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Encl. to pkg. sent
to MJB for Cook
3/18/85

GUIDANCE FOR THE READER

Document That Was Reviewed:

SD-BWI-CR-018, "Draft Waste Acceptance Requirements for the BWIP,"
June 1983.

Reviewers:

- Department of Energy (Richland Operations Office and Headquarters)
- Subcontractors chosen by the Department of Energy

Review Comments Received Via Department of Energy From:

- Department of Energy (Richland Operations Office and Headquarters)
- Roy F. Weston, Inc.
- Pacific Northwest Laboratory (PNL)
- Rockwell Hanford Operations
B-Plant Immobilization Pilot Plant (BIPP) (Assisted by PNL)
- Savannah River Laboratory

- First Review*

- Second Review

*A BWIP response provided to SRL August 1983

Proposed Dispositions by:

Dr. E. H. Randklev and Staff
Engineered Barriers Department
Basalt Waste Isolation Project
MO-407/200 East Area
Phone: (509) 373-2853, FTS 440-2853

Review Comment/Disposition Package:

The comments from each reviewer are presented and dispositioned as separate subparts of the attachment package. The BWIP response to each topical set of reviewer comments is presented immediately following the comments. The BWIP response to each review comment consists of two parts: **REPLY** and **ACTION** (proposed disposition) subsections. The **REPLY** subsection provides the overall response considered necessary to adequately address each review comment and to provide background support for the proposed disposition. The **ACTION** subsection provides the proposed disposition, which is restricted to the particular changes, if any, to be made in the subject document (SD-BWI-CR-018).

Review Terminology for the BWIP Waste Package:

The nomenclature used for identifying components of the reference waste package for the BWIP was revised (March 1983). Attachments I and II discuss and illustrate the changes. The subject document, SD-BWI-CR-018, was issued for review in June 1983 and will, thus, need to be revised accordingly. Some reviewers submitted comments referring to waste package components using their own preferred nomenclature. The BWIP did not edit or correct such reviewer naming of components. The comments were reproduced and dealt with in the as-received format and wording.

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PDR WASTE PDR
WM-10

*See Packet 16 for
encl.*

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WM DOCKET CONTROL
CENTER

'85 MAR 18 P2:16

WM Record File
101

Docket No. 10

PDR *✓ w/o rept*
LPDR *✓ w/o rept*

Distribution:

MSB
(Return to WM, 623-SS) 13

*Sent to MSB for
Cook for mtg.*

1269



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

To: M.J. Bell

From: JK Cook

Subj. Items Regarding
DNPF/Reportable Coordination
Meeting —

Enclosed are various items which may be of use in preparing for the Subject Meeting. These are in response to your letter of March 8 1985 requesting pertinent information.

I'm sorry I do not have a copy of 50-BNF-CR-018 of 6/85 but have requested one via the document release system. I suspect Nancy Still may have a copy in the W.M. file. If not she Cheng or White should have a copy.

JK Cook

Enclosures.

- A) Disposition of Comments on 50-BNF-CR-018 of 4/85
- B) OOE letter, Olson to Purcell 3/2/85
- C) Waste Acceptance Process (Paragraphs etc) 2/5/85
- D) UCIP 20165/Aug 84 + E) ONWI 463

Attachment I

Revised (March 1984) Terminology for
Components of the BWIP Waste Package

- (1) Canister - The first material envelope surrounding a waste form (i.e., a processed waste form such as a glass, crystalline ceramic, etc., and possibly in some cases light water reactor spent fuel rods). The canister is installed by the waste form producer/shipper.

Note: The BWIP formerly called this component the container.

- (2) Overpack - A material envelope surrounding an as-canisterized waste form in which the specific canister is not in compliance with the acceptance specifications of the repository but is in compliance when housed within the envelope provided by the overpack. The overpack is not intended for routine application.

Note: This is a new optional component.

- (3) Container - The (metal or ceramic) envelope in the waste package that provides the primary containment function of the waste package to meet the containment requirements of 10 CFR 60 (NRC).

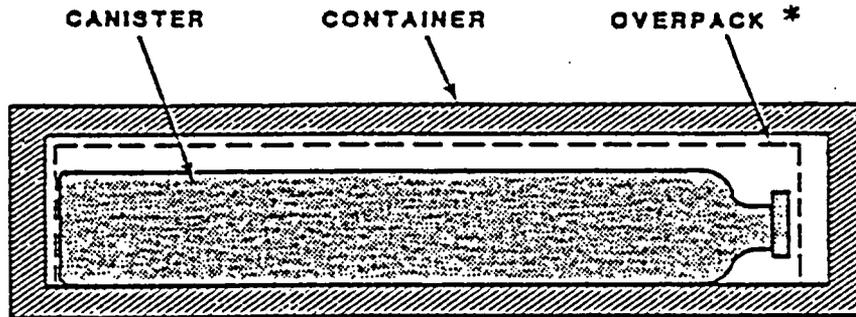
Note: The BWIP formerly called this component the canister.

- (4) Packing - The part of the waste package that contributes to the performance of the total waste package by minimizing groundwater interaction with the container and waste form materials, limiting radionuclide transport, and/or altering groundwater chemistry to minimize waste form/canister/container degradation and radionuclide solubility.

Thus, the renamed component sequence across the cross-section of the reference design case in the waste package conceptual design (RHO-BW-CR-136 P/AESD-TME-3142, 1982) is waste form/canister/overpack (optional)/container/packing.

ATTACHMENT II

The Revised (March 1984) Terminology for components
of the BWIP Waste Package



* THIS IS A NEW OPTIONAL COMPONENT - SEE ATTACHMENT I FOR DESCRIPTION

WP8312-54A

The BWIP Reply Proposed Dispositions to the DOE-RL Review Comments
 DOE COMMENTS ON SD-BWI-CR-018
 DRAFT WASTE ACCEPTANCE REQUIREMENTS
 FOR THE BASALT WASTE ISOLATION PROJECT

Comments dispositioned by:

E. H. Randklev
 Engineered Barriers Dept.
 Basalt Waste Isolation Project
 (509) 373-2853, FTS 440-2853

DOE COMMENTS

1. 2.2.1, page 9 - The statement that the WVHLW form would use a different composition than DHLW implies that requirements for WVHLW might differ substantially from DHLW acceptance requirements; the text should be rewritten to clarify this point. References should be cited for the "reference container and waste forms" mentioned here and elsewhere.

BWIP REPLY: Line 1 - It is not possible to say how different the WVHLW form will be relative to CHLW or DHLW until WVHLW product design is referenced and a reference waste form (glass) composition is established. The types of requirements that will apply to WVHLW form will be the same as for those listed in this document for CHLW and DHLW forms, but the respective limits for some requirements may be different. It should also be noted that the limits presented in the design related requirements (e.g., size, weight, etc.) in the DHLW section are primarily based upon the Savannah River DWPf product as referenced to date by SRL and DOE and are not necessarily applicable to other DHLW disposal products.

Line 4 - The specifics of the reference WVHLW form, etc. have not been established by DOE/subcontractors yet.

Note: The BWIP will draft acceptance requirements (planned for FY-85) for the WVHLW disposal product following receipt of such referenceable information.

BWIP ACTION: The text will be revised to make it clearer that WVHLW is considered by DOE to be a CHLW and to provide a status and plan for preparing draft acceptance requirements for WVHLW form product.

2. 3.1, Page 10 - Explain how the listed regulatory criteria apply. That is, indicate whether the regulatory criteria are: (1) additional requirements, (2) to be applied only as cited in the waste acceptance requirements document, or (3) redundant in the sense that any applicable provisions are included in SD-BWI-CR-018.

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BWIP_REPLY: The specific requirements and supporting Federal regulatory criteria are listed in the text and in more detail in Appendix A (Basis and Rationale for Requirements and Requirement Limits). Section 3.1 is only a listing of applicable "high-level" supporting documents, as dictated in style and format for a federal specifications document.

BWIP_ACTION: None required.

3. 4.2.1.1.3, page 15 - Specify the temperature for which the pressure should not exceed 7psig, e.g., 25°C, 500°C, 800°C, or other.

BWIP_REPLY: The temperature will not be specified by the BWIP. The pressure requirement applies to whatever temperatures the canister void volume will achieve between the time the canister is sealed and when the repository receives and accepts it. When the producers provide appropriate temperature information, then it will be included in the requirement as a reference case.

BWIP_ACTION: No changes needed at this time.

4. 4.2.1.1.8, page 16 - The means by which "chemical compatibility" can be demonstrated should be explained.

BWIP_REPLY: Demonstration is accomplished through existing reference data for analog systems and the proposed system and through a testing program for the proposed system.

BWIP_ACTION: A qualifying statement will be added to the text of 4.2.1.1.8 or A1.1.1.8 to help explain the requirement.

5. 4.2.1.1.9, page 17 - Reword this section to state whether the fire test is required to demonstrate the acceptability of a waste form (prior to an accidental fire) or whether the test needs to be conducted only after a fire (and then the waste may still be acceptable on a case-by-case basis even if it fails the test.) Natural cooling seems less stringent than immersion in water. The reason for requiring both should be provided.

BWIP_REPLY: It was written to apply to the performance of the waste form within a canister (formerly called the container by the BWIP) exposed to an accident involving fire. Immersion was initially judged to be a more stringent performance condition, but for completeness and the

desire to start from a position of conservatism, both conditions were included.

BWIP ACTION: A statement to this effect will be included in Appendix A1.1.1.9.

6. 4.2.1.2.1, page 17-18 - The reference to 10CFR20 appears to apply to both particle size and the "as low as reasonable achievable" provisions. The reference to Section 4.2.2.1 appears to be an error. The terms "anticipated processes and events" and "unanticipated processes and events" should be defined.

BWIP REPLY: Line 2 - Agreed.

Line 3 - The terms anticipated and unanticipated processes and events should be applied as per their definition and discussion in 10 CFR 60 (NRC) (June 1983) or later drafts as produced.

BWIP ACTION: The text will be modified to include the reference to 10 CFR 60. Also, 4.2.2.1 contains a typographical error and will be corrected to 4.2.1.1.

7. 4.2.1.3.1, page 18 - Repository/waste package heat transfer parameters should be provided so that the waste producer has the means to determine compliance with the 500°C temperature limit. State the appropriate parameters and current estimated values, or TBD, if no value is known.

BWIP REPLY: Basically, the producer/shipper only needs to be concerned with 500°C as a maximum waste form temperature limit relative to the handling, lag storage and shipping conditions that the product (waste/form) will experience up to receipt/acceptance by the repository. For further information on assumed conditions in the repository system and efforts to deal with this same peak temperature requirement, the reviewer is directed to waste package conceptual design document RHO-BW-CR-136P/AESD-TME-3142, which was referenced in the subject document (SD-BWI-CR-018). For the repository conceptual system design description, the reader is directed to SD-BWI-SD-005, Vol. I and II, Rev. 0-0, April 1983, a reference not available at the time the subject document (SD-BWI-CR-018) was drafted.

BWIP ACTION: We will insert SD-BWI-SD-005 as a reference on repository conceptual system design.

8. 4.2.1.4.2, pages 19-20 - Cite the exact section of 40CFR 191 which contains the "EPA limit". The receiver should be able to calculate the

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inventory at any desired time, if the producer is required to provide a radionuclide inventory at the time of waste production.

BWIP_REPLY: Agreed.

BWIP_ACTION: Will insert in the text that the "EPA limits" are found in Table 2 of subpart B of 40 CFR 191 (2/1/83).

9. 4.2.1.5, page 20 - The statement starting with "Waste form dissolution rates shall be assessed..." appears to be based more on a "leach rate" model rather than the steady-state concentration release model used by BWIP. This should be clarified. Also, delete the word "appropriately" from the phrase "appropriately conservative assumption" until subsystem performance requirements are adopted by the project. Experimental data should be referenced to support the 150°C temperature (instead of a lower temperature) for the compliance test.

BWIP_REPLY: Line 1 - Accepted.

Line 4 - Accepted.

Line 6 - 150°C is just a suggested starting point in the development of the compliance test, which PNL began working on in FY-84 for the BWIP.

BWIP_ACTION: Line 1 - The text will be changed to state that it is the steady-state concentration that is to be determined.

Line 4 - Will change the text as suggested.

Line 6 - Footnote to Table 4.1 will be changed to indicate that 150°C is only a suggested starting point for this test development parameter.

10. Table 4.1, page 21 - Change the title from "Radionuclide solubilities at the..." to "Steady-state radionuclide concentrations at the". Change the word "solubility" to "steady-state concentration" and delete the first sentence in the first footnote. Indicate that the compliance limit is the more restrictive of the EPA and NRC limits.

BWIP_REPLY: Accepted.

BWIP_ACTION: Text will be changed accordingly.

11. 4.2.1.6.1, page 22 - Clarify whether or not the "±5 weight percent" is absolute or relative. That is, if SiO_2 is nominally 40 weight percent of the glass, is the limit 40 ± 5 percent or 40 ± 2 percent. For minor constituents the ±5 percent could be unnecessarily restrictive. Ultimately, a range of acceptable concentrations should be provided for the actual waste form.

BWIP_REPLY: Line 1 - It was intended to mean a relative percentage, which is admittedly very conservative, if applied to all constituents.

BWIP_ACTION: We propose to delete the ±5 wt% value and leave the limit as a (To Be Determined). The specific limit(s) for this requirement will not be established until the BWIP waste/barrier/rock testing program and the waste package performance analysis work have produced enough results to adequately evaluate and assess the need for such a requirement.

12. 4.2.1.6.2, page 22 - The statement "to help certify compliance..." is vague. The specific information for certifying compliance with the release requirement should be stated.

BWIP_REPLY: One potential example (not yet confirmed) is information on waste aging effects.

BWIP_ACTION: Text will be changed accordingly.

13. 4.2.1.7, page 23 - The criticality requirement should be stated in terms which can be readily complied with on the part of the waste producer, i.e. average concentration of fissile material per unit volume of glass, or grams per waste container (based on a reference container size). The k-effective [infinity?] of 0.95 should be the basis for the requirement, rather than the requirement.

BWIP_REPLY: Line 1 - The BWIP considers it to be the producer's responsibility to establish a baseline of evidence (predictives and measured) that demonstrates compliance with this requirement. When such detail becomes available, we will add it to the document.

Line 4 - The point on K-effective as the basis for the requirement is accepted. It is K-effective +3 sigma deviation.

BWIP_ACTION: Line 1 - The requirement will remain as written for now.

Line 4 - Text will be modified to avoid confusion on K effective limit.

14. 4.2.1.8.1, page 24 - A temperature range should be provided for the thermal decomposition behavior. The BWIP Acceptance Test Procedure (i.e. MCC-14) or a TBD procedure should be stated as the appropriate procedure for CHLW form/barrier materials/rock interactions testing. It is not clear whether the required data is for each waste package or general data for the reference waste package design. This should be clarified.

BWIP_REPLY: Line 1 - This is a TBD for now.

Line 5 - These are to be general data on each reference case and ~~not~~ for each waste package and will only be required for a representative number (TBD) of samples of a given reference type of waste/form.

In the case of a requirement on radionuclide release limits for a waste (form) candidate, the MCC 14.4 compliance test procedure is being developed for the BWIP and mention of this will be added to the text.

BWIP_ACTION: None required.

15. 4.2.2.2.1, page 25 - The reason why the required limit on the waste form loaded container is expected to be less than 5,000 pounds when specifications are written should be stated; this could have a significant impact on a potential waste producer.

BWIP_REPLY: This was explained on page 88 in Appendix A. The weight limit was only a proposed value at the time, as referenced against the BWIP conceptual design and information on transportation.

BWIP_ACTION: The proposed maximum weight limit will be increased to 7000 lbs., based upon current conceptual designs for the BWIP. A statement will be added to further qualify the proposed value.

16. 4.2.2.2.7, page 28 - The last paragraph appears to allow a breach, which is inconsistent with the breach test described in this section, unless the breach is a result of more severe conditions than specified for the test. The intention should be clarified. A specific reference should be provided for the dose limits.

BWIP_REPLY: Line 3 - The word "breach" is defined as a footnote on page 27 of SD-BWI-CR-018.

Line 5 - Agreed.

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BWIP ACTION: Line 3 - Footnote, as modified, will be repeated on page 28 as indicated by the asterisk after "...breaching*..."
 Line 5 - The footnote on page 27 of the text will be changed by adding "...In addition, the radiation dose limits specified in 10 CFR 20, paragraphs 103, 105, and 106 must be met."

17. 4.2.2.4, page 28 - It is not clear that measuring surface temperature to determine compliance with thermal requirements is necessary. It may be possible to compute the thermal load with sufficient accuracy, or if not, then perhaps a calorimeter test is required.

BWIP REPLY: Measuring the surface temperature is a proposal that seems applicable to the requirement and easily done on a routine basis.

Note: Just predicting the thermal load is not a sufficient check against the requirement due to possible deviations in actual production of the product.

BWIP ACTION: Will change text to read "...shall be confirmed by testing the product, e.g., by measuring the surface...". Definition of a specific test will be left for future efforts.

18. 4.2.2.7, page 28-29 - An overpack may not be the appropriate corrective action for all possible violations of the required physical and chemical acceptance requirements. Each violation should be dispositioned on a case-by-case basis. The requirement that overpacked containers not exceed five percent per year should be deleted; if violations are excessive, corrective action by the shipper must be taken (or the requirements should be relaxed if appropriate). The requirement as written implies that the normal size of the waste container be small enough to accommodate an overpack, which will fit into the normal waste package overpack; this would probably be impractical. Requirements are needed on container closure (welding) in order to assure compliance with ASME or ASTM standards on inclusions (slag), linear cracks, lack of fusion, etc.

BWIP REPLY: Line 1 - Agreed. The opening statement in 4.2.2.7 (and also 4.4.2.7) was not intended to be so general and will be revised. The proposed requirement is not meant to exclude any workable alternatives to correcting cases of noncompliance.

Line 4 - Suggestion for deleting the 5% limit is accepted.

Line 10 - The comment on welding was noted. Whether a separate requirement is needed is under consideration, and whatever is decided will also apply to the overpack (optional) component.

BWIP ACTION: Line 1 - Text will be changed accordingly.

Line 4 - Text will be changed as suggested.

Line 10 - No changes needed at this time.

19. 4.3.1, page 34 - Delete the word "normal" preceding "uranium dioxide fuel".

BWIP REPLY: Accepted.

BWIP ACTION: Will delete the word "normal".

20. 4.3.1.1, page 35 - An explanation should be provided as to why fuel assembly hardware material is considered to be remote-handled transuranic waste.

BWIP REPLY: It was noted in this section of the subject document that the reference, DOE/ET-0028, (May 1979), provided the referenceable basis for the statement.

BWIP ACTION: None required.

21. 4.3.1.5, page 36 - Release-rate requirements for spent fuel should be derived and presented in a manner which parallels the corresponding section on CHLW. The basis for acceptance must be established based on compliance with EPA and NRC requirements. If the spent fuel does not comply in the form discharged from the reactor, then it would have to be altered significantly. Potential methods of altering the spent fuel include changing the burnup, reprocessing (to make glass or other waste form), encapsulating the fuel, or otherwise changing the reference waste package concept.

BWIP REPLY: Line 1 - Agreed.

Line 5 - Not necessarily, it may be possible to handle by additional design revision of waste package for spent fuel. Consideration of the need for methods of altering the spent fuel, as proposed, are judgements that will be dependent upon the future results of the testing, analysis and design efforts of the BWIP and cannot be adequately addressed at this early stage in the program.

BWIP ACTION: Line 1 - The text of this requirement will be changed and will contain the results of the same type of analysis as used to address this requirement for CHLW (4.2.1.5) and DHLW (4.4.1.5). Work is currently nearing completion on this analysis task.

22. 4.3.1.8.1, page 37 - It should be clear that the chemical data can be obtained by calculation, or at least non-destructive means, except in very rare cases. Frequent destructive analyses would be costly and create additional waste disposal problems.

BWIP REPLY: Agreed.

BWIP ACTION: The text will be modified to indicate such possibilities.

Note: It is likely that nearly all information requested in 4.3.1.8.1 can be provided by general fabrication, and irradiation history records of the spent fuel assemblies. The radionuclide inventory values can be provided by predictive means (e.g. the ORIGIN code) and nondestructive testing. Some destructive confirmation testing may be needed to confirm the estimated quality of the predictive methods and actual codes, especially in the beginning, in order to certify their acceptability for providing the information needed. Specific details of the types and extent of nondestructive and/or destructive testing that may be needed must await future evaluation and testing and analyses efforts by DOE, NWTS, etc. programs.

Note: If the reviewer meant to use the word "...clearer..." instead of "...clear..." in the comment, then our answer is that such detail is beyond the scope of this particular document.

23. 4.3.3.1.3, page 39 - A time period should be specified for which the shipper must maintain documentation; this should be a relatively short period following shipment.

BWIP REPLY: The time period that a waste/form producer/shipper must retain records will likely be established by guidance from DOE-HQ for all NWTS programs.

BWIP ACTION: We propose to change the requirement to state that the producer/shipper should retain such records for 10 years following waste/form shipment. After 10 years, the receiver (repository) should be notified and, at the receiver's discretion, the records either saved (e.g., sent to the receiver) or destroyed.

24. 4.4, pages 40-58 - Comments on CHLW generally apply to the corresponding sections on DHLW and should be addressed similarly.

BWIP_REPLY: The same applies to the dispositions.

BWIP_ACTION: Text will be appropriately changed in both CHLW and DHLW requirements sections.

25. 4.4.1.3.1, page 44 - Delete the second sentence referring to ceramic waste forms; the reference waste form is borosilicate glass.

BWIP_REPLY: Accepted.

BWIP_ACTION: Text will be changed accordingly.

26. 4.4.1.5, page 46 - In the case of CHLW, Pu-239 was evidently the controlling plutonium isotope with respect to the EPA limit, and the steady-state concentration required to meet the NRC limit was more restrictive than the EPA-related steady-state concentration limit. It is not clear why, therefore, that the total plutonium solubility with respect to meeting the EPA limit is all that is needed for DHLW.

BWIP_REPLY: For DHLW, the analysis could only be provided relative to the EPA limit because at the time we did not have predicted radionuclide inventory values for their DHLW at 1,000 year of age, which is what is needed to perform the exercise relative to the NRC 10 CFR 60 regulation. Such values were not available in the literature and had to be specially requested from SRL and were finally received in 3/84.

BWIP_ACTION: The results relative to the NRC limits and an updated revision of the results relative to the EPA limits will both be included in the document.

27. 4.2.2.2.5 [sic], page 52 - The cooling conditions for the DHLW fire test are more specific than for the CHLW fire test.

Correction: Reviewer comment concerns 4.4.2.2.6,
not 4.2.2.2.5.

BWIP_REPLY: Agreed.

BWIP_ACTION: This was an error in the CHLW section and will be corrected.

28. 5.4, page 60 - It is not clear why the waste form producer needs to maintain documentation for at least fifty years. Once the waste is emplaced, adequate records should be maintained by the repository. (The repository could keep duplicate record sets in two different locations as a precaution.)

BWIP_REPLY: The time period that a waste/form producer/shipper must retain records should be established by guidance from DOE-HQ for all NWTS programs.

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BWIP ACTION: We propose to change the requirement such that the producer/shipper should retain such records for 10 years following waste/form shipment. After 10 years, the receiver (repository) should be notified and, at the receiver's discretion, the records either saved (e.g., sent to the receiver) or destroyed.

29. 5.5.1, page 61 - If test procedures such as MCC-14-type procedures are contemplated, then these procedures should be described to the extent they are currently understood.

BWIP REPLY: The topics of the compliance tests have not been identified at this early stage in the process, with the exception of that for radionuclide release from the waste form (MCC 14.4 test method under initial development by PNL/MCC during FY-84).

BWIP ACTION: No changes needed at this time.

30. 7.1 Definitions

COMBUSTIBLE - This term was not readily apparent in the requirements, furthermore, it is not clear that this definition is appropriate for all "combustible" materials (e.g., sodium). Consequently, the definition should be deleted.

BWIP REPLY: The comment is noted. It was inserted in anticipation of the future sections on commercial transuranic wastes. It also relates to the 4.2.1.1.6 and 4.4.1.1.6 requirements. The 4.2.1.1.6 and 4.4.1.1.6 requirements adequately cover the case for materials such as sodium.

BWIP ACTION: No change needed at this time.

COMMERCIAL HIGH-LEVEL WASTE (CHLW) - This definition includes both CHLW and SF as used previously. The definition should distinguish between CHLW (glass) and SF.

BWIP REPLY: Suggestion is accepted.

BWIP ACTION: Commercial High Level Waste Process. Insert "...high-level..." between "...principally..." and "...waste..." Delete "...in power reactors..." through end of sentence. Replace with "...during the reprocessing of commercial spent fuel."

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CONTACT-HANDLED (CH) TRANSURANIC (TRU) WASTES - This term does not appear to be used in the document and could therefore be deleted.

BWIP_REPLY: Comment is noted and will be considered further. This was mentioned up front as a topic that would be included in later versions, following further DOE definition.

BWIP_ACTION: No changes needed at this time.

PACKING MATERIAL - Change the word "components" to "canister" because the packing material is a waste package component.

BWIP_REPLY: We prefer to replace the definition of packing material with a more appropriate one. The following definition will be used.

BWIP_ACTION: Packing - The part of the waste package that contributes to the performance of the total waste package by minimizing groundwater interaction with the container and waste form materials, limiting radionuclide transport, and/or altering groundwater chemistry to minimize waste form/canister/container degradation and radionuclide solubility.

RETRIEVABILITY - Insert the words "features and" after "engineering".

BWIP_REPLY: Accepted.

BWIP_ACTION: Text will be changed accordingly.

31. Al.1.1.7, page 75-76 - Items 1, 2, and 3 are all part of the same concern.

BWIP_REPLY: Agreed.

BWIP_ACTION: The item numbers will be dropped and the sentences combined into a paragraph.

32. Al.1.2.3.1, page 80 - The "recent guidance from DOE to the BWIP" should be referenced. Neither of the documents mentioned state a technical basis for specific limits on curies of fission products or actinides per liter; additional information in support of these limits should be provided.

BWIP_REPLY: The DOE guidance was not listed as a reference because it is not considered to be a referenceable document and was received as just a draft. The BWIP responded to the draft with comments to DOE-HQ via DOE-RL, but never received a final version.

BWIP_ACTION: No changes needed at this time.

33. Al.1.2.3.2, page 81 - The "activity limits" mentioned here should be explained further.

BWIP_REPLY: The activity levels were explained in 4.2.1.4.2, Specific Inventory (CHLW) and in 4.4.1.4.2 (DHLW) as resulting from the radionuclide inventory of any given reference case for these waste types and applying sequentially the two screening steps described.

BWIP_ACTION: Delete "...chosen for requiring..." after "...activity limits..." and insert "...that should be applied in providing the required...". Delete "...were..." after "...data..." and insert "...should be...".

34. Table A1, page 84 - The term "solubility" used in Table A1 refers to total chemical solubility; the same term in Table 4.1 appears to refer to chemical solubility times isotopic ratio.

BWIP_REPLY: True

BWIP_ACTION: None required.

35. Table A2, page 85 - References should be provided for all the physical parameters listed in the table (except R, x, and Co).

BWIP_REPLY: Agreed.

BWIP_ACTION: References provided.

36. A1.1.2.4, page 87 - Radionuclide release calculations should be completed for SF. If the SF cannot meet EPA and NRC criteria, it will have to be altered.

BWIP REPLY: Line 1 - Agreed.

Line 2 - If this comment refers to a situation that covers all practicable waste package design alternatives, then we agree with the comment.

BWIP ACTION: Line 1 - Results for the case of spent fuel will be included in the as-dispositioned document.

37. A1.1.2.6, page 88 - Although the defined value for k-effective is a suitable basis for criticality control, actual limiting concentrations or quantities of fissile material should be derived for the CHLW and DHLW forms. In the case of SF, the control should be a directly-controlled parameter such as number of fuel pins per waste package, etc.

BWIP REPLY: The comment is noted. Concentrations limits are not appropriate until reference design cases have been established.

BWIP ACTION: No changes needed at this time.

BWIP Reply to Weston Review Comments
and Proposed Dispositions
of SD-BWI-CR-018

Comments dispositioned by:

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WESTON SUMMARY

This document is described as the first stage in developing Waste Acceptance Specifications. It is not a Waste Acceptance Specification. In certain sections it presents specific values for parameters. In other sections it gives maximum dimensions or just lists the parameters for which values must be supplied.

Section 1 is the introduction and discusses the BWIP program status and the purpose of this document. It provides the technical information required for waste forms and containers. Section 2 discusses the document's scope and presents some basic definitions. Section 3 lists applicable documents and references.

Section 4 is the requirements section. It contains the specific waste form and container requirements for spent fuel, defense high-level waste and commercial high-level waste.

Section 5 of the document describes the Quality Assurance (QA) program that will be set up by the waste form producer. The sections on waste and canister certification have not been completed. BWIP states that the certification methods must wait for additional refinement of waste package and repository designs.

Section 6 briefly discusses preparation for shipping. Section 7 includes definitions and Section 8 presents the data submittal requirements. Appendix A presents the technical or regulatory basis for the requirements included in the remainder of the document.

BWIP REPLY: We agree with the summary comments.

BWIP ACTION: No changes needed.

WESTON COMMENTS

1. When repository conditions and chemistry are available, they should be added to this document. These data must be included in order to design and specify a waste form and its canister. Since this is the Waste

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Acceptance Requirements document, it seems appropriate to include this information.

BWIP REPLY: The repository conditions, as presently available, are already reflected in the limits specified for selected requirements (e.g., 4.2.1.5 Radionuclide Release).

BWIP ACTION: Such information, as available, will be included in future stages of documentation produced in the program to develop waste/form acceptance specifications. References already in the document, such as the waste package conceptual design description, contain most of the reference case values for the conditions of interest. Additional BWIP documents, such as the repository conceptual design descriptions, will be referenced in the subject document (SD-BWI-CR-018) as an interim solution to the problem.

2. BWIP is asking for a complete chemical and metallurgical description of the canister material (Section 4.2.2.8). All of this information can be included by reference to an ASTM material or product specification.

BWIP REPLY: It will not all be available from an ASTM material specification but much of the remaining information should be available from the producers own material acceptance specification.

BWIP ACTION: No changes needed at this time.

3. Pages 15 and 41, Section 4.2.1.1.2 and 4.4.1.1.2 demand total absence of any free liquid. That is very difficult to comply with and to prove compliance. Modify with phrasing as in 10 CFR 60, 60.135(b)(2).

BWIP REPLY: Agreed.

BWIP ACTION: The text will be changed to conform to the requirements on this topic in 10 CFR 60 (June 1983).

4. Pages 15 and 41, Sections 4.2.1.1.3 and 4.4.1.1.3 require total absence of any free gases "other than helium, argon, and air." Modify by adding, "...in an amount that could compromise the ability of the underground facility to contribute to waste isolation or the ability of the geologic repository to satisfy the performance objectives." This phrase is quoted from 10 CFR 60, 60.125(b)(1).

BWIP REPLY: Agreed.

BWIP ACTION: The text will be modified to conform to the requirement on this topic in 10 CFR 60 (June 1983).

5. Pages 16 and 42, Sections 4.2.1.1.6, 4.4.1.1.6, 4.2.1.1.7, and 4.4.1.1.7--we have the same comment as for 4.2.1.1.3.

BWIP REPLY: Agreed.

BWIP ACTION: The text will be modified to conform to the requirements on these topics in 10 CFR 60 (June 1983).

6. Pages 18 and 44, Sections 4.2.1.3.2 and 4.4.1.3.2 state, "The containerized reference waste form for CHLW shall not exceed a decay heat generation rate at the time of emplacement in the repository of (TBD) watts per" (add the underline).

BWIP REPLY: Agreed.

BWIP ACTION: Will change text accordingly.

7. Page 19, Section 4.2.1.4.1, add the underlined words, "...actinides per liter of a glass form at the time of casting of the glass waste form."

BWIP REPLY: Accepted.

BWIP ACTION: Will change text accordingly.

8. Page 22, Section 4.2.1.6.2, add the underlined word, "...chemical state of the waste and uniformity of character) properties over the..."

BWIP REPLY: Accepted.

BWIP ACTION: Text will be changed accordingly.

9. Pages 24 and 48, Sections 4.2.1.8.1 and 4.4.1.8.1, add the underlined words, "Analyses data to confirm that the following are not present in quantities in excess of those specified in 10 CFR 60, paragraph 60.125(b) in the loaded waste form..."

BWIP REPLY: Accepted.

BWIP ACTION: Text will be changed accordingly.

10. Page 28, Section 4.2.2.2.7, if the waste form container is breached, the escape of waste form material from the container shall not exceed the radiation dose limits specified in 10 CFR 20, paragraphs 203, 105, and 106.

BWIP REPLY: True. Accepted.

BWIP ACTION: No changes needed at this time.

11. In Section 5 (Quality Assurance Program), it is felt that it is acceptable as a "...first stage BWIP effort to develop site-specific waste acceptance specifications..." with the following comments:

5.2 Quality Assurance Program should in accordance with Appendix B, 10 CFR 50. ANSI/ASME NQA-1, latest revision may be used as a guide in establishing the QA program. The Quality Assurance program is subject to the approval of the receiver's QA organization or designated representative prior to the start of any activity.

BWIP REPLY: Agreed.

BWIP ACTION: No changes needed at this time.

5.4 Is 50 years too long, too short, or adequate? Is guidance provided elsewhere for length of time the records must be retained normally through the life of the repository, or until X years after waste has been received. Additional information could be provided to clarify when the documentation certification on waste acceptance along with all records pertaining to the requested/approved waste form disposal are to be forwarded to the repository for retention.

BWIP REPLY: Fifty years is probably too conservative. The time period that a waste/form producer/shipper must retain records will likely be established for all NWTS programs by guidance from DOE.

BWIP ACTION: We propose to change the requirement such that the producer/shipper should retain such records for 10 yr following waste/form shipment. After 10 yr the receiver (repository) should be notified and, at the receiver's discretion, the records are either saved (e.g., sent to the receiver) or destroyed.

It appears from Section 6 that this is done prior to obtaining approval from the receiver to initiate shipment.

BWIP REPLY: Section 6 does not say that nor imply it. Some form of written communications (to be determined) should be exchanged between the producer/shipper and the receiver prior to shipment. Further specification of the documentation and communication forms that will be needed are beyond the scope of this particular document (SD-BWI-CR-018).

BWIP ACTION: No changes needed at this time.

5.5.1, 5.5.2 Certification methods are awaiting additional refinement of waste package and repository design.

BWIP REPLY: No comment needed.

BWIP ACTION: None required.

14. On page 82, Appendix A, a one-dimensional transport model to relate waste form leach rates to nuclide release rates is discussed, but no results are presented. This should be discussed in greater detail and some results presented in later drafts of this document.

BWIP REPLY: First, the model does not deal with waste form leach rates. It is used to determine the upper limit of radionuclide steady-state concentration (labeled as solubility) that is allowed to occur at the packing material-waste form interface (canister and container barriers are assumed to be breached).

BWIP ACTION: The results for this analysis were presented in 4.2.1.5 for CHLW and 4.4.1.5 for DHLW and will be added to 4.3.1.5 in the revised document.

15. Paragraph 4.2.1.4.2 implies that the waste canisters will be retrievable for 50 years after the 100 year repository operating period. The present plan requires retrievability only during the operating period. Retrievability should be made a separate requirement applicable to all waste forms.

BWIP REPLY: Agreed.

BWIP ACTION: Text will be changed accordingly regarding time. Retrieval will not be covered as a separate requirement.

16. Add units for solubility to Table 4.1.

BWIP REPLY: It is already shown as molarity, i.e., moles/liter of solution.

ACTION: We will insert the wording "maximum steady-state concentration (molarity) M" in place of "...Solubility Limit (M) in Table 4.1."

WESTON RECOMMENDATIONS

There is much information that is listed as "to be determined." Weston understands that there is work in progress and that specifying the waste packages will require the interaction of many organizations. The BWIP project should add the repository conditions to this document. As the other information becomes available, it also should be added.

BWIP REPLY: Line 1—Very few requirements have associated TBD limits at this time. Limits were left as TBD only when there was not enough design, testing and/or performance assessment done yet for the BWIP to justify any quantitative value(s) at this time. However, all quantitative limits presented in the subject document should only be considered as preliminary at this stage of the BWIP.

Line 4—Most conditions that can be supported by testing and analysis work to date are noted in the justification section relative to each requirement.

BWIP Reply to Pacific Northwest Laboratory Review
Comments and the Proposed Dispositions
of SD-BWI-CR-018

Comments dispositioned by:

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PNL COMMENTS

1. p. 15 Specification 4.2.1.1.1 Waste Form Matrix

The wording appears to eliminate the use of metals in waste forms. I would drop the word "non-metallic" to allow the potential use of metal matrices, coatings, or cements. I also wondered about the use of metals such as lead for filler (4.2.2.2.5).

BWIP REPLY: In regard to the comment on "nonmetallic", we agree. With regard to lead, we have not evaluated it as a candidate material.

BWIP ACTION: The text will be changed to conform with the requirement on this topic in 10 CFR 60, Section 60.135.

The last sentence requires a report, "on the quantity of each element present..." If one considers trace quantities, all 96+ elements may be present. I would like to see the lower limit included, such as all elements >0.1 wt%.

BWIP REPLY: 4.2.1.1.1 only applies to the waste form matrix material. It should not have included mention of the waste constituents. Section 4.4.1.4.2 addresses data needs on radionuclide inventory.

Note: Waste + Waste Form Matrix = a waste/form system, and the document addresses them as subparts or as the whole system according to whichever approach is most applicable to the subject and context of the requirement.

BWIP ACTION: The sentence on supply data on radionuclide inventory of the waste stream will be deleted from this section.

2. p. 15 4.2.1.1.3 Gases

The requirement as written would appear to be easy to meet. Pressurization would most likely be the result from a fire and specification, 4.2.2.6 would seem more appropriate. I understand that 1 atm may be acceptable before the pressure vessel code gets involved. Therefore, I would suggest a higher number unless 7 psi can be shown to represent a real limit.

BWIP REPLY: If the reviewer cares to specify the "higher number" referred to, the BWIP will be happy to consider it. For now, however, we plan to leave the proposed limit as is.

BWIP ACTION: No changes needed at this time.

3. p. 16 4.2.1.1.5 Toxic Materials

I have not been able to locate a copy of 30 CFR 57 and, therefore, am not sure what toxic materials are covered in that regulation. I am concerned that some waste elements may be included (e.g., Cd, Te).

BWIP REPLY: The context of the requirement is considered to be sufficiently clear as presently worded. It is the waste/form producer's responsibility to characterize their waste/form product. The 4.2.1.1.5 requirement is directed primarily at the concern for safe handling and as a result supports the other requirements noted in 4.2.

BWIP ACTION: No changes needed at this time.

4. p. 17 4.2.1.2.1 Particle Sizes and Fractions

Since 10 CFR 20 deals with airborne concentration of radioactivity, I am not sure how this requirement should be interpreted. The specific subsections of interest should be specified. Not all particles in the waste form should be considered to be airborne. The fraction of particles in the canister which may become airborne need to be specified if 10 CFR 20 limits are to be applied. Also, the environment where the proposed release occurs must be considered since much higher release to a hot cell should be permitted than to a non-contained area in the repository. However, the canisters will be overpacked within the repository, and a double-canister breach would be necessary for a release. I would anticipate that the limit on the fraction of fine particles should be quite high.

BWIP REPLY: Line 3 - The suggestion is accepted.

Line 4 - True, and the particle sizes as defined are considered adequate for now.

Line 7 - The requirements applies to any handling environment. The BWIP handling facilities are presently designed for contact maintenance to be used for as long as is practicable.

Line 9 - The overpack option only covers situations up to receipt at the repository.

BWIP ACTION: Line 2 - Text will be changed to include the specific sections of applicable federal regulations.

Line 4 - No changes needed.

Line 7, 9 - No changes needed.

5. p. 20 4.2.1.5 Radionuclide Release - Also A1.1.2.5

The approach outlined by BWIP is quite different than the previously considered requirements. We do not have all of the data and evaluations needed to fully comment on this requirement. However, the following are preliminary comments:

BWIP REPLY: There isn't any applicable data yet. As noted in the Appendix A--it's an approach based on a recent BWIP analysis.

BWIP ACTION: None required.

- Solubility may not be strongly effected by the waste form composition or processing. Therefore, waste form design may not be successful in meeting the requirements.

BWIP REPLY: True.

BWIP ACTION: None required.

- The 150°C data generation requirement will be very difficult or impossible to meet on the potential frequency required by 4.2.1.6.1. The high temperatures would appear to be only important at the short -100 year-time frame. Since some actinides have retrograde solubility the values may not be conservative. Determination of solubilities at 90°C or less would reduce some

experimental difficulties and also be more appropriate for the anticipated conditions.

BWIP REPLY: The 150°C temperature was proposed so as to achieve at least some acceleration of the move toward steady-state concentration in the liquid solution. Tests will also be run at 90°C, but 90°C may present too low a temperature to achieve steady-state in an acceptable time (e.g., <3 months; or <6 months).

BWIP ACTION: No changes needed at this time.

- Review of the values in Table 4.1 indicates that most limits would likely be met with realistic solubility data except for Am²⁴¹. Current data indicates that Am²⁴¹ will exceed the limit by ~5x. Therefore, we would recommend that the EPA approach be directly applied (i.e., fractional sum = 1.0) rather than that imposing an extra order of magnitude conservatism for all isotopes.

BWIP REPLY: The analysis is currently being updated and the reviewer's comment will be considered.

BWIP ACTION: Changes will be made if needed.

- Spent fuel solubility and release rates should be directly addressed, even if they cannot be changed. They provide a perspective for the other waste form requirements and indicate a need for waste package development or modifications in regulations.

BWIP REPLY: We agree with the suggestion and the analysis effort is nearing completion.

BWIP ACTION: The text will be revised accordingly.

6. p. (22) 4.2.1.6.1 Chemical Homogeneity

The ±5 wt% limit can be interpreted as either relative or absolute. Relative is too tight, and absolute may be too loose. For example,

	<u>Potential</u> <u>Value</u>	<u>Relative</u> <u>Limits</u>	<u>Absolute</u> <u>Limits</u>
SiO ₂ -	45%	42.7 - 47.3 wt%	40-50 wt%
Na ₂ O	8%	7.6 - 8.4 wt%	3-13 wt%
CaO	1%	0.95 - 1.05 wt%	0- 6 wt%

Chemical analysis of a complex oxide is not generally accurate to the suggested limit. In an MCC Round Robin which included chemical analysis of a non-radioactive glass the standard deviation for components present at concentrations less than 10 wt% was 10-20% relative. Therefore a three-sigma level would be $\pm 30-60\%$ relative. Therefore, the requirement needs to allow for analytical variability in addition to process variations and should have large limits for minor components. I feel this requirement should be based on the maximum change in composition which can be tolerated without effecting the ability to meet other requirements. If a need can be shown I would require that the limits be waste form component specific. However, I think this requirement as written should be dropped.

BWIP REPLY: It was intended to mean a relative percentage, which is admittedly a very conservative limit for many constituents.

BWIP ACTION: We propose to delete the ± 5 wt% value and leave the limit as a (To Be Determined). The specific limit(s) for this requirement will not be established until the BWIP waste/barrier/rock testing program and the waste package performance analysis work have produced enough results to adequately evaluate and assess the limits needed for the requirement.

7. p. 22 4.2.1.6.2 Chemical and Physical Stability

The implication in the requirement is that the waste form is monolithic (i.e., uncracked). Ceramic materials including glass cannot be produced in the intended size and at reasonable process rates without cracks. Cracks will likely form with time and thermal decay, even if upmost care was used to produce the form. Solubility would appear to be unaffected by cracking as long as the cracks are tight and the waste form remains a single unit. I would drop the word "monolithic."

BWIP REPLY: Line 1 - The term monolithic was used to convey an indication of the general physical condition referred to, in contrast with other general conditions such as powders, granules, loose chunks, etc. The requirement regarding the physical condition of the waste form is in reflection of the criteria on waste package Section 60.135 of 10 CFR 60, i.e., that the waste form be a solid and any particulate waste forms shall be consolidated, such as into an encapsulating matrix.

Line 4 - The likelihood of cracking is recognized. The extent of cracking is considered to be a secondary variable, with respect to most relevant requirements, but still remains to be evaluated.

Last line - We agree with the suggested deletion.

BWIP ACTION: We will substitute "...solid and consolidated as per 10 CFR 60.135."

8. p. 23 4.2.1.8 Properties and Characteristics

I am assuming that this data is obtained on a typical container(s) only. It should not be required on each canister or each group of canisters. However, some data such as length and density may be desirable on all canisters. Such data should be separated from this section.

BWIP REPLY: Yes, this is the intent of the requirement as written. Frequency of measurement will be determined in part by the producer's own Quality Assurance program.

BWIP ACTION: A qualifying sentence will be added to make this intent clearer.

Test methods will need to be defined for each of these tests. The Materials Characterization Organization (MCO) may need to have a role in developing and approving the tests outlined. If so, work should begin very soon to accomplish this.

BWIP REPLY: MCO (?) Must mean the Materials Characterization Center (MCC). Work is underway (FY84) on MCC 14.4, Compliance Test on Radionuclide Release from the Waste/Form and also on a general survey of all NWTS Waste/Form Acceptance Requirements and Specifications documents.

I still object to the 150°C test temperature for hydrothermal tests, see comments on 4.2.1.5.

BWIP REPLY: The objection will be noted, but for now the initial BWIP proposal of 150°C will remain as the starting value for this parameter in the MCC 14.4 procedure and test development, which just began in FY-84.

9. p. 26 4.2.2.2.1 Weight

A maximum canister 410 cm in length and 61 cm in diameter would significantly exceed the allowed weight. Note the following:

Using 24" diameter schedule 40 pipe data from Perry's
 Volume of glass = $2.792 \text{ ft}^2 \times (12 \text{ in./ft} \times 2.54 \text{ cm/in.})^2$
 $\times 410 \text{ cm}$
 $= 1.06 \times 10^6 \text{ cm}^3$
 Weight of glass = 3.0 + 3200 kg
 Weight of canister - 171 lbs/ft $\times 410 \text{ cm}/12 \text{ in./ft} \times 2.54 \text{ cm/in.}$
 $= 2300 \text{ lbs}$
 $= 1040 \text{ kg} + \text{end fitting}$
 Total weight > 4240 kg
 With 10% for flexibility + 4660 - 4700 kg.
 or 10,000 lbs.

The value selected by Slate as a reference for CHLW was based on a 12" diameter canister. Recent studies by McKee have shown that a 16-17" diameter is more optimum for 10-year waste. Older wastes will have an optimum which exceeds 17" diameter. The longer length should also be considered in economic assignments. Until the assessments are completed, a maximum of flexibility should be maintained. If a crystalline ceramic were used rather than glass the waste form weight might increase 50% to 4800 kg, which would then have a canister weight of ~6000 kg. The use of metal filler (if required) would further increase the weight. The maximum weight should, therefore, be significantly increased to 5000-6000 kg.

The tolerance of $\pm 5\%$ in weight might be met in routine operation, but minor process upset could result in much larger variations. The $\pm 5\%$ seems too tight; $\pm 10\%$ would result in fewer canisters requiring off-standard treatment, but a simple maximum weight would appear sufficient.

BWIP_REPLY: Correct. The upper limits on dimensions and weight are and will remain mutually independent until a final reference design is established for each given waste/form type. We agree that only a maximum weight limit is needed.

The BWIP recognizes the potential for providing a shaft hoist and other needed handling systems that could accommodate the suggested payload of a high level waste/form plus canister. However, given the current conceptual designs for the BWIP, the proposed maximum weight limit can be increased to 7,000 lbs, with the added qualification that the BWIP intends to evaluate higher practicable weight limits (e.g., up to at least 20,000 lbs) during the conceptual design upgrade programs (FY-85).

BWIP_ACTION: The text will be changed to state only a maximum weight limit. A qualifying statement will be inserted in Section 4.2.2.2.1 to alert the readers to the situation noted above.

10. p. 26 4.2.2.2.2 and 4.2.2.2.3 Length and Diameter
 [Note comments under 4.2.2.2.1]

Tolerances should be as large as possible; we have been recommending ± 5 inches. What is the justification for a lower limit?

BWIP_REPLY: The ± 5 cm tolerance will not be changed for now, because to increase it would result in diameter values for the canister and container that would not be compatible as per current reference cases in the conceptual design. However, the reviewer's suggestion of using tolerances as large as possible is noted. And as per future BWIP waste package design efforts, consideration will be given to possibly increasing the length and diameter tolerance for the canister e.g. to ± 1 cm.

NOTE: Until notified to the contrary, the BWIP is assuming that the producers will use canister material (pipe) manufactured to standard schedules as per ASTM specifications.

BWIP_ACTION: Will consider making it ± 1 cm instead of the present ± 0.5 cm. The NOTE will be added to Section 4.2.2.2 and 4.4.2.2, and the Section 4.2.2.2.4 and 4.4.2.2.4 on ovality will be revised to include other dimensional tolerance topics as well.

11. p. 27 4.2.2.2.4 Ovality

Why should ovality be controlled tighter than diameter? It has been recommended that the specification be written such that a canister must fit within a idealized cylinder. This avoids a pile-up of tolerances in diameter and ovality and would appear to be functional.

BWIP_REPLY: Comments are noted.

BWIP_ACTION: Ovality section will be revised as noted earlier.

12. p. 27 4.2.2.2.5 Free Volume

Fillers would most likely be metallic. That metallics are acceptable in accordance with this requirement and 4.2.1.1 needs to be acknowledged in light of requirement 4.2.1.1.1.

BWIP_REPLY: Section 4.2.1.1.1 only referred to the waste form, and a filler is not part of the waste form. It is also not obvious why the filler would "...likely be a metallic."

BWIP ACTION: No changes needed at this time.

13. p. 27 4.2.2.2.6 and 4.2.2.2.7 Burst Strength and Drop Test

The definition of canister breach may be excessively tight. Industrial practice specifies that 10^{-4} cc gas/sec can be considered water tight and further, that particles can be considered to behave as water. Since the radioactivity is present as a solid or solid particles, the 10^{-4} cc/sec should be sufficient. The last sentence of 4.2.2.2.7 appears to conflict with the first sentence, i.e. either it's unbreached or breached.

BWIP REPLY: The comment is noted.

BWIP ACTION: The text will be changed to read at end of the footnote "...In addition, the radiation dose limits specified in 10 CFR 20, paragraphs 103, 105 and 106 must be met."

Line 5 - Because of the uncertainties that remain with respect to applying the (leak rate) requirement to a loaded canister, the 10^{-5} Atm-cc/sec limit will remain in effect for now.

14. p. 29 4.2.2.5.3 Radioactive Contamination

My copy of 49 CFR 173.397 (October, 1982) gives the limits as 220 dis/min/cm² for beta and gamma and 22 dis/min/cm² for alpha. Also, subparagraph (b) implies that exclusive use shipments which would be used with HLW canisters may exceed the above values by 10x. Therefore, limits of 2200 dis/min/cm² for beta and gamma and 220 dis/min/cm² for alpha would be acceptable.

BWIP REPLY: Line 5 - Correct, the regulation specifies limits of 2200 (β+γ) and 220 (α) dis/min/cm² for natural and depleted uranium and natural thorium and that is the proposal for the BWIP requirement.

BWIP ACTION: No changes needed at this time.

15. p. 29 4.2.2.7 Noncompliance Containers

I agree with the need and use of overpacks for special case wastes. However, I don't think that an overpack will provide increased protection in all cases and would recommend that their use be on an approved and agreed basis only and not be required for every deviation. This is particularly the case where the initial canister has adequate integrity.

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It should be noted that handling systems must be compatible with the larger overpack size and weight.

BWIP REPLY: Line 1 - The overpack is proposed as an optional component to correct some of those cases that are not in compliance with the requirements on the physical and chemical conditions of the waste/form filled container (now called canister by the BWIP). The requirement does not exclude, at this time, any workable alternatives to correcting the noncompliance.

Line 9 - If this applies to the overpack, then what is proposed is that the same procedure be used as for the canister.

BWIP ACTION: Line 1 - The text will be changed to clarify the intended purpose and limitations of the overpack (optional) component.

Line 9 - A NOTE: will be added to the text to highlight the need for future design consideration of this optional component.

16. p. 30 4.2.2.8 Properties and Characteristics

I am concerned about the cost and time required to generate the extensive list of data required. Before such data is obtained, a use and need for the data should be shown.

BWIP REPLY: Much of the requested information should be available from reference sources on the subject material and will only need to be supplemented by limited confirmation testing on the material. At least some of the test data will likely be available from satisfying the producer's own QA program requirements on the component material. Simulated conditions using non-radioactive components would probably be satisfactory for most of the work. The receiver must have available a thorough data base of materials behavior information for this component in order to be able to base predictive behavior and evaluate and address types of expected and unexpected performance events in operating the repository system.

The properties list can be shortened by the producer providing evidence that the information is not relevant. (See also Appendix, SD-BWI-CR-018).

Note: The requirement of testing for properties after exposure to conditions simulating the burst test may be a candidate for deletion. This is contingent upon the acceptance of an overpack as an optional component of the system and that any product exposed to such conditions would be overpacked as soon as possible. However, most of the requested information

would likely be available as part of the producer's demonstrating compliance with the burst test requirement 4.2.2.2.6.

BWIP ACTION: An additional qualifying statement will be added to make the intent and scope of the requirements clearer to the reader.

17. p. 33 4.2.2.9.3 Documentation

Since the wastes from different sources will likely be mixed in holding and interim storage containers, the exact origin of the waste may be lost. A need for the data should be shown before reprocessing and waste processing systems are designed at greater cost and reduced flexibility to provide the exact origin of the waste.

Also, once the data is provided to the repository the requirement that the processor maintain records should be limited to a few years at most.

BWIP REPLY: The exact origin of the waste was not requested. All that is needed is what is required to support the producer's characterization of their product material. Such information will support the receiver in judging the adequacy of the producer's characterization efforts and data and possibly to assist in handling unanticipated events.

BWIP ACTION: The text will be changed to make the purpose of the requirement more obvious.

The time period that a waste/form producer/shipper must retain records should be established by guidance from DOE-HQ for all NWTS programs.

BWIP ACTION: We propose to change the requirement such that the producer/shipper should retain such records for 10 years following waste/form shipment. After 10 years, the receiver (repository) should be notified and, at the receiver's discretion, the records either saved (e.g., sent to the receiver) or destroyed.

The BWIP Reply to the
Rockwell-Hanford/B Plant Immobilization Pilot Plant (BIPP) Project/
Pacific Northwest Laboratory (Subcontractor) Comments
on SD-BWI-CR-018

Comments dispositioned by:

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NOTE: This review comment/disposition package will be typed on the standard Rockwell Review Comment Record Forms for approval signature once the BWIP and Rockwell (BIPP) agree upon final wording of the dispositions.

ROCKWELL (BIPP)/PNL
GENERAL COMMENTS

1. The distinction between "canister", "container", and "overpack" is not clear throughout the document. These terms should be defined in the glossary and the text checked for consistency.

BWIP_REPLY: All waste package components are defined in the glossary, except for canister which was inadvertently omitted.

Note: The BWIP has recently revised the naming applied to waste package components in an effort to achieve a more logical terminology system and also more commonality with component nomenclature used by other NWTs programs, DOE, NRC and others. A copy of the new terminology for components in the BWIP waste package design is attached.

BWIP_ACTION: Will add the term "canister" to document glossary, and revise the waste package component definitions and usages in the document according to the recent BWIP changes.

2. Difficulties were encountered in evaluating the limitations referenced in 10 CFR 60, 49 CFR 173, 30 CFR 57, etc.

BWIP_REPLY: True. It is not appropriate to the document to quote extensive passages from the regulations. However, the relevant subsections should be noted.

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BWIP ACTION: Text will be changed to include relevant subsections, parts, etc. of the appropriate regulations.

3. Metric units are used as the primary stated measurement, but these result in odd metric measurements such as "2268 kg, and rounded English equivalents such as (5000 pounds)". Why not 2300 kg. or 2200 kg. and the equivalent pounds? Think metric.

BWIP REPLY: We agree with the suggestion, but the BWIP, DOE, etc. has defined most design limits in English units, and the metric units are merely the equivalent to these English units. See the references used to support usage of such values in SD-BWI-CR-018. For design related requirements, the preference is to use referenceable values from BWIP design, DOE documents, etc.

BWIP ACTION: The text will be revised to emphasize metric units.

**ROCKWELL (BIPP)/PNL
SPECIFIC COMMENTS**

4. 2.2.1 - Hanford high-level waste is not being considered for BWIP. This will eliminate B Plan Immobilization Pilot Plant canisters from consideration for terminal storage. Rockwell should not allow that to happen.

BWIP REPLY: True, Hanford high-level waste is not being considered in the subject document nor is it formally being considered by the BWIP, at this time. DOE has not provided guidance to the BWIP with regard to formally considering Hanford DHLW in the BWIP design, testing (e.g. reference waste/waste form materials) and performance assessment. To be accomplished, such tasks will require project resources (funding/manpower/facilities). Currently, only the Savannah River DWPF waste/form product is being considered in the BWIP program as per DOE-HQ approval, guidance and funding. Qualitatively, the DHLW requirements in Section 4.4 are applicable to the Hanford DHLW. Specifying associated limits for the acceptance requirements for a BIPP waste/form cannot be done until reference design case information is available and the task authorized by DOE.

BWIP ACTION: No changes needed at this time.

5. 4.2.1.1 Waste Form Matrix - Why nonmetallic solid material only? It appears to eliminate the use of metals in waste forms. Drop word nonmetallic.

BWIP_REPLY: Agreed.

BWIP_ACTION: The wording will be changed to conform to the requirements of 10 CFR 60 (June 1983 version).

6. 4.2.1.1.1 - The last sentence is not attainable. The analysis for each element in stored waste is not economically feasible. It would seem that heat load and formulation data would be more reasonable and achievable. Also, either specific elements of interest or lower limit of constituents should be established.

BWIP_REPLY: 4.2.1.1.1 only applies to the waste form matrix material. It should not have included mention of the waste constituents. Section 4.4.1.4.2 addresses data on radionuclide inventory.

Note: Waste + waste form matrix = a waste/form system and the document addresses them as subparts or as the whole system according to whichever approach is most applicable to the subject and context of the requirement.

BWIP_ACTION: The sentence on supplying data on radionuclide inventory of the waste stream will be deleted from this section.

7. 4.2.1.1.3 - This section would require canister closure under pressure below 1 atm. Section 4.2.2.2.6 seems more appropriate. Any justifications?

BWIP_REPLY: The review comment is not correct. A pressure of 7 psig means 7 psi above 1 atmosphere. The limit was chosen so as to avoid having the canister come under the specifications of the ASME Boiler and Pressure Vessel Code - Sections 3 and 8. Section 4.2.2.2.6 refers to a specific type of incident; namely involving fire and the requirement 4.2.1.1.3 only contributes to the situation.

BWIP_ACTION: No changes needed at this time.

8. 4.2.1.1.5 - These criteria should be self standing. Do the toxic materials in question include elements such as Cd, Te, etc?

BWIP REPLY: The context of the requirement is considered to be sufficiently clear as presently worded. It is the waste/form producer's responsibility to characterize their waste/form product and satisfy the 4.2.1.1.5 requirement, which is primarily directed at the concern for safe handling.

BWIP ACTION: No changes needed at this time.

9. 4.2.1.1.7 - BIPP cannot guarantee compliance with this requirement.

BWIP REPLY: The primary concern addressed by this requirement is to notify waste producers that organics are to be avoided and minimized in processing the waste "canister" up through filling with waste/form and through transport to the repository.

Note: The BWIP is open to comments from the RHO/BIPP program regarding the specifics of the problem(s) they envision.

BWIP ACTION: No changes needed at this time.

10. 4.2.1.2.1 - Since 10 CFR 20 deals with airborne concentration of radioactivity, it is not clear how this requirement should be interpreted. The specific subsections of interest should be specified. Not all particles in the waste form should be considered to be airborne. The fractions of particles in the canisters which may become airborne need to be specified, if 10 CFR 20 limits are to be applied. Also, the environment where the proposed release occurs must be considered, since much higher release to a hot cell should be permitted than to a non-contained area in the repository. One would anticipate that the limit on the fraction of fine particles should be quite high.

BWIP REPLY: Line 3 - The suggestion is accepted.

Line 4 - True, and the particle sizes as defined are considered adequate for now.

Line 7 - The requirements applies to any handling environment. The BWIP handling facilities are presently designed for contact maintenance to be used for as long as is practicable.

Line 9 - The overpack option only covers situations up to receipt at the repository.

BWIP ACTION: Line 3 - Text will be changed to include the specific sections of applicable federal regulations.

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Line 4 - No changes needed at this time.

Lines 7, 9 - No changes needed at this time.

11. 4.2.1.3.1 - The producer cannot guarantee a 500° maximum temperature in the waste form in the absence of specification of the temperature and heat transfer characteristics of the surrounding media. For example, a canister exposed to air at an air temperature of 100°F.

BWIP_REPLY: The requirement applies to the conditions from the time of manufacture of the sealed waste/form product up to acceptance at the repository but not thereafter.

BWIP_ACTION: A qualifying statement will be added to the text.

12. 4.2.1.3.2 - What decided 2.21 kw per canister? BIPP canisters will require substantial cooling time prior to shipment to meet this criteria.

BWIP_REPLY: The 2.21 kw/container is what is specified for the current reference waste package conceptual design (RHO-BW-CR-136P/AESD-TME-3142) and is keyed against temperature limits for packing, rock and waste form assumed in that work. The PNL-3838 (Slate, 1981) document provided the reference case values for CHLW, and lists a value of 2.2 kw/canister for waste that is 10 years old from time of reactor discharge. All NWTs reference cases for processed CHLW are keyed against a 10 year old waste as per DOE-HQ guidance.

BWIP_ACTION: No changes needed at this time.

13. 4.2.1.4 - Why inert material inventory? What is the benefit of knowing inert material.

BWIP_REPLY: Information on non-radioactive constituents of the waste/waste form is needed to ensure conformance with the data base and licensing obtained using approved test materials representing proposed waste/form systems scheduled for disposal.

BWIP_ACTION: No changes needed at this time.

14. 4.2.1.4.2 - The \pm range for radionuclide inventory will have to be wide to accommodate variations in the waste. Also, the key radionuclide list will need to be specified; measurement of "each" will not be possible. Discrete limits stated as "no more than ____Ci of all other radionuclides and daughters" might be attainable.

BWIP_REPLY: The comment is noted and will be taken into consideration when drafting the later (more specific) versions of the subject document.

BWIP_ACTION: No changes needed at this time.

15. 4.2.1.4.2 - Inventory of each radionuclide is economically and technically unattainable. If possible, give specific radionuclides only.

BWIP_REPLY: The reviewer is assuming that all values must be measured. The requirement includes the possibility of also using predicted values (e.g., ORIGEN, etc.). It is likely that there will only be a few "key" radionuclides of special concern need to be confirmed by actual measurements, and then only occasionally, provided the waste stream was not changed beyond the accepted limits for given radionuclides as per testing, analysis and licensing.

BWIP_ACTION: A qualifying statement will be added to the text.

16. 4.2.1.5

The approach outlined by BWIP is quite different than the previously considered requirements. We do not have all of the data and evaluations needed to fully comment on this requirement. However, the following are preliminary comments:

BWIP_REPLY: There are not any data yet. As noted in the Appendix A--it's an approach based on a recent BWIP analysis.

BWIP_ACTION: No changes needed at this time.

- Solubility may not be strongly effected by the waste form composition or processing. Therefore, waste form design may not be successful in meeting the requirements.

BWIP REPLY: True.

BWIP ACTION: None required.

- The 150°C data generation requirement will be very difficult or impossible to meet on the potential frequency required by 4.2.1.6.1. The high temperatures would appear to be only important at the short -100 year-time frame. Since some actinides have retrograde solubility the values may not be conservative. Determination of solubilities at 90°C or less would reduce some experimental difficulties and also be more appropriate for the anticipated conditions.

BWIP REPLY: The 150°C temperature was proposed so as to achieve at least some acceleration of the move toward steady-state concentration in the liquid solution. Tests will also be run at

90°C, but 90°C may present too low a temperature to achieve steady-state in an acceptable time (e.g., < 3 months; or < 6 months).

BWIP ACTION: No changes needed at this time.

- Review of the values in Table 4.1 indicates that most limits would likely be met with realistic solubility data except for Am²⁴¹. Current data indicates that Am²⁴¹ will exceed the limit by ~5x. Therefore, we would recommend that the EPA approach be directly applied (i.e., fractional sum = 1.0) rather than that imposing an extra order of magnitude conservatism for all isotopes.

BWIP REPLY: The analysis is currently being updated and the reviewer's comment will be considered.

BWIP ACTION: Changes will be made if needed.

- Spent fuel solubility and release rates should be directly addressed, even if they cannot be changed. They provide a perspective for the other waste form requirements and indicate a need for waste package development or modifications in regulations.

BWIP REPLY: We agree with the suggestion and the analysis effort is nearing completion.

BWIP ACTION: The text will be revised accordingly.

17. 4.2.1.6.1 - This requirement should be based on the maximum change in composition which can be tolerated. If a need for a specific limitation on composition range for a given component can be shown, the limit should be waste form component specific.

In addition to there being no performance justification given for this requirement, the ± 5 wt% limit can be interpreted as either relative or absolute. For example:

	Potential Value	Relative Limits	Absolute Limits
SiO ₂ -	45%	42.7 - 47.3 wt%	40-50 wt%
Na ₂ O	8%	7.6 - 8.4 wt%	3-13 wt%
CaO	1%	0.95 - 1.05 wt%	0- 6 wt%

Chemical analysis of a complex oxide is not generally accurate to the suggested limit. In an MCC Round Robin which included chemical analysis of a non-radioactive glass the standard deviation for components present at concentrations less than 10 wt% was 10-20% relative. Therefore a three-sigma level would be ± 30 -60% relative. Ultimate criteria must allow for analytical variability in addition to process variations and should have large limits for minor components.

The requirement as written should be dropped.

BWIP REPLY: It was intended to mean a relative percentage, which is admittedly a very conservative limit for many constituents.

BWIP ACTION: We propose to delete the ± 5 wt% value and leave the limit as a (To Be Determined). The specific limit(s) for this requirement will not be established until the BWIP waste/barrier/rock testing program and the waste package performance analysis work have produced enough results to adequately evaluate and assess the limits needed for the requirement.

18. 4.2.1.6.2 - The implication in the requirement is that the waste form is monolithic (i.e., uncracked). Ceramic materials including glass cannot be produced in the intended size and at reasonable process rates without cracks. Cracks will likely form with time and thermal decay, even if upmost care was used to produce the form.

Solubility would appear to be unaffected by cracking as long as the cracks are tight and the waste form remains a single unit.

BWIP REPLY: Line 1--The term monolithic was used to convey an indication of the general physical condition referred to, in contrast with other general conditions such as powders, granules, loose chunks, etc. The requirement regarding the physical condition of the waste form is in reflection of the criteria on waste package Section 60.135 of 10 CFR 60, i.e., that the waste form be a solid and any particulate waste forms shall be consolidated, such as into an encapsulating matrix.

Line 4--The likelihood of cracking is recognized. The extent of cracking is considered to be a secondary variable with respect to most relevant requirements, and probably a minor one, but still remains to be evaluated.

Last line - We agree with the suggestion.

BWIP ACTION: We will substitute "...solid and consolidated as per 10 CFR 60.135."

19. 4.2.1.8 - Wording of this requirement should make it clear that this data should be obtained to qualify the process and the typical waste container. Obtaining such data for each individual canister would neither be feasible or possible within conceivable funding limitations. Data such as length and weight may be desirable for the individual canister, but such possible individual requirements should be separated from this section.

BWIP REPLY: Yes, this is the intent of the requirement as written. Frequency of measurement will be determined in part by the producer's own Quality Assurance program.

BWIP ACTION: A qualifying sentence will be added to make this intent clearer.

Test methods will need to be defined for each of these tests. Will the repository sites reach agreement on those test methods through the Materials Characterization organization? Work would need to be initiated immediately.

BWIP REPLY: MCC (?) Must mean the Materials Characterization Center (MCC). Work is underway (FY84) on MCC 14.4, Compliance Test on Radionuclide Release from the Waste/Form and also on a general survey of all NWTS Waste/Form Acceptance Requirements and Specifications documents.

BWIP ACTION: Text will be updated to indicate that the test method and procedures development work has begun.

20. 4.2.2.2.1 - A maximum canister 410 cm in length and 61 cm in diameter would significantly exceed the allowed weight. Note the following:

Using 24" diameter schedule 40 pipe data from Perry's
 Volume of glass = $2.792 \text{ ft}^2 \times (12 \text{ in./ft} \times 2.54 \text{ cm/in.})^2$
 $\times 410 \text{ cm}$
 $= 1.06 \times 10^6 \text{ cm}^3$
 Weight of glass = $3.0 + 3200 \text{ kg}$
 Weight of canister = $171 \text{ lbs/ft} \times 410 \text{ cm}/12 \text{ in./ft} \times 2.54 \text{ cm/in.}$
 $= 2300 \text{ lbs}$
 $= 1040 \text{ kg} + \text{end fitting}$
 Total weight > 4240 kg
 With 10% for flexibility + $4660 - 4700 \text{ kg.}$
 or 10,000 lbs.

The value selected by State as a reference for CHLW was based on a 12" diameter canister. Recent studies by McKee have shown that a 16-17" diameter is more optimum for 10-year waste. Older wastes will have an optimum which exceeds 17" diameter. The longer length should also be considered in economic assignments. Until the assessments are completed, a maximum of flexibility should be maintained. If a crystalline ceramic were used rather than glass, the waste form weight might increase 50% to 4800 kg, which would then have a canister weight of ~6000 kg. The maximum weight should, therefore, be significantly increased to 5000-6000 kg.

The tolerance of $\pm 5\%$ in weight might be met in routine operation, but minor process upset could result in much larger variations. The $\pm 5\%$ seems too tight; $\pm 10\%$ would result in fewer canisters requiring off-standard treatment, but a simple maximum weight would appear sufficient.

BWIP_REPLY: Correct. The upper limits on dimensions and weight are and will remain mutually independent until a final reference design is established for each given waste/form type. We agree that only a maximum weight limit is needed.

The BWIP recognizes the potential for providing a shaft hoist and other needed handling systems that could accommodate the suggested payload of a high level waste/form plus canister. However, given the current conceptual designs for the BWIP the proposed maximum weight limit can be increased to 7,000 lbs, with the added qualification that the BWIP intends to evaluate higher practicable weight limits, (e.g., up to at least 20,000 lbs) during the conceptual design upgrade programs (FY-85).

BWIP_ACTION: The text will be changed to state only a maximum weight limit. A qualifying statement will be inserted in Section 4.2.2.2.1 to alert the readers to the situation noted in the above REPLY.

21. 4.2.2.2.2 and 4.2.2.2.3 - Tolerances should be as large as possible. ± 0.5 inches has previously been recommended. What is the justification for a lower limit?

BWIP_REPLY: The ± 5 cm tolerance will not be changed for now, because to increase it would result in diameter values for the canister and container that would not be compatible. However, the reviewer's suggestion of using tolerances as large as possible is noted. And as per future BWIP waste package design efforts, consideration will be given to possibly increasing the length and diameter tolerance for the canister to e.g. ± 1 cm.

NOTE: Until notified to the contrary, the BWIP is assuming that producers will use canister material (pipe) manufactured to standard schedules as per ASTM specifications.

BWIP_ACTION: Will consider making it ± 1 cm instead of the present ± 0.5 cm. The Note will be added to Section 4.2.2.2 and 4.4.2.2 and the Sections 4.2.2.2.4 and 4.4.2.2.4 on ovality will be revised to include other dimensional tolerance topics as well.

22. 4.2.2.2.4 - Why should ovality be controlled tighter than diameter? It has been recommended that the specifications be written such that a canister must fit within an idealized cylinder. This avoids a pile-up of tolerances in diameter and ovality and would appear to be functional.

BWIP_REPLY: Comments are noted.

BWIP_ACTION: Ovality section will be revised as noted earlier.

23. 4.2.2.2.5 - Free volume limitation must either be practicle within the limitations of good process practice, or the additional material and operating costs of adding filler must be justified by identifying the need for this limitation. Any filler material added would probably be metallic, and would require modification of 4.2.1.1.1.

BWIP_REPLY: Line 1 - The requirement as written just says the free volume should be minimized and to less than a To Be Determined volume percentage. Appendix A provides justification for this requirement. 4.2.1.1.1 only referred to the waste form, and a filler is not part of the waste form. It is not obvious why the filler would "...likely be a metallic."

BWIP_ACTION: No changes needed at this time.

24. 4.2.2.2.6 and 4.2.2.2.7 - The definition of canister breach may be excessively tight. The ANSI-N14.5 reference specifies that 10^{-4} cc gas/sec can be considered water tight and further, that particles can be considered to behave as water. Since the radioactivity is present as a solid or solid particles, the 10^{-4} cc/sec should be sufficient. The last

sentence of 4.2.2.7 appears to conflict with the first sentence, i.e., either it's unbreached or breached.

BWIP_REPLY: The comment is noted.

BWIP_ACTION: The text will be changed to read at end of the footnote "...In addition, the radiation dose limits specified in 10 CFR 20, paragraphs 103, 105 and 106 must be met."

Line 5 - Because of the uncertainties that remain with respect to applying the (leak rate) requirement to a loaded canister, the 10^{-5} Atm -cc/sec limit will remain in effect for now.

25. 4.2.2.5.3 - 49 CFR 173.397 (October, 1982) gives the limits as 220 dis/min/cm² for beta and gamma and 22 dis/min/cm² for alpha. Also, subparagraph (b) implies that exclusive use shipments which would be used with HLW canisters may exceed the above values by 10x. Therefore, limits of 2200 dis/min/cm² for beta and gamma and 220 dis/min/cm² for alpha would be acceptable.

This requirement should be reconsidered.

BWIP_REPLY: Line 5 - Correct. The regulation does specify 2200 (β+γ) and 220 (α) dis/min/cm² for natural and depleted uranium and natural thorium, and that is the proposal for the BWIP requirement.

BWIP_ACTION: No changes needed at this time.

26. 4.2.2.7 - (a) The need and use of overpacks for special case wastes is acknowledged; however, it is not apparent that an overpack will provide increased protection in all cases. It is recommended that their use be on an approved and agreed basis only and not be required for every deviation. This is particularly the case where the initial canister has adequate integrity.

(b) No reason is given for the requirement that "the overpack shall be made of the same type of material as the waste form container." Are other repository sites in agreement?

(c) It should be noted that handling systems must be compatible with the larger overpack size and weight.

(d) What are the dimensional limits on the overpack? On the canister?

BWIP REPLY: (a) The purpose of the proposed overpack (component) is to provide a means to correct a noncompliance with the waste/form acceptance specifications for those situations that are judged to be correctible by use of the overpack. Thus, the overpack would not necessarily apply to all situations of noncompliance and would only be used when authorized by the receiver. The proposed requirement, at this time, does not exclude any workable alternatives to correcting the noncompliance.

(b) Given that the canister (formerly called the container by BWIP in the subject document) is a component material acceptable to the producer and receiver, it makes sense to construct the overpack from the same type of material. This would reduce the need to evaluate and judge the acceptability of a new material introduced into the respective producer, shopper, and receiver systems.

(c) It is not a function of a waste/form acceptance specification to be specifying features of support systems (e.g., handling). The acceptance requirement (specification) on weight adequately address such concerns.

(d) The dimensional limits on the proposed overpack (optional) component are To Be Determined and dependent upon consideration of this component in the upgrading of the Conceptual Design. Currently, the conceptual design of the reference container (formerly called the canister) is specified in RHO-BW-CR-136P/AESD-TME-3142 (1982).

BWIP ACTION: a) The text will be changed to clarify the intended purpose and limitations of the overpack (optional) component.

d) A **NOTE** will be added to the text to highlight the need for future design considerations of this optional component.

27. **4.2.2.8** - (a) Generating the extensive list of data required will be costly and time consuming. Before such data are obtained, the use to be made of the data and the specific need for th data should be shown.

(b) In addition, under 4.2.2.8.1, bullet three, the corrosion data requirement cannot be interpreted. Is the requirement for flow or static tests, general corrosion, slow strain rate, fatigue-crack-growth rate, or?

BWIP REPLY: (a) Much of the requested information should be available from reference sources on the subject material and will only need to be supplemented by limited confirmation testing on the material. At least some of the test data will likely be available from satisfying the producer's own QA program requirements on the component material. Simulated conditions using non-radioactive components would probably be satisfactory for most of the work. The receiver must have available a thorough data base of materials behavior information for this component in order to be able to base predictive behavior and evaluate and address types of expected and unexpected performance events in operating the repository system.

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The properties list can be shortened by the producer providing evidence that the information is not relevant. (See also Appendix, SD-BWI-CR-018).

Note: The requirement of testing for properties after exposure to conditions simulating the burst test may be a candidate for deletion. This is contingent upon the acceptance of an overpack as an optional component of the system and that any product exposed to such conditions would be overpacked as soon as possible. However, most of the requested information would likely be available as part of the producer's demonstrating compliance with the burst test requirement 4.2.2.2.6.

(b) It is relevant to any behavior that could occur within the projected time frame and conditions up to acceptance by the repository.

BWIP ACTION: An additional qualifying statement will be added to make the intent and scope of the requirement clearer to the reader.

28. 4.2.2.9.3 - Since the waste from different sources will probably be mixed in different holding and interim storage containers, the exact origin of the waste may be lost. A need for the data should be shown before reprocessing and waste handling systems are redesigned at much greater cost and reduced flexibility.

BWIP REPLY: The exact origin of the waste was not requested. All that is needed is what is required to support the producer's characterization of their product material. Such information will support the receiver in judging the adequacy of the producer's characterization efforts and data and possibly to assist in handling unanticipated events.

BWIP ACTION: The text will be changed to make the purpose of the requirements more obvious.

Once such data as is required is provided to the repository, the requirement that the producer maintain records should be limited to a few years at most.

BWIP REPLY: The time period that a waste/form producer/shipper must retain records should be established by guidance from DOE-HQ for all NWTs programs.

BWIP ACTION: We propose to change the requirement such that the producer/shipper should retain such records for 10 years following waste/form shipment. After 10 years, the receiver (repository) should be

notified and, at the receiver's discretion, the records either saved (e.g., sent to the receiver) or destroyed.

29. 4.3.1.5 - This statement is difficult to understand. It would appear that the criteria should hold for all systems. Does this imply that spent fuel will not meet the criteria?

BWIP_REPLY: Line 1 - Agreed.

BWIP_ACTION: The text of this requirement will be changed and will contain the results of the same type of analysis as used to address this requirement for CHLW (4.2.1.5) and DHLW (4.4.1.5). Work is currently nearing completion on this analysis task.

30. 4.4 - The comments for comparable sections under CHLW apply to all DHLW sections.

BWIP_REPLY: The same applies to the dispositions.

BWIP_ACTION: None required.

31. 4.4.1.1.3 - Second sentence: The term "no more than 7 psig atmosphere" is stilted. Reword the sentence.

BWIP_REPLY: Accepted.

BWIP_ACTION: We will reword text so that it is the same as what is provided in Section 4.2.1.1.3 (CHLW).

32. 4.4.1.5 - This section states that the waste form for DHLW "shall limit plutonium solubility." Waste forms do not control solubility -- specific solid phases in a specific aqueous environment determines the solubility. The waste form can control the release kinetics of groups of elements and thus contribute to the rate of attainment of a solubility limit but it does not control that limit.

In considering the complexity of the waste package, i.e., other components interacting together, the presence of a radiation environment that can radically change the Eh in the aqueous contact fluid, and the creation and dissolution of different alteration products, the statement as it appears become irrelevant. This point should be clarified.

BWIP_REPLY: The BWIP agrees with the reviewer's statement, and the BWIP testing program reflects a recognition of this fact. The problem in the text for 4.4.1.5 is that the word solubility was used without noting, by a footnote, that the authors were applying a restrictive definition to the word. See Table 4.1, page 21 in CHLW section (4.2). To avoid such understandable confusion, we propose to substitute the term "...steady-state concentration..." for the word "...solubility..." in all appropriate places in Section 4.4.1.5, 4.2.1.5 and in A1.1.2.4. The limiting values for steady-state concentration refer to the maximum respective value for each radionuclide concerned, and the text will also be changed to reflect this intended condition. The analysis for radionuclide release relative to 40 CFR 191 (EPA) is being redone to correct errors in inventory values used in the FY-83 analysis and to use the latest draft of 40 CFR 191 2/1/84 which enables a more straight forward consideration of a DHLW case. The analysis results relative to 10 CFR 60 (NRC) will also be included.

BWIP_ACTION: The text will be revised accordingly.

33. 4.4.1.6.1 - The stated "±5 percent" tolerances are too tight for chemical content control of a waste.

BWIP_REPLY: The comment is note and we recognize that this would have been a very conservative limit for many constituents.

BWIP_ACTION: We will substitute "...solid and consolidated as per 10 CFR 60.135."

34. 5.0 - The section does not yet provide sufficient information to permit meaningful comment.

BWIP_REPLY: The section was included only for completeness of listing and briefly describing all major topics that must ultimately be covered in the specifications version of the document.

BWIP_ACTION: No changes need at this time.

35. A1.2.1.1 - Second set of numbered items, item no. 1: Here "canister" and "container" are confusing terms. Are they the same? See general comment.

BWIP_REPLY: The BWIP has recently corrected the situation by renaming components of the current reference waste package so as to be both more logical in the matching a name to a component and its function in the

waste package and to attain more commonality with the current choices of waste package component names used within the DOE and NWTS programs.

BWIP ACTION: Text will be revised accordingly.

36. A1.2.1.1 - There are two sets of numbered items in this section which is confusing.

BWIP REPLY: Agreed.

BWIP ACTION: The second set will be relabelled as a. and b.

37. A1.2.2.5 - The specs on free volume may not be attainable due to outage or voids created in the pour cycle of glass.

BWIP REPLY: A "spec" was not given for the maximum allowable free volume (see 4.2.2.2.5 and 4.4.2.2.5) and was listed only as a (To Be Determined).

BWIP ACTION: No changes needed at this time.

38. A1.1.2.6 - The 3 gamma limit should be spelled out as "standard deviation" since it is inserted here as an isolated statistical value and catches the reader off guard.

BWIP REPLY: Agreed.

BWIP ACTION: Insert "...a standard deviation of..." after "effective".

The BWIP Reply to the First Savannah River Laboratory
Review of SD-BWI-CR-018



EDWARD H. RANDKLEV

OCT 01 1983

Rockwell Hanford Operations
Energy Systems Group
P.O. Box 800
Richland, WA 99352

Rockwell
International

October 7, 1983

In reply, refer to letter R83-3792

M. J. Plodinec
Technical Division
Savannah River Laboratory
E.I. du Pont du Nemours & Company
Aiken, South Carolina 29808

Dear Mr. Plodinec:

COMMENTS ON DPST-83-789, "TECHNICAL EVALUATION OF WASTE FORM ACCEPTANCE CRITERIA FOR THE BASALT WASTE ISOLATION PROJECT"

I recently received a copy of your memorandum (DPST-83-789), via the DOE-Richland office. I have had members of my staff review it and prepare a review record (Attachment I) to aid in the process of resolving, to our mutual satisfaction, Savannah River Laboratory (SRL) points of concern (DPST-83-789) regarding the (draft) Waste Acceptance Requirements for DHLW recently proposed by the BWIP (SD-BWI-CR-018). The review comment record in Attachment I is not the final BWIP disposition of the SRL review comments (DPST-83-789) on the draft of SD-BWI-CR-018. Final disposition, by the BWIP, of reviewer comments on SD-BWI-CR-018 will occur following receipt of review comments from all the principal reviewer organizations, evaluation by the BWIP of all such comments and, if needed, followup discussions between the BWIP and specific reviewers.

Your memorandum (DPST-83-789) seems to imply that the SRL has not completed its review of the SD-BWI-CR-018 document. If the SRL intends to provide DOE and the BWIP with additional review comments, the BWIP would appreciate notification, as soon as possible, and receipt of such comments by October 28, 1983.

Thank you for your review comments. If you or your staff have any questions or replies regarding our comments on your memorandum (DPST-83-789), please call me (373-3535) or Dr. E. H. Randklev (373-2843) of my staff.

Very truly yours,

M. J. Smith, Manager
Engineered Barriers Department

MJS/EHR/kit

Att.

OUTGOING LTR. NO.			
R83-3792			
INCOMING LTR. NO.			
ACTION			
REPLY DUE			
DIST:	TR	INCL	APPR
Abb, E.B.			
Burthelmeier, D.C.			
Bullifanta, M.			
Carry, J.M.			
Coakern, D.J.			
Crawford, A.C.			
Deist, R.A.			
Deitchman, J.L.			
Dombos, J.W.			
Gimera, R.J.			
Gruba, R.S.			
Hammond, R.D.			
Heineman, R.E.			
Kiezer, J.E.			
Knight, B.E.			
Larson, M.P.			
Lorenzini, P.G.			
McDermott, R.J.			
Digston, L.R.			
Paceo, K.J.			
Patterson, J.W.			
Perkins, J.D.			
Rochter, J.H.			
Selina, C.M.			
Show, H.P.			
Wool, V.R.			
Zahn, L.L.			
Contract Administrator			
Control File	X	X	
M.J. Aple	X	X	
E.H. Randklev	X	X	
L.P. Fitch	X	X	
P.F. Selter	X	X	
T.B. McCall	X	X	
G.S. Bernou	X	X	
E.L. Moore	X	X	
J. Higgins	X	X	
Rec. Elm	X	X	
H.T. Sisk	X	X	
R.L. Howard	X	X	
DATE			



Rockwell International
Rockwell Hanford Operations
Energy Systems Group

REVIEW COMMENT RECORD (RCR)

1. Date 9/21/83	2. Review No. 1
3. Project No.	4. Page 1 of _____

5. Document Number(s)/Title(s) DPST-83-789 Memorandum Technical Evaluation of Waste Form Acceptance Criteria For the Basalt Waste Isolation Project	6. Program/Project/Building Number RIIO/BWIP/MO-407/200 East	7. Reviewer E.H. Randklev M.J. Apted	8. Organization/Group Engineered Barriers Dept.	9. Location/Phone 373-2853
	10. Agreement with indicated comment disposition(s) _____ Date _____ Reviewer _____ Project/Cognizant Engineer	11. CLOSED _____ Date _____ Reviewer _____ Project/Cognizant Engineer		

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	14. Hour Point	15. Disposition (provide justification if NOT accepted).	16. Status
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NOTE: This RCR does NOT represent a final dispositioning of the SRL review comments (DPST-83-789) on the draft BWIP document (SD-BWI-CR-018). Final dispositioning of the comments will occur following BWIP receipt and review of all DOE and RIIO requested reviews.

GENERAL COMMENTS

- The BWIP subject document (SD-BWI-CR-018) is referred to as a criteria document on waste acceptance. It is not. It is a requirements document, written in a format similar to a specifications document and is the first stage, beyond the NWT-33(4a), criteria document, toward developing a Waste Acceptance Specifications document for the BWIP. The review draft of SD-BWI-CR-018 only presents numerical values associated with the proposed requirements; a) as a means of relating the document to the current status (as per cleared documents only) of relevant portions of the BWIP design programs and b) in cases where a proposed value(s), could be justified, and thus enable the process of review and discussion to begin concerning the transition of such requirements into specifications. The current BWIP schedule identifies revising and releasing the SD-BWI-CR-018 document, then producing an upgraded requirements document, if needed, and then a preliminary specifications document before producing a Final Waste Acceptance Specifications document for the BWIP. The schedule for this sequence is

REVIEW COMMENT RECORD (RCR) CONTINUATION

Item	Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status
	<p><u>GENERAL COMMENTS CON'T</u></p> <p>is being integrated with the schedules for BWIP design and testing programs and the draft schedules are current under review.</p> <ol style="list-style-type: none"> The subject SRL document appears to represent a limited (scope) review of the SD-BWI-CR-018/BWIP document, which implies a possible SRL misinterpretation of the function of the SD-BWI-CR-018 document. If SRL intends to provide additional review comments on the draft of SD-BWI-CR-018, the BWIP would appreciate receiving such review comments, as soon as possible. To the extent that it is defensible and practicable, as per the BWIP needs for performance assessment, testing, design and licensing plans, it is to be expected that the testing required to demonstrate general and specific compliance with the proposed requirements and later specifications, will be done on cold or low level doped simulants of the waste form materials. Some testing will, however, have to be done with fully loaded waste form material in order to confirm such compliance. SRL should notify the NHTS sites, as soon as possible, as to what types of information on radionuclide inventory, activity, etc. and the units that the information can be expressed in without compromising national security. This situation needs to be evaluated and resolved well in advance of a repository program entering into its primary testing, design and repository system performance assessment needed for a licensable repository, if it is to include any DILLW. <p><u>SPECIFIC COMMENTS</u></p> <p>Page/Paragraph/Line</p> <p>1/1/3 - Review comments from Hanford defense waste related programs, the Transportation Technology Center (Sandia), and DOE-Headquarters will also be involved in completing the</p>			

REVIEW COMMENT RECORD (RCR) CONTINUATION

Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status
	<p><u>SPECIFIC COMMENTS CON'T</u></p> <p>Page/Paragraph/Line</p> <p>subject <u>Requirements</u> document (SD-BWI-CR-018). The role of Reference 1 in revising (SD-BWI-CR-018) is yet to be determined.</p> <p>2 1/2/1 - What is the "profoundly different viewpoint" that SRL believes exists between Reference 2 and SD-BWI-CR-018?</p> <p>3 1/2/- (Bullit statements) To some extent each of these activities are likely to be required by an NWRB program, except for the matter of defense nuclear materials production, which is a matter that needs to be evaluated further by DOE, BWIP, SRL, etc..</p> <p>4 2/1/1 - The requirements reflect Federal regulatory guidelines and needs of a repository program to support application and conformance with a license (NRC) to operate.</p> <p>5 2/3 - See GENERAL COMMENTS Item 3.</p> <p>6 2/4/- Testing needed for requirements on chemical homogeneity (4.4.1.8.1) and radionuclide release (4.4.1.5) are still to be decided and will not be finalized for several years, which should allow ample opportunity for SRL, et. al. concerns to be evaluated.</p> <p>7 2/4/3 - Chemical homogeneity of the waste, in an as-filled container, will have to be determined and verified to be within limits acceptable to support the data base used to comply with the radionuclide release requirement (4.4.1.5) and others. The extent and frequency of such testing is yet to be decided and is certainly open for discussion. The matter of how waste form samples are obtained to support compliance testing for requirements such as 4.4.1.5, etc. is open for discussion and the proposal made in SD-BWI-CR-018 represents a conservative starting position.</p>			

Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status
8	2/4/9 - The concern is for gross chemical inhomogeneities resulting from waste form and/or container filling operations. Devitrification, if relevant on this scale, can indeed be at least partially addressed by nonradioactive testing.			
9	2/5/1 - Some testing of radioactively doped (including fully doped) waste form material will be required by the producer in order satisfy Quality Assurance provisions of the Final Waste Acceptance Specifications and the overall requirement to demonstrate conformance within the limits set by the approved license (NRC) for operating the repository. It would be advisable for SRL to share with the NHTS repository programs, in the near future, the status of the testing facilities plans for the DWFP. Testing of radioactively doped (including fully doped) will certainly be required to obtain the data required to support design and performance assessment requirements for licensing, and the extent to which SRL expects to be involved will need to be decided.			
10	3/2/- See GENERAL COMMENTS - Item 4			
11	3/4/- Comments on this paragraph areas follows: a) SLR needs to keep in mind that the compliance test(s) for the specification on radionuclide release will <u>not</u> be providing the primary data base on the waste/barrier materials/rock interactions testing that will be used to demonstrate that a proposed (hypothetical) class of waste and waste form combinations would be compatible with the general repository systems requirements to support the license proposal. Rather the compliance test applies to the need for confirming that specific compositions and production examples of such material perform within the limits set by the data base supporting license approval. b) The specifics of a compliance test for the radionuclide release requirement (4.4.1.5) are just entering the development stage and details presented in SD-BWI-CR-018 are just an initial proposal for initiating this effort.			

Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status
11	<p>c) 150°C does relate to maximum temperatures expected of an early waste package breach scenario.</p> <p>d) Elevated testing temperatures (e.g. 150°C) are required to assess formation of alteration products, which dominate long term radionuclide release. If testing is conducted only at 90°C, the reaction kinetics would dictate unreasonably long test durations in order to obtain the data required. Abundant evidence exists to support the general conclusion that the mechanism for glass dissolution is similar at 90°C and 150°C.</p> <p>e) The SRL proposal to include 90°C testing is one that should certainly be considered in the future development effort to define a suitable compliance test for the needs of a radionuclide release requirement (4.4.1.5).</p> <p>f) The "temperature expected at the onset of leaching of DWPF glass" in an NWRB is not known by the BWIP.</p>			
12	<p>3/5/- Comments on this paragraph are as follows:</p> <p>a) Characterization of long-term radionuclide release behavior requires solubility data and is <u>not</u> adequately characterized by leach test type data.</p> <p>b) Uranium is <u>not</u> a suitable analog for plutonium to address the needs for data on solubility, reaction product formation, and especially other formations such as colloids.</p> <p>c) Currently, it is <u>not</u> expected that there will be a BWIP radionuclide release specification level for technetium relative to the DWFP waste form.</p>			

REVIEW COMMENT RECORD (RCR) CONTINUATION

Item	Comments/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status
13	<p>4/1/ - Comments on this paragraph are as follows:</p> <p>a) The proposed (relative%) value stated in the draft of SD-BWI-CR-018 is recognized as very conservative and will be further evaluated. The limit may be left as a (To be determined) for the purposes of the document at this stage in the BWIP program.</p> <p>b) Note that the compositional and mineralogic phasing control refers to production variations relative to the values for material used to demonstrate compliance with the radionuclide release specification for requirement 4.4.1.5. Obviously, if material was proposed for production that did not lie within this (\pm) range then a new set of compliance tests (4.4.1.5) could be run to qualify such material. The compliance tests are meant to be relatively simple and fast so as to be amenable to such needs.</p> <p>c) It is expected that the requirement 4.4.1.6.1 only be applied as a specification to the "major" (to be determined) chemical and mineralogic components of the waste form and only radionuclides that qualified for limits on radionuclide release, as per the performance assessment requirements for the repository system.</p> <p>d) A key point is that if SRL knows what "the anticipated range of glass composition"... is expected to be then it would be very helpful to the BWIP on this matter, and our own waste form procurement work for BWIP testing, if SRL would send the BWIP this information, as soon as possible.</p>			
14	<p>4/2/ - Comments on this paragraph are as follows:</p> <p>a) Some limits have to be set on compositional control, etc. otherwise the producer, et. al. would have to run compliance tests for each slight variation in composition that was produced.</p>			

Reviewer(s) (MJ Apted) Eli Randklev		REVIEW COMMENT RECORD (RCR) CONTINUATION		Review No. 1	Page of
Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status	
14	<p>b) The "better approach" SRL proposes is what the compliance tests are expected to accomplish for expected waste (waste form) compositions, or these found to be outside composition limits agreed to as reasonable by the producer and repository, supportable by the existing data base, of the repository testing program, at that time.</p> <p>c) The use of "grab samples" is probably an acceptable approach and should be considered in developing such detail in the preliminary specifications document.</p>				
15	4/4/1 - The tolerances were included in SD-BWI-CR-018 only to provide a perspective (conservative) for compatibility between the DWFP reference container design and the current conceptual design for the BWIP waste package canister for DILLW.				
16	4/4/4 - It is obvious that SRL and BWIP need to maintain close communication between their respect design efforts to insure the compatibility of dimensions and tolerances for containers and canisters (and overpack containers, if needed).				
17	4/5/1 - A repository program will have to maintain a comprehensive data base on the characteristics of all materials (e.g. containers, overpacks, etc.) involved with the as-received waste forms, in order to evaluate and handle accident or performance related events prior to or even after emplacement.				
18	5/1/2 - As of now, the BWIP does not intend to take credit for the DILLW form container, but until it is canisterized the container must perform as a primary containment barrier at the repository receiving facilities. Extensive knowledge of the characteristics of such a container material is <u>not</u> unwarranted under such circumstances. The list of specific characteristics and the types and amounts of data needed are certainly open for discussion up through development of the specifications documents.				

Review (MJ Apted) Ell Randklev		REVIEW COMMENT RECORD (RCR) CONTINUATION		Review No. 1	Page of
Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hot/Point	Disposition (provide justification if NOT accepted).	Status	
19	5/2/- Does SRL have a problem with the concept of a container overpack, if needed? The matter of noncompliance with certain waste acceptance specifications and what the producer and repository system propose as solutions to this type of problem is certainly open for and deserving of further discussion.				
20	5/3/- Comments on this paragraph are as follows: a) The draft of SD-BWI-CR-018 states..."the combination of the following screening steps" and that means both. It also states that such information..."can be composed of both predicted and measured values." It would be expected that the measured values would apply to the primary radionuclides identified as important and especially those specified as requiring controls on radionuclide release (4.4.1.5). b) There is a garbled sentence-starting at line 7. c) The Compliance test for radionuclides release will be concerned primarily with the radionuclides that have been specified as requiring limits on their release from waste form.				
21	5/4/ - Comments on this paragraph are as follows: a) If SRL intends to provide more review comments on the draft of the Waste Acceptance Requirements document (SD-BWI-CR-018), then the BWIP expects to be notified of this and to receive them as soon as possible. Other review comments are coming in and all comments on hand will be dispositioned, as per the schedule to complete revisions to the document within several weeks following receipt of the DOE-Headquarters review comments. b) What improvements were suggested by SRL?				

Reviewer (MJ Apted)
Eli Randklev

REVIEW COMMENT RECORD (RCR) CONTINUATION

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Item	Comments(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/problem indicated).	Hold Point	Disposition (provide justification if NOT accepted).	Status
21	c) The BHIP is interested in seeing that SD-BWI-CR-018 is issued with "well-defined and well-justified" <u>requirements</u> and appreciates whatever assistance SRL personnel are able to provide.			

BWIP Comments and Proposed Dispositions on the
Second Savannah River Laboratory Review
of SD-BWI-CR-018

Comments dispositioned by:

E. H. Randklev
Engineered Barriers Dept.
Basalt Waste Isolation Project
(509) 373-2853, FTS 440 2853

**SRL
GENERAL COMMENTS**

1. As you will see in our detailed comments, there are several areas where the testing you call for in the document appears to be at odds with the way we intend to operate the DWPF. Where these areas exist, I have indicated how we intend to supply you with the type of information needed. In general, our philosophy has been to minimize testing of the actual DWPF product, and to emphasize proof testing of equivalent non-radioactive products for certification. It is difficult for us to determine, from the present document, which, if any, of the requirements can be satisfied in this way. If, in your opinion, the information we intend to provide is not sufficient, we must resolve these issues promptly, since any modifications to the DWPF are very unlikely once the design and procurement of the embedded piping is completed, early in 1984.

BWIP REPLY: Some testing of radioactively doped (including fully doped) waste form material will be required by the producer (or subcontractor) in order to satisfy Quality Assurance provisions of the Final Waste/Form Acceptance Specifications of an NWTs repository and, thus, to demonstrate conformance with the limits set by the approved license (NRC) for operating the repository. It would be helpful if SRL shared with the NWTs repository programs, in the near future, the status of the testing facilities program plans for the DWPF.

The BWIP/DOE decisions as what test methods and procedures should be used to certify compliance with the final specifications, which will evolve from the proposed acceptance requirements, will be made over the next four years (FY85 to FY88) per the current schedule. Starting in FY84, the BWIP has Pacific Northwest Laboratory (PNL) working on developing a test method and procedure for the radionuclide release requirement (Section 4.4.1.5 in SD-BWI-CR-018). DOE has not provided guidance to the NWTs projects yet on how the overall program on compliance test method and procedure development should be handled (i.e., budgeted, assigned, directed, etc.).

BWIP ACTION: We await receipt of information from SRL on current plans for test facilities and testing scope in support of the DWPF operation and waste/form product quality assurance. We have initiated discussions

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with DOE-Richland regarding further guidance on how to set up the program on compliance tests and procedures development.

**SRL
SPECIFIC COMMENTS**

Our comments refer to the indicated sections of the draft document. Quotations are from the draft document.

2. Section 4.4.1.1.1, page 40. "At present the reference waste form for DHLW is a borosilicate glass..."

It probably would be better to reword this to say that borosilicate glass will be produced in the DWPF, and that this is also the reference form for Hanford waste.

BWIP REPLY: The comment is noted and the suggestion is accepted.

BWIP ACTION: Text will be changed to note the SRL suggested thermal heat generation rate limit for the canisterized Savannah River DWPF waste/form.

3. 4.4.1.1.1, page 40. "The waste form producer shall also supply data on the quantity of each element listed in the waste stream's radionuclide inventory, present in the reference waste form...shall provide a complete batch formulation..."

There needs to be some limit as to which elements are included. In DP-1606, Revision 1, several radionuclides are listed which we have never been able to detect in the waste, and probably could not without excessive efforts. The DWPF will supply analyses of all major frit and waste components, both radioactive and non-radioactive, based on analyses of melter feed samples.

BWIP REPLY: The statement of radionuclide inventory should not have appeared in the 4.4.1.1.1 section, as this topic is covered in Section 4.4.1.4.2. The general description of what "...the DWPF will supply..." regarding analyses appears to be topically complete. The frequency, method of sampling, and analysis are yet to be determined in establishing a Quality Assurance plan that will be consistent with the needs of NRC in approving an NWTS repository operating license.

BWIP ACTION: The statement on radionuclide inventory values (measured and/or predicted) will be deleted from Section 4.4.1.1.1.

4. Section 4.4.1.1.2 "The waste form shall not contain free liquids." The glass itself contains no liquids after processing in the DWPF melter. However, water is used to decontaminate the exterior surface of the canister. The DWPF process is designed to prevent water from entering the canister by insertion of a tight fitting plug into the canister nozzle prior to decontamination. The plug is leak tested to ensure tightness. If a small quantity of water were to leak past the closure, however, it would not be detected, prior to welding. However, we intend to examine this, and similar questions, during cold run-in of the DWPF facility.

BWIP REPLY: The comment is noted and being considered.

BWIP ACTION: This requirement will be modified in accordance with 10 CFR 60 (NRC) language regarding limiting the presence of undesirable constituents. Following "...liquids..." we will insert "...in amounts that could compromise the containment integrity of the canister (formerly labelled container by the BWIP) up through the operating period of the repository. Free liquids shall also not be present in amounts that could compromise the ability of the underground facility to contribute to waste isolation or the ability of the geologic repository to satisfy the performance objectives."

5. Section 4.4.1.1.5 "Toxic materials...shall not be present in the waste form and/or internal volume of the waste form container..."

The inside surface of the canister may have a small amount (a few grams) of salts which have condensed on the void space above the glass surface. The exact quantities and compositions are being determined using simulated waste glass. However, the motivation for this requirement is not clear, since a breach of the canister is necessary before exposure to operating personnel or the public can occur. A breach would also be necessary to admit water to the canister so that these salts could contribute to corrosion.

BWIP REPLY: Comment is noted and being considered. The requirement was written primarily in support of 4.4.2.2.6, Burst Strength, and 4.4.2.2.7, Drop Test.

BWIP ACTION: The requirement will be modified to state that it applies to toxic materials that are not chemically bound into the waste form as per the needs of the other requirements noted.

6. Section 4.4.1.1.8 "The waste form shall be chemically compatible (e.g., nonreactive and noncorrosive) with the container material..."

We suggest adding the phrase "at storage temperatures." The phrase "nonreactive and noncorrosive" is not very precise. At 1150°C, glass is very corrosive to 304L. At expected pouring conditions ($T_{max} = 600^{\circ}C$),

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there is very little corrosion. At expected storage temperatures, there is no corrosion of the container by the glass, at all. We intend to document the amount of corrosion of the canister wall by the glass, based on the results of nonradioactive tests.

BWIP REPLY: Comment is noted and being considered.

BWIP ACTION: Insert a sentence at the end of the paragraph that reads "The requirement on chemical compatibility applies to the temperature and time range involved up through the operating period of the repository."

7. Section 4.4.1.2.1 "The fractions (and amounts) of waste form within a container that are present as particles...less than 200 μm but greater than 10 μm ...and less than 10 μm ...shall not exceed the limits established by 10 CFR Part 20 and the ALARA public and occupational limits..."

We intend to document the particle size distribution based on tests using non-radioactive simulated waste glass. The canisters of glass will be filled at our reference rate and handled as closely as possible to the DWPF process. The results of this test will represent a sort of expectation value for particle size distribution in DWPF canisters. A companion set of canisters will be transport to the WIPP site, emplaced in a heated environment, then removed and returned to SRL for characterization. These canisters will most likely represent worst case conditions for DWPF canisters arriving at BWIP.

BWIP REPLY: The comment is noted.

BWIP ACTION: None required.

8. Section 4.4.1.3.1 "The borosilicate glass waste forms...shall not exceed 500 °C at any given position within the containerized waste form after fabrication is completed."

The last phrase is unnecessarily vague. We suggest changing it to "...after the canister has cooled following filling."

BWIP REPLY: The SRL suggested change is also considered too vague in that the cooling time is not specified.

BWIP ACTION: After "...fabrication..." insert "...and the start of lag storage prior to shipment to the repository." An alternate suggestion

is for the BWIP and SRL to agree on a specific time period following filling of the canister with waste form.

9. Section 4.4.1.3.2 "The containerized waste form for DHLW shall not exceed a thermal heat generation rate of..."

We suggest setting this limit at 800 watts. If we should completely fill a canister with the our design basis waste glass, and if that glass is as dense as our densest glass (3.1 g/cm^3), this canister would have a heat generation rate of about 730 watts. Since this is a fairly credible worst case, it appears to be a reasonable basis for a design limit.

BWIP REPLY: Comment is noted and the suggestion is accepted.

BWIP ACTION: Text will be changed to note the SRL suggested thermal heat generation rate limit for the canisterized Savannah River DWPF waste/form.

10. Section 4.4.1.4.2 "The specific radionuclide inventory (curies and in grams) equivalents per unit volume of waste form..."

This will be supplied based on periodic analysis of the contents of the melter feed tank. The accuracy of the estimate will be determined during non-radioactive testing in 1988. For reasons which will be discussed below, we do not intend to extensively sample waste glass produced in the DWPF (see comment on 4.4.1.5).

However, it may not be possible for the DWPF to comply with this specification, as written. We cannot analyze for many of the trace radionuclides in the presence of the major species, which implies the use of separation techniques. While many of these can be done in the laboratory with a specified precision, we will not guarantee that we can achieve this in practice in a production setting. We would suggest that this requirements be modified to include only those radionuclides actually of interest, and those only if their concentration in the waste form is a significant fraction of the relevant EPA or NRC criteria for that particular radionuclide. In any event, this requirement should be rewritten to indicate which of the possible interpretations is the right one. We do not know whether all radionuclides satisfying either (1) or (2), or only those radionuclides satisfying both are included.

BWIP REPLY: The comment is noted and being considered. The requirement was written to apply to radionuclides which satisfied both screening criteria noted in the requirement (4.4.1.4.2). The February 1, 1984 working draft 3 (February 1, 1984) of 49 CFR 191 (EPA) eliminates the need for having radionuclide inventory values for nuclear wastes per

MTHM in order to evaluate a given case against the radionuclide release limits in Table 2 of 49 CFR 191.

BWIP ACTION: Additional qualifying statements will be added to this section as per the completion of additional analysis and revision of Section 4.4.1.5 (Radionuclide Release). We plan to delete the requirement of expressing radionuclide inventory values for DHLW on a per MTHM basis.

11. Section 4.4.1.5 "The waste form...shall limit the plutonium solubility...The suggested test temperature is 150°C..."

While we support the concept of giving us a definite target for product adequacy, we cannot support the suggested test temperature of 150°C. WE have three objections which must be addressed before we can support this temperature.

(1) It must be shown that this is, indeed, a conservative case: there are several studies suggesting retrograde solubility of plutonium and other actinides.

BWIP REPLY: The comment is noted. Our FY 84 program plan for developing the test method and procedures relative to the radionuclide release requirement calls for 150°C as the suggested maximum and also for test development work to be done at 90°C to evaluate the effects of the temperature parameter.

BWIP ACTION: Text will be modified to indicate that the parameter of test temperature is being investigated as part of test method and procedure development.

(2) While we understand that the maximum possible temperature for DWPF glass in a NWRB is around 150°C, we are confident that BWIP will prevent water/waste interactions from occurring at these temperatures. We do not see the need for extensive testing at this temperature. This is not meant to imply that SRL will not test at 150°C; it means we do not see any reason to concentrate our efforts there.

BWIP REPLY: The comment is noted. The purpose of the compliance test at this time is to determine waste/form system performance values relative to limits set by the BWIP for steady-state concentration values of specific radionuclides in hydrothermal test solutions.

BWIP ACTION: The BWIP will continue to interface with SRL on this topic. No change needed in the document at this time.

(3) The use of equipment such as Dickson rocking autoclaves severely limits the number of samples which can be run at any time, and is not very compatible with hot cell operation. If extensive 150°C testing is ultimately required, better test equipment must be developed.

BWIP REPLY: We do not propose to use Dickson autoclaves for this test. The compliance test method and procedures development work initiated in FY 84 for this requirement is evaluating the applicability of using a small closed reaction vessel (titanium).

BWIP ACTION: Text will be modified to note that test method and procedures development were initiated in FY 84.

12. Section 4.4.1.5.1 "The waste form shall be controlled...to be sufficiently close ($\pm 5\%$ to the chemical content...of the waste form material used to certify compliance...The waste form samples used to certify compliance...shall be obtained by representative sampling..."

We do not believe that we can certify our ability to analyze glass with the required accuracy. In particular, actinides and other refractory oxides are extremely difficult to reliably dissolve from a glass matrix. On the other hand, we are rather confident of our ability to analyze SRP waste slurries. Thus, we believe we will provide better compositional data from our melter feed samples than from our glass.

BWIP REPLY: Comment is noted.

BWIP ACTION: We intend to replace the $\pm 5\%$ value with a (To Be Determined) value until more test data and analysis information is available from the BWIP program and the Savannah River DWPF program.

A few glass samples will be taken by pouring molten glass into a one liter container; we do not intend to core drill any filled canisters. Canisters will be capped almost as soon as they rotate out from under the melter, to avoid possible intrusion of water into the filled canister. It is our intention to qualify the DWPF product based on non-radioactive glass from our full-scale pilot plant, and to limit testing of the DWPF product to verification and validation of the non-radioactive test results.

BWIP REPLY: Comment is noted. It still seems that some sort of product stream sampling on a periodic basis is called for in order to certify compliance with Quality Assurance approved ranges of product characteristics.

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BWIP ACTION: No document changes required at this time.

We agree that any changes in the process with the potential to compromise the ability of the glass to perform acceptably must be investigated further. However, the allowed variance is less than that expected during operation of the DWPF. We would prefer that the allowed variance be redefined to include the full range of compositions to be used by BWIP for testing in support of the repository license application. We would then undertake to insure that BWIP would have results on glasses covering the full range of DWPF compositions. In any event, since BWIP is only interested in solubility data, virtually all of our credible product compositions should lead to the same solubility values.

BWIP REPLY: Comment is noted and being considered.

BWIP ACTION: No document changes required at this time.

13. Section 4.4.1.6.2

The glass product will not be monolithic. Do you have any reason to expect that the solubility of cracked glass would be different than that of a monolith?

BWIP REPLY: The requirement was intended to express the need for a waste/form product that is solid and consolidated as per the general requirements of 10 CFR 60 (NRC), Section 60.135C, and to support the 4.4.2.2.7 Drop Test requirement.

BWIP ACTION: The term "...monolithic..." will be deleted and "...solid and consolidated..." will be inserted.

14. Section 4.4.1.6.2 "The waste form producer will provide data and information to demonstrate that the waste form retains its general physical...and chemical properties over the time span from manufacture..."

Assuming that there is absolute containment of the glass for the first 300 years as called for in 10 CFR 60, and that the packing density in the repository is not excessive, there should be no alteration of the glass except for transmutation of elements. However, it will be rather unrealistic to expect data to prove this. The extrapolation of even several years' data to 300 years seems a bit tenuous.

BWIP BEPLY: The comment is noted and is being considered. We still believe some consideration needs to be given to the matter of aging effects up the chemical and physical characteristics of the waste/form material.

BWIP ACTION: No document change required at this time.

15. Section 4.4.1.7 Criticality

We intend to demonstrate that we meet this requirement by submitting analyses of feed samples.

BWIP BEPLY: Comment is noted.

BWIP ACTION: No change required.

16. Section 4.4.1.8 Properties and Characteristics

Please indicate definitely which measurements are required from production samples.

BWIP BEPLY: Comment is noted. Relative to the Chemical category, it is too early in the BWIP testing program to judge which of the listed requirements might be deleted entirely or not require any production sample testing, or to decide the frequency of any sampling and testing that will be required. It would seem likely that most of the Physical, Mechanical, and Thermal information can be provided without resorting to radioactively contaminated material let alone any production sampling. Decisions on such detailed matters will be made during future program efforts done in support of developing preliminary waste/form acceptance specifications.

BWIP ACTION: A qualifying statement(s) will be added to 4.4.1.8 to reflect the situation noted in the above BWIP BEPLY.

17. Section 4.4.1.8.1 Chemical

Several of our earlier comments on sampling and devitrification are directly applicable here.

- The allowed variance in chemical composition is less than that expected for the DWPF. We suggest basing your allowed variance on our information on expected DWPF glass compositions.

BWIP REPLY: Comment and suggestion are noted.

BWIP ACTION: We propose to delete the ± 5 wt% value and leave the limit as a (To Be Determined). The specific limit(s) for this requirement will not be established until the BWIP waste/barrier/rock testing program and the waste package performance analysis work have produced enough results to adequately evaluate and assess the need for such a requirement.

- The number of radionuclides to be analyzed needs to have some defensible basis: we suggest tying analytical requirements directly to the appropriate criteria.

BWIP REPLY: Comment is noted. Section 4.4.1.4.2 Specific Inventory provides a two-step screening criteria that does key against a regulatory criteria (EPA). Further reduction in the list of radionuclides of concern may be possible once a sufficient data base is available from the BWIP testing program. As long as the range of expected concentrations for each radionuclide expected the the waste/form are set wide enough and approved as acceptable by the repository program, then the need for confirmatory production sampling and testing should be relatively infrequent. The predicted radionuclide concentration value for the reference design cases(s), and the predicted range of values about the reference case value (especially the maximum) are important initial input to the repository program efforts to refine the requirements pertaining to radionuclide inventory values. There will obviously be a need for data that confirms such predicted values.

BWIP ACTION: A qualifying statement will be added to Section 4.4.1.4.2 to help explain the expected scope of the requirement.

- We do not intend to perform drop or fire tests of canisters containing radioactive material.

BWIP REPLY: The comment is noted. It will be up to the future development of acceptable compliance tests for these requirements to confirm or invalidate the stated position.

BWIP ACTION: No changes required at this time.

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18. Section 4.4.1.8.2-4 Physical, Mechanical, Thermal

Much of the data requested does not seem particularly relevant to your needs as stated in the justification.

BWIP REPLY: See the BWIP REPLY and BWIP ACTION on preceding SRL comment on Section 4.4.1.8.

Note: Much of this information should be available from the producers own materials acceptance specifications. Final judgments on specific reductions in the lists of information called for in 4.4.1.8.1-4 is a topic for future stages of refinement in the requirements (specifications).

BWIP ACTION: No changes needed at this time.

19. Section 4.4.2.2.1Weight

The limits on these properties need to better reflect the expected variations in the DWPF product. The density of the glass may vary from 2.5 to 3.1 g/cc. We can anticipate that underfilling and overfilling will occur, on occasion. For purposes of equipment design, it seems prudent to use the worst expected case (overfilling with the densest glass). Also, the lower bound on canister weight needs to be discarded.

BWIP REPLY: Comment is noted. We agree that only a maximum limit is needed.

BWIP ACTION: Text will be changed accordingly. A statement will be added to further qualify the proposed value.

20. Section 4.4.2.2.1 "The waste form container, as filled...shall not exceed 2268 kilograms."

We suggest this be increased to 6000 lbs (2700 kg) based on the expected worst case.

BWIP REPLY: The suggestion is noted. The BWIP recognizes the potential for providing a shaft hoist and other needed handling systems to accommodate payloads of a high-level waste/form plus canister that exceed the proposed 5000 lb limit. Some reviewers suggested maximum values in the 10,000 to 15,000 lb range. However, given the current status of the BWIP design programs (i.e., conceptual stage completed and reference documented), the proposed maximum weight limit can be increased to

7000 lbs, but with the added qualification that the BWIP intends to evaluate higher practicable weight limits (e.g., up to at least 20,000 lbs) during design upgrade programs (FY85).

BWIP ACTION: Text will be changed to state only a maximum weight. A qualifying statement will be inserted in Section 4.4.2.2.1 to alert the readers to the situation noted above.

21. Section 4.4.2.2.3 Diameter

The current canister specification for the DWPF is 24.00 ± 0.12 inches, which is equivalent to a maximum diameter of 61.26 cm. The wall thickness of the canister is a nominal $3/8$ inch, or 0.95 cm.

BWIP REPLY: The comment is noted.

BWIP ACTION: No changes needed at this time.

22. Section 4.4.2.2.5 Free Volume

We do not see the need for this specification.

BWIP REPLY: The comment is noted. Our concerns remain as noted in the Appendix Section A1.2.2.5 of the subject document (SD-BWI-CR-018). The requirement will be reviewed further when more design information becomes available.

BWIP ACTION: No changes required at this time.

23. Section 4.4.2.4 "...Compliance with thermal requirements...will be tested by measuring the surface temperature of the waste form loaded container."

There is currently no provision in the DWPF to measure the surface temperature of the canister.

BWIP REPLY: The comment is noted. We erred in drafting the statement and had intended to simply suggest that the temperature measurement is one possible test method. It is beyond the scope of the current status of the BWIP and the subject document (SD-BWI-CR-018) to be specifying the test specific methods and procedures for the compliance tests. Likewise it is only possible to propose interim values with respect to

most maximum and/or minimum limits that are appropriate to specific requirements, with the exception of those dictated by selected Federal regulations.

BWIP ACTION: The statement on the test method will be changed to only suggest the particular method as a candidate.

24. Section 4.4.2.7 "The waste form producer will overpack any containers...that are not able to be brought into compliance..."

This statement seems a little bit presumptuous as written. We suggest you change this to read that the repository would reserve the right of refusal, but would consider variances on a case-by-case basis. In particular, we are most concerned about the weight specifications. As presently written, it is conceivable that much of the DWPF production could fail to meet this specification.

BWIP REPLY: The comment is noted. The first sentence in 4.4.2.7 is admittedly too general and will be changed. The Subsections 4.4.2.7.1 and 4.4.2.7.2 do focus upon the intended purpose of the requirement. The requirement already states that approval to ship such overpacked containers is to be arranged on a case-by-case basis with the repository. The limit of 5% will be deleted as per DOE reviewer comments. The concern about exceeding the weight limit is noted and the BWIP is confident that the further refinements in the proposed maximum weight limit will be sufficient to handle such concerns. However, we are quite concerned about the last sentence of the comment (i.e., "...much of the DWPF production could fail to meet this specification.") If "this" refers to the maximum weight specification, then the preceding statements in the REPLY should handle such concerns--see also the Section 4.4.2.2.1 comment. However, if the statement is referring to meeting the general subject requirement (4.4.2.7) then it is not apparent why such a situation is expected, and we would appreciate receiving further explanation.

BWIP ACTION: The first sentence in Section 4.4.2.7, and also in 4.2.2.7 (CHLW), will be rewritten to more specifically state the intended purpose of the requirement.

25. Section 4.4.2.8 Properties and Characteristics

From the wording, we interpret this to mean that all of the data called for in this section can be measured on non-radioactive samples. Please verify our interpretation. Also, we will not supply data unless its need is clearly justified: we want to minimize the manipulations of radioactive materials.

BWIP REPLY: The comments are noted. See the BWIP REPLY to the SRL reviewer's preceding comments on Section 4.4.1.8, for further discussion of our current opinion regarding these two Properties and Characteristics requirements (4.4.1.8 and 4.4.2.8).

BWIP ACTION: A qualifying statement will be added to help further define our intent with respect to the 4.4.2.8 requirement.

26. Section 4.4.2.8.4 Thermal

We intend to supply the data requested to allow you to calculate the thermal history of the waste package.

BWIP REPLY: The comment is noted.

BWIP ACTION: No changes needed.

27. Section 4.4.2.9.2 Labeling

Labeling specifications have not been determined for the DWPF; however, the top surface of the flange probably will have stamped identification on its top and side to permit sealing of the bellows assembly, and use of a canister throat protector.

BWIP REPLY: The comment is noted. The labeling specification must be compatible with the needs of both the DWPF and the BWIP.

BWIP ACTION: No changes required at this time.

28. I hope these comments will be useful to you in preparing the next draft of this document. We are confident that, working together, we can product acceptance requirements that will adequately safeguard the public without placing an undue burden on the waste form producer.

BWIP REPLY: The BWIP appreciates the SRL review comments on the subject document. The second set of review comments were a very helpful stage in the dispositioning task effort to this point. We are confident that a mutually satisfactory revision of the appropriate sections of the document can be accomplished in the near future following final decisions by the SRL and the BWIP on the review comment dispositions.