

dtd 6-13-83

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<u>R. WRIGHT</u>	
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TABLE 1

NRC ISSUES FROM THE DSCA HAVING
SIGNIFICANT IMPACT
ON THE BWIP

May 25, 1983

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Per R. Wright, WMHT,
this document represents the
modifications agreed to by
DOE & NRC during meetings
in Richland 6/13-15/83.

00485

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- A Agree
C Further Clarification
D Disagree

DISPOSITIONS AND RESPONSES TO NRC ISSUES
HAVING SIGNIFICANT POTENTIAL IMPACT ON THE PROJECT

GROUNDWATER

IILM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT ⁺			DISPOSITION
			TOTAL \$	YEAR** IMPACTED	SCHEDULE IMPACT	
P. xvi Item (2)	Head data obtained by "Drill and Test" technique must be validated by establishing a correlation between "Drill and Test" data and a baseline obtained from continuously monitored piezometers. <i>• test conceptual models</i> <i>• define boundary conditions</i> <i>• calc. hydraulic gradients</i> <i>• calibrate numerical models</i>	A	3.8M	1983 1984	TBD ***	Detailed plans for this validation will be provided in the groundwater monitoring plan. Three additional piezometric monitoring stations will be provided and a baseline established by: <i>o Observing equilibration of the monitored zones.</i> <i>o Correlating the monitored zones with head data obtained in existing wells using packers, and</i> <i>o Correlating the monitored zones with head data obtained during drilling.</i> Drilling of these wells is expected to begin shortly and can be completed in FY 84. <i>Plans will be discussed w/ NRC as they are developed.</i>
Sec. 3.5 P. 3-11 Para. 4	NRC requests that DOE consider state-of-the-art, large-scale, multiple well tests which utilize continuous head measurements in various hydro-stratigraphic units.	A	1M*	FY 1984	TBD	Additional large-scale testing will be conducted, but the specific test design and number of required tests will be based on DC-16 test results. Additional facilities for any additional required testing will be coordinated with monitoring facilities. It is anticipated that two additional pumping wells will be needed which would be located to optimize observation locations including the new piezometer stations described above. BWIP recommends that these wells be drilled in FY 84 as soon as the piezometer sites are completed. <i>Plans will be discussed with NRC as they are developed.</i>
⁺ refers to the impact of the NRC position and not the impact of our recommended program unless the NRC's and BWIP's positions are in agreement. [*] This represents the additional funding required to do these tests if the wells needed for the preceding items are completed. ^{**} All years are fiscal years. ^{***} TBD=To be determined						

A - Agrée
C - Further Clarification
D - Disagree

DISPOSITION OF NRC ISSUES HAVING
SIGNIFICANT IMPACT ON THE PROJECT

GEOLOGY

ITEM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT			DISPOSITION
			TOTAL \$	YEAR IMPACTED	SCHEDULE IMPACT	
Sec. 4.5 P. 4-6 Para. 4	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.	C	TBD	1984-1986	TBD	<p>The BWIP agrees that more data are needed on possible structures in the buried basalt in and around the RRL. This information is required for performance assessment and the development of a tectonic model(s). The following data collection and analysis programs are outlined to obtain information on the structure in the Cold Creek syncline;</p> <ol style="list-style-type: none"> 1. Collect additional ground geophysical data 2. Seismic exploration (several lines of reflection) in the RRL. 3. Selected additional magnetotelluric stations (Along RAW, particularly) 4. Long off-set refraction 5. Continued geodetic survey 6. Seismic surveillance 7. Completion of gridded gravity survey and ground magnetics data acquisition. 8. Depending on structures encountered in DC-18, a deep borehole near DC-1 may be required to determine nature of anomalous zones 9. Borehole verification of selected geophysical anomalies. <p>The extent of the investigative program envisioned by the NRC in the DSCA needs clarification.</p>
Sec. 4.4.3 P. 4-9 Para. 6	Two anomalous zones have been identified in borehole DC-1. SCR does not include plans to evaluate these anomalous zones.					
Sec. 4.3.2 P. 4-5 Para. 5	...Uncertainties of geologic structure at depth.					
Sec. 4.4.1 P. 4-7 Para. 3	The DOE should include plans to retrieve oriented core to provide definitive data on the orientation of fractures in the candidate repository horizons.	C	200K 100K 100K	1984 1985 1986	No	<p>Orientation of core in the Untanum 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. In addition, the core scribing process tends to disrupt the integrity of the core samples. It is therefore suggested that core orientation be attempted by use of impression packers. It is also suggested that such attempts be limited to the preferred candidate horizon and zones of possible tectonic breccia. Total cost impact shown represents orientation of core from candidate horizons in 5 existing or planned boreholes and from 8 tectonic zones. Data on fracture orientation will also be obtained in the Exploratory Shaft, Phase II. Clarification regarding the extent of the NRC envisioned program is necessary.</p>

A - Agree
C - Further Clarification
D - Disagree

DISPOSITION OF NRC ISSUES HAVING
SIGNIFICANT IMPACT ON THE PROJECT

GEOLOGY

ITEM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT			DISPOSITION
			TOTAL \$	YEAR IMPACTED	SCHEDULE IMPACT	
Sec. 4.4.1 P. 4-7 Para. 3	The DOE should obtain vertical fracture data by means of deviated, cored boreholes.	C	1M 500K 500K	1984 1985 1986	TBD	Data on vertical fractures have been obtained from surface exposures but the applicability of such data to the RRL is a matter of debate. Moreover, it is impossible to obtain data on fracture infilling minerals from surface exposures. The only way to demonstrate that fracture infilling mineralogy and average widths are not different from those encountered in vertical boreholes is to drill deviated cored 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. It is, therefore, proposed by BWIP that a limited number of deviated boreholes be constructed from existing boreholes in the RRL. These boreholes could well 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. Clarification regarding the extent of the NRC envisioned program is necessary.
Sec. 4.4.2 P. 4-8 Para. 4	The proposed boring program will not adequately define the subsurface geology so that engineering fixes will effectively resolve geologic problems adversely impacting inflow of groundwater into drifts and stability of openings.	C	TBD	TBD	Possible, TBD	The BWIP plans to address this question using a combination of geostatistics, observation of surface outcrops and performance assessment, in conjunction with existing borehole data. If performance assessment indicates that the worst-case bounds of uncertainty still provide the required performance, then additional boreholes may not be appropriate. On the other hand, if geostatistics indicate that the probability of detecting certain features is significantly improved by additional boreholes, then they may be warranted and would so be recommended. The exact number of boreholes required is not yet known. BWIP would like agreement from NRC regarding the adequacy of our approach and the extent of the investigative program they envision.

A - Agrée
C - Further Clarification
D - Disagree

DISPOSITION OF NRC ISSUES HAVING
SIGNIFICANT IMPACT ON THE PROJECT

GEOLOGY

ITEM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT			DISPOSITION
			TOTAL \$	YEAR IMPACTED	SCHEDULE IMPACT	
Sec. 4.4.3 P. 4-9 Para. 3	The impact of Rattlesnake-Wallula Alignment (RAW) on the repository should be determined.	A,C	TBD	1984- 1986	TBD	The impact of the RAW on the repository will be investigated by means of modeling the effect of a 6.5 magnitude earthquake on the alignment on a repository in the RRL. A phased approach to determine the level of additional work will be guided by the results of this modeling. In addition, mapping in Snively Basin and along the Rattlesnake Mountain will be completed and ground geophysical surveys will be extended from the RRL to the flanks of Rattlesnake Mountain. 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 this assessment will be to determine whether or not there are any structures that splay from the RAW into the RRL. Based on the results of these studies, the requirements for field studies south of Wallula Gap will be determined. The extent of the investigative program envisioned by the NRC in the DSCA needs clarification.
Sec. 4.4.3 P. 4-9 Para. 5 Sec. 4.5 P. 4-10 Para. 7	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.	C	TBD	1984- 1986	TBD	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 will have to be studied with a drilling program. It is not agreed that the Nancy linear can be classified as a structure at this time. The extent of the investigative program envisioned by the NRC in the DSCA needs clarification.

**DISPOSITION OF NRC ISSUES HAVING
SIGNIFICANT IMPACT ON THE PROJECT**

GEOLOGY

A - Agree
C - Further Clarification
D - Disagree

ITEM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT			DISPOSITION
			TOTAL \$	YEAR IMPACTED	SCHEDULE IMPACT	
Sec. 5.4.2 P. 5-12 Para. 3	Plans to characterize the stratigraphy and mineralogy below Grande Ronde Basalt were omitted from the SCR.	D,C	TBD	1984 1985 1986	TBD	BWIP disagrees with this issue and would like 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 that 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 investigative program they envision.
Sec. 5.4.2 P. 5-12 Para. 3	More detailed 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.	C	400K 500K 500K 300K	1984 1985 1986 1987	No	It is agreed that mineralogy along the flow paths must be determined. Detailed characterization to meet NRC concerns would require detailed descriptions of Grande Ronde and Wanapum flows and interbeds in RRL boreholes and at available boreholes farther down the syncline in the presumed direction of groundwater transport. These descriptions would include a detailed visual estimate of abundance of secondary minerals, and vesiculation, and detailed measurement of filled fracture widths. These data would need to be supported by additional mineral analysis and identification, including X-ray diffraction, electron microprobe, optical microscope, and electron microscope analysis. Clarification and 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. BWIP believes that adequate characterization for performance assessment could be accomplished with lesser detail than implied by the DSCA. Specifically, examination of selected boreholes and strata with focus on the candidate horizons should achieve the desired end.

A - Agree
C - Further Clarification
D - Disagree

DISPOSITION OF NRC ISSUES HAVING
SIGNIFICANT IMPACT ON THE PROJECT

GEOCHEMISTRY

ITEM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT			DISPOSITION
			TOTAL \$	YEAR IMPACTED	SCHEDULE IMPACT	
Ch. 11 P. 11-9 Sec. 5.5.1 P. 5-14 Para. 3 & 4	The NRC recommends a classical thermodynamic approach to the determination of radionuclide solubilities.	D,C	8M	1984- 1986	Yes	The BWIP does not agree with a thermodynamic approach to evaluating radionuclide solubilities. Technology may not be available to adequately identify and make sufficient quantities of radionuclide-containing solid phases to conduct the experiments NRC suggests. The NRC program would result in a 7 to 10 year delay in project schedule. The BWIP feels that a more empirical approach to evaluating radionuclide solubilities is appropriate.
Ch. 11 P. 11-6	More information is required to adequately define site redox conditions through time and its effect on radionuclide solubility/sorption and the site isolation capability.	A	150K 150K	1984 1985	No	This requires development of in-situ Eh monitoring capabilities, extensive characterization of secondary minerals lining fractures and in flow tops, and detailed analysis of redox couples in groundwaters; detailed planning will be incorporated into the Barrier Materials Test Plan.
Sec. 5.3.2 P. 5-6 Para. 5; Sec. 5.4.2 P. 5-12 Para. 2-5; Sec. 5.5.1 P. 5-14 Para. 3-5; Ch. 11 P. 11-7 p. 11-8	More information is required pertaining to solids characterization; i.e., sorption/solubility phase identification, backfill stability, corrosion products, validation of Eh control of basalt environment.	A, C	TBD	1984- 1986	TBD	The level of effort suggested by the NRC in the areas of radionuclide sorption and solubility behavior, backfill stability Eh validation, and canister corrosion behavior would require a considerably increased level of effort in solids characterization. Clarification is needed regarding the exact level of effort envisioned.

A - Agree
C - Further Clarification
D - Disagree

DISPOSITION OF NRC ISSUES HAVING
SIGNIFICANT IMPACT ON THE PROJECT

WASTE FORM/WASTE PACKAGE

ITEM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT			DISPOSITION
			TOTAL \$	YEAR IMPACTED	SCHEDULE IMPACT	
Sec. 7.3.4 P. 7-9 Para. 3; App. B P. 11-14 Para. 8	Waste Form Issue: Borosilicate glass questioned as an effective release barrier in NWRB, particularly under hydrothermal conditions. Requires DOE decision on development of contingency (alternate) waste form.	C	TBD	TBD	Likely, TBD	The BWIP approach has been to not emphasize waste form release, but fate of radionuclides; i.e., no performance required of waste form. All release and containment performance is required of the canister, backfill and the site. If testing of an alternate waste form were required, testing of the alternate would effectively double the waste-barrier-rock interaction work currently underway.
Ch. 11 P. 11-13	Develop and implement a reliability program to demonstrate satisfaction of NRC performance criteria.	A,C	250K TBD	1984 1985 1986	No	Development of engineering design and reliability analysis plan for waste package is underway. Discussions with NRC regarding the program they envision would be desirable.

A - Agree
C - Further Clarification
D - Disagree

DISPOSITION OF NRC ISSUES HAVING
SIGNIFICANT IMPACT ON THE PROJECT

QUALITY ASSURANCE

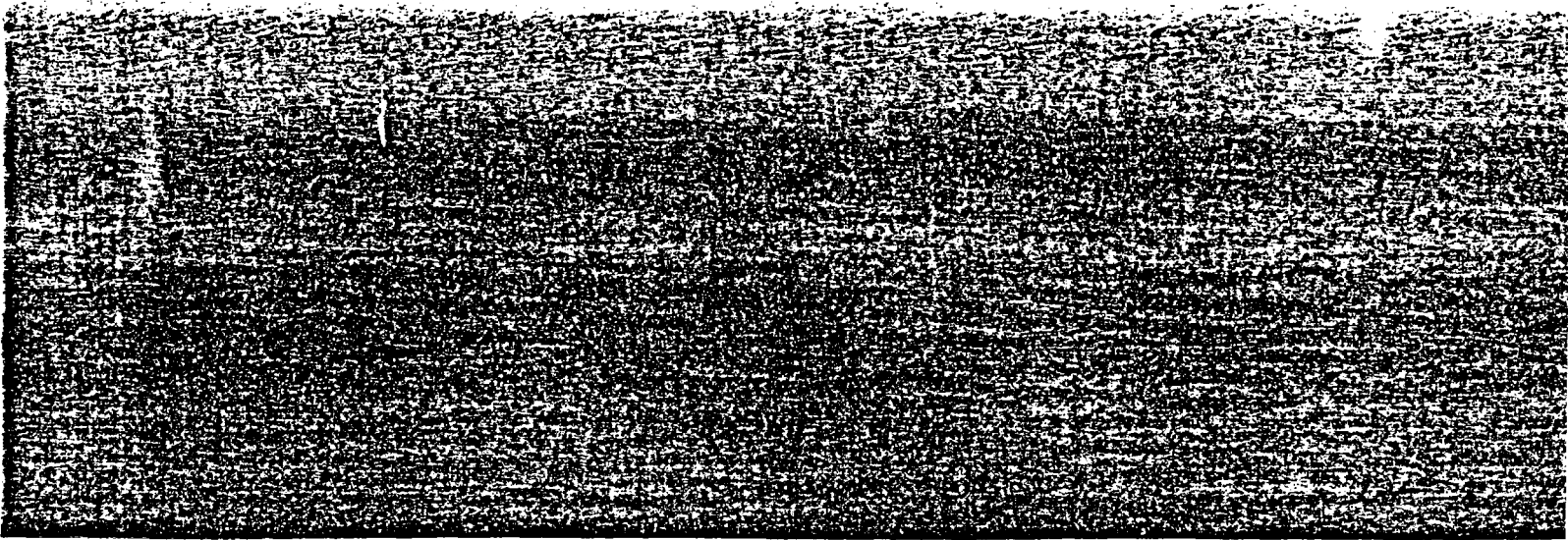
ITEM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT			DISPOSITION
			TOTAL \$	YEAR IMPACTED	SCHEDULE IMPACT	
App. B P. 94 Item 4	Verification of conformance to requirements is to be accomplished only by personnel within the Quality Assurance (BWIP QA) organization.	D	300K TBD	1984 1985	No	Verification activities are performed by individuals at all levels across the BWIP. These activities are conducted in accordance with overall QA Program requirements and are subject to surveillance and audit by BWIP QA personnel.
App. B P. 97 Item 1	Provide for proficiency testing of personnel performing and verifying activities affecting quality. Develop acceptance criteria to determine if individuals are properly trained and qualified, and issue certificates of qualification indicating specific skills for which the individual is qualified.	D	TBD	1984- 1986	No	Proficiency testing during the construction phase is limited to nondestructive testing disciplines and selected special processes. During the operations phase, however, proficiency testing for Control Room and operations personnel is required by 10 CFR 60.*
Ch. 11 P. 11-16 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.	C	TBD	1984- 1986	No	DOE has provided guidance on implementing a repository design "Reliability, Availability, and Maintainability (RAM)" program in ONWI-334. Implementation of the requirements of DOE-RL order 5700.2 and DOE order 6430 is complete, and will be addressed in the SCP. BWIP recommends discussing these issues with NRC to understand their interpretation of the extent of these requirements.
* No assessment of the impact of proficiency testing on technical pay scales is possible at this time. Traditionally, institution of proficiency testing has resulted in increases to technical staff base pay of from 6% to 20%.						

A - Agree
C - Further Clarification
D - Disagree

DISPOSITION OF NRC ISSUES HAVING
SIGNIFICANT IMPACT ON THE PROJECT

QUALITY ASSURANCE

ITEM REFERENCE	MAJOR NRC ISSUES	RECOMMENDED POSITION	OVERALL IMPACT +			DISPOSITION
			TOTAL \$	YEAR** IMPACTED	SCHEDULE IMPACT	
Ch. 10 P. 10-3 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 to detailing specific technical procedures." The planning "must start by considering EPA and NRC criteria." Also, "few detailed test plans are referenced in the SCR for any of the major test programs mentioned." 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.	D, C	TBD	1984	Yes	A major planning effort, similar to that imposed on production reactors, has yet to be instituted for the BWIP. Should the determination be made that this planning must precede the site characterization effort, the impact would be extensive, both in terms of cost and schedule delay.



Note: BWIP Comments in tables 2 and 3 refer to information and plans that the NRC staff has not seen. Therefore, NRC cannot fully evaluate the "BWIP comments" until the information and plans are made available for analysis and are discussed between NRC and BWIP.

TABLE 2

DISPOSITIONS AND RESPONSES TO NRC COMMENTS

FROM CHAPTERS 1 THROUGH 11 OF THE DSCA

May 25, 1983

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A Agree
 C Requires further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)

GROUNDWATER

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Page xii Second ¶	Uncertainties in groundwater flow system inadequately conveyed	A	Comprehensive programmatic planning is under way 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. <i>Plans will be discussed w/ the NRC as they are developed.</i>
Page xiii and xiv, Items 1-4	Hydraulic data is inadequate to support a defensible conceptual model.	A	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. <i>Plans will be discussed with the NRC as they are developed.</i>
Page xvi Item 1	Large scale pump tests to the north and east of the RRL are required to adequately establish groundwater flow conditions.	A, X	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.
Page xvi Item 2	Head data must be validated by groundwater monitoring techniques.	A, X	Detailed plans for this validation will be provided in the groundwater monitoring plan. Additional monitoring wells will be drilled.
Page xx and xxi	A careful and clearly documented strategy for data collection and interpretation must be provided.	A	Chapter 13 of the SCP will contain a framework under which this planning will take place. Programmatic planning documents will provide the necessary detail.
Section 3.4.3, p. 3-10, last sentence	Furthermore, the...Carbon-14 relationships. (Need for paleohydrologic and paleoclimatological models to interpret data and develop geochemical models) <i>[Lesser priority item]</i>	C.	We would like to understand what paleohydrologic and paleoclimatological modeling techniques are being proposed. <i>NRC will provide written clarification.</i>

- A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)

GROUNDWATER

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Section 3.5 p. 3-11 Item (1)	<u>Representative hydraulic parameter values</u> (Need for state-of-the-art large-scale multiple well pumping tests.)	A, X	Large scale pumping tests from DC-16B will be conducted to obtain the required data. Additional pumping holes will be drilled and tested in clusters. <i>Plans will be discussed w/ the NRC as they are developed</i>
Section 3.5 p. 3-11 Item (2)	<u>External Boundary Conditions</u> (Need for long-term measurements of hydraulic heads)	A, X	A network of three piezometric monitoring stations 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.
Section 3.5 p. 3-12 Item (3)	<u>Effective Porosity</u> (Need for state-of-the-art multiple-well tracer tests)	A	<i>Findings of the hydrology model task force should be as</i> Tracer tests are planned or have been conducted at <i>in the</i> all multiple well sites. The status of these and future plans will be documented in the SCP. <i>Plans will be discussed w/ the NRC as they are developed.</i>
Section 3.5 p. 3-12 Item (4)	<u>Hydrochemistry</u> o Integration of data with defensible data on the hydraulic flow system is needed	A	Chapter 13 of the SCP will be modified to provide a framework for better integration. Geochemical modeling will be utilized to support integration.
	o Matrix diffusion data should be obtained to support transport modeling <i>[lesser priority item]</i>	C	Discussions with NRC staff are necessary to understand their recommendations. <i>NRC will provide additional references to clarify the techniques.</i>
Section 3.5 p. 3-12, Item (5)	<u>Alternate Conceptual Models</u> (Need for sensitivity studies to test alternative conceptual models)	A	Chapter 13 of the SCP will be modified to include plans for consideration of a full range of conceptual models. <i>Alternative conceptual models</i> <i>Plans will be discussed with the NRC at a future date.</i>

KEY TO PRIORITIES

- I Structural geology / Plans / Open items
 -intraflow
 -tectonic
- II Seismicity
- III Tectonic Stability

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC COMMENTS
(FROM CHAPTERS 1 through 11 OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 4.3.2 p 4-4 para. 1	The SCR inappropriately places too much emphasis on the predictive accuracy for total flow thickness...	<i>Presumably</i> 1 A	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 this concern relative to flow top thickness.
Sec. 4.3.2 p 4-5 para. 3	...DOE should consider that the intact volumes of rock...are far more complex in structure than the SCR indicates (see page 3.7-28, para. 1).	1 C A	The BWIP recognizes that the "relatively intact volumes of bedrock in the RRL are complex, and has so stated in the SCR (3.7-28, para. 3). The term "relatively intact" has been used as a structural term to indicate those areas that are less likely to have been disrupted by deformational processes than adjacent areas known to have experienced significant deformation. <i>A more balanced treatment will be presented in the SCP.</i>
Sec. 4.3.2 p 4-5 para. 5	...Uncertainties of geologic structure at depth.	1 C X A	The BWIP agrees that more data are needed on possible structures in the buried basalt in and around the RRL. This information is required for performance assessment and the development of a tectonic model(s). The following data collection and analysis programs are outlined to obtain information on the structure in the Cold Creek syncline: <ol style="list-style-type: none"> 1. Collect additional ground geophysical data. 2. Seismic exploration (several lines of reflection) in the RRL. 3. Selected additional magnetotelluric stations (Along RAW, particularly) 4. Long off-set refraction 5. Continued geodetic survey 6. Seismic surveillance 7. Completion of gridded gravity survey and ground magnetics data acquisition. 8. Depending on structures encountered in DC-18, a deep borehole near DC-1 may be required to determine nature of anomalous zones. 9. Borehole verification of selection geophysical anomalies.

Subsequent discussions with NRC will be held to discuss the matter of constraining uncertainties.

The extent of the investigative program envisioned by the NRC in the DSCA needs clarification.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM CHAPTERS 1 through 11 OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 4.3.2 p 4-5 para. 3	The extent to which these stratigraphic and structural features adversely influence hydrologic isolation, inflow into drifts, and the stability of openings must be determined.	1 A	Such determinations, as will be outlined in the SCP plans, constitute a significant part of BWIP's work. <i>These plans will be integrated with hydrology and engineering.</i>
Sec. 4.3.3 p 4-6 para. 3	DOE should update their references to include alternate tectonic models while completing their detailed studies.	3 A	Additional tectonic models will be presented and discussed in the SCP.
Sec. 4.3.3 p 4-6 para. 4	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).	3 C, X A	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.
Sec. 4.3.3 p 4-6 para. 4	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.	1 G, X A	See Sec. 4.3.2, p 4-5, para. 4 <i>Plans for assessing possibilities of low-angle faulting will be addressed in Chapter 13 of the SCP.</i>
Sec. 4.4.1 p 4-7 para. 3	The DOE should include plans to retrieve oriented core to provide definitive data on the orientation of fractures in the candidate repository horizons.	1 G, X A	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. In addition, the core scribing process tends to disrupt the integrity of the core samples. It is, therefore, suggested that core orientation be attempted by use of impression packers. It is also suggested that such attempts be limited to the preferred candidate horizon and zones of possible tectonic breccia. Data on fracture orientation will also be obtained in the Exploratory Shaft, Phase II. Clarification regarding the extent of the NRC envisioned programs is necessary. <i>Alternative methods for providing definitive data on the orientation of fractures are being investigated.</i>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM CHAPTERS 1 through 11 OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 4.4.1 p 4-7 para. 3	The DOE should obtain vertical fracture data by means of deviated, cored boreholes.	/ C, X A	Data on vertical fractures have been obtained from surface exposures but the applicability of such data to the RRL is a matter of debate. Moreover, it is impossible to obtain data on fracture infilling minerals from surface exposures. The only way to demonstrate that fracture infilling mineralogy and average widths are not different from those encountered in vertical boreholes is to drill deviated cored 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. <i>It is, therefore, proposed by BWIP that a limited number of deviated boreholes be constructed from existing boreholes in the RRL. These boreholes could well 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. Clarification regarding the extent of the NRC envisioned program is necessary.</i> <i>These boreholes were analyzed and based on these results,</i>
Sec. 4.4.1 p 4-7 para. 4	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...	4 A	Data points will be added to the top-of-basalt contour map in the SCP.
	Figure 3.5.2 (SCR, page 3.7-29) does not distinguish between known and inferred structures.	4 A	A distinction between known and inferred structures will be made on Figure 3.7-29 of the SCP.
	Inconsistencies between text, tables, and figures.	4 A	Tables, text, and figures will be checked for consistency.
	Schematic or incomplete presentation of data...	4 A	Details will be added by inserting data and/or references to published data in the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM CHAPTERS 1 through 11 OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 4.4.2 p 4-8 para. 2	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.	1 <i>DA</i>	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 NRC at the April, 1983 Geologic Stability Workshop. The BWIP plans to proceed with the lateral variation studies described in the SCR.
Sec. 4.4.2 p 4-8 para. 4	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.	1 A	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. <i>Details will be provided in St-28 (Horizon Identification Study)</i>
Sec. 4.4.2 p 4-8 para.4	...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...	1 <i>DA</i>	The BWIP plans to address this question using a combination of geostatistics, observation of surface outcrops and performance assessment, in conjunction with existing borehole data. If performance assessment indicates that the worst-case bounds of uncertainty still provide the required performance, then additional boreholes may not be appropriate. On the other hand, if geostatistics indicate that the probability of detecting certain features is significantly improved by additional boreholes, then they may be warranted and would so be recommended. The exact number of boreholes required is not yet known. The BWIP would like agreement from NRC regarding the adequacy of our approach and the extent of the investigative program they envision. <i>Plans will be presented in Chapter 13 of SEP and in the ES Test Plan.</i>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 4.4.2 p 4-8 para. 4	The use of "state-of-the-art" geophysical techniques...in the repository host rock.	/ A	State-of-the-art techniques are being developed for Exploratory Shaft investigations. A phased approach will be used to insure that the applicability of all the more routine methods are thoroughly investigated. The approach will be documented in the SCP.
Sec. 4.4.2 p 4-8 para.4	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.	/ A	The fundamental basis for determining the adequacy of knowledge of the site is a performance assessment evaluation. Additional borehole investigations will be based on the need to reduce uncertainty as prescribed by performance assessment allocations. The requested rationale will be included in the drilling and testing plan and will be referenced in the SCP.
Sec. 4.4.3 p 4-9 para. 2	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.	3 C X A	<i>See Test Plan</i> 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 will be included in the SCP.
Sec. 4.4.3 p 4-9 para. 3	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.	2 C X A	A phased approach will be used to assess the RAW. Field investigations will concentrate in that portion of the RAW northwest of Wallula Gap to determine the character and location of 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 south of Wallula Gap, as required.

A -- Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM CHAPTERS 1 through 11 OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 4.4.3 p 4-9 para. 3	The impact of Rattlesnake-Wallula Alignment (RAW) on the repository should be determined.	2 A. DX	The impact of the RAW on the repository will be investigated by means of modeling the effect of a 6.5 earthquake on the alignment on a repository in the RRL. A phased approach to determine the level of additional work will be guided by the results of this modeling. In addition, mapping in Snively Basin and along the Rattlesnake Mountain will be completed and ground geophysical surveys will be extended from the RRL to the flanks of Rattlesnake Mountain. 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 this assessment will be to determine whether or not there are any structures that splay from the RAW into the RRL. Based on the results of these studies, the requirements for field studies south of Wallula Gap will be determined. The extent of the investigative program envisioned by the NRC in the DSCA needs clarification. <i>Plans will be presented in Chapter 13.</i>
Sec 4.4.3 p 4-9 para. 3	The NRC staff is concerned about reliance on geophysical investigations to define geologic structure in the Pasco Basin.	1 DX A	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. <i>Plans in Chapter 13.</i>
Sec. 4.4.3 p 4-9 para. 5;	The NRC is concerned about the adequacy 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.	1 DX A	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 extent of the investigative program envisioned by the NRC in the DSCA needs to be clarified. <i>Plans will be presented in Chapter 13.</i>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM CHAPTERS 1 through 11 OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 4.4.3 p 4-9 para. 6	Two anomalous zones have been identified in borehole DC-1 from 1,210 to 1,222 m and 1,273 to 1,301 m.	1 C *	Plans will be developed to investigate the nature of these zones based upon results from DC-18. If assessment is required, an additional borehole may be needed near DC-1.
Sec 4.4.3 p 4-10 para. 1	Develop plans to evaluate the effect of near-field ground motion from micro-earthquakes to determine what influence they may have on seismic design.	2 C A	The Seismic Surveillance Test Plan provides for data collection; a Seismic Design Task Force has been established to evaluate seismic design needs for a repository in basalt.
Sec. 4.5 p 4-10 para. 2 Item 1	...details of the work plan's 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.	1 A	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.
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.	4 A	Data will be included in future documents to the extent practicable. Additional data will be referenced as appropriate.
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.	1 C * A	(See Sec. 4.4.3, p 4-9, para. 5)
Item 6	No plans to investigate micro-earthquake triggering mechanisms in the controlled zone.	2 A	Such plans are included in the Seismic Surveillance Test Plan. This plan will be referenced in the SCP.
Sec. 5.4.2 p 5-12 para. 3	Plans to characterize the stratigraphy and mineralogy below Grande Ronde Basalt were omitted from the SCR.	1 C * NRC OPEN ITEM	BWIP disagrees with this issue and would like 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

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO DISPOSITIONS
 (FROM CHAPTERS 1 through 11 OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 5.4.2 p. 5-12 para. 3	More detailed 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.	① X A	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. <i>more information is required fully</i> It is agreed that mineralogy along the flow paths must be determined. Detailed characterization to meet NRC concerns would require detailed descriptions of Grande Ronde and Wanapum flows and interbeds in RRL boreholes and at available boreholes farther down the syncline in the presumed direction of groundwater transport. These descriptions would include a detailed visual estimate of abundance of secondary minerals, and vesiculation, and detailed measurement of filled fracture widths. These data would need to be supported by additional mineral analysis and identification, including X-ray diffraction, electron microprobe, optical microscope, and electron microscope analysis. Clarification and 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. The BWIP believes that adequate characterization for performance assessment could be accomplished with lesser detail than implied by the DSCA. Specifically, examination of selected boreholes and strata with focus on the candidate horizons should achieve the desired end.
Chap. 11 p 11-6 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.	① X OPEN ITEM NRC	The causes of volcanic activity in the Pasco Basin were not considered because the basaltic rocks in the basin all have a similar origin (cause). By assuming that future volcanism in the Pasco Basin would be similar in origin, it was possible to focus on frequency. Clarification of the applicability of the causal approach is required.

- A - Agree
- C - Requires Further Clarification
- D - Disagree
- X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC INRC COMMENTS
(FROM CHAPTERS 1 through 11 OF THE DSCA)

GEOLOGY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 11 p 11-6 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.	4 C A	The BWIP agrees that such scenarios should be considered. However, the level of detail required in such considerations needs to be clarified. Plans for modeling the effect of renewed glaciation on the host flow will be added.
Chap. 11 p 11-8 item 9	Petrology of flow tops and interbeds where groundwater will spend 85 to 90 percent of travel time.	1 C X A	See the response to Section 5.4.2, p 5-12, para. 3, on same subject.
Chap. 11 p 11-10 item 12	The groundwater and geochemical environment of the Middle Sentinel Bluffs flow; relation to Umtanum data base.	4 A	The currently available data on the groundwater and geochemical environment of the Middle Sentinel Bluffs flow (Cohasset flow) will be reported in ST-28 (Horizon Identification Report).

Insert "A"

ADD TO GEOCHEM MEETING NOTES

RECEIVED
JUN 15 1983

6/15/83

Philip S. Jurek

M. J. SMITH

The comments in the right hand columns discussed in Tables 2 and 3 contain both information and references to plans that NRC staff has not ~~previously~~ seen ~~revised~~; some publications referred to are not yet available. NRC cannot, therefore, fully evaluate the "BWIP Comments" until the new data and proposed plans are made available for analysis and are discussed between NRC and BWIP staff such that a thorough and constructive evaluation can be made.

rsj

Priorities

Categories

- ① {
 - Redox ①
 - Sorption ④
 - Mineral Stability ⑤
 - Solubility ②
 - Geochem. transport/modeling ③
- ② {
 - Speciation/Complexation ⑥
 - Natural Analogs ⑦
- ③ Other

C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)

GEOCHEMISTRY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 5 p. 5-2 Para. 1 (also re- lated items on pages 5-4, 5-10, 5-11 and 5-13)	① 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.	A	A more complete summary of future plans will be included in Chapter 15 of the SCP.
Chap. 5 p. 5-6 Para. 5 and p. 5-12 p. 4	④ Sufficient sorption data including solid phase characterization are not available for flowtops and interbeds where ground-water will spend most its time flowing.	A, X	The BWIP has been conducting sorption experiments on a limited number of flowtop materials. Available data will be incorporated into the SCP. Detailed plans for evaluating radionuclide sorption behavior will be referenced in the SCP. (Sorption test plans will be included in the BMTTP)
Chap. 5 p. 5-12 p. 2-5	② 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.	A	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) also will 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.
Chap. 5 p. 5-14 Para. 3	② The NRC staff believes that solubility determinations (steady-state condition) should be approached from both oversaturation and under saturation.	C ✓	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 BMTTP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)
 GEOCHEMISTRY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 5 p. 5-14 Para. 4 (2)	<p>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, under the whole range of possible conditions, and experimentally verifying thermodynamic phase boundaries pertinent to solubility relationships.</p> <p>If the BWIP adopts an rigorous thermodynamic approach to determining radionuclide solubilities, then...</p> <p>including complex formation.</p>	A X	<p>The BWIP does not</p> <p>It is unrealistic to expect the BWIP 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 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 radionuclide concentration on solubility will be considered as parameters.</p>
Chap. 5 p. 5-14 Para. (2)	<p>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.</p>	A	<p>Preliminary plans have been made to determine solubilities of some key radionuclides at elevated temperatures (>100°C) beginning in FY 1984. They will be summarized in the SCP. Plans will be summarized in the SCP. update. Reliable data from BWIP.</p>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)
Geochemistry

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
① Chap. 11 p. 11-6 Item 4	More information is required to adequately define site redox conditions through time and its effect on radionuclide solubility/sorption and the site isolation capability.	A, X	This requires development of in situ Eh monitoring capabilities, extensive characterization of secondary mineral lining fractures and in flow tops, and detailed analysis of redox couples in groundwaters. Detailed planning will be incorporated into the Barrier Materials Test Plan (SC-BWI-TP-022). <i>Response of radionuclides to redox environment.</i>
④ Chap. 11 p. 11-7 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.	A, X	The BWIP has supported 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 complete and BWIP is now directing its effort to complete work on flow top, backfill materials, and basalt from several candidate repository horizons. This additional information and plans will be included in the SCP. <i>altered basalt</i>
④ Chap. 11 p. 11-7 Item 8	<i>det</i> Radionuclide Kd measurements and isotherm determinations be determined by the batch method. <i>also per Appendix T; SCP.</i> <i>and flow through</i>	A, X	BWIP has found very few radionuclide sorption reactions that have linear isotherms. For this reason BWIP now reports most sorption data in terms of isotherms rather than single distribution coefficients (K _d 's). 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.
④ Chap. 11 p. 11-7 Item 9	Find grinding. Effect of fines generation by mechanical abrasion during batch Kd measurements on radionuclide sorption behavior.	A	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.
④ Chap. 11 p. 11-7 Item 10	Rock:water ratio. Effect of mass ratio of rock to groundwater used in the batch Kd experiments on radionuclide sorption	A	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 Chapter 6 of the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)
 GEOCHEMISTRY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
① Chap. 11 p. 11-7 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 condition.	A	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 to a NWRB. BWIP has been concerned with control of groundwater 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 rates of radionuclide reduction. The second approach used is to remove oxygen to very low levels in the groundwater-solid system so that naturally-occurring 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 are being completed and will be discussed in Chapter 6 of the SCP.
④ Chap. 11 p. 11-8 Item 1	Reversibility of sorption reactions on evaluating radionuclide transport.	A	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 of these studies will be presented in Chapter 6 of the SCP. <i>and discussion</i>
④ Chap. 11 p. 11-8 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.	A	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 of these studies will be summarized in the SCP. <i>and evaluation</i>

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 11 p. 11-8 Item 4 (4)	The effects <u>on sorption</u> 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.	A	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 radionuclides is recognized as a potentially significant mechanism by the BWIP and will be discussed in Chapter 6 of the SCP.
Chap. 11 p. 11-8 Item 5 (9)	Large variability of the Kd values.	A	The wide ranges of Kd values reported in the SCR are due to non-linearity of respective sorption isotherms and differences in experimental conditions used for the measurements. The ranges are <u>not</u> 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.
Chap. 11 p. 11-8 Item 10 (6)	NRC recommends a more detailed evaluation of radionuclide speciation/complexation behavior, particularly effect of available ligands on radionuclide sorption behavior.	A, S , X <i>a parametric approach to speciation/complexation behavior is used.</i>	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 ²⁻ 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 of completed studies will be presented in Chapter 6 of the SCP. Clarification is needed from NRC regarding the extent of the program they envision. Future plans will be discussed in the SCP. <i>Speciation will be discussed and detailed.</i>
Chap. 11. p. 11-8 Item 11 (4)	NRC recommends that more emphasis be placed on evaluating the potential for colloid formation in both the near field and far field. Colloids provide a potential mechanism for radionuclide transport. <i>Soil field physical-chemical characteristics as related to radionuclide transport.</i>		The BWIP is aware of the potential importance of colloids as a means of transport of radionuclides 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.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)

GEOCHEMISTRY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
2 Chap. 11 p. 11-9 Item 1, 2, 3	Mineralogical changes due to heat generated by the repository - Availability of K as the result of dissolution of basaltic glass at elevated temperature. - Dehydration of smectite under reduced water pressure followed by hydration under later saturated conditions.	A & X	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 <u>dehydration</u> and are, therefore, not misapplied. If saturated fracture environments are characterized by high pressure (hydrostatic to lithostatic) then dehydration will not occur. Additional information on this subject will be included in the SCP.
Chap. 11 p. 11-9 Item 4	(delete) The NRC recommends a classical thermodynamic approach to the determination of radionuclide solubilities.	D, C, X	BWIP does not agree with thermodynamic approach to evaluating radionuclide solubilities. Technology may not be available to adequately identify and make sufficient quantities of radionuclide-containing solid phases to conduct the experiments NRC suggests. The NRC program would result in a 7 to 10 year delay in project schedule. The BWIP feels that a more empirical approach to evaluating radionuclide solubilities is appropriate.
2 Chap. 11 p. 11-9 Item 11, 12	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^{2-} , H_2O/OH^-) and that should be evaluated.	A	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 (100°-300°C) hydroxyl (OH^-) and carbonate (CO_3^{2-}) equilibria become important. This will be addressed in Chapter 6 of the SCP. <i>dominant and evaluated</i>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)
 GEOCHEMISTRY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
1 Chap. 11 p. 11-10 Item 1 <i>NRC OPEN</i>	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." <i>"open to NRC response" - will be clarified</i>	C	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. <i>A discussion of how the natural studies will be used to support WP design will be included in the SCP.</i>
2 Chap. 11 p. 11-10 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.	<i>X</i> A	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 statement needs to be expanded for clarity.
3 Chap. 11 p. 11-10 Item 3 <i>NRC OPEN</i>	Experimental data from available literature on montmorillonite suggest that this material may not be stable under expected repository conditions.	C	See comment on mineralogical changes due to heat, p. 11-9. <i>NRC should provide referenced literature as basis for discussion/clarification of item.</i>
4 Chap. 11 p. 11-10 Item 6	The applicability of the DOE natural analog program should be addressed. <i>including evaluation natural uranium deposits</i>	A	The natural analogues discussed in the SCR will be re-evaluated in terms of their applicability to the basalt geochemical environment. Because the spatial and temporal variations of geochemical conditions are important parameters that affect the applicability of "natural analog" comparisons may not be known and require that such studies must be approached cautiously. The SCP 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," p. 11-10). In addition, the fresh water-basalt hydrothermal fields in Iceland will be the subject of a future analog study by BWIP.

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)
 GEOCHEMISTRY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
<i>2</i> Chap. 11 p. 11-10 Item 7, 8	The possibility of enhanced migration of radionuclides by particulate and colloid transport should be investigated.	A	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. ✓
<i>6</i> Chap. 11 p. 11-10 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.	A	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 will be discussed in the SCP. <i>and available data</i> ✓
<i>0</i> Chap. 11 p. 11-10 Item 10 <i>NRC OPEN</i>	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. <i>NRC open item.</i>	D	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 to support this contention. All data and test results to date still confirm this statement. The statement will be clarified to assure it is properly understood. <i>in the SCR</i>
<i>8</i> Chap. 11 p. 11-10 Item 11	The plans by the BWIP to define background radiation level, should be thoroughly discussed. <i>as result of potential leakage from defense waste processing activities at the Hanford site.</i> <i>previous and potential.</i>	<i>EA</i>	This NRC concern requires clarification <i>Background radiation level will be addressed as part of the baseline environmental assessment. The EA will be referenced in the SCP in Chapter 8.</i>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)
GEOCHEMISTRY

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chapter 11 p. 11-10 Item 14	<p><i>The SCR states that</i> The SCR gives a conceptual geochemical model of the prevailing geochemical conditions of the basalt environment as controlled by rock/water interactions. All of the available evidence for this model should be addressed and alternate explanations should be investigated.</p> <p><i>guided by observed and postulated geochemical reactions mechanisms, has been outlined.</i></p> <p><i>The status of these models as to their validity and construction of alternative conceptual models shld be evaluated.</i></p>	C A	<p>The BWIP recognizes certain limitations in the conceptual models as they relate to Eh, radionuclide sorption, and solubility as presented in the SCR. Currently, we are 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. Both experimental studies and geochemical modeling of the ambient basalt geochemical system will be discussed in Chapter 6 of the SCP.</p> <p><i>and plans for</i></p>
Chap. 11 p. 11-11 Item 1	<p><i>procedures</i> The manner by which geochemical data is input into the performance assessment models should be clarified</p> <p><i>are</i> and assessed.</p>	C A	<p>Detailed plans to provide information for determining the source terms at the very near-field, through performance assessment modeling of the waste package will be addressed in the Barrier Materials Test Plan. Additional geochemical input requires clarification from NRC regarding this concern.</p> <p><i>In particular how this relationship to geochemical models will be discussed.</i></p>
Chap. 11 p. 11-11 Item 6	<p>There should be a fuller discussion of whether radionuclide releases are leach limited versus solubility limited.</p>	A	<p><i>Relationship of geochemical models to (waste package system) to overall performance assessment will be discussed in Chapter 12</i></p> <p>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.</p>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)

II
 REPOSITORY DESIGN

S = NRC concerned over
 schedule and/or timing
 of activity. DOE/RMO has
 action to provide revised input
 to NRC.

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
1 Sec. 6.3.1 p. 6-3 Para. 2	"Conceptual design of openings in the underground facility has not considered the potential variability in important rock parameters properties." (NRC supplemented comment 1)	A S	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 the parameters is. The results of these activities will then be factored into the upgraded conceptual design. A statement ^{discussion} regarding the plans will be included in Section 10.5. for sensitivity analyses.
2 Sec. 6.3.1 p. 6-3 Para. 3	"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.). (NRC Sup. com. 2)	A S	Details and results of scoping calculations based on empirical methods and two- and three-dimensional numerical modeling studies will be presented in a <u>cleared report</u> and referenced in Section 10.10.
3 Sec. 6.3.1 p. 6-4 Para. 3	"Low priorities are given to important activities." (Specifically Work Element R.1.10.A - Sensitivity Studies of Rock Mechanic Parameters). NRC Sup. com. 3)	A S	The importance of a parameter sensitivity study is recognized and this activity will be given higher priority in the future; the priority rating of <u>Work Element R.1.10.A</u> will be changed to 1 from 2.
4 Sec. 6.3.1 p. 6-3 Para. 4	"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)." (NRC Sup. comment 4)	A	Future evaluations of rock mass strength will be based on Hoek and Brown's 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 described above will be included in the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC ITEM COMMENTS
 (FROM APPENDICES D AND E OF THE DSCA)

Ch 1 -11

REPOSITORY DESIGN

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
6 6.3.1 p. 6-3 Para. 4	"The assumptions of linear elastic analysis used in the conceptual design for computing excavation-induced and thermal stresses are not applicable to jointed basalts." (NRC #5)	A	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 constitutive 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. 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. <i>and rock temperatures</i>
6 6.3.1 p. 6-3 Para. 5	"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." (NRC #6)	A	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 Exploratory Shaft tests. This will provide adequate information on in situ property ranges which might be expected throughout the RRL. It should be noted that long horizontal boreholes will be driven ahead of drift development to better anticipate rock mass variability. <i>plus</i> The detailed discussion of this plan will be included in Chapters 17 and 18. <i>the development to investigate and deal with geologic variability</i>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

REPOSITORY DESIGN

ITEM REFERENCE	STATEMENT OF ITEM - COMMENT'S CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
7 Sec. 6.3.2 p. 6-5 Para. 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. (NRC Item 7)	A	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.
8 Sec. 6.3.3 p. 6-6 Para. 2	"...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." (NRC Comment 8)	A	The contents of ^P 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.
9 Sec. 6.3.3 p. 6-7 Para. 3	"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." (NRC Comment 9)	A	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. The Schedules for laboratory and field test are being evaluated and will be included in the SCP.

- A Agree
- C Requires Further Clarification
- D Disagree
- E Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

REPOSITORY DESIGN

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
10 Sec. 6.3.3 p. 6-7 Para. 3	"No schedule for completion of this work element (R.1.18.D) is provided." (NRC Comment 10)	A	Section 10.8 will be modified in the SCP to include performance requirements for the repository seal system which will be available June 30, 1983. (Note. It is anticipated that all seal requirements relative to repository radionuclide isolation performance can be met through the action of shaft seals alone, i.e., no tunnel seals required.)
11 Sec. 6.3.3 p. 6-7 Para. 4	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 the input parameters for performance assessment will be addressed. (NRC Comment 11)	A	A new repository performance assessment plan for allocating isolation performance among site, seals, and waste package will be available in June 1983. 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. <i>Method for identifying uncertainties will be addressed.</i>
12 Sec. 6.3.3 p. 6-7 Para. 5	"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." (NRC Comment 12)	A	SCP Section 10.8 will refer to detailed descriptions of the data which must be acquired during site characterization for the purposes of seal development. <i>procedures and</i>

- A - Agree
- C - Requires Further Clarification
- D - Disagree
- X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

REPOSITORY DESIGN

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
13 Sec. 6.3.3 p. 6-7 Para. 5 Item (1)	"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 of the site and waste package in determining what 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." (13)	A	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. <i>Minimum design objectives (i.e., performance requirements) are being developed and will be discussed in the SCP.</i>
14 Sec. 6.3.3 p. 6-8 Para. 1 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." (14)	A	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. Laboratory testing of these materials is in progress. <i>SCP Chapter 17 will also be modified to reflect plans for laboratory and field testing of materials.</i>
15 Sec. 6.3.3 p. 6-8 Para. 1 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." (15)	A	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. <i>The SCP will reference appropriate documentation.</i>

- A - Agree
 C - Requires Further Clarification
 D - Disagree
 E - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

REPOSITORY DESIGN

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
16 Sec. 6.3.3 p. 6-8 Para. 1 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." NRC (16)	A	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 seal are to be emplaced. <i>liner removal in other areas, as well as liner retention, will be evaluated for impact in view of performance objectives.</i>
17 Sec. 6.3.4 p. 6-8 Para. 2, 3	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. NRC (17)	A	A paragraph 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. <i>Additional discussion is required at an NRC workshop.</i>
18 Sec. 6.3.5 p. 6-12 Para. 3	"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." <i>See NRC comment 10</i>	A	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 for in situ testing details and plans.
19	<i>Conceptual Design Report required by the NRC</i>	A S	<i>Will be furnished to NRC upon clearance</i>
20	<i>Horizon Selection Report required by the NRC</i>	A S	<i>'Ibid'</i>

NRC (Cook) discussed BWIP comments on issues identified by the SCA and summarized in tables 2 and 3. The issues listed in column 2 of the tables ("Statement") were revised and agreed upon by BWIP DOE and NRC (Cook).

BWIP comments ^{in column 4 of tables 2 and 3} on the issues were also reviewed. The BWIP revised various BWIP comments, ~~the~~ reflecting NRC input. NRC (Cook) did not agree or disagree with the BWIP comments.

NRC (Cook) noted that since the conceptual design for waste packages ^{is} ~~not~~ not complete and design criteria including reliability design criteria were not established (OVER)

it ~~is~~^{is} not possible for NRC to comment
on the sufficiency or necessity of BWIP
plans for resolution of issues associated
with gathering data in test programs.

NRC indicated priorities for
subsequent detailed discussion of issues
identified in Column 2. The
first priority for future^a work shop ~~interaction~~
was item 1 and item 2 on page 29
of table 2 concerning reliability analyses
and the related engineering analyses of the
waste packages.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)

WASTE PACKAGE

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 11 p. 11-13 Item 1	Develop and implement a reliability program to demonstrate satisfaction of NRC performance criteria. <i>including identification of pertinent design requirements for reliability of long term post emplacement performance.</i>	A, C , X	Development of engineering design and reliability <i>Further</i> analysis plan for waste package is underway. Discussions with NRC regarding the program they envision would be desirable. <i>will be based on NRC position paper on WP reliability. It is expected that reliabilities will be assigned to each waste package components.</i>
Chap. 11 p. 11-14 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 <i>conjunction with reliability analyses.</i>	A, X <i>identified</i>	The present BWIP engineering analysis plan does not account for all possible failure modes nor does it estimate their contribution towards failures of the waste package. <i>all identified failure modes</i> Only the most probable will be considered. A considerable effort is planned for the hydrothermal testing, the results of which address how and when the water reaches the canister through the backfill, estimates of canister life and release rates from the waste package backfill. This will be discussed in the Barrier Materials Test Plan and will be referenced in the SCP. <i>The materials testing effort necessary to support this activity will be detailed in the BWIP EMT which will be completed when the SCP is issued. A lot of work of this test plan will be done of these tests to</i>
Chap. 11 p. 11-14 Item 3	The NRC suggests that pitting corrosion is a very likely cause for low carbon steel container failure. Therefore, effect of pitting corrosion on the integrity of the carbon steel container should be discussed in greater detail and plans for future evaluation of pitting corrosion provided. <i>stress corrosion, cracking, and H₂ embrittlement</i>	A	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. The SCP will include additional material and appropriately reference the Barrier Materials Test Plan. <i>stress corrosion cracking and H₂ embrittlement</i> <i>reliability objectives for the waste package.</i>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)

WASTE PACKAGE

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
Chap. 11 p. 11-14 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.	A	<i>and/or become acclimated to</i> 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 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.
Chap. 11 p. 11-14 Item 5	<i>(effective groundwater flow rate)</i> The details of plans to collect data to determine the effect of groundwater residence time on waste form degradation and on transport should be discussed. This is a key factor in determining whether radionuclide release will be limited by leach rate or by solubility concentrations.	A	These kinds of tests are planned for the flow-through autoclaves and are described in the Barrier Materials Test Plan. They will be referenced in the SCP.
Chap. 11 p. 11-14 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 SCR.	A	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 Sorret diffusion coefficients is not planned because of the estimated low thermal gradient across the backfill component of the waste package. Additional information will be summarized in the SCP. <i>Degradation mechanism connected to thermal gradients (e.g., corrosion, leaching, diffusion, pitting, attack, etc.) will be...</i>
Chap. 11 p. 11-14 Item 7	Insufficient details of plans to determine changes in waste form properties such as devitrification, phase separation, radiation effects, etc.	A, X	A large part of the waste package materials 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. They will be referenced in the SCP. <i>Effect of waste aging during containment (dry) will be addressed, i.e. effect of H₂ gas on glass during...</i>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)

WASTE PACKAGE

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 11 p. 11-14 Item 8	No plans to collect data to estimate rate of flow of water through a failed container were presented in the SCR. <i>Water flow rate is important to determining the conditions at the waste form following container failure and transport of radionuclides within the waste package.</i>	<i>CA</i>	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 process 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 status of planning will be covered in the SCP. <i>The effect of local convection will be addressed in field tests.</i>
Chap. 11 p. 11-14 Item 9	The details of plans to predict changes in environment surrounding the waste package should be expanded. These data are basic to the evaluation of barrier components performance and radionuclide transport. <i>Mechanical, thermohydraulic, and chemical changes as well as radiation effects need to be addressed with engineering tests of prototype systems to support degradation modeling.</i>	<i>CA, X</i>	The hydrothermal test equipment to be used by the BWIP permits sampling of test solutions for analysis during the test runs. These test vessels are capable of producing and withstanding the full range of test parameters such as temperature, pressure and radiation field.
Chap. 11 p. 11-15 Item 10	Description of a plan to demonstrate that mechanical loading is being properly addressed. <i>This effort is to include the effects on canister, backfill (packing material) and waste form.</i>	<i>A</i>	<i>mechanical testing and fabrication plan for testing materials in WP</i> A waste package design and fabrication testing and analysis plan 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. <i>to assure that chemical changes necessary to verify the performance model are addressed. Mechanical and radiation testing will be based on potential failure mode. It is hoped that the WP design developed will be sufficiently conservative to obviate the need for characterizing every failure mode in detail.</i>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)

WASTE PACKAGE

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 7. p. 7-9 Sec. 7.3	<p>Waste Form Issue: Borosilicate glass questioned as an effective release barrier in MWRB, particularly under hydro-thermal conditions. <u>Requires DOE decision on development of contingency (alternate) waste form.</u></p> <p>Concern centers about the stability of glass and predicting its long term behavior. The behavior of the waste form under hydrothermal conditions should be well documented. Emphasized if waste package container reliability is for the selected design life is insufficient to exclude such conditions from the glass form.</p>	C, X	The BWIP approach has been to not emphasize Waste Form release, but fate of radionuclides; i.e., no performance required of waste form. All release and containment performance is required of the canister, backfill and the site. If testing of an alternate waste form were required, testing of the alternate would effectively double the waste-barrier-rock interaction work currently underway.
Chpts 7 p 7-12 Item 1	<p>Viability of long borehole horizontal WP emplacement needs to be demonstrated and alternate designs ^{conceptual} considered prior to selecting a final WP design. The WP design selected must be capable of meeting overall reliability objectives established.</p>	A	

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)

* Items for discussion

PERFORMANCE ASSESSMENT

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 9.3.1 p. 9-7 Para. 3	"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."	A	Chapter 12, Section 12.1.1, of the SCP will contain a complete and precise restatement of the minimum traveltime criterion. O.K.
Sec. 9.3.3 p. 9-9 Para. 1	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.	* X A	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 <u>all</u> performance measurements in a probabilistic framework, e.g., cumulative probability versus performance measure. O.K.
Sec. 9.3.4 p. 9-9 Para. 3	"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."	A	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. O.K.
Sec. 9.3.5 p. 9-9 Para. 4	Descriptions in the SCR of the performance assessment approaches and methods in use or under development appear to be fragmented and incompletely described.	A	Additional detail on the performance assessment approach will be provided in Chapter 12, Section 12.2, of the SCP. O.K.
Sec. 9.3.5 p. 9-11 Para. 1	The SCR should have included a detailed discussion of how the subsystem models that <u>might</u> be integrated into system models (SCR Figure 12-3) would be used to address each performance objective.	A	A detailed description of the performance assessment models and how they are interfaced will be included in Chapter 12, Section 12.3. O.K.
Sec. 9.3.6 p. 9-11 Para. 4	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.	A	Detailed definitions will be included in Chapter 12, Section 12.1, of the SCP. O.K.
Sec. 9.3.7 p. 9-13 Para. 3	The methods used for scenario development were not described in adequate detail in the SCR.	A	A detailed discussion on scenario analysis will be included in Chapter 12, Section 12.2, of the SCP. O.K.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)
 PERFORMANCE ASSESSMENT

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 9.3.10 p. 9-14 Para. 5	The NRC staff would like the problem of <u>complete</u> validation, verification and documentation of performance assessment methods to be addressed. This should include numerical models and computer codes.	A	Technical reports and user's guides are currently being prepared for the <u>major</u> 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.
Sec. 9.3.11 p. 9-15 Para. 2	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. : :	A	<u>O.K.</u> 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. <u>O.K.</u>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)

PERFORMANCE ASSESSMENT

Items for discussion

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 11 p. 11-3 Item 8	Numerical models of groundwater flow reported in the SCR.	A	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.
Chap. 11 p. 11-3 Item 9	The code PORFLO	A	See NRC reference item p. 11-3, Item 8. User's Guide publication is imminent, and verification/validation of several PORFLO components are in progress.
Chap. 11 p. 11-3 Item 10	The level of confidence in preliminary traveltime calculations.	A *	Stochastic analysis from The Baseline Report will be incorporated into Chapter 5, Section 5.1.8 of the SCP emphasizing on-going efforts.
Chap. 11 p. 11-4 Item 1	Quantitative sensitivity studies which show the effects of uncertainty in key parameters (e.g. vertical hydraulic conductivity).	A *	Two work elements, S.1.28.C and S.1.40.D-SD, will be rewritten to incorporate the use of sensitivity and uncertainty analyses to examine their effect on travel-time calculations.
Chap. 11 p. 11-4 Item 2	Description of plans to determine the probabilities and consequences of natural changes which could affect groundwater flow.	A *	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.
Chap. 11 p. 11-4 Item 3	Description of plans to determine the probabilities and consequences of human-induced changes (excluding repository - induced changes) that could affect groundwater flow.	A *	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.
Chap. 11 p. 11-4 Item 4	Description of plans to determine the probabilities and consequences of repository-induced changes that could affect groundwater flow.	A *	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
 (from Chapters 1 through 11 of the DSCA)

* Items for discussion

PERFORMANCE ASSESSMENT

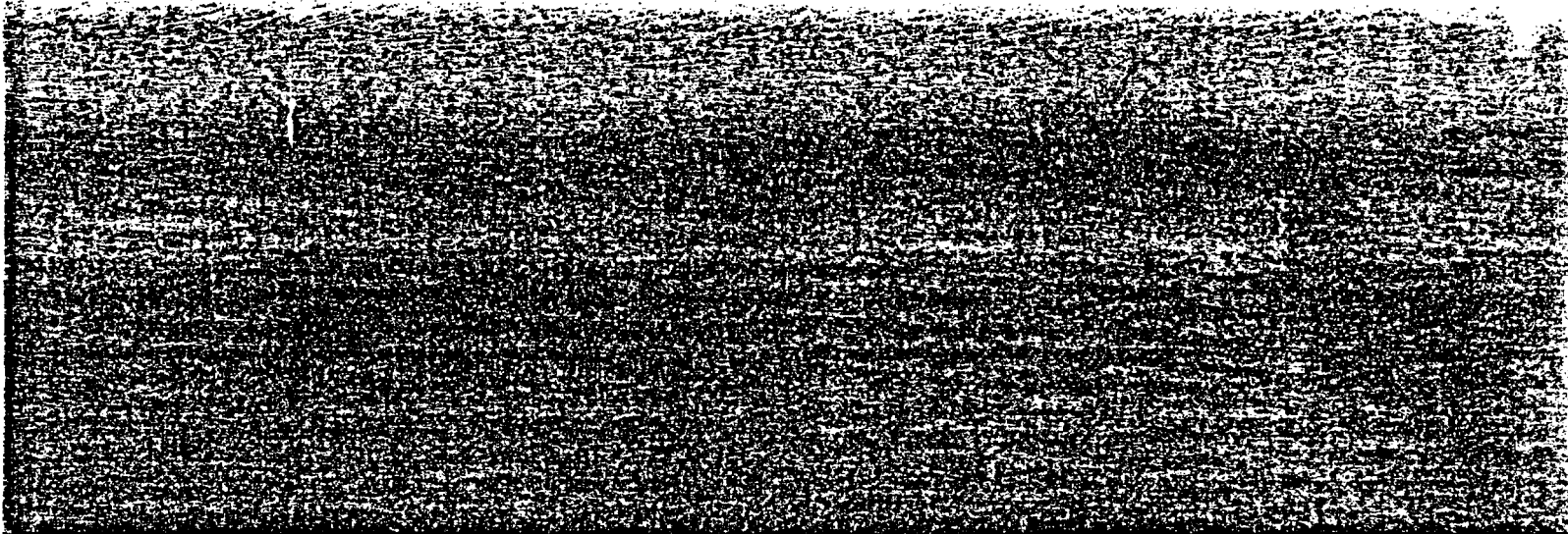
ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Chap. 11 p. 11-11 Item 1	Geochemical inputs to performance assessment models.	* A	Discussion of current plans for integration of source term (very-near-field) and transport models will be added to Chapters 15 and 16 of the SCP.
Chap. 11 p. 11-11 Item 2	Coupling geochemical models to transport models.	x A	Discussion of current plans for coupling the geochemical and transport models will be addressed in Chapter 15 of the SCP.
Chap. 11 p. 11-11 Item 4	Source term (including contributions by the waste package other than radionuclides).	* A	See NRC reference item p. 11-11, Item 2.
Chap. 11 p. 11-11 Item 5	Release scenarios.	* A	See NRC reference item p.11-11, Item 2.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO NRC COMMENTS
(from Chapters 1 through 11 of the DSCA)

QUALITY ASSURANCE

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
1 Ch. 10 p. 10-3 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 ..."	D	These documents can be made available to the NRC. Referencing them in the SCP is not advised. Resolution of the document clearance process is required to satisfy this item.
2 Ch. 10 p. 10-3 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. (Add NRC Comment 2)	D, C, X D, A	A major planning effort, similar to that imposed on power reactors, has yet to be instituted for the BWIP. Should the determination be made that this planning must precede further site characterization effort, the impact would be extensive both in terms of cost and schedule delays. Disagreement on access, only, details of the structured test planning program, updated to 10CFR60 requirements, will be discussed in the SCP. <i>Amend</i>
3 Ch. 11 p. 11-16 Item #1	[This item is addressed above under comment to Ch. 10, p. 10-3 (2)].		
Item #2	[This item is addressed above under comment to Ch. 10, p. 10-3 (1)].		
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."	X, A	This item will be addressed in the revised Chapter 10 of the SCR. Refer to item above
4 Ch. 11 p. 11-16 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.	C, X	DOE has provided guidance on implementing a repository design "Reliability, Availability, and Maintainability (RAM)" program in ONMI 334. The BWIP approach is to use confidence levels of waste package/backfill/seals/host rock, etc. This will be clarified in the SCP. <i>Amend</i>



Note: BWIP Comments in tables 2 and 3 refer to information and plans that the NRC staff has not seen. Therefore, NRC cannot fully evaluate the "BWIP comments" until the information and plans are made available for analysis and are discussed between NRC and BWIP.

TABLE 3

**DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
FROM APPENDICES B AND C OF THE DSCA**

May 25, 1983

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Note: No comments on Chapters 1,2,7,8,9 and 19.

COMMENT CODES IN NRC DSCA APPENDIX B

- | | |
|--|--|
| 1. Incorrect statement | 12. Confidence level too high |
| 2. Not covered in the SCR | 13. Nonconservative approach , |
| 3. Inadequately covered in the SCR | 14. Conflicts with previous statement |
| 4. Unsupported assertion | 15. Incomplete data base |
| 5. Unsupported conclusion | 16. Incorrect or no reference |
| 6. Alternatives not considered | 17. Outdated reference |
| 7. Lack of supporting data | 18. Planned analysis insufficient for resolution |
| 8. Conflicts with 10 CFR 60 | 19. No plan presented |
| 9. Uncertainty about testing techniques | 20. Reference inadequate to support statement |
| 10. Uncertainty about analysis methods | 21. Plans presented in insufficient detail to evaluate likely level
of success in a timely manner |
| 11. Data not representative - biased selection of data | |

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Executive Summary

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
ES-1 Para. 2 Item 5	Preliminary tests indicate... favor long-term stability./ 4, 12	A	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.
ES-7 Para. 4	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."	A	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.
ES-7 Para. 4	At the end of the waste containment period ... relative to release criteria./ 3, 4, 6, 7, 11, 12, 13, 15 -- "This statement is much too strong and glosses over the need for site-specific solubility."	A	Statement will be re-written to address all mechanisms likely to control radionuclide concentrations in the groundwater.
ES-8 Para. 1	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."	A	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 conditions in a basalt environment have been initiated and the preliminary results will be reported.
ES-8 Para. 1	Under these conditions ... iron oxide existing in the basalt./ 3, 4, 6, 7, 12	A	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.
ES-8 Para 1.	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."	A	Statement will be re-written to properly qualify the anticipated radionuclide behavior under reducing conditions.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Executive Summary

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
ES-11 Para 3 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."	A	Statement will be re-written and the sorption data used in the modeling will be qualified to more closely reflect the available data.
ES-11 Para. 3 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."	A	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.
ES-12 Item 1	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."	A	Statement will be re-written to properly qualify this conclusion from the predictive modeling, and the prelimi- nary nature of the input data.
ES-13 Para. 2	A description ... in this report./ 3, 21	A	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.
ES-14 Para. 1	The methods to be used ... modeling./ 3, 21	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Executive Summary

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
ES-14 Para. 2	Logic diagrams and schedules ... a repository./ 3, 21	A	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.

Geology Session Wed. 6-16

The accuracy and compliances of BWIP's statement of item (left hand column) was assessed and found to be ^{satisfactory} ~~good~~. All BWIP disposition items (center column) are now "A" items with two exceptions. The NRC will provide clarification on these two topics.

The BWIP comments (right hand column) have been modified, by mutual agreement, to respond to the NRC concern as stated in the left hand column. However, since the NRC has not reviewed the plans and procedures noted in the BWIP comments column nor has the NRC received or reviewed a number of the documents cited in the comments column, the NRC cannot ~~evaluate~~ evaluate the adequacy or pertinence of those plans and procedures at this time.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)
CHAPTER 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.2.1 p. 3.2-1 para. 3	"Two slant core holes...through the Umtanum..."/ "This data is not provided."	A	Data are in Fenix & Scisson, inc. (1978) ^{nb} and the borehole files. Existing references will be added.
Sec. 3.4.1 p. 3.4-1 para. 2	"Anticlinal ridges of the Yakima folds were avoided...8-kilometer offset from fold hinge lines..."/1--"This statement does not account for Yakima Ridge."	A	The statement will be changed to account for Yakima Ridge.
Sec. 3.4.2 p. 3.4-4 para. 3	The SCR states that "less than 50 meters are flood deposits; ...Pleistocene catastrophic floods."/5--"There is insufficient data to make this statement."	A	Figure 3-14 shows the thickness limitation in a generalized cross-section. The additional suprabasalt data will be added to the SCP.
Sec. 3.5.4 p. 3.5-15 para. 4	"It has distinctly...chemical type."/14--"See Table 6.1 and Figure 6.3."	A	This does not disagree with the previous statement. The statement is correct, but Figure 6-3 requires change to reflect TiO ₂ for upper portion of Schwana sequence and/or the upper low Mg flow below the Umtanum.
Sec. 3.5.4 p. 3.5-28 para. 2	"The petrographic characteristics...rate for the entablature."/16	A	The reference to Wood and Long (1981) and Long and Others (1980) (SA-67) will be added.
Sec. 3.5.4 p. 3.5-28 para. 4	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."	A	The use of the Umtanum flow as an example was inappropriate. The statement will be revised to <i>clarify which flows display "considerable continuity"</i>
Sec. 3.5.4 p. 3.5-31 para. 2	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."	A	The borehole data (e.g., RRL-2, DC-12, DC-15) will be included in interpretation. The statement "anomalously" thick will be eliminated.
Sec. 3.5.4 p. 3.5-32 para. 2	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."	A	The paragraph will be reworded to indicate what level of prediction can likely be made. <i>A discussion of prediction accuracy will be made in the SCP.</i>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)
CHAPTER 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.5.4 p. 3.5-32 para. 1	Lines 7-11, "The occurrence of the ...host flow itself."/3--"Hydrogeologic implications not adequately covered in Chapter 5 of the SCR."	A, X	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 will be included in the SCP. <i>(large scale pump test)</i>
Sec. 3.5.4 p. 3.5-32 para. 3	Lines 33-36, "These features should...exploratory test facility."/3 -- "Hydrogeologic implications not adequately covered in Chapter 5 of SCR."	A	The hydrogeologic implications of these features will be addressed in the SCP.
Sec. 3.3.5 p. 3.5-33 para. 5	Lines 35-39, "A vesicular zone....to be interconnected."/3--Hydrogeologic implications not adequately covered in Chapter 5 of the SCR"	A	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 ST-28 will be included in the SCP.
Sec. 3.5.4 p. 3.5-33 para. 1	"The total volume...percent."/7, 10	A	<i>(Horizon Identification Report)</i> Data from ST-28 will be included in the SCP.
Sec. 3.5.4 p. 3.5-33 para. 1	"The volume of unfilled fractures...percent."/7, 10	A	Recent review of data indicate that reference to "unfilled" fractures as a percentage is inappropriate; such references will be deleted. <i>these data are discussed in ST-28 and plans in Chapter 13.</i>
Sec. 3.5.4 p. 3.5-33 para. 1	The SCR states "the great majority of fractures...to assess their hydraulic conductivity."/1, 3, 11, 13, 15--"The majority of fractures are vertical or subvertical so would not be considered. Hydrogeologic implications not adequately covered in Chapter 5 of the SCR."	A	The statements will be reworded to include data from ST-28. A statement relative to vertical or near vertical fractures will be added for clarification. <i>(Horizon Identification Report)</i>
Sec. 3.5.4 p. 3.5-33 para. 2	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."	A	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. <i>ES-II plans will be included or referenced in the SCP.</i>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)
CHAPTER 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.5.4 p. 3.5-33 para. 4	"The interior of the Sentinel Bluffs flow...entablature and colonnade may also exist."/4, 12, 15	A	The statements will be modified to be descriptive only. Additional data will be supplied from ST-28.
Sec. 3.5.4 p. 3.5-33 para. 5	"This zone occurs...(see Figure 3.22, 3.23, and 3.24)."/3--"Zone is not shown on diagrams cited."	A	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.
Sec. 3.5.4 p. 3.5-35 para. 1	"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."	A	Additional data will be added from ST-28.
Sec. 3.5.5 p. 3.5-38 para. 2	"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 effects of a thermal pulse are not considered."	A	Reference to the results of recent hydrothermal experiments will be made. <i>(Chapter 6, SCP)</i>
Sec. 3.5.6 p. 3.5-39 para. 2	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."	A	The general stratigraphy is well known; however, a statement that the intraflow and interbed characteristics are not as well understood will be included. <i>with respect to constructability and performance assessment. Plans for data collection will be presented.</i>
Sec. 3.5.6 p. 3.5-39 para. 2	Additional detailed...candidate repository horizons.../21	A	Plans will be included for additional host flow characterization and data will be added from ST-28. <i>SCP.</i>
Sec. 3.6.6 p. 3.6-20 para. 4	"Remote sensing studies...are summarized."/3, 7--"No maps are provided."	A	Because of the volume of maps, it is not practical to include them in the SCP. <i>Information is available to NRC for independent assessment. Sandness and others, (1993)</i>
Sec. 3.7.2 p. 3.7-2 para. 1	The SCR states that "Overall, the fold and strain...predicted in the mechanical model."/6, 11	A	Alternatives will be discussed in the SCP. <i>Models and evaluated</i>

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)
CHAPTER 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.7.2 p. 3.7-4 para. 4	Lines 46-48, "Planned studies...in basalt."/3--"Not adequately covered in Chapter 13 of the SCR."	A	<i>The detailed plans for and structure</i> A tectonic breccia study will be described in Chapter 13. Tectonic breccia zones will be hydrologically tested and the program will be described in Chapter 13 <i>and the Drilling and Testing Plan</i>
Sec. 3.7.2 p. 3.7-7 para. 3	The SCR states that "since the scarps cut deposits...they are assumed to be late Quaternary age."/5, 7--"The SCR doesn't present any justification for this statement."	<i>M</i>	No additional work necessary to justify dating of Quaternary deposits. SCR only summarizes work by Campbell and Bentley (1981). Additional information is in Campbell and Bentley (1981) and in Bentley and others (1980). Work to demonstrate the origin of the features is predicated on access being granted by the Yakima Nation.
Sec. 3.7.2 p. 3.7-8 para. 3	Location of the Silver Dollar fault on Figure 3-48/"The Silver Dollar fault is incorrectly located on Figure 3-48."	A	The location of the Silver Dollar fault is taken from 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.
Sec. 3.7.2 p. 3.7-17 para. 4	The SCR states "small fault zones a few centimeters...taken from many core holes."/7, 15--"Which core holes and at what intervals?"	A	The SCR summarizes the discussion of Moak (1981) in ST-14. The data are given in Table 6-2 of ST-14. The discussion is on pages 6-1 to 6-8 of ST-14. <i>Specific table and discussion pages in ST-14 will be added to SCR on p. 3.7-17.</i>
Sec. 3.7.2 p. 3.7-18 para. 5	The SCR states that "these structures have been interpreted as part of a wrench-fault system."/7	A	The evidence for wrench fault interpretation is given in Swanson and others (1979) and in Anderson (1983). An additional sentence will be inserted in the SCR on p. 3.7-18 to express the evidence, which is largely the geometry of faults and fault-fold relationships. <i>Alternate interpretations will be considered in SEP.</i>
Sec. 3.7.2 p. 3.7-19 para. 4	The SCR states "structural analyses at five locations...along any one anticline and between different anticlines."/11	<i>A & X</i>	The SCR restates the conclusions of Price (1982). Clarification is needed from NRC regarding the extent of future studies they envision. <i>Recognition of alternatives and analysis of uncertainties will be presented in the SEP.</i>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 CHAPTER 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.7.2 p. 3.7-19 para. 4	The SCR states that "the strain is interpreted to be related to the folding process."/12, 15	C A	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. Clarification is needed from NRC regarding the extent of studies they envision.
Sec. 3.7.2 p. 3.7-26 para. 4	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."	A	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. <i>Expand on qualification of top-of-basalt as a structure datum</i> Some clarification will be added to the SCP, para. 3, as to how the structure contour maps of deeper horizons were prepared. These maps will be updated as data from new boreholes are collected.
Sec. 3.7.2 p. 3.7-28 para. 1	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." Lines 32-33, "Future studies will...(Chapter 13)."/3--"Not adequately covered in Chapter 13 of the SCR."	A C	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. <i>Hydrologic significance will be addressed in Chapter five and plans for investigating anomalies presented in Chapter 13.</i> A study of tectonic breccias is currently under way. The plan of investigation will be added to Chapter 13 of the SCP.
Sec. 3.7.2 p. 3.7-31 para. 4	The SCR states that "the pattern of joints described above...found in the Cold Creek Syncline."/6, 14--"DOE has stated that tectonic breccia is found in every borehole in the Cold Creek Syncline that penetrates the Umtanum flow."	A	<i>and fractures. "relatively few" tectonic joints will be made</i> Clarification of specific statements in the SCR will be added to the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

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 CHAPTER 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.7.2 p. 3.7-32 para. 3	The SCR states "the presence of miocene basalt...slow enough to permit ductile deformation."/6, 30 , 11	CA A	The SCR summarizes (briefly) the work of E. Price (1982). (RHO-BWI-SA-138). <i>Additional discussion of deformation, models will be added to the SCR.</i>
Sec. 3.7.3 p. 3.7-35 para. 3	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."	CA A	The largest and most frequent earthquakes since 1979 have been in the southern Cascades. Two M > 5 and four M > 4 earthquakes have occurred in this period. The largest, the M = 5.5 Elk Lake earthquake occurred 15 km NNW of Mt. St. Helens. This paragraph accurately reflects the occurrence of large earthquakes since the M = 5.5 event is the largest in the region since 1965. <i>Statement changed to refer to earthquakes > M=3</i> The seismicity of the Columbia Plateau and Pasco Basin are described in detail (three pages) only one paragraph after the referenced paragraph. The seismicity of the RBL is described in detail in a later section (3.7.4, p. 3.7-54).
Sec. 3.7.3 p. 3.7-35 para. 5	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."	A	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." 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.

A - Agree
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CHAPTER 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.7.3 p. 3.7-36 and 3.7.42	Figures 3-54 and 3-55/11--"Microearthquakes are not shown, giving an unrealistic view of seismicity in the Pasco Basin."	<i>C</i>	Figure 3-54 shows all historical earthquakes--MMI > IV. Since micro-earthquakes are not usually felt, they are not uniformly representative of the regional seismicity. Even at the MMI V level, the concentration of seismicity around early population centers is apparent. This figure is considered to be representative of the historical seismicity since 1969. Figure 3-55 shows all instrumental earthquakes $M \geq 3.0$. These are classified as "earthquakes." Micro-earthquakes are $M < 3.0$. Micro-earthquakes have not been uniformly located since 1969. The estimated magnitude threshold for location of all earthquakes is about $M = 3$, showing events above the location threshold is the only way to show the representative seismicity of a region rather than the extent of seismograph networks.
Sec. 3.7.3 p. 3.7-43 Fig. 3.56	Figure 3-56/11--"Not all microearthquakes are shown. Does not indicate what years are covered."	A	The intent was to select earthquakes which were well located to determine any correlations with geologic structures. A clarifying statement will be included in the SCP. <i>Figure 3-56 shows well-located earthquakes $M \geq 1.5$ or greater from 1969 through 1979. Additional figures of all recorded earthquakes $M \geq 1$ will be added to the SCP.</i>
Sec. 3.7.3 p. 3.7-52 para. 4	The SCR states that "the permeability effects of swarms...single large magnitude earthquake."/5, 6, 7, 13, 15--"A number of swarms occurring near the repository over time could have a very significant effect on the repository and isolation."	A	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.
Sec. 3.7.3 p. 3.7-53 para. 4	"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)."	A	The entire sentence will be deleted.

A - Agree
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Chapter 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.5.7 p. 3.7-57 para. 1	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."	A C X	The statement is qualified and nothing has been found to date that is interpreted to have a high potential of disqualifying the site. Clarification is needed regarding the extent of the program NRC envisions in this area. <i>Statement will be changed to changed to reflect current level of understanding.</i>
Sec. 3.8.1 p. 3.8-1 para. 5	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."	A	<i>most clearly the</i> Microearthquakes do not appear to align in a manner suggestive of unmapped faults, nor do they appear to align along mapped faults. Earthquakes, however small, indicate fracturing of rock or slip on existing fractures. <i>Statement will be revised in SCP.</i> The installation of borehole network may help delineate any causative structures. Present plans for gathering and processing earthquake data is addressed in the Seismic Surveillance Test Plan and should address this concern. This plan will be referenced in the SCP.
Sec. 3.8.1 p. 3.8-2 para. 1	"These results indicate...criteria for tectonic stability."/5, 6, 7, 13, 15--"This conclusion is very premature."	A	Same comment as above (3.7-57).
Sec. 3.8.2 p. 3.8-3 para. 4	The SCR states that "Davis (1981) postulated that...deformation as the folds begin to lock up."/17--"Davis no longer holds this view."	A	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.
Sec. 3.8.2 p. 3.8-5 para. 4	Price (1982) showed that the basalts...reasonable for the Yakima fold system./11, 12	C X A	Other hypotheses for Yakima fold development are possible and need to be tested. <i>The statement merely reflects the interpretation of Price. will be presented in the SCP.</i> A major effort is required to develop a mechanical model for the development of the Yakima folds in the central plateau. Clarification is needed regarding the extent of the program NRC envisions in this area.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

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 Chapter 3

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 3.8.2 p. 3.8-5 para. 5	The SCR states "According to this model...buttress in the sub-basalt basement."/5	CX A	Statement will be revised. The statement was intended to indicate that the experiment shows one way of producing Yakima-like folds. Clarification is needed regarding the HRC's position as to the program required to develop and test mechanical models for Yakima fold development.
Sec. 3.9.2 p. 3.9-3 para. 1	"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."	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 E - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 4

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
1 Sec. 4.0 p. 4.0-1 Para. 4	"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."	A	The text will be expanded to include site-specific differences in Section 4.0 of the SCP.
2 Sec. 4.1.2 p. 4.1-2 Table 4-1; p. 4.1-3 Table 4-2	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."	A	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.
3 Sec. 4.1.3 p. 4.1-7 Para. 1	"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."	A	Tables 4-2 (a), (b), and (c) will be completely updated using test results obtained from RRL cores. Appropriate conclusions will be drawn and included in Section 4.1.3 of the SCP.
4 Sec. 4.1.3 p. 4.1-7 Para 1	"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."	A	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 geomechanics 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.

- A - Agree
- C - Requires Further Clarification
- D - Disagree
- E - Programmatic Impact

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CHAPTER 4

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
6 Sec. 4.2.1 p. 4.2-1 Para. 1	"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."	A	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.
6 Sec. 4.2.1 p. 4.2-1 Para. 2	"Strength" "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."	A	Bullets will be revised to more accurately reflect the complexity of the constitutive behavior of basalt in Section 4.2.1.
A Sec. 4.2.2 p. 4.2-2 Para. 4	"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."	A	Limitations of the test method discussed on page 4.2-2 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. <i>BWIP to add discussion on low values from tests.</i>

- A Agree
- C Requires Further Clarification
- D Disagree
- E Programmatic Impact

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CHAPTER 4

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
8 Sec. 4.2.3 p. 4.2-5 Para. 4	"The pressure in the flat jacks ... perpendicular to the tunnel." / 9, 10 -- "The theoretical basis for using borehole stressmeters to infer cancellation stresses is shaky. The procedure outlined for establishing the stress distribution in the tunnel sidewall is not very practical; other methods should be considered."	A	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.
9 Sec. 4.2.3 p. 4.2-9 Para. 1	"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."	A	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.
10 Sec. 4.2.4 p. 4.2-11 Para. 1	<i>Goodman-Jack and the</i> "The tests results obtained ... block test results." / 9 -- "Test results of the 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?"	A	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. <i>A discussion on test method validation will be provided in the SCP.</i> *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.

- A Agree
- C Requires Further Clarification
- D Disagree
- E Programmatic Impact

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CHAPTER 4

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
11 Sec. 4.2 p. 4.2-12	"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."	A	This statement cannot be found on p. 4.2-12. DWIP is fully considering use of the suggested method.
12 Sec. 4.3.2 p. 4.3-2 Para. 5	"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 frictional properties of joints been thoroughly analyzed?"	A	Laboratory tests were initiated recently to investigate the effect of joint infilling on frictional 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.
13 Sec. 4.3.3 p. 4.3-3 Para. 2	"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." (and joint roughness)	A	The current data base on joint properties is very limited. No joint stiffness data are available presently. As data becomes available, a thorough analysis will be conducted and the results of the analysis will be published. (joint roughness and residual friction angles) included
14 Sec. 4.3.3 p. 4.3-3 Para. 4	"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 not seem unlikely in triaxial testing.)"	A	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 prohibited us in generating non-linear failure criteria. Clarification will be made in Section 4.3.3 of the SCP. ie. limited (ie, lack of sufficient data)
15 Sec. 4.4.3 p. 4.4-4 Para. 4 Item 3	"The influence of ... understood. Laboratory tests ... this relationship." / 3 -- "In addition, the effect of moisture on the thermal properties must be studied."	A	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.

- A Agree
- C Requires Further Clarification
- D Disagree
- A Programmatic Impact

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CHAPTER 4

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
16 Sec. 4.5.1 p. 4.5-1 Para. 3 Bullet 3	"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."	A	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.
17 Sec. 4.6.4 p. 4.6-13 Para. 2	"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. 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." <i>The predicted stress levels around the opening are high.</i>	A	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.
18 Sec. 4.7.1 p. 4.7-1 Para. 3	"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."	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

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Chapter 6

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.3.1 p. 6.3-1 Para. 4	Lemoine obtained the uranium solubility...the UO ₂ dissolution rate was... /3, 7.	A	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.
Sec. 6.3.1 p. 6.3-2 Para. 1	...higher than when the oxygen fugacity...(Jacobs and Apted, 1981). / 4, 16 --"Reference improper. What about backfilling effect on pH for example?"	A	See response to Item 6.3-1, paragraph 4. The SCP will contain an acceptable reference. Hydrothermal tests completed to date support that backfill may lower the pH of the aqueous solution by 0.5 to 1.0 pH units.
Sec. 6.3.1 p. 6.3-2 Fig. 6-13	Figure 6-13 Estimated UO ₂ solubility...plotted as a thin line. / 3, 5 --"What is basis?"	A	See response to Item 6.3-1, paragraph 4. The basis for the UO ₂ solubility line will be addressed in Section 6.3.1 of the SCP.
Sec. 6.3.1 p. 6.3-3 Para. 4	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."	A	Additional data on the dissolution of borosilicate glass is available in Apted and Myers (1982) and will be incorporated in Section 6.3.3 of the SCP.
Sec. 6.3.1 p. 6.3-4 Table 6-10	Table 6-10. /14, 16.	A	Table 6-10 is from Wood and Coons (1982).
Sec. 6.3.1 p. 6.3-5 Para. 1	The shape of the curves suggests...under oxidizing conditions. / 3, 6, 7 --"Could be quite different with groundwater from Grande Ronde."	A	The experiments quoted in the SCP 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

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

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 Chapter 6

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.3.1 p. 6.3-5 Para. 1 cont.			experiments will hopefully determine if technetium will be incorporated into secondary phases. The results will be incorporated in Section 6.3.3 of the SCP when they become available.
Sec. 6.3.1 p. 6.3-5 Para. 1	...(similar to those expected in the repository)... /4, 7.	A	This reference has been superseded by more recent theoretical and experimental solubility studies which will be incorporated into Section 6.4.1 of the SCP. Future reference to these data will include more detail of the relevant Eh conditions considered.
Sec. 6.3.1 p. 6.3-5 Para. 4	At 100°C to 200°C, ...supercalcines are comparable. / 5, 7, 11.	A	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.
Sec. 6.3.1 p. 6.3-6 Fig. 6-14	Figure 6-14. / 16.	A	Figure 6-14 is from Smith et al (1980). The figure represents a compilation of solution composition data extracted from the literature (Turcotte and Wald, 1978/ McCarthy and Others, 1978). Data from experiments conducted at different laboratories under the same conditions are in agreement (Westsik and Turcotte, 1978). These references will be cited in Section 6.6.3 of the SCP.
Sec. 6.3.2 p. 6.3-8 Para. 4	<i>Delete</i> 2 x 10 ⁻¹⁴ meter per second. / 1 -- "Undoubtedly too small a hydraulic conductivity"	D	The data is correctly reported from Pasch (1979), and corroborated in independent test by Wheelwright and others (1981). (PNL-3873)

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 6

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.3.2 p. 6.3-9 Para. 1	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."	A	Laboratory data generated after the SCR was written (Wood, 1983) indicates that the conversion of bentonite to illite is not a significant reaction in a <u>bentonite-basalt-groundwater system</u> . The potassium concentration in hydrothermal runs at 300°C first increases and then decreases with time. Examination of hydrothermal solids shows that a potassium-bearing zeolite is the dominant reaction product. This suggest that a basalt glass to zeolite is the preferred alteration process in this sytem 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 6, Section 6.3.2 of the SCP.
Sec. 6.3.2 p. 6.3-9 Para. 1 <i>RHO OPEN</i>, Weaver (1979) has compiled studies... lesser extent, chlorite. / 3.	D <i>RHO - give a reason →</i>	The discussion by Weaver (1979) is of interest ^{↑ include} but not directly applicable to the basalt environment. Therefore, no further discussion of these data are warranted. <i>X</i>
Sec. 6.3.2 p. 6.3-9 Para. 1	The low potassium content...(approximately 1.5 weight percent and 5.9 milligrams per... /7.	A	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 6, Section 6.2.1. <i>1.14</i>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 6

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.3.2 p. 6.3-10 Para. 1	...liter, respectively) and the smectite-dominated... significant degree. / 5, 7.	D A	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.
Sec. 6.3.3 p. 6.3-11 Para. 2	...known to be stable in spent fuel with Hanford basalt and basalt phases. /4, 15 --"Check reference."	A	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.
Sec. 6.3.3 p. 6.3-11 Para. 4	Barnes and Scheetz (1979). / 9, 15, 16 --"Improper reference (abstract)."	A	This reference will be removed in the SCP. In the revision this section (6.3.3) will include detailed discussion of more recent data obtained from basalt-water hydrothermal experiments conducted in the laboratories of the BWIP and its subcontractors.
Sec. 6.3.3 p. 6.3-11 Para. 4	Other than a very slight decrease...not change significantly. / 6, 7, 14.	A	This section (6.3.3) will be revised to include more recent data obtained from basalt-water hydrothermal experiments.
Sec. 6.3.3 p. 6.3-12 Table 6-14	Table 6-14. / 16.	A	Same reference as 6.3-11, paragraph 2, Komarneni, et al (1980).
Sec. 6.3.3 p. 6.3-13 Table 6-15	Table 6-15. / 16.	A	Same reference as 6.3-11, paragraph 2, Komarneni, et al (1980).

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Chapter 6

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.3.3 p. 6.3-13 Para. 1	Barnes and Scheetz (1979). / 15, 16 -- "Improper reference (abstract)."	A	See response to Item 6.3-11, paragraph 4.
Sec. 6.3.3 p. 6.3-13 Para. 1	These early results suggest..the early thermal period. / 3, 5, 9.	XA	Recent experiments 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.
Sec. 6.4.1 p. 6.4-1	Section 6.4.1 <u>Radionuclide Solubilities</u> (all). / 3, 4 -- "Complexation must be considered."	A	The section on Radionuclide Solubilities (6.4.1) will be modified and expanded in the SCP. Modifications will take advantage of recent estimates of key radionuclide solubilities based upon thermodynamic analyses and experimental solubility measurements currently in progress.
Sec. 6.4.1 p. 6.4-1 Para. 3	...; Giggenbach, 1981). / 15, 16 -- "Reference doesn't really apply to subject discussed."	XD	See NRC reference Item Sec. 6.4.1, p. 6.4-1.; <i>exact pages of Giggenbach reference will be added. are p 405-406.</i>
Sec. 6.4.1 p. 6.4-2 Para. 2	However, the effect of complexing ligands...in these estimates. complexation needs / 3, 13 -- "Carbonate effects on consideration."	A	See NRC reference Item Sec. 6.4.1, p. 6.4-1.
Sec. 6.4.1 p. 6.4-2 Para. 2	...reducing conditions expected...containment of uranium. / 3, 4, 9.	A	See NRC reference Item Sec. 6.4.1, p. 6.4-1.
Sec. 6.4.1 p. 6.4-2 Para. 3	Under oxidizing conditions, neptunium...solubility estimates. / 3, 9, 13 -- "Complexation is important."	A	See NRC reference Item Sec. 6.4.1, p. 6.4-1.

NRC OPEN

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 6

ITLM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.4.1 p. 6.4-2 Para. 4	...this value does not take...plutonium solubility. / 2, 3, 13.	A	The section on Radionuclide Solubilities (6.4.1) will be greatly modified and expanded in the SCP. Modifications will take advantage of recent estimates of key radionuclide solubilities based upon thermodynamic analyses and experimental solubility measurements currently in progress.
Sec. 6.4.1 p. 6.4-3 Para. 1	Final americium concentrations...less than 10^{-9} mole per liter at pH 10. / 3, 9, 19 -- "Not acceptable method of calculating solubilities."	A	See NRC reference Item p. 6.4-2, Para. 4.
Sec. 6.4.1 p. 6.4-3 Para. 2	Groundwater containing uranium...under repository conditions. / 3, 6, 7 -- "Oxide assumption not acceptable."	A	See NRC reference Item p. 6.4-2, Para. 4
Sec. 6.4.1 p. 6.4-3 Para. 2	...to complex or colloid formation. / 3.	A	The section on Radionuclide Solubilities (6.4.1) will be greatly modified and expanded in the SCP. 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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 6

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.4.1 p. 6.4-4 Fig. 6-15 <i>BWP open</i>	Figure 6-15. / 11, 14 --"Am results are several orders of magnitude low."	A	Within the context of proposed NRC (10 CFR 60) and EPA (40 CFR 191) regulations, Figure 6-15 and the related discussion in the text probably are not useful. It will be dropped; include reasons <i>BWP</i>
Sec. 6.4.1 p. 6.4-4 Fig. 6-15	(NRC, 1981). / --"Incorrect reference. MPC rules are in 10 CFR Part 10, not Part 60."	A	See NRC reference Item p. 6-4, Fig. 6-15.
Sec. 6.4.1 p. 6.4-4 Fig. 6-15	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 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 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 orders of magnitude. Therefore, the MPC values used in SCR Figure 6-15 are too high. (Appendix U)."	A ✓	See NRC reference Item p. 6-4, Fig. 6-15.
Sec. 6.4.1 p. 6.4-5 Para. 1	low Eh. / 4.	A	See response to Item 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 6.2.3.4.

C - Requires further clarification
 D - Disagree
 X - Programmatic Impact

Chapter 6

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.4.2 p. 6.4-5 Para. 2	6.4.2 Radionuclide Sorption (all). /12 -- "Data lacking on portion on secondary minerals in potential flow paths."	A	Although we do have some data on radionuclide sorption on secondary minerals found in vugs and on the surfaces of altered basalt found in porous flowtops, the BWIP does need more information in this area. 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.
Sec. 6.4.2 p. 6.4-5 Para. 2	In the basalt environment...sediments above the basalts. /3.	A	Additional information on possible radionuclide sorbants will be included in Section 6.4 in the SCP.
Sec. 6.4.2 p. 6.4-6 Para. 2	Due to the uniqueness...Columbia River basalt geohydrologic system. /4, 9. "Extremely reducing conditions expected" /4, 9. ✓	A	Much of the available sorption data in the literature are empirical in nature and strongly depend on the conditions of the measurements. Radionuclide sorption is dependent on a large number of variables (including solid mineral composition, groundwater composition, Eh, pH, flowrate, temperature, etc.) which can greatly influence sorption parameters. To extrapolate literature sorption data to conditions of a repository in deep basalt would be highly questionable. Detailed discussion of expected Eh will be included in chp 6 of the SCP.
Sec. 6.4.2 p. 6.4-6 Para. 3	Groundwater composition effects on the distribution coefficient ...large errors.../3.	A	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.
Sec. 6.4.2 p. 6.4-7 Table 6-16	Table 6-16. /6, 7, 9, 10, /4 -- "Results not relevant for conditions."	A	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

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.4.2 p. 6.4-7 Table 6-16 cont.			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.
Sec. 6.4.2 p. 6.4-7 Table 6-17	Table 6-17. / 6, 7, 9, 10, 14 -- "Results are not relevant for conditions.:"	1D	The supporting data, testing techniques, and analytical methods are given in a reference to be added to Section 6.4 of the SCP. It is not clear which previous statement the data in this table conflicts with. See comments for Table 6-16 for statements on "alternatives not considered," and results not "relevant for conditions."
Sec. 6.4.2 p. 6.4-8 Para. 1	The decrease in cesium distribution coefficient ... at higher temperatures. /3, 4, 14.	A	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.
Sec. 6.4.2 p. 6.4-9 Table 6-18	Table 6-18. /5, 14, 16.	1A	It is not clear how this table of data can be an unsupported conclusion, or which previous statement this data conflicts with. The appropriate reference will be given for this table in Section 6.4 of the SCP.
Sec. 6.4.2 p. 6.4-9 Para. 1	Reducing conditions expected for a repository ... /4, 9, 10, 12.	A	The 0.1 M hydrazine used in these experiments 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 6.4 of the SCP.

I - Requires further clarification
 D - Disagree
 X - Programmatic Impact

Chapter 6

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
✓ Sec. 6.4.2 p. 6.4-10 Table 6-19	Table 6-19. /7, 10, 14, 16.	A	The supporting data and analysis methods are contained in the reference which will be added to Section 6.4 of the SCP. The previous statement that distribution coefficients for technetium, uranium, and neptunium increase by one order of magnitude under reducing conditions is not precisely correct (see distribution coefficient for uranium at 60°C) and will be changed to correct this error.
Sec. 6.4.2 p. 6.4-11 Para. 3	It becomes independent of radionuclide...at trace levels. /3, 4, 10.	A	This statement is incorrect since sorption depends on radionuclide concentration at all concentration levels. It will be removed from Section 6.4 of the SCP.
Sec. 6.4.2 p. 6.4-11 Para. 3	These equations (Table 6-21) ...radionuclide retardation factors. /3, 4, 7, 10, 16.	A	The supporting data and analysis methods are given in a reference to be added to Section 6.4 of the SCP.
✓ Sec. 6.4.2 p. 6.4-12 Table 6-20	Table 6-20. /7, 10, 14, 16.	A	The use of distribution coefficients in this table for modeling radionuclide transport conflicts with the statement in 6.4.2.2 which states that sorption isotherm equations should be used in transport modeling, rather than the distribution coefficients. However, until adequate sorption isotherm equations are available and transport models are modified to utilize these equations, the distribution coefficients provide a reasonable first estimate of sorption behavior and can be used in preliminary radionuclide transport analyses. Reference was omitted by accident, will be added.
Sec. 6.4.2 p. 6.4-13 Table 6-21	Table 6-21. /7, 10, 14, 16.	A	The supporting data and analysis methods are contained in the reference which will be added to Section 6.4 of the SCP.

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The use of K_d values in Tables 6-17, 18, 19, and 20 has been reviewed and replaced with isotherm models. Values of K_d are being replaced with isotherm models.

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.5.1 p. 6.5-1 Para. 2	Thus, although most volcanic glass...repository performance requirements./7, 11, 14	A	This discussion will be deleted modified in Section 6.5.1 of the SCP.
Sec. 6.5.1 p. 6.5-8 Para. 4	...hazards from uranium...uranium ore deposits./3, 7, 10	A	The paragraph containing this statement will be expanded to provide more adequate coverage of the discussion in Section-6.5.1-of the SCP.
Sec. 6.5.1 p. 6.5-10 Para. 1	The observations support...life of the repository./4, 7, 9	A	Cross reference of this discussion with the appropriate portions of Sections 6.2.3.4, 6.4.1, 6.4.2, and Chapter 12 in the SCP will provide justification for this statement.
Sec. 6.5.2 p. 6.5-11 Para. 2	Preliminary calculations indicate...(see Section 11.4)./2, 4, 14	A	Actual calculations have not been included in the SCP, therefore, the statement can be considered unsupported. 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.
Sec. 6.5.2 p. 6.5-11 Para. 4	Hanford Site, where ambient Eh conditions are also expected to be quite reducing/4, 14.	A	See response to Item 6.2-5.
Sec. 6.5.2 p. 6.5-11	6.5.2.3 <u>Archaeological Objects and Metal Meteorites.</u> (all)/3	A	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 SCP paragraph adequately covers and references the source information. Meteorites are inappropriate analogs and reference to them will be deleted in the SCP. <i>Explain why deleted?</i>

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ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.5.3 p. 6.5-12 Para. 1	Limited experimental data...(see Sections 6.3.../4, 11, 15 -- "Montmorillonite stability is in question."	A	See the discussion under Item Reference 6.3-9. The expected repository conditions refer to ambient conditions. Alteration of smectite to illite is insignificant in this case.
Sec. 6.5.3 p. 6.5-12 Para. 1	The groundwaters in the candidate repository...not be affected./ 4, 6, 11, 14 -- "Dissolution of basalt at higher temperatures will add K to water."	A	See NRC reference item p. 6.5-12, Para. 1.
Sec. 6.6 p. 6.6-1	6.6 FIELD TESTS (all)./3 -- "The discussion is for granite."	A	Current scoping plans call for extensive field testing of waste package backfill and canister materials under repository conditions at Hanford. Furthermore, these plans include provision for determining in situ radionuclide migration rates in the basalt geochemical environment. Plans for these field tests will be addressed in the SCP.
Sec. 6.7 p. 6.7-1 Para. 2	Geologic and hydrologic studies have established...Grande Ronde Basalt./3, 4, 7, 11, 12, 14	A	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 6.1, 6.2, and 6.4).
Sec. 6.7 p. 6.7-1 Para. 2	The indication is...(especially the glass portion of the basalt)./ 4, 7, 12.	A	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.
Sec. 6.7 p. 6.7-1 Para. 3	...results confirm the dominant control...at high temperature./ 4, 7, 12	A	A significant increase in the data base from hydrothermal basalt-water systems has been achieved and will be incorporated in Section 6.3 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	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 6.7 p. 6.7-1 para. 4	...hydrothermal studies demonstrate...to isolation criteria./4, 7, 12 -- "Laboratory studies have not been related to in situ conditions."	A	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.
Sec. 6.7 p. 6.7-2 para. 1	Field investigations of granites...the geochemical program at Hanford./3, 4, 11 -- "This has to be related to basalt; the geochemistry is quite different."	A	See response to 6.6-1.
Sec. 6.8 p. 6.8-1	6.8 SUMMARY OF UNRESOLVED ISSUES (all). / 3 ✓	AD	<i>This discussion of unresolved issues</i> This section (6.8) will be significantly expanded in the SCP. is included in Chapter 15. This section only identifies where these issues will be discussed in the
Sec. 6.9 p. 6.9-1	6.9 REFERENCES (all)	A	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 SCP was written. <i>See table. References to appropriate test plans will be included in those discussions.</i>

6/1/83

5. GEOCHEMISTRY

5.1 Introduction

This chapter provides an analysis both of preliminary DOE assessments of the geochemical conditions that will affect the long-term containment of high-level waste (HLW) in the Grande Ronde, and of DOE's plans for characterizing the geochemical parameters needed for assessing radionuclide release rates. DOE has contended that the results of its preliminary work "established the prevailing geochemical conditions of the Grande Ronde basalt..." (SCR, pages 7 and 6.7-1). This chapter discusses the basis for the NRC staff's opinion that this general contention is premature because the data presented in the SCR are incomplete and therefore too uncertain to establish the prevailing geochemical conditions.

The most likely means of migration of radionuclides from an HLW repository to the accessible environment is transport in solution by groundwater. As dissolved radionuclides move, interactions among the radionuclides, rock, and water result in changes in chemical form (speciation) and concentration of the radionuclides which affect further radionuclide mobility. Reactions near the waste are influenced by radiation and elevated temperatures. Because the release rates of radionuclides and their accumulation at the accessible environment must be modeled with confidence to assess compliance with NRC and EPA standards, the uncertainty of each of the important geochemical parameters must be evaluated.

5.1.1 Type of Material Presented in the SCR

In the SCR, DOE presents selected results of preliminary investigations and general plans for characterizing (1) geochemical/petrographic observations for the basalt and the fracture/vesicle filling, (2) site-specific groundwater/rock (basalt) alteration reactions, (3) chemical reactions among the materials used in the engineered waste package, (4) dissolution reactions of waste forms, (5) concentration limits imposed on selected dissolved radionuclides by solubility constraints, and (6) selected radionuclide precipitation and sorption reactions in both the near-field and far-field environments. The NRC staff supports the multi-phased approach to characterization of site geochemistry that is implied in the SCR. 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
- (3) observations of natural systems that can be used to support extrapolation of experimental results to repository scale and time frame.

NINE "NEW" ITEMS
WITH AGREED UPON PRIORITY

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8

However, 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 site characterization, experimental assumptions, experimental design, experimental methods, approaches to data analysis, and detailed milestones.

5.1.2 Relevant Sections of Proposed 10 CFR 60 (Subpart E)

Principal sections of the proposed 10 CFR 60 that are related to geochemical processes are:

§60.11(a), requiring an SCR with a description of the site characterization program with respect to investigation activities that address the ability of the site to host a repository and isolate radioactive waste.

§60.21(c), requiring that the SCR contain an analysis of the geochemical aspects of the site that bear significantly on its suitability for disposal of radioactive waste.

§60.31(a), indicating that the NRC must determine whether DOE has adequately described the geochemical characteristics of the proposed site before it grants construction authorization.

§60.111(a), requiring that the geologic repository and each of its components satisfy specific requirements related to radionuclide release rates.

§60.122, specifying geochemical conditions at the site that may be considered favorable in their effects on the ability of the site to meet performance objectives.

§60.123, specifying geochemical conditions that might have potentially adverse effects on the ability of the site to meet performance objectives.

§60.132, specifying additional design requirements for the underground facility that will provide control of radionuclide releases and migration.

5.2 Background

A key DOE assertion about the performance of a repository at the Hanford site is stated on SCR page 6.4-3 as follows:

"Based on solubility, the maximum possible release rates for all the radionuclides considered will be below the NRC 10⁻⁶ proposed release rate criterion (NRC, 1981) and the draft cumulative release criterion (EPA, 1981)."

2 This assertion could mean that adequate performance is ensured by one favorable geochemical condition at the site. It is based, for the most part, on the use of the following seven considerations by DOE about the geochemical interactions within the basalt environment, that the NRC staff considers premature:

A

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.

A

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

See pages 5-4, 5-10, 5-11 and 5-13.

- (1) Spent fuel oxides are the dominant waste form (SCR page 6.4-3).
- (2) Radionuclide release is, in most cases, solubility controlled (SCR pages 6.4-1, 6.4-3, 6.4-11, 7, and 11).
- (3) The prevailing redox conditions at Hanford are estimated to be very low (-0.45 volt). After waste emplacement and closure, it is estimated that the repository will quickly return to some low oxidation potential (SCR pages 5.1-131, 5.2-26, 8.2-5, 6.4-3, 6.5-10, 6.7-1, and 8).
- (4) The pH of the rock-water system is restricted by silica dissolution to a range between 8.8 to 10.1 (SCR pages 5.1-130, and 5.2-26).
- (5) The basalt groundwater and geochemical environment is benign (SCR pages 11.2-4).
- (6) The concentration of radionuclides will not significantly increase due to complex or colloid formation (SCR page 6.4-3).
- (7) The effect of complexing ligands such as carbonate was not considered in estimates of solubility (SCR pages 6.4-2, 6.4-3).

In addition to limitation of radionuclide migration by solubility, the SCR asserts that a further restriction to migration is provided by sorption (pages 6.1-20, 6.4-1). Also, the SCR asserts that the heat produced by the waste material will not degrade, to any significant extent, the sorptive properties of the host rock and backfill in the near field (pages 6.3-9, 6.3-10, 6.3-11, 6.3-12, 6.3-13, and 6.5-12).

Further, the SCR asserts that natural analog studies of waste form, canister, overpack, and repository suggest that long-term hazards from HLW in a repository in basalt should be minimal (pages 6.5-8, 6.5-10, and 6.5-12).

As discussed in Section 5.3 below, it is the opinion of the NRC staff that the above assertions and conclusions are only superficially supported by data presented in the SCR and do not accurately reflect the extent of present uncertainties. Other concerns of the NRC staff are presented in Chapter 11 and Appendix B.

5.3 Analysis of Issues

DOE's characterization of issues and work elements relating to geochemical retardation appears to be reasonably complete when compared to the independent identification of BWIP issues performed by the NRC staff. Both sets of issues address hydrochemical conditions, radionuclide speciation, solubility, sorption and long-term predictability. Appendix C provides details on issue comparison.

In general terms, both sets of issues are aimed at defining

- (1) the geochemical conditions of the waste package initially and over time
- (2) the conditions and processes affecting radionuclide retardation in the engineered system and in the natural system over time

Although the SCR contains some representative geochemical data, the SCR is deficient when viewed as more than preliminary support for the assertions presented in the previous section (Section 5.2). There are several reasons for this: (1) a detailed description of experimental strategy and analytical techniques, needed for peer review, is not provided (see Section 5.4); (2) statements concerning the status of DOE's geochemical positions are seldom documented (see Appendix B); (3) many conclusions, where referenced, are broad generalizations or extrapolations based on very narrowly conceived and executed research results (see Appendix B); and (4) there is little discussion concerning the methods of assessment of uncertainties pertaining to existing data or data to be obtained.

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Determining the quantity of radionuclides that might be in solution and transported to the accessible environment is of fundamental importance. Once radionuclides are released from the waste package, those that remain dissolved in the groundwater are available for transport to the accessible environment. The primary geochemical factors that might be expected to control the transport rate of radionuclides to the accessible environment are the solubilities of radionuclides and the sorption of the radionuclides during migration through the repository. The solubility and sorption of the radionuclides are controlled by the geochemical environment of the waste package (groundwater chemistry, temperature, pH, Eh) and geochemical conditions and reactions along the migration path. The following subsections deal with specific uncertainties pertaining to solubility, sorption, and long-term predictability (discussed below and in Appendices S, T, and U).

5.3.1 Uncertainties of Solubility Determinations

The SCR presentation on solubility is deficient because quantitative assessments of concentrations of dissolved radionuclides (such as release rates or cumulative concentration values) do not reflect the uncertainties of parameters such as groundwater chemistry, temperature, and redox conditions, which control radionuclide solubility. For example, whether or not a radionuclide remains in solution and how much of it does remain depends on specific groundwater characteristics (parameters such as chemical composition, Eh, pH) and repository conditions (parameters such as temperature and pressure) along the flow path, and reactions of the radionuclides under these conditions. Therefore, the values--or ranges of values--of at least these groundwater and repository parameters must be defined and used to determine the limits of radionuclide concentrations, if solubility arguments are employed by DOE (see Appendix U).

The following brief discussions provide additional examples of deficiencies in the SCR regarding solubility.

- (1) There are two general approaches to the determination of radionuclide concentrations. Solubilities can either be calculated from existing thermodynamic data for substances (solid and aqueous) assumed (or known) to be present, or measured experimentally in the laboratory using a particular set of conditions. Further, solubility data most likely will have to be extrapolated through the 10,000-year performance assessment period. However, there are examples of directly measured concentrations of a radionuclides dissolved in a groundwater exceeding, by several orders of magnitude, the calculated solubilities (Moody, 1982, page 27; Appendix U). Thus, the NRC staff considers it essential that the relevant thermodynamic data that

underlie the theoretical calculations be verified by selected laboratory measurements. Also, verification of selected calculations will have to be done using site-specific groundwater compositions and conditions.

- (2) Some radionuclides that form relatively insoluble compounds with common groundwater ions could form colloids. Chemically, colloids behave differently from dissolved species and they are not retarded in the same way during migration (NUREG/CR-3062). Therefore, it is important to determine what fraction of the radionuclides in the waste is released in a colloidal form as compared to dissolved species, and to determine the role of colloids in radionuclide migration.

- (3) Formation of complex ions could play a dominant role in determining solubilities of important radionuclides (Allard, 1982; Moody, 1982; Cleveland, 1982). Chemical speciation is a function of groundwater characteristics, temperature, pressure, and interactive effects between the aqueous phases and solids along the migration path. The groundwater characteristics are a major determinant of whether a radionuclide will occur in solution as a simple or complex ion. For example, uranium and actinide ions, regardless of valence state, can form complexes of varying stability with all anions (ligands) found in groundwater (e.g., carbonate (CO_3^{2-}), fluoride (F^-), phosphate (PO_4^{3-}), chloride (Cl^-), hydroxide (OH^-), silicate (SiO_4^{4-}), and sulfate (SO_4^{2-})). The level of uncertainty of solubility data are directly related to the uncertainty in the accuracy of site groundwater characteristics.

- (4) 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 CFR 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 ratio 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).

- (5) Thermodynamic estimates of the solubility of limiting actinide compounds (e.g., $\text{UO}_2(\text{OH})_2(\text{s})$, $\text{UO}_2(\text{s})$, $\text{NpO}_2(\text{s})$, $\text{Am}(\text{OH})_3$, and $\text{PuO}_2(\text{s})$) require that the cumulative contributions by all important complexes are accounted for in the analysis. Failure to account for all important complexes (carbonate complexes) will result in underestimates of maximum concentrations that could be achieved under repository conditions. In addition to common inorganic anions typical of deep groundwaters (e.g., OH^- , HCO_3^- , CO_3^{2-} , HPO_4^{2-} , F^- , SO_4^{2-} , H_2SiO_4^- , $\text{H}_2\text{SiO}_4^{2-}$), anions that will be released by the waste package (e.g., H_2BO_4^- , HBO_4^{2-} , BO_3^{3-}) must also be considered. Therefore, the solubility values used in SCR Figure 6-15 are too low (Appendix U, Part 2).

- (6) When the overall ratio of solubility versus MPC presented in SCR Figure 6-15 is corrected to account for the adjustment to MPC and carbonate complexation (Appendix U, Part 1), the ratios increase by 5 or more orders of magnitude. The importance of such uncertainties in performance assessments which credit solubility must be discussed and evaluated.

- (7) The measured Eh values in Grande Ronde basalt groundwater range from -0.22 volt to +0.21 volt (SCR, page 5.1-131). The predicted values are extremely low (-0.45 volt). The measured values are probably, but not necessarily, imprecise, because of well known uncertainties associated with analytical techniques (Appendix S; NUREG/CR-2863; NUREG/CR-2983). The predicted values are based on assumptions that iron-bearing minerals in the host rock control the redox potential. However, the mineral assemblages used to predict Eh values (notably magnetite and pyrite) have not been verified. Although magnetite and pyrite may be present throughout the basalt, it has not been shown that they are close enough to each other and sufficiently in contact with the groundwater to control Eh. Further, Benson (1978, page 16) and the SCR (page 5.1-125, Table 5-28; page 5.1-129 Table 5-29) suggest that concentration of dissolved species is not large enough to control (poise) Eh. Finally, there is no information in the SCR on the buffering capacity of the solid phases of the system. Redox information must include Eh, redox buffering (poising), and redox reaction kinetics for the repository (Appendix S). Theoretical, predictive, and direct measurement methods should be employed for validation purposes.

- (8) The groundwater composition in the near field may be altered by radiolysis reactions and by the degradation of the waste package with the consequent addition of waste package chemicals such as borate from proposed borosilicate glass and iron from proposed canisters. Solubility estimates presented in the SCR may not be relevant because pH may be significantly lowered by hydrolysis reactions and by gamma ray-induced production of H_2 and H_2O_2 . Validated information on the effects of radiation and waste package components on near-field geochemical conditions and their persistence into the far field is needed.

2. 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.

5.3.2 Uncertainties of Sorption Determinations

The SCR presentation on sorption is deficient because the discussion does not reflect the uncertainties of parameters, such as redox condition and chemical speciation, which have been identified by Barney (1981) among others, as factors which affect sorption. For example, sorption onto primary basalt minerals, secondary minerals, sedimentary rocks, or engineered barrier materials contacted by radionuclides can affect the concentration of the radionuclides in solution (see Appendix T). As water flows through the repository, the process of re-equilibration between the water and rock minerals takes place continuously. If the water is rich in elements that are either absent or present in very low concentrations in the rock, then the re-equilibration process involves removal

of some quantity of each element through sorption on the rock. To date, hydro-chemical data needed for sorption studies are incomplete (Rockwell, 1982, pages 3 through 7), and, therefore, the associated sorption data must be considered preliminary. Additionally, even though groundwater will spend most of its time flowing through flow tops and interbeds, many sorption studies were not conducted under conditions typical of these zones (Appendix D; Barney and Wood, 1980; Ames, 1981).

The following brief discussions provide additional examples of deficiencies in the SCR regarding sorption.

- (1) The sorption work discussed in the SCR deals primarily with the interpretation of results from batch sorption experiments carried out under oxidizing conditions (SCR pages 6.4-6 through 6.4-13). Batch experiments can be valid only if a single species dominates the solution. Actinides, as well as technetium and selenium, are noted for providing more than one species in solution (Moody, 1982; HUREG/CR-3062). Because repository conditions are presumed (in the SCR) to be reducing, the results of experiments under oxidizing conditions (SCR, pages 6.4-6 through 6.4-13) must be shown to be conservative; otherwise, these data are of questionable relevance. This problem was addressed briefly through the use of hydrazine to control and lower the Eh during some of the experimental runs. However, hydrazine is not an expected repository constituent. Further, hydrazine may be excessively reducing and no discussion of the dissociation of hydrazine hydrate and experimental complications as a result of the possible sorption of the hydrate or of possible complex ion formation was presented. In addition, El-Naggar et al. (1982) have recently shown that reduction of Np(V) by hydrazine may be kinetically limited in some experimental systems. Thus, an evaluation of the uncertainties associated with the effect of speciation on sorption measurements is needed.
- (2) Barney (1981, 1982) showed that sorption values for most radionuclides vary with radionuclide concentration, indicating that the sorption isotherms are not linear over the concentration ranges studied. In such cases, simple distribution coefficients (K_d s) are not appropriate for characterizing sorption. Although some isotherm data are presented in the SCR (Table 6-21), they are inadequate because there is no discussion and evaluation of their inherent uncertainties. These uncertainties are the result of the large number of variables (identified by Barney (1981) and discussed in Appendix T) that must be adjusted in the laboratory to bound or define the conditions present in the groundwater and along pathway from the waste form to the accessible environment. Remaining sorption information needs include sorption isotherms for long-lived radionuclides on primary basalt minerals and especially on secondary minerals in fracture fillings and flow tops, and interbed material. These isotherms should be determined for the ranges of expected repository groundwater chemistry. Sorption reversibility also must be discussed in terms of uncertainties it introduces into the data.
- (3) Some of the data reported in SCR Table 6-20 demonstrate the variability in results under the anticipated range of Eh that characterizes the repository environment. For example, the reported K_d for ^{237}Np /basalt ranges from 7 to 2,000; the reported K_d for ^{235}U /basalt ranges from 1 to 650; and the

reported value for ^{76}Se /basalt ranges from 2 to 18 (SCR, page 6.4-12). The uncertainties associated with the variability of the values or ranges of values of the sorption data need to be explained. For example, in the basalt environment, sorption of radionuclides can occur on the primary basalt itself, on the secondary minerals associated with the basalt flows, on interbeds, on glaciofluvial sediments above the basalts, and on backfill material used to close repository openings. Although the general mineralogy, petrology, and chemistry of the Grande Ronde basalt are known, only a qualitative description of the composition of the glassy portion of the basalt and of the flowtops and interbeds is provided. Therefore, considerable uncertainty in sorption data can be introduced if the experimental design does not bound expected repository mineralogy/temperature conditions.

- (4) The secondary minerals and the natural volcanic glasses of the basalt flows are expected to provide the sorptive mineral and alteration products to retard radionuclide migration along potential pathways (SCR, page 6.4-2). If these materials are altered as a result of waste emplacement, changes in their retardation properties must be taken into account. The secondary minerals, smectite clay, zeolites, and silica make up the fracture filling. Backfill may be a mixture of crushed host rock basalt (~75%) and smectite clay (~25%) (SCR page 11.2-8). If potassium is available, the clay component could change its mineral structure under the elevated temperatures anticipated in the repository. The SCR position is that the smectite clay (whether in the backfill or in the fractures) will be stable under repository temperature conditions because there is currently not much potassium in the groundwater. This conclusion is premature, because the potassium concentration in the groundwater increases markedly with elevated temperature as a result of the dissolution of the potassium-enriched basalt glass must be evaluated (SCR, page 6.4-8). Further, hydrothermal experiments of Koster van Groos cited to support stability of the fracture filling clay (SCR, page 6.1-20) and backfill clay (SCR, page 11.3-38) were not designed to demonstrate stability. Also, the scenario proposed in the SCR (page 6.1-20) is unrealistic and appears to make inappropriate use of the cited Koster van Groos (1981) data in that it requires immediate saturation to provide the necessary water pressure to ensure the stability of the clays. Thus, DOE should continue to consider that dissolution of the potassium-rich basalt glass at elevated temperatures could lead to the alteration of the smectite clay in fractures and the backfill to illite, thereby reducing the sorptive and swelling capacity of these materials. The staff considers that it is premature to conclude otherwise.

These and other uncertainties associated with sorption measurements are summarized by Apps et al. (1978) and in Appendix I. Until these uncertainties are characterized and evaluated, little confidence can be placed in the DOE assertions concerning sorption.

5.3.3 Uncertainties of Long-Term Predictability of Geochemistry

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. The study of appropriate natural analogs of waste repository environments and the use of geochemical models can provide important information about long-term chemical reactions and transport. Such

work can be used to extrapolate experimental data from laboratory time (days/months) to geologic time (hundreds to hundreds of thousands of years) for modeling the isolation of waste in a repository.

The discussion of natural analogs in the SCR (pages 6.5-1 to 6.6-1) involves waste form analogs, uranium ore bodies as natural analogs, canister and overpack analogs, and backfill analogs. The discussion, however, draws no direct relationship to the conditions at the BWIP. Further, the SCR (page 6.0-1) states that characterization of prevailing in situ geochemical conditions and reactions represents a natural experiment. This line of reasoning was not further developed. As a minimum, DOE must address the applicability and relationship of the natural analogs to the BWIP environment.

The only field test discussed in the SCR (page 6.6-1) involved granite, not basalt. There was no discussion concerning how these results relate to basalt.

Until a clear relationship between analogs, laboratory and field tests, and performance assessment models has been presented, little confidence can be placed in the DOE assertions concerning long-term predictability of radionuclide release.

5.4 Analyses of the Site Characterization Plans

The NRC staff supports the general site-characterization approach in the SCR, which consists of (1) calculations based on theoretical considerations, backed by (2) observations of laboratory and field experiments, and (3) observations of natural systems. The plans are presented in limited detail in the SCR. If the NRC staff interprets these plans and work elements broadly and if DOE fulfills them accordingly, the site would be adequately characterized. However, the presentation of plans and work elements in SCR Chapter 15 provides insufficient details on which the staff may assess with confidence whether the plans are adequate. Further, as discussed by DOE in SCR Chapter 17, the resolution of an issue by DOE does not mean that a particular report will be issued at that time (SCR, page 17.3-1). 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.

5.4.1 Solubility Plans

DOE proposes to experimentally measure the solubilities of compounds of uranium, plutonium, americium, and other key radionuclides under conditions anticipated to occur in the basalt repository (low Eh, high temperature, high radiation field, and complexing ligands) (SCR RMO Work Elements W.1.4.A, W.1.10.A, W.1.12.A, W.2.4.A, W.2.5.A, W.2.6.A, W.2.8.A, W.2.11.A, W.2.9.B, W.1.11.D, W.2.12.D, W.2.13.D, R.1.18.D, S.1.26.C, and S.1.38.D.)

Specifically, DOE intends to

- (1) Use computational schemes or numerical codes for preliminary solubility/speciation work.

- (2) Continue experiments already initiated on the interactions between the waste form, basalt, and groundwater over the temperature, pressure, and Eh-pH conditions expected for the repository.
- (3) Use data supplied by other laboratories from long-term static and low flow rate dynamic leach tests on simulated spent fuel and borosilicate glass.
- (4) Experimentally identify the dominant radionuclide species in basalt groundwater, and to evaluate conditions that could lead to possible radionuclide colloid formation and subsequent particulate transport.
- (5) Investigate the possible effects of the radiation field on radionuclide geochemical behavior.
- (6) Couple the solubility, speciation, and colloid data with an uncertainty analysis to ensure the accurate prediction of radionuclide concentrations in the basalt groundwater.

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:

- (1) A detailed description of experimental and analytical techniques was not provided (NRC Regulatory Guide (RG) 4.17).
- (2) A rationale concerning the choice of radionuclide spikes to be used in the solubility experiments was not provided. In addition, it is not clear whether DOE will examine the compounds one at a time or as aggregates.
- (3) A strategy for determination of the speciation of critical radionuclides was not provided.
- (4) A strategy for determination of the types of colloids expected to form (oxides, hydroxides, oxyhydroxides, organics) was not provided.
- (5) The expected influence of the radiation field (radiolysis) on radionuclide behavior at high temperature was not discussed.
- (6) The methods of ensuring compatibility between BWIP data and data generated by other laboratories trying to simulate the in situ conditions of the basalt repository were not described.
- (7) The methods of assessment of uncertainties on existing data or data to be obtained were not provided.
- (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.

DOE plans to conduct experiments to determine more precisely the (ambient) redox conditions present in the basalt groundwater system including collection of in situ data from drill holes. Critical Eh values will be estimated in several ways (RHO Work Element W.2.10.C) including (1) down-hole potentiometric methods

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Broader issue
NRC

transport modeling

using reversible electrodes, (2) redox indicator dyes, and (3) measurement of selected redox couples (e.g., $\text{As}^{3+}/\text{As}^{5+}$) in groundwater. Post-closure conditions will be extrapolated from experimental data from autoclave tests (elevated temperature and pressure) using basalt and/or mineral assemblages and site groundwater (RHO Work Element W.1.5.A). It appears that emphasis will be placed on defining Eh-pH controlling mechanisms and the kinetics of changes from oxidizing to reducing conditions.

These plans for better defining redox conditions, both pre-emplacement and post-closure, are not presented in a concise and adequately detailed manner, and the practicality of some of the proposed approaches to estimating redox conditions is questionable. For example, it seems unlikely that attempts to make down-hole potentiometric measurements will be successful, or, if such measurements are obtained, that their credibility and meaning will be established unequivocally (NUREG/CR-2983). Indirect approaches to Eh estimation and direct measurements made under carefully controlled conditions at the well-head may be more successful. Plans to define redox controlling mechanisms and the kinetics of changes from oxidizing (repository operation period) to reducing (post-closure period) conditions, although not given in much detail, represent a reasonable approach to assess post-closure conditions. The experimental plans presume that the rate of return to equilibrium conditions (reducing) will be rapid enough to be detectable in laboratory hydrothermal experiments, and preliminary RHO experiments seem to confirm this. No detailed plans were given that would address the question of presumed equilibrium between radionuclide redox couples and the predominant mineral redox couple controlling Eh within various zones of the repository. Predictions of repository performance for redox-sensitive radionuclides based on the use of mineral couple data will not be reliable if equilibrium cannot be demonstrated.

The SCR states that certain actinides may form carbonate complexes and that the effect of complexing ligands has not been considered in making the solubility estimates provided (page 6.4-1.2). However, the discussion of pertinent plans, such as W.1.4.A and W.1.10.A, does not specifically indicate that actinide-complex solubility experiments will actually be performed. The staff has determined from calculations of actinide complexation based on existing data, that the solubilities of the limiting solids for U, Np, Pu, and Am calculated by DOE are orders of magnitude less than in cases where carbonate ions are considered (Appendix U, Part 2).

Finally, colloid/particulate formation by groundwater interaction with the waste form or dissolution/precipitation phenomena, as well as the transport of radionuclides as colloids or particulates, is only superficially treated in the SCR. It is mentioned under RHO Work Element W.1.10.A (Determine the formation and stability of complexes and/or colloids over expected repository near-field and far-field conditions). It is not possible to estimate from SCR plans when an adequate understanding of colloid/particulate migration/retardation will be reached.

5.4.2 Sorption Plans

The geochemical process of sorption is not specifically addressed as an issue in the SCR. However, the need to develop additional sorption data is identified in work elements under RHO Issue W.2.A: "Are the geochemical and hydrologic

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properties of the geologic setting (in conjunction with the waste forms) sufficient to meet or exceed U.S. NRC proposed waste isolation requirements?" and the utilization of sorption data in modeling and analysis is treated under RHO Issue W.3.A, "Testing and Performance Confirmation." Additional sorption experiments include investigation of irreversible phenomena and the effect of multiple speciation. Field migration tests may also be conducted to confirm the distribution coefficients and sorption isotherms obtained in the laboratory. The plans associated with DOE issues and work elements are not detailed enough for the NRC staff to assess with any degree of confidence whether they are adequate.

The work elements in the SCR appear to cover a large range of possible parameters. The expected temperature and radiation regime to be experienced by backfill, and the water-exclusion and radionuclide-sorption properties needed, are included in RHO Issue W.1.8 (Is a unique borehole backfill required?). The greatest uncertainty that will impact on the likelihood of success lies in the area of the availability of an adequate characterization of the waste form and load. Spent fuel elements and glass or ceramic waste forms could require different backfill materials because of different behavior in the presence of groundwater. Also, the waste load has not been determined, and this also will influence the backfill requirements and materials.

The general near-field and far-field mineralogy of the Columbia River basalts is known. However, the mineral distributions within flows have not been established. Therefore, the limited additional testing indicated in the SCR does not appear to be adequate to meet the information needs for characterization. Further, plans to characterize the stratigraphy and mineralogy below the Grande Ronde appear to be omitted. In addition, 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.

The issue of near-field mineralogical information and its use in the assessment of radionuclide migration data or predictions seems adequately identified in the SCR, but specific experiments remain to be identified. The proposed extensive use of hydrothermal studies using the host basalt and groundwater is a reasonable approach but experimental materials and conditions must be thoroughly evaluated as to their relevance. For example, where crushed basalt may be relevant for defining backfill chemical reactions, an assemblage of secondary minerals known to be major components of fracture fillings in the near field and far field is needed to define reactions in these zones. Further, the sorption properties of flow top and interbed materials must be quantitatively defined.

Finally, the effect of accelerated potassium leaching from basalt glass at elevated temperature on the stability of Na-bentonite will apparently be examined under RHO Work Element W.1.12.A, but it is not mentioned specifically. Determination of solubility/concentration information needed for sorption work may require substantial additional work (see Section 5.4.1).

5.4.3 Long-Term Predictability Plans

Confidence in long-term predictions can only be enhanced by the corroboration of analyses of natural analogs, laboratory simulations of repository systems,

A Plans to characterize the stratigraphy and mineralogy below Grande Ronde Basalt were omitted from the SCR.

D, C, X

BWIP disagrees with this issue and would like 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.

B, C More detailed 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.

C, X

It is agreed that mineralogy along the flow paths must be determined. Detailed characterization to meet NRC concerns would require detailed descriptions of Grande Ronde and Hanapum flows and interbeds in RRL boreholes and at available boreholes farther down the syncline in the presumed direction of groundwater transport. These descriptions would include a detailed visual estimate of abundance of secondary minerals, and vesiculation, and detailed measurement of filled fracture widths. These data would need to be supported by additional mineral analysis and identification, including X-ray diffraction, electron microprobe, optical microscope, and electron microscope analysis. Clarification and 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. The BWIP believes that adequate characterization for performance assessment could be accomplished with lesser detail than implied by the DSCA. Specifically, examination of selected boreholes and strata with focus on the candidate horizons should achieve the desired end.

A

Sufficient sorption data including solid phase characterization are not available for flowtops and interbeds where groundwater will spend most its time flowing.

A, X

The BWIP has been conducting sorption experiments on a limited number of flowtop materials. Available data will be incorporated into the SCP. Detailed plans for evaluating radionuclide sorption behavior will be referenced in the SCP.

1)

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.

A

The DWIP 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) also will 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.

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or additional tests and experiments that tend to validate the geochemical assessment models.

DOE gives no specific plans for analog research beyond stating: "Determine what natural analogs of waste package components can be used to verify the compatibility of the waste package with the repository environment" (RHO Work Element W.3.4.A), and "Determine suitability of using nonradioactive chemical analogs for actual waste forms in the hydrothermal testing program" (RHO Work Element W.3.7). The expectation of using metal artifacts, nickel-iron meteorites, and basalt-iron deposits is expressed. However, no discussion is provided to demonstrate how the environments of these analogs are related to BWIP.

It is not clear what kind of field tests are planned beyond the general statement of RHO Work Element W.3.6, "Determine and conduct field, engineering, and in situ testing as may be appropriate to meet design needs...and proposed performance requirements." Therefore, the plans associated with these DOE work elements are not detailed enough for the NRC staff to assess with any degree of confidence whether they are adequate to carry out the determinations, when the determinations will be made, and how the results will be used.

3 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.

5.5 Summary

In general, planned tests, experiments, and calculations to be conducted during site characterization should be described in detail and made available to the NRC. The relationship of the planned tests and experiments to information presented in the SCR and to the unresolved DOE issues should be clearly stated. The quality assurance program to be applied to data collection during site characterization should also be described. A schedule for completion of the tasks showing how work will be completed in time to support construction authorization should also be made available. Reporting of issue resolution should not be put off until FY87/88 if a particular issue has been resolved before that time. Work element progress and results should be made available for NRC and other peer review.

For each test or experiment, the necessary testing and instrumentation should be described. The description should include the testing method and testing apparatus, data collection systems, methods of analysis and reduction of data, and the applicability and limitations of the testing and instrumentation in acquiring the necessary information. For each test or experiment requiring short-term or long-term monitoring, the monitoring goal and technique(s) should be described. The description should include specifications for the monitoring system, the instrumentation and data collection systems, the methods of analysis and reduction of data, and the applicability and limitations of the monitoring system in acquiring the necessary information. A suggested format for description of planned tests and experiments is provided in NRC Regulatory Guide (RG) 4.17.

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Performance
assessment
link

Finally, the use of geochemical data for characterizing radionuclide transport relies on demonstrated accuracy, precision, and reproducibility of the data. Given the requirement for data of high quality, there is a need for interlaboratory comparisons of research results to demonstrate reproducibility. In this regard, results and procedures should be accurately reported and widely circulated to increase peer review.

5.5.1 Summary of Solubility Determinations

Based on its review of the data and plans outlined in the SCR, the NRC staff concludes that the following concerns regarding solubility determination should be addressed if DOE intends to consider solubility a factor in meeting radionuclide release criteria:

- (1) There is a need to acquire more relevant radionuclide solubility data, especially within the actinide series. The NRC staff believes that solubility determinations (steady-state condition) should be approached from both oversaturation and undersaturation.
- (2) The reliability of the thermodynamic data used in geochemical modeling must be established, especially for the high-temperature conditions expected in the repository. 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 under the whole range of possible conditions, and experimentally verifying thermodynamic phase boundaries pertinent to solubility relationships.
- (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.

(4) The formation of colloids and their influence on migration in groundwater are poorly understood. Determinations are needed on the nature, radionuclide content, and migration properties of colloidal forms produced through degradation of proposed high-level waste forms. In addition, the nature, concentrations, particle size distribution, and migration properties of naturally occurring colloidal material suspended in the subsurface waters should be evaluated.	X
(5) Identification and confirmation of mineral couples and mineral-water-waste package reactions that control redox conditions in various zones of the repository must be demonstrated.	X
(6) The effect of groundwater radiolysis on redox condition values must be examined experimentally.	X
(7) The kinetics by which repository conditions (especially redox conditions) will return to their original state or evolve to new states imposed by repository construction and waste emplacement must be confirmed.	X
(8) It must be confirmed that key radionuclide redox couples (e.g., Tc^{2+}/Tc^{4+}) will be reactive (approach equilibrium) under conditions present in the	X

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

There are serious questions concerning the feasibility of approaching solution equilibrium from undersaturation. The time necessary to achieve equilibrium may be unrealistically long.

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 under the whole range of possible conditions, and experimentally verifying thermodynamic phase boundaries pertinent to solubility relationships.

D, X It is unrealistic to expect the BWIP 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 the BWIP safeguards the geochemical modeling effort in cases where steady-state rather than true solubility conditions may be limiting radionuclide concentrations.

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.

Preliminary plans have been made to determine solubilities of some key radionuclides at elevated temperatures (>100°C) beginning in FY 1984. They will be summarized in the SCP.

repository. The radionuclides may either react readily with the redox-controlling mineral couples, or they may react with an intermediate couple that is in equilibrium with the controlling couple. Failure of a radionuclide to come to equilibrium may invalidate predictions of repository performance.

5.5.2 Summary of Sorption Determinations

Based on its review of the data and plans outlined in the SCR, the NRC staff concludes that the following concerns regarding sorption determinations should be addressed as long as DOE intends to consider sorption a factor in meeting radionuclide release criteria:

- (1) The chemistry of the leachate moving from the waste package must be characterized. This requires that many engineered system parameters and components be defined. These include waste-form chemistry and load, chemistry of any overpack materials, and chemistry of backfill components. These data are required so that the radionuclide species that might be released from the waste package for the anticipated thermal and radiation conditions can be established.
- (2) Additional experiments that bound expected repository conditions will be necessary to define radionuclide retardation in the near field and far field. Materials for sorption determinations should include backfill materials, altered basalt, fracture filling minerals, flow top, and interbed materials along the flow path.
- (3) Isotherms are the minimum acceptable approach for quantitative analyses of sorption. The use of constant K_{ds} is acceptable only if isotherm determination shows that the ratio between the radionuclide in solution and the radionuclide sorbed is constant.
- (4) Reversibility of sorption reactions must be addressed.
- (5) The possibility that accelerated dissolution of potassium from basalt/backfill (as a result of elevated temperatures) will lead to degradation/alteration of backfill and fracture-filling clays should be examined.
- (6) The effects on speciation of critical radionuclides on sorption must be clarified.
- (7) Colloidal transport must be addressed.

5.5.3 Summary of Long-Term Predictability of Geochemistry

Based on its review of the data and plans outlined in the SCR, the NRC staff concludes that the following concerns regarding geochemical stability should be addressed:

- (1) Understanding the causes and effects of diverse naturally occurring radioactive processes that are relevant to assessing long-term repository performance should focus on applications specific to BWIP.

*uranium deposit
analog*

(2) Emphasis should be given to forming a connection between natural occurrences of radionuclide migration, site-specific repository conditions, field experiments, and laboratory experiments. This connection is necessary to establish a basis for extrapolating the results of laboratory analyses and short-term field experiments for the assessment of the performance of a repository over long time periods. Establishing such an understanding would assist in validation of numerical models and the rendering of license assessments.

REFERENCES

Allard, B., "Solubilities of Actinides in Neutral or Basic Solutions," in Proceedings of the Actinides 1981 Conference, Pergamon Press, Oxford, 1982.

Ames, L. L., "Basalt Radionuclide Reactions Fiscal Year 1981," Rockwell Hanford Operations, RHO-BW-CR-127, 1981.

Apps, J. A., M. G. W. Cook, and P. A. Witherspoon, "An Appraisal of Underground Radioactive Waste Disposal in Argillaceous and Crystalline Rocks: Some Geochemical, Geomechanical, and Hydrogeological Questions," presented at Lawrence Berkeley Laboratory, Invitational Symposium on Geotechnical Assessment and Instrumentation Needs in Crystalline and Argillaceous Rocks for Radioactive Waste Storage, LBL-7047, 1978.

Barney, G. S., B. J. Wood, "Identification of Key Radionuclides in A Nuclear Waste Repository in Basalt," Rockwell Hanford Operations, RHO-BWI-ST-9, 1980.

Barney, G. S., "Radionuclide Reactors with Groundwater and Basalts from Columbia River Basalt Formations," Rockwell Hanford Operations, RHO-BWI-SA-217, 1981.

Barney, G. S., "Radionuclide Sorptions of Columbia River Basalt Interbed Materials," Rockwell Hanford Operations, RHO-BW-SA-198P, 1982.

Benson, L. V., "Secondary Minerals, Oxidation Potentials, Pressure and Temperature Gradients in the Pasco Basin of Washington State," Rockwell Hanford Operations, RHO-BWI-C-34, 1978.

Cleveland, J. M., T. F. Rees, and K. L. Nash, "Chemical Speciation of Plutonium in Selected Ground Waters," presented at 183rd American Chemical Society national meeting, 1982.

El-Naggar, H. A., O. Gouisse, and M. S. Masoud, "Neptunium Reduction by Hydrazine and Hydroxylamine," in Radiochemica Acta, Vol 31, 1982.

EPA, 1981, "Working Draft No. 20, Environmental Protection Agency, 40 CFR 191, Environmental Standards and Federal Radiation Protection Guidance for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste," U.S. Environmental Protection Agency, Washington, D.C.

International Commission on Radiological Protection, ICRP Publication 30, "Limits for Intakes of Radionuclides by Workers," Eimsford, New York, Pergamon Press, 116 p., 1979.

Koster van Groos, A. F., "Determination of Dehydration Temperatures of a Secondary Vug-Filling Mineral (Smectite Clay) Using a Differential Thermal Analysis at Various Pressures, RHO-BWI-C-102, University of Illinois for Rockwell Hanford Operations, 1981.

Moody, J.B., "Radionuclide Migration/Retardation: Research and Development Technology Status Report," ONWI-321, Office of Nuclear Waste Isolation, 1982.

NRC, 1981, "Nuclear Regulatory Commission, 10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories," Federal Register, Vol 46, No.130, Proposed Rules, July 8, 1981.

NUREG/CR-2863, Meyer, R. E., W. D. Arnold, F. Case, S. Y. Shiao, and D. A. Palmer, "Valence Effects on Adsorption - A Preliminary Assessment of the Effects of Valence State Control on Sorption Measurements," U.S. Nuclear Regulatory Commission, 1983.

NUREG/CR-3062, "Status of Geochemical Problems Relating to the Burial of High-Level Radioactive Waste," U.S. Nuclear Regulatory Commission, March 1983.

NUREG/CR-2983, "Selected Hydrologic and Geochemical Issues in Site Characterization for Nuclear Waste Disposal - Flood Basalts at the Hanford Reservation," 1983.

Rockwell Hanford Operations, "Assessment of Hydrologic Data Needs Requiring Borehole Drilling and Testing to Support Site Characterization Activities for a Nuclear Waste Repository in Basalt," RHO-BW-EV-3P, 1982.

COMMENT CODES IN NRC DSCA APPENDIX B

- | | |
|--|---|
| 1. Incorrect statement | 12. Confidence level too high |
| 2. Not covered in the SCR | 13. Nonconservative approach |
| 3. Inadequately covered in the SCR | 14. Conflicts with previous statement |
| 4. Unsupported assertion | 15. Incomplete data base |
| 5. Unsupported conclusion | 16. Incorrect or no reference |
| 6. Alternatives not considered | 17. Outdated reference |
| 7. Lack of supporting data | 18. Planned analysis insufficient for resolution |
| 8. Conflicts with 10 CFR 60 | 19. No plan presented |
| 9. Uncertainty about testing techniques | 20. Reference inadequate to support statement |
| 10. Uncertainty about analysis methods | 21. Plans presented in insufficient detail to evaluate likely level of success in a timely manner |
| 11. Data not representative - biased selection of data | |

A.

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, ^areevaluation 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.

A

The discussion on MPC values for radionuclides which appeared in the SCR will be deleted from the SCP. This change reflects ~~reflects~~ derives from the fact that NRC (10 CFR 60) and EPA (40 CFR 191) regulations will apply to ^{release from} the repository.

Chap 5

P. 5-2

Section 5.2

"Based on solubility, the maximum possible release rates for all the radionuclides considered will be below the NRC 10^{-3} 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.

Chap. 5

P. 5-5

Item 4

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 CFR 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 Radiological 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 ratio in SCR Figure 6-15 by 1 to 2 order magnitude. Therefore, the MPC values in SCR Figure 6-15 are too high (Appendix U, Part 1).

A 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 the sensitivity analysis. 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.

A A detailed discussion of the ^{method} ~~computation~~ employed by the BWIP for computing ^{of the} solubilities of key radionuclides is included in Section 6.5.2 of the SCP and associated references. An empirical ~~rather than computational~~ 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.

Chapter 5

P. 5-6

Para. 4

(Refers to preceding
& items)

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.

Chap 5

P 5-10

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:

Item 6

The methods of ensuring compatibility between BWIP data and data generated by other laboratories trying to simulate the in situ conditions of the basalt repository were not described.

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.

D There seems to be a ^{confusion} ~~problem~~ in what is meant by "resolution" of issues. The BUIP and DOE will publish, ^{in such documents as the SEP,} the adopted approach to resolution of geotechnical issues for NRC review long before FY87. In addition, updates on progress ⁱⁿ resolving these issues will also be made available to NRC, ^{in a timely manner} for comment on a continuing basis ^{before} ~~reported~~ FY87. However, final resolution is not required or expected before this FY87/FY88 time frame noted by NRC in its comment.

A This issue is a key consideration of Chapter ¹⁸ ~~5~~ of the SEP and further description of BUIP's approach to ^{this topic} ~~problem~~ can be found in appropriate BUIP Quality Assurance documents such as the Basalt Grouting Procedure, ~~RA-4~~ RTE-BUI-MA-4.

A This relationship of the geotechnical model, as well as other ~~issues~~ ^{the integrated} The BUIP performance assessment ~~will~~ will be covered in Chapter 12 of the SEP. The issue of sensitivity analysis ^{including} the effect of data uncertainty on performance assessment results is also covered in Chapter 12 of the SEP.

Item
Reference

Chap. 5
p. 59

that time (SCR, page 17.3-1). 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 MRC 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 MRC staff and other peer reviewers to provide constructive, timely commentary.

Chap. 5
p. 5-10

(6). The methods of ensuring compatibility between BWIP data and data generated by other laboratories trying to simulate the in situ conditions of the basalt repository were not described.

Chap. 5
p. 5-13

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.

A The BIRP approach to characterization of site geochemistry and subsequent repository/waste packaging 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.

A The BIRP reviews its approach and associated assumptions regarding resolution of time issues in Section 11.4.5 of the SCP. A more extensive comparative treatment ^{regarding extrapolating short-term test data to} ~~is~~ ^{is} included in the Basic Material Test Plan, ~~not~~ with the Chapter Appendices ~~of the SCP~~ F and G.

Chapter 5

p 5-1

~~Immun. con.~~ 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
- (3) observations of natural systems that can be used to support extrapolation of experimental results to repository scale and time frame.

Chap 5

p 5-2

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. ~~The study of appropriate natural analogs~~

A = Agree
 C = Requires Further Clarification
 D = Disagree
 X = Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 10

NRC ITEM REFERENCE	NRC STATEMENT OF ITEM	DWIP DISPOSITION	DWIP COMMENTS
1 Sec. 10.0 P. 10.0-1 Para. 2	"In the conceptual design, the deeper and more widely ... using the deeper of the candidate flows, ... schedule improvement, and less technologic risk." 73, 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."	A	<p>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 sentences on this subject in the introduction to Chapter 10 (page 10.0-1) will be rewritten to be fully supported by the additional information.</p> <p>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.</p>
2 Sec. 10.2.2 P. 10.2-5 Para. 4	"After the borehole is filled with packages, ... is transferred to the next borehole" 73 --"There is no discussion of retrievability and its impact on design requirements."	A	<p><i>Discussion</i> A sentence 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.</p>

- A = Agree
- C = Requires Further Clarification
- D = Disagree
- X = Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)
CHAPTER 10

NRC ITEM REFERENCE	NRC STATEMENT OF ITEM	BWIP DISPOSITION	BWIP COMMENTS
3 Sec. 10.3.6 P. 10.3-4 Para. 4	"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."	A	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 ventilation system capacity or shaft cross-sectional area, but would provide additional design conservatism. Additional description will be provided based on information developed as part of the horizon selection study.
A Sec. 10.4.1 P. 10.4-4 Para. 4	"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."	C	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. <i>This will be the topic of a future Workshop with NRC.</i>
b Sec. 10.4.2 P. 10.4-6 Fig. 10-11	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."	A	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.

A = Agree
 C = Requires further Clarification
 D = Disagree
 X = Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 10

NRC ITEM REFERENCE	NRC STATEMENT OF ITEM	BWIP DISPOSITION	BWIP COMMENTS
6 Sec. 10.5 P. 10.5-1 Para. 1	"The conceptual design ... stress ratio. Current test data ... of 200 to 220 megapascals."/3 -- "A rock stress of 186 MPa together with a rock strength of 200 MPa provides a safety factor of only 1.00. How 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."	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 10

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
1 Sec. 10.5 p. 10.5-1 Para. 1	"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. "	A	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 also response to item 10.5-1 above.
2 Sec. 10.5 p. 10.5-1 Para. 5	"Time dependent near field phenomena, such as ... and more detailed stress analyses."/3, 8 --"Does not address retrievability, and barely containment. "	A	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.
3 Sec. 10.5 p. 10.5-2 Table 10-4	Table 10-4. /14 --"Rock maximum design temperature is shown to be 500°C rather 300°C shown in Table 10.5. "	A	Consistent values of the basalt maximum design temperature limit will be included in Tables 10-4 and 10-5 of the SCP.
10 Sec. 10.5.1 p. 10.5-3 Para. 3	"When the horizontal-to-vertical ... at the repository horizon."/ 7 --"The assumed maximum horizontal stress of 60 MPa is significantly less than several measured values in Table 4.11. "	A	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.
11 Sec. 10.5.1 p. 10.5-3 Para. 4	"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. "	A	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 10.5-1, above.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 10

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
12 Sec. 10.5.1 p. 10.5-5 Para. 2	"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."	A	See first comment under NRC Item Reference 10.5-1 above.
13 Sec. 10.5.3 p. 10.5-9 Para. 4	"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."	A	Same as first comment under 10.5-1 above. The existing BWIP plans will be expanded to include additional detail relative to joint behavior.
14 Sec. 10.5.3 p. 10.5-9 Para. 4	"The consequence of ... along rock joints." / 4 -- "Any justification for claiming that the motions along joints will be minor?"	A	Same as first comment under 10.5-1 above. The existing BWIP plans will be expanded to include additional detail relative to joint behavior and redistribution.
15 Sec. 10.5.3 p. 10.5-9 Para. 5	"The proposed rock support ... potential rock motion." / 3 -- "How will the grouted bolts react to the elevated temperature?"	A	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.
16 Sec. 10.5.3 p. 10.5-9 Para. 5	"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."	A	Plans for assessing roof support requirements will be included in Section 14.3.1 of the SCP.
17 Sec. 10.5.4 p. 10.5-9 Para. 7	"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."	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 10

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
§ Sec. 10.6.2 p. 10.6-2 Para. 6	"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. "	A	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 disturbed 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 on waste isolation performance to be included in Section 12.4.2. It is anticipated that 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 predominantly vertical.

- A = Agree
- I = Requires Further Clarification
- D = Disagree
- P = Programmatic Impact

**DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)**

CHAPTER 10

NRC ITEM REFERENCE	NRC STATEMENT OF ITEM	BWIP DISPOSITION	BWIP COMMENTS
19 Sec. 10.7.2 P. 10.7-2 Para. 1	"This sequence continues ... height of the room"/1 --"The filling sequence appears to indicate room heights greater than 10 ft."	A	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.
20 Sec. 10.7.2 P. 10.7-2 Para. 1	"To achieve maximum ... next lift is started."/3 --"Because back-fill will be moistened when emplaced, this moisture may turn into high pressure steam that will hamper retrieval. This needs to be discussed."	A	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.
21 Sec. 10.7.3 P. 10.7-3 Para. 7	"Prior to retrieval ... to approximately 27°C."/4 --"The cooling rates assumed seem very optimistic."	A	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.
22 Sec. 10.7 P. 10.7-3 Para. 1	"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?"	A	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.

- A -- Agree
- I -- Requires Further Clarification
- D -- Disagree
- A -- Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 10

INC. ITEM REFERENCE	NRC STATEMENT OF ITEM	DWIP DISPOSITION	DWIP COMMENTS
23 Sec. 10.7.3 p. 10.7-3 Para. 3	"The approach that will be followed to resolve ... in the decision flow chart (Fig. 10-14). The requirement for the proposed 10CFR 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."	A	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 commenter merit only brief mention as justification for this design philosophy.
24 Sec. 10.7.3 p. 10.7-4 Fig. 10.14	Figure 10-14./3 --"It is not clear when backfilling will take place."	A	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. <i>Current plans are to demonstrate retrievability without backfill.</i>

- A = Agree
- C = Requires Further Clarification
- D = Disagree
- I = Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC HRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 10

HRC ITEM REFERENCE	HRC STATEMENT OF ITEM	DWIP DISPOSITION	DWIP COMMENTS
15 Sec. 10.8 p. 10.8-3 Para. 4	"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?"	A	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 disturbed 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 disturbed rock zone. Rock mass characterization and any necessary remediation at specific seal sites will be done prior to seal emplacement.
16 Sec. 10.8.1 p. 10.8-5 Para. 1	"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?"	D	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 done to support the LA.
27 Sec. 10.8.1 p. 10.8-6 Fig. 10-17 Fig. 10-18	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."	A	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 10.8-1, 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.

A Agree
 I Requires Further Clarification
 D Disagree
 Y - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Chapter 11

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 11.2.1 p. 11.2-7 Para. 3	"The site conditions have eliminated the need for a buffer and overpack by providing an environment that canister corrosion..." / 4.	A	Additional information will be included in Section 11.2 to support this statement.
Sec. 11.2.5 p. 11.2-10 Para. 6	"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	A	The text on page 11.2-10, 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.
Sec. 11.2.5 p. 11.2-12 Para. 2	"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."	<i>Defined by A</i> A	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. <i>Add definition of conceptual design</i>
Sec. 11.2.5 p. 11.2-12 Para. 3	"...backfill materials and additives have been selected..." / 2, 3, 4, 6	A	The appropriate reference for the backfill material development and selection process will be added.
Sec. 11.2.2 p. 11.2-6	A11/4, 5, 6, 9, 10	<i>(B)</i> A	The text of Section 11.2-6 will be revised to 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. <i>Add definition of conceptual design</i>
Sec. 11.3.1 p. 11.3-1 Para. 2	"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	A	Sentence will be revised to indicate that preliminary estimates are not based upon a well-developed data base, testing techniques and analysis methods.
Sec. 11.2.1 p. 11.2-4 Para. 2	Groundwater will not reach canister before about 100 years and will have returned to anoxic conditions by that time / 4, 5, 6, 10	A	Paragraph will be revised to clarify the preliminary nature of the analyses leading to these assertions.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 11

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 11.3.2 p. 11.3-3 Para. 3	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."	A	Paragraph will be revised to emphasize the term"...over-simplified..."
Sec. 11.3.2 p. 11.3-4	All including Figure 11-7./3, 9, 10 -- "Accordingly to Figure 11-17 the HM buffer doesn't affect the solubility until >300°C, which is higher than temperature will be at thermal peak."	A	This page of the SCR will be revised to emphasize the uncertainties of the test techniques and clarify the significance of Figure 11-7 to prevent the reader from drawing unfounded conclusions.
Sec. 11.3.2 p. 11.3-20 Para. 7	The strategy for testing...scientific practices./4	A	Sentence will be deleted.
24 Sec. 11.3.2 p. 11.3-20 Para. 4	A series of experiments...disposal of nuclear waste./3, 4, 15 ^{NR} X (NY)	C A	Comment could not be found.
Sec. 11.3.2 p. 11.3-30 Para. 1	This suggests that interlayer water...potential backfill alteration./10, 16	A	The BWIP will add clarification to the reasoning supporting the statement.
Sec. 11.3.2 p. 11.3-37 Para. 3	The continued application...waste package final designs./3, 21 -- "This is an extensive program that deserves elaboration."	A	Cross reference will be made to Chapter 15 of the SCR, where the plans for testing will be updated to yield greater detail.
Sec. 11.3.3 p. 11.3-38 Para. 1	Important conclusions drawn...disturbed zone of the repository./5, 9, 10, 15.	A	The word "conclusions" will be replaced by "inferences."
Sec. 11.4.1 p. 11.4-1 Para. 2	The composition of the Grande Ronde Basalt...and HCO ₃ ./5, 14, 16 -- "Previously the groundwater was claimed to have low F- concentration."	C A	We cannot find the conflicting statement. If found, it will be corrected.
4 Sec. 11.4.1 p. 11.4-6 Para. 2	Irreversible loss of water...(Deer, et al., 1967)/10 -- "what X when F- is present?"	C	Fluoride has no relevance to the irreversible loss of water. Comment difficult to interpret. Note of dehydration Correct for

A - Agree
 I - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC HRC COMMENTS
 (FROM APPENDICES D AND C OF THE DSCA)
 Chapter 11

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 11.4.1 p. 11.4-7 Para. 2	The high pH values...(Krauskopf, 1979)./3 -- "Carbonates are claimed to be important but there is no further discussion of them."	A	The revised text will clarify the reason carbonate influence on pH is not discussed extensively. There was no mention of the importance of carbonates.
Sec. 11.4.1 p. 11.4-7 Para. 3	Equation (11-2)./10 -- "The reference title implies pH is a result of H_4SiO_4 dissociation only."	A	No reference was used for Equation (11-2). Text will be revised to clarify that the equation is entirely hypothetical, to prevent the reader from misinterpreting the reference titles.
Sec. 11.4.1 p. 11.4-7 Para. 5	The Hanford groundwater...dissociation of silicic acid./10, 14 -- "Previously stated that carbonates were also important."	A	See Item 11.4-7, paragraph 2.
Sec. 11.4.1 p. 11.4-8	Equations (11.4) and (11-5)/"Equations are not balanced."	D	Equations are balanced.
Sec. 11.4 p. 11.4-8 Para. 4	Precipitation and hydrolysis...steady-state value./10, 16	A	The revised text 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.
Sec. 11.4.1 p. 11.4-9 Para. 1	For instance, pH depression...200°C using seawater./16	D	This discussion relates to Figure 11-24, which contains reference on the curves; those for basalt will be added.
Sec. 11.4.1 p. 11.4-9 Para. 3	Barnes and Sheetz (1979)./16 -- "Improper reference."	A	Reference will be deleted.
Sec. 11.4.1 p. 11.4-10	Equation (11-6)/16.	A	Equation 2.6 will be referenced.
Sec. 11.4 p. 11.4-12 Para. 1	...(Fig. 11-25 and 11-26), ...ratios are low./10 -- "What about carbonates.?"	A	See Item 11.4-7, paragraph 2

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC HRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Chapter 11

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 11.1.1 p. 11.1-4 para. 5	...include the THOREX wastes...metric ton of heavy metal./16.	D A	<i>(Add reference)</i> The paragraph consists of suppositions regarding possible waste streams. As such, citing a reference is not considered necessary.
Sec. 11.1.1 p. 11.1-13 para. 3	...fins 6.4 millimeters thick (Mendel, et al., 1977)./14 -- "Figure 11-1 says 2.4 millimeters."	A	Figure 11-1 will be corrected to 6.4 millimeters.
Sec. 11.2.1 p. 11.2-4 para. 3	Preliminary results of heat transfer...waste package for basalt./5, 10, 16 -- "The groundwater may be relatively benign, but 1000 years is a long time. Analysis demonstrating this seems necessary."	A	Additional information will be included in Section 11.2 to support this statement.
Sec. 11.2.2 p. 11.2-7 Para. 3	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."	A	Additional information will be included in Section 11.2 to support this statement.
Sec. 11.2.5 p. 11.2-10 Para. 6	This groundwater, pH...controlled by the geology./4.	A	Additional information will be included in Section 11.2 to support this statement.
Sec. 11.4.1 p. 11.4-16 Para. 3	The reducing conditions...radiolysis of water./4, 16	A	Paragraphs 2 and 3 will be reorganized to place the reference at the proper place.
Sec. 11.4.1 p. 11.4-14 Para. 2	The equations for ...(Robie, et al., 1978)./16 -- "This reference is not the correct one."	A	The revised text will be corrected to show that data came from correct references.
Sec. 11.4.3 p. 11.4-21 para. 1	Assuming that at elevated...100°C to 300°C/16 -- "Boric acid dissociation could be problem at pH's as low as 6.2 (Herm, 1977)."	D A	<i>Will provide discussion on pH 2</i> The comment is not relevant, since the source of boric acid (glass waste form) will not be available until after breach of the canister wall <i>appropriate</i>
Sec. 11.6 p. 11.6-5 Para. 1	Under geologic control...varying with temperature./4 -- "That low an Eh has not been established for the unperturbed target horizon."	A	The revised text will be clarified to show that analysis of available data indicate the value cited.

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
⑦ Sec. 12.1 p. 12.1-1 Para. 1 C	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."	A	The <u>July 1981</u> wording of 10 CFR 60 will be used.
Sec. 12.1 p. 12.1-1 Para. 1	The SCR states that travel times will be evaluated under anticipated geologic conditions and postulated disruptive conditions. /8 -- "10 CFR 60 requires analysis of <u>preemplacement</u> travel times."	A	The passage will be rewritten to conform to the comment.
Sec. 12.1 p. 12.1-1 Para. 1	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."	A D see ① above.	In the 7/81 published version of 10 CFR 60, the "such other" provision is not included.
Sec. 12.1.2 p. 12.1-2 Para. 1	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."	A	The distinction between "release at source" and "release into accessible environment" will be clarified to avoid misunderstandings.
Sec. 12.1.3 P. 12.1-3 Para. 4	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 judgment."	A A	A clarification will be incorporated in the SCP.
Sec. 12.1.3 p. 12.1-3 Para. 4	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."	A	The statement will be modified to be more precise.

A Agree
C Requires Further Clarification
D Disagree
X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.2 P. 12.2-1 (1)★	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."	A	The SCP will be clarified to include probability estimates and an assessment of residual uncertainty.
Sec. 12.2.1 p. 12.2-1 Para. 3★	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."	A	The SCP statement will be revised accordingly.
Sec. 12.2.1 p. 12.2-2 Para. 2	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 <u>occurring once in 10,000 years.</u> "	A	The SCP statement will be revised to conform to the EPA requirements.
Sec. 12.2.1 p. 12.2-4 Para. 3★	The SCR discusses the method for scenario selection. /3 -- " <u>The process to assign probabilities to scenarios was not described.</u> "	A	A statement will be added to address probability value assignments. <i>Describe the process. This will likely be more lengthy than a single statement.</i>
Sec. 12.2.1 p. 12.2-4 Para. 4	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."	A	The NRC comment will be incorporated. NRC is emphasizing that additional <u>scenario analysis</u> is needed <u>how</u> . Additional statements will be added to reaffirm this. Plans will be discussed in an expanded fashion.
Sec. 12.2.1 p. 12.2-4 Para. 3★	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."	A	The statement will be deleted from the SCP.

means what?

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

*Deirdre Enright
 10/20/01*

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.2.1 p. 12.2-5 Para. 1	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."	A	A specific computation will be added or the statement will be amended to indicate that the possibility of such tests will be evaluated.
Sec. 12.2.1 p. 12.2-5 Para. 4, 5; p. 12.2-7 Para. 1	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	A	A paragraph will be added to explain the statement. <i>Does this mean that a technique for addressing systematic error will be presented?</i>
Sec. 12.2.1 p. 12.2-5 Para. 2	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."	A	A description will be added either in the glossary or in the text. <i>should conform to 10 CFR 60.</i>
Sec. 12.2.1 p. 12.2-7 Para. 1	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."	A	The word "will" will be changed to "may".
Sec. 12.2.1 p. 12.2-5 to 7	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."	A	A clear definition and scope of "conceptual model" is needed and will be added to Chapter 5 and Chapter 12.
Sec. 12.2.1 p. 12.2-7 Para. 2	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 ϕ on page 12.4-13)."	<i>C</i> → A OVER CONSERVATION NOT NEEDED, USE PRA. IF APPROPRIATE.	Substantial elements of <u>conservatism</u> will be included. Porosity value on page 12.4-13 is in error. Further clarification on the basis for categorization will be provided.

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
Sec. 12.3 p. 12.3-1-4	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."	A	A sentence will be added to address source term modeling.
① ★ Sec. 12.3.1 p. 12.3-4 Para. 4 Bullet 2	Sorption of the dissolved ... linear isotherm, /1, 14 -- See Section 6.4.2.2.	A	A statement will be added to Section 6.4.2.2 to indicate that <u>constant and conservative K_d's are a reasonable alternative</u> to precise linear isotherms. ←
Sec. 12.3.1 p. 12.3-4 Para. 6 X	The SCR states that a mathematical model has been developed which describes the transport of any radionuclides in fractured 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."	A	There are no firm plans for the use of the 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 used will depend on the extent of its/funture need. <i>(what code is this? CHANT?)</i>
Sec. 12.3.2 p. 12.3-6 Table 12.2	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."	A	PECTRA 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).
① ★ Sec. 12.3.2 p. 12.3-7 Para. 3	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."	A	No firm decision has been made to use this code for performance assessment. The discussion of ANSYS will be deleted. - PLS LET US KNOW. WERE NOW BENCHMARKING
① ★ Sec. 12.3.2 p. 12.3-6 X to 12	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."	A	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.

① I PRESUME & RECOMMEND THAT ALL
REFERENCE TO 10 CFR PART 60 WILL
USE THE FINAL VERSION WHICH WAS
AFFIRMED MAY 23, 1983.

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
① ★ Sec. 12.3.2 p. 12.3-13 Para. 4	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."	A	Clarifying statements will be added to Section 12. Full details will be provided in <u>future documentation</u> . <u>WHEN?</u> Plans for this will be addressed in the SCP. <i>in how much detail</i> [★] = <i>These plans will be discussed with the NRC as they are developed.</i>
① ★ Sec. 12.3.3 p. 12.3-15 Para. 1	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."	A	A brief discussion of the scope of verification and benchmarking will be added. Full detail on a code-by-code basis will be provided in future documentation. <u>WHEN?</u> Plans to accomplish this will be addressed in the SCP. <i>in how much detail</i> [★]
Sec. 12.3.3 p. 12.3-15 Para. 4	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."	A	An expanded discussion to provide additional detail will be added to Section 12. Full detail on a code-by-code basis will be provided in future documentation. Plans to accomplish this will be addressed in the SCP. <i>when?</i> [★]
Sec. 12.4.1 p. 12.4-1 Para. 2	Lines 23-26, "In spite of ... exceeding 10,000 years. /3, 6, 12, 13	A	Code 3; the scope of our document did not provide for detailed discussions and explanations of these studies. The references may be examined for detail.
		A	Code 6; 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	Code 12: <i>However</i> a detailed site characterization is clearly justified.

TABLE 2
 here

CONFIDENCE LEVEL TOO
 HIGH.

Conforming to 10 CFR part 60.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1	Continued	C → A	Code 13; certain aspects may be nonconservative in the disruptive scenario analyses. The conservative factors are believed to far outweigh the limited nonconservative factors in the pre-waste emplacement analyses. Additional data and further analysis is clearly needed. <i>Discuss AT Hydrology or AT PA mtg.</i>
Sec. 12.4.1 p. 12.4-3 Para. 7	*(Detailed comments about early modeling efforts are not included.)* Lines 39-40, "The total travel ... to be 33,000 years" /6, 13	A	Discussions of obsolete analyses will be deleted from future revisions.
		A	Code 6; 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.
		A	Code 13; substantial conservatism was incorporated into the study. Some factors (e.g., effective porosity) may be nonconservative. Clarification in the SCP will address this concern.
Sec. 12.4.1 p. 12.4-3 Para. 4 C	The vertical hydraulic conductivity of Layer 2 also included the intervening basalt layers. /13 <i>what does this sentence mean? Suggest we discuss @ PA or hydrology workshop.</i>	C C	Basis for the categorization is not stated and is unknown. Specific and detailed reasons for this categorization are needed. <i>suggested workshop Item</i>
Sec. 12.4.1 p. 12.4-3 Para. 5, 6	Model Calibration /3	A	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. The discussion of this obsolete study will be deleted.

- A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p. 12.4-3 Para. 6	Assumed values of thickness and porosity shown in Table 12-4. /3 <i>Combination is non conservative, as well as porosities.</i>	A	The current single point estimate of effective porosity for flow tops is lower. The basis for categorizing thickness as nonconservative is not clear. Limitations will be noted in the SCP.
Sec. 12.4.1 p. 12.4-5 Para. 3	This composite vertical hydraulic conductivity was used in the calibration of the groundwater travel time. /3	A	The authors of the study have earlier disagreed with this same criticism. The discussion of this study will be deleted.
Sec. 12.4.1 p. 12.4-7 Para. 3	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	A	See comments on NRC reference item pg. 12.4-5. It should be noted that the shaft and fault analyses are disruptive scenarios and not estimates of pre-waste emplacement groundwater travel times. The discussion of this analysis will be deleted.
Sec. 12.4.1 p. 12.4-6 Para. 4	Lines 31-32, "The traveltime ... comparison purposes." /13	A	It is not clear how non-conservative 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.
Sec. 12.4.1 p. 12.4-7	Line 1-bottom, "... 12.4.1.1.2.2 <u>Assumptions</u> ... to 100,000 years." /3	A	This was a very preliminary analysis and was presented as such. The discussion of this study will be deleted from the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p. 12.4-7 Para. 1	<p>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</p> <p><i>NRC will have to provide clarification</i></p> <p>① <i>Compositing is generally non-conservative</i> ② <i>Assumption of vertical doesn't compensate.</i></p>	<p><i>2/22</i></p> <p>D</p> <p><i>data on approach?</i></p>	<p>The basis for the nonconservative categorization is not stated and is not clear. 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 travel-time calculations do not apply for that portion of the flowpath. The travel time 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.</p>
Sec. 12.4.1 p. 12.4-7 Para. 1	Values of porosity assumed for traveltime calculations. /2	A	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.
Sec. 12.4.1 p. 12.4-7 Para. 3	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	A	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.
		A	Code 13: the analysis was acknowledged to be deficient due to lack of definition of the structural features.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p. 12.4-8	Line 1-bottom "12.4.1.1.3 <u>Pacific</u> ... of the Hanford Site." /3	A	The objective in discussing the various far-field studies was to present a factual summary. Value judgments and criticisms of these studies were excluded from the SCR descriptions. The reference should be examined for further details. <i>what is DOE's proposed action?</i>
Sec. 12.4.1 p. 12.4-9 Table 12-5	Classifications of conservatism of assumptions. /3, 4	A	No additional information was available in the reference. <i>what is DOE's proposed action?</i>
Sec. 12.4.1 p. 12.4-13 Para. 1, 13-18	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."	A	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.
Sec. 12.4.1 p. 12.4-13 Para. 1 Item 8	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."	A	The statement in the SCR is presented as an <u>assumption</u> , } so what? not as an observation or conclusion. 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. This concern will be addressed in future updates of Chapter 12. <i>what is DOE's proposed action for the SCP?</i> <i>the SCP</i>

*This suggests that
 It seems reasonable
 to delete work which
 makes assumptions which
 are not consistent with
 other portions of the SCR.*

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p 12.4-13 Para. 1 Item 6	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."	A	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 travel time. This particular study was not specifically designed to be conservative.
Sec. 12.4.1 p 12.4-13 Para. 1 Item 4	<p>NRC NOTES THE</p> <p>Lines 19-21, "The horizontal ... variations."/4 ASSUMPTIONS</p> <p>Lines 22-23, "The hydraulic ... vertical plane."/4 "</p>	<p>WITHDRAW</p> <p>(D) → A</p> <p>(D) → A</p>	<p>This is an <u>assumption</u>, not a assertion of fact. It is considered a <u>reasonable</u> assumption given the amount of information available and the preliminary nature of the study. It was acknowledged on page 12.4-15 to be the principal limitation of the study.</p> <p>Again, this is not an assertion of fact but a reasonable <u>assumption</u>. 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 in the horizontal plane is anitotropy. If anisotropy had been assumed, it would also have been necessary to assume an anisotropy ratio and orientation without supporting information.</p>
Sec. 12.4.1 p 12.4-13 Para. 1 Item 8	Lines 31-33, "The hydraulic conductivity values in ... as a whole."/4 "	(D) → A	This statement is an <u>assumption</u> and not an assertion of fact. See the comments on NRC reference item p 12.4-13, lines 22-23

A - Agree
 I - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p 12.4-13 Para. 1 Item 8	Lines 38-40, "The model composite ... per second."13--"Noted page 12.4-14."	A	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 next revision.
Sec. 12.4.1 p 12.4-13 Para. 1 Item 9	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."	A	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.
Sec. 12.4.1 p 12.4-13 Para. 2	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."	6 →A	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.
Sec. 12.4.2 p 12.4-14 Table 12-6	Table 12-6/13 <i>delete</i>	6 →A D	The basis for the overall categorization is not clear. The conservative and nonconservative nature of modeling analysis will be discussed in the SCP.
Sec. 12.4.1 p 12.4-15 Para. 3	The SCR states that for travel time calculations a horizontal conductivity of 10^{-7} m/s is used./13 -- "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." QUESTION IS ONE OF 'CONSERVATIVE' OR 'REASONABLE'.	6 →A D	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. Using a single point extreme of data without evidence of extensive areal correlation is incorrect. Recent statistical studies of horizontal conductivities in the Grande Ronde Flow tops support 10^{-7} m/s. This point will be addressed in some detail in the SCP.

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p 12.4-15 Para. 1	"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, 13-- "Normally, material properties are adjusted." <i>DRP</i>	C (W)	Text should correctly read DC- <u>12</u> , -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 properly values can produce misleading results. The analysis summarized in this section of the SCR emphasized that point. The modeling task-force 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.
Sec. 12.4.1 p 12.4-15	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."	A	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.

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p 12.4-15 Para. 3	<p>Lines 17-19, "The groundwater as ... Wallula (Figure 12-8),"/6, 17, 13 -- "Input gradient and subsequent direction of travel are not consistent with data"</p> <p>15</p> <p>Input gradient and subsequent direction of travel are not consistent with data."</p> <p>Lines 31-32, "After reduction ... than 100,000 years."/3, 13</p> <p>DEFER TO HYDROLOGY OR P.A. WORKSHOP</p>	<p>A</p> <p>X A</p> <p>C A</p> <p>C A</p>	<p>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.</p> <p>Code 11: The data available at the time were used. Use of extreme values without evidence of spatial correlation is not technically sound.</p> <p>Code 13: See previous comments. 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 that can be interpreted from current data, however, and alternative conceptual models are being developed. Specific and detailed reasons for this categorization are needed.</p> <p>Intent was to present summary in SCR. Detail is available in the reference. Specific and detailed reasons for categorization are needed.</p>

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 Fig 12-8	¹⁵ Figure 12-8/6, 11 , 13 -- "Forced gradient and subsequent direction of travel are not consistent with data (see comments Chapter 5 of SCR)." (D) - <u>Defer</u> what is meant here?	A BA (D) → A	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. ¹⁵ Code 11 : Flow direction is consistent with data. Discussion on conceptual models will be expanded in the SCP. Code 13: Both horizontal and vertical gradients in the analysis were much higher than gradients calculated from <u>recent head data</u> . Specific and detailed reasons for the categorization are needed.
Sec. 12.4.1 p 12.4-17 Para. 2	Lines 5-7, "The travel time ... travel distance."/13 Lines 20-24, "(1) Vertical migration ... accessible environment."/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."	(D) → A ✓ A	See comments NRC reference item pg 12.4-16, Figure 12-8. 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. Problem will be addressed in the SCP.
Sec. 12.4.1 p 12.4-17 Item 2	Lines 30-31, "The accessible environment ... southeast of the repository."/11, 13	(D) D, C → A	See comments on NRC reference Figure 12-8. NRC concerns will be addressed in future studies. <u>study to be deleted from SCP.</u>

- A Agree
C Requires Further Clarification
D Disagree
X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

*Pat. 12-4-17
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ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
Sec. 12.4.1	"A study to assess ... borehole needs."/2, 16 -- The document which presents this work is not referenced."	A	Code 2: The performance assessment aspects of the study are summarized in the SCR.
Sec. 12.4.1		A	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.
Sec. 12.4.1 p 12.4-17 Para. 5 Item 2	"The accessible environment was the Columbia River at Wallula Gap, 60 km southeast of the repository."/8 -- "Accessible environment is presently taken to be 10 km from the repository."	A	Definition of accessible environment as 10 km will be used.
Sec. 12.4.1 p 12.4-17 Para. 5 Item 2	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."	A	Reference to the TASC analysis will be omitted in the revision of Chapter 12.
Sec. 14.4.1 p 12.4-18 Para. 3	Lines 43-bottom, "In all cases, but ... minimum requirement."/13	A	References to the TASC analysis will be omitted from the SCP.
Sec. 12.4.1 p 12.4-20 Table 12-8	Table 12-8/5, 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."	D WITH DRAW A	Code 5: No conclusion is presented. Codes 11, 13: References to the TASC analysis will be omitted from the SCP.
Sec. 12.4.1 p 12.4-20 Tables 12-7, 12-8	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."	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p 12.4-21 Table 12-10	"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."	A	References to the TASC study will be omitted from the SCP.
Sec. 12.4.1 p 12.4-21 Table 12-9	Table 12-9/5, 7, 13 -- "See previous comment. <u>Vertical hydraulic conductivity is not conservative and not measured.</u> "	A A	Code 5: No conclusion is presented in the table. Code 7: References to the TASC study will be omitted from the SCP.
Sec. 12.4.1 p 12.4-22 Tables 12-10, -11, -12	Tables 12-10, 12-11, 12-12/13	C → A VERTICAL CONDUCTIVITIES C → A D	Code 13: Effective porosities may be nonconservative, otherwise it is not clear that the values (especially the head gradients) are nonconservative. It is not evident that the travel time estimates overall are nonconservative.
Sec. 12.4.1 p 12.4-23 Table 12-13	Table 12-13/7, 13 -- "Additional data needs are outlined in previous paragraph." There's a thread running through these last few pages that leads to some pretty strong conclusions about the groundwater travel times. The assumptions have a way of disappearing. ALSO APPLIES TO NEXT COMMENT	A, C → A D	See NRC reference item p. 12.4-22. There is no statement in the SCR that claims a full understanding of the groundwater flow systems (sufficient for a license application). Uncertainties are acknowledged and additional data needs mentioned. The purpose of Section 12.4.1 was not to prove compliance with the 1,000 year travel time subsystem criteria, but to summarize studies (including their limitations) and to provide a background for judging the value of proceeding with site characterization.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC HRC COMMENTS
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CHAPTER 12

NRC Workshop June 12-13
 Perf. Assess. Mark-up
 C. Jacobs

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.1 p 12.4-24 Para. 2	Lines 6-10, "Even with the ... to the accessible environment."/ 12, 13 Lines 13-17, "Although a PATH 3D ... as the repository horizon."/4	D A	In spite of the deficiencies and uncertainties, it is our judgment that confidence in the travel times exceeding 1,000 years is sufficient to justify detailed site characterization. It is acknowledged that uncertainties exist and compliance with the NRC subsystems criteria is not demonstrated sufficiently for licensing purposes at this time. <u>Put this into SCP.</u> Some support is offered but not at the same level as for the Umtanum flow. Groundwater travel times for the Cohasset (formerly middle sentinel bluffs), flow will be included in the SCP.
Sec. 12.4.2 p 12.4-25 Para. 1 Item 3	Lines 6-7, "An effective porosity ... for the basalt."/4, 13	WITHDRAWN A	Code 4: This is a stated assumption, <u>not</u> an assertion of fact. 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.
Sec. 12.4.2 p 12.4-25 Para. 1 Item 8	"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 explicitly stated in that area."	A	Supporting data will be added or the analysis will be replaced by a more up to date analysis with supporting data.
Sec. 12.4.2 p 12.4-25 Para. 2	"Study of the disruptive phenomenon."/ 3 "The difference in Case I and Case II is less than a 20 percent of interstitial velocity."	EA	The velocities reported are assumed <u>interstitial</u> velocities. Effective porosities are <u>independently</u> assumed in order to calculate the retardation factors. It is likely that this analysis will be omitted in future updates of the SCR <u>since most key hydrologic parameters were merely assumed.</u> It does not properly fit into the performance assessment category. CURRENT PLAN - IN OR OUT OF SCP?

DID WE SAY OTHERWISE? ←

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.2 p 12.4-28 Para. 3	Additional geochemical data ... Solubility-limited conditions./14, 21 -- "See ES page 7 last sentence and 6.4-3 last sentence."	A	This will be rewritten for the SCP.
Sec. 12.4.3 p 12.4-29 Para. 3	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."	A	Justification of 2-D analysis will be added. 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.
Sec. 12.4.3 p 12.4-30 Para 4	Lines 27-29, "The stratigraphic section ... conceptual model."/4	A	This will be rewritten for the SCP.
Sec. 12.4.3 p 12.4-30 Para. 2	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."	A	This will be rewritten for the SCP.
Sec. 12.4.3 p 12.4-33 Para. 2	Lines 7-13, "(1) Within the model ... regional groundwater flow."/4, 7, 13 -- "Geologic assumptions cannot be tied explicitly to hydrogeologic conditions." → 15	WITH DRA D, A, C D	The statement in the SCR is a reasonable assumption, not an assertion of fact. Additional clarification and a discussion of conservative/nonconservative features will be included in the SCP.
Sec. 12.4.3 p 12.4-34 Para. 4	The SCR states that for the 2-D modeling an anisotropy ratio of 10 is used./14 -- "This is not consistent with Arnett et. al., 1980, which uses an anisotropy ratio of 100 (page 12.4-14."	A	There is an inconsistency between analyses performed at different times. A ratio of 10 is considered to be reasonably conservative whereas ratio of 100 is very conservative.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC ITEM COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITLM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.3 p. 12.4-30 Para. 2	The SCR states that consequences of shaft seal failure are bounded by the fault scenario /4 "Since the modeling reported evaluates faults outside the immediate repository area, shaft seal failure is not considered with these analysis."	A	This will be rewritten for the SCP.
Sec. 12.4.3 p. 12.4-33 Para. 2	Lines 7-13, "(1) Within the model...regional groundwater flow."/ 4, 7, 13 "Geologic assumptions cannot be tied explicitly to hydrogeologic conditions."	D, A, C	The statement in the SCR is a reasonable assumption, not an assertion of fact. Additional clarification and a discussion of conservative/nonconservative features will be included in the SCP.
Sec. 12.4.3 p. 12.4-33 Para. 5	Lines 27-39, "The representative or...5 x 10⁻¹⁴ meter per second."/ 3, 13	A, <i>AG</i>	This section will be expanded to incorporate a statistical description of data and a probabilistic analysis. The basis for the nonconservative categorization is not stated. Specific and detailed reasons for this categorization are needed. "Conservatism has not been demonstrated"
Sec. 12.4.3 p. 12.4-34 Para. 4	The SCR states that for the 2-D modeling, an anisotropy ratio of 10 is used./14 "This is not consistent with Arnett et al., 1980, which uses an anisotropy ratio of 100 (page 12.4-14)."	A	There is an inconsistency between analyses performed at different times. A ratio of 10 is considered to be reasonably conservative where a ratio of 100 is very conservative.
Sec. 12.4.3 p. 12.4-34 Para. 5	"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."	A	The basis for vertical head profiles used in the modeling will be presented in the SCP.
Sec. 12.4.3	Lines 3-7, "(1) the hydraulic conductivity...10⁻¹⁰ meter per second."/4, 13 Lines 22-25, "12.4.3.2.2 Hydraulic Heads... same range."/4 "Correct flow direction is not demonstrated at this time. See comments page 5.1-63."	A	Additional clarification will be provided.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC HRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.3 p. 12.4-35 Para. 1	Lines 4-8, "The specific storage...compressibility data."/3, 7 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."	A A, C, A (D)	This will be rewritten for the SCP. This will be rewritten to use updated information. A discussion of data selection and conservative/nonconservative assumptions and features will be added to the SCP.
Sec. 12.4.3 p. 12.4-35 Para. 1	"Values of specific storage"/3--"Must be associated with a unit of measure." "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 5-5 and are erroneously referred to as effect porosity. These are values of total porosity."	A D Agree with text? If so, we'll delete # 11.	This will be rewritten for the SCP. It is not clear that the selection of data is "biased." <i>so, the porosities were assumed</i>
Sec. 12.4.3 p. 12.4-35 Para. 2	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)."	A	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.
Sec. 12.4.3 p. 12.4-35 Para. 3	12.4.3.2.2.5 (all)/14--"C sorption coefficient is indeed 0 but it not given in Chapter 6 as stated."	A	The sorption coefficient of carbon will be addressed in Chapter 6 of the SCP.
Sec. 12.4.3 p. 12.4-36 Para. 4	"One intuitively expects, however, that after tens of thousands of years..."/14--"Some people may intuitively expect this to occur in a matter of 1 to 10 years."	BA Revise TEXT	The current design target for the waste package will provide a minimum of 1,000 years containment.
Sec. 12.4.3 p. 12.4-36 Para. 5	"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."	A (withdrawn) C A	The typographic error on the last line is corrected to read 1,000.
Sec. 12.4.3 p. 12.4-37 Para. 1	"Assumption of constant fracture release rate of 10 ⁻⁵ per year."/14--"Achievement of this release rate must be verified."		It is unclear as to how this release rate will be verified. Additional clarification is required.

*Here note flexibility provisions.
If I go for less in Engineered
System, then apply it here.*

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.3 p. 12.4-37 Para. 4	Lines 31-32, "The maximum and minimum...years, respectively."/ 6, 11, 13	A	The sentence will be changed to say that for selected parameters, compliance is achieved.
Sec. 12.4.3 p. 12.4-38, 39 Figure 12- 13, 12-14	Figures 12-13 and 12-14/6, 11, 13	A	Groundrules for the analysis will be clarified by adding a sentence or two at the front of 12.4.3 to indicate that this is representative, not worst case.
Sec. 12.4.3 p. 12.4-40 Para. 2	"The SCR states that the 2-D model results show that the travel-times 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."	A	The word "assure" will be changed to "indicate, for the reference conditions utilized in the analysis."
Sec. 12.4.3 p. 12.4-40 Para. 2	Lines 11-13, "The groundwater...to 37,000 years."/6, 11, 13	A	The statement will be modified to clarify that this is a current snapshot, not a firm conclusion.
Sec. 12.4.3 p. 12.4-41 Figure 12-15	Figure 12-15/6, 11, 13	A	The statement will be modified to clarify that this is a preliminary finding, not a firm conclusion
Sec. 12.4.3	Lines 9-11, "At 10,000 years...the downstream end."/6, 11, 13	A	No change

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.3 p. 12.4-42 Para. 4	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."	C ✓ D	This is a consideration which will be resolved in the SCP. The statement of insensitivity will be deleted. The issue of nonconservatism is not clear. Specific and detailed reasons supporting the categorization of nonconservatism are needed.
Sec. 12.4.3 p. 12.4-43 Figure 12-16	Figure 12-16/6; 11, 13	A, D, C ✓ D	The need for alternative analyses will be included in the SCP. The limitations of analysis are explained. Specific and detailed reasons for the categorization of nonconservatism are needed.
Sec. 12.4.3 p. 12.4-44 Para. 1	Lines 1-2, "(2) The fault creates...Vantage interbed."/4, 6--"Not physically reasonable: why would a fault stop at the Vantage?"	C, A.	Analysis assumptions and limitations are clearly stated. No assertions are made. The need for alternative analyses will be included in the SCP.
Para. 3	Lines 5-7, "(4) The properties of...porosity of 10^{-3} ."/4, 6	withdrew D, A	This was an <u>assumption</u> not an assertion of fact. Discussion of alternatives will be included in the SCP.
Sec. 12.4.3 Para. 3	Lines 9-11, "12.4.3.4.2.1 Repository in...of the fault."/6, 13 Lines 19-21, "The traveltimes...to 41,000 years."/6, 13	A, C D	A discussion on alternative assumptions or analysis will be included in the SCP. The basis for nonconservatism is not clear. Specific and detailed reasons for this categorization are needed.
Para. 5	Lines 38-43, "The existence of...30,000 to 36,000 years."/6, 13	A, C D	See NRC reference issue page 12.4-44.
Sec. 12.4.3 p. 12.4-46 Figure 12-18	Figure 12-18/6, 13		
Sec. 12.4.3 p. 12.4-47 Para. 4	"The SCR states that the fault is not effective in transferring significant amounts of radionuclides upward in the basalt sequence." 3, 4--"More information is needed to evaluate this conclusion. The information should be presented in terms of changes in traveltimes and mass flux."	A	Additional information and explanation will be added to the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)



CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.3 p. 12.4-47 Para. 4	The SCR states some preliminary analyses have been conducted of a fault passing directly through the repository./3--"No discussion of the analysis is given."	A	The results of analysis will be added or the reference deleted.
Sec. 12.4.3 p. 12.4-47 Para. 4	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."	A	The concern with existing faults, not new ones, should be noted in the assumptions for analysis.
Sec. 12.4.3 p. 12.4-47 Para. 2	Lines 15-17, "As in the base...through 10,000 years."/6, 13	A, C ⓓ	Questions of alternatives will be addressed in the SCP. The basis for categorization of nonconservatism is unclear. Specific and detailed reasons for categorization of nonconservatism are needed.
Sec. 12.4.3 Para. 3	Lines 25-27, "As in the case of...after 10,000 years."/6, 13	A, C ⓓ	
Sec. 12.4.3 Para. 4	Lines 38-40, "Even under such...the basalt sequence."/4, 6, 13	A, A, C ⓓ	See previous comment.
Sec. 12.4.3 p. 12.4-48 Figure 12-19	Figure 12-19/6, 13	C ⓓ	
Sec. 12.4.3 p. 12.4-49 Figure 12-20	Figure 12-20/6, 13	C ⓓ	See previous comment
Sec. 12.4.3 p. 12.4-50 Para. 2	Lines 9-18, "First if one compares...in excess of 10,000 years."	C ⓓ	Consideration of alternatives was outside the scope of this analysis. The basis for nonconservatism is not clear.
Para. 3	Lines 22-29, "Third in view of the fact...capability of the system."		
Para. 5	Lines 30-35, "The analysis results...of the site selected."		
Para. 5	Lines 33-35, "The fact that the...the site selected."/All 8 , 6, 12 , 15		

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.3 p. 12.4-50 Para. 3	"Second a comparison of the minimum groundwater travel times to the reference boundary, 10 km from the repository, lead to a similar conclusion."/5, 6	A	A brief discussion of alternatives and limitations will be added.
Sec. 12.4.3 p. 12.4-50 Para. 4	"The release scenarios are of a bounding nature."/1, 4, 13	A	The SCP will include an explanation of what is meant by the term "bounding nature" in this specific case.
Sec. 12.4.3 p. 12.4-50	"The repository system does not appear to hinge on a single hydro-geologic factor or condition."/8, 6	A D 	The basis for the conclusions are stated in the SCR. These conclusions are fully qualified in Section 12.4.5.
Sec. 12.4.4 p. 12.4-51 Para. 3	"The SCR states that 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)"	A 	There are some minor nonconservative assumptions and data choices and many conservative assumptions and choices. The assumptions and data choices which are felt to be nonconservative should be identified and the specific reasons for such categorization provided in detail.
Sec. 12.4.4 p. 12.4-51 Para. 2	"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."	A	Additional information and proper qualifications will be added to the SCP.
Sec. 12.4.4 p. 12.4-51 Para. 2	"In particular,...key radionuclides"/5, 11, 13-- "The primary conclusions... o Solubility of radionuclides...plutonium o High sorptive properties of basalt...americium."/5, 11, 12, 13-- "Again the (input assumptions used for modeling have become the (output) conclusions."	A	The change of "primary" to "preliminary" will correct the statement.
Sec. 12.4.4 p. 12.4-51 Para. 3	"There is no incentive...capability."/5, 6, 12, 13	A	

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE USCA)

CHAPTER 12

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 12.4.5 p. 12.4-53 Para. 4	"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 applies only to the studies presented in the SCR. Uncertain analyses are not presented."	A	The change of "the basic finding of these analyses is" to "current analytical and experimental data indicate" will correct the statement.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 13.3 p. 13.3-7 W.E. S.1.10.A	Work Element S.1.10.A; "Mandatory measurement condition,"/3.	A, X	Borehole Drilling and Test Plan will describe the testing. Additional pumping holes are being considered.
Sec. 13.3 p. 13.3-7 W.E. S.1.10.A	Work Element S.1.10.A; "Status achieved (references)," lines 5-7./5.	A	This sentence will be deleted in the SCP.
Sec. 13.3 p. 13.3-9 W.E. S.1.1.A	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.	A	This statement will be modified. The SCP description will be expanded to include additional work to better define lateral variations.
Sec. 13.3 p. 13.3-10 W.E. S.1.4.A	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."	A	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.
Sec. 13.3 p. 13.3-11 W.E. S.1.5.A	"Data on relative orientation and distribution of fracture have been collected from Umtanum flow core samples from existing boreholes." "Determination of the orientation and distribution of fractures from vertical borings without oriented core is not feasible.	A, X	The limits of this technique to define the fractures will be explained. Plans include deviated boreholes within the RRL.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	DWIP COMMENTS
Sec. 13.3 p. 13.3-12 W.E. S.1.5.A	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 predominantly 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."	A, X	This statement will be modified and the description of the method of determining fracture orientation will be expanded. Plans include deviated boreholes within the RR.
Sec. 13.3 p. 13.3-14 W.E. S.1.7.A	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."	A	The reference to 10 CFR 60 will be deleted and actual hole depth will be specified.
Sec. 13.3 p. 13.3-16 W.E. S.1.9.A	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."	C	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.
Sec. 13.3 p. 13.3-16 W.E. S.1.10.A	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."	A, X	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.
Sec. 13.3 13.3-17 W.E. S.1.10.A	"Plans."/3.	A, X	This section will be expanded, referencing Expanded Borehole Drilling and Testing Plan and the ES Test Plan.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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 CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 13.3 p. 13.3-17 W.E. S.1.10.A	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."	A	This section will be modified and reference expanded plans.
Sec. 13.3 p. 13.3-26 W.E. S.1.12.B	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.	A	This sentence will be re-written to define the data base. Expanded reference plans will also be included in the SCP.
Sec. 13.3 p. 13.3-26 W.E. S.1.12.B	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."	A	This sentence will be re-written to define the data base. Expanded reference plans will also be included in the SCP.
Sec. 13.3 p. 13.3-26 W.E. S.1.12.B	Under Plans, the SCR states that "emphasis of additional work ... potential influence on groundwater traveltime can be more fully assessed."/18.	A	This section will be expanded to include information from the revised Borehole Drilling and Testing Plan and Exploratory Shaft Test Plan.
Sec. 13.3 p. 13.3-28 W.E. S.1.12.B	Under Plans, the SCR states that "nature of doubly plunging folds ... associated with Gable Mountain and Gable Butte."/18.	A	This section will be expanded to describe how data on folds will be obtained. Status and Plans will be modified to include expanded plans.
Sec. 13.3 p. 13.3-28 W.E. S.1.12.B	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?"	A	This sentence will be modified to more clearly describe how correlation of strata between boreholes serves to define dip and strike.

A -- Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
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 CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 13.3 p. 13.3-32 W.E. S.1.15.B	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.	A	Additional discussion of concern is contained in "Preliminary Interpretation of the Stability of the RRL Cold Creek Syncline and Hanford Site." The information will be added to the work element.
Sec. 13.3 p. 13.3-34 W.E. S.1.16.B	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."	A	A clarifying statement will be added to work element S.1.16.B.
Sec. 13.3 p. 13.3-39 W.E. S.1.24.C	"Mandatory measurement conditions;" Work Element S.1.24.C./9, 10 -- "Lack of detail; i.e., test intervals, duration of test, etc."	A	This information will be incorporated in work element S.1.24.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-39 W.E. S.1.25.C	"Mandatory measurement conditions;" Work Element S.1.25.C./"Lack of detail, especially concerning time variant measurements; i.e., duration, zones monitored, isolation procedure, etc."	A	This information will be incorporated in work element S.1.25.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-40 W.E. S.1.26.C	"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?"	A	This information will be incorporated in work element S.1.26.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-41 W.E. S.1.27.C	"Information needs (data and analysis)" and "Mandatory measurement conditions;" Work Element S.1.27.C./8, 9, 10 -- "Note references to earlier Work Elements."	A	This information will be incorporated in work element S.1.27.C or the relevant test plan will be referenced.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC HRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)
CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 13.3 p. 13.3-41 W.E. S.1.28.C	"Mandatory measurement conditions;" Work Element S.1.28.C./9, 10 -- "Note reference to earlier Work Elements."	A	This information will be incorporated in work element S.1.28.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-42 W.E. S.1.29.C	Work Element S.1.29.C; "Mandatory measurement condition. "/9, 10 -- "Note reference to earlier Work Elements."	A	This information will be incorporated in work element S.1.29.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-42 W.E. S.1.30.C	Work Element S.1.30.C; "Mandatory measurement conditions. "/6, 11 -- "Other conceptual models can fit current data."	A	This information will be incorporated in work element S.1.30.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-43 W.E. S.1.31.C	Work Element S.1.31.C; "Information needs (data and analysis). "/7 -- "Documentation of all codes is needed."	A	The statement of status will be expanded to show the current documentation of codes.
Sec. 13.3 p. 13.3-44 W.E. S.1.33.C	Work Element S.1.33.C; "Status achieved (references). "/4, 11, 13, 12, 15.	A	The issues involved in determining the bounds of uncertainty in model predictions of pre-waste-emplacement groundwater travel times will be detailed in the SCP Chapter 12. Status in S.1.33.C will be revised accordingly.
Sec. 13.3 p. 13.3-44 W.E. S.1.32.C	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."	A	The required descriptive material will be prepared explaining how evaluation of hydrologic changes will be made.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 13.3 p. 13.3-44 W.E. S.1.34.C	Work Element S.1.34.C; "Status achieved (reference)," lines 1 and 2, "Preliminary conceptual...available..."/6.	A	This statement will be modified to reflect changes in Chapter 5, Section 5.1.10, regarding alternate conceptual models.
Sec. 13.3 p. 13.3-45, 13.3-46 13.3-47 W.E. S.1.24.C	"Plans;" Work Element S.1.24.C/9, 10.	A	This information will be expanded in work element S.1.24.C
Sec. 13.3 p. 13.3-48 13.3-49 W.E. S.1.25.C	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."	A	This information will be incorporated in work element S.1.25.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-50 13.3-51 W.E. S.1.26.C	"Plans;" Work Element S.1.26.C/9, 10 -- "How will samples from existing boreholes be sampled to minimize mixing."	A	This information will be incorporated in work element S.1.26.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-51 13.3-52 W.E. S.1.27.C	"Status" - first paragraph; Work Element S.1.27.C/4, 5, 6. "Plans" - Work Element S.1.27.C/9, 10.	A	This information will be incorporated in work element S.1.27.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-52 W.E. S.1.28.C	"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."	A	This section will be rewritten to reflect data limitations. The information will be incorporated in work element S.1.28.C or the relevant test plan will be referenced.

A - Agree.
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 13.3 p. 13.3-53 W.E. S.1.29.C	Work Element S.1.29.C; "Status," lines 23-25, "No known...to date."/9, 10 -- "Where and how was a discontinuity tested?"	A	This statement will be deleted.
	Work Element S.1.29.C; "Plans."/9, 10 -- "Note reference to earlier Work Elements."	A	This information will be incorporated in work element S.1.29.C or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-54 W.E. S.1.30.C	Work Element S.1.30.C; "Status," lines 25-28, "Available evidence... systems exist. Vertical and areal gradients are small."/4, 5	A	This sentence will be modified to indicate that data are now being collected to address the vertical and areal gradients.
	"Plans," first paragraph."/9, 10 -- "Note reference to earlier Work Elements."	A	Section will be rewritten to show the changes in the test plans and the relevant plans will be referenced in the SCP.
Sec. 13.3 p. 13.3-56 W.E. S.1.33.C	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."	A	NRC-5: Each study did indeed calculate preemplacement groundwater travel times in excess of 1,000 years. It is acknowledged that there are deficiencies and limitations. The word "concluded" will be changed to "calculated."
		D	NRC-11: Average values of hydraulic conductivity should be used for far-field analysis. Using extreme point values cannot be justified unless spatial correlation can be shown (which is not the case).
		A	NRC-12: Detailed characterization will be completed.
		C	NRC-13: The basis for this categorization is not explained. There are conservative features in all the studies. A discussion on conservatism and nonconservatism will be added to the section.
		A	NRC-15: The enlarged data base will be presented and analyzed.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 13.3 p. 13.3-56 W.E. S.1.33.C	(continued)	A	NRC-9: This information will be incorporated or the relevant test plan will be referenced.
Sec. 13.3 p. 13.3-57 W.E. S.1.33.C	Work Element S.1.33.C, line 1./6.	A D	NRC-10: Additional detail will be provided. 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
Sec. 13.3 p. 13.3-57 W.E. S.1.33.C	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?"	A	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.
Sec. 13.3 p. 13.3-73 W.E. S.1.41.D	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."	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)
CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 13.3 p. 13.4-2 Fig. 13-4	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."	A	Figure 13-4 will be modified to include alternate conceptual models.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC HRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 CHAPTER 13

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
App. C PC-26 5.4.1.1	What is the probability that groundwater withdrawals for irrigation would trigger microearthquake or earthquake swarms?	C	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.
App. C PC-27 5.4.2.2	What is the probability that water impoundments behind possible future dam construction (Ben Franklin dam) will cause microearthquake or earthquake swarms?	C	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 14

S = NRC concerned with
 BWIP schedule of
 work elements

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
1 Sec. 14.1 p. 14.1-2 Fig. 14-1	Figure 14-1. /14 -- "Provisions for retrieval should be included under key proposed criteria related to 10 CFR 60."	A	Retrievability will be included as a performance objective under key proposed criteria.
2 Sec. 14.3.1 p. 14.3-30 Para. 4	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."	A S	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.
3 Sec. 14.3.1 p. 14.3-31 Para. 3, 4	Work Element R.1.3.A Plans /3, 9 -- "Specific plans to address this work element are not discussed in adequate detail."	A	Plans for work element R.1.3.A will describe methodology for rock mechanics model development based on Exploratory Shaft (ES) and other test data.
4 Sec. 14.3.1 p. 14.3-31 Para. 3	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."	A	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.
5 Sec. 14.3.1 p. 14.3-32 Para. 5	Work Element R.1.4.A Plans /3 -- "Specific plans to address this work element are not discussed in adequate detail."	A	Plans for work element R.1.4.A will describe methodology for rock mechanics model development based on ES and other test data.
6 Sec. 14.3.1 p. 14.3-33 Para. 2	Work Element R.1.5.A Plans /3 -- "Specific plans to address this work element are not discussed in adequate detail."	A	Plans for work element R.1.5.A will describe methodology for rock mechanics model development based on ES and other test data.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 14

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
7 Sec. 14.3.1 p. 14.3-33 Para. 2	"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."	A	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.
9 Sec. 14.3.1 p. 14.3-34 Para. 6	"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? "	A	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.
9 Sec. 14.3.1 p. 14.3-35 Para. 3	Work Element R.1.9.A <u>Plans</u> /15 -- "The sensitivity analyses should be performed early in order to guide site characterization activities. "	A	Plans for the early completion of sensitivity analyses will be described in work element R.1.9.A.
10 Sec. 14.3.1 p. 14.3-35 Para. 6	"The acceptable range of rock mass characteristics must also be known for performance assessment purposes." /18 -- "This should be done for the rock mechanics tests plans. Priority 1 is necessary."	A	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.
11 Sec. 14.3.1 p. 14.3-36 Para. 1	"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. "	A	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.
12 Sec. 14.3.1 p. 14.3-37 Para. 3	"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. "	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 14

ITLM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
13 Sec. 14.3.1 p. 14.3-38 Para. 3	"Sufficient numerical modeling studies ... with little or no additional development." /12 --"The status of validation of coupled thermomechanical and hydrological models needs improvement."	A	Status for work element R.1.13.B will be rewritten to acknowledge the need for validation of coupled thermomechanical and hydrological models. Plans for work element R.1.13.B will describe methodology for validating coupled thermomechanical and hydrological models.
14 Sec. 14.3.1 p. 14.3-38 Para. 6	"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."	A	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.
15 Sec. 14.3.1 p. 14.3-38 Para. 2	Work Element R.1.13.B /12 --"Does not account for problems associated with predicting deformations across joints as experienced in the NSTF."	A	Work element R.1.13.B will be rewritten to clarify that mechanical, thermal, and thermochemical models must satisfactorily account for the jointed nature of a basalt rock mass.
16 Sec. 14.3.1 p. 14.3-42 Para. 6	Work Element R.1.18.D <u>Plans</u> /3 --"Specific plans to address this work element are not discussed in adequate detail."	A	Plans for work element R.1.18.D will describe methodology for establishing sealing performance requirements.
17 Sec. 14.3.1 p. 14.3-43 Para. 3	Work Element R.1.19.D <u>Plans</u> /3 --"Specific plans to address this work element are not discussed in adequate detail."	A	Plans for work element R.1.19.D will describe methodology for selecting seal materials and developing test techniques.
18 Sec. 14.3.1 p. 14.3-45 Para. 2	"Field scale tests at potential repository depths ... with time, temperature, and permeability." /18 --"Field scale tests will be required."	A	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 disturbed rock zone.
19 Sec. 14.3.1 p. 14.3-46 Para. 4	"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?"	A	Status for work element R.1.24.D will describe the site specific seal performance assessment model to be completed during FY 1983.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 14

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
20 Sec. 14.3.1 p. 14.3-48 Para. 1	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? "	A	Plans for work element R.1.28 will describe provisions to control any adverse effects from site characterization, <i>including the appropriate quality assurance program!</i>
21 Sec. 14.3.1 p. 14.3-50 Para. 7	"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."	A	Plans for work element R.1.31 will describe engineering studies for optimizing the waste package storage configuration and determining the associated shielding requirements.
22 Sec. 14.3.1 p. 14.3-64 Para. 2	"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."	A	Plans for work element R.1.57 will describe methodology for determining the factors which influence the geometry and configuration of openings.
23 Sec. 14.3.1 p. 14.3-64 Para. 4	"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? "	A	Plans for work element R.1.57 will describe methodology for determining the factors which influence the geometry and configuration of openings.
24 Sec. 14.3.1 p. 14-3-65 Para. 2	"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? "	A	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.
25 Sec. 14.3.1 p. 14.3-66 Para. 7	"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?"	A	Plans for work element R.1.61 will describe methodology for designing roof support systems considering cyclic thermal shocks during local rehabilitation and retrieval.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 14

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
26 Sec. 14.3.1 p. 14.3-67 Para. 1	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."	A	Work element R.1.62 will be revised to Priority 1.
27 Sec. 14.3.1 p. 14.3-67 Para. 3	"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?"	A	Plans for work element R.1.62 will describe the retrieval scenarios to be considered in the preparation of retrieval procedures.
28 Sec. 14.3.1 p. 14.3-69 Para. 3	"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."	A	Plans for work element R.1.65 will include consideration of ventilation requirements imposed by retrieval operations. <i>local</i>
29 Sec. 14.3.1 p. 14.3-72 Para. 2	"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."	A	Plans for work element R.1.70 will describe methodology for utilizing coupled thermomechanical/hydrological analyses.
30 Sec. 14.3.1 p. 14.3-72 Para. 1	"No information on the effects of stress and elevated ... of a work mass is presently available." /1 --"Work done in granite provides preliminary information on these effects."	A	Status for work element R.1.70 will be reworded to include available granite test results.
31 Sec. 14.3.1 p. 14.3-73 Para. 7	"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."	A	Work element R.1.72 will be revised to Priority 1 and applicable ES construction plans and procedures will conform with 60.134(c).

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES D AND C OF THE DSCA)

CHAPTER 14

III REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
32 Sec. 14.3.1 p. 14.3-73 Para. 1	"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?"	A	Plans for work element R.1.71 will be revised to confirm that these tests will be conducted in the ES-II facility. The ES test plan will provide test details.
33 Sec. 14.3.1 p. 14.3-73 Para. 3	"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?"	A	Plans for work element R.1.13.B will describe methodology for rock mechanics model development.
34 Sec. 14.3.2 p. 14.3-75 Para. 3	Work Element R.2.1 /3 -- "This work element should receive a higher priority."	A	Work element R.2.1 will be revised to Priority 2.
35 Sec. 14.4 p. 14.4-1 Para. 2	"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."	A	Plans for work element R.1.13.B will describe methodology for rock mechanics model development and use of test data.
36 Sec. 14.4 p. 14.4-2 Fig. 14-2	"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."	A	Plans for work element R.1.13.B will describe methodology for use of test data to resolve all relevant issues.
37 Sec. 14.4 p. 14.4-8 Para. 3	"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."	A	Section 14.4 will stipulate that all porthole tests will start with check of grout seal. The ES test plan will provide test details.

- A Agree
- C Requires Further Clarification
- D Disagree
- X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 14

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
3d Sec. 14.5 p. 14.5-2 Table 14-4	Table 14-4. /3 -- "These criteria do not reflect changes found in the July 7, 1982, proposed 10 CFR 60 Technical Criteria. "	A	The SCP will continue to reference the ^{final rule} July 1981 draft of 10 CFR 60, until the rule is finalized.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.2 p. 15.2-1 Para. 1	The Basalt Waste Isolation Project (BWIP) ... have not been resolved. /3 -- "Issues not listed in Chapters 6, 11, or 15.	D	The BWIP defines the issue in the introduction to Chapter 13 and clearly states that issue resolution, as defined, is NOT a BWIP goal, but completion of work elements to satisfy criteria is our goal.
Sec. 15.3 p. 15.3-1 Para. 1	The operating temperature limits for candidate ... from extrapolations of existing data. /10, 16.	A	Additional information will be supplied in future BWIP documentation. Available information will be added to Section 11.3.2.2 and other SCP sections specifically on thermal limits of backfill, and referenced where possible.
Sec. 15.3.1 p. 15.3-12 Para. 1	These premises will be verified. /19.	A	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.
Sec. 15.3.1 p. 15.3-12 W.1.1.A Para. 1	A materials development test program ... obtain the required data. /3, 18.	A	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.
Sec. 15.3.1 p. 15.3-12 Status Para. 2	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 p. 6.3-9."	A	Additional information on the performance of backfill materials will be supplied in future documentation. Dehydration, if reversible, does not invalidate the thermal limit.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.3.1 p. 15.3-13 W.1.1.A Plans (All)	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."	A	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.
Sec. 15.3.1 p. 15.3-13 W.1.2.A	Status and Plans. /16, 21.	A	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.
Sec. 15.3.1 p. 15.3-14 Para. 2 and 3 W.1.3.A	If, in some manner ... (and hence, release rates 1 of multivalent radionuclides. Conversely, it can be hypothesized ... or minimally affected by radiation. /3, 5, 7, 15, and 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."	A	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.
Sec. 15.3.1 p. 15.3-15 Para. 1 W.1.3.A Plans	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."	A	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.
Sec. 15.3.1 p. 15.3-15 Para. 2 (All)	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, par. 1) nothing is mentioned about effects of water flow rates."	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.3.1 p. 15.3-15 Para. 1 W.1.4.A Status	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."	D	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.
Sec. 15.3.1 p. 15.3-16 Para. 2 W.1.4.A Status	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. Colloid formation could occur during the leaching process also."	A	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.
Sec. 15.3.1 p. 15.3-17 Para. 2 W.1.4.A Status	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."	A	More isotope-specific information will be added to the specifics of the status section, reflecting additional data that will be provided in Section 6.3 or 11.3 of the SCP.
Sec. 15.3.1 p. 15.3-17 Para. 3 Status	However, insufficient data are available ... expected repository conditions. /16, 18 -- "What are the expected repository conditions? Ref?"	D	Repository-specific conditions are defined in Chapter 6 and 11 of the SCR, and references contained therein, as well as Chapter 5 (hydrochemistry). Cross references will be supplied in the SCP.
Sec. 15.3.1 p. 15.3-18 Para. 1 Plans	The behavior of these waste forms ... conditions expected for the repository. /16, 21 -- "Very general. What about resolving uncertainties in K_d s?"	D	K_d s 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_d s. Planning for resolution of this item is under way and will be included.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.3.1 p. 15.3-18 Para. 1 Plans	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?"	A	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.
Sec. 15.3.1 p. 15.3-18 Para. 1 W.1.5.A Status	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."	A	The statement will be rewritten.
Sec. 15.3.1 p. 15.3-19 Para. 1 Status	... control probably results ... the basalt groundwater system. /5, 16	A	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.
Sec. 15.3.1 p. 15.3-19 Para. 1	In direct Eh measurements (oxygen depletion) ... the basalt groundwater system. /5, 7, 9, 10, 16, and 18.	A	Presently available (new) data will be added to Sections 6.3 or 11.3 of the SCP, defining oxygen consumption with time, and as additional details become available they will be reported in SCP updates.
Sec. 15.3.1 p. 15.3-19 Plans (A11)	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."	A	The details of testing and analysis will be provided in the Barrier Materials Test Plan and in the Performance Assessment Plan, which will be made available to the NRC and will be referenced and summarized in the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.3.1 p. 15.3-20 Para. 1 W. 1.6.A Status	Using the environmental conditions expected in a repository constructed in basalt as a basis. /11, 16	A	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.
Sec. 15.3.1 p. 15.3-22 Para. 1 W.1.10.A Status	Grande Ronde groundwater ... hydroxides and hydroxyoxides. /5, 6, 11 -- "These points in dispute. What is the effect of the high carbonate and fluorine content for example?"	A	The Barrier Materials Test Plan will contain experiments aimed at verifying the radionuclide species and the effects of anion complexation on available species in the waste package environment.
Sec. 15.3.1 p. 15.3-23 Para. 1 W.1.10.A Status	The radiation field, however ... a significant detrimental factor. /5, 6, 13, 16 -- "What happens in the very near field can affect speciation farther downstream."	A	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.
Sec. 15.3.1 p. 15.3-23 W.1.10.A Plans (All)	Ongoing research to evaluate the effect ... in the basalt geo-hydrologic 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.	A	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.
Sec. 15.3.1 p. 15.3-24 Para. 3 W.1.12.A Status (All)	The various dissolution/growth mechanisms ... under projected hydrothermal conditions. /5, 16	A	Information in the Barrier Materials Test Plan, which will be available to NRC and will be referenced and summarized in the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.3.1 p. 15.3-25 Para. 2	The dissolution of basalt ... to the accessible environment. /5, 16	A	Additional information on present status will be included in the data section of 11.3 or 6.3 of the SCP, and in future updates of the SCP.
Sec. 15.3.1 p. 15.3-25 W.1.12.A Para. 3	Waste forms show a complex set ... ordering of the solid waste form. /5, 16	A	Additional information on present status will be included in the data section of 11.3 or 6.3 of the SCP, and in future updates of the SCP.
Sec. 15.3.1 p. 15.3-25 Status Para. 4	These data can be coupled ... meaningful radionuclide release rates. /5, 12, 16. "This is probably the most difficult of models to construct."	A	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.
Sec. 15.3.1 p. 15.3-26 W.1.12.A Plans (A11)	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."	A	Details of test and analysis planning are included in the Barrier Materials Test Plan and the Performance Assessment Plan, which will be made available to the NRC and will be summarized and referenced in the SCP.
Sec. 15.3.1 p. 15.3-28 Para. 1 W.1.14.B Status	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."	A	Additional evaluation of data obtained in hydrothermal reactions (Barrier Materials Test Plan) will be made to determine whether Eh is correctly stated, and to define the real migrating species obtained from waste dissolution.
Plans (A11)	All of Plans. /21 -- "These are difficult experiments. How will they be performed?"	A	Information in Barrier Materials Test Plan, which will be available to NRC and will be referenced and summarized in the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.3.1 p. 15.3-28 para. 1 W.1.14.B Status	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 $<0.1 \mu D$ (10^{-10} cm/sec)."	A	This item will be clarified in text of the SCP.
Sec. 15.3.1 p. 15.3-29 W.1.15.B Plans (all)	All of Plans./10, 21 -- "Hydraulic conductivities will be in the meaningless area and diffusion will control. No specifics are given to <u>measure</u> diffusion rates."	A	More details will be provided in SCP text and supported by the Barrier Materials Test Plan.
Sec. 15.3.2 p. 15.3-41 para. 4 W.2.1.A Plans	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 unknown?"	A	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.
Sec. 15.3.2 p. 15.3-41 W.2.1.A Plans General	All of Plans/19 -- "Nothing is said about near-field heat induced effects."	A	This will be clarified in the text of the SCP.
Sec. 15.3.2 p. 15.3-42 para. 9 W.2.4.A Status (bottom of page)	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."	A A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)
 Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.3.2 P. 15.3-43 para. 3 W.2.4.A Plans	All of Plans/21 -- "Sorption and solubility are the most important items. The sorption R&D plans need much more elucidation."	A	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.
Sec. 15.3.2 P. 15-3.45 W.2.8.A. Status	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.	A	Correction will be made to the key parameters list.
Sec. 15.3.2 P. 15.3-45 W.2.8.A Plans	All of plans and particularly "The BWIP <u>plans to proceed</u> in acceptable release rates..." /19	A	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.
Sec. 15.3.2 P. 15.3-46 Para. 7 W.2.10.C Status	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."	A	Additional data will be provided, and the Barrier Materials Test Plan has details of test strategy to verify assumptions, by further detailed testing.
Sec. 15.3.2 P. 15.3-47 W.2.10.C Plans	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."	A	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 development for measurement of Eh in situ are in the Barrier Materials Test Plan which will be referenced and summarized in the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.32 P. 15.3-48 Para. 7 W.2.12.D Plans	General Comment/19 -- "The so called plan consists merely of some vague assertions as to what will eventually be done."	D	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 EPA 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.
Sec. 15.32 P. 15.3-49 W.2.13.D Plans	General Comment/21 -- "What are plans for verification of coupled-hydrologic models?"	A	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.
Sec. 15.3.3 P. 15.3-53 W.3.1.A	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?"	C	We are not clear on what NRC means by this statement, please clarify.
Sec. 15.3.3 P. 15.3-58 Para. 1 W.3.2.A Plans	... (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."	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

Chapter 15

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 15.3.3 P. 15.3-58 W.3.2.A Plans (All)	General Comment/21 -- "Considering the great detail in the "status" part, the so-called plan is virtually non-existent."	A	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.
Sec. 15.3.3 P. 15.3-59 W.3.3.A Status and Plans	General Comment./16 -- "References should be given for documentation of status and the various. If some plans are not documented, it should be noted."	A	The Performance Assessment Plan will contain details, and an expanded text of W.3.3.A will be provided in the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 16

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 16.3.1 p. 16.3-1 Para. 2	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."	A	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.
Sec. 16.3.1 p. 16.3-2 Para. 1	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."	A	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.
Sec. 16.3.1 p. 16.3-3 Para. 2	Lines 25-27, "The validation of...and the measured data."/3 -- "What is meant by sufficient?"	A	The text will be rewritten to emphasize the importance of determining a priori acceptance criteria and then working towards this objective. The word 'sufficient' will be deleted.
Sec. 16.3.3 p. 16.3-8 Para. 3	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."	A	Change priority of work element S.1.40.D-SD to priority 1.
Sec. 16.4 p. 16.4-7 Para. 5	Lines 38-40, "The validation of an...the measured data."/3 -- "What is meant by 'sufficient'?"	A	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'.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 16

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	BWIP COMMENTS
Sec. 16.5 p. 16.5-2 Table 16-2	"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."	A	Work elements will be revised in Chapter 13 and integrated into Table 16-2, Chapter 16, of the SCP.
Sec. 16.5	"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."	A	Work elements will be revised in Chapter 13 and integrated into Table 16-2, Chapter 16, of the SCP.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 17

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
1 Sec. 17.1 p. 17.1-1 Para. 4	"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."	A	The paragraph will be revised to delete "is somewhat flexible in response to schedule and budgetary requirements."
2 Sec. 17.1 p. 17.1-1 Para. 4	The logic diagrams ... issues will be resolved. / 1 -- "The time when issues will be resolved is not provided as stated."	A	The paragraph will be revised to delete "and the time where the issues will be resolved."
3 Sec. 17.2.2 p. 17.2-4 Para. 3	"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."	A	This comment requests general information on testing strategy that should be in the revised ES test plan and in the discussion of horizon selection. The exploratory shaft will be used to enhance characterization of the RRL. The Test Plan will describe this process, explaining the relationship Paragraph will be modified to more accurately reflect the decision analysis process.
A Sec. 17.2.2 p. 17.2-4 Para. 3	"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."	A	to other site characterization testing.
5 Sec. 17.2.2 p. 17.2-7 Para. 2	Lines 18-19, "Vertical transport ... for isolation." / 5 -- "Is this a general statement or specifically related to shaft integrity?"	A	Sentence will be modified to relate to shaft integrity.

A Agree
C Requires Further Clarification
D Disagree
I Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 17

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
6 Sec. 17.2.3 p. 17.2-8 Para. 2	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? "	A	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.
1 Sec. 17.2.3 p. 17.2-13 Table 17-4	"Pressure differential and grout strength." / 18 -- "These parameters do not provide sufficient data on the shaft seal."	A	ES test plan will provide more information and will be referenced in the SCP.
9 Sec. 17.2.3 p. 17.2-14 Para. 1	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.?	A S	Additional information on interval testing and analyses will be presented in the Exploratory Shaft Test Plan.
9 Sec. 17.2.4 p. 17.2-17 Table 17-6	"The tunnel layout in the repository horizon ... to minimize the stress concentration." / 10 -- "The primary goal of the tunnel layout should be to maximize radionuclide containment, with a secondary goal of maximizing stability."	A	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.
10 Sec. 17.2.4 p. 17.2-19 Para. 6	Line 17. / 9 -- "Work elements S.1.24.C and S.1.25.C should be included."	A	ES Test Plan will identify additional work elements and work elements S.1.24.C and S.1.25.C will be added.
11 Sec. 17.2.4 p. 17.2-20 Para. 4	Lines 13-25, "Test Program Objective 3 (Phase I)." / 3,9 -- "Demonstrate hydrogeologic isolation in vicinity of shaft."	A	Paragraph will be revised to include demonstration of hydrogeologic isolation in vicinity of shaft.

A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 17

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
12 Sec. 17.2.6 p. 17.2-24 Para. 1	"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. "	A	The first NRC comment is not a complete sentence. Further clarification is necessary for resolution of the comment.
13 Sec. 17.2 p. 17.2.24 Para. 3	"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."	A	Paragraph will be revised to defend and restrict conclusion and reference will be made to Chapter 4 of the SCP.
14 Sec. 17.2.6 p. 17.2-26 Para. 3	"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."	A	Information on large-scale rock mass testing will be included in the Exploratory Shaft Test Plan and will be referenced in the SCP.
15 Sec. 17.2.7 p. 17.2-26 Para. 4	Line 34-bottom, "17.2.7.2 <u>Hydrologic</u> ... repository flow." / 3,9,10	A	Exploratory Shaft Test Plan will provide needed details.
16 Sec. 17.2.7 p. 17.2-27 Para. 1	Lines 1-11, "Based on the conditions ... presented in Table 17-9." / 3, 9, 10	A	Exploratory Shaft Test Plan will provide needed details.
17 Sec. 17.2.7 p. 17.2-28 Table 17-9	Table 17-9./ 3, 6 --"Values for parameters other than in repository horizon should also be determined."	A	This table is not restricted to tests to be performed in a candidate horizon. Table will be revised to reflect this.

A - Agree.
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 17

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	DWIP DISPOSITION	DWIP COMMENTS
18 Sec. 17.2.8 p. 17.2-29 Para. 3	"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."	D	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. <i>A workshop will be held to discuss this item.</i>
19 Sec. 17.3 p. 17.3-1 Para. 3	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 2Q FY87 could unnecessarily delay review of the license application."	/A	Issuing a specific report to satisfy every issue that may arise will result in fragmented and incomplete reporting or much redundancy. The semi-annual reporting system proposed is appropriate to the rate of data collection and analysis planned. Topical reports are issued as issues are resolved. The semi-annual report will catalog topical reports and address other topics.
20 Sec. 17.3 p. 17.3-2, 17.3-3, 17.3-4, 17.3-5	Figures 17.8, 17.9, 17.10, 17.11. /21 --"The figures do not provide enough on how the information 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."	/A	This level of detail is not appropriate for SCP, however. Additional details will be provided to NRC separately.
21 Sec. 17.3 p. 17.3 -3 Fig. 17-9	"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."	A	Plans for resolution of these issues will describe methodology for integration ES-II testing with testing in boreholes RRL-2, RRL-6 and RRL-14.

- A Agree
 C Requires Further Clarification
 D Disagree
 X Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 18

Introductory Note: NRC comments, taken from an early version of the Std. Review Plan, are subject to change and clarification. NRC will provide a revised draft in July 1983.

REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 18.1 p. 18.1-1 to 18.1-4 Para. 18.1	The organizational structure, functional responsibility ... throughout the entire project. --	X	
	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.	A, D	Evaluations will be performed. Frequency will not be established in the SCP.
	Describe the criteria for determining the size of the QA organization (including the inspection staff) of DOE and its principal contractors.	D	Management forecasting of manpower requirements is not suitable for the SCP.
	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.	D	Qualification requirements for this position are not appropriate for the SCP. and are contained in internal documents
	Provide a commitment that verification of conformance to established requirements is accomplished by personnel within the QA organization.	D, X	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.
	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, and (4) stop unsatisfactory work. (5) Describe how these actions are accomplished.	A (1-4) D (5)	This will be clarified in the SCP, Chapter 18. ^{implementing} These actions are described in procedures. Details are not appropriate for the SCP.
	Describe how disputes involving quality arising from a difference of opinion between QA personnel and other department personnel are resolved.	A	This will be clarified in the SCP, Chapter 18. Generally, disputes are elevated to upper management until resolution is achieved.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
(FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 18

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 18.1 p18.1-1 to 18.1-4	Continued 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; that he 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.	A, D	This will be clarified in the SCP, Chapter 18. <i>Freedom from non-QA duties is not essential, however.</i>
2 Sec. 18.2 p.18.2-1 to 18.2-2 Para. 18.2	The Secretary of the DOE, in DOE Order ... of the supplier-quality-system evaluation. -- Identify existing or proposed QA procedures reflecting that each criterion of 10 CFR 50 Appendix B will be met by documented procedures. Describe how management (above or outside the QA organization) maintains frequent contact with program status through meetings, reports, and/or audits. For both DOE and its 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. 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	A A, D A, D A, D, X	This will be clarified in the SCP, Chapter 18. This will be clarified in the SCP, Chapter 18. <i>This will be clarified in the SCP, Chapter 18. Details are more appropriate for implementing procedures, however.</i> Chapter 18 currently addresses Rockwell QA assessments, but additional clarification will be provided in the SCP. <i>Frequency is not appropriate for the SCP, however.</i> 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 - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 18

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 18.2 p18.2-1 to 18.2-2	Continued 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.		A program of this type is required at the time the Repository operations begin. A full-time training coordinator would be required at that time. Traditionally, where proficiency exams are required, salaries for technical personnel are increased accordingly.
Sec. 18.3 p18.3-1 to 18.3-2 Para. 18.3 3	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.	A	This will be clarified in the SCP, Chapter 18.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 18

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
4 - Sec. 18.4 p 18.4-1 Para 18.4	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.	AgC	This will be clarified in the SCP, Chapter 18. <i>Personnel other than QA also approve procurement documents. Delegation of responsibility to a purchasing subcontractor, for example, is discussed in the SCP.</i>
5 Sec. 18.6 p 18.6-1 to 18.6-2 Para 18.6	Each principal contractor is required ... and revision receipt forms. -- Describe how the identity of the applicable revision of instructions, procedures, specifications, drawings, and procurement documents is made known to personnel performing the work.	A	This will be clarified in the SCP, Chapter 18.
6 Sec. 18.7 p 18.7-1 to 18.7-2 Para 18.7	The procurement of items and services for the BWIP ... commercial, "off-the-shelf" items procured by Rockwell. -- 2 Describe the organizational responsibilities for the control of purchased material, equipment, and services. Clarify that vendors, suppliers, and service type organizations are required to furnish the following records to the purchaser: 6 (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." C 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.	A A D	This will be clarified in the SCP, Chapter 18. This will be clarified in the SCP, Chapter 18. 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 finished upon delivery. <i>Certified material Test Reports are required for the ES liner and gasket materials.</i>

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 18

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
7 Sec. 18.9 p 18.9-1 Para. 18.9	Processes affecting quality of 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.	A	This will be clarified in the SCP, Chapter 18.
9 Sec. 18.10 p 18.10-1 to 18.10-2 Para 18.10	An inspection program has been established ... requirements for inspection. -- 2 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.	A, D	Equipment accuracy and inspection frequency are a product of the design iterative processes. The participation of the QA function will be clarified in the revised Chapter 18. <i>QA involvement should not be mandatory.</i>
Q Sec. 18.11 p 18.11-1 Para. 18.11	Clarify that the appropriate QA organization performs (1) final acceptance inspection and (2) source and receiving inspection. Rockwell prepares test plans ... changes in operating facilities. -- Describe how the QA organization is involved in scoping the test control program.	A, D A	This will be clarified in the SCP, Chapter 18. <i>Personnel performing inspections need only be free from responsibility for performing work, and may not be a part of the QA organization.</i>
10 Sec. 18.12 p 18.12-1 Para 18.12	Tools, gauges, instruments, and other ... by Rockwell's Quality Assurance Function. -- 2 Describe the procedures and identify the organization responsible for calibration, maintenance, and control of measuring and test equipment.	A	This will be clarified in the SCP, Chapter 18.
	5 Clarify that measuring and test equipment is labeled or tagged to indicate due date of the next calibration.	A	This will be clarified in the SCP, Chapter 18.
	✓ Clarify that measuring and test equipment is identified and traceable to the calibration test data.	A	This will be clarified in the SCP, Chapter 18.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

CHAPTER 18

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Sec. 18.12 p 18.12-1	Continued 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 possible, have an accuracy that assures the equipment being calibrated will be within tolerance. The basis of acceptance is documented and authorized by responsible management.	A, D	Calibration requirements will be clarified in the revised Chapter 18 of the SCP. Accuracy criteria and responsibilities will also be clarified. <i>The 4x value is not universally applicable</i>
Sec. 18.14 p 18.14-1 Para 18.14	Provide a commitment that primary calibrating standards have greater accuracy than secondary standards being calibrated. Contractors involved in inspection and ... prior to approved corrective action. -- Describe procedures which control altering the sequence of inspection and tests.	A A	Calibration requirements will be clarified in the revised Chapter 18 of the SCP. Clarification will be provided in the revised Chapter 18 of the SCP.
Sec. 18.17 p 18.17-1 Para. 18.17	A quality assurance records system for the ... principal contractors and their subcontractors. -- 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.	A	Records management responsibilities will be clarified in the revised Chapter 18 of the SCP. <i>Complete details are contained in implementing procedures.</i>
Sec. 18.18 p. 18.18.1	Identify what items the inspection and test records will include. Describe the facilities for the storage of records. Planned and scheduled quality assurance audits ... and his affected department managers. / Clarify that DOE performs both internal and external audits to assure that procedures and activities comply with the overall QA program.	A A	Records management responsibilities will be clarified in the revised Chapter 18 of the SCP. <i>Complete details are contained in implementing procedures.</i> DOE-RL must provide the response to this item. <i>This will be provided in the SCP.</i>

1/14

NEW

S 6.1.1 "A comprehensive conceptual design ---
p 6-1 is to be submitted to NRC" S

Q 4 "Q" where is it? When will it be delivered?

NEW

Q 4 "Two candidate horizons --- are ident" S

Q "Q" When will the horizon selection report be delivered?

23(1)

S 6.3.1
p 6.3
Q 2
"C" rock "properties"

1

response does not seem to be timely.
when will this effort be presented to NRC.

"staff considers that a realistic stability analysis --- should be performed at an early date"

rock properties need to be reviewed

23(2)
2

S 6.3.1
p 6.3
Q 3
"B" when will cleared report be released?
what takes so long?

23(3)
§ 6.3.1
p 6-4
A 3
"A" *

What is the schedule for W.E R.1.10.A? S
it is a key W.E. NRC would like
to follow it closely.

23(4)
§ 6.3.1
p 6-3
A ?
"A"

"Single value"
~~It is out of order?~~ *Pageing out of order.*
This should be part of W.E R.1.10.A
How much will be done before start of design?

24(1)
6.3.1
p 6-3
A ?
"A"

"the assumptions ..."
(The point is "linear elastic analysis" is
not realistic. Will analysis include thermal expansion?)

NEW
6.3.1
p 6-4
A
"A" *

"What tests should be performed, how
many measurements -- how accurate
how -- will affect the design."
A
key point! i.e. What is the logic behind
the test plans? What is the status of these?

Workshop discussion
item. Test plans will
provide a portion of
this information, and
will be followed up
with discussions.

Response should be as detailed as possible with identification of limitations

24(2)
6

S6.3.1
p6-4 error in methodology -- used to extend findings to entire horizon

"A" pg.
*

key item Many comments on inadequate # of BH's, need for inclined BH's, ACRS comments! How predictable is geology? Need to explain logic. Any Experience?

25(1)
1

S6.3.2 Engineered Barriers

p6-5
"C"
*

This is a key item and apparently is not understood by BWEP
backfill placement density is difficult to control ... difficult to quantify on horizontal emplacement

NEW "D"

- Analytical sensitivity studies considering a range of waste emplacement configurations and backfill properties are needed

NEW "E"

- some credit for retardation by emplacement room backfill

Waste Package disposition required for following items

A } combined response
A }

A

A

Comments Added on page 3.1 of 14, following.

Note: These comments will be moved to the Waste Package section in the final report.

②

A

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 required waste package backfill functions for a NWRB is approximately 3 orders of magnitude less than that believed to be achievable by pneumatic emplacement, so the emplacement process need not be a precise operation. If the full-scale backfill emplacement test now in progress is not successful or shows the process to be difficult to control, the method will be abandoned in favor of other techniques.

A

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.

A

The waste package configuration studies not 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.

4/14

may be needed to satisfy
the engineered barrier release
rate criteria.

NEW

"C1"

- Ch 15 summary narrative 5
(Conduct trade studies) and
W.12. W.3.6 need further
explanation. Results should
be provided to NRC at an early
date. .. How many tests, when, where?

\$

NEW "C1"

- How will quality control be
provided for fill in horizontal
holes?

25(2) S 6.3.3
P 6.6
⑧ H
"A"

Note different Perf. Objectives
apply to BH/SS (i.e., meet TEPA std)
and room and drift backfill (i.e., 10^{-5})

NEW S 6.3.3
P 6.6
H
"C1"

- "concerned with delaying laboratory
and field testing"

A

Workshop discussions
will be held with NRC

5/14

Workshop
Item

NEW

- "need to understand potential problems with site specific placement techniques delaying lab and field testing could impact repository schedules"

A

HOLD

A

- Staff also determined that the SCR does not provide or reference detailed information concerning the exp. shaft or (QA) and testing procedures

A

- A design and construction QA plan is mentioned but not presented (SCR page 14.4-73) TPO

Much of this information has been presented to date. Additional information will be made available as it is developed and issued.

A

- 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

NEW

NEW

NEW

NEW

6/14

25(3)
S 6.3.3
p 6-7
9
"B"
(9)

Point is -- concern about late
start in lab and field tests
not just seal design schedule.
~~what is sched for WE R.I.B.O.~~

26(1)
S 6.3.3
p 6-7
9
"C"
(10)

- "No sched for (R.I.B.O.)
"all seal requirements can be met through
shot seals -- no tunnel seals
required" - I don't understand?

26(2)
S 6.3.3
p 6-7
9
"B"
(11)

Identify how uncertainties will
be addressed

26(3)
S 6.3.3
p 6-7
9
"B"
(12)

add - description of the procedures
and data ---

Note: procedures can be referenced

7/14

S 6.3.3

P 6.7

A

^{also}
Minimum design objectives
should be developed (discuss)

27(1)

(13)

Item (1)

"B"

S 6.3.3

P 6-8

A

what about placement techniques,
~~longevity tests~~, and field tests

27(2)

(14)

Item (2)

"B"

S 6.3.3

P 6-8

A

Need to ref. documents used to date
"currently being conducted"

27(3)

(15)

Item (3)

"A"

S 6.3.3

P 6-8

Item (4)

"C"

what is impact of leaving liners
in place in other areas.

27(4)

(16)

NEW

S6.3.3

P 6-B
Item (5)

Need to track this item

8/14

A

(See previous
comment - this
is a duplicate item)

28(2)

S6.3.4

P 6-B

"C"

- What in situ tests are planned?
- retrieval NE given low priority
- evaluate problems with horizontal emplacement
- no details re: seals, number, timing
- type of tests, ^{unproven} ~~unproven~~
- constructability is ~~unproven~~
- 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 @ L. A. retrieval of waste is indeed possible.
- demonstration of (1) drilling (2) emplacement (3) retrieval will build confidence

Defer to NRC
Workshop

S 6.3.5

P 6-10

A

NEW



- plan lacks a logical development and rationale for developing.
- identify important design parameters
- document their potential variability
- identify measuring techniques and reliability
- provide references to test procedures and Q. A.

major limitation lack of plans for (1) full-scale room excavation and (2) large-scale thermal-hydrologic testing in underground facility during Phase II.

S 6.3.5

P 6-11

A



NEW

- Commitment to perform necessary and sufficient testing
- difficult to evaluate site characteristics in the absence of test plan details.
- there should be a sense of urgency about resolving these concerns

A

Discussion will be added as previously discussed

A (1) ^{Future}

Excavation plans will be discussed in the SCP.

X, A (2)

Will be ^{included} ~~discussed~~ at a future NRC workshops with ^{discussion} ~~action~~ of future planning incorporated in the SCP.

A

These philosophies will be incorporated in the SCP and future test plans.

10/14

P6-12
O

- many tests performed at the NSTF
may not be repeated (Needs explanation)

28(3)

S 6.3.5

P6-12

H

"C"

X

(18)

The point is that we need to
come to closure on what is
an adequate in-situ test plan.
To do this the 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~~
NUREG/CR-3065 be used as
a point of reference.

^{Detailed}
- Plans should be referenced in
the SCP

A

An explanation will
be provided in the SCP.

A

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.

A

Available detailed
test plans will be
referenced in the SCP.

S 10.2
P 10-1

11/12/1

Chapter 10

- detailed test plans and procedures are not provided or referenced
- detailed description of the QA procedures in each program area is lacking
- specific methods to be used in data gathering ... be subject of preliminary consultation

P 10.2



- (1) data should be documented ... recorded under full QA
- (2) available to all interested parties - inspection at an early date
- staff recognizes not all test plans may be needed at this time - however some should be available for review.

2
Set 10
Page 37
T-II

A (1) This system presently exists and will be clarified in the SCP.
(2) Workshop item

12/14

37(1)

S10.3

P10-3

Item(1)

"C"

Disagree: Any document available
to me why can't documents
be referenced.

37(2)

S10.3

P10-3

Item(2)

"C"

A major planning effort, similar to
power reactors, indicates a
misunderstanding of what is needed
let's discuss.

S10.3

P10-3

Item(3)

"C"

- Methods for reliability analyses,
... establishing reliability design
requirements for components and
systems should be developed
early in the design program.

"0"

- Evaluate releases to the unrestricted areas within limits in 10 CFR 20 and 40 CFR 191, Part A

"0"

- Evaluate stable zoning requirements

"0"

- Determine role of backfill in engineered barrier system

"0"

- ✓ Review results of sealing performance assessment

"0"

- ✓ Evaluate exploratory shaft construction and QA procedures

"0"

- ✓ Evaluate retrieval options and construction problems

"0"

- ✓ Evaluate ongoing thermal and geomechanical test plans on Workshop list

(agenda for future consultation)

Ch 11
pg 11-16
Item 1
"C"

discussion is needed

QA

Ch 11
pg 11-16
Item 2
"C"

disagree - discussion is needed

Ch 11
pg 11-16
item (4)
"C"

"?"

Ch 11
pg 11-16 As noted in Ch 10
item (3)
"C"

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC HRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

SCR APPENDIX

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Appendix p.11 Para. 2 p.12 Para. 9 Sec. 6.1 p. 6.1-15 Para. 4	<u>Disturbed rock zone</u> . . . BWIP defines the disturbed rock zone at the 100°C isotherm. . . <u>Engineered system</u> . . . 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 groundwater at low-temperature (less than 300°C) hydrothermal conditions."	C	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 alteration 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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

APPENDIX C

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Appendix C p. C-10 Item P.1	How do the design criteria and conceptual design address releases of radioactive materials to unrestricted areas within the limits specified in 10 CFR 20?	A	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.
Appendix C p. C-10 Item P.2	How do the design criteria and conceptual design accommodate the retrievability option?	A	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.
Appendix C p. C-11 Item P.12	Have the NEPA environmental/institutional/siting requirements for nuclear facilities been met?	A	The "Proposed General Guidelines for Recommendation of Sites for Nuclear 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 available 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 Chap. 20 of the SCP.
Appendix C p. C-16 Item 2.12	How do microbes effect conditions affecting corrosion modes? What effect do microbes have on the conditions affecting transport?	A	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, microbes cannot survive and affect the source term. The question is, therefore, not an issue but a work element.
Appendix C p. C-16 Item 2.15	What is the effect of water residence time on release of radio-nuclides from the waste form?	A	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.

A - Agree
C - Requires Further Clarification
D - Disagree
X - Programmatic Impact

DISPOSITIONS AND REVISIONS TO
(FROM APPENDICES B AND C OF THE DSCA)

APPENDIX C

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Appendix C p. C-16 Item 2.16	What are the ranges of residence times of a unit volume of water in contact with a unit area waste form and when do the residence times occur? For spent fuel how do hulls change the effective residence time?	A	Discussion of residence time and its impact of waste release will be discussed in Work Elements W.1.4.A/W.1.12.A. If BWIP decides to take credit for the cladding in spent fuel, it too will be considered.
Appendix C p. C-17 Item 2.21	What are the transport and retardation processes and how do they effect the flux of radionuclides with time in packing materials?	A	These will be more explicitly identified in existing Work Element W.1.4.A.
Appendix C p. C-17 Item 2.23	Can actinides be concentrated to increase heating in the packing materials or create a potential for criticality?	A	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 are is not at issue, since the waste package design must accommodate greater thermal loading from fission products. Criticality prevention specifications are covered by <u>Work Element W.1.21</u> .
Appendix C p. C-17 Item 2.25	What are the convective flows in the waste package vs. time? (relates to 2.1)	A	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.
Appendix C p. C-17 Item 2.27	What are the conditions which affect criticality?	A	For the most part (see Item 2.23), 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. <u>See Item 2.23.</u>
Appendix C p. C-19 Item 3.3	How is the migration behavior (including solubility and retardation) of radionuclides being validated/verified?	A	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.

A - Agree
 C - Requires Further Clarification
 D - Disagree
 X - Programmatic Impact

DISPOSITIONS AND RESPONSES TO SPECIFIC NRC COMMENTS
 (FROM APPENDICES B AND C OF THE DSCA)

APPENDIX C

ITEM REFERENCE	STATEMENT OF ITEM - COMMENTS CODE/REMARKS	BWIP DISPOSITION	BWIP COMMENTS
Appendix C p. C-19 Item 3.4	How are the geochemical data that have been and will be gathered be shown to be appropriate for use in anticipated performance assessment methods?	A	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.
Appendix C p. C-22 Item 4.1.1	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)?	A	See NRC reference item p. C-10, Item P.1.
Appendix C p. C-22 Item 4.1.2	How do the design criteria and conceptual design accommodate the retrievability option (Performance Issue B.2)?	A	See NRC reference item p. C-10, Item P.2.
Appendix C p. C-24 Item 4.5.1	How is the repository performance expected to be affected by construction of the exploratory shaft?	A	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.
Appendix C p. C-26 Item 5.4.1.	What is the probability that groundwater withdrawals for irrigation would trigger microearthquake or earthquake swarms?	A	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.
Appendix C p. C-27 Item 5.4.2.2	What is the probability that water impoundments behind possible future dam construction (Ben Franklin dam) will cause micro-earthquakes or earthquake swarms?	A	Rewrite work element S.1.41.D to incorporate recent work on disruptive scenarios.