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Complete only applicable items.

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Recommended Values for HLW Glass for Consistent Usage on the Yucca Mountain Project

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Tanya Sloma assisted in creating the DIRS report.

The Checker is the EGS but is not the supervisor of the Originator. Therefore, prior approval was not required per EG-PRO-3DP-G04B-00037.

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DISCLAIMER

The calculations contained in this document were developed by Bechtel SAIC Company, LLC (BSC) and are intended solely for the use of BSC in its work for the Yucca Mountain Project.

CONTENTS

TABLES

Page

ACRONYMS

ANL-W	Argonne National Laboratory -West
BSC	Bechtel SAIC Company, LLC
CRWMS M&O	Civilian Radioactive Waste Management System Management & Operating Contractor
DIRS	Document Input Reference System
DOE	U.S. Department of Energy
DWPF	Defense Waste Processing Facility
HLW	High-Level Waste
INTEC	Idaho Nuclear Technology and Engineering Center
NRC	U.S. Nuclear Regulatory Commission
SAR	Safety Analysis Report
SRS	Savannah River Site
TBV	To Be Verified
WVDP	West Valley Demonstration Project
WVNS	West Valley Nuclear Services Company
WTP	Waste Treatment Plant

1 PURPOSE

The purpose of this analysis is to resolve 27 TBVs (TBVs are data sources marked as To Be Verified and prevent use of the information in a final licensing or construction related product) associated with the document *Source Terms for HLW Glass Canisters* (Reference 2.2.3 [DIRS 151947]). A secondary purpose of this document is to recommend which HLW glass waste values/parameters to use for shielding and dose rate analyses in the case of each waste source for each TBV to promote consistent usage on the Yucca Mountain Project.

2 REFERENCES

2.1 PROCEDURES/DIRECTIVES

2.1.1 EG-PRO-3DP-G04B-00037. Rev. 7. *Calculations and Analyses.* Las Vegas, Nevada: Bechtel SAIC Company.

2.2 DESIGN INPUTS

2.2.1 Allison, J.M. 2004. "*Request for Referenceable Information on High-Level Waste (HLW) Radionuclide Inventories in Support of Preparation of the Yucca Mountain Project License Application (Your Letter, JCP-0445, 1/28/04).*" Memorandum from J.M. Allison (DOE/SR) to J. Arthur, III (OCRWM), February 26, 2004, 0303040661, with attachment. ACC: MOL.20040317.0265. [DIRS 168734]

2.2.2 BSC (Bechtel SAIC Company) 2004. *Inventory and Characteristics of Potential Repository Wastes.* 000-00C-MGR0-01200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20040517.0003; ENG.20050815.0015; ENG.20050825.0001; ENG.20050906.0017. [DIRS 167441]

2.2.3 CRWMS M&O 2000. *Source Terms for HLW Glass Canisters.* CAL-MGR-NU-000002 REV 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.20000823.0004; DOC.20050816.0004; DOC.20050817.0002. [DIRS 151947]

2.2.4 DOE (U.S. Department of Energy) 1999. *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada.* DOE/EIS-0250D. Summary, Volumes I and II. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.19990816.0240. [DIRS 105155]

2.2.5 DOE (U.S. Department of Energy) 2002. *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada.* DOE/EIS-0250. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314; MOL.20020524.0315; MOL.20020524.0316; MOL.20020524.0317; MOL.20020524.0318; MOL.20020524.0319; MOL.20020524.0320. [DIRS 155970]

2.2.6 Reserved

2.2.7 Duguid, J. 2003. "*Re: Hanford Glass Information.*" E-mail from J. Duguid to J. Tang, July 16, 2003, with attachment. ACC: MOL.20030722.0095. [DIRS 164360]

2.2.8 Fowler, J.R.; Edwards, R.E.; Marra, S.L.; and Plodinec, M.J. 1995. *Chemical Composition Projections for the DWPF Product (U).* WSRC-IM-91-116-1, Rev. 1.

Aiken, South Carolina: Westinghouse Savannah River Company. TIC: 232731. [DIRS 101829]

2.2.9 Goff, K.M. 1998. "*ANL-West Comments from Review of Appendix A - Yucca Mountain Repository Environmental Impact Statement.*" Letter from K.M. Goff (ANL-West) to M.B. Heiser (Lockheed), May 20, 1998, with attachment. ACC: MOL.19990511.0377. [DIRS 104392]

2.2.10 Goff, K.M. 1998. "*Revision to Original INEEL Response to Yucca Mountain Site Characterization Office Data Call for High-Level Waste (Ref. Palmer and Benedict to Wichmann, July 2, 1997).*" Letter from K.M. Goff (ANL-West) to M.B. Heiser (Lockheed), April 15, 1998, with attachment, "Modifications to Yucca Mountain Data Call." ACC: MOL.19990608.0032. [DIRS 104389]

2.2.11 NRC (U.S. Nuclear Regulatory Commission) 2003. *Yucca Mountain Review Plan, Final Report.* NUREG-1804, Rev. 2. Washington, D.C.: U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. TIC: 254568. [DIRS 163274]

2.2.12 Pearson, W.D. 1998. "*SRS Data Request Followup.*" E-mail from W.D. Pearson to Private User, February 18, 1998. ACC: MOL.19990511.0281. [DIRS 104403]

2.2.13 Picha, K.G., Jr. 1997. "*Response to Repository Environmental Impact Statement Data Call for High-Level Waste.*" Memorandum from K.G. Picha, Jr. (DOE) to W. Dixon (YMSCO), September 5, 1997, with attachments. ACC: MOL.19970917.0273. [DIRS 104406]

2.2.14 Picha, K.G., Jr. 1998. "*Clarification of High-Level Waste and Special Performance Assessment Required Data for Repository Environmental Impact Statement.*" Memorandum from K.G. Picha, Jr. (DOE) to K. Skipper (DOE/YMSCO), May 8, 1998, with attachments. ACC: MOL.19990610.0297. [DIRS 104407]

2.2.15 Plodinec, M.J. and Marra, S.L. 1994. *Projected Radionuclide Inventories and Radiogenic Properties of the DWPF Product (U).* WSRC-IM-91-116-3, Rev. 0. Aiken, South Carolina: Westinghouse Savannah River Company. TIC: 242337. [DIRS 101908]

2.2.16 WVNS (West Valley Nuclear Services Company) 1998. *Waste Form Qualification Report (WQR), West Valley Demonstration Project.* WVDP-186. West Valley, New York: West Valley Nuclear Services Company. TIC: 242094. [DIRS 103500]

2.2.17 WVNS (West Valley Nuclear Services Company) 2001. *WVDP Waste Form Qualification Report - Canistered Waste Form Specifications, Chemical Specification.* Chapter 1 of *Waste Form Qualification Report (WQR).* WVDP-186. West Valley, New York: West Valley Demonstration Project. ACC: MOL.20020211.0184. [DIRS 157559]

2.2.18 BSC 2005. *Q-List.* 000-30R-MGR0-00500-000-003. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20050929.0008. [DIRS 175539]

2.2.19 Heiser, M.B. 1998. "INEL HLW Vit Breakdown." Memorandum from M.B. Heiser to J. Rivers, March 5, 1998, EIS:AR-GEN-35642. ACC: MOL.19990511.0370.

2.2.20 WVNS (West Valley Nuclear Services) 2003. "Estimated Radionuclide Inventory." Addendum 2 of *WVDP Waste Form Qualification Report - Waste Form Specifications, Radionuclide Inventory Specification.* WVDP-186, Rev. 0. [West Valley, New York]: West Valley Nuclear Services. ACC: MOL.20040329.0112. [DIRS 168661]

2.2.21 Picha, K.G., Jr. 1998. "*Follow Up Response to Repository Environmental Impact Statement Data Call for High-Level Waste.*" Memorandum from K.G. Picha, Jr. (DOE) to W. Dixon (YMSCO), March 12, 1998, with attachment. ACC: MOL.19981006.0206. [DIRS 104413]

2.2.22 Palmer, R.A. and Misercola, A.J. 2003. "Waste Form Qualification Experience at the West Valley Demonstration Project." *Proceedings, Waste Management 2003 Symposium, Waste Management, Energy Security and a Clean Environment, HLW, TRU, LL/ILW, Mixed Hazardous Wastes and Environmental Management, February 23-27, 2003, Tucson, Arizona.* Tucson, Arizona: WM Symposia. TIC: 254433. [DIRS 163863]

2.3 DESIGN CONSTRAINTS

None

2.4 DESIGN OUTPUTS

The output from this document may be used to revise the *Source Terms for HLW Glass Canisters* calculation (Ref. 2.2.3) and the *Inventory and Characteristics of Potential Repository Wastes* document (Ref.2.2.2).

3 ASSUMPTIONS

3.1 ASSUMPTIONS REQUIRING VERIFICATION

This design analysis does not use assumptions that require verification.

3.2 ASSUMPTIONS NOT REQUIRING VERIFICATION

This design analysis does not use assumptions that do not require verification.

4 METHODOLOGY

4.1 QUALITY ASSURANCE

This analysis is prepared in accordance with the procedure EG-PRO-3DP-G04B-00037, *Calculations and Analyses* (Reference 2.1.1). This analysis resolves TBVs associated with HLW glass and recommends HLW glass design values/parameters. The HLW canisters have been classified as an ITS (important to safety) Safety Category item on the *Q-list* (Reference 2.2.18, Table A-1, p. A-4). Therefore, the approved version is designated as QA:QA.

4.2 USE OF SOFTWARE

Software was not used in this analysis to perform calculations. A few simple hand calculations, however, were performed.

4.3 ANALYSIS APPROACH

This analysis provides the basis for resolving 27 TBVs associated with the document *Source Terms for HLW Glass Canisters* (Reference 2.2.3 [DIRS 151947]). In addition, it recommends which HLW glass waste values/parameters to use for shielding and dose rate analyses to promote consistent usage on the Yucca Mountain Project. The analysis approach involved obtaining and reviewing information on the HLW glass canisters from the various sites, including Savannah River Site (SRS), Hanford, West Valley Demonstration Project (WVDP), and Idaho. Based on this information, the TBV values were evaluated to see if they needed to be revised to reflect the current information of the HLW glass canisters. For revised TBV values, justification was provided for the revised values and the updated reference.

5 LIST OF ATTACHMENTS

None

6 RESOLUTION

The following sections describe how each TBV was resolved and recommends values for HLW glass waste for consistent usage on the Yucca Mountain Project. The recommended values in this document represent a bounding scenario in terms of waste loading. Other source terms should be considered when maximized waste loading is not the objective of the analysis (e.g., glass degradation scenarios).

6.1 RESOLUTION OF TBV-3840 AND RECOMMENDED VALUES

TBV-3840

TBV-3840 is associated with the chemical composition of Hanford HLW glass taken from reference Picha 1997 (Reference 2.2.13 [DIRS 104406]). The TBV values are used in Table 5-1 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The chemical composition of Hanford HLW glass presented in Table 1 of the more recent reference, Duguid, 2003 (Reference 2.2.7 [DIRS 164360]), has some minor differences from the values used in Table 5-1 of Reference 2.2.3 [DIRS 151947]. It is recommended that the values used in Table 5-1 of Reference 2.2.3 [DIRS 151947] be updated to those of the more recent reference. The reason is that the selected, or recommended, values are bounding (namely, Technology Case in Reference 2.2.7 [DIRS 164360]) with the highest waste loading (i.e., 45%) for conservative radiological consequences. Table 1 below compares the values from Table 5-1 of Reference 2.2.3 [DIRS 151947] to the recommended values.

Table 1. Comparison of Hanford Chemical Compositions

Compound/Metal	Hanford TBV Value (wt%)[a]	Hanford Revised Value (wt%)[b]	Hanford Recommended Value (wt%)[c]
Ag_2O		0.01 – 0.02	0.02
[d] Al_2O_3	9.31	10.04 – 11.94	11.94
[d] B_2O_3	7.02	6.13-7.90	6.13
BaO	0.0	0.04 – 0.06	0.06
BeO		0.01	0.01
Bi_2O_3	1.15	1.29 – 2.10	2.10
CaO	0.83	0.71 – 1.16	1.16
CdO		0.01 – 0.02	0.02
CeO_2		0.05 – 0.07	0.07
Ce_2O_3	1.13		
Co_2O_3		0.01	0.01
Cr_2O_3	0.36	0.37 – 0.61	0.61
Cs_2O		0.00 – 0.01	0.01
CuO		0.01 – 0.02	0.02
[d] Fe_2O_3	4.49	6.58 – 8.59	8.59
K_2O	0.17	0.16 – 0.26	0.26

Table 1. Comparison of Hanford Chemical Compositions (cont.)

Compound/Metal	Hanford TBV Value (wt%)[a]	Hanford Revised Value (wt%)[b]	Hanford Recommended Value (wt%)[c]
La_2O_3	0.11	0.07 – 0.11	0.11
[d] Li_2O	2.01	2.35 - 3.07	2.35
MgO		0.14 – 0.23	0.23
MnO_2	1.17	0.72 – 1.17	1.17
MoO_3		0.02 – 0.04	0.04
NaF	0.63		
[d] Na_2O	11.79	20.42 – 21.50	21.50
Na_2SO_4	0.10		
Nd_2O_3		0.05 – 0.07	0.07
NiO	1.08	0.41 – 0.67	0.67
P_2O_5	1.56	0.78 – 1.26	1.26
PbO		0.19 – 0.30	0.30
PbO_2	0.14		
PuO_2		0.00 – 0.01	0.01
Sb_2O_3		0.02 – 0.04	0.04
SeO_2		0.01 – 0.02	0.02
[d] SiO_2	46.11	42.96 – 34.80	34.8
SO_3		0.23 – 0.37	0.37
SrO	0.18	0.43 – 0.69	0.69
Tc_2O_7		0.01	0.01
ThO_2	0.01	0.35 – 0.58	0.58
TiO_2		0.01	0.01
Ti_2O_3		0.03 – 0.05	0.05
UO_3	6.69		
U_3O_8		1.76 – 2.86	2.86
V_2O_5		0.03 – 0.04	0.04
WO_3		0.01	0.01
ZnO		0.02 – 0.04	0.04
ZrO_2	3.79	0.66 – 1.07	1.07
Cl		0.00 – 0.01	0.01
F		0.40 – 0.64	0.64
Other	0.17		
Total	100.00	------	100.00

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-1
[b] Duguid 2003 (Reference 2.2.7 [DIRS 164360]), Table 1 (all cases)
[c] Duguid 2003 (Reference 2.2.7 [DIRS 164360]), Table 1 (WTP Technology Case)
[d] Weight percentages represents the sum of the contribution from both the waste oxide and the glass formers

Justification

The recommended values are suitable for use in the design and licensing of the repository, based on the following justification:

- The data were provided by a DOE office (Richland, Washington) and directly from the waste generator, which represents the most authoritative source of information.

- The data represent the only data available for this type of information. There are no better sources for these data.
- The bounding case that contains the highest waste loading was selected.

6.2 RESOLUTION OF TBV-3841 AND RECOMMENDED VALUES

TBV-3841

TBV-3841 is associated with the chemical composition of INTEC HLW glass taken from reference Picha 1997 (Reference 2.2.13 [DIRS 104406]). The TBV values are used in Table 5-1 of Reference 2.2.3 [DIRS 151947].

Recommended Values

It is recommended that the values used in Table 5-1 of Reference 2.2.3 [DIRS 151947] be updated to those shown in Table 2 (fourth column). Similar values to these recommended values in Table 2 (third column) have been previously used in *Inventory and Characteristics of Potential Repository Wastes* (Reference 2.2.2 [DIRS 167441], Table 23) to provide the chemical composition for the INL/INTEC glass waste. These values were subsequently used to provide the waste form composition as required in the *Yucca Mountain Review Plan* (Reference 2.2.11 [DIRS 163274], Section 2.1.1.2.2, p. 2.1-15). Except for rounding, the recommended values in Table 2 (fourth column) are consistent with those previously used in Reference 2.2.2 [DIRS 167441]. The values come directly from DOE 2002 (Reference 2.2.5 [155970]) which cites Picha 1997 (Reference 2.2.13 [104406]). The weight percent values presented in Table 2 below were calculated by taking the total weight of each component and dividing it by the total weight of the waste form. These weights were found in Table A-33 of DOE 2002 (Reference 2.2.5 [155970]). It should also be noted that due to the fact that this is not the limiting HLW waste form it will have no significant impact on the repository design criteria. This TBV recommendation is not expected to result in a revision to the *Inventory and Characteristics of Potential Repository Wastes*.

Table 2. Comparison of INTEC Chemical Compositions

Compound/Metal	INL/INTEC Glass TBV Value (wt%)[a]	INL/INTEC Glass Revised Value (wt%)[b]	INL/INTEC Glass Recommended Value (wt%)[b]
Al_2O_3	7.35	6.99	6.99
B_2O_3	11.30	10.75	10.75
CaF_2	7.99	7.53	7.53
CaO	0.23	0.22	0.22
Cs_2O	0.02	0.02	0.02
Fe_2O_3	0.05	0.04	0.04
Na_2O	13.92	13.44	13.44
P_2O_5	0.06	0.05	0.05
SiO_2	56.68	54.84	54.84
ZrO_2	0.96	0.97	0.97
AMP[(3)]	1.44	1.40	1.40
As	---	0.01	0.01

Table 2. Comparison of INTEC Chemical Compositions (cont)

Compound/Metal	INL/INTEC Glass TBV Value (wt%)[a]	INL/INTEC Glass Revised Value (wt%)[b]	INL/INTEC Glass Recommended Value (wt%)[b]
Cd	---	2.26	2.26
Cr	---	0.75	0.75
Hg	---	0.01	0.01
Ni	---	0.08	0.08
Pb	---	0.10	0.10
Total	100.00	100.00	100.00

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-1
[b] DOE 2002 (Reference 2.2.5 [155970]), Table A-33, Values in the third column (Revised Values) rounded to the second decimal place

Justification

The data contained in DOE 2002 (Reference 2.2.5 [155970]) was provided by a DOE office (Idaho) and directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.3 RESOLUTION OF TBV-3842 AND RECOMMENDED VALUES

TBV-3842

TBV-3842 is associated with the radionuclide inventory of SRS HLW glass canisters taken from reference *Projected Radionuclide Inventories and Radiogenic Properties of the DWPF Product (U)* (Reference 2.2.15 [DIRS 101908]). The TBV values are used in Table 5-5 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The radionuclide inventory of SRS HLW glass canisters presented in Table 2 of the more recent reference, Allison, 2004 (Reference 2.2.1 [DIRS 168734]) are different from Table 5-5 of Reference 2.2.3 [DIRS 151947]. It is recommended that the values used in Table 5-5 of Reference 2.2.3 [DIRS 151947] be updated to those shown in Table 3 (fourth column). These values represent the maximum loading data (i.e., maximum radiological loading) for future production and serve as a basis only for shielding design for storage at the SRS, and subsequent transport to and disposal at the repository (Reference 2.2.1 [DIRS 168734], Table 2).

Table 3. Comparison of SRS Radionuclide Inventory

Compound/Metal	SRS Glass TBV Value (Ci)[a]	SRS Glass Revised Value (Ci)[b]	SRS Glass Recommended Value (Ci)[c]
Co-60	1.70E+02	1.72E+02	7.15E+02
Ni-59	2.39E-02	2.42E-02	2.16E-01
NI-63	2.97E+00	3.01E+00	1.41E+01
Se-79	1.70E-01	1.72E-01	5.91E-02
Sr-90	4.82E+04	4.73E+04	7.62E+04
Y-90	4.77E+04	4.84E+04	7.62E+04
Zr-93	1.12E+00	1.13E+00	1.88E-01
Nb-93m	------	-------	1.47E-01
Tc-99	3.07E+00	3.11E+00	1.56E+01
Ru-106	2.24E+03	2.28E+03	4.70E+03
Rh-106	2.25E+03	------	------
Pd-107	1.47E-02	1.49E-02	1.29E-03
Cd-113	-----	5.06E-14	2.56E-11
Sn-126	4.38E-01	4.46E-01	3.09E-02
Sb-125	8.60E+02	------	--------
I-129	------	------	7.35E-05
Cs-134	3.36E+02	3.41E+02	2.40E+02
Cs-135	9.92E-02	1.01E-01	2.62E-01
Cs-137	4.33E+04	4.39E+04	6.67E+04
Ba-137m	4.14E+04	4.20E+04	6.24E+04
Ce-144	9.84E+03	9.98E+03	1.80E+00
Pr-144	9.85E+03	-----	------
Pr-144m	------	9.98E+03	1.80E+00
Pm-147	2.41E+04	2.45E+04	4.86E+03

Table 3. Comparison of SRS Radionuclide Inventory (cont.)

Compound/Metal	SRS Glass TBV Value (Ci)[a]	SRS Glass Revised Value (Ci)[b]	SRS Glass Recommended Value (Ci)[c]
Sm-151	2.39E+02	2.51E+02	1.22E+02
Eu-154	6.20E+02	6.26E+02	1.68E+03
Eu-155	4.91E+02	4.80E+02	6.70E-01
Np-237	8.86E-03	9.00E-03	3.39E-02
Th-229	------	------	8.78E-05
Th-230	------	------	7.88E-06
Th-232	------	------	9.44E-04
U-232	------	1.35E-02	3.68E-04
U-233	------	1.60E-06	2.75E-02
U-234	3.42E-02	3.47E-02	8.10E-02
U-235	------	1.59E-04	6.00E-04
U-236	------	1.14E-03	7.54E-03
U-238	1.05E-02	1.06E-02	5.17E-02
Pu-238	1.48E+03	1.50E+03	5.93E+03
Pu-239	1.29E+01	1.31E+01	4.90E+01
Pu-240	8.67E+00	8.78E+00	3.34E+01
Pu-241	1.66E+03	1.69E+03	3.49E+03
Pu-242	1.22E-02	1.24E-02	1.11E-01
Am-241	1.10E+01	1.11E+01	2.28E+02
Am-242m	------	1.46E-02	1.30E-01
Am-243	5.79E-03	5.85E-03	3.68E-01
Cm-243	------	5.63E-03	4.14E-01
Cm-244	1.07E+02	1.09E+02	1.86E+03
Cm-245	------	6.79E-06	1.49E-01
Cm-246	------	5.40E-07	4.34E-02
Cm-247	------	6.68E-13	1.71E-06
Cm-248	------	6.94E-13	------
Cf-249	------	------	3.58E-03
Cf-251	------	------	8.20E-03
Total	2.35E+05	2.34E+05	3.05E+05

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-5
[b] Allison 2004 (Reference 2.2.1 [DIRS 168734]), Table 2 (Original Design Basis)
[c] Allison 2004 (Reference 2.2.1 [DIRS 168734]), Table 2 (New Projected Maximum)

Justification

The recommended values are from a report by J.R. Fowler, *Projected Glass Composition and Curie Content of Canister from the Savannah River Site (U)* attached as a memorandum from J. M. Allison, Manager, Department of Energy (DOE) Savannah River Operations Office (SR), to John Arthur III, Deputy Director, Office of Civilian Radioactive Waste Management, Las Vegas, NV (Reference 2.2.1 [DIRS 168734], Appendix 1).

The memorandum (Reference 2.2.1 [DIRS 168734]) states that these data have been reviewed and determined by the Deputy Director, Office of Civilian Radioactive Waste Management (OCRWM) as technically adequate and referenceable information on HLW glass. It has been determined that the use of these data is appropriate for this analysis and characterization of the

radionuclide inventory for HLW forms/glass for the SRS. The memorandum included in this qualification notes that the Westinghouse Savannah River Company endorses the report demonstrating the reliability of the source.

In brief, these data are directly from the waste generator, which represents most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.4 RESOLUTION OF TBV-3843 AND RECOMMENDED VALUES

TBV-3843

TBV-3843 is associated with the chemical composition of SRS HLW glass taken from *Chemical Composition Projections for the DWPF Product (U)* (Reference 2.2.8 [DIRS 101829]). The TBV values are used in Table 5-1 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The chemical composition of SRS HLW glass presented in Table 3 of the more recent reference, Allison 2004 (Reference 2.2.1 [DIRS 168734]) varies from the values used in Table 5-1 of Reference 2.2.3 [DIRS 151947]. It is recommended that the values used in Table 5-1 of Reference 2.2.3 [DIRS 151947] be updated to those of the more recent reference. The updated/revised values in Table 4 (third column) were used in *Inventory and Characteristics of Potential Repository Wastes* document (Reference 2.2.2 [DIRS 167441]) to provide the ranges of the chemical compositions. These ranges were subsequently used to provide the waste form composition as required in the *Yucca Mountain Review Plan* (Reference 2.2.11 [DIRS 163274], Section 2.1.1.2.2, p. 2.1-15). The recommended values in Table 4 (fourth column) represent a set of single point values for a possible worst-case composition from the high viscosity glass (Reference 2.2.1 [DIRS 168734], Table 3). Therefore, the recommended values bound the data previously used in terms of glass waste composition. This TBV recommendation is not expected to result in a revision to the *Inventory and Characteristics of Potential Repository Wastes* document (Reference 2.2.2 [DIRS 167441]).

Table 4. Comparison of SRS Chemical Compositions

Compound/Metal	SRS TBV Value (wt%)[a]	SRS Revised Value (wt%)[b]	SRS Recommended Value (wt%)[c]
Al_2O_3	3.97	2.88 - 7.06	7.06
B_2O_3	7.98	6.92 - 10.17	6.92
BaO		0.12 - 0.19	0.12
$BaSO_4$	9.27		
CaO	0.96	1.03 - 1.05	1.05
CdO		0.00077 - 0.0020	0.00
$CaSO_4$	0.08		
CoO		0 – 0.0041	0.01
Cr_2O_3	0.12	0.085 – 0.14	0.085
Cs_2O	0.12	0.073 – 0.08	0.073
CuO	0.44	0.25 – 0.42	0.25
Fe_2O_3	10.37	7.36 – 12.69	7.36
K_2O	3.85	2.13 – 3.57	2.13
La_2O_3		0.0082 - 0.088	0.09
Li_2O	4.38	3.1 - 4.61	4.61
MgO	1.35	1.33 - 1.45	1.45
MnO		1.98 - 2.07	2.07
MnO_2	2.02		
MoO_2		0.00026 - 0.00055	0.00

Table 4. Comparison of SRS Chemical Compositions (cont.)

Compound/Metal	SRS TBV Value (wt%)[a]	SRS Revised Value (wt%)[b]	SRS Recommended Value (wt%)[c]
Na_2O	8.7	8.22 – 12.15	8.22
Na_2SO_4	0.1		
NaCl	0.19		
NiO	0.88	1.21 - 0.40	0.40
P_2O_5		0.023 - 0.047	0.05
PbO		0.0066 – 0.049	0.01
PbS		0.058 – 0.079	0.06
PuO_2		0.00022 - 0.058	0.06
SiO_2	50.01	44.39 - 54.26	54.26
SnO_2		0.00029 - 0.0031	0.00
SO_3		0.14 – 0.24	0.14
SrO		0.0088	0.01
TcO_2		0.0033	0.00
ThO_2	0.19	0.011 - 0.55	0.55
TiO_2	0.89	0.55 – 0.64	0.55
U_3O_8	2.13	1.01 – 2.88	1.01
Y_2O_3		0.0031 - 0.038	0.04
ZnO		0.016 – 0.11	0.02
ZrO_2		0.034 - 0.37	0.37
$(R.E.)_2O_3$[(2)]		0.058 - 0.63	0.63
Pd		0.0095 - 0.031	0.03
Rh		0.0031 - 0.015	0.02
Ru		0.0099 - 0.082	0.08
Other	1	0.25 – 0.50	0.25
Total	100.00	-------	100.0

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-1
[b] Allison 2004 (Reference 2.2.1 [DIRS 168734]), Table 3 (all cases)
[c] Allison 2004 (Reference 2.2.1 [DIRS 168734]), Table 3 (WAPS Glasses, High Visc/HM Only) with rounding.

Justification

The recommended values are from a report by J.R. Fowler, *Projected Glass Composition and Curie Content of Canister from the Savannah River Site (U)* attached as a memorandum from J. M. Allison, Manager, Department of Energy (DOE) Savannah River Operations Office (SR), to John Arthur III, Deputy Director, Office of Civilian Radioactive Waste Management, Las Vegas, NV (Reference 2.2.1 [DIRS 168734], Appendix 1).

The memorandum (Reference 2.2.1 [DIRS 168734]) states that these data have been reviewed and determined by the Deputy Director, Office of Civilian Radioactive Waste Management (OCRWM) as technically adequate and referenceable information on HLW glass. It has been determined that the use of these data is appropriate for this analysis and characterization of the radionuclide inventory for HLW forms/glass for the SRS. The memorandum included in this qualification notes that the Westinghouse Savannah River Company endorses the report demonstrating the reliability of the source.

In brief, these data are directly from the waste generator, which represents most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.5 RESOLUTION OF TBV-3844 AND RECOMMENDED VALUES

TBV-3844

TBV-3844 is associated with the chemical composition of West Valley HLW glass taken from *Waste Form Qualification Report (WQR), West Valley Demonstration Project* (Reference 2.2.16 [DIRS 103500]). The TBV values are used in Table 5-1 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The chemical composition of West Valley glass presented in Table 2 of the more recent reference, West Valley Nuclear Services Company (WVNS) 2001 (Reference 2.2.17 [DIRS 157559]), is identical to the values used in Table 5-1 of Reference 2.2.3 [DIRS 151947] as illustrated in Table 5. The recommended values in Table 5 (fourth column) are the same as those used in *Source Terms for HLW Glass Canisters* (Reference 2.2.3 [DIRS 151947]), *Inventory and Characteristics of Potential Repository Wastes* (Reference 2.2.2 [DIRS 167441]). Therefore, consistency in usage is maintained. The reference should, however, be updated to WVNS 2001 (Reference 2.2.17 [DIRS 157559], WRQ-1.1, Table 2).

Table 5. Comparison of West Valley Chemical Compositions

Compound/Metal	WVDP TBV Value (wt%)[a]	WVDP Revised Value (wt%)[b]	WVDP Recommended Value (wt%)[b]
Al_2O_3	6.00	6.00	6.00
B_2O_3	12.89	12.89	12.89
$BaSO_4$	0.16	0.16	0.16
CaO	0.48	0.48	0.48
Ce_2O_3	0.31	0.31	0.31
Cr_2O_3	0.14	0.14	0.14
Fe_2O_3	12.02	12.02	12.02
K_2O	5.00	5.00	5.00
Li_2O	3.71	3.71	3.71
MgO	0.89	0.89	0.89
MnO_2	0.82	0.82	0.82
Na_2O	8.00	8.00	8.00
Nd_2O_3	0.14	0.14	0.14
NiO	0.25	0.25	0.25
P_2O_5	1.20	1.20	1.20
RuO_2	0.08	0.08	0.08
SiO_2	40.98	40.98	40.98
SrO	0.02	0.02	0.02
ThO_2	3.56	3.56	3.56
TiO_2	0.80	0.80	0.80
UO_3	0.63	0.63	0.63
ZnO	0.02	0.02	0.02
ZrO_2	1.32	1.32	1.32
Other	0.58	0.58	0.58
Total	100.00	100.00	100.00

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-1
[b] WVNS 2001 (Reference 2.2.17 [DIRS 157559]), WQR-1.1, Table 2

Justification

The data contained in Reference 2.2.17 [DIRS 157559] were provided by WVNS and directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.6 RESOLUTION OF TBV-3846 AND RECOMMENDED VALUES

TBV-3846

TBV-3846 is associated with chemical composition of INTEC HLW glass taken from reference Heiser 1998 (Reference 2.2.19 [DIRS 104395]). The TBV values are used in Table 5-1 of Reference 2.2.3 [DIRS 151947].

Recommended value

This is a redundant TBV since it is the same as TBV-3841. Resolution of TBV-3841 automatically closes this TBV.

Justification

N/A

6.7 RESOLUTION OF TBV-4595 AND RECOMMENDED VALUES

TBV-4595

TBV-4595 is associated with the number of the Hanford Site HLW canisters taken from the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV value is used in Section 5.1 of Reference 2.2.3 [DIRS 151947].

Recommended Value

The number of Hanford Site HLW canisters presented in Table 3 of the more recent reference, Duguid 2003 (Reference 2.2.7 [DIRS 164360]) varies from the value used in Section 5.1 of Reference 2.2.3 [DIRS 151947]. It is recommended that the values used in Section 5.1 of Reference 2.2.3 [DIRS 151947] be updated to those of the more recent reference. The revised values in Table 6 (third column) represent the range from the minimum expected HLW canister production estimate (7,071) to the maximum expected production of Hanford Site HLW canister (13,205). The minimum value represents 100 % canister fill level while the maximum value only includes 87% canister fill level (Reference 2.2.7 [DIRS 164360], Table 3). It is not expected that the canister will be filled to 100%. Therefore, the recommended value in Table 6 (fourth column) represents the maximum number of canisters at 87% canister fill level.

Table 6. Comparison of Number of Hanford HLW Canisters

	Hanford TBV Value [a]	Hanford Revised Value [b]	Hanford Recommended Value
Number of the Hanford Site HLW canisters	14,500	7,071 to 13,205	13,205 (87% canister fill)

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Section 5.1
[b] Duguid 2003 (Reference 2.2.7 [DIRS 164360]), Table 3

Justification

The recommended values are suitable for use in the design and licensing of the repository, based on the following justification:

- The data were provided directly from the waste generator, which represents the most authoritative source of information.
- The data represent the only data available for this type of information. There are no better sources for these data.
- The representative case with a canister fill of 87% of total volume was selected.

6.8 RESOLUTION OF TBV-4596 AND RECOMMENDED VALUES

TBV-4596

TBV-4596 is associated with the mass of the Hanford Site HLW in each canister taken from *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Reference 2.2.4 [DIRS 105155]). The TBV value is used in Section 5.1 of Reference 2.2.3 [DIRS 151947].

Recommended Value

The mass of the Hanford Site HLW in each canister presented in the more recent reference, Duguid 2003 (Reference 2.2.7 [DIRS 164360], Results) is slightly larger than the value used in Section 5.1 of Reference 2.2.3 [DIRS 151947]. It is recommended that the values used in Section 5.1 of Reference 2.2.3 [DIRS 151947] be updated to the bounding value of the more recent reference. The recommended value in Table 7 (fourth column) is based on a bounding maximum fill level (100% fill represents a bounding source term while 87% fill represents a maximum number of canisters).

Table 7. Comparison of Mass of Hanford HLW Glass per Canister

	Hanford TBV Value [a]	Hanford Revised Value [b]	Hanford Recommended Value [b]
Mass of the Hanford Site HLW in each Canister	3040 kg	3360 kg max	3360 kg

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Section 5.1
[b] Duguid 2003 (Reference 2.2.7 [DIRS 164360]), Results (WTP Technology Case)

Justification

The recommended values are suitable for use in the design and licensing of the repository, based on the following justification:

- The data were provided directly from the waste generator, which represents the most authoritative source of information.
- The data represent the only data available for this type of information. There are no better sources for these data.
- The bounding case (i.e., Technology Case) that contains the highest waste loading was selected.

6.9 RESOLUTION OF TBV-4597 AND RECOMMENDED VALUES

TBV-4597

TBV-4597 is associated with the total activity of Hanford HLW glass taken from *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Reference 2.2.4 [DIRS 105155]). The TBV values are used in Table 5-4 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The total activity of Hanford HLW glass presented in Table 2 of the more recent reference, Duguid 2003 (Reference 2.2.7 [DIRS 164360]), is different from the values used in Table 5-4 of Reference 2.2.3 [DIRS 151947] as illustrated in Table 8. It is recommended that the values used in Table 5-4 of Reference 2.2.3 [DIRS 151947] be updated to the values of the more recent reference, as shown in Table 8 for year 2010 (fourth column). Also, the recommended values in Table 8 (fourth column) are the same as those used in *Inventory and Characteristics of Potential Repository Wastes* (Reference 2.2.2 [DIRS 167441]). This TBV recommendation is not expected to result in a revision to the *Inventory and Characteristics of Potential Repository Wastes* document (Reference 2.2.2 [DIRS 167441]).

Table 8. Comparison of the Total Activity of Hanford HLW Glass

Compound/Metal	Hanford Glass TBV Value (Ci)[a]	Hanford Glass Revised Value (Ci)[b]	Hanford Glass Recommended Value (Ci)[b]
Co-60	1.23×10^{4}	2.48×10^{3}	2.48×10^{3}
Ni-59	9.34×10^{2}	1.37×10^{3}	1.37×10^{3}
Ni-63	9.20×10^{4}	1.20×10^{5}	1.20×10^{5}
Se-79	7.73×10^{2}	1.22×10^{2}	1.22×10^{2}
Sr-90	9.73×10^{7}	4.07×10^{7}	4.07×10^{7}
Y-90	2.85×10^{8}	4.07×10^{7}	4.07×10^{7}
Zr-93	3.63×10^{3}	4.81×10^{3}	4.81×10^{3}
Nb-93m	2.69×10^{3}	2.65×10^{3}	2.65×10^{3}
Tc-99	3.26×10^{4}	2.97×10^{4}	2.97×10^{4}
Ru-106	1.04×10^{5}	2.00×10^{0}	2.00×10^{0}
Rh-106	1.35×10^{7}	--	--
Pd-107	8.79×10^{1}	--	--
Sn-126	1.19×10^{3}	5.79×10^{2}	5.79×10^{2}
Sb-125	2.08×10^{5}	2.47×10^{3}	2.47×10^{3}
I-129	3.20×10^{1}	4.80×10^{1}	4.80×10^{1}
Cs-134	8.89×10^{4}	8.91×10^{2}	8.91×10^{2}
Cs-137	1.12×10^{8}	3.72×10^{7}	3.72×10^{7}
Ba-137m	2.47×10^{8}	3.51×10^{7}	3.51×10^{7}
Ce-144	5.88×10^{7}	--	--
Pr-144m	------	--	--
Pm-147	1.44×10^{8}	--	--
Sm-151	2.75×10^{6}	3.27×10^{6}	3.27×10^{6}
Eu-152	1.48×10^{3}	1.03×10^{3}	1.03×10^{3}
Eu-154	1.47×10^{5}	6.68×10^{4}	6.68×10^{4}

Table 8. Comparison of the Total Activity of Hanford HLW Glass (cont.)

Compound/Metal	Hanford Glass TBV Value (Ci)[a]	Hanford Glass Revised Value (Ci)[b]	Hanford Glass Recommended Value (Ci)[b]
Eu-155	1.36×10^{5}	2.42×10^{3}	2.42×10^{3}
Np-237	1.41×10^{2}	1.41×10^{2}	1.41×10^{2}
Th-229	1.81×10^{0}	2.00×10^{0}	2.00×10^{0}
Th-230	------	--	--
Th-232	2.11×10^{0}	8.00×10^{0}	8.00×10^{0}
U-232	1.23×10^{2}	4.00×10^{1}	4.00×10^{1}
U-233	4.76×10^{2}	5.10×10^{2}	5.10×10^{2}
U-234	3.46×10^{2}	2.20×10^{2}	2.20×10^{2}
U-235	1.45×10^{1}	9.00×10^{0}	9.00×10^{0}
U-236	9.57×10^{0}	6.00×10^{0}	6.00×10^{0}
U-238	3.22×10^{2}	1.99×10^{2}	1.99×10^{2}
Pu-238	2.77×10^{3}	4.55×10^{3}	4.55×10^{3}
Pu-239	3.91×10^{4}	6.91×10^{4}	6.91×10^{4}
Pu-240	8.93×10^{3}	1.23×10^{4}	1.23×10^{4}
Pu-241	2.29×10^{5}	8.10×10^{4}	8.10×10^{4}
Pu-242	1.16×10^{0}	1.00×10^{0}	1.00×10^{0}
Am-241	6.99×10^{4}	1.43×10^{5}	1.43×10^{5}
Am-242m	------	------	------
Am-243	9.34×10^{0}	1.50×10^{1}	1.50×10^{1}
Cm-243	1.00×10^{1}	1.10×10^{1}	1.10×10^{1}
Cm-244	2.42×10^{2}	2.09×10^{2}	2.09×10^{2}
Ac-227	------	9.80×10^{1}	9.80×10^{1}
Cf-249	------	------	------
Cf-251	------	------	------
Total	2.13×10^{8}	1.60×10^{8}	1.60×10^{8}

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-4
[b] Duguid 2003 (Reference 2.2.7 [DIRS 164360]), Table 2 (year 2010)

Justification

The data contained in Duguid 2003 (Reference 2.2.7 [DIRS 164360]) were provided directly from the waste generator (Hanford), which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.10 RESOLUTION OF TBV-4598 AND RECOMMENDED VALUES

TBV-4598

TBV-4598 is associated with the total mass and volume of the SRS HLW glass taken from *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Reference 2.2.4 [DIRS 105155]). The TBV values are used in Section 5.2 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The total mass and volume of SRS HLW glass can be calculated from the following sources:

The number of SRS HLW glass canisters reported on p. 5 of the more recent reference, Allison 2004 (Reference 2.2.1 [DIRS 168734]) states that the total number of SRS canisters is 5,060. Table 2 of Allison 2004 (Reference 2.2.1 [DIRS 168734]) shows that the mass of each SRS canister is 1,790 kg. Multiplying 5060 by 1,790 kg, it can be found that the total mass is approximately 9060 MT. This value differs from that reported in Section 5.2 of Reference 2.2.3 [DIRS 151947].

Reference Allison 2004 (Reference 2.2.1 [DIRS 168734], p. 5) states that the projected total waste glass volume in the 5,060 canisters is about 3400 m^3. This value differs from that reported in Section 5.2 of Reference 2.2.3 [DIRS 151947].

It is recommended that the values used in Section 5.2 of Reference 2.2.3 [DIRS 151947] be updated to reflect the recommended values shown in Table 9. Similar values are also reported in *Inventory and Characteristics of Potential Repository Wastes* (Reference 2.2.2 [DIRS 167441], Tables 21 and 22).

Table 9. Comparison of Mass and Volume of SRS HLW Glass

	SRS TBV Value [a]	SRS Revised Value [b]	SRS Recommended Value [b]
Total Mass and Volume of the SRS HLW Glass	11,600 MT 4240 m^3	9060 MT 3400 m^3 [c]	9060 MT 3400 m^3 [c]

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Section 5.2
[b] Allison 2004 (Reference 2.2.1 [DIRS 168734], Table 2 & p. 5)
[c] Allison 2004 (Reference 2.2.1 [DIRS 168734], p. 5)

Justification

The recommended values are from a report by J.R. Fowler, *Projected Glass Composition and Curie Content of Canister from the Savannah River Site (U)* attached as a memorandum from J. M. Allison, Manager, Department of Energy (DOE) Savannah River Operations Office (SR), to John Arthur III, Deputy Director, Office of Civilian Radioactive Waste Management, Las Vegas, NV (Reference 2.2.1 [DIRS 168734]).

The memorandum (Reference 2.2.1 [DIRS 168734]) states that these data have been reviewed and determined by the Deputy Director, Office of Civilian Radioactive Waste Management (OCRWM) as technically adequate and referenceable information on HLW glass. It has been determined that the use of these data is appropriate for this analysis and characterization of the radionuclide inventory for HLW forms/glass for the SRS. The memorandum included in this qualification notes that the Westinghouse Savannah River Company endorses the report demonstrating the reliability of the source.

In brief, these data are directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.11 RESOLUTION OF TBV-4599 AND RECOMMENDED VALUES

TBV-4599

TBV-4599 is associated with the total mass and volume of the SRS HLW glass taken from *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Reference 2.2.4 [DIRS 105155]). The TBV values are used in Section 5.2 of Reference 2.2.3 [DIRS 151947].

Recommended Value

This is a redundant TBV since it is the same as TBV-4598. Resolution of TBV-4598 automatically closes this TBV.

Justification

N/A

6.12 RESOLUTION OF TBV-4600 AND RECOMMENDED VALUES

TBV-4600

TBV-4600 is associated with the number of SRS HLW glass canisters taken from the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV value is used in Table 5-5 of Section 5.2 of Reference 2.2.3 [DIRS 151947].

Recommended Value

Allison 2004 (Reference 2.2.1 [DIRS 168734], p. 5) states that the total number of SRS HLW glass canisters is 5,060. This value is slightly different than the value reported in Table 5-5 of Reference 2.2.3 [DIRS 151947]. The value and reference should be changed to the recommended value in Table 10.

Table 10. Comparison of Number of SRS HLW Glass Canisters

	SRS TBV Value [a]	SRS Revised Value [b]	SRS Recommended Value [b]
Number of SRS HLW Glass Canisters	5978	5060	5060

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-5
[b] Allison 2004 (Reference 2.2.1 [DIRS 168734]), p. 5

Justification

The recommended values are from a report by J.R. Fowler, *Projected Glass Composition and Curie Content of Canister from the Savannah River Site (U)* attached as a memorandum from J. M. Allison, Manager, Department of Energy (DOE) Savannah River Operations Office (SR), to John Arthur III, Deputy Director, Office of Civilian Radioactive Waste Management, Las Vegas, NV (Reference 2.2.1 [DIRS 168734]).

The memorandum (Reference 2.2.1 [DIRS 168734]) states that these data have been reviewed and determined by the Deputy Director, Office of Civilian Radioactive Waste Management (OCRWM) as technically adequate and referenceable information on HLW glass. It has been determined that the use of these data is appropriate for this analysis and characterization of the radionuclide inventory for HLW forms/glass for the SRS. The memorandum included in this qualification notes that the Westinghouse Savannah River Company endorses the report demonstrating the reliability of the source.

In brief, these data are directly from the waste generator, which represents the most authoritative source of information. Therefore, the data is unique and considered reliable.

6.13 RESOLUTION OF TBV-4601 AND RECOMMENDED VALUES

TBV-4601

TBV-4601 is associated with the total mass and volume of the West Valley HLW glass taken from the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV values are used in Section 5.3 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The total mass and volume of West Valley HLW glass can be calculated from the following sources:

Palmer and Misercola 2003 (Reference 2.2.22 [DIRS 163863], p. 2) states that the total number of West Valley canisters is 275. The glass volume is 0.76 m^3 and is based on a previous calculation (Reference 2.2.2 [DIRS 167441], Table 21). 0.76 m^3 is obtained by multiplying the available volume (Reference 2.2.17 [DIRS 157559], WQR-2.2, p. 2 & WQR-3.11, p. 13) by the nominal fill height (Reference 2.2.22 [DIRS 163863], p. 6). Multiplying these values gives an approximate volume of 210 m^3 (0.76 x 275, rounded value), which differs slightly from the value reported in Section 5.3 of Reference 2.2.3 [DIRS 151947].

Picha 1997 (Reference 2.2.13 [DIRS 104406], Attachment 1, p.2) reports that the mass of each West Valley canister is 2,000 kg. Multiplying 275 by 2,000 kg, it can be found that the total mass is approximately 550 MT. This value also differs slightly from that reported in Section 5.3 of Reference 2.2.3 [DIRS 151947].

It is recommended that the values used in Section 5.3 of Reference 2.2.3 [DIRS 151947] be updated to reflect the recommended values shown in Table 11. Similar values are also reported in *Inventory and Characteristics of Potential Repository Wastes* (Reference 2.2.2 [DIRS 167441], Tables 21 and 22 & Section 5.3).

Table 11. Comparison of Mass and Volume of WVDP HLW Glass

	WVDP TBV Values [a]	WVDP Revised Values [b]	WVDP Recommended Values [b]
Total Mass and Volume of the West Valley HLW Glass	540-630 MT 200 m^3	550 MT 210 m^3	550 MT 210 m^3

[a] CRWMS M&O 2000 (Reference 2.2.3[DIRS 151947]), Section 5.3

[b] Palmer and Misercola 2003 (Reference 2.2.22 [DIRS 163863], p. 2), Picha 1997 (Reference 2.2.13 [DIRS 104406], Attachment 1, p.2), and WWNS 2001 (Reference 2.2.17 [DIRS 157559], WQR-2.2, p. 2 & WQR-3.11, p. 13)

Justification

The data contained in References 2.2.17 [DIRS 157559] and 2.2.22 [DIRS 163863] were provided by West Valley Nuclear Services Company (WVNS) and directly from the waste generator, which represents the most authoritative source of information. In addition, the

information contained in Picha 1997 (Reference 2.2.13 [DIRS 104406]) was transmitted through the DOE. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.14 RESOLUTION OF TBV-4602 AND RECOMMENDED VALUES

TBV-4602

TBV-4602 is associated with the mass of each West Valley HLW glass canister taken from the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV value is used in Section 5.3 of Reference 2.2.3 [DIRS 151947].

Recommended value

Picha 1997 (Reference 2.2.13 [DIRS 104406], Attachment 1, p.2) reports that the mass of each West Valley canister is 2,000 kg, which is the same value used in Section 5.3 of Reference 2.2.3 [DIRS 151947]. By resolving TBV-4601 and TBV-4603, this TBV can automatically be closed.

Justification

N/A

6.15 RESOLUTION OF TBV-4603 AND RECOMMENDED VALUES

TBV-4603

TBV-4603 is associated with the number of West Valley HLW glass canisters taken from the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV value is used in Section 5.3 of Reference 2.2.3 [DIRS 151947].

Recommended Value

Palmer and Misercola 2003 (Reference 2.2.22 [DIRS 163863], p. 2) states that the total number of West Valley canisters is 275. The value used in Section 5.3 of Reference 2.2.3 [DIRS 151947] is slightly different. It is recommended that the value be updated to reflect that shown in Table 12 below. Also, the value of 275 is used in the *Inventory and Characteristics of Potential Repository Wastes* calculation (Reference 2.2.2 [DIRS 167441], Table 24 & Section 5.3).

Table 12. Comparison of Number of West Valley HLW Glass Canisters

	WVDP TBV Value [a]	WVDP Revised Value [b]	WVDP Recommended Value [b]
Number of West Valley HLW Glass Canisters	260 - 300	275	275

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Sect. 5-3
[b] Palmer & Misercola (Reference 2.2.22 [DIRS 163863], p. 2)

Justification

The data contained in Reference 2.2.22 [DIRS 163863] were provided by West Valley Nuclear Services Company (WVNS) and directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.16 RESOLUTION OF TBV-4604 AND RECOMMENDED VALUES

TBV-4604

TBV-4604 is associated with the dimensions of the INEEL HLW glass canister taken from reference the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV values are used in Section 5.4 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada.* document (Reference 2.2.5 [DIRS 155970], p. A-40) states that the canister is nominally 10 ft long and 2 ft OD. These are the same values that are quoted in Section 5.4 of Reference 2.2.3 [DIRS 151947]. This TBV can be resolved by updating the reference to the DOE 2002 (Reference 2.2.5 [DIRS 155970]) for these numbers, which are shown in Table 13.

Table 13. Comparison of Dimensions of INTEC HLW Glass Canisters

	INL/INTEC Glass TBV Values [a]	INL/INTEC Glass Revised Values [b]	INL/INTEC Glass Recommended Values [b]
Dimensions of INEEL HLW Glass Canister	2 ft. OD 10 ft. long	2 ft. OD 10 ft. long	2 ft. OD 10 ft. long

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Section 5.4
[b] DOE 2002 (Reference 2.2.5 [DIRS 155970]), p. A-40

Justification

The data is presented in the DOE sponsored *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.5 [DIRS 155970]) and directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.17 RESOLUTION OF TBV-4605 AND RECOMMENDED VALUES

TBV-4605

TBV-4605 is associated with physical parameters of HLW glass canisters taken from the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV values are used in Table 5-11 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The mass and volume of the HLW glass canisters have been addressed through TBVs 4596, 4598, 4601, and 4604. Therefore, this is a redundant TBV.

Justification

N/A

6.18 RESOLUTION OF TBV-4606 AND RECOMMENDED VALUES

TBV-4606

TBV-4606 is associated with the physical parameters of HLW glass canisters taken from the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV values are used in Table 5-11 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The mass and volume of the HLW glass canisters have been addressed through TBVs 4596, 4598, 4601, and 4604. Therefore, this is a redundant TBV.

Justification

N/A

6.19 RESOLUTION OF TBV-4608 AND RECOMMENDED VALUES

TBV-4608

TBV-4608 is associated with the candidate waste for HLW for Hanford taken from Picha 1997. (Reference 2.2.13 [DIRS 104406]). This TBV information is used as part of Assumption 3.3 of Reference 2.2.3 [DIRS 151947].

Recommended Value

Assumption 3.3 of Reference 2.2.3 [DIRS 151947] essentially states that strontium and cesium capsules currently stored in water basins would be blended with liquid HLW prior to vitrification. This assumption is re-affirmed in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.5 [DIRS 155970], p. A-38). Therefore, this TBV can be resolved by using Reference 2.2.5 [DIRS 155970].

Justification

The information is presented in the DOE sponsored *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.5 [DIRS 155970]) and directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.20 RESOLUTION OF TBV-4609 AND RECOMMENDED VALUES

TBV-4609

TBV-4609 is associated with the total activity for Sr-90 in Hanford HLW glass taken from Picha, 1997 (Reference 2.2.13 [DIRS 104406]). The TBV value is used in Table 5-4 of Reference 2.2.3 [DIRS 151947].

Recommended Value

The value used in Reference 2.2.3 [DIRS 151947] is 9.73E+07 Ci (as of 1994) while the value used in Table 25 of Reference 2.2.2 [DIRS 167441] is 4.07E+07 (as of 2010). The source document is Duguid, J. 2003 (Reference 2.2.7 [DIRS 164360], Table 2). It is recommended that the reference and value be updated to reflect those shown in Table 14.

Table 14. Comparison of Sr-90 Total Activity for Hanford HLW Glass

	Hanford TBV Value [a]	Hanford Revised Value [b]	Hanford Recommended Value [b]
Total Activity for Sr-90 in Hanford HLW Glass	9.73E+07Ci as of 1994	4.07E+07Ci as of 2010	4.07E+07Ci as of 2010

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-4
[b] Duguid 2003 (Reference 2.2.7 [DIRS 164360]), Table 2

Justification

The data contained in Duguid 2003 (Reference 2.2.7 [DIRS 164360]) were provided directly from the waste generator (Hanford), which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.21 RESOLUTION OF TBV-4610 AND RECOMMENDED VALUES

TBV-4610

TBV-4610 is associated with the total activity for I-129 in Hanford HLW glass taken from Picha, 1998 (Reference 2.2.14 [DIRS 104407]). The TBV value is used in Table 5-4 of Reference 2.2.3 [DIRS 151947].

Recommended Value

The value used in Reference 2.2.3 [DIRS 151947] is 3.20E+01 Ci (as of 1994) while the value used in Table 25 of Reference 2.2.2 [DIRS 167441] is 4.80E+01 (as of 2010). The source document is Duguid, J. 2003 (Reference 2.2.7 [DIRS 164360], Table 2). It is recommended that the reference and value be updated to reflect those shown in Table 15.

Table 15. Comparison of I-129 Total Activity for Hanford HLW Glass

	Hanford TBV Value [a]	Hanford Revised Value [b]	Hanford Recommended Value [b]
Total Activity for I-129 in Hanford HLW Glass	3.20E+01Ci as of 1994	4.80E+01Ci as of 2010	4.80E+01Ci as of 2010

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-4
[b] Duguid 2003 (Reference 2.2.7 [DIRS 164360]), Table 2

Justification

The data contained in Duguid 2003 (Reference 2.2.7 [DIRS 164360]) were provided directly from the waste generator (Hanford), which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.22 RESOLUTION OF TBV-4611 AND RECOMMENDED VALUES

TBV-4611

TBV-4611 is associated with the mass of each SRS HLW glass canister taken from Pearson, 1998 (Reference 2.2.12 [DIRS 104403]). The TBV value is used in Section 5.2 of Reference 2.2.3 [DIRS 151947].

Recommended Value

The more recent reference, Allison 2004 (Reference 2.2.1 [DIRS 168734]), shows in Table 2 that the mass of each SRS canister is 1,790 kg. This value is also utilized in Table 22 of Reference 2.2.2 [DIRS 167441]. The value used in Reference 2.2.3 [DIRS 151947] is 2000 kg. It is recommended that the value be updated to the recommended value and reference shown in Table 16.

Table 16. Comparison of Mass of SRS HLW Glass Canisters

	SRS TBV Value [a]	SRS Revised Value [b]	SRS Recommended Value [b]
Mass of SRS HLW Glass Canisters	2000 kg	1790 kg	1790 kg

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Section 5.2
[b] Allison 2004 (Reference 2.2.1 [DIRS 168734]), Table 2

Justification

The recommended values are from a report by J.R. Fowler, *Projected Glass Composition and Curie Content of Canister from the Savannah River Site (U)* attached as a memorandum from J. M. Allison, Manager, Department of Energy (DOE) Savannah River Operations Office (SR), to John Arthur III, Deputy Director, Office of Civilian Radioactive Waste Management, Las Vegas, NV (Reference 2.2.1 [DIRS 168734]).

The memorandum (Reference 2.2.1 [DIRS 168734]) states that these data have been reviewed and determined by the Deputy Director, Office of Civilian Radioactive Waste Management (OCRWM) as technically adequate and referenceable information on HLW glass. It has been determined that the use of these data is appropriate for this analysis and characterization of the radionuclide inventory for HLW forms/glass for the SRS. The memorandum included in this qualification notes that the Westinghouse Savannah River Company endorses the report demonstrating the reliability of the source.

In brief, these data are directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.23 RESOLUTION OF TBV-4612 AND RECOMMENDED VALUES

TBV-4612

TBV-4612 is associated with the activity of West Valley HLW glass taken from reference WVNS 1998 (Reference 2.2.16 [DIRS 103500]). The TBV values are used in Table 5-6 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The radionuclide inventory presented in Table 5-6 of Reference 2.2.3 [DIRS 151947] is as of year 1996. Data for West Valley HLW glass is also presented for year 2010 in Table 25 of Reference 2.2.2 [DIRS 167441], which uses the source, document WVNS 2003 (Reference 2.2. 20 [DIRS 168661], Attachment A). It is recommended that the radionuclide inventory of WVDP HLW glass be updated to reflect those listed in Table 17.

Table 17. Comparison of Total Activity of WVDP HLW Glass

Radionuclide	WVDP TBV Values [a] (Ci)	WVDP Revised Values [b] (Ci)	WVDP Recommended Values [b] (Ci)
^{3}H	5.87×10^{1}	--	--
^{14}C	1.37×10^{2}	--	--
^{55}Fe	1.42×10^{2}	--	--
^{60}Co	3.49×10^{2}	--	--
^{59}Ni	1.06×10^{2}	1.09×10^{2}	1.09×10^{2}
^{63}Ni	8.17×10^{3}	8.84×10^{3}	8.84×10^{3}
^{79}Se	6.02×10^{1}	--	--
^{90}Sr	5.81×10^{6}	2.65×10^{6}	2.65×10^{6}
^{90}Y	5.81×10^{6}	2.65×10^{6}	2.65×10^{6}
^{93}Zr	2.72×10^{2}	1.86×10^{2}	1.86×10^{2}
^{93m}Nb	2.07×10^{2}	1.86×10^{2}	1.86×10^{2}
^{99}Tc	1.70×10^{3}	8.16×10^{2}	8.16×10^{2}
^{106}Ru	2.31×10^{-1}	--	--
^{106}Rh	2.31×10^{-1}	--	--
^{107}Pd	1.10×10^{1}	--	--
^{113m}Cd	1.60×10^{3}	--	--
^{121m}Sn	1.61×10^{1}	--	--
^{126}Sn	1.04×10^{2}	4.97×10^{1}	4.97×10^{1}
^{125}Sb	1.62×10^{3}	--	--
^{126m}Sb	1.04×10^{2}	4.97×10^{1}	4.97×10^{1}
^{126}Sb	1.46×10^{1}	6.96×10^{0}	6.96×10^{0}
^{125m}Te	3.97×10^{2}	--	--
^{129}I	2.10×10^{-1}	--	--
^{134}Cs	6.87×10^{2}	--	--
^{135}Cs	1.61×10^{2}	1.77×10^{2}	1.77×10^{2}
^{137}Cs	6.29×10^{6}	4.66×10^{6}	4.66×10^{6}
^{137m}Ba	5.95×10^{6}	4.40×10^{6}	4.40×10^{6}
^{144}Ce	3.11×10^{-3}	--	--
^{144}Pr	3.11×10^{-3}	--	--

Table 17. Comparison of Total Activity of WVDP HLW Glass (cont.)

Radionuclide	WVDP TBV Values [a] (Ci)	WVDP Revised Values [b] (Ci)	WVDP Recommended Values [b] (Ci)
^{146}Pm	5.11×10^{0}	--	--
^{147}Pm	1.80×10^{4}	--	--
^{151}Sm	8.05×10^{4}	4.66×10^{4}	4.66×10^{4}
^{152}Eu	2.69×10^{2}	--	--
^{154}Eu	5.91×10^{4}	--	--
^{155}Eu	1.03×10^{4}	--	--
^{207}Tl	9.40×10^{0}	--	--
^{208}Tl	3.09×10^{0}	6.10×10^{-1}	6.10×10^{-1}
^{211}Pb	9.43×10^{0}	--	--
^{212}Pb	8.62×10^{0}	--	--
^{211}Bi	9.43×10^{0}	--	--
^{212}Bi	8.62×10^{0}	--	--
^{212}Po	5.52×10^{0}	--	--
^{215}Po	9.43×10^{0}	--	--
^{216}Po	8.62×10^{0}	--	--
^{219}Rn	9.43×10^{0}	--	--
^{220}Rn	8.62×10^{0}	--	--
^{223}Fr	1.30×10^{-1}	--	--
^{223}Ra	9.43×10^{0}	--	--
^{224}Ra	8.62×10^{0}	--	--
^{228}Ra	1.58×10^{0}	1.90×10^{0}	1.90×10^{0}
^{227}Ac	9.43×10^{0}	4.51×10^{1}	4.51×10^{1}
^{228}Ac	1.58×10^{0}	--	--
^{227}Th	9.30×10^{0}	--	--
^{228}Th	8.62×10^{0}	--	--
^{229}Th	2.15×10^{-1}	6.88×10^{-3}	6.88×10^{-3}
^{230}Th	5.87×10^{-2}	3.01×10^{-4}	3.01×10^{-4}
^{232}Th	1.64×10^{0}	2.33×10^{0}	2.33×10^{0}
^{231}Pa	1.52×10^{1}	4.50×10^{1}	4.50×10^{1}
^{232}U	6.87×10^{0}	--	--
^{233}U	9.53×10^{0}	5.59×10^{0}	5.59×10^{0}
^{234}U	4.61×10^{0}	2.43×10^{0}	2.43×10^{0}
^{235}U	1.01×10^{-1}	1.97×10^{-5}	1.97×10^{-5}
^{236}U	2.96×10^{-1}	4.20×10^{-4}	4.20×10^{-4}
^{237}U	--	5.87×10^{-1}	5.87×10^{-1}
^{238}U	8.54×10^{-1}	--	--
^{236}Np	9.47×10^{0}	--	--
^{237}Np	2.35×10^{1}	3.25×10^{1}	3.25×10^{1}
^{238}Np	--	2.72×10^{0}	2.72×10^{0}
^{239}Np	3.47×10^{2}	5.59×10^{2}	5.59×10^{2}
^{236}Pu	8.43×10^{-1}	--	--
^{238}Pu	8.04×10^{3}	4.76×10^{3}	4.76×10^{3}
^{239}Pu	1.65×10^{3}	1.43×10^{3}	1.43×10^{3}
^{240}Pu	1.22×10^{3}	1.02×10^{3}	1.02×10^{3}

Table 17. Comparison of Total Activity of WVDP HLW Glass (cont.)

Radionuclide	WVDP TBV Values [a] (Ci)	WVDP Revised Values [b] (Ci)	WVDP Recommended Value [b] (Ci)
^{241}Pu	6.13×10^{4}	2.45×10^{4}	2.45×10^{4}
^{242}Pu	1.65×10^{0}	2.79×10^{-3}	2.79×10^{-3}
^{241}Am	5.35×10^{4}	4.20×10^{4}	4.20×10^{4}
^{242m}Am	2.89×10^{2}	6.03×10^{2}	6.03×10^{2}
^{242}Am	2.87×10^{2}	6.01×10^{2}	6.01×10^{2}
^{243}Am	3.47×10^{2}	5.59×10^{2}	5.59×10^{2}
^{242}Cm	2.38×10^{2}	4.98×10^{2}	4.98×10^{2}
^{243}Cm	1.16×10^{2}	--	--
^{244}Cm	6.07×10^{3}	5.64×10^{3}	5.64×10^{3}
^{245}Cm	8.81×10^{-1}	--	--
^{246}Cm	1.01×10^{-1}	--	--
Sum (Ci)	2.42×10^{7}	1.45×10^{7}	1.45×10^{7}

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-6
[b] BSC 2004 (Reference 2.2.2 [DIRS 167441], Table 25) and WVNS 2003 (Reference 2.2.20 [DIRS 168661], Attachment A)

Justification

The data contained in Reference 2.2.20 [DIRS 168661] were provided by West Valley Nuclear Services Company (WVNS) and directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.24 RESOLUTION OF TBV-4615 AND RECOMMENDED VALUES

TBV-4615

TBV-4615 is associated with the mass of the ANL-W HLW ceramic matrix taken from reference Goff 1998 (Reference 2.2.9 [DIRS 104392]). The TBV value is used in Table 5-7 of Reference 2.2.3 [DIRS 151947].

Recommended Value

The TBV value for the mass of ANL-W ceramic is 144,000 kg (Reference 2.2.3 [DIRS 151947], Table 5-7). This value is re-affirmed in the *Inventory and Characteristics of Potential Repository Wastes* (Reference 2.2.2 [DIRS 167441], Table F-2, p. F-1). Therefore, it is recommended that the same value be used, as shown in Table 18, and that this TBV is resolved by using Picha 1997 (Reference 2.2.13 [104406], Attachment 1, Table ID-2), Goff 1998 (Reference 2.2.10 [DIRS 104389], and Goff 1998 (Reference 2.2.9 [104392]) which are also referenced by DOE 2002 (Reference 2.2.5 [DIRS 155970], p. A-40) and in BSC 2004 (Reference 2.2.2 [167441]).

Table 18. Comparison of Total Mass of ANL-W Ceramic Matrix

	ANL-W Ceramic TBV Value [a]	ANL-W Ceramic Revised Value [b]	ANL-W Ceramic Recommended Value [b]
Total mass of ANL-W ceramic matrix	144,000 kg	144,000 kg	144,000 kg

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-7
[b] Picha 1997 (Reference 2.2.13 [104406]), Attachment 1, Table ID-2, Goff 1998 (Reference 2.2.10 [104389]), Goff 1998 (Reference 2.2.9 [104392])

Justification

The data is presented in Picha 1997 (Reference 2.2.13 [104406]), Goff 1998 (Reference 2.2.10 [DIRS 104389], and Goff 1998 (Reference 2.2.9 [104392]) which are also reference by DOE 2002 (Reference 2.2.5 [DIRS 155970]) and BCS 2004 (Reference 2.2.2 [167441]). The data is directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.25 RESOLUTION OF TBV-4616 AND RECOMMENDED VALUES

TBV-4616

TBV-4616 is associated with the total West Valley HLW glass mass and volume taken from Picha 1998 (Reference 2.2.21 [DIRS 104413]). The TBV values are used in Table 5-7 of Reference 2.2.3 [DIRS 151947].

Recommended Values

This is a redundant TBV since it is the same as TBV-4601. Resolution of TBV-4601 automatically closes this TBV

Justification

N/A

6.26 RESOLUTION OF TBV-4617 AND RECOMMENDED VALUES

TBV-4617

TBV-4617 is associated with the total activity of INTEC HLW glass taken from Picha 1998 (Reference 2.2.21 [DIRS 104413]). The TBV values are used in Table 5-8 of Reference 2.2.3 [DIRS 151947].

Recommended Values

The radionuclide inventory presented in Table 5-8 of Reference 2.2.3 [DIRS 151947] is as of year 2035. Data for INTEC HLW glass is presented for year 2010 in Table 25 of Reference 2.2.2 [DIRS 167441] which uses the source document Picha 1998 (Reference 2.2.21 [DIRS 104413], Table ID-II) as its basis. It is recommended that the radionuclide inventory be updated to reflect that of year 2010, as shown in Table 19.

Table 19. Comparison of Total Activity of INTEC HLW Glass

	INEEL/INTEC TBV Value [a] (Ci)	INEEL/INTEC Revised Value [b] (Ci)	INEEL/INTEC Recommended Value [b] (Ci)
^{3}H	3.56×10^{3}	1.45×10^{4}	1.45×10^{4}
^{14}C	2.78×10^{-2}	2.79×10^{-2}	2.79×10^{-2}
^{60}Co	3.21×10^{1}	8.61×10^{2}	8.61×10^{2}
^{90}Sr	7.04×10^{6}	1.30×10^{7}	1.30×10^{7}
^{90}Y	7.04×10^{6}	1.30×10^{7}	1.30×10^{7}
^{93m}Nb	4.74×10^{2}	1.39×10^{3}	1.39×10^{3}
^{94}Nb	5.36×10^{-3}	5.37×10^{-3}	5.37×10^{-3}
^{99}Tc	3.41×10^{3}	3.41×10^{3}	3.41×10^{3}
^{102}Rh	1.99×10^{-5}	--	--
^{126}Sn	8.91×10^{1}	8.91×10^{1}	8.91×10^{1}
^{125}Sb	1.03×10^{0}	5.89×10^{2}	5.89×10^{2}
^{129}I	5.64×10^{0}	5.64×10^{0}	5.64×10^{0}
^{134}Cs	3.28×10^{-2}	1.46×10^{2}	1.46×10^{2}
^{135}Cs	1.63×10^{2}	1.63×10^{2}	1.63×10^{2}
^{137}Cs	5.95×10^{6}	1.06×10^{7}	1.06×10^{7}
^{137m}Ba	5.60×10^{6}	1.03×10^{7}	1.03×10^{7}
^{147}Pm	2.67×10^{1}	1.98×10^{4}	1.98×10^{4}
^{154}Eu	5.98×10^{3}	4.50×10^{4}	4.50×10^{4}
^{155}Eu	7.55×10^{0}	3.06×10^{2}	3.06×10^{2}
^{226}Ra	--	5.62×10^{-3}	5.62×10^{-3}
^{230}Th	3.95×10^{-1}	3.73×10^{-1}	3.73×10^{-1}
^{232}Th	9.89×10^{-8}	9.70×10^{-8}	9.70×10^{-8}
^{232}U	4.63×10^{-3}	5.94×10^{-3}	5.94×10^{-3}
^{233}U	1.33×10^{-3}	5.97×10^{-4}	5.97×10^{-4}

Table 19. Comparison of Total Activity of INTEC HLW Glass (cont.)

	INEEL/INTEC TBV Value [a] (Ci)	INEEL/INTEC Revised Value [b] (Ci)	INEEL/INTEC Recommended Value [b] (Ci)
^{234}U	9.95×10^{1}	9.25×10^{1}	9.25×10^{1}
^{235}U	5.90×10^{-1}	5.90×10^{-1}	5.90×10^{-1}
^{236}U	1.54×10^{0}	1.54×10^{0}	1.54×10^{0}
^{238}U	2.94×10^{-2}	2.94×10^{-2}	2.94×10^{-2}
^{237}Np	6.26×10^{0}	6.16×10^{0}	6.16×10^{0}
^{238}Pu	8.98×10^{4}	1.09×10^{4}	1.09×10^{4}
^{239}Pu	1.81×10^{3}	1.81×10^{3}	1.81×10^{3}
^{240}Pu	1.57×10^{3}	1.57×10^{3}	1.57×10^{3}
^{241}Pu	1.93×10^{4}	6.45×10^{4}	6.45×10^{4}
^{242}Pu	3.42×10^{0}	3.42×10^{0}	3.42×10^{0}
^{241}Am	1.27×10^{4}	1.17×10^{4}	1.17×10^{4}
^{242m}Am	--	1.70×10^{-2}	1.70×10^{-2}
^{242}Am	--	1.70×10^{-2}	1.70×10^{-2}
^{243}Am	1.39×10^{-2}	1.39×10^{-2}	1.39×10^{-2}
^{242}Cm	--	1.70×10^{-2}	1.70×10^{-2}
^{243}Cm	4.70×10^{-4}	8.64×10^{-4}	8.64×10^{-4}
^{244}Cm	1.03×10^{-2}	2.68×10^{-2}	2.68×10^{-2}
^{245}Cm	--	3.70×10^{-6}	3.70×10^{-6}
^{246}Cm	--	8.69×10^{-8}	8.69×10^{-8}
^{247}Cm	--	3.09×10^{-14}	3.09×10^{-14}
^{248}Cm	--	9.35×10^{-15}	9.35×10^{-15}
Sum (Ci)	2.58×10^{7}	4.72×10^{7}	4.72×10^{7}

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-8
[b] BSC 2004 (Reference 2.2.2 [DIRS 167441], Table 25) and Picha 1998 (Reference 2.2.21 [DIRS 104413], Table ID-II)

Justification

The data contained in Reference 2.2.21 [DIRS 104413] were provided by the DOE and directly from the waste generator, which represents the most authoritative source of information. There are no better sources for these data. Therefore, the data is unique and considered reliable.

6.27 RESOLUTION OF TBV-4618 AND RECOMMENDED VALUES

TBV-4618

TBV-4618 is associated with the total activity of Hanford HLW glass taken from the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* report (Reference 2.2.4 [DIRS 105155]). The TBV values are used in Table 5-4 of Reference 2.2.3 [DIRS 151947].

Recommended Values

This is a redundant TBV since it is the same as TBV-4597. Resolution of TBV-4597 automatically closes this TBV

Justification

N/A

7 RESULTS AND CONCLUSIONS

Section 6 of this analysis has provided the basis for resolving 27 TBVs associated with the document *Source Terms for HLW Glass Canisters* (Reference 2.2.3 [DIRS 151947]). In addition, it has recommended which HLW glass waste values/parameters to use for shielding and dose rate analyses to promote consistent usage on the Yucca Mountain Project. Table 20 below provides a summary and overview of the resolution for each TBV.

Table 20. Summary of TBV Resolution and Recommendations

TBV No.	Description	Resolution/Values Description	Recommendations
TBV-3840	Chemical composition of Hanford HLW glass	Section 6.1	Update TBV values to use the values in Ref. 2.2.7 [DIRS 164360], Table 1
TBV-3841	Chemical composition of INTEC HLW glass	Section 6.2	Update TBV values to use the values in Ref. 2.2.5 [DIRS 155970], Table A-33
TBV-3842	Radionuclide inventory of SRS HLW glass canister	Section 6.3	Update TBV values to use the values in Ref. 2.2.1 [DIRS 168734], Table 2
TBV-3843	Chemical composition of SRS HLW glass	Section 6.4	Update TBV values to use the values in Ref. 2.2.1 [DIRS 168734], Table 3
TBV-3844	Chemical composition of West Valley HLW glass	Section 6.5	No change in TBV values but use Ref. 2.2.17 [DIRS 157559], WQR-1.1, Table 2 instead
TBV-3846	Chemical composition of INTEC HLW	Section 6.6	Redundant TBV (same as TBV-3841)
TBV-4595	Number of the Hanford Site HLW canisters	Section 6.7	Update TBV values to use the values in Ref. 2.2.7 [DIRS 164360], Table 3
TBV-4596	Mass of the Hanford Site HLW in each canister	Section 6.8	Update TBV values to use the values in Ref. 2.2.7 [DIRS 164360], Results
TBV-4597	Total activity of Hanford HLW glass	Section 6.9	Update TBV values to use the values in Ref. 2.2.7 [DIRS 164360], Table 2 (year 2010)
TBV-4598	Total mass and volume of the SRS HLW glass	Section 6.10	Update TBV values to use the values in Ref. 2.2.1 [DIRS 168734] , Table 2 & p. 5
TBV-4599	Total mass and volume of the SRS HLW glass	Section 6.11	Redundant TBV (same as TBV-4598)
TBV-4600	Number of SRS HLW glass canisters	Section 6.12	Update TBV values to use the values in Ref. 2.2.1 [DIRS 168734], p. 5
TBV-4601	Total mass and volume of the West Valley HLW glass	Section 6.13	Update TBV values to use the values in Ref. 2.2.17 [DIRS 157559], WQR-2.2, p. 2 & WQR-3.11, p. 13, Ref. 2.2.13 [DIRS 104406], Attachment 1, p. 2, & Ref 2.2.22 [DIRS 163863], p. 2
TBV-4602	Mass of each West Valley HLW glass canister	Section 6.14	Resolving TBV-4601 and TBV-4603 will automatically resolve this TBV
TBV-4603	Number of West Valley HLW glass canisters	Section 6.15	Update TBV values to use the values in Ref. 2.2.22 [DIRS 163863], p. 2
TBV-4604	Dimensions of INEEL HLW glass canister	Section 6.16	No change in TBV values but use Ref. Ref. 2.2.5 [DIRS 155970], p.A-40 instead

Table 20. Summary of TBV Resolution and Recommendations (cont.)

TBV No.	Description	Resolution/Values Description	Recommendations
TBV-4605	Physical parameters of HLW glass canister	Section 6.17	This TBV has been resolved by TBVs 4596, 4598, 4601, and 4604
TBV-4606	Physical parameters of HLW glass canister	Section 6.18	This TBV has been resolved by TBVs 4596, 4598, 4601, and 4604
TBV-4608	Candidate waste for HLW for Hanford Site	Section 6.19	No change in TBV values but use Ref. Ref. 2.2.5 [DIRS 155970], p. A-38 instead
TBV-4609	Total activity for SR-90 in Hanford HLW Glass	Section 6.20	Update TBV values to use the values in Ref. 2.2.7 [DIRS 164360], Table 2
TBV-4610	Total Activity for I-129 in Hanford HLW Glass	Section 6.21	Update TBV values to use the values in Ref. 2.2.7 [DIRS 164360], Table 2
TBV-4611	Mass of each SRS HLW glass canister	Section 6.22	Update TBV values to use the values in Ref. 2.2.1 [DIRS 168734], Table 2
TBV-4612	Activity of West Valley HLW glass	Section 6.23	Update TBV values to use the values in Ref. 2.2.2 [167441],Table 25 & Ref. 2.2.20 [DIRS 168661]
TBV-4615	Mass of the ANL-W HLW Ceramic	Section 6.24	No change in TBV values but use Refs. 2.2.13 [DIRS 104406], 2.2.10 [DIRS 104389], & 2.2.9 [DIRS 104392]
TBV-4616	Total West Valley HLW Glass Mass and Volume	Section 6.25	Redundant TBV (same as TBV-4601)
TBV-4617	Total Activity of INTEC HLW Glass	Section 6.26	Update TBV values to use the values in Ref. 2.2.2 [DIRS 167441], Table 25 & Ref. 2.2.21 [DIRS 104413], Table ID-II
TBV-4618	Total Activity of Hanford HLW Glass	Section 6.27	Redundant TBV (same as TBV-4597)