are needed.

ITEM REFERENCE: Section 12.4.1, page 12.4-17, paragraph 2

NRC COMMENT: Lines 5-7. "The travel time...travel distance."/13

STATUS: Agreed

BWIP RESPONSE: See the response to NCR reference item page 12.4-16, Figure 12-8.

. . . . . .

NRC COMMENT: Lines 20-14. "(1) Vertical migration...accessible environment."/11, 13 -- "Lateral flow in the Frenchman Springs or Priest Rapids is not calculted. See page 5.1-42 concerning potential yields of Wanapum Basalt."

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: RRL data was not available at the time this study was performed. Analysis of lateral flow in the Priest Rapids member was considered but insufficient data existed at the time to satisfy the statistical nature of the analysis. The problem will be addressed in the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-17, Item 2

NRC COMMENT: Lines 30-31, "The accessible environment...southeast of the repository."/11, 13

STATUS: Agreed

BWIP RESPONSE: This study will be deleted from the SCP.

ITEM REFERENCE: Section 12.4.1

NRC COMMENT: "A study to assess...borehole needs."/12, 16 -- "The document which presents this work is not referenced."

STATUS: Agreed

BWIP RESPONSE: Code 2. The performance assessments aspects of the study are summarized in the SCR.

BWIP RESPONSE: Code 16. This is an obsolete study that was not primarily designed to provide a performance assessment. References to this study will be deleted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-17, paragraph 5, Item 2

NRC COMMENT: "The accessible environment was the Columbia River at Wallula Gap, 60 km southeast of the repository."/8 -- "Accessible environment is presently taken to the 10 km from the repository."

STATUS: Agreed

BWIP RESPONSE: The definition of accessible environment as found in 10 CFR 60 will be used in the SCP.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.1, page 12.4-17, paragraph 5, Item 2

NRC COMMENT: "The SCR states that the path length used for the TASC analysis was vertically to the Mabton interbed and then 60 km southeast to Wallula Gap."/14 -- "The data in Chapter 5 (page 4.1-54) show the Mabton flow traveling along shorter paths and discharging either near Gable Mountain or along a more northern portion of the Columbia River.

STATUS: Agreed

BWIP RESPONSE: Any reference to the TASC analysis will be omitted from Chapter 12 of the SCP.

ITEM REFERENCE: Section 14.4.1, page 12.4-18, paragraph 3

NRC COMMENT: Lines 43-bottom, "In all cases, but...minimum requirement."/13

STATUS: Agreed

BWIP RESPONSE: Any references to the TASC analysis will be omitted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-20, Table 12-8

NRC COMMENT: Table 12-8. /11, 13 -- "Lateral flow in the Frenchman Springs or Priest Rapids is not calculated. See page 5.1-42 concerning potential yields of Wanapum Basalt. Effective porosities are too high."

STATUS: Agreed

BWIP RESPONSE: Any references to the TASC analysis will be omitted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-20, Tables 12-7 and 12-8

NRC COMMENT: "Data presented in Tables 12-7 and 12-8."/7, 13 -- "Supporting data for the assumed values of gradient and effective porosity are not given. Values are nonconservative when compared with data presented in Chapter 5, but this is not noted in the text."

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: Effective porosities may be nonconservative relative to the current single point estimate. However, the assumed values are consistent with values in technical literature. References to the TASC report will be omitted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 1.4-21, Table 12-10

NRC COMMENT: "The SCR presents Table 10 with groundwater flow rates."/14 -- "The flow given in Table 12.10 is not equal to the product of the cross-section, hydraulic conductivity, and the hydraulic gradient given in Table 12.8."

STATUS: Agreed

BWIP RESPONSE: Any references to the TASC study will be omitted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-21, Table 12-9

NRC COMMENT: Table 12-9. /5, 7, 13 -- "See previous comment. Vertical hydraulic conductivity is not conservative and not measured."

STATUS: Agreed

BWIP RESPONSE: Code 5. No conclusion is presented in the table.

BWIP RESPONSE: Code 7. References to the TASC study will be omitted from the SCP.

BWIP RESPONSE: Code 13. Effective porosities may be nonconservative, otherwise it is not clear that the values (especially the head gradients) are nonconservative.

ITEM REFERENCE: Section 12.4.1, page 12.4-22, Tables 12-10, -11, and -12

NRC COMMENT: Tables 12-10, 12-11, 12-12. /13

STATUS: Agreed

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

BWIP RESPONSE: This obsolete study will be deleted from the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-23, Table 12-13

NRC COMMENT: Table 12-13. /7, 13 -- "Additional data needs are outlined in previous paragraph." "There is a thread running through these last few pages that lead to some pretty strong conclusions about the groundwater travel times. The assumptions have a way of disappearing."

STATUS: Agreed

BWIP RESPONSE: The limitations and qualifications of the analyses will be stressed in the conclusionary section of the SCP.

ITEM REFERENCE: Section 12.4.1, page 12.4-24, paragraph 2

NRC COMMENT: Lines 6-10. "Even with the...to the accessible environment."/12,13

STATUS: Agreed

BWIP RESPONSE: It is acknowledged that uncertainties exist and compliance with the NRC subsystems criteria is not demonstrated sufficiently for licensing purposes at this time. This last statement will be added to Chapter 12 of the SCP.

. . . . . .

NRC COMMENT: Lines 13-17. "Although a PATH 3D...as the repository horizon."/4

STATUS: Agreed

BWIP RESPONSE: Some support is offered but not at the same level as for the Umtanum flow. Groundwater travel times for the Cohassett (formerly middle Sentinel bluffs) flow will be included in the SCP.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.2, page 12.4-25, paragraph 1, Item 3

NRC COMMENT: Lines 6-7. "An effective porosity...for the basalt."/4, 13

STATUS: Agreed (Open)

BWIP RESPONSE: Code 4. Clarification is needed as to why NRC believes this to be an assertion of fact.

. . . . . .

NRC COMMENT: Lines 6-7. "An effective porosity...for the basalt."/4, 13

STATUS: Agreed

BWIP RESPONSE: Code 13. This was a preliminary analysis. Appropriate explanations of limitations and nonconservative features will be explained in future updates or the summary of this analysis will be eliminated from the SCP.

ITEM REFERENCE: Section 12.4.2, page 12.4-25, paragraph 1, Item 8

NRC COMMENT: "The SCR states that minimal radionuclide retardation was assumed."/7 -- "The K_d values used are not specified. The reader is referred to another section, but the modeling conditions are not explicity stated in that area."

STATUS: Agreed

BWIP RESPONSE: Supporting data will be added or the analysis will be replaced by a more up to date analysis with supporting data.

ITEM REFERENCE: Section 12.4.2, page 12.4-25, paragraph 2

NRC COMMENT: "Study of the disruptive phenomenon."/ -- "The difference in Case I and Case II is less than a 20 percent of interstitial velocity."

STATUS: Agreed

BWIP RESPONSE: This obsolete study is being deleted from the SCP.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.2, page 12.4-28, paragraph 3

NRC COMMENT: "Additional geochemical data...Solubility-limited conditions."/14, 21 -- "See ES page 7 last sentence and 6.4-3 last sentence."

STATUS: Agreed

BWIP RESPONSE: This will be rewritten for the SCP on the basis of the data presented in the section on Radionuclide Solubilities (6.5.2) of the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-29, paragraph 3

NRC COMMENT: "In Section 12.4.3 the SCR contains a description of the 2D modeling with water flow and thermal effects."/10 -- "No justification is given for using a two-dimensional analysis. This contradicts the statement on page 12.4-12 that two-dimensional analysis was basically an instructional exercise and is considered nonconservative."

STATUS: Agreed

BWIP RESPONSE: Justification of 2-D analysis will be added to the SCP. The 2-D mentioned on 12.4.12 was a far-field analysis much larger in scale and lacking in detail. It was conducted prior to 3-D analysis. Near-field 2-D analysis are not limited in the same fashion.

ITEM REFERENCE: Section 12.4.3, page 12.4-30, paragraph 4

NRC COMMENT: Lines 27-29, "The stratigraphic section...conceptual model."/4

STATUS: Agreed

BWIP RESPONSE: This statement will be rewritten to clarify the assumptions made in using this stratigraphic section.

ITEM REFERENCE: Section 12.4.3, page 12.4-30, paragraph 2

NRC COMMENT: "The SCR states that consequences of shaft seal failure are bounded by fault scenario."/4 -- "Since the modeling reported evaluates faults outside the immediate repository area, shaft seal failure is not considered with these analysis."

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: This statement will be rewritten. Consequence analysis of shaft seal failure and faulting will not be included in the first issue of the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-33, paragraph 2

NRC COMMENT: Lines 7-13, "(1) Within the model...regional groundwater flow."/4, 7, 15 -- "Geologic assumptions cannot be tied explicity to hydrogeologic conditions."

STATUS: Agreed

BWIP RESPONSE: The statement in the SCR will be reworded to clearly reflect that it is an assumption and not an assertion of fact. Additional clarification and a discussion of conservative/nonconservative features will be included in the SCP. This topic will be discussed with the NRC staff during future workshops.

ITEM REFERENCE: Section 12.4.3, page 12.4-34, paragraph 4

NRC COMMENT: "The SCR states that for the 2-D modeling an anisotrophy ratio of 10 is used."/14 -- "This is not consistent with Arnet et. at., 1980, which uses an anisotrophy ratio of 100 (page 12.4-14.)."

STATUS: Agreed

BWIP RESPONSE: There is an inconsistency between analyses performed at different times and these changes were not adequately discussed in the SCR. A ratio of 10 is considered to be reasonably conservative whereas ratio of 100 is very conservative. A more complete discussion of anistropy will be included in the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-33, paragraph 5

NRC COMMENT: Lines 27-39, "The representative or...5 x 10^{-14} meter per second."/3, 13

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: This section will be expanded to incorporate a statistical description of data and a probabilistic analysis.

ITEM REFERENCE: Section 12.4.3, page 12.4-34, paragraph 5

NRC COMMENT: "The vertical head profile measured at Borehole RRL-2 is representative across the model study area."/3, 10 "Discussion of the method for enforcing this condition is required."

STATUS: Agreed

BWIP RESPONSE: The basis for vertical head profiles used in the modeling will be presented in the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-34, paragraph 1

NRC COMMENT: Lines 3-7, "(1) the hydraulic conductivity...10-10 meter per second."/4, 13 Lines 22-25, "12.4.3.2.2.2 Hydraulic Heads...same range."/4 "Correct flow direction is not demonstrated at this time. See comments page 5.1-63."

STATUS: Agreed

BWIP RESPONSE: An expanded discussion of groundwater flow direction and hydraulic heads will be included in the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-35, paragraph 1

NRC COMMENT: Lines 4-8. "The specific storage...compressibility data."/3, 7

STATUS: Agreed

BWIP RESPONSE: The basis for the specific storage coefficients used will be expanded in the SCP.

. . . . . .

NRC COMMENT: Lines 11-14. "The effective porosities... et al., (1982)."/4, 11, 13 -- "Data used are not consistent with page 3.5-33 or page 5.1-46."

STATUS: Open

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

BWIP RESPONSE: This will be rewritten to use updated information. The effective porosity was an assumption made prior to the availability of field data referenced on SCR pages 3.5-33 and 5.1-46, and therefore selection of value could not have been purposely biased at the time of the analysis. A discussion of data selection and conservative/nonconservative assumptions and features will be added to the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-35, paragraph 1

NRC COMMENT: "Values of specific storage."/3 -- "Must be associated with a unit of measure."

STATUS: Agreed

BWIP RESPONSE: The units of measure will be given in the SCP.

. . . . . .

NRC COMMENT: "These values are believed to be representative of, if not smaller than, the values expected for the Columbia River Basalt Group: See Chapter 5, especially Section 5.2.1.2."/11 -- "The values in Section 5.2.1.2 appear to come from Table 5-49 and are erroneously referred to as effective porosity. These are values of total porosity."

STATUS: Open

BWIP RESPONSE: Clarification of effective porosity estimates will be discussed with the NRC.

ITEM REFERENCE: Section 12.4.3, page 12.4-35, paragraph 2

NRC COMMENT: "The SCR states that the 2-D model uses an effective porosity value of .001."/14 -- "This is not consistent with Arnett et al., which uses a value of .01 (page 12.4-13)."

STATUS: Agreed

BWIP RESPONSE: The SCR is correct. Arnett et al., contains typographical errors. The effective porosity should have read 0.001 and the effective interval should have been 0.01.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.3, page 12.4-35, paragraph 3

NRC COMMENT: "12.4.3.2.2.5 (all)."/14 -- "C sorption coefficient is indeed 0 but it not given in Chapter 6 as stated."

STATUS: Agreed

BWIP RESPONSE: The sorption coefficient of carbon will be addressed in Chapter 6 of the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-36, paragraph 4

NRC COMMENT: "One intuitively expects, however, that after tens of thousands of years..."/4 -- "Some people may intuitively expect this to occur in a matter of 1 to 10 years."

STATUS: Agreed

BWIP RESPONSE: The current design target for the waste package will provide a minimum of 1,000 years containment. The text will be revised according to this hypothesis.

ITEM REFERENCE: Section 12.4.3, page 12.4-36, paragraph 5

NRC COMMENT: "all canisters fail simultaneous after 10,000 years."/8 -- "This appears to be a typographic error, but perhaps is noted for completeness as it is a critical value."

STATUS: Agreed

BWIP RESPONSE: The typographic error on the last line is corrected to read 1,000.

ITEM REFERENCE: Section 12.4.3, page 12.4-37, paragraph 1

NRC COMMENT: "Assumption of constant fractional release rate of 10^{-5} per year."/-- "Achievement of this release rate must be verified."

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: Plans for verification of the fractional release rate are included in Chapter 15.

ITEM REFERENCE: Section 12.4.3, page 12.4-37, paragraph 4

NRC COMMENT: Lines 31-21, "The maximum and minimum...years, respectively."/6, 11, 13

STATUS: Agreed

BWIP RESPONSE: The sentence will be changed to say that for selected parameters, compliance is achieved.

ITEM REFERENCE: Section 12.4.3, page 12.4-38, 39, Figure 12-13 and 12-14

NRC COMMENT: Figures 12-13 and 12-14. /6, 11, 13

STATUS: Agreed

BWIP RESPONSE: The basis for the analysis will be clarified by adding a sentence or two at the front of Section 12.4.3 of the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-40, paragraph 2

NRC COMMENT: "The SCR states that the 2-D model results show that the traveltimes are sufficiently long to ensure compliance with the EPA standard."/12 -- "Given the preliminary nature of the analysis, the uncertainty associated with the data choice and the limited scope of the analysis, this conclusion is not justified."

STATUS: Agreed

BWIP RESPONSE: The reference conditions utilized in the analysis will be qualified to indicate the preliminary nature of the analysis. The results will also be qualified appropriately.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.3, page 12.4-40, paragraph 2

NRC COMMENT: Lines 11-13, "The groundwater...to 37,000 years."/6, 1, 13

STATUS: Agreed

BWIP RESPONSE: The statement will be modified to clarify the preliminary nature of the analysis. The results will also be appropriately qualified. The BWIP needs clarification on why this is an incorrect statement.

ITEM REFERENCE: Section 12.4.3, page 12.4-41, Figure 12-15

NRC COMMENT: Figure 12-15. /6, 11, 13

STATUS: Agreed

BWIP RESPONSE: The statement referring to Figure 12-15 will be modified to clarify the basis for this analysis.

ITEM REFERENCE: Section 12.4.3, page 12.4-42, paragraph 2

NRC COMMENT: Lines 9-11. "At 10,000 years...the downstream end."/6, 11, 13

STATUS: Agreed

BWIP RESPONSE: Proper qualification of such analyses will be added in the SCP.

. . . . . .

NRC COMMENT: Lines 43-bottom. "(1) A fault develops...the repository."/6 -- "Why not closer? or worse?"

STATUS: Agreed

BWIP RESPONSE: The fault analysis scenario will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses

are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-42, paragraph 5

NRC COMMENT: "The SCR states that the hydraulic conductivity chosen for the fault zone is 10^{-7} m/s."/6 -- "Choice of this value needs to be justified since it will have a direct impact on results."

STATUS: Agreed

BWIP RESPONSE: The fault analysis scenario will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-42, paragraph 6

NRC COMMENT: "The SCR states that the fault analyzed is located 0.8 km from the repository."/6 -- "on page 12.4-42 the report also stresses the importance of fault location but conclusions are based on only one fault location."

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.3, page 12.4-42, paragraph 4

NRC COMMENT: "The SCR states that the calculations of mass flux were relatively insensitive to layer thickness."/13, 14 -- "On page 12.4-37 the SCR states that the thickness of the flow top controls the direction of water and radionuclide movement. The lack of response into mass flux calculated cannot be used as a justification for thickness choice."

STATUS: Open (Agreed)

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-43, Figure 12-16

NRC COMMENT: Figure 12-16. /6, 11, 13

STATUS: Open (Agreed)

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-44, paragraph 1

NRC COMMENT: Lines 1-2, "(2) The fault creates...Vantage interbed."/6 -- "Not physically reasonable: why would a fault stop at the Vantage?"

STATUS: Agreed

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-44, paragraph 3

NRC COMMENT: Lines 5-7, "(4) The properties of...porosity of 10^{-3}."/6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-45, paragraph 3

NRC COMMENT: Lines 9-11. "12.4.3.4.2.1 Repository in...of the fault."/6

Lines 19-21. "The traveltimes...to 41,000 years."/6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses

are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-45, paragraph 5

NRC COMMENT: Lines 38-43, "The existence of...30,000 to 36,000 years."/6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-46, Figure 12-18

NRC COMMENT: Figure 12-18./6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.3, page 12.4-47, paragraph 4

NRC COMMENT: "The SCR states that the fault is not effective in transferring significant amounts of radionuclides upward in the basalt sequence."/3 -- "More information is needed to evaluate this conclusion. The information should be presented in terms of changes in traveltimes and mass flux."

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-47, paragraph 4

NRC COMMENT: "The SCR states some preliminary analyses have been conducted for a fault passing directly through the repository."/3 -- "No discussion of the analysis is given."

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-47, paragraph 4

NRC COMMENT: "The SCR states that a 20-meter fault zone would be discovered during excavation of the repository."/4 -- "The argument does not seem appropriate since the analysis is directed at post-closure scenarios."

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-47, paragraph 2

NRC COMMENT: Lines 15-17, "As in the base...through 10,000 years."/6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, paragraph 3

NRC COMMENT: Lines 25-27, "As in the case of ...after 10,000 years."/6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, paragraph 4

NRC COMMENT: Lines 38-40, "Even under such...the basalt sequence."/4, 6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, Page 12.4-48, Figure 12-19

NRC COMMENT: Figure 12-19. /6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-49, Figure 12-20

NRC COMMENT: Figure 12-20. /6

STATUS: Agreed

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-50, paragraph 2

NRC COMMENT: Lines 9-18, "First if one compares...in excess of 10,000 years." Lines 22-29, "Third in view of the fact...capability of the system." Lines 30-35, "The analysis results...of the site selected." Lines 33-35, "The fact that the...the site selected."/All 6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-50, paragraph 3

NRC COMMENT: "Second a comparison of the minimum groundwater travel times to the reference boundary, 10 km from the repository, lead to a similar conclusion."/6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific

properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-50, paragraph 4

NRC COMMENT: "The release scenarios are of a bounding nature."/1, 4, 13

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-50

NRC COMMENT: "The repository system does not appear to hinge on a single hydrogeologic factor or condition."/6

STATUS: Agreed

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

ITEM REFERENCE: Section 12.4.4, page 12.4-51, paragraph 1

NRC COMMENT: "The SCR states that the pre-emplacement groundwater travel times calculated to date significantly exceed the NRC 1,000-year travel-time."/12, 13 -- "The results of these studies are frequently based on nonconservative assumptions and data choices (see other comments)."

STATUS: Open

BWIP RESPONSE: BWIP agrees that the degree of conservatism has not been adequately demonstrated. This topic will be discussed with the NRC during future workshops.

ITEM REFERENCE: Section 12.4.4, page 12.4-51, paragraph 2

NRC COMMENT: "Simulation studies...geochemical environment of the basalt."/5, 6, 11, 13 -- "The modeling assumes a benign geochemical environment and the results of the modeling do no more than reflect the assumptions."

STATUS: Agreed

BWIP RESPONSE: Additional information and proper qualification of the geochemical environment of the basalt will be added to the SCP.

ITEM REFERENCE: Section 12.4.4, page 12.4-51, paragraph 2

NRC COMMENT: "In particular,...key radionuclides."/5, 11, 13 -- "The primary conclusions...

- Solubility of radionuclides...plutonium
- High sorptive properties of basalt...americium."/5, 11, 12, 13 --

"Again the input assumptions used for modeling have become the (output) conclusions."

STATUS: Agreed

BWIP RESPONSE: Additional information and proper qualification of the very Near-Field Modeling Studies will be added to the SCP.

ITEM REFERENCE: Section 12.4.4, page 12.4-51, paragraph 3

NRC COMMENT: "There is no incentive...capability."/5, 6, 12, 13

TABLE III

CHAPTER 12 (PERFORMANCE ASSESSMENT)

STATUS: Agreed

BWIP RESPONSE: This conclusion, regarding a complex waste package, will be deleted from the SCP.

ITEM REFERENCE: Section 12.4.5, page 12.4-53, paragraph 4

NRC COMMENT: "Compliance with the NRC-proposed technical criterion (NRC, 1981) of a 1-part-in-100,000-per-year maximum fraction release rate would be achieved with considerable margin for many radionuclides."/5, 11, 12 -- "This conclusion applied only to the studies presented in the SCR. Uncertain analyses are not presented."

STATUS: Agreed

BWIP RESPONSE: Alternative scenarios will be discussed in the SCP.

ITEM REFERENCE: Section 13.3, page 13.3-7, W.E. S.1.10.A

NRC COMMENT: Work Element S.1.10.A; "Mandatory measurement condition."/3

STATUS: Agreed

BWIP RESPONSE: Borehole Drilling and Test Plan will describe in detail the testing to determine the pressure and characteristics of other possible anomalies that could serve as zones of greater permeability

---

ITEM REFERENCE: Section 13.3, page 13.3-7, W.E. S.1.10.A

NRC COMMENT: Work Element S.1.10.A; "Status achieved (references)," lines 5-7./5

STATUS: Agreed

BWIP RESPONSE: This sentence will be deleted in the SCP.

TABLE III

CHAPTER 13 (SITE ISSUES)

ITEM REFERENCE: Section 13.3, page 13.3-9, W.E. S.1.1.A

NRC COMMENT: Under Plans, the SCR states that "lateral variations in basalt flow outcrop north of Vantage will provide a basis for predicting typical short-range thickness variations that could occur in Grande Ronde basalt flow, including the candidate repository horizons."/9, 10, 18 -- "The Vantage outcrops will not provide a basis for predicting typical short-range thickness variations in intra-flow structure."

STATUS: Agreed

BWIP RESPONSE: This statement will be modified. The SCP description will be expanded to include additional work to better define lateral variations.

ITEM REFERENCE: Section 13.3, page 13.3-10, W.E. S.1.4.A

NRC COMMENT: Under Status, the SCR states that "variations of intra-flow structures of the Umtanum flow within the Pasco Basin are known."/4, 12 -- "There is a great variation in thickness of intra-flow structures within the Pasco Basin; see SCA Chapter 4."

STATUS: Agreed

BWIP RESPONSE: The phrase, "and variations of these features across the Pasco Basin are known" will be deleted. An explanation of the data base will be added along with a description of the uncertainties involved. The Plans Section will include a description of how additional data will be obtained.

ITEM REFERENCE: Section 13.3, page 13.3-11, W.E. S.1.5.A

NRC COMMENT: "Data on relative orientation and distribution of fractures have been collected from Umtanum flow core samples from existing borehole."/-- "Determination of the orientation and distribution of fractures from vertical borings without oriented core is not feasible."

STATUS: Agreed

BWIP RESPONSE: The limits of this technique to define the fractures will be explained. Plans include both drilling deviated boreholes within the RRL and obtaining oriented core from the boreholes.

TABLE III

CHAPTER 13 (SITE ISSUES)

ITEM REFERENCE: Section 13.3, page 13.3-12, W.E. S.1.5.A

NRC COMMENT: Under plans, the SCR states that "fracture characteristics in the candidate flow will be predicted using core and outcrop exposure of the candidate flow."/9, 10,15, 18 -- "Because of predominately vertical fracturing, core will not be representative. Outcrop data from surface exposures at a distance are probably not representative. The use of petrography to predict likely fracture characteristics is unproved."

STATUS: Agreed

BWIP RESPONSE: This statement will be modified and the description of the method of determining fracture orientation will be expanded. Plans include both drilling deviated boreholes within the RRL and obtaining oriented core from the boreholes.

ITEM REFERENCE: Section 13.3, page 13.3-14, W.E. S.1.7.A

NRC COMMENT: Under Plans, the SCR states that "DC-16A will be drilled to 1,675 meters so as to meet 10 CFR 60 (NRC, 1981) proposed criteria for geologic characterization to 500 meters below the repository level."/8 -- "This refers to an obsolete version of proposed 10 CFR 60."

STATUS: Agreed

BWIP RESPONSE: The reference to 10 CFR 60 will be deleted and actual hole depth will be specified.

ITEM REFERENCE: Section 13.3, page 13.3-6, W.E. S.1.9.A

NRC COMMENT: Under Status, the SCR states that "pillow zones and flow tops are known from boreholes and that general distributions can be interpreted from this data."/18 -- "The spacing of data points is too broad for resolution."

STATUS: Open

BWIP RESPONSE: The statement will be modified and plans to collect more data on pillow zones and flow tops will be described. BWIP would like clarification from the NRC on what spacing of data points would be adequate for resolution.

TABLE III

CHAPTER 13 (SITE ISSUES)

ITEM REFERENCE: Section 13.3, page 13.3-16, W.E. S.1.10.A

NRC COMMENT: Under Status, the SCR states that "features in the vicinity of the candidate flow such as localized increase of flow top thickness and anomalous fractures or fissures will be 'revealed' by the cluster hydrologic test at DC-16A, B, and C. It is inferred that this is true for the RRL."/1, 12, 18 -- "The DC-16A, B, and C test will test only the radius of the test pattern. The RRL will not be tested."

STATUS: Agreed

BWIP RESPONSE: The status and plans sections will be written to include expanded plans noted under item 13.3-17. Reference to new test plans will be made.

ITEM REFERENCE: Section 13.3, page 13.3-17, W.E. S.1.10.A

NRC COMMENT: "Plans."/3.

STATUS: Agreed

BWIP RESPONSE: This section will be expanded to include more detailed information, referencing Expanded Borehole Drilling and Testing Plan, and the ES Test Plan.

ITEM REFERENCE: Section 13.3, page 13.3-17, W.E. S.1.10.A

NRC COMMENT: Under Plans, the SCR states that "anomalous flow top thickness and anomalous fractures or fissures, as well as some other structural features, are small scale and only significant in the near-field."/4, 6, 7 -- "There is no data to support this statement."

STATUS: Agreed

BWIP RESPONSE: This section will be modified to include more detailed information on the significance of these structures in the near-field and reference expanded plans to obtain more data.

TABLE III

CHAPTER 13 (SITE ISSUES)

ITEM REFERENCE: Section 13.3, page 13.3-26, W.E. S.1.12.B

NRC COMMENT: Under Status, the SCR states that "few tectonic fractures have been found in the thousands of meters drilled within the Pasco Basin synclines."/-- The word "few" is not defined. DOE has stated that "fractures of tectonic origin have been found in every core hole penetrating the Wanapum and Grande Ronde."

STATUS: Agreed

BWIP RESPONSE: This sentence will be re-written to more accurately define the data base. Expanded reference plans will also be included in the SCP.

ITEM REFERENCE: Section 13.3, page 13.3-26, W.E. S.1.12.B

NRC COMMENT: Under Status, the SCR states that "faults of major displacement are not anticipated in shallow-dipping synclinal strata."/12, 15 -- "There is insufficient data to support this statement."

STATUS: Agreed

BWIP RESPONSE: This sentence will be re-written to define the data base. Expanded reference plans will also be included in the SCP.

ITEM REFERENCE: Sec. 13.3, page 13.3-26, W.E. S.1.12.B

NRC COMMENT: Under Plans, the SCR states that "emphasis of additional work ... potential influence on groundwater traveltime can be more fully assessed."/18

STATUS: Agreed

BWIP RESPONSE: This section will be expanded to include information from the revised Borehole Drilling and Testing Plans and Exploratory Shaft Test Plan.

ITEM REFERENCE: Section 13.3, page 13.3-28, W.E. S.1.12.B

NRC COMMENT: Under Plans, the SCR states that "nature of doubly plunging folds...associated with Gable Mountain and Gable Butte."/18

TABLE III

CHAPTER 13 (SITE ISSUES)

STATUS: Agreed

BWIP RESPONSE: This section will be expanded to describe how data on folds will be obtained and evaluated. Status and Plans will be modified to include expanded plans.

ITEM REFERENCE: Section 13.3, page 13.3-28, W.E. S.1.12.B

NRC COMMENT: Under Plans, the SCR states that "to calculate and verify the strike and dip of candidate repository horizons ... borehole RRL-2 was drilled."/7, 9 -- "What method was used to orient core from RRL-2?"

STATUS: Agreed

BWIP RESPONSE: This sentence will be modified to more clearly describe how correlation of strata between boreholes serves to define the general dip and strike on the candidate repository horizon.

ITEM REFERENCE: Section 13.3, page 13.3-32, W.E. S.1.15.B

NRC COMMENT: Under Plans, the SCR states that "further work will be focused on assessing deformation ... or has occurred in periodic pulses."/10 -- "From the discussion, it is unclear how this will be accomplished."

STATUS: Agreed

BWIP RESPONSE: A more detailed discussion of the methods and approach used to assure deformation rates will be added to this work element.

ITEM REFERENCE: Section 13.3, page 13.3-34, W.E. S.1.16.B

NRC COMMENT: Under Status, the SCR states that "earthquakes (swarms) are not known to be associated with mapped geologic structures."/--"Even though the structures are not mapped, the swarms, and they are found within 10 km of the RRL, must occur on faults."

STATUS: Agreed

TABLE III

CHAPTER 13 (SITE ISSUES)

BWIP RESPONSE: A clarifying statement will be added to work element S.1.16.B describing the relationship between earthquake swarms and geologic structures, both mapped and unmapped.

ITEM REFERENCE: Section 13.3, page 13.3-39, W.E. S.1.24.C

NRC COMMENT: "Mandatory measurement conditions;" Work Element S.1.24.C./9, 10 -- "Lack of detail; i.e., test intervals, duration of test, etc."

STATUS: Agreed

BWIP RESPONSE: More detailed information on hydraulic properties will be incorporated in work element S.1.24.C and the relevant test plans will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-39, W.E. S.1.25.C

NRC COMMENT: "Mandatory measurement conditions;" Work Element S.1.25.C./ "Lack of detail, especially concerning time varient measurements; i.e., duration, zones monitored, isolation procedure, etc."

STATUS: Agreed

BWIP RESPONSE: Detailed information on hydraulic heads will be incorporated in work element S.1.25.C and the relevant test plans will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-40, W.E. S.1.26.C

NRC COMMENT: "Mandatory measurement conditions;" Work Element S.1.26.C./9, 10 -- "Will the same test and quality assurance procedures be followed? Will data be manipulated in any new ways to determine groupings?"

STATUS: Agreed

BWIP RESPONSE: The same test and quality assurance procedure will be followed for each test interval. Evaluation and interpretation of the data will factor in new analysis techniques.

TABLE III

CHAPTER 13 (SITE ISSUES)

ITEM REFERENCE: Section 13.3, page 13.3-41, W.E. S.1.28.C

NRC COMMENT: "Mandatory measurement conditions;" Work Element S.1.28.C./9, 10 -- "Note reference to earlier Work Elements."

STATUS: Agreed

BWIP RESPONSE: The information on vertical groundwater movement will be incorporated in work element S.1.28.C and the relevant test plans will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-42, W.E. S.1.29.C

NRC COMMENT: Work Element S.1.29.C; "Mandatory measurement condition."/9, 10 -- "Note reference to earlier Work Elements."

STATUS: Agreed

BWIP RESPONSE: Detailed information on flow paths and solute travel times will be incorporated in work element S.1.29.C and the relevant test plans will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-41, W.E. S.1.27.C

NRC COMMENT: "Information needs (data and analysis)" and "Mandatory measurement conditions;" Work Element S.1.27.C./8, 9, 10 -- "Note references to earlier Work Elements."

STATUS: Agreed

BWIP RESPONSE: Detailed information on the confined flow systems will be incorporated in work element S.1.27.C and the relevant test plans will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-42, W.E. S.1.30.C

NRC COMMENT: Work Element S.1.30.C; "Mandatory measurement conditions."/6, 11 -- "Other conceptual models can fit current data."

TABLE III

CHAPTER 13 (SITE ISSUES)

STATUS: Agreed

BWIP RESPONSE: The development of a conceptual model and the data needs will reflect a consensus opinion of the Modeling Task Force. This information will be incorporated in work element S.1.30.C and the relevant test plans will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-43, W.E. S.1.31.C

NRC COMMENT: Work Element S.1.31.C; "Information needs (data and analysis)."/7 -- "Documentation of all codes is needed."

STATUS: Agreed

BWIP RESPONSE: The statement of status will be expanded to show the documentation status of all codes.

ITEM REFERENCE: Section 13.3, page 13.3-44, W.E. S.1.33.C

NRC COMMENT: Work Element S.1.33.C; "Status achieved (references)."/4, 11, 13, 12, 15

STATUS: Agreed

BWIP RESPONSE: Status in S.1.33.C will be revised to reflect the bounds of uncertainty in model predictions of pre-waste-emplacement groundwater travel times.

ITEM REFERENCE: Section 13.3, page 13.3-44, W.E. S.1.32.C

NRC COMMENT: Work Element S.1.32.C; refers to Work Element S.1.41.D, 13.3-62, 72-74./9, 10 -- "Nothing is noted in 'Status' or 'Plans' in S.1.41.D."

STATUS: Agreed

BWIP RESPONSE: The required descriptive material will be prepared explaining how evaluation of hydrologic changes will be made.

TABLE III

CHAPTER 13 (SITE ISSUES)

ITEM REFERENCE: Section 13.3, page 13.3-44, W.E. S.1.34.C

NRC COMMENT: Work Element S.1.34.C; "Status achieved (reference)," lines 1 and 2, "Preliminary conceptual...available ..."/6

STATUS: Agreed

BWIP RESPONSE: This statement will be modified to reflect changes in Chapter 5, Section 5.1.10, regarding alternate conceptual models.

ITEM REFERENCE: Section 13.3, page 13.3-45, 13.3-46, 13.3-47

NRC COMMENT: "Plans;" Work Element S.1.24.C./9, 10

STATUS: Agreed

BWIP RESPONSE: More detailed information on testing and analyses will be included in work element S.1.24.C and the relevant test plans referenced.

ITEM REFERENCE: Section 13.3, page 13.3-48, 13.3-49, W.E. S.1.25.C

NRC COMMENT: Test Plans; Work Element S.1.25.C, lines 26-29, "It is recognized in new holes. Nevertheless, there data ... assessment."/9, 10 -- "Lack of detail."

STATUS: Agreed

BWIP RESPONSE: More detailed information on the methods of determining and analyzing hydraulic heads will be incorporated in work element S.1.25.C and the relevant test plan will be referenced.

ITEM REFERENCE: Section 13.3, page 13.33-50, 13.3-51, W.E. S.1.26.C

NRC COMMENT: "Plans;" Work Element S.1.26.C./9, 10 -- "How will samples from existing boreholes be sampled to minimize mixing."

STATUS: Agreed

TABLE III

CHAPTER 13 (SITE ISSUES)

BWIP RESPONSE: More detailed information on the methods of determining and analyzing the hydrochemistry will be incorporated in work element S.1.26.C and the relevant test plan will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-51, 13.3-52, W. E. S.1.27.C

NRC COMMENT: "Status" - first paragraph; Work Element S.1.27.C./4, 5, 6 "Plans" - Work Element S. 1.27.C./9, 10

STATUS: Agreed

BWIP RESPONSE: More detailed information on the methods of testing and analysis to determine the groundwater flow system will be incorporated in work element S.1.27.C and the relevant test plan will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-52, W.E. S.1.28.C

NRC COMMENT: "Status" - second paragraph; Work Element S.1.28.C./4 "Plans" - first paragraph; Work Element S.1.28.C./9, 10 -- "Note reference to earlier Work Elements."

STATUS: Agreed

BWIP RESPONSE: This section will be rewritten to reflect data limitations. The information on vertical groundwater movement will be incorporated in work element S.1.28.C and the relevant test plan will be referenced.

ITEM REFERENCE: Section 13.3, page 13.3-53, W. E. S.1.29.C

NRC COMMENT: Work Element S.1.29.C; "Status," lines 23-25, "No known...to date."/9, 10 -- "Where and how was a discontinuity tested?"

STATUS: Agreed

BWIP RESPONSE: This statement will be deleted.

. . . . . .

TABLE III

CHAPTER 13 (SITE ISSUES)

NRC COMMENT: Work Element S.1.29.C; "Plans."/9,10 -- "Note reference to earlier Work Elements."

STATUS: Agreed

BWIP RESPONSE: The plans section will describe the input to be obtained from the referenced work elements.

ITEM REFERENCE: Section 13.3, page 13.3-54, W.E. S.1.30.C

NRC COMMENT: Work Element S.1.30.C; "Status," lines 25-28, "Available evidence...systems exist. Vertical and areal gradients are small."/4,5

STATUS: Agreed

BWIP RESPONSE: This sentence will be modified to indicate that data are now being collected to address the vertical and areal gradients.

. . . . . .

NRC COMMENT: "Plans," first paragraph./9, 10 -- "Note reference to earlier Work Elements."

STATUS: Agreed

BWIP RESPONSE: Section will be rewritten to show the changes in the test plans and the relevant plans will be referenced in the SCP.

ITEM REFERENCE: Section 13.3, page 13.3-56, W.E. S.1.33.C

NRC COMMENT: Work Element S.1.33.C, lines 29-32, "In spite...criteria (NRC, 1981)"; lines 38-39, "(1) Additional Hydrologic...through S.1.26.C."/5, 11, 12, 13, 15, 9, 10 -- "Note reference to earlier Work Elements."

STATUS: Agreed

BWIP RESPONSE: NRC-5: Additional information and proper qualification of the data will be added to the SCP.

. . . . . .

TABLE III

CHAPTER 13 (SITE ISSUES)

STATUS: Open

BWIP RESPONSE: NRC-11: Qualification of the hydrologic data will be added to the SCP.

. . . . . .

STATUS: Agreed

BWIP RESPONSE: NRC-12: Hydrologic data will be properly qualified in the SCP.

. . . . . .

STATUS: Open

BWIP RESPONSE: NRC-13: Additional information and proper qualification of the hydrologic data will be added to the SCP. BWIP would like clarification from the NRC on what constitutes a conservative approach to groundwater modeling.

. . . . . .

STATUS: Agreed

BWIP RESPONSE: NRC-15: Additional detailed information will be presented and analyzed in the SCP.

. . . . . .

STATUS: Agreed

BWIP RESPONSE: NRC-9: Additional information on testing techniques will be incorporated in the SCP and the relevant test plans referenced.

. . . . . .

STATUS: Agreed

BWIP RESPONSE: NRC-10: Additional information on testing techniques will be incorporated in the SCP and the relevant test plans referenced.

TABLE III

CHAPTER 13 (SITE ISSUES)

ITEM REFERENCE: Section 13.3, page 13.3-56, W.E. S.1.33.C

NRC COMMENT: Work Element S.1.33.C, line 1./6

STATUS: Open

BWIP RESPONSE: BWIP plans to model the far-field at two basic scales; the Pasco Basin and the Western Cold Creek Syncline. The Pasco Basin boundaries are rather fixed, whereas the Western Cold Creek Syncline boundaries are somewhat flexible. Thus, several alternatives will be considered. The Western Cold Creek Syncline model is an alternative to the Pasco Basin Model rather than a replacement for it. Additional modeling is being conducted at an expanded Pasco Basin scale to assist in defining the Pasco Basin boundary correlations. The discussions will be included in work element S.1.33.C.

ITEM REFERENCE: Section 13.3, page 13.3-57, W.E. S.1.33.C

NRC COMMENT: Work Element S.1.33.C., lines 2-6, "Establishment of the...model parameters."/10 -- "Would model limit be set at limit of accessible environment?"

STATUS: Agreed

BWIP RESPONSE: Model limits would not necessarily be set at the limit of accessible environment. It may even be set within the 10 km limit if the initial analysis indicated that flow would not be toward such a boundary. The western boundary might be set coincident with the hydrologic "barrier," for example. If later analysis indicated a reasonable chance that flow would be toward such a boundary, the model boundary could be moved out.

ITEM REFERENCE: Section 13.3, page 13.3-73, W.E. S.1.41.D

NRC COMMENT: Under Status, the SCR states, "Preliminary analysis of the consequences of a microearthquake event...effects over the 10,000 year period of interest."/2, 10 -- "A microearthquake event might not be significant, but a number might be--the consequence of a number of events over time should be determined."

STATUS: Agreed

BWIP RESPONSE: This section will be rewritten to show the status of the seismic surveillance effort in obtaining the necessary information. The appropriate test plans will be referenced in the SCP.

TABLE III

CHAPTER 13 (SITE ISSUES)

ITEM REFERENCE: Section 13.3, page 13.4-2, Figure 13-4

NRC COMMENT: Figure 13-4, Logic Diagram for Site./6, 15 -- "Geologic characterization should be part of input to conceptual hydrologic model. Alternative, refined conceptual models should be used to help plan field testing program for hydrologic parameters."

STATUS: Agreed

BWIP RESPONSE: Figure 13-4 will be modified to include alternate conceptual models and show input on geologic characterization.

ITEM REFERENCE: App. C, PC-26 5.4.1.1

NRC COMMENT: "What is the probability that groundwater withdrawals for irrigation would trigger microearthquake or earthquake swarms?"

STATUS: Open

BWIP RESPONSE: Work Elements S.1.46.D and 5.1.51.D address this issue superficially. More specific reference to this concern will be added to Status, Plans, and Tables.

ITEM REFERENCE: App. C, PC-27, 5.4.2.2

NRC COMMENT: "What is the probability that water impoundments behind possible future dam construction (Ben Franklin dam) will cause microearthquake or earthquake swarms?"

STATUS: Open

BWIP RESPONSE: Work elements S.1.45.D, S.1.41.D, and S.1.16.D address the issue superficially. More specific reference to this concern will be added to Status, Plans, and Tables.

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

ITEM REFERENCE: Section 14.1, page 14.1-2, Figure 14-1

NRC COMMENT: Figure 14-1. /14 -- "Provisions for retrieval should be included under key proposed criteria related to 10 CFR 60."

STATUS: Agreed

BWIP RESPONSE: Retrievability will be included as a performance objective under key proposed criteria.

ITEM REFERENCE: Section 14.3.1, page 14.3-30, paragraph 4

NRC COMMENT: "An analysis of energy changes...will be necessary to estimate excavation sequences are unfavorable."/18 -- "This analysis should consider the jointing in basalt and the different extraction ratios in BWIP and other documented stable and unstable excavations."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.2.A will describe methodology for comparing the stability of openings constructed in jointed basalt at design extraction ratios to other documented stable and unstable excavations.

ITEM REFERENCE: Section 14.3.1, page 14.3-31, paragraph 3, 4

NRC COMMENT: Work Element R.1.3.A Plans. /3, 9 -- "Specific plans to address this work element are not discussed in adequate detail."

STATUS: Agreed

BWIP RESPONSE: Additional detailed information on the plans for work element R.1.3.A will be input to the SCP and describe methodology for rock mechanics model development based on Exploratory Shaft (ES), and other test data.

ITEM REFERENCE: Section 14.3.1, page 14.3-31, paragraph 3

NRC COMMENT: "The analysis will begin by employing...to determine the magnitude and rate of tunnel and borehole closure."/10 -- "The acceptable rates tunnel and borehole closure should be defined, the rock mass and support characteristics determined, and the confidence level in model results delineated."

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.3.A will describe methodology for establishing acceptable (a) rates of opening closure; (b) performance of rock support systems; and (c) confidence levels in models.

ITEM REFERENCE: Section 14.3.1, page 14.3-32, paragraph 5

NRC COMMENT: Work Element R.1.4.A Plans. /3 -- "Specific plans to address this work element are not discussed in adequate detail."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.4.A will describe methodology for rock mechanics, model development based on ES, and other test data.

ITEM REFERENCE: Section 14.3.1, page 14.3-33, paragraph 2

NRC COMMENT: Work Element R.1.5.A Plans. /3 -- "Specific plans to address this work element are not discussed in adequate detail."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.5.A will describe methodology for rock mechanics, model development based on ES, and other test data.

ITEM REFERENCE: Section 14.3.1, page 14.3-33, paragraph 2

NRC COMMENT: "The numerical simulation to determine the temperature profile performance assessment process prior to the Title II (detailed) design."/10 -- "The design logic for the use of numerical simulation results in the performance assessment process should be provided."

STATUS: Agreed

BWIP RESPONSE: Work element R.1.5.A will be rewritten to correct this erroneous statement. The purpose of the numerical simulation is to support analysis of opening stability during repository design rather than to support the performance assessment process.

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

ITEM REFERENCE: Section 14.3.1, page 14.3-34, paragraph 6

NRC COMMENT: "Data obtained from...to verify the spatial variation of the in situ stress in the reference repository location (RRL)."/10 -- "What is the acceptable spatial variation of the in situ stress in the RRL?"

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.8.A will describe methodology for establishing acceptable spatial variation of in situ stress based on ES and other test data.

ITEM REFERENCE: Section 14.3.1, page 14.3-35, paragraph 3

NRC COMMENT: Work Element R.1.9.A Plans. /15 -- "The sensitivity analyses should be performed early in order to guide site characterization activities."

STATUS: Agreed

BWIP RESPONSE: Plans for the early completion of sensitivity analyses will be described in work element R.1.9.A.

ITEM REFERENCE: Section 14.3.1, page 14.3-35, paragraph 6

NRC COMMENT: "The acceptable range of rock mass characteristics must also be known for performance assessment purposes."/18 -- "This should be done for the rock mechanics test plans. Priority 1 is necessary."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.10.A will describe methodology for determining the acceptable range of rock mass characteristics in support of the rock mechanics tests included in the ES test plan. Work element R.1.10.A will be revised to Priority 1.

ITEM REFERENCE: Section 14.3.1, page 14.3-36, paragraph 1

NRC COMMENT: "A parametric and sensitivity analysis...the repository to function as necessary to achieve safety and isolation objectives."/10 -- "The failure continue to be used should be defined, and acceptable failure or factor of safety should be bracketed before performing this analysis."

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.10.A will describe methodology for establishing rock mass failure criteria and associated factors of safety prior to sensitivity analysis.

ITEM REFERENCE: Section 14.3.1, page 14.3-37, paragraph 3

NRC COMMENT: "The relationship between the rock-mass test results and the corresponding...more reliably. The results will establish the spatial variation ... within the reference repository location (RRL)."/9, 10 -- "The testing will establish the spatial variation of rock properties in the ES-II test area. The spatial variation within the RRL can be estimated from the test results, and the process by which this will be done should be described."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.11.B will describe methodology for establishing spatial variation of rock mass properties based on ES and other test data.

ITEM REFERENCE: Section 14.3.1, page 14.3-38, paragraph 3

NRC COMMENT: "Sufficient numerical modeling studies...with little or no additional development."/12 -- "The status of validation of coupled thermomechanical and hydrological models needs improvement."

STATUS: Agreed (Open)

BWIP RESPONSE: Clarification on availability of modeling techniques which couple the thermomechanical and hydrological data need to be discussed with the NRC.

ITEM REFERENCE: Section 14.3.1, page 14.3-38, paragraph 6

NRC COMMENT: "Validation of the near-field and canister-scale models...and measured rock mass behavior."/10 -- "Will heaters be placed in horizontal holes drilled in the ES-II facility to measure rock-mass behavior."

STATUS: Agreed

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

BWIP RESPONSE: Plans for work element R.1.13.B will address heated borehole tests being planned for the ES-II facilities. The ES test plan will provide test details.

ITEM REFERENCE: Section 14.3.1, page 14.3-38, paragraph 2

NRC COMMENT: Work Element R.1.13.B. /12 -- "Does not account for problems associated with predicting deformations across joints as experienced in the NSTF."

STATUS: Agreed

BWIP RESPONSE: Work element R.1.13.B will be rewritten to clarify that mechanical, thermal, and thermomechanical models must satisfactorily account for the jointed nature of a basalt rock mass.

ITEM REFERENCE: Section 14.3.1, page 14.3-42, paragraph 6

NRC COMMENT: Work Element R.1.18.D Plans. /3 -- "Specific plans to address this work element are not discussed in adequate detail."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.18.D will describe methodology for establishing sealing performance requirements.

ITEM REFERENCE: Section 14.3.1, page 14.3-43, paragraph 3

NRC COMMENT: Work Element R.1.19.D Plans. /3 -- "Specific plans to address this work element are not discussed in adequate detail."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.19.D will describe methodology for selecting seal materials and developing test techniques.

ITEM REFERENCE: Section 14.3.1, page 14.3-45, paragraph 2

NRC COMMENT: "Field scale tests at potential repository depths...with time, temperature, and permeability."/18 -- "Field scale tests will be required."

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.22.D will describe in situ tests to be conducted to determine the effects of temperature, rock mass deformation and time on the permeability of the sealed rock zone.

ITEM REFERENCE: Section 14.3.1, page 14.3-46, paragraph 4

NRC COMMENT: "The results of testing will be compared with a seal performance assessment model."/10 -- "Will the seal performance assessment model be specific to the BWIP site, and when will it be developed?"

STATUS: Agreed

BWIP RESPONSE: Status for work element R.1.24.D will describe the site specific seal performance assessment model to be completed during FY 1983.

ITEM REFERENCE: Section 14.3.1, page 14.3-48, paragraph 1

NRC COMMENT: Work Element R.1.28. /3 -- "What provisions have been made to control any adverse safety-related effects from site characterization including appropriate quality assurance programs?"

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.28 will describe provisions to control any adverse effects from site characterization including the appropriate quality assurance program."

ITEM REFERENCE: Section 14.3.1, page 14.3-50, paragraph 7

NRC COMMENT: "Waste package storage configurations will be analyzed and their effect on shielding requirements will be assessed."/18 -- "Several storage and retrieval scenarios should be considered in determining dose rates and shielding requirements."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.31 will describe engineering studies for optimizing the waste package storage configuration and determining the associated shielding requirements.

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

ITEM REFERENCE: Section 14.3.1, page 14.3-64, paragraph 2

NRC COMMENT: "The geometry and configuration of openings...be determined by the magnitude and direction of in situ stresses."/13 -- "The geological structure, retrievability, and radionuclide containment should also be considered."

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.57 will describe methodology for determining the factors which influence the geometry and configuration of openings.

ITEM REFERENCE: Section 14.3.1, page 14.3-64, paragraph 4

NRC COMMENT: "In addition, the geometry and configuration...will be optimized to enhance confinement of the waste."/10 -- "How will the layout of the repository take into consideration the interaction of waste package, backfill and rock?"

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.57 will describe methodology for determining the factors which influence the geometry and configuration of openings.

ITEM REFERENCE: Section 14.3.1, page 14.3-65, paragraph 2

NRC COMMENT: "During these reviews, failure analysis and its consequences will be taken into consideration in assessing design flexibility."/10 -- "How will analysis of failure and its consequences fit into the overall design logic?"

STATUS: Agreed

BWIP RESPONSE: Sentence will be deleted from plans work element R.1.58 since it does not contribute toward an understanding of how construction flexibility within the underground facility can be provided to accommodate adverse site specific conditions.

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

ITEM REFERENCE: Section 14.3.1, page 14.3-66, paragraph 7

NRC COMMENT: "Currently available roof support techniques...in the anticipated repository environment assessed."/18 -- "The effectiveness of roof support under the cyclic thermal shocks imposed during local retrieval should be analyzed. Will the rehabilitation of openings during the retrieval period be a consideration in support design?"

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.61 will describe methodology for designing roof support systems considering cyclic thermal shocks during local rehabilitation and retrieval.

ITEM REFERENCE: Section 14.3.1, page 14.3-67, paragraph 1

NRC COMMENT: Work Element R.1.62. /3 -- "This work element should receive a higher priority. Retrieval requirements are a key part of the 10 CFR 60 performance objectives."

STATUS: Agreed

BWIP RESPONSE: Work element R.1.62 will be revised to Priority 1.

ITEM REFERENCE: Section 14.3.1, page 14.3-67, paragraph 3

NRC COMMENT: "Specific procedures for retrieval will be defined and incorporated into the appropriate documents."/10 -- "Will local retrieval and other retrieval scenarios be considered in defining the procedures?"

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.62 will describe the retrieval scenarios to be considered in the preparation of retrieval procedures.

ITEM REFERENCE: Section 14.3.1, page 14.3-69, paragraph 3

NRC COMMENT: "Details on the adequacy of the...will be presented in the safety analysis report."/13 -- "The ventilation design does not consider local retrieval, and is quite optimistic regarding ventilation losses."

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.65 will include consideration of ventilation requirements imposed by local retrieval operations.

ITEM REFERENCE: Section 14.3.1, page 14.3-72, paragraph 2

NRC COMMENT: "This testing will be conducted as a part of other full-scale hydrologic or rock mechanics tests."/10 -- "The manner in which test results will be used in coupled thermomechanical/hydrological analyses should be defined before finalizing test plans."

STATUS: Agreed (Open)

BWIP RESPONSE: Clarification on availability of modeling techniques which couple thermomechanical and hydrological test results need to be discussed with the NRC.

ITEM REFERENCE: Section 14.3.1, page 14.3-72, paragraph 1

NRC COMMENT: "No information on the effect of stress and elevated...of a work mass is presently available."/1 -- "Work done in granite provides preliminary information on these effects."

STATUS: Agreed

BWIP RESPONSE: Status for work element R.1.70 will be reworded to include available granite test results.

ITEM REFERENCE: Section 14.3.1, page 14.3-73, paragraph 7

NRC COMMENT: "The plan and the procedures...and will be revised periodically for adequacy and compliance."/13 -- "Plan and procedures for exploratory shaft construction should receive priority 1."

STATUS: Agreed

BWIP RESPONSE: Work element R.1.72 will be revised to Priority 1 and applicable ES construction plans and procedures will conform with 60.134(c).

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

ITEM REFERENCE: Section 14.3.1, page 14.3-73, paragraph 1

NRC COMMENT: "The effect of heated water on the joints...on the integrity of the structural support systems with time will be determined."/9 -- "Will these tests be conducted in the ES-II facility?"

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.71 will be revised to confirm that these tests will be conducted in the ES-II facility. The referenced ES test plan will provide test details.

ITEM REFERENCE: Section 14.3.1, page 14.3-73, paragraph 3

NRC COMMENT: "All of this information will be used to improve the numerical used for analysis and performance confirmation."/10 -- "How will this be achieved, and what is improvement level sought?"

STATUS: Agreed

BWIP RESPONSE: Plans for work element R.1.13.B will describe methodology for rock mechanics model development.

ITEM REFERENCE: Section 14.3.2, page 14.3-75, paragraph 3

NRC COMMENT: Work Element R.2.1. /3 -- "This work element should receive a higher priority."

STATUS: Agreed

BWIP RESPONSE: Work element R.2.1 will be revised to Priority 2.

ITEM REFERENCE: Section 14.4, page 14.4-1, paragraph 2

NRC COMMENT: "A wide range of testing has been ... These data will be input to the performance assessment models and repository design activities."/9, 10 -- "The logic that will be used in incorporating test data in performance assessment models and repository design should be clearly defined."

STATUS: Agreed

TABLE III

CHAPTER 14 (REPOSITORY ISSUES)

BWIP RESPONSE: Plans for work element R.1.13.B will describe methodology for rock mechanics model development and use of test data.

ITEM REFERENCE: Section 14.4, page 14.4-2, Figure 14-2

NRC COMMENT: "The logic diagram for geoengineering and repository design that all major issues (R.1.A, R.1.B, R.1.C, and R.1.D) will be resolved from ES-I and ES-II testing."/18 -- "It is not clear how results from ES-I and ES-II testing will be extrapolated to the RRL to resolve issues R.1.A and R.1.D."

STATUS: Agreed

BWIP RESPONSE: The logic diagram, Figure 14-2, will be revised to show those elements of the ES-I and ES-II testing which are used to resolve the relevant issues. Plans for work element R.1.13.B will describe methodology for use of test data to resolve all relevant issues.

ITEM REFERENCE: Section 14.4, page 14.4-8, paragraph 3

NRC COMMENT: "Porthole testing will be conducted at the...to isolate the various aquifers from each other and from the candidate repository horizons."/18 -- "All portholes should be used for testing the effectiveness of the shaft grout."

STATUS: Agreed

BWIP RESPONSE: Section 14.4 will stipulate that all porthole tests will start with check of grout seal. The ES test plan will provide test details.

ITEM REFERENCE: Section 14.5, page 14.5-2, Table 14-4

NRC COMMENT: Table 14-4. /3 -- "These criteria do not reflect changes found in the July 7, 1982, proposed 10 CFR 60 Technical Criteria."

STATUS: Agreed

BWIP RESPONSE: The SCP will be consistent with and reference the final rule of 10 CFR 60.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

ITEM REFERENCE: Section 15.2, page 15.2-1, paragraph 1

NRC COMMENT: "The Basalt Waste Isolation Project (BWIP) ... have not been resolved."/3 -- "Issues not listed in Chapters 6, 11, or 15."

STATUS: Open (Agreed)

BWIP RESPONSE: Work elements (related to NRC issues) or expanded information needs will be identified in Chapters 6 and 11 and added to Chapter 15.

ITEM REFERENCE: Section 15.3, page 15.3-1, paragraph 1

NRC COMMENT: "The operating temperature limits for candidate ... from extrapolations of existing data."/10, 16

STATUS: Agreed

BWIP RESPONSE: Additional information will be supplied in future BWIP documentation. Available information will be added to Sections 11.3, 11.4, and other SCP sections specifically on thermal limits of backfill, and referenced where possible.

ITEM REFERENCE: Section 15.3.1, page 15,3-12, paragraph 1

NRC COMMENT: "These premises will be verified."/19

STATUS: Agreed

BWIP RESPONSE: If BWIP decides to take credit for the containment value of intact cladding, the detailed planning associated with testing this assumption will be incorporated in the Barrier Materials Test Plan. At the present time, BWIP is not taking any credit for intact cladding, and this will be so stated in paragraph 1.

ITEM REFERENCE: Section 15.3.1, page 15.3-12, W.1.1.A, paragraph 1

NRC COMMENT: "A materials development test program ... obtain the required data."/3, 18

STATUS: Agreed

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

BWIP RESPONSE: Details of the test program are included in the Barrier Materials Test Plan which will be made available to the NRC and will be referenced in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-13, Status, paragraph 2

NRC COMMENT: "A temperature limit of 300°C ... atmospheric pressure (Anderson, 1982, Section 2.4)."/15, 16 -- "This reference does not back up 300°C limit. Bentonite begins to dehydrate as low as 50°C (SCR Ref. Weaver, 1979) on page 6.3-6."

STATUS: Agreed

BWIP RESPONSE: Additional information on the performance of backfill materials will be supplied in future documentation. Dehydration, if reversible, does not invalidate the thermal limit.

ITEM REFERENCE: Section 15.3.1, page 15.3-13, W.1.1.A, Plans (All)

NRC COMMENT: "A material development and test program ... corrosion allowance for waste package design."/3, 18 -- "The plans discussed here and under 'status' covers the requirements generally but more detail is needed for evaluation."

STATUS: Agreed

BWIP RESPONSE: Details of the test planning are included in the Barrier Materials Test Plan which will be made available to NRC and will be referenced in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-13, W.1.2.A

NRC COMMENT: "Status and Plans."/16, 21

STATUS: Agreed

BWIP RESPONSE: Additional details outlining the status and plans for completing work element W.1.2.A will be added. The detailed plans are found in the Barrier Materials Test Plan, which will be available to the NRC and will be referenced in the SCP.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

ITEM REFERENCE: Section 15.3.1, page 15.3-14, paragraphs 2 and 3, W.1.3.A

NRC COMMENT: "If, in some manner ... (and hence, release rates l of multivalent radionuclides. Conversely, it can be hypothesized ... or minimally affected by radiation."/3, 5, 7, 15, 20 -- "These are speculative statements that could bound the conditions, but a discussion of some mechanisms and supporting references should be given to add credibility. Jacobs and Apted (1981) is not a proper reference; as it is merely an abstract of a paper that was presented orally."

STATUS: Agreed

BWIP RESPONSE: The materials in W.1.3.A will be clearly labeled hypothesis where appropriate, and existing new data will be added to narratives in Section 11.3 with detailed information to be provided, as available in update of the SCP or BWIP topical reports. Should experimental results from testing described in the Barrier Materials Test Plan required testing over a broader range of experimental conditions than defined therein, this work will be planned, implemented, and documented.

ITEM REFERENCE: Section 15.3.1, page 15.3-15, paragraph 1, W.1.3.A, Plans

NRC COMMENT: "At present, only one test ... of deleterious radiation effects."/21 -- "One test seems very inadequate. Some mechanism studies seemed required even if corrosion rates do not increase, which seems probable."

STATUS: Agreed

BWIP RESPONSE: Details of additional test planning are included in the Barrier Materials Test Plan, which will be made available to the NRC and will be referenced in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-15, paragraph 2 (All)

NRC COMMENT: "Measuring the effects of radiation ... performance of waste package component materials."/21 -- "In this part for effects of radiation on barrier material and (on corrosion also, paragraph 1) nothing is mentioned about effects of water flow rates."

STATUS: Agreed

BWIP RESPONSE: Flow-through experiments are described in the Barrier Materials Test Plan, which will be made available to NRC and will be referenced in the SCP.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

ITEM REFERENCE: Section 15.3.1, page 15.3-15, paragraph 1, W.1.4.A, Status

NRC COMMENT: "Solubility data are more useful than leach rate ... waste package."/4, 16 -- "This is not a generally true statement. Leach rate could be more useful in that it may set an upper bound."

STATUS: Open

BWIP RESPONSE: Preliminary laboratory results of hydrothermal tests demonstrate that solubility, not leach rate, is the controlling effect in a waste package containing backfill in basalt. The position that solubility is important is also reflected in attention to interactions (10 CFR 60) and in the NRC position paper on Radionuclide Speciation and Solubility determination received by DOE 1/28/83.

ITEM REFERENCE: Section 15.3.1, page 15.3-16, paragraph 2, W.1.4.A, Stat··

NRC COMMENT: "Solubilities of solid phases ... phase does not precipitate."/13, 16 -- "If a species is solubility controlled on leaching, it may not be in the cooler regions where metastable conditions could exist. Coloid formation could occur during the leaching process also."

STATUS: Agreed

BWIP RESPONSE: The Barrier Materials Test Plan contains testing aimed at determining whether colloid formation is significant in the basalt/bentonite backfill and basalt host-rock system. The phraseology of this paragraph will be clarified. Also see W.1.10.A.

ITEM REFERENCE: Section 15.3.1, page 15.3-17, paragraph 2, W.1.4.A, Status

NRC COMMENT: "Generally, a strongly reducing environment ... for radionuclide-bearing phases."/5, 7, 13, 16 -- "The oxidation state in the Grande Ronde groundwater has not been established as yet. A change of 6 to 10 orders of magnitude is much too large in a general statement without a specific reference to a particular nuclide."

STATUS: Agreed

BWIP RESPONSE: More isotope-specific information will be added to the specifics of the status section, reflecting additional data that will be provided in Section 6.5 of the SCP.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

ITEM REFERENCE: Section 15.3.1, page 15.3-17, paragraph 3, Status

NRC COMMENT: "However, insufficient data are available...expected repository conditions."/16, 18 -- "What are the expected repository conditions? Ref.?"

STATUS: Open

BWIP RESPONSE: Repository-specific conditions are defined in Chapters 6 and 11 of the SCR, and references contained therein, as well as Chapter 5 (hydrochemistry). Cross references will be supplied in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-18, paragraph 1, Plans

NRC COMMENT: "The behavior of these waste forms...conditions expected for the repository."/16, 21 -- "Very general. What about resolving uncertainties in K_ds?"

STATUS: Open

BWIP RESPONSE: K_ds are discussed in W.2.4.A and although not specifically excluded, are not considered relevant to this work element. BWIP's program included work on determining the uncertainties in K_ds. Planning for resolution of this item is under way and will be included.

ITEM REFERENCE: Section 15.3.1, page 15.3-18, paragraph 1, Plans

NRC COMMENT: "Otherwise, they will be incorporated...concentrations in natural."/4, 16 -- "How will these Plans uncertainty factors be used and can assurance of conservatism be possible?"

STATUS: Agreed

BWIP RESPONSE: The phrase will be rewritten. Test and performance plans such as the Barrier Materials Test Plan and the Performance Assessment Plan will contain treatment of uncertainty and conservatism in this and other data/analysis areas. They will be referenced and summarized in the SCP.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

ITEM REFERENCE: Section 15.3.1, page 15.3-18, paragraph 1, W.1.5.A, Status

NRC COMMENT: "The BWIP is confident...constructed in basalt."/4, 12 -- "In view of the lack of samples from the disposal horizon and admitted lack of knowledge of the Eh-pH controlling mechanism, this statement is a non-sequitur."

STATUS: Agreed

BWIP RESPONSE: The statement will be rewritten.

ITEM REFERENCE: Section 15.3.1, page 15.3-19, paragraph 1, Status

NRC COMMENT: "...control probably results...the basalt groundwater system."/5, 16

STATUS: Agreed

BWIP RESPONSE: A statement will be added that as additional data become available, alternative mechanisms will be considered to determine which one (or ones) best fit the available data.

ITEM REFERENCE: Section 15.3.1, page 15.3-19, paragraph 1

NRC COMMENT: "In direct Eh measurements (oxygen depletion)...the basalt groundwater system."/5, 7, 9, 10, 16, 18

STATUS: Agreed

BWIP RESPONSE: Presently available (new) data will be added to Section 6.4 of the SCP, defining oxygen consumption with time, and as additional details become available they will be reported in SCP updates.

ITEM REFERENCE: Section 15.3.1, page 15.3-19, Plans, (All)

NRC COMMENT: "The BWIP plans to experimentally determine...the rate of Eh reduction in a sealed repository."/21 -- "This represents one of the most important pieces of knowledge required yet no discussion is given of the experiments to be conducted and the applicability and transferability of these results to in-situ conditions.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

STATUS: Agreed

BWIP RESPONSE: The details of testing and analysis will be provided in the Barrier Materials Test Plan, which will be made available to the NRC and will be referenced and summarized in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-20, paragraph 1, W.1.6.A, Status

NRC COMMENT: "Using the environmental conditions expected in a repository constructed in basalt as a basis."/11, 16

STATUS: Agreed

BWIP RESPONSE: Details of environmental conditions used as experimental variables are contained in the Barrier Materials Test Plan. The literature search referenced in Smith, 1980, provided the early selection basis (screening) to narrow materials down for detailed testing. Should tests demonstrate a need for alternate materials for the waste package, they will be identified and tested. The Barrier Materials Test Plan will be updated to incorporate this, as needed.

ITEM REFERENCE: Section 15.3.1, page 15.3-22, paragraph 1, W.1.10.A, Status

NRC COMMENT: "Grande Ronde groundwater...hydroxides and hydroxyoxides."/5, 6, 11 -- "These points in dispute. What is the effect of the high carbonate and fluoride content for example?"

STATUS: Agreed

BWIP RESPONSE: The Barrier Materials Test Plan will contain experiments aimed at evaluating the effects of anion complexation on radionuclides in the waste package environment.

ITEM REFERENCE: Section 15.3.1, page 15.3-23, paragraph 1, W.1.10.A, Status

NRC COMMENT: "The radiation field, however...a significant detrimental factor."/5, 6, 13, 16 -- "What happens in the very near field can affect speciation farther downstream."

STATUS: Agreed

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

BWIP RESPONSE: The statement will be rewritten to state "is hypothetical in nature." Detailed experiments to validate this statement are defined in the Barrier Materials Test Plan.

ITEM REFERENCE: Section 15.3.1, page 15.3-23, W.1.10.A, Plans (All)

NRC COMMENT: "Ongoing research to evaluate the effect...in the basalt geohydrologic system."/18, 21 -- "Very important information. The plans should be more specific as to colloid and polymer formation on leaching, stability along flow path, and influence of flowtops and interbeds."

STATUS: Agreed

BWIP RESPONSE: This activity will be included in the Barrier Materials Test Plan, which will be available to NRC and will be referenced and summarized in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-24, paragraph 3, W.1.12.A, Status

NRC COMMENT: "The various dissolution/growth mechanisms...under projected hydrothermal conditions."/5, 16

STATUS: Agreed

BWIP RESPONSE: Information will be included in the Barrier Materials Test Plan, which will be available to NRC and will be referenced and summarized in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-25, paragraph 2

NRC COMMENT: "The dissolution of basalt...to the accessible environment."/5, 16

STATUS: Agreed

BWIP RESPONSE: Additional information on present status will be included in the data section of 6.4 of the SCP, and in future updates of the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-25, W.1.12,A, paragraph 3

NRC COMMENT: "Waste forms show a complex set...ordering of the solid waste form."/5, 16

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

STATUS: Agreed

BWIP RESPONSE: Additional information on present status will be included in the data section of Chapter 11 of the SCP, and in future updates of the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-25, paragraph 4, Status

NRC COMMENT: "These data can be coupled...meaningful radionuclide release rates."/5, 12, 16 -- "This is probably the most difficult of models to construct."

STATUS: Agreed

BWIP RESPONSE: Additional testing is described in the Barrier Materials Test Plan, which will be available to NRC, and will be summarized and referenced in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-26, W.1.12.A, Plans (All)

NRC COMMENT: "All of 'Plans' section."/21 -- "Again an important set of experiments with only a listing of experimental types to be performed. A more detailed description is needed. For example, what are methods, conditions (chemical and flow), etc."

STATUS: Agreed

BWIP RESPONSE: Details of test and analysis planning are included in the Barrier Materials Test Plan which will be made available to the NRC and will be summarized and referenced in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-28, paragraph 1, W.1.14.B, Status

NRC COMMENT: "In these experiments, the detection of sulfide...was rapidly in the system."/5, 6, 12, 13 -- "What about time for other constituents to reduce, e.g., Fe, Mn? The sulfur reaction may not be controlling. Besides it has not been established that the natural Eh - 0.5V."

STATUS: Agreed

BWIP RESPONSE: Additional evaluation of data obtained in hydrothermal reactions (Barrier Materials Test Plan) will be made to determine whether Eh is correctly stated.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

ITEM REFERENCE: Plans (All)

NRC COMMENT: "All of Plans."/21 -- "These are difficult experiments. How will they be performed?"

STATUS: Agreed

BWIP RESPONSE: Information will be included in the Barrier Materials Test Plan, which will be available to NRC and will be referenced and summarized in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-29, paragraph 1, W.1.14.B, Status

NRC COMMENT: "A calculation of 'average' velocities...transport to diffusion (Wood, et al., 1982)."/5 -- "The report says 10^{-7} m/sec assures diffusion control. The 10^{-11} m/sec was assumed for conservative calculation purposes. Flow measurements for 0.1μ D (10^{-10} cm/sec)."

STATUS: Agreed

BWIP RESPONSE: This statement will be clarified in text of the SCP with respect to the work done by Wood, 1982.

ITEM REFERENCE: Section 15.3.1., page 15.3-29, W.1.15.B, Plans, (All)

NRC COMMENT: "All of plans."/10, 21 -- "Hydraulic conductivities will be in the meaningless area and diffusion will control. No specifics are given to measure diffusion rates."

STATUS: Agreed

BWIP RESPONSE: More details will be provided in SCP text and supported by the Barrier Materials Test Plan.

ITEM REFERENCE: Section 15.3.2, page 15.3-41, paragraph 4, W.2.1.A, Plans,

NRC COMMENT: "Grande Ronde Basalts will be emphasized...redox buffering capacity for these materials."/5 -- "What about vertical flow to other horizons? How can controlling redox phases be selected when they are known?"

STATUS: Agreed

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

BWIP RESPONSE: More details will be provided as data become available. Additional analysis of interbed and in-filling materials will be made and interpreted to determine whether the controlling redox phases are similar to or different from initial measurements, and conditions used in hydrothermal experiments. Details will be provided in the Borehole Drilling and Test Plan.

ITEM REFERENCE: Section 5.3.2, page 15.3-41, W.2.1.A, Plans, General

NRC COMMENT: "All of Plans."/19 -- "Nothing is said about near-field heat induced effects."

STATUS: Agreed

BWIP RESPONSE: Near-field heat induced effects will be discussed in the text of the SCP and plans for their experimental definitions included in the Barrier Material Test Plan which will be referenced.

ITEM REFERENCE: Section 15.3.2, page 15.3-42, paragraph 9, W.2.4.A, Status (bottom of page)

NRC COMMENT: "The current accepted values...in Section 11.4. A more detailed discussion...and W.2.10.C."/5 -- "Accepted by whom?"/1 -- "Sections W.1.5.A and W.2.1.A provide no additional information or plans."

STATUS: Agreed

BWIP RESPONSE: Details will be provided of the SCP. Eh control data will be provided in Sections 6.3 and 11.3 and the Barrier Materials Test Plan, and for far-field characterization in the Borehole Drilling and Test Plan.

ITEM REFERENCE: Section 15.3.2, page 15.3-43, paragraph 3, W.2.4.A, Plans

NRC COMMENT: "All of Plans."/21 -- "Sorption and solubility are the most important items. The sorption R&D plans need much more elucidation."

STATUS: Agreed

BWIP RESPONSE: Details of characterization will be found in the Borehole Drilling and Test Plan and for interaction studies in the Barrier Materials Test Plan, which will be available to the NRC. These plans will be summarized and referenced in the SCP.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

ITEM REFERENCE: Section 15.3.2, page 15.3-45, W.2.8.A, Status

NRC COMMENT: "Key parameter list."/15 -- "The key parameter list is incomplete, e.g., waste package design, package component stability, colloid formation, etc. The above could be considered as subsets of containment time, but no colloid formation."

STATUS: Agreed

BWIP RESPONSE: Additions will be made to the key parameters list to assure completeness of planning.

ITEM REFERENCE: Section 15.3.2, page 15.3-45, W.2.8.A, Plans

NRC COMMENT: "All of plans and particularly 'The BWIP plans to proceed in acceptable release rates'..."/19

STATUS: Agreed

BWIP RESPONSE: Details of test planning are included in the Barrier Materials Test Plan, which will be made available to the NRC. Acceptability of data with respect to release criteria will be discussed in the Performance Assessment Plan and, in part, in the SCP. Both of these plans will be summarized in the SCP.

ITEM REFERENCE: Section 15.3.2, page 15.3-46, paragraph 7, W.2.10.C, Status

NRC COMMENT: "Current evidence indicates that...or allow canister materials."/4, 16 -- "Jacobs and Apted (1981) is not an acceptable reference. That the Eh is low and still in the hypotheses stage."

STATUS: Agreed

BWIP RESPONSE: Additional data will be provided, and the Barrier Materials Test Plan has details of test strategy to verify assumptions, by further detailed testing.

ITEM REFERENCE: Section 15.3.2, page 15.3-47, W.2.10.C, Plans

NRC COMMENT: "General Comment/None." -- "What are the specific plans to model aqueous redox conditions with advanced geochemical codes? Since meaningful downhole measurements of Eh is generally not possible and the probability of future success seems small, the calculational methods are very important and should be outlined."

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

STATUS: Agreed

BWIP RESPONSE: Specifics of modeling plans and their impacts on the test program (iteration and feedback) are in the Performance Assessment Plan. Treatment of this topic in Chapter 15 of the SCP will be expanded. Additional methodologies for determining Eh in situ are included in the Barrier Materials Test Plan which will be referenced and summarized in the SCP.

ITEM REFERENCE: Section 15.3.2, page 15.3-48, paragraph 7, W.2.12.D, Plans

NRC COMMENT: General Comment./19 -- "The so called plan consists merely of some vague assertions as to what will eventually be done."

STATUS: Open

BWIP RESPONSE: The sum of the preceding work elements that lead to a definition of release from the engineered systems and transport to the accessible environment will provide the answer to the work element. Any analysis required to determine the relationship to NRC release objectives and EPS release limits will be documented in future SCP updates. The Performance Assessment Plan contains a description of techniques used by BWIP to determine required performance of waste package and repository subsystems and their individual component performances.

ITEM REFERENCE: Section 15.3.2, page 15.3-49, W.2.13.D, Plans

NRC COMMENT: General Comment./21 -- "What are plans for verification of coupled-hydrologic models?"

STATUS: Agreed

BWIP RESPONSE: The sum of the preceding work elements that lead to a definition of release from the engineered system and transport to the accessible environment will provide the answer to the work element. Any analysis required to determine the relationship of NRC release objectives and EPA release limits will be documented in future SCP updates. The Performance Assessment Plan contains a description of techniques used by BWIP to determine subsystems and their individual component performances. This plan will be referenced in the SCP.

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

ITEM REFERENCE: Section 15.3.3, Page 15.3-53, W.3.1.A

NRC COMMENT: "Statistical techniques for extrapolating data over time."/None -- "Has DOE systematically considered the limitation of an approach that is 'fundamentally based on expert scientific options?'"

STATUS: Open

BWIP RESPONSE: It is not clear what NRC means by this statement, additional information is needed on why this preliminary approach is limiting.

ITEM REFERENCE: Section 15.3.3, page 15.3-58, paragraph 1, W.3.2.A, Plans

NRC COMMENT: "...(10^{-3} to 10^{-5} meters per year in the Grande Ronde Basalt)..."/5 -- "Obviously these flows are not realistic for the whole formation undoubtedly inferred from regional hydrology."

STATUS: Agreed

BWIP RESPONSE: Better data will be presented when it is available as a result of testing defined in the Borehole Drilling and Test Plan and the Exploratory Shaft Test Plan. Tests using variable flow rates as a variable are described in the Barrier Materials Test Plan. These plans will be summarized and referenced in the SCP.

ITEM REFERENCE: Section 15.3.3, page 15.3-58, W.3.2.A, Plans, (All)

NRC COMMENT: General Comment./21 -- "Considering the great detail in the 'status' part, the so-called plan is virtually non-existent."

STATUS: Agreed

BWIP RESPONSE: As detailed analysis is completed, it will be reported in future updates of the SCP. Test details will be provided in the Borehole and Drilling Test Plan and the Barrier Materials Test Plan as well as the Exploratory Shaft Plan.

ITEM REFERENCE: Section 15.3.3, page 15.3-59, W.3.3.A, Status and Plans

NRC COMMENT: General Comment./16 -- "References should be given for documentation of status and the various. If some plans are not documented, it should be noted."

TABLE III

CHAPTER 15 (WP/GEOCHEMISTRY ISSUES)

STATUS: Agreed

BWIP RESPONSE: The Performance Assessment Plan will contain details, and an expanded text of W.3.3.A will be provided in the SCP.

TABLE III

CHAPTER 16 (PERFORMANCE ASSESSMENT ISSUES)

ITEM REFERENCE: Section 16.3.1, page 16.3-1, paragraph 2

NRC COMMENT: Lines 12-bottom, "ISSUE S.1.C-SC ... (NRC, 1981a), and the."/3 -- "Actual data are needed to describe and develop a conceptual groundwater model and then to model for predictions of groundwater traveltime."

STATUS: Agreed

BWIP RESPONSE: Activity 3 in Section 16.4 of the Site Characterization Report (SCR) describes the preparation of the Performance Assessment Plan. The plan details this item. The information contained in the plan will be incorporated into the work element. Also, the logic diagram (Figure 16.3) will be redrawn to address the concerns raised by the NRC on the iterative nature between data collection and model development.

ITEM REFERENCE: Section 16.3.1, page 16.3-2, paragraph 1

NRC COMMENT: Lines 1-37, "U.S. Environmental ... complement the engineered system."/3 -- "Actual data are needed to describe and develop a conceptual groundwater model and then to model for predictions of groundwater traveltime."

STATUS: Agreed

BWIP RESPONSE: Beginning on page 16.3-1, the plans portion of work element P.1.1-SC will be rewritten to emphasize the importance of data both in the preparation of models and the testing of models. The logic diagram in Figure 16.3 will be redrawn to show this interaction.

ITEM REFERENCE: Section 16.3.1, page 16.3-3, paragraph 2

NRC COMMENT: Lines 25-27, "The validation of ... and the measured data."/3 -- "What is meant by sufficient?"

STATUS: Agreed

BWIP RESPONSE: The text will be rewritten to emphasize the importance of determining apriori acceptance criteria and then working towards this objective. The word "sufficient" will be deleted.

TABLE III

CHAPTER 16 (PERFORMANCE ASSESSMENT ISSUES)

ITEM REFERENCE: Section 16.3.3, page 16.3-8, paragraph 3

NRC COMMENT: Lines 12-14, "Work Element S.1.40.D-SD ... accessible environment."/14 -- "The priority on this work element should be as high as previous work element."

STATUS: Agreed

BWIP RESPONSE: Change priority of work element S.1.40.D-SD to priority 1.

ITEM REFERENCE: Section 16.4, page 16.4-7, paragraph 5

NRC COMMENT: Lines 38-40, "The validation of an ... the measured data."/3 -- What is meant by "sufficient"?

STATUS: Agreed

BWIP RESPONSE: This item, model validation, is discussed in the performance assessment plan. The text will be rewritten to incorporate contents of the plan into the SCP. Discussion of procedures on model validation, presently in preparation, will be cited. The use of acceptance criteria will be substituted for the word "sufficient".

ITEM REFERENCE: Section 16.5, page 16.5-2, Table 16-2

NRC COMMENT: "Work Element"; "S.1.30.C-SC," "S.1.31.C-SC," S.1.33.C-SC," "S.1.34.C-SC."/ 9,10 -- "See comments for appropriate Work Elements in Chapter 13 of SCR."

STATUS: Agreed

BWIP RESPONSE: Work elements will be revised in Chapter 13 and integrated into Table 16-2, Chapter 16, of the SCP.

ITEM REFERENCE: Section 16.5

NRC COMMENT: "Work Element"; "S.1.41.D-SD," "S.1.30.C-SD," "S.1.3.7.D."/ 9,10 -- "See comments for appropriate Work Elements in Chapter 13 of SCR."

STATUS: Agreed

BWIP RESPONSE: Work elements will be revised in Chapter 13 and integrated into Table 16-2, Chapter 16, of the SCP.

TABLE III

CHAPTER 17 (SITE PROGRAM)

ITEM REFERENCE: Section 17.1, page 17.1-1, paragraph 4

NRC COMMENT: "Each sequence shown is one of several that could be ... requirements. The logic diagrams may also be changed as increased knowledge is acquired."/9 -- "The objectives and minimum data requirements for resolving key issues should not be affected by schedule and budgetary requirements."

STATUS: Agreed

BWIP RESPONSE: The paragraph will be revised to delete "is somewhat flexible in response to schedule and budgetary requirements."

ITEM REFERENCE: Section 17.1, page 17.1-1, paragraph 4

NRC COMMENT: "The logic diagrams ... issues will be resolved."/1 -- "The time when issues will be resolved is not provided as stated."

STATUS: Agreed

BWIP RESPONSE: The paragraph will be revised to delete "and the time where the issues will be resolved."

ITEM REFERENCE: Section 17.2.2, page 17.2-4, paragraph 3

NRC COMMENT: "Selection of the candidate horizon for breakout ... as well as the principal borehole (RRL-2)."/9 -- "The tests that will be performed in these holes and the manner in which the data from these holes will be used in extrapolating ES-II data base to the RRL should be defined!"

STATUS: Agreed

BWIP RESPONSE: The Exploratory Shaft will be used to enhance characterization of the RRL. The Test Plan will describe this process, explaining the relationship to other site characterization testing.

ITEM REFERENCE: Section 17.2.2, page 17.2-4, paragraph 3

NRC COMMENT: "The various characteristics of the candidate horizons ... will be ranked to select the best horizon for breakout."/8 -- "10 CFR 60 defines site characterization as a program which establishes the ranges of relevant parameters for a particular site. Hence, favorable or unfavorable decisions should be based on acceptable ranges of relevant parameters."

TABLE III

CHAPTER 17 (SITE PROGRAM)

STATUS: Agreed

BWIP RESPONSE: Paragraph will be modified to more accurately reflect the decision analysis process.

ITEM REFERENCE: Section 17.2.2, page 17.2-7, paragraph 2

NRC COMMENT: Lines 18-19, "Vertical transport ... for isolation."/5 -- "Is this a general statement or specifically related to shaft integrity?"

STATUS: Agreed

BWIP RESPONSE: Sentence will be modified to relate to shaft integrity.

ITEM REFERENCE: Section 17.2.3, page 17.2-8, paragraph 2

NRC COMMENT: Lines 19-26, "After completion ... of the exploratory shaft."/3 -- "What is the ultimate fate of these hydrofractured zones and how will they affect groundwater flow?"

STATUS: Agreed

BWIP RESPONSE: Perturbation caused by hydraulic fracturing stress measurement is too small to be detected in performance assessment models. This question will be discussed in Chapter 4 and Chapter 16 of the SCP.

ITEM REFERENCE: Section 17.2.3, page 17.2-13, Table 17-4

NRC COMMENT: "Pressure differential and grout strength."/18 -- "These parameters do not provide sufficient data on the shaft seal."

STATUS: Agreed

BWIP RESPONSE: ES test plan will provide more information and will be referenced in the SCP.

ITEM REFERENCE: Section 17.2.3, page 17.2-14, paragraph 1

NRC COMMENT: Lines 1-10, "Drilling of horizontal ... given in Table 17.5."/3 -- "What type of tests and analyses will be used on what intervals, etc..?"

TABLE III

CHAPTER 17 (SITE PROGRAM)

STATUS: Agreed

BWIP RESPONSE: Additional information on interval testing and analyses will be presented in the Exploratory Shaft Test Plan.

ITEM REFERENCE: Section 17.2.4, page 17.2-17, Table 17-6

NRC COMMENT: "The tunnel layout in the repository horizon ... to minimize the stress concentration."/1 -- "The primary goal of the tunnel layout should be to maximize radionuclide containment, with secondary goal of maximizing stability."

STATUS: Agreed

BWIP RESPONSE: Tunnel orientation in the repository horizon for the purpose of minimizing stress concentrations around the tunnel is a factor in maximizing radionuclide containment. Minimum stress concentrations around the tunnel will reduce the possibility of rock breakage around the tunnel and therefore provide better radionuclide containment. This point will be addressed in more detail in Sections 10.4 and 10.5 of the SCP.

ITEM REFERENCE: Section 17.2.4, page 17.2-19, paragraph 6

NRC COMMENT: Line 17./9 -- "Work elements S.1.24.C and S.1.25.C should be included."

STATUS: Agreed

BWIP RESPONSE: ES Test Plan will identify additional work elements and work elements S.1.24.C and S.1.25.C will be added.

ITEM REFERENCE: Section 17.2.4, page 17.2-20, paragraph 4

NRC COMMENT: Lines 13-25, "Test Program Objective 3 (Phase I)."/3.9 -- "Demonstrate hydrogeologic isolation in vicinity of shaft."

STATUS: Agreed

BWIP RESPONSE: Paragraph will be revised to include demonstration of hydrogeologic isolation in vicinity of shaft.

TABLE III

CHAPTER 17 (SITE PROGRAM)

ITEM REFERENCE: Section 17.2.6, page 17.2-24, paragraph 1

NRC COMMENT: "A series of observations during construction of the Exploratory Shaft - Phase II, ..."/10 -- "Criteria for final geotechnical information prior to submittal of the license assessment of application. The site should be defined to properly analyze the data from ES-II."

STATUS: Agreed (Open)

BWIP RESPONSE: The BWIP would like clarification from the NRC on this comment.

ITEM REFERENCE: Section 17.2, page 17.2.24, paragraph 3

NRC COMMENT: "This will greatly increase the data base ... by not repeating tests previously performed."/12 -- "A good correlation of the Pomona basalt characteristics with basalt from the candidate horizon is required before this statement can be made."

STATUS: Agreed

BWIP RESPONSE: Paragraph will be revised to defend and restrict conclusion and reference will be made to Chapter 4 of the SCP.

ITEM REFERENCE: Section 17.2.6, page 17.2-26, paragraph 3

NRC COMMENT: "Tests may be conducted, if required, to establish the rock-mass strength. No specific test has been ... could be used to develop the testing techniques."/9 -- "Large-scale rock mass testing is important to characterize rock mass behavior especially coupled thermo-mechanical/hydrological behavior."

STATUS: Agreed

BWIP RESPONSE: Information on large-scale rock mass testing will be included in the Exploratory Shaft Test Plan and will be referenced in the SCP.

ITEM REFERENCE: Section 17.2.7, page 17.2-26, paragraph 4

NRC COMMENT: Line 34-bottom, "17.2.7.2 Hydrologic ... repository flow."/3,9.10

STATUS: Agreed

BWIP RESPONSE: Exploratory Shaft Test Plan will provide needed details.

TABLE III

CHAPTER 17 (SITE PROGRAM)

ITEM REFERENCE: Section 17.2.7, page 17.2-27, paragraph 1

NRC COMMENT: Lines 1-11, "Based on the conditions ... presented in Table 17-9."/3,9,10

STATUS: Agreed

BWIP RESPONSE: Exploratory Shaft Test Plan will provide needed details.

ITEM REFERENCE: Section 17.2.7, page 17.2-28, Table 17.9

NRC COMMENT: Table 17-9. /3,6 -- "Values for parameters other than in repository horizon should also be determined."

STATUS: Agreed

BWIP RESPONSE: This table is not restricted to tests to be performed in a candidate horizon. Table will be revised to reflect this.

ITEM REFERENCE: Section 17.2.8, page 17.2-29, paragraph 3

NRC COMMENT: "Provide geotechnical information to enable characterization of a volume ... to allow a decision on the suitability of this site for repository."/18 -- "Sealing, backfill performance, and retrievability are not addressed in this testing program."

STATUS: Open

BWIP RESPONSE: The need for testing sealing, backfill performance, and retrievability in the ES-Phase II is not yet evident. With the possible exception of sealing, this testing, to the extent that testing is warranted, could be performed in other facilities (e.g., NSTF). Regardless of where such testing is done, it would be for design confirmation purposes rather than site characterization purposes, and thus does not necessarily support a site suitability decision. A workshop will be held to discuss this item with the NRC.

ITEM REFERENCE: Section 17.3, page 17.3-1, paragraph 3

NRC COMMENT: "However, the resolution ... the second quarter of fiscal year 1987."/6 -- "If no report is issued, how will the resolution of the issue be assessed? Receipt of documentation of issue resolution by DOE as late as 20 FY87 could unnecessarily delay review of the license application."

TABLE III

CHAPTER 17 (SITE PROGRAM)

STATUS: Agreed

BWIP RESPONSE: Topical reports are issued as issues are resolved. The semi-annual report will catalog topical reports and address other topics.

ITEM REFERENCE: Section 17.3; pages 17.3-2, 17.3-3, 17.3-4, 17.3-5

NRC COMMENT: Figures 17.8, 17.9, 17.10, 17.11. /21 -- "The figures do not provide enough information on how the needs identified in Chapter 15 under each work element will be met in order to meet the time restraint of the final progress report and license application. The information presented is not adequate for NRC to provide guidance to DOE."

STATUS: Agreed

BWIP RESPONSE: The NRC is asked to clarify if this level of detail is appropriate for SCP. Additional details can be provided to NRC separately.

ITEM REFERENCE: Section 17.3, page 17.3-3, Figure 17-9

NRC COMMENT: "Results of ES-II testing will resolve issues R.1.A, R.1.B, and R.1.D, as presented in the schedule, Figure 17.9."/10 -- "The manner in which ES-II testing will be integrated with testing in boreholes RRL-2, RRL-6, and RRL-14 to resolve R.1.A and R.1.D is not clear."

STATUS: Agreed

BWIP RESPONSE: Plans for resolution of these issues will describe methodology for integration ES-II testing with testing in boreholes RRL-2, -6, and-14.

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

ITEM REFERENCE: Section 18.1, page 18.1-1 to 18.1-4, items 1-8

NRC COMMENT: "The organization structure, functional responsibility ... throughout the entire project." --

. . . . . .

NRC COMMENT: Item 1. "Provide a commitment that DOE will annually perform an evaluation of the QA program of its principal contractors and describe how this evaluation will be performed."

STATUS: Open

BWIP RESPONSE: Evaluations will be performed to meet the requirements of NQA-1. The frequency will be established in the DOE-RL BWIP QA manual. Additional clarification will be provided in the current revision to NRC's draft QA Standard Review Plan.

. . . . . .

NRC COMMENT: Item 2. "Describe the criteria for determining the size of the QA organization (including the inspection staff) of DOE and its principal contractors."

STATUS: Open

BWIP RESPONSE: Management forecasting of manpower requirements is not suitable for the SCP. The DOE does not establish formal criteria for determining size of staffing levels. This is a management determination based on consideration of numerous inputs including current staffing levels and experience, formal and informal evaluations of performance, planned activities, activities currently being performed, etc. Clarification will be provided in the revision to the NRC draft QA Standard Review Plan. This topic will also be discussed in an upcoming QA workshop with the NRC.

. . . . . .

NRC COMMENT: Item 3. "Describe the qualification requirements for the position of safety and QA Division Director and discuss the time spent on QA matters by the individual holding the position."

STATUS: Open

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

BWIP RESPONSE: Qualification requirements for this position are included in the DOE-RL BWIP QA manual. The DOE does not agree with a need to discuss "time spent on QA matters." The issue of significance is effective implementation of the QA program, which is evaluated through planned reviews and internal audits. The NRC will provide clarification in a revision to the draft QA Standard Review Plan. This topic will also be discussed in future QA workshops with the NRC.

. . . . . .

NRC COMMENT: Item 4. "Provide a commitment that verification of conformance to established requirements is accomplished by personnel within the QA organization."

STATUS: Open

BWIP RESPONSE: Verification of conformance to established requirements is conducted under purview of the QA program. The actual verification, however, may be performed by non-QA personnel. QA retains audit and surveillance authority over all verification activities. The NRC will provide clarification in a revision to the draft QA Standard Review Plan. This topic will also be discussed in future QA workshops with the NRC.

. . . . . .

NRC COMMENT: Item 5. "Identify QA personnel (by position title) in DOE and in the principal contractor's organization who are authorized to: (1) identify quality problems, (2) initiate, recommend or provide solutions through designated channels, (3) verify implementation of solutions, (4) stop unsatisfactory work, and (5) describe how these actions are accomplished."

STATUS: Open

BWIP RESPONSE: Accomplishment of these actions is described in referenced implementing procedures. Detailed descriptions of day to day work methods add little value and are not included (by requirement) in formal QA procedures.

. . . . . .

NRC COMMENT: Item 6. "Describe how disputes involving quality arising from a difference of opinion between QA personnel and other department personnel are resolved."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. Generally, disputes are elevated to upper management until resolution is achieved.

. . . . . .

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

NRC COMMENT: Item 7. "Identify (by position title) the individual at the site who, during and after site selection, is responsible for directing and managing the site QA program. Clarify that this individual has an appropriate organizational position, responsibilities, and authority to exercise proper control over the QA program."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18.

. . . . . .

NRC COMMENT: Item 8. "The individual is free from non-QA duties; and that he can thus give full attention to assuring that the QA program at the site is being effectively implemented."

STATUS: Open

BWIP RESPONSE: Freedom from non-QA duties is not essential. This is a management issue and not a QA program prerequisite. As such, inputs to management like those identified under the previous NRC comment responding to staffing levels are used to establish appropriate manpower for a given assignment. The NRC will provide clarification in a revision to the draft QA Standard Review Plan. This topic will be discussed at a future QA workshop with the NRC.

ITEM REFERENCE: Section 18.2, page 18.2-1 to 18.2-2, items 1-4

NRC COMMENT: "The Secretary of the DOE, in DOE Order ... of the supplier-quality-system evaluation." --

. . . . . .

NRC COMMENT: Item 1. "Identify existing or proposed QA procedures reflecting that each criterion of 10 CFR 50 Appendix B will be met by documented procedures."

STATUS: Agreed

BWIP RESPONSE: This is established in the QA Program Index which will be referenced in the SCP.

. . . . . .

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

NRC COMMENT: Item 2. "Describe how management (above or outside the QA organization) maintains frequent contact with program status through meetings, reports, and/or audits."

STATUS: Open

BWIP RESPONSE: This is described in implementing procedures to be referenced in the SCP.

. . . . . .

NRC COMMENT: Item 3. "For both DOE and it principal contractors, provide a commitment that management (above or outside the QA organization) will annually perform a preplanned and documented assessment of its QA program and that corrective action is identified and tracked."

STATUS: Open

BWIP RESPONSE: Chapter 18 currently addresses Rockwell QA assessments, but additional clarification will be provided in the SCP. Frequency is not appropriate for the SCP, however. Information in the SCP will clarify that the requirement for regular assessments of the QA program is met through implementation of referenced procedures. The frequency for such assessments is established therein. The NRC will provide clarification in a revision to the draft QA Standard Review Plan. This topic will be discussed at future QA workshops with the NRC.

. . . . . .

NRC COMMENT: Item 4. "Provide a commitment that the indoctrination, training, and qualification program described on page 18.2.2 of the SCR for both doers and verifiers includes provisions such that: (1) documentation of formal training and qualification includes the objective, content of the program, attendees, and date of attendance, (2) proficiency tests are given to those personnel performing and verifying activities affecting quality, and acceptance criteria are developed to determine if individuals are properly trained and qualified, and (3) certificates of qualifications clearly delineate the specific functions personnel are qualified to perform and the criteria used to qualify personnel in each function."

STATUS: Open

BWIP RESPONSE: Clarification will be provided in the revised Chapter 18 as to the content and extent of the BWIP Training Program. The blanket use of proficiency testing, however, will not be utilized. Certification is limited to the disciplines of Non-Destructive Examination and performance of "Special Processes." A program of proficiency testing and certification of both "doers" and "verifiers" is required at the time the Repository operations begin.

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

ITEM REFERENCE: Section 18.3, page 18.3-1 to 18.3-2

NRC COMMENT: "To identify and control the BWIP criteria ... in accordance with established procedures."/ -- "This section should include the following: (1) the design control program includes design activities associated with the preparation and review of design documents including the correct translation of applicable regulatory requirements and design bases into design, procurement, and procedural documents, (2) organizational responsibilities are described for preparing, reviewing, approving, and verifying design documents, (3) design interface controls are described, (4) procedures require a documented check to verify the dimensional accuracy and completeness of design drawings, (5) procedures require that design drawings and specifications be reviewed by the QA organization to assure that the documents are prepared, reviewed, and approved in accordance with procedures and that the documents contain the necessary quality assurance requirements, (6) procedures are established and described for design verification activities which assure that the verifier is qualified and is not directly responsible for the design, and (7) the responsibilities of the verifier, the areas and features to be verified, the pertinent considerations to be verified, and the extent of documentation are identified in procedures."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. Mandatory QA organizational involvement in design review will be clarified in a revision to the draft NRC QA Standard Review Plan. This topic will also be discussed in an upcoming QA workshop with the NRC.

ITEM REFERENCE: Section 18.4, page 18.4-1, paragraph 18.4

NRC COMMENT: "Applicable regulatory requirements, technical ... that the supplier has been approved."/-- "Clarify that the QA personnel review of procurement documents assures that quality requirements are correctly stated, inspectable, and controllable; that there are adequate acceptance and rejection criteria; and that procurement documents have been prepared, reviewed, and approved in accordance with QA program requirements."

STATUS: Open

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. Personnel other than QA may also approve procurement documents for this purpose. This will be clarified in a revision to the draft NRC QA Standard Review Plan. This topic will also be discussed at future QA workshops with the NRC.

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

ITEM REFERENCE: Section 18.6, page 18.6-1 to 18.6-2

NRC COMMENT: "Each principal contractor is required ... and revision receipt forms."/-- "Describe how the identity of the applicable revision of instruction, procedures, specification, drawing, and procurement documents is made known to personnel performing the work."

STATUS: Agreed

BWIP RESPONSE: This is described in referenced implementing procedures and will be clarified in the SCP.

ITEM REFERENCE: Section 18.7, page 18.7-1 to 18.7-2, items 1-3

NRC COMMENT: "The procurement of items and services for the BWIP ... commercial, 'off-the-shelf' items procured by Rockwell." --

. . . . . .

NRC COMMENT: Item 1. "Describe the organizational responsibilites for the control of purchased material, equipment, and services."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18.

. . . . . .

NRC COMMENT: Item 2. "Clarify that vendors, suppliers, and service type organizations are required to furnish the following records to the purchaser: (1) documentation that identifies the purchased item and the specific procurement requirements met by the item, (2) documentation identifying any procurement requirements that have not been met, and (3) a description of those nonconformances from the procurement requirements dispositioned 'accept as is' or 'repair.'"

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18.

. . . . . .

NRC COMMENT: Item 3. "Provide a commitment that supplier's certificates of conformance are periodically evaluated by audits, independent inspections, or tests to assure they are valid and the results documented."

STATUS: Open

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

BWIP RESPONSE: Rockwell does not require nor accept "Certificates of Conformance" for critical items. Necessary evaluations are conducted in advance of procurement, and inspections and tests performed concurrent with the supplier at the point of origin. Documentation is furnished upon delivery. Certified material test reports are required for the ES liner and grout materials.

ITEM REFERENCE: Section 18.9, page 18.9-1

NRC COMMENT: "Processes affecting quality items ... by the Rockwell Quality Assurance Function."/-- "Clarify that procedures are established for recording evidence of acceptable accomplishment of special processes using qualified procedures, equipment, and personnel."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18.

ITEM REFERENCE: Section 18.10, page 18.10-1 to 18.10-2, items 1 and 2

NRC COMMENT: "An inspection program has been established ... requirements for inspection." --

. . . . . .

NRC COMMENT: Item 1. "Clarify that procedures provide criteria for determining the accuracy requirements of inspection equipment and criteria for determining when inspections are required or define how and when inspections are performed. Verify that the QA organization participates in assuring the completeness of procedures regarding these matters and in the implementation of these functions."

STATUS: Open

BWIP RESPONSE: Equipment accuracy and inspection frequency are a product of the design iterative processes. The participation of the QA function will be clarified in Chapter 18 of the SCP. QA involvement should not be mandatory.

. . . . . .

NRC COMMENT: Item 2. "Clarify that the appropriate QA organization performs (1) final acceptance inspection, and (2) source and receiving inspection."

STATUS: Open

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. Personnel performing inspections need only be free from responsibility for performing work, and may not be a part of the QA organization. This will be clarified in a revision to the draft NRC QA Standard Review Plan. This topic will be discussed at a future QA workshop with the NRC.

ITEM REFERENCE: Section 18.11, page 18.11-1

NRC COMMENT: "Rockwell prepares test plans ... changes in operating facilities." -- "Describe how the QA organization is involved in scoping the test control program."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. The test control program including organizational responsibility is described in BOP D-6. QA involvement is described in referenced implementing procedures.

ITEM REFERENCE: Section 18.12, page 18.12-1, items 1-5

NRC COMMENT: "Tools, gauges, instruments, and other ... by Rockwell's Quality Assurance Function." --

. . . . . .

NRC COMMENT: Item 1. "Describe the procedures and identify the organization responsible for calibration, maintenance, and control of measuring and test equipment."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18.

. . . . . .

NRC COMMENT: Item 2. "Clarify that measuring and test equipment is labeled or tagged to indicate due date of the next calibration."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. Details are contained in referenced implementing procedures.

. . . . . .

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

NRC COMMENT: Item 3. "Clarify that measuring and test equipment is identified and traceable to the calibration test data."

STATUS: Agreed

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. Details are contained in referenced implementing procedures.

. . . . . .

NRC COMMENT: Item 4. "Clarify that the measuring and test equipment is calibrated at specified intervals based on the required accuracy, purpose, degree of usage, stability characteristics, and other conditions affecting the measurement. Calibration of this equipment is against standards that have an accuracy of at least four times the required accuracy of the equipment being calibrated or, when this is impossible, have an accuracy that assure the equipment being calibrated will be within tolerance. The basis of acceptance is documented and authorized by responsible management."

STATUS: Open

BWIP RESPONSE: Calibration requirements will be clarified in Chapter 18 of the SCP. Accuracy criteria and responsibilities will also be clarified. The 4X value is not universally applicable. Specific technical requirements for a calibration program are not appropriate for the SCP. Accuracy criteria will be clarified in the revision to the draft NRC QA Standard Review Plan. This topic will be discussed at a future QA workshop with the NRC.

. . . . . .

NRC COMMENT: Item 5. "Provide a commitment that primary calibrating standards have greater accuracy than secondary standard being calibrated."

STATUS: Agreed

BWIP RESPONSE: Calibration requirements will be clarified in the revised Chapter 18 of the SCP.

ITEM REFERENCE: Section 18.14, page 18.14-1

NRC COMMENT: "Contractors involved in inspection and ... prior to approved corrective action." -- "Describe procedures which control altering the sequence of inspection and tests."

STATUS: Agreed

TABLE III

CHAPTER 18 (QUALITY ASSURANCE)

BWIP RESPONSE: Clarification will be provided in the revised Chapter 18 of the SCP. Implementing procedures provide assurance of consistent review and approval for initial issuances and revisions.

ITEM REFERENCE: Section 18.17, page 18.17-1, items 1 and 2

NRC COMMENT: "A quality assurance records system for the ... principal contractors and their subcontractors." --

. . . . . .

NRC COMMENT: Item 1. "Describe the scope of the records program. Identify QA and other organizations and their responsibilities for the definition and implementation of activities related to QA records."

STATUS: Agreed

BWIP RESPONSE: Records management responsibilities will be clarified in the revised Chapter 18 of the SCP. Complete details are contained in the implementing procedures.

. . . . . .

NRC COMMENT: Item 2. "Identify what items the inspection and test records will include. Describe the facilities for the storage of records."

STATUS: Agreed

BWIP RESPONSE: Records management responsibilities will be clarified in the revised Chapter 18 of the SCP. Complete details are contained in the implementing procedures.

ITEM REFERENCE: Section 18.18, page 18.18.1

NRC COMMENT: "Planned and scheduled quality assurance audits ... and his affected department managers."/ "Clarify that DOE performs both internal and external audits to assure that procedure and activities comply with the overall QA program."

STATUS: Agreed

BWIP RESPONSE: This will be provided in the SCP.

TABLE III

SCR APPENDIX

ITEM REFERENCE: Appendix page 11, paragraph 2, page 12, paragraph 9, section 6.1, page 6.1-15, paragraph 4

NRC COMMENT: "Disturbed rock zone...BWIP defines the disturbed rock zone at the 100°C isotherm...Engineered system...100°C isotherm."/--"To what degree might mineral alteration occur at temperatures below 100°C? It is stated in the SCR that the interstitial glassy mesostasis is the 'most reactive' basaltic phase with the groundwater at low-temperature (less than 300°C) hydrothermal conditions."

STATUS: Open

BWIP RESPONSE: The expected alteration minerals for basalt are the same at 100°C and at 50°C (Giggenbach, 1981; Winkler, 1979). The persistence of glassy mesostasis at ambient temperature conditions is evidence that complete alternation of basalt, to form the most stable alteration minerals, has not occurred over the several million years since the formation of the basalt. The alteration of existing basalt is probably due to the partial alteration reaction of the glassy mesostasis, and this is supported by preliminary laboratory data (Apted and Myers, 1982). Raising repository temperatures from ambient to 100°C will cause the rate of this reaction to increase. This rate increase, however, should not be significant relative to the hundreds of years under consideration due to the thermal pulse from waste emplacement. Thus, the alteration of basalt will not be greatly different between 100°C and ambient temperature of the repository.

TABLE III

APPENDIX C

ITEM REFERENCE: Appendix C, page C-10, item P.1

NRC COMMENT: "How do the design criteria and conceptual design address releases of radioactive materials to unrestricted areas within the limits specified in 10 CFR 20?"

STATUS: Agreed

BWIP RESPONSE: SCR Sections 16.4, 16.5, and 16.6 will be rewritten to summarize the preclosure performance discussion contained in the Performance Assessment Plan. The Conceptual Design study that addressed this concern explicitly will be made available. Work elements R.1.33, and P.4.1 will be revised and integrated into Chapter 16.

ITEM REFERENCE: Appendix C, page C-10, item P.2

NRC COMMENT: "How do the design criteria and conceptual design accommodate the retrievability option?"

STATUS: Agreed

BWIP RESPONSE: Sections 16.4, 16.5, and 16.6 will be rewritten and a discussion from the Performance Assessment Plan will be included. Work element P.4.2 will be rewritten to address the subject of retrievability.

ITEM REFERENCE: Appendix C, page C-11, item P.12

NRC COMMENT: "Have the NEPA environmental/institutional/siting requirements for nuclear facilities been met?"

STATUS: Agreed

BWIP RESPONSE: The "Proposed General Guidelines for Recommendation of Sites for Nuclar Waste Repositories" (10 CFR 960) have been evaluated in DOE-EA-0210 for environmental, institutional, siting and other related requirements. This evaluation was based on currently availble data. Preliminary conclusions presented in the environmental assessment indicate that the reference repository location appears to meet the siting guidelines. A summary of the evaluation will be presented in Chapter 20 of the SCP.

TABLE III

APPENDIX C

ITEM REFERENCE: Appendix C, page C-16, item 2.12

NRC COMMENT: "How do microbes effect conditions affecting corrosion modes? What effect do microbes have on the conditions affecting transport?"

STATUS: Agreed

BWIP RESPONSE: This work will be incorporated in work element W.1.6.A on corrosion. The source term for radionuclide transport is release rate from the waste package boundary. In the temperature and radiation fields existing within the waste package, it is expected that microbes cannot survive and affect the source term. See the response to NRC reference item page 11-14, item 4.

ITEM REFERENCE: Appendix C, page C-16, item 2.15

NRC COMMENT: "What is the effect of water residence time on release of radionuclides from the waste form?"

STATUS: Agreed

BWIP RESPONSE: Discussion of water residence time will be more explicitly treated in work element W.1.4.A and/or W.1.12.A, and W.3.2.A, and W.3.3.A. See the response to NRC reference item page 11-14, item 5.

ITEM REFERENCE: Appendix C, page C-16, item 2.16

NRC COMMENT: "What are the ranges of residence times of a unit volume of water in contact with a unit area waste form and when does the residence times occur? For spent fuel how do hulls change the effective residence time?"

STATUS: Agreed

BWIP RESPONSE: Discussion of residence and its impact of waste release will be discussed in work elements W.1.4.A/W.1.12.A. If the BWIP decides to take credit for the cladding in spent fuel, it too will be considered. See the response to NRC reference item Chapter 11, page 11-14, item 5.

ITEM REFERENCE: Appendix C, page C-17, item 2.21

NRC COMMENT: "What are the transport and retardation processes and how do they effect the flux of radionuclides with time in packing materials?

STATUS: Agreed

TABLE III

APPENDIX C

BWIP RESPONSE: These will be more explicitly identified in existing work element W.1.4.A.

ITEM REFERENCE: Appendix C, page C-17, item 2.23

NRC COMMENT: "Can actinides be concentrated to increase heating in the packing materials or create a potential for criticality?"

STATUS: Agreed

BWIP RESPONSE: A new work element will be added: Assess the impact of radionuclide migration/reprecipitation around a waste package for potential criticality problems. The thermal effect of potential actinide redistribution is not at issue, since the waste package design must accommodate greater thermal loading from fission products. Criticality prevention specifications are covered by work elements W.1.21.A and R.1.45.

ITEM REFERENCE: Appendix C, page C-17, item 2.25

NRC COMMENT: "What are the convective flows in the waste package vs. time?" (relates to 2.1)

STATUS: Agreed

BWIP RESPONSE: This issue is part of issues W.1.A and W.1.B. Resolution is provided by work elements W.1.2.A, W.1.11.A, W.1.15.B, and W.3.3.A.

ITEM REFERENCE: Appendix C, page C-17, item 2.27

NRC COMMENT: "What are the conditions which affect criticality?"

STATUS: Agreed

BWIP RESPONSE: For the most part, criticality is a repository problem relating to aggregates of waste packages and is addressed in work element R.1.45 and in W.1.21.A for individual waste packages. See the response to NRC reference item page C-17, item 2.23.

TABLE III

APPENDIX C

ITEM REFERENCE: Appendix C, page C-19, item 3.3

NRC COMMENT: "How is the migration behavior (including solubility and retardation) of radionuclides being validated/verified?"

STATUS: Agreed

BWIP RESPONSE: Sections 16.4.8 and 16.4.13 narratives will be rewritten and comments contained in the Performance Assessment Plan and validation procedure will be incorporated. Waste Package and performance assessment work elements will be rewritten to address this concern.

ITEM REFERENCE: Appendix C, page C-19, item 3.4

NRC COMMENT: "How are the geochemical data that have been and will be gathered be shown to be appropriate for use in anticipated performance assessment methods?"

STATUS: Agreed

BWIP RESPONSE: Sections 16.4.8 and 16.4.13 will be rewritten for the SCP. This is a critical subject that will be addressed jointly by Performance Assessment, Waste Package and Site. Work elements will be revised in Chapters 13, 15, and 16 to better address this subject.

ITEM REFERENCE: Appendix C, page C-22, item 4.1.1

NRC COMMENT: "How do the design criteria and conceptual design address releases of radioactive materials to unrestricted areas within the limits specified in 10 CFR 20 (Performance Issue B.1)?"

STATUS: Agreed

BWIP RESPONSE: The repository design criteria restrict releases to the unrestricted areas to below the 10 CFR 20 limits and ALARA criteria.

ITEM REFERENCE: Appendix C, page C-22, item 4.1.2

NRC COMMENT: "How do the design criteria and conceptual design accommodate the retrievability option (Performance Issue B.2)?"

STATUS: Agreed

TABLE III

APPENDIX C

BWIP RESPONSE: See BWIP response to NRC reference item Appendix C, page C-10, item P.2.

ITEM REFERENCE: Appendix C, page C-24, item 4.5.1

NRC COMMENT: "How is the repository performance expected to be affected by construction of the exploratory shaft?"

STATUS: Agreed

BWIP RESPONSE: This subject is discussed in the Draft Environmental Assessment DOE/EA-0210 Section 3.3. This discussion will be incorporated into Chapter 10 of the SCP.

ITEM REFERENCE: Appendix C, page C-26, item 5.4.1.1

NRC COMMENT: "What is the probability that groundwater withdrawals for irrigation would trigger microearthquake or earthquake swarms?"

STATUS: Agreed

BWIP RESPONSE: Work elements S.1.46.D and 5.1.51.D address this issue superficially. More specific reference to this concern will be added to Status, Plans, and Tables of these work elements.

ITEM REFERENCE: Appendix C, page C-27, item 5.4.2.2

NRC COMMENT: "What is the probability that water impoundments behind possible future dam construction (Ben Franklin dam) will cause microearthquakes or earthquate swarms?"

STATUS: Agreed

BWIP RESPONSE: Work element S.A.41.D will be rewritten to incorporate recent work on disruptive scenarios.

TABLE IV

OPEN ITEMS FROM TABLES II AND III

TABLE IV

GROUNDWATER OPEN ITEMS

ITEM REFERENCE: Section 3.4.3, page 3-10, last sentence

NRC COMMENT: "Furthermore, the...Carbon-14 relationships." (Need for paleohydrologic and paleoclimatological models.)

STATUS: Open

BWIP RESPONSE: We would like to understand what paleohydrologic and paleoclimatological modeling techniques are being proposed. (NRC will provide written clarification.)

ITEM REFERENCE: Section 3.5, page 3-11, 3-12, item 4

NRC COMMENT: Item 4. Second Bullet. (Matrix diffusion data should be obtained to support transport modeling.)

STATUS: Open

BWIP RESPONSE: Discussions with NRC staff are necessary to understand their recommendations. (The NRC will provide additional written references to clarify the techniques.)

TABLE IV

GEOLOGY OPEN ITEMS

ITEM REFERENCE: Section 5.4.2, page 5-12, paragraph 3

NRC COMMENT: "Plans to characterize the stratigraphy and mineralogy below Grande Ronde Basalt were omitted from the SCR."

STATUS: Open

BWIP RESPONSE: BWIP disagrees with the need to characterize the stratigraphy and mineralogy below the Grande Ronde, thousands of feet below the candidate horizons. This issue needs further clarification. It is BWIP's opinion that obtaining this information would not significantly alter estimates of repository performance. The objectives of such characterization could be met by data from petroleum exploration wells currently being drilled in the vicinity of the Pasco Basin and through geophysical studies. BWIP feels that it is important to understand the stratigraphy below the candidate repository layer but does not feel it is cost-effective and technically justified to drill wells to depths of 10,000 to 15,000 feet to assess the "very deep" stratigraphy. The BWIP would like clarification from the NRC regarding how extensive an investigation program they envision.

ITEM REFERENCE: Chapter 11, page 11-6, item 2

NRC COMMENT: Item 2. "DOE has concluded that volcanic activity in the Pasco Basin in the next 10,000 years is very unlikely. This conclusion is based on frequency studies. No consideration has been given to the causes of past volcanism. Studies should consider both causes and frequency of volcanic activity when considering the probability and nature of future volcanism in the Pasco Basin."

STATUS: Open

BWIP RESPONSE: Clarification of this comment is needed from the NRC.

TABLE IV

HYDROLOGY OPEN ITEMS

ITEM REFERENCE: Section 5.1.2, page 5.1-11, Table 5-3

NRC COMMENT: Table 5-3, "Groundwater hydrochemistry."/5, 7, 15

STATUS: Open

BWIP RESPONSE: The column only claims to portray general groundwater hydrochemistry information. The term "isotopically heavier" will be replaced with "isotopically distinct." The title of the table will be changed or the information will be moved to the conceptual model section.

ITEM REFERENCE: Section 5.1, page 5.1-74, paragraph 1

NRC COMMENT: Lines 9-11, "Hydrochemical data...<+5 percent)."/3 -- "Basis for restrictive criterion?"

STATUS: Open

BWIP RESPONSE: The NRC reference should be 5.1-85. This criterion is equivalent to that used by the USGS (Hem, 1970) for the low TDS waters of the Saddle Mountains and is less restrictive than the USGS criteria for waters of elevated TDS in the Grande Ronde. Less restrictive criteria are used for Grande Ronde water due to the limitations of sampling from deep, small diameter boreholes. The NRC has agreed to provide additional written clarification.

ITEM REFERENCE: Section 5.1.5, page 5.1-87

NRC COMMENT: "The wide range in concentration..."/(Gephart, et al., 1979a). "If waste water disposal is controlling groundwater at site, required analyses are irrelevant."

STATUS: Open

BWIP RESPONSE: Discussion with the NRC staff will serve to clarify this item. Clarification will then be added to the SCP distinguishing between the hydrochemistry of natural vs. disturbed groundwater systems.

TABLE IV

HYDROLOGY OPEN ITEMS

ITEM REFERENCE: Section 5.1.5, page 5.1-95, paragraph 4

NRC COMMENT: Lines 29-38, "Examination of Figure 5-50...chloride concentration."/5, 12 -- "The groundwater flow flow directions are not firmly established."

STATUS: Open

BWIP RESPONSE: The groundwater flow direction is inferred from hydraulic head data (Figure 5-31) and hydrochemical data principally from the Mabton Interbed, therefore, the conclusion is supported. Wording in the SCR will be changed to indicate the appropriate confidence level. Plans for correlating hydrochemical data with hydraulic properties of the groundwater flow system will be discussed in Chapter 13 of the SCP. The NRC staff will provide additional written clarification on their concerns regarding the groundwater flow direction.

ITEM REFERENCE: Section 5.1.5, page 5.1-98, paragraph 4

NRC COMMENT: "Sulfate reduction proceeds...catalyst for the reaction."/1 -- "Hem (1970, p. 160) also states microbes are needed for reduction."

STATUS: Open

BWIP RESPONSE: The NRC staff has agreed to provide written clarification concerning this topic.

ITEM REFERENCE: Section 5.1.5, page 5.1-102, Figure 5-53

NRC COMMENT: Figure 5-53. /15

STATUS: Open (Agreed)

BWIP RESPONSE: Appropriate data on total dissolved solids will be included in the SCP.

ITEM REFERENCE: Section 5.1.5, page 5.1-108, paragraph 2

NRC COMMENT: "An environment conducive...bacteria."/14 -- "See p. 5.1-98, paragraph 4."

STATUS: Open

TABLE IV

HYDROLOGY OPEN ITEMS

BWIP RESPONSE: Page 5.1-98 discussed a possible reason for low sulfate in some Mabton waters. Page 5.1-108 indicates that this low sulfate condition is a prerequisite for methanogenic bacteria to thrive. Low sulfate correlates well with the occurrence of methane. The NRC staff will provide additional written clarification on the nature of the conflicting statement.

ITEM REFERENCE: Section 5.1.5, page 5.1-121, Table 5-26

NRC COMMENT: Table 5-26./3, 10, 16 -- "Alternative units are suggested."

STATUS: Open

BWIP RESPONSE: The NRC staff will provide additional written clarification on the alternative units suggested and on the methods used to obtain these data.

ITEM REFERENCE: Section 5.1.5, page 5.1-125, Table 5-28

NRC COMMENT: Table 5-28./3, 10, 16 -- "Primary data are included in the SCR. Presentation of range and mean does not permit independent evaluation of data. Potassium content is significant with respect to montmorillonite altering to illite."

STATUS: Open

BWIP RESPONSE: See the modified response to NRC reference item page 5.1-27 regarding primary data. The NRC staff will provide written clarification on formation of illite from montmorillonite at the measured potassium content.

ITEM REFERENCE: Section 5.1.5, page 5.1-132, paragraph 2

NRC COMMENT: "In borehole DC-15,...then found farther east"./9, 10

STATUS: Open

BWIP RESPONSE: Measurement and sampling techniques associated with collection of gas will be discussed with the NRC in a future workshop. The NRC will provide written clarification on this topic.

TABLE IV

HYDROLOGY OPEN ITEMS

ITEM REFERENCE: Section 5.1.6, page 5.1-158, paragraph 1

NRC COMMENT: Lines 8-10, "This would have the...(Fritz, et al., 1979)."/1 -- "Significant deviations from slope of +8 are known for only arid or semi-arid closed basins and high temperature geothermal systems."

STATUS: Open

BWIP RESPONSE: The Pasco Basin is a semi-arid region with 8 inches of precipitation annually. Local precipitation indicates that significant evaporation occurs. The NRC will provide additional written clarification on this topic.

ITEM REFERENCE: Section 5.1.6, page 5.1-167, paragraph 1

NRC COMMENT: "At the time of actual sampling...evaluate sample representativeness."/16

STATUS: Open

BWIP RESPONSE: The sampling procedure will be referenced.

ITEM REFERENCE: Section 5.1.6, page 5.1-170, Table 5-42

NRC COMMENT: Table 5-42. /1, 3, 10, 16 -- "Primary data are not presented in the SCR and data are not corrected for effects of methane."

STATUS: Open

BWIP RESPONSE: See the modified response to NRC reference item 5.1-27 regarding primary data. The BWIP would like to discuss correction techniques with the NRC staff to see how they would suggest making the corrections.

ITEM REFERENCE: Section 5.1.6, page 5.1-170, paragraph 1

NRC COMMENT: Lines 6-10, "The general pattern...potentiometric information."/4

STATUS: Open

TABLE IV

HYDROLOGY OPEN ITEMS

BWIP RESPONSE: The conjectural nature of the statement will be further clarified. This topic will be discussed with the NRC staff at a future workshop.

TABLE IV

GEOCHEMISTRY OPEN ITEMS

ITEM REFERENCE: Chapter 5, page 5-9

NRC COMMENT: "In fact, the resolution of geochemical issues is not to be presented by the DOE until FY87 and FY88 (SCR, page 17.3-1 and Table 17-12). The NRC staff does not consider this aspect of DOE's plan to be timely. The progress of each work element that contributes to the resolution of an issue should be published sufficiently early during site characterization and in enough detail to permit the NRC staff and other peer reviewers to provide constructive, timely commentary."

STATUS: Open

BWIP RESPONSE: The BWIP and DOE will publish, in such documents as the SCP, the adopted approach to resolution of geochemical issues for NRC review long before FY 87. In addition, updates on progress on resolving these issues will also be available to NRC in a timely manner for comment on a continuing basis before FY 87. However, final resolution is not required or expected before this FY 87/FY 88 time frame. This interpretation of "resolution" needs further clarification.

ITEM REFERENCE: Chapter 5, page 5-14, paragraph 2, item 1

NRC COMMENT: Item 1. "The NRC staff believes that solubility determinations (steady-state condition) should be approached from both oversaturation and under saturation."

STATUS: Open

BWIP RESPONSE: There are serious questions concerning the feasibility of approaching solution equilibrium from undersaturation. The time necessary to achieve equilibrium may be unrealistically long. Identification and synthesis of solid phases required to perform solubility studies from undersaturation may not be possible. The approach to solubility determinations to be used by the BWIP will be documented in the BMTP.

ITEM REFERENCE: Chapter 11, page 11-10, items 1, 3, and 10

NRC COMMENT: Item 1. Use of baseline geochemical data as a "natural experiment". There should be use of the baseline information which must be gathered during characterization of the prevailing in situ geochemical conditions as a "natural experiment".

TABLE IV

GEOCHEMISTRY OPEN ITEMS

STATUS: Open

BWIP RESPONSE: It is not clear if the "natural experiment" refers to "geochemical conditions", "characterization of conditions", or "baseline information". The BWIP will be including in the SCP a discussion of in situ, diagenetic alteration of Columbia River basalts as evidence for expected alteration of basalt after emplacement of nuclear waste. Thus, site characterization data will be used as a "natural analog" for long-term basalt alteration. A discussion of how the natural analog studies will be used to support waste package design will be included in the SCP, Chapter 6. The NRC will provide additional written clarification.

. . . . . .

NRC COMMENT: Item 3. Experimental data from available literature on montmorillonite suggest that this material may not be stable under expected repository conditions. (paraphrased)

STATUS: Open

BWIP RESPONSE: See the BWIP comment on mineralogical changes due to heat, item reference page 11-9, items 1, 2, and 3. The NRC should provide the referenced literature as the basis for discussion/clarification of this item.

. . . . . .

NRC COMMENT: Item 10. The basalt-groundwater and geochemical environment is stated to be benign. Because of the limited data available, the problems with determining uncontaminated down-hole measurements, and outstanding questions on the interpretation of data, this statement appears to be premature. (paraphrased)

STATUS: Open

BWIP RESPONSE: This statement in the SCR refers to canister corrosion and is supported by data presented therein. The BWIP is currently expanding and improving its data base. All data and test results to date still confirm this statement. The statement in the SCP will be clarified to assure that the reader is aware that the statement is referring only to canister corrosion.

ITEM REFERENCE: Section 6.0, page 6.0-1, paragraph 3

NRC COMMENT: "Unresolved geochemical issues are addressed in Section 6.8."/3.

TABLE IV

GEOCHEMISTRY OPEN ITEMS

STATUS: Open

BWIP RESPONSE: Unresolved geochemical issues will be addressed in Chapter 15 of the SCP.

ITEM REFERENCE: Section 6.1.5, page 6.1-20, paragraph 2

NRC COMMENT: "Experimental evidence indicates...the clay minerals (see Section 6.3)."/5, 7, 16 -- "These pressures are not effective for controlling mineral stability."

STATUS: Open (Agreed)

BWIP RESPONSE: A more detailed discussion of the effects of temperature and pressure on clay mineral degradation (dehydration versus hydrothermal reaction mechanism) will be included in the SCP.

ITEM REFERENCE: Section 6.1.5, page 6.1-21, Figure 6-8

NRC COMMENT: Figure 6-8./4, 6

STATUS: Open (Agreed)

BWIP RESPONSE: A more detailed discussion of fracture filling will be included in the SCP. Figure 6-8 will be deleted.

ITEM REFERENCE: Section 6.1.5, page 6.1-22, paragraph 3

NRC COMMENT: "The fractures generally contain..."/3, 4

STATUS: Open (Agreed)

BWIP RESPONSE: Additional data on fracture and vesical filling will be included in the SCP.

TABLE IV

GEOCHEMISTRY OPEN ITEMS

ITEM REFERENCE: Section 6.1.5, page 6.1-22, paragraph 3

NRC COMMENT: "...smectite seems to occur...illite occurs unevenly through the section."/3, 4

STATUS: Open (Agreed)

BWIP RESPONSE: The data presented in the SCP on vertical zonation of secondary minerals will be appropriately qualified and referenced.

ITEM REFERENCE: Section 6.3.2, page 6.3-9, paragraph 1

NRC COMMENT: "..., Weaver (1979) has compiled studies...lesser extent, chlorite."/3

STATUS: Open

BWIP RESPONSE: The discussion by Weaver (1979) is of interest but not directly applicable to the basalt environment. Therefore, no further discussion of these data are warranted.

ITEM REFERENCE: Section 6.4.1, page 6.4-1, paragraph 3

NRC COMMENT: "...; Giggenbach, 1981)."/15, 16 -- "Reference doesn't really apply to subject discussed."

STATUS: Open

BWIP RESPONSE: See the response to NRC reference item page 6.4-1; the exact pages of Giggenbach are pages 405, 406.

ITEM REFERENCE: Section 6.4.2, page 6.4-7, Table 6-16

NRC COMMENT: Table 6-16. /6, 7, 9, 10 -- "Results not relevant for conditions."

STATUS: Open

TABLE IV

GEOCHEMISTRY OPEN ITEMS

BWIP RESPONSE: These groundwater compositions were chosen for use in sorption studies because of their compositional differences and because they represent two potentially important groundwaters. Alternative compositions were carefully considered before choosing those being used. The supporting data for choosing these compositions will be given in Section 5.2.3.1.2 of the SCP. The testing and analysis method will be referenced.

ITEM REFERENCE: Section 6.4.2, page 6.4-7, Table 6-17

NRC COMMENT: Table 6-17. /6, 7, 9, 10 -- "Results are not relevant for conditions."

STATUS: Open

BWIP RESPONSE: The supporting data, testing.techniques, and analytical methods are given in a reference to be added to Section 6.5 of the SCP. See comments for Table 6-16 for statements on "alternatives not considered," and results not "relevant for conditions."

ITEM REFERENCE: Section 6.8, page 6.8-1

NRC COMMENT: "6.8 SUMMARY OF UNRESOLVED ISSUES (all)."/3

STATUS: Open

BWIP RESPONSE: This discussion of unresolved issues is included in Chapter 15. This section in Chapter 6 only identifies where these issues will be discussed in the SCP. References to appropriate test plans will be included in those discussions.

TABLE IV

REPOSITORY DESIGN OPEN ITEMS

ITEM REFERENCE: Section 10.4.1, page 10.4-4, paragraph 4

NRC COMMENT: "This panel will ... the retrieval period."/6,8 -- "The experimental panel is provided to conduct tests. Many of these tests may be needed prior to License Application (LA), yet the panel comes after the LA."

STATUS: Open

BWIP RESPONSE: This paragraph, and the list of tests to be performed in an experimental panel, will be revised to clarify that the tests envisioned are not intended to provide necessary input to the construction permit or operating license applications, but instead are intended as performance confirmation tests as defined in 10 CFR 60. This topic will be discussed with the NRC staff at future workshops.

ITEM REFERENCE: Section 10.8.1, page 10.8-5, paragraph 1

NRC COMMENT: "These materials will be tested ... at the repository horizon. Emplacement techniques ... as needed."/3 -- "Where will the referenced shaft seal be demonstrated? Prior to LA?"

STATUS: Open

BWIP RESPONSE: Current plans do not include shaft seal demonstration prior to construction license application. However, the overall seal field testing program is being reevaluated to determine the extent of shaft seal testing to be d to support the LA.

TABLE IV

WASTE PACKAGE OPEN ITEMS

ITEM REFERENCE: Section 7.3, page 7-9

NRC COMMENT: Waste Form Issue: Borosilicate glass is questioned as an effective release barrier in a NWRB, particularly under hydrothermal conditions. The concern centers about the stability of glass and predicting its long term behavior. The behavior of the waste form under hydrothermal conditions should be emphasized if the waste package container reliability for the selected design life is insufficient to exclude such conditions from the waste form. (paraphrased)

STATUS: Open

BWIP RESPONSE: The BWIP approach has been to not emphasize the waste form leach rate, but the solubility limits to concentrations (and hence release) imposed by radionuclide bearing solids. In this manner, the BWIP follows the fate of radionuclides rather than just the fate of the initial waste form. If testing of an alternate waste form were required, testing of the alternate would effectively double the waste-barrier-rock interaction work currently underway. This requires a DOE decision on development of contingency (alternate) waste forms. This will be the subject of future discussions with the NRC.

ITEM REFERENCE: Section 11.3.2, page 11.3-28, paragraph 4

NRC COMMENT: "A series of experiments...disposal of nuclear waste."/3, 4, 15

STATUS: Open (Agreed)

BWIP RESPONSE: The discussion of mineral alterations and dehydration will be expanded and more appropriately qualified in the SCP.

ITEM REFERENCE: Section 11.3.3, page 11.3-38, paragraph 1

NRC COMMENT: "Important conclusions drawn...disturbed zone of the repository."/5, 9, 10, 15

STATUS: Open

BWIP RESPONSE: The work "conclusions" will be replaced by "inferences."

TABLE IV

WASTE PACKAGE OPEN ITEMS

ITEM REFERENCE: Section 11.4.1, page 11.4-6, paragraph 2

NRC COMMENT: "Irreversible loss of water...(Deer, et al., 1967)."/10 -- "What, when F- is present?"

STATUS: Open

BWIP RESPONSE: To our knowledge fluoride has no relevance to the irreversible loss of water. If there are known mechanisms involving fluoride which cause an irreversible loss of water below temperatures of 300°C, we would like to discuss this aspect at a future NRC workshop.

ITEM REFERENCE: Section 11.4.1, page 11.4-9, paragraph 1

NRC COMMENT: "For instance, pH depression...200°C using seawater."/16

STATUS: Open

BWIP RESPONSE: This discussion relates to Figure 11-24, which contains references on the curves; those for basalt will be added. This statement and action has been deleted from Section 6.4 of the SCP as more applicable site specific data is now available. This information will be included in the SCP.

TABLE IV

PERFORMANCE ASSESSMENT OPEN ITEMS

ITEM REFERENCE: Section 12.4.1, page 12.4-7, paragraph 1

NRC COMMENT: "The initial ratios of horizontal-to-vertical hydraulic conductivities were determined for each layer by compositing the estimated conductivities of dense basalt, interflow, and interbed materials."/13

STATUS: Open

BWIP RESPONSE: The basis for the nonconservative categorization code needs clarification. In this analysis, vertical movement from the repository horizon to the Mabton Interbed was assumed (a highly conservative assumption). The normal limitations of using composite layers for traveltime calculations do not apply for that portion of the flowpath. The traveltime in the Mabton Interbed was estimated using best estimates of the horizontal hydraulic conductivity for the Mabton. No credit was taken for the vertical flowpath from the Mabton to the river. The NRC staff will provide further written clarification on this topic.

ITEM REFERENCE: Section 12.4.1, page 12.4-15, paragraph 1

NRC COMMENT: "Reasonable adjustments in the values of the boundary conditions were made to obtain a match with the head data within the model boundaries. For the Wanapum and Grande Ronde Basalts, emphasis was placed on adjusting boundary conditions to approximate the head measurements in boreholes DC-13, -14, and -15."/10 -- "Normally, material properties are adjusted."

STATUS: Open

BWIP RESPONSE: Text should correctly read DC-12, -14, and -15. In this analysis, the boundary conditions and locations of the effective boundaries for the RRL were considered to be particularly uncertain. Using the initial set of boundary conditions, even extreme ratios of hydraulic conductivity were unsatisfactory in matching heads. Unless the boundary conditions are satisfactorily known, adjusting material property values can produce misleading results. The analysis summarized in this section of the SCR emphasized that point. The modeling taskforce has agreed to the uncertainty in the boundary conditions and the need to first define boundary conditions. A discussion of boundary conditions and material properties will be added to the SCP.

TABLE IV

PERFORMANCE ASSESSMENT OPEN ITEMS

ITEM REFERENCE: Section 12.4.3, page 12.4-35, paragraph 1

NRC COMMENT: Lines 11-14. "The effective porosities... et al., (1982)."/4, II, 13 -- "Data used are not consistent with page 3.5-33 or page 5.1-46."

STATUS: Open

BWIP RESPONSE: This will be rewritten to use updated information. The effective porosity was an assumption made prior to the availability of field data referenced on SCR pages 3.5-33 and 5.1-46, and therefore selection of value could not have been purposely biased at the time of the analysis. A discussion of data selection and conservative/nonconservative assumptions and features will be added to the SCP.

ITEM REFERENCE: Section 12.4.3, page 12.4-35, paragraph 1

NRC COMMENT: "These values are believed to be representative of, if not smaller than, the values expected for the Columbia River Basalt Group: See Chapter 5, especially Section 5.2.1.2."/11 -- "The values in Section 5.2.1.2 appear to come from Table 5-49 and are erroneously referred to as effective porosity. These are values of total porosity."

STATUS: Open

BWIP RESPONSE: Clarification of effective porosity estimates will be discussed with the NRC.

ITEM REFERENCE: Section 12.4.3, page 12.4-42, paragraph 4

NRC COMMENT: "The SCR states that the calculations of mass flux were relatively insensitive to layer thickness."/13, 14 -- "On page 12.4-37 the SCR states that the thickness of the flow top controls the direction of water and radionuclide movement. The lack of response into mass flux calculated cannot be used as a justification for thickness choice."

STATUS: Open (Agreed)

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for

TABLE IV

PERFORMANCE ASSESSMENT OPEN ITEMS

identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.3, page 12.4-43, Figure 12-16

NRC COMMENT: Figure 12-16. /6, 11, 13

STATUS: Open (Agreed)

BWIP RESPONSE: The fault scenario analysis will be deleted from the SCP. Credible disruptive events associated with a basalt repository at Hanford have been identified through a delphi study. The results of this study will be documented and a summary discussion included in the SCP. Plans for identification, prioritization, and characterization of the ranges of specific properties needed to conduct defensible consequence and probability analyses are included in Chapter 16 of the SCP. Preliminary consequence and probabilistic analyses will not be included in the SCP, but will be included in subsequent SCP updates.

ITEM REFERENCE: Section 12.4.4, page 12.4-51, paragraph 1

NRC COMMENT: "The SCR states that the pre-emplacement groundwater travel times calculated to date significantly exceed the NRC 1,000-year travel-time."/12, 13 -- "The results of these studies are frequently based on nonconservative assumptions and data choices (see other comments)."

STATUS: Open

BWIP RESPONSE: BWIP agrees that the degree of conservatism has not been adequately demonstrated. This topic will be discussed with the NRC during future workshops.

TABLE IV

SITE ISSUES OPEN ITEMS

ITEM REFERENCE: Section 13.3, page 13.3-6, W.E. S.1.9.A

NRC COMMENT: Under Status, the SCR states that "pillow zones and flow tops are known from boreholes and that general distributions can be interpreted from this data."/18 -- "The spacing of data points is too broad for resolution."

STATUS: Open

BWIP RESPONSE: The statement will be modified and plans to collect more data on pillow zones and flow tops will be described. BWIP would like clarification from the NRC on what spacing of data points would be adequate for resolution.

ITEM REFERENCE: Section 13.3, page 13.3-56, W.E. S.1.33.C

NRC COMMENT: Work Element S.1.33.C, lines 29-32, "In spite...criteria (NRC, 1981)"; lines 38-39, "(1) Additional Hydrologic...through S.1.26.C."/5, 11, 12, 13, 15, 9, 10 -- "Note reference to earlier Work Elements."

STATUS: Open

BWIP RESPONSE: NRC-11: Qualification of the hydrologic data will be added to the SCP.

. . . . . .

NRC COMMENT: Work Element S.1.33.C, lines 29-32, "In spite...criteria (NRC, 1981)"; lines 38-39, "(1) Additional Hydrologic...through S.1.26.C."/5, 11, 12, 13, 15, 9, 10 -- "Note reference to earlier Work Elements."

STATUS: Open

BWIP RESPONSE: NRC-13: Additional information and proper qualification of the hydrologic data will be added to the SCP. BWIP would like clarification from the NRC on what constitutes a conservative approach to groundwater modeling.

ITEM REFERENCE: Section 13.3, page 13.3-56, W.E. S.1.33.C

NRC COMMENT: Work Element S.1.33.C, line 1./6

STATUS: Open

TABLE IV

SITE ISSUES OPEN ITEMS

BWIP RESPONSE: BWIP plans to model the far-field at two basic scales; the Pasco Basin and the Western Cold Creek Syncline. The Pasco Basin boundaries are rather fixed, whereas the Western Cold Creek Syncline boundaries are somewhat flexible. Thus, several alternatives will be considered. The Western Cold Creek Syncline model is an alternative to the Pasco Basin Model rather than a replacement for it. Additional modeling is being conducted at an expanded Pasco Basin scale to assist in defining the Pasco Basin boundary correlations. The discussions will be included in work element S.1.33.C.

ITEM REFERENCE: App. C, PC-26 5.4.1.1

NRC COMMENT: "What is the probability that groundwater withdrawals for irrigation would trigger microearthquake or earthquake swarms?"

STATUS: Open

BWIP RESPONSE: Work Elements S.1.46.D and 5.1.51.D address this issue superficially. More specific reference to this concern will be added to Status, Plans, and Tables.

ITEM REFERENCE: App. C, PC-27, 5.4.2.2

NRC COMMENT: "What is the probability that water impoundments behind possible future dam construction (Ben Franklin dam) will cause microearthquake or earthquake swarms?"

STATUS: Open

BWIP RESPONSE: Work elements S.1.45.D, S.1.41.D, and S.1.16.D address the issue superficially. More specific reference to this concern will be added to Status, Plans, and Tables.

TABLE IV

WP/GEOCHEMISTRY ISSUES OPEN ITEMS

ITEM REFERENCE: Section 15.2, page 15.2-1, paragraph 1

NRC COMMENT: "The Basalt Waste Isolation Project (BWIP) ... have not been resolved."/3 -- "Issues not listed in Chapters 6, 11, or 15."

STATUS: Open (Agreed)

BWIP RESPONSE: Work elements (related to NRC issues) or expanded information needs will be identified in Chapters 6 and 11 and added to Chapter 15.

ITEM REFERENCE: Section 15.3.1, page 15.3-15, paragraph 1, W.1.4.A, Status

NRC COMMENT: "Solubility data are more useful than leach rate ... waste package."/4, 16 -- "This is not a generally true statement. Leach rate could be more useful in that it may set an upper bound."

STATUS: Open

BWIP RESPONSE: Preliminary laboratory results of hydrothermal tests demonstrate that solubility, not leach rate, is the controlling effect in a waste package containing backfill in basalt. The position that solubility is important is also reflected in attention to interactions (10 CFR 60) and in the NRC position paper on Radionuclide Speciation and Solubility determination received by DOE 1/28/83.

ITEM REFERENCE: Section 15.3.1, page 15.3-17, paragraph 3, Status

NRC COMMENT: "However, insufficient data are available...expected repository conditions."/16, 18 -- "What are the expected repository conditions? Ref.?"

STATUS: Open

BWIP RESPONSE: Repository-specific conditions are defined in Chapters 6 and 11 of the SCR, and references contained therein, as well as Chapter 5 (hydrochemistry). Cross references will be supplied in the SCP.

ITEM REFERENCE: Section 15.3.1, page 15.3-18, paragraph 1, Plans

NRC COMMENT: "The behavior of these waste forms...conditions expected for the repository."/16, 21 -- "Very general. What about resolving uncertainties in K_ds?"

TABLE IV

WP/GEOCHEMISTRY ISSUES OPEN ITEMS

STATUS: Open

BWIP RESPONSE: K_ds are discussed in W.2.4.A and although not specifically excluded, are not considered relevant to this work element. BWIP's program included work on determining the uncertainties in K_ds. Planning for resolution of this item is under way and will be included.

ITEM REFERENCE: Section 15.3.2, page 15.3-48, paragraph 7, W.2.12.D, Plans

NRC COMMENT: General Comment./19 -- "The so called plan consists merely of some vague assertions as to what will eventually be done."

STATUS: Open

BWIP RESPONSE: The sum of the preceding work elements that lead to a definition of release from the engineered systems and transport to the accessible environment will provide the answer to the work element. Any analysis required to determine the relationship to NRC release objectives and EPS release limits will be documented in future SCP updates. The Performance Assessment Plan contains a description of techniques used by BWIP to determine required performance of waste package and repository subsystems and their individual component performances.

ITEM REFERENCE: Section 15.3.3, page 15.3-53, W.3.1.A

NRC COMMENT: "Statistical techniques for extrapolating data over time."/None -- "Has DOE systematically considered the limitation of an approach that is 'fundamentally based on expert scientific options?'"

STATUS: Open

BWIP RESPONSE: It is not clear what NRC means by this statement, additional information is needed on why this preliminary approach is limiting.

TABLE IV

SITE PROGRAM OPEN ITEMS

ITEM REFERENCE: Section 17.2.8, page 17.2-29, paragraph 3

NRC COMMENT: "Provide geotechnical information to enable characterization of a volume ... to allow a decision on the suitability of this site for repository."/18 -- "Sealing, backfill performance, and retrievability are not addressed in this testing program."

STATUS: Open

BWIP RESPONSE: The need for testing sealing, backfill performance, and retrievability in the ES-Phase II is not yet evident. With the possible exception of sealing, this testing, to the extent that testing is warranted, could be performed in other facilities (e.g., NSTF). Regardless of where such testing is done, it would be for design confirmation purposes rather than site characterization purposes, and thus does not necessarily support a site suitability decision. A workshop will be held to discuss this item with the NRC.

TABLE IV

QUALITY ASSURANCE OPEN ITEMS

ITEM REFERENCE: Chapter 10, page 10-2

NRC COMMENT: Data should be documented and recorded under a full QA program and be made available to all interested parties for inspection at an early date. (paraphrased)

STATUS: Open

BWIP RESPONSE: The system of QA documentation of data collection and recording exists and will be clarified in the SCP. The issue of open availability will be discussed at a future NRC workshop.

ITEM REFERENCE: Chapter 10, page 10-3, items 1 and 2

NRC COMMENT: Item 1. "...implementing functional procedures manuals, the BWIP procedures manual, the Data Package Manuals, and (other Rockwell manuals and documents applicable to the overall QA program should be referenced and identified)."

STATUS: Open

BWIP RESPONSE: Resolution of the DOE document clearance process is required to satisfy this issue. Rockwell's Quality Assurance Program Index references applicable Rockwell manuals.

. . . . . .

NRC COMMENT: Item 2. The SCR does not present adequate details regarding implementation of site characterization plans. Plans should be developed "from identification of general performance objectives and criteria." Also, "few detailed test plans are referenced in the SCR for any of the major test programs mentioned." The planning "must start by considering EPA and NRC criteria." Additionally, "a description of the QA program to be applied to each planned test and a discussion of the limitations and uncertainty in the data" should be provided. The NRC staff recognizes that not all test plans may be needed at this time, however some (plans) should be available for review. (paraphrased)

STATUS: Open

BWIP RESPONSE: Details of the structured test planning program, updated to 10 CFR 60 requirements, will be discussed in the SCP. Resolution of the DOE

document clearance process is required to fully satisfy this issue. A description of the QA program applied to each test and discussion of data limitations and uncertainty is contained in the test plans and is not considered appropriate for the SCP.

ITEM REFERENCE: Chapter 11, page 11-16, item 3

NRC COMMENT: Item 3. "Methods for reliability analyses should be identified. Implementation of the requirements of DOE-RL Order 5700.2 and DOE Order 6430 involving design control should be identified and documented."

STATUS: Open

BWIP RESPONSE: The BWIP approach is to use confidence levels of waste package/backfill/seals/host rock, etc. This will be clarified in an upcoming workshop with the NRC and addressed in the SCP.

ITEM REFERENCE: Section 18.1, page 18.1-1 to 18.1-4, paragraph 18.1, items 1, 2, 3, 4, 5, and 8

NRC COMMENT: Item 1. "Provide a commitment that DOE will annually perform an evaluation of the QA program of its principal contractors and describe how this evaluation will be performed."

STATUS: Open

BWIP RESPONSE: Evaluations will be performed to meet the requirements of NQA-1. The frequency will be established in the DOE-RL BWIP QA manual. Additional clarification will be provided in the current revision to NRC's draft QA Standard Review Plan.

. . . . . .

NRC COMMENT: Item 2. "Describe the criteria for determining the size of the QA organization (including the inspection staff) of DOE and its principal contractors."

STATUS: Open

BWIP RESPONSE: Management forecasting of manpower requirements is not suitable for the SCP. The DOE does not establish formal criteria for determining size of staffing levels. This is a management determination based on consideration of numerous inputs including current staffing levels and experience,

formal and informal evaluations of performance, planned activities, activities currently being performed, etc. Clarification will be provided in the revision to the NRC draft QA Standard Review Plan. This topic will also be discussed in an upcoming QA workshop with the NRC.

. . . . . .

NRC COMMENT: Item 3. "Describe the qualification requirements for the position of safety and QA Division Director and discuss the time spent on QA matters by the individual holding the position."

STATUS: Open

BWIP RESPONSE: Qualification requirements for this position are included in the DOE-RL BWIP QA manual. The DOE does not agree with a need to discuss "time spent on QA matters." The issue of significance is effective implementation of the QA program, which is evaluated through planned reviews and internal audits. The NRC will provide clarification in a revision to the draft QA Standard Review Plan. This topic will also be discussed in future QA workshops with the NRC.

. . . . . .

NRC COMMENT: Item 4. "Provide a commitment that verification of conformance to established requirements is accomplished by personnel within the QA organization."

STATUS: Open

BWIP RESPONSE: Verification of conformance to established requirements is conducted under purview of the QA program. The actual verification, however, may be performed by non-QA personnel. QA retains audit and surveillance authority over all verification activities. The NRC will provide clarification in a revision to the draft QA Standard Review Plan. This topic will also be discussed in future QA workshops with the NRC.

. . . . . .

NRC COMMENT: Item 5. "Identify QA personnel (by position title) in DOE and in the principal contractor's organization who are authorized to: (1) identify quality problems, (2) initiate, recommend or provide solutions through designated channels, (3) verify implementation of solutions, (4) stop unsatisfactory work, and (5) describe how these actions are accomplished."

STATUS: Open

TABLE IV

QUALITY ASSURANCE OPEN ITEMS

BWIP RESPONSE: Accomplishment of these actions is described in referenced implementing procedures. Detailed descriptions of day to day work methods add little value and are not included (by requirement) in formal QA procedures.

. . . . . .

NRC COMMENT: Item 8. "The individual is free from non-QA duties; and that he can thus give full attention to assuring that the QA program at the site is being effectively implemented."

STATUS: Open

BWIP RESPONSE: Freedom from non-QA duties is not essential. This is a management issue and not a QA program prerequisite. As such, inputs to management like those identified under the previous NRC comment responding to staffing levels are used to establish appropriate manpower for a given assignment. The NRC will provide clarification in a revision to the draft QA Standard Review Plan. This topic will be discussed at a future QA workshop with the NRC.

ITEM REFERENCE: Section 18.2, page 18.2-1 to 18.2-2, items 2-4

NRC COMMENT: Item 2. "Describe how management (above or outside the QA organization) maintains frequent contact with program status through meetings, reports, and/or audits."

STATUS: Open

BWIP RESPONSE: This is described in implementing procedures to be referenced in the SCP.

. . . . . .

NRC COMMENT: Item 3. "For both DOE and it principal contractors, provide a commitment that management (above or outside the QA organization) will annually perform a preplanned and documented assessment of its QA program and that corrective action is identified and tracked."

STATUS: Open

BWIP RESPONSE: Chapter 18 currently addresses Rockwell QA assessments, but additional clarification will be provided in the SCP. Frequency is not appropriate for the SCP, however. Information in the SCP will clarify that the requirement for regular assessments of the QA program is met through

implementation of referenced procedures. The frequency for such assessments is established therein. The NRC will provide clarification in a revision to the draft QA Standard Review Plan. This topic will be discussed at future QA workshops with the NRC.

. . . . . .

NRC COMMENT: Item 4. "Provide a commitment that the indoctrination, training, and qualification program described on page 18.2.2 of the SCR for both doers and verifiers includes provisions such that: (1) documentation of formal training and qualification includes the objective, content of the program, attendees, and date of attendance, (2) proficiency tests are given to those personnel performing and verifying activities affecting quality, and acceptance criteria are developed to determine if individuals are properly trained and qualified, and (3) certificates of qualifications clearly delineate the specific functions personnel are qualified to perform and the criteria used to qualify personnel in each function."

STATUS: Open

BWIP RESPONSE: Clarification will be provided in the revised Chapter 18 as to the content and extent of the BWIP Training Program. The blanket use of proficiency testing, however, will not be utilized. Certification is limited to the disciplines of Non-Destructive Examination and performance of "Special Processes." A program of proficiency testing and certification of both "doers" and "verifiers" is required at the time the Repository operations begin.

ITEM REFERENCE: Section 18.4, page 18.4-1, paragraph 18.4

NRC COMMENT: "Applicable regulatory requirements, technical ... that the supplier has been approved."/-- "Clarify that the QA personnel review of procurement documents assures that quality requirements are correctly stated, inspectable, and controllable; that there are adequate acceptance and rejection criteria; and that procurement documents have been prepared, reviewed, and approved in accordance with QA program requirements."

STATUS: Open

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. Personnel other than QA may also approve procurement documents for this purpose. This will be clarified in a revision to the draft NRC QA Standard Review Plan. This topic will also be discussed at future QA workshops with the NRC.

TABLE IV

QUALITY ASSURANCE OPEN ITEMS

ITEM REFERENCE: Section 18.7, page 18.7-1 to 18.7-2, item 3

NRC COMMENT: Item 3. "Provide a commitment that supplier's certificates of conformance are periodically evaluated by audits, independent inspections, or tests to assure they are valid and the results documented."

STATUS: Open

BWIP RESPONSE: Rockwell does not require nor accept "Certificates of Conformance" for critical items. Necessary evaluations are conducted in advance of procurement, and inspections and tests performed concurrent with the supplier at the point of origin. Documentation is furnished upon delivery. Certified material test reports are required for the ES liner and grout materials.

ITEM REFERENCE: Section 18.10, page 18.10-1 to 18.10-2, items 1 and 2

NRC COMMENT: Item 1. "Clarify that procedures provide criteria for determining the accuracy requirements of inspection equipment and criteria for determining when inspections are required or define how and when inspections are performed. Verify that the QA organization participates in assuring the completeness of procedures regarding these matters and in the implementation of these functions."

STATUS: Open

BWIP RESPONSE: Equipment accuracy and inspection frequency are a product of the design iterative processes. The participation of the QA function will be clarified in Chapter 18 of the SCP. QA involvement should not be mandatory.

. . . . . .

NRC COMMENT: Item 2. "Clarify that the appropriate QA organization performs (1) final acceptance inspection, and (2) source and receiving inspection."

STATUS: Open

BWIP RESPONSE: This will be clarified in the SCP, Chapter 18. Personnel performing inspections need only be free from responsibility for performing work, and may not be a part of the QA organization. This will be clarified in a revision to the draft NRC QA Standard Review Plan. This topic will be discussed at a future QA workshop with the NRC.

TABLE IV

QUALITY ASSURANCE OPEN ITEMS

ITEM REFERENCE: Section 18.12, page 18.12-1, item 4

NRC COMMENT: Item 4. "Clarify that the measuring and test equipment is calibrated at specified intervals based on the required accuracy, purpose, degree of usage, stability characteristics, and other conditions affecting the measurement. Calibration of this equipment is against standards that have an accuracy of at least four times the required accuracy of the equipment being calibrated or, when this is impossible, have an accuracy that assure the equipment being calibrated will be within tolerance. The basis of acceptance is documented and authorized by responsible management."

STATUS: Open

BWIP RESPONSE: Calibration requirements will be clarified in Chapter 18 of the SCP. Accuracy criteria and responsibilities will also be clarified. The 4X value is not universally applicable. Specific technical requirements for a calibration program are not appropriate for the SCP. Accuracy criteria will be clarified in the revision to the draft NRC QA Standard Review Plan. This topic will be discussed at a future QA workshop with the NRC.

TABLE IV

SCR APPENDIX OPEN ITEMS

ITEM REFERENCE: Appendix page 11, paragraph 2, page 12, paragraph 9, section 6.1, page 6.1-15, paragraph 4

NRC COMMENT: "Disturbed rock zone...BWIP defines the disturbed rock zone at the 100°C isotherm...Engineered system...100°C isotherm."/--"To what degree might mineral alteration occur at temperatures below 100°C? It is stated in the SCR that the interstitial glassy mesostasis is the 'most reactive' basaltic phase with the groundwater at low-temperature (less than 300°C) hydrothermal conditions."

STATUS: Open

BWIP RESPONSE: The expected alteration minerals for basalt are the same at 100°C and at 50°C (Giggenbach, 1981; Winkler, 1979). The persistence of glassy mesostasis at ambient temperature conditions is evidence that complete alternation of basalt, to form the most stable alteration minerals, has not occurred over the several million years since the formation of the basalt. The alteration of existing basalt is probably due to the partial alteration reaction of the glassy mesostasis, and this is supported by preliminary laboratory data (Apted and Myers, 1982). Raising repository temperatures from ambient to 100°C will cause the rate of this reaction to increase. This rate increase, however, should not be significant relative to the hundreds of years under consideration due to the thermal pulse from waste emplacement. Thus, the alteration of basalt will not be greatly different between 100°C and ambient temperature of the repository.