BSC

Design Calculation or Analysis Cover Sheet

Complete only applicable items.

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2. Page 1 of 51

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

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Attachment 2 Compact Disk (Electronic Attachment)	N/A
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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.

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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 for this analysis is to revise and update the previous analysis to address CR 10439. The revision also includes an update of the Savannah River Site (SRS) source term composition and reference. In addition, included are updates to the West Valley Nuclear Services, Idaho National Engineering and Environmental Laboratory, and the Hanford Waste Treatment Plant (WTP) site.

This document resolves 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 2.2.2 [DIRS 151947]). In addition, recommendations are included for 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. 8. *Calculations and Analyses.* Las Vegas, Nevada: Bechtel SAIC Company.

2.2 DESIGN INPUTS

2.2.1 Ray, Jeff W. 2007. *Projected Glass Composition and Curie Content of Canisters from Savannah River Site (U).* X-ESR-S-00015, Rev 1. 1. 17. Aiken, SC: Washington Savannah River Company. ACC: MOL.20070704.0427 [DIRS 181690]

2.2.2 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]

2.2.3 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]

2.2.4 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: [DIRS 155970]

2.2.5 Shleien, B., ed. 1992. *The Health Physics and Radiological Health Handbook.* Revised Edition. Silver Spring, Maryland: Scinta. TIC: 9360. [DIRS 127299]

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2.2.7 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]

2.2.8 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]

2.2.9 Reserved

2.2.10 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]

2.2.11 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]

2.2.12 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]

2.2.13 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]

2.2.14 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]

2.2.15 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]

2.2.16 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]

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

2.2.18 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. [DIRS 104395]

2.2.19 Reserved

2.2.20 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]

2.2.21 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]

2.2.22 DOE (U.S. Department of Energy) 2004. Waste Treatment and Immobilization Plant (WTP) High-Level Waste (HLW) Canister Production Estimates to Support Analyses by the Yucca Mountain Project. DOE/ORP-2004-03, Rev. 0. Richland, Washington: U.S. Department of Energy, Office of River Protection. ACC: MOL.20041005.0256. [DIRS 172092]

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. 2.2.2 [DIRS 151947]).

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 2.2.17, Table A-1, p. A-4). Therefore, the approved version is designated as QA:QA.

4.2 USE OF SOFTWARE

The commercially available Microsoft® Excel® 2003 (11.8105.8107 SP2) which is a component of Microsoft Office 2003 Professional, is used to perform simple algebraic calculations for this calculation.

Microsoft® Office 2000 Professional is installed on a personnel computer running Microsoft® Windows 2000 Professional (Central Processing number 503117). Microsoft® Office 2000 Professional is listed on the Controlled Software Report and is identified in the Repository Project Management automation plan. The use of Excel® constitutes level 2 software usage per Ref. 2.1.3 and does not require qualification.

Attachment 2 contains the Excel spreadsheet for this document.

4.3 ANALYSIS APPROACH

This analysis provides the basis for resolving 27 TBVs associated with the document *Source Terms for HLW Glass Canisters* (Reference 2.2.2 [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

	Number of Pages
Attachment 1: List of Files on attached CD	1
Attachment 2: Compact Disk (Electronic Attachment)	N/A
Attachment 3: E-mail Pearson to Private User	1

6. BODY OF CALCULATION

The following sections provide the bases for each TBV resolution 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 with respect to the source term. 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 2.2.12 [DIRS 104406]). The TBV values are used in Table 5-1 of Reference 2.2.2 [DIRS 151947].

Recommended Values

The chemical composition of Hanford HLW glass presented in Table 1 of the more recent reference DOE 2004 (Reference 2.2.22 [DIRS 172092]), has different values from the values used in Table 5-1 of Reference 2.2.2 [DIRS 151947]. It is recommended that the values used in Table 5-1 of Reference 2.2.2 [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 2.2.22 [DIRS 172092]) with the highest waste loading (i.e., 45%) for conservative radiological consequences. Table 1 below compares the values from Table 5-1 of Reference 2.2.2 [DIRS 151947] to the recommended values for waste oxides that contribute > 0.01% to the total weight. Note that for bounding shielding calculations involving Hanford HLW canisters, it is appropriate to use the composition for the AZ-101 canister as described in DOE 2004 (Reference 2.2.22 [DIRS 172092], Table 4).

Table 1. Comparison of Hanford Chemical Compositions

Compound/Metal	Hanford TBV Values (wt%) [a]	Hanford Revised Values (wt%) [b]	Hanford Recommended Values (wt%) [c,d]
Ag_2O	----	0.01-0.02	0.02
Al_2O_3 [d]	9.31	10.04-11.98	11.98
B_2O_3 [d]	7.02	6.03-7.20	6.03
BaO	0.06	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
Ce_2O_3	1.13	0.05-0.07	0.07
Cl	----	0.00-0.01	0.01
Co_2O_3	----	0.01	0.01
Cr_2O_3	0.36	0.37-0.61	0.61

Table 1. Comparison of Hanford Chemical Compositions (Continued)

Compound/Metal	Hanford TBV Values (wt%) [a]	Hanford Revised Values (wt%) [b]	Hanford Recommended Values (wt%) [c,d]
Cs_2O	----	0.00-0.01	0.01
CuO	----	0.01-0.02	0.02
F	----	0.40-0.64	0.64
Fe_2O_3 [d]	4.49	6.58-8.59	8.59
K_2O	0.17	0.16-0.26	0.26
La_2O_3	0.11	0.07-0.11	0.11
Li_2O [d]	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
Na_2O [d]	11.79	20.42-21.50	21.50
NaF	0.63	0.00	0.00
Na_2SO_4	0.1	0.00	0.00
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	0.00	0.00
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
SiO_2 [d]	46.11	42.16-34.80	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
Tl_2O_3	----	0.03-0.05	0.05
UO_3	6.69	0.00	0.00
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

Table 1. Comparison of Hanford Chemical Compositions (Continued)

Compound/Metal	Hanford TBV Values (wt%) [a]	Hanford Revised Values (wt%) [b]	Hanford Recommended Values (wt%) [c,d]
ZrO_2	3.79	0.66-1.07	1.07
Total			**100**

[a] CRWMS M&O 2000 (Reference 2.2.2 [DIRS 151947]), Table 5-1

[b] DOE 2004 (Reference 2.2.22 [DIRS 172092], Table 1 (all cases)

[c] DOE 2004 (Reference 2.2.22 [DIRS 172092]), 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 2.2.12 [DIRS 104406]). The TBV values are used in Table 5-1 of Reference 2.2.2 [DIRS 151947].

Recommended Values

It is recommended that the values used in Table 5-1 of Reference 2.2.2 [DIRS 151947] be updated to those shown in Table 2 (fourth column). These values were subsequently used to provide the waste form composition as required in the *Yucca Mountain Review Plan* (Reference 2.2.10 [DIRS 163274], Section 2.1.1.2.2, p. 2.1-15). The values come directly from DOE 2002 (Reference 2.2.4 [DIRS 155970]) which cites Picha 1997 (Reference 2.2.12 [DIRS 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 Tables ID-1, ID-3, and ID-4 of Picha 1997 (Reference 2.2.12 [DIRS 104406]).

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	7.11	7.11
B_2O_3	11.30	10.94	10.94
CaF_2	7.99	7.75	7.75
CaO	0.23	0.22	0.22
Cs_2O	0.02	0.01	0.01
Fe_2O_3	0.05	0.04	0.04
Na_2O	13.92	13.48	13.48
P_2O_5	0.06	0.05	0.05
SiO_2	56.68	54.87	54.87
ZrO_2	0.96	0.93	0.93
$N_3H_{12}PMo_{12}O_{40}$	1.44	1.40	1.40
Cd	---	2.27	2.27
Cr	---	0.73	0.73
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 2.2.2 [DIRS 151947]), Table 5-1
[b] Values are calculated in Excel file *HLW.xls*, Spreadsheet INTEC

Justification

The data contained in DOE 2002 (Reference 2.2.4 [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 2.2.14 [DIRS 101908]). The TBV values are used in Table 5-5 of Reference 2.2.2 [DIRS 151947].

Recommended Values

The radionuclide inventory of SRS HLW glass canisters presented in Table 2 of the more recent reference, Ray 2007 (Reference 2.2.1 [DIRS 181690]) are different from Table 5-5 of Reference 2.2.2 [DIRS 151947]. It is recommended that the values used in Table 5-5 of Reference 2.2.2 [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 (Reference 2.2.1 [DIRS 181690], Table 2).

Table 3. Comparison of SRS Radionuclide Inventory per Canister

Nuclide	SRS Glass TBV Values (Ci) [a]	SRS Glass Revised Values (Ci) [b]	SRS Glass Recommended Values (Ci) [c]
Year of Inventory >>>>>>	2010	1982	11/16/2006
Co-60	1.70E+02	1.72E+02	1.86E+02
Ni-59	2.39E-02	2.42E-02	8.44E-01
NI-63	2.97E+00	3.01E+00	8.01E+01
Se-79	1.70E-01	1.72E-01	5.34E-01
Sr-90	4.82E+04	4.73E+04	3.43E+04
Y-90	4.77E+04	4.84E+04	3.43E+04
Zr-93	1.12E+00	1.13E+00	3.86E-01
Nb-93m	------	-------	1.49E-01
Tc-99	3.07E+00	3.11E+00	9.16E+00
Ru-106	2.24E+03	2.28E+03	4.36E+00
Rh-106	2.25E+03	------	------
Pd-107	1.47E-02	1.49E-02	1.31E-03
Cd-113	-----	5.06E-14	2.62E-11
Sn-121m	-------	-------	1.94E+00
Sn-126	4.38E-01	4.46E-01	7.83E-01
Sb-125	8.60E+02	------	1.20E+02
I-129	------	------	3.22E-04
Cs-134	3.36E+02	3.41E+02	1.95E+02
Cs-135	9.92E-02	1.01E-01	2.16E-01
Cs-137	4.33E+04	4.39E+04	5.55E+04
Ba-137m	4.14E+04	4.20E+04	5.25E+04
Ce-144	9.84E+03	9.98E+03	3.83E+00
Pr-144	9.85E+03	-----	------
Pr-144m	------	9.98E+03	3.83E+00
Pm-147	2.41E+04	2.45E+04	2.22E+03
Sm-151	2.39E+02	2.51E+02	1.61E+02
Eu-154	6.20E+02	6.26E+02	4.19E+02

Table 3. Comparison of SRS Radionuclide Inventory per Canister (Continued)

Nuclide	SRS Glass TBV Values (Ci) [a]	SRS Glass Revised Values (Ci) [b]	SRS Glass Recommended Values (Ci) [c]
Year of Inventory >>>>>>	2010	1982	11/16/2006
Eu-155	4.91E+02	4.80E+02	6.79E-01
Th-229	------	------	8.89E-05
Th-230	------	------	7.98E-06
Th-232	------	------	1.40E-03
U-232	------	1.35E-02	2.98E-04
U-233	------	1.60E-06	5.59E-02
U-234	3.42E-02	3.47E-02	4.52E-02
U-235	------	1.59E-04	6.64E-04
U-236	------	1.14E-03	3.67E-03
U-238	1.05E-02	1.06E-02	4.74E-02
Np-237	8.86E-03	9.00E-03	2.88E-02
Pu-238	1.48E+03	1.50E+03	9.86E+02
Pu-239	1.29E+01	1.31E+01	1.74E+01
Pu-240	8.67E+00	8.78E+00	8.40E+00
Pu-241	1.66E+03	1.69E+03	8.44E+02
Pu-242	1.22E-02	1.24E-02	2.14E-02
Am-241	1.10E+01	1.11E+01	3.33E+02
Am-242m	------	1.46E-02	7.77E-02
Am-243	5.79E-03	5.85E-03	1.37E+00
Cm-243	------	5.63E-03	4.23E-01
Cm-244	1.07E+02	1.09E+02	4.37E+02
Cm-245	------	6.79E-06	2.42E-02
Cm-246	------	5.40E-07	2.90E-02
Cm-247	------	6.68E-13	2.20E-02
Cm-248	------	6.94E-13	------
Cf-249	------	------	2.34E-02
Cf-251	------	------	1.85E-02
Total	2.35E+05	2.33E+05	1.83E+05

[a] CRWMS M&O 2000 (Reference 2.2.2 [DIRS 151947]), Table 5-5
[b] Ray 2007 (Reference 2.2.1 [DIRS 181690]), Table 2 (DWPF Design Basis)
[c] Ray 2007 (Reference 2.2.1 [DIRS 181690]), Table 2 (New Projected Maximum)

Justification

The recommended values are from a report Ray (2007) *Projected Glass Composition and Curie Content of Canister from the Savannah River Site U* (Reference 2.2.1 [DIRS 181690], Appendix 1). It has been determined that the use of these updated data is appropriate for this analysis and characterization of the radionuclide inventory for HLW forms/glass for the SRS (Reference 2.2.1 [DIRS 181690]).

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 2.2.7 [DIRS 101829]). The TBV values are used in Table 5-1 of Reference 2.2.2 [DIRS 151947].

Recommended Values

The chemical composition of SRS HLW glass presented in Table 3 of the more recent reference, Ray 2007 (Reference 2.2.1[DIRS 181690]) varies from the values used in Table 5-1 of Reference 2.2.2 [DIRS 151947]. It is recommended that the values used in Table 5-1 of Reference 2.2.2 [DIRS 151947] be updated to those of the more recent reference. The recommended values in Table 4 (fourth column) were normalized and present a set of single point values for a possible worst-case composition from the high viscosity glass (Reference 2.2.1 [DIRS 181690], Table 3). Therefore, the recommended values bound the data previously used in terms of glass waste composition. Note that the recommended values have been renormalized to 100% ("other" compound/metal was removed).

Table 4. Comparison of SRS Chemical Compositions

Compound/Metal	SRS TBV Values (wt%)[a]	SRS Revised Values (wt%)[b]	SRS Recommended Values (wt%)[c,d]
Al_2O_3	3.97	2.88 - 7.06	7.08
B_2O_3	7.98	6.92 - 10.17	6.94
BaO	------	0.12 - 0.19	0.12
$BaSO_4$	9.27	------	0.00
CaO	0.96	1.03 - 1.05	1.05
CdO	------	0.00077 - 0.0020	0.00
$CaSO_4$	0.08	------	0.00
CoO	------	0 – 0.0041	0.00
Cr_2O_3	0.12	0.085 – 0.14	0.09
Cs_2O	0.12	0.073 – 0.08	0.07
CuO	0.44	0.25 – 0.42	0.25
Fe_2O_3	10.37	7.36 – 12.69	7.38
K_2O	3.85	2.13 – 3.57	2.14
La_2O_3	------	0.0082 - 0.088	0.09
Li_2O	4.38	3.1 - 4.61	4.62
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
Na_2O	8.7	8.22 – 12.15	8.24
Na_2SO_4	0.1	------	0.00
NaCl	0.19	------	0.00
NiO	0.88	1.21 - 0.40	0.40
P_2O_5	------	0.023 - 0.047	0.05

Table 4. Comparison of SRS Chemical Compositions (Continued)

Compound/Metal	SRS TBV Values (wt%)[a]	SRS Revised Values (wt%)[b]	SRS Recommended Values (wt%)[c,d]
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	54.39
SnO_2	------	0.00029 - 0.0031	0.00
SO_4	------	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
$(R.E.)_2O_3$[(a)]	------	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	------
Total	100.00	-------	100.00

[a] CRWMS M&O 2000 (Reference 2.2.2 [DIRS 151947]), Table 5-1
[b] Ray 2007 (Reference 2.2.1, [DIRS 181690] Table 3 (WAPS Glasses)
[c] Ray 2007 (Reference 2.2.1 [DIRS 181690] Table 3 (WAPS Glasses, High Visc/HM) with rounding.
[d] Values normalized (see Excel file *HLW.xls*, Spreadsheet SRS)

Justification

The memorandum (Reference 2.2.1 [DIRS181690]) states that these data provides a revision to the SRS glass composition. 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.

6.5 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 2.2.15 [DIRS 103500]). The TBV values are used in Table 5-1 of Reference 2.2.2 [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 2.2.16 [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 2.2.2 [DIRS 151947]) normalized to 100%. Therefore, consistency in usage is maintained. The reference should, however, be updated to WVNS 2001 (Reference 2.2.16 [DIRS 157559], WRQ-1.1, Table 2). Note that the recommended values have been renormalized to 100% ("other" compound/metal was removed).

Table 5. Comparison of West Valley Chemical Compositions

Compound/Metal	WVDP TBV Value (wt%)[a]	WVDP Revised Value (wt%)[b]	WVDP Recommended Value (wt%)[c]
Al_2O_3	6.00	6.00	6.04
B_2O_3	12.89	12.89	12.97
BaO ~~Bao~~	0.16	0.16	0.16
CaO ~~CIO~~	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	12.09
K_2O	5.00	5.00	5.03
Li_2O	3.71	3.71	3.73
MgO ~~Mao~~	0.89	0.89	0.90
MnO	0.82	0.82	0.82
Na_2O	8.00	8.00	8.05
Nd_2O_3	0.14	0.14	0.14
NiO	0.25	0.25	0.25
P_2O_5	1.20	1.20	1.21
RuO_2	0.08	0.08	0.08
SiO_2	40.98	40.98	41.22
SrO	0.02	0.02	0.02
ThO_2	3.56	3.56	3.58
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	1.33
Other	0.58	0.58	0.00
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 2.2.16 [DIRS 157559]), WQR-1.1, Table 2

[c] Values normalized (see Excel file *HLW.xls*, Spreadsheet WVDP)

Justification

The data contained in Reference 2.2.16 [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 2.2.18 [DIRS 104395]). The TBV values are used in Table 5-1 of Reference 2.2.2 [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 2.2.3 [DIRS 105155]). The TBV value is used in Section 5.1 of Reference 2.2.2 [DIRS 151947].

Recommended Value

The number of Hanford Site HLW canisters presented in Table 3 of the more recent reference, DOE 2004 (Reference 2.2.22 [DIRS 172092]) varies from the value used in Section 5.1 of Reference 2.2.2 [DIRS 151947]. It is recommended that the values used in Section 5.1 of Reference 2.2.2 [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 2.2.22 [DIRS 172092], Table 3). The recommended value in Table 6 (fourth column) represents the maximum number of canisters at 87% canister fill level. To obtain a bounding source term for shielding purposes, however, the value of 7,071 should be used.

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 2.2.2 [DIRS 151947]), Section 5.1

[b] DOE 2004 (Reference 2.2.22 [DIRS 172092]), 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 2.2.3 [DIRS 105155]). The TBV value is used in Section 5.1 of Reference 2.2.2 [DIRS 151947].

Recommended Value

The mass of the Hanford Site HLW in each canister presented in the more recent reference, DOE 2004 (Reference 2.2.22 [DIRS 172902]) are slightly larger than the value used in Section 5.1 of Reference 2.2.2 [DIRS 151947]. It is recommended that the values used in Section 5.1 of Reference 2.2.2 [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). However, since the AZ-101 canister is bounding for all Hanford HLW, the mass of glass for this canister type, i.e. 3345 kg (Reference 2.2.22 [DIRS 172902], Table 4), should be used in canister shielding calculations.

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 2.2.2 [DIRS 151947]), Section 5.1

[b] DOE 2004 (Reference 2.2.22 [DIRS 172902]), Section 2.2, p.2

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.

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 2.2.3 [DIRS 105155]). The TBV values are used in Table 5-4 of Reference 2.2.2 [DIRS 151947].

Recommended Values

The total activity of Hanford HLW glass presented in Table 2 of the more recent reference, DOE 2004 (Reference 2.2.22 [DIRS 172092]), is different from the values used in Table 5-4 of Reference 2.2.2 [DIRS 151947] as illustrated in Table 8. It is recommended that the values used in Table 5-4 (for year 1994) of Reference 2.2.2 [DIRS 151947] be updated to the values of the more recent reference, as shown in Table 8 for year 2010 (fourth column). Note that for bounding shielding calculations, it is appropriate to use the AZ-101 canister and isotopic composition (Reference 2.2.22 [DIRS 172092], Table 5).

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

Compound/Metal	Hanford Glass TBV Values (Ci) [a]	Hanford Glass Revised Values (Ci) [b]	Hanford Glass Recommended Values (Ci) [b]
Year of Inventory >>>>>>	01/01/1994	01/01/2010	01/01/2010
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} [c]	3.51×10^{7} [c]
Cd-113m	------	1.03×10^{4}	1.03×10^{4}
Ce-144	5.88×10^{7}	------	------
Pa-231	------	2.72×10^{2}	2.72×10^{2}
Pm-147	1.44×10^{8}	------	------

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

Compound/Metal	Hanford Glass TBV Values (Ci) [a]	Hanford Glass Revised Values (Ci) [b]	Hanford Glass Recommended Values (Ci) [b]
Year of Inventory >>>>>>	**01/01/1994**	**01/01/2010**	**01/01/2010**
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}
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-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}
Ra-226	------	9.00×10^{-2}	9.00×10^{-2}
Ra-228	------	2.1×10^{1}	2.1×10^{1}
Am-241	6.99×10^{4}	1.43×10^{5}	1.43×10^{5}
Am-243	9.34×10^{0}	1.50×10^{1}	1.50×10^{1}
Cm-242	7.70×10^{1}	0.00	0.00
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}
Total	2.13×10^{8}	1.60×10^{8}	1.60×10^{8}

[a] CRWMS M&O 2000 (Reference 2.2.2 [DIRS 151947]), Table 5-4

[b] DOE 2004 (Reference 2.2.22 [DIRS 172092]), Table 2 (2010)

[c] This value is calculated based on a 94.6% branching fraction to account for secular equilibrium between Cs-137 and the Ba137m radionuclide (Reference 2.2.5 [DIRS 127299]), p. 291

Justification

The data contained in DOE 2004 (Reference 2.2.22 [DIRS 172092]) 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 2.2.3 [DIRS 105155]). The TBV values are used in Section 5.2 of Reference 2.2.2 [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, Ray 2007 (Reference 2.2.1 [DIRS 181690]) states that the total number of SRS canisters is 6833. The mass of each SRS canister is 1,795 kg (calculated in Excel file *HLW.xls*, Spreadsheet SRSMASS). Multiplying 6833 by 1,795 kg, it can be found that the total mass is 12,265 MT. This value differs from that reported in Section 5.2 of Reference 2.2.2 [DIRS 151947].

Reference Ray 2007 (Reference 2.2.1 [DIRS 181690], p. 8) states that the projected total waste glass volume in the 6,833 canisters is about 4600 m^3. This value differs from that reported in Section 5.2 of Reference 2.2.2 [DIRS 151947].

It is recommended that the values used in Section 5.2 of Reference 2.2.2 [DIRS 151947] be updated to those recommended in Table 9.

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

	SRS TBV Values [a]	SRS Revised Values [b,c]	SRS Recommended Values [b,c]
Total Mass and Volume of the SRS HLW Glass	11,600 MT 4240 m^3	12,265 MT [c] 4600 m^3	12,265 MT [c] 4600 m^3

[a] CRWMS M&O 2000 (Reference 2.2.2 [DIRS 151947]), Section 5.2

[b] Ray 2007 (Reference 2.2.1 [DIRS 181690]), p. 8

[c] Value calculated (see text above Table 9 under Recommended Values)

Justification

The memorandum (Reference 2.2.1 [DIRS 181690]) states that these data reflect revised glass composition and radionuclide inventories as provided from Westinghouse Savannah River Company to the U.S. Department of energy as prepared by JKLW Enterprises and are considered 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 SRS HLW. 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 2.2.3 [DIRS 105155]). The TBV values are used in Section 5.2 of Reference 2.2.2 [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 2.2.3 [DIRS 105155]). The TBV value is used in Table 5-5 of Section 5.2 of Reference 2.2.2 [DIRS 151947].

Recommended Value

Ray 2007 (Reference 2.2.1 [DIRS 181690], p. 8) states that the total number of SRS HLW glass canisters is 6833. This value is different than the value reported in Table 5-5 of Reference 2.2.2 [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	6833	6833

[a] CRWMS M&O 2000 (Reference 2.2.3 [DIRS 151947]), Table 5-5

[b] Ray 2007 (Reference 2.2.1 [DIRS 181690]), p. 8

Justification

The memorandum (Reference 2.2.1 [DIRS 181690]) states that these data reflect revised glass composition and radionuclide inventories as provided from Westinghouse Savannah River Company to the U.S. Department of energy as prepared by JKLW Enterprises and are considered 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 SRS HLW. 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.

6.13 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 2.2.3 [DIRS 105155]). The TBV values are used in Section 5.3 of Reference

Recommended Values

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

Palmer and Misercola 2003 (Reference 2.2.21 [DIRS 163863], p. 2) states that the total number of West Valley canisters is 275. The glass volume of 0.76 m^3 is obtained by multiplying the available volume (Reference 2.2.16 [DIRS 157559], WQR-2.2, p. 2 & WQR-3.11, p. 13) by the nominal fill height (Reference 2.2.21 [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 2.2.2 [DIRS 151947].

Picha 1997 (Reference 2.2.12 [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 2.2.2 [DIRS 151947].

It is recommended that the values used in Section 5.3 of Reference 2.2.2 [DIRS 151947] be updated to reflect the recommended values shown in Table 11.

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 2.2.2[DIRS 151947]), Section 5.3

[b] Values calculated in Excel file *HLW.xls*, Spreadsheet WVDPCANVOL

Justification

The data contained in References 2.2.16 [DIRS 157559] and 2.2.21 [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 2.2.12 [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 2.2.3 [DIRS 105155]). The TBV value is used in Section 5.3 of Reference 2.2.2 [DIRS 151947].

Recommended value

Picha 1997 (Reference 2.2.12 [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 2.2.2 [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 2.2.3 [DIRS 105155]). The TBV value is used in Section 5.3 of Reference 2.2.2 [DIRS 151947].

Recommended Value

Palmer and Misercola 2003 (Reference 2.2.21 [DIRS 163863], p. 2) states that the total number of West Valley canisters is 275. The value used in Section 5.3 of Reference 2.2.2 [DIRS 151947] is slightly different. It is recommended that the value be updated to reflect that shown in Table 12 below. The values in columns 3 and 4 are final values as the pouring process is complete.

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 2.2.2 [DIRS 151947]), Section 5-3

[b] Palmer & Misercola (Reference 2.2.21 [DIRS 163863], p. 2)

Justification

The data contained in Reference 2.2.21 [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 2.2.3 [DIRS 105155]). The TBV values are used in Section 5.4 of Reference 2.2.2 [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 2.2.4 [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 2.2.2 [DIRS 151947]. This TBV can be resolved by updating the reference to the DOE 2002 (Reference 2.2.4 [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 2.2.2 [DIRS 151947]), Section 5.4

[b] DOE 2002 (Reference 2.2.4 [DIRS 104406]), 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 2.2.4 [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 2.2.3 [DIRS 105155]). The TBV values are used in Table 5-11 of Reference 2.2.2 [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 2.2.3 [DIRS 105155]). The TBV values are used in Table 5-11 of Reference 2.2.2 [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 2.2.12 [DIRS 104406]). This TBV information is used as part of Assumption 3.3 of Reference 2.2.2 [DIRS 151947].

Recommended Value

Assumption 3.3 of Reference 2.2.2 [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 2.2.4 [DIRS 155970], p. A-38). Therefore, this TBV can be resolved by using Reference 2.2.4 [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 2.2.4 [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 2.2.2 [DIRS 151947].

Recommended Value

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

Justification

N/A

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 2.2.2 [DIRS 151947].

Recommended Value

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

Justification

N/A

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 2.2.11 [DIRS 104403] Attachment 2). The TBV value is used in Section 5.2 of Reference 2.2.2 [DIRS 151947].

Recommended Value

The more recent reference, Ray 2007 (Reference 2.2.1 [DIRS 181690]), shows in Table 2 the average mass per SRS canister. The value used in Reference 2.2.2 [DIRS 151947] is 2000 kg. It is recommended that the value be updated to the recommended value and reference shown in Table 14. The values shown in columns 3 and 4 of Table 14 were calculated by utilizing the average mass per canister from Ray 2007 (Reference 2.2.1 [DIRS 181690], Table 2) and converting the average weight to mass in kilograms (see Excel file *HLW.xls*, spreadsheet SRSMASS).

Table 14. 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 per Canister	2000 kg	1795 kg	1795 kg

[a] CRWMS M&O 2000 (Reference 2.2.2 [DIRS 151947]), Section 5.2

[b] Calculation is shown in Excel file *HLW.xls*, Spreadsheet SRSMASS

Justification

The recommended values are from a report by Ray 2007 (Reference 2.2.1 [DIRS181690]). 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 2.2.15 [DIRS 103500]). The TBV values are used in Table 5-6 of Reference 2.2.2 [DIRS 151947].

Recommended Values

The radionuclide inventory presented in Table 5-6 of Reference 2.2.2 [DIRS 151947] is as of year 1996. The same data for West Valley HLW glass is also presented in Appendix 2 of the document WVNS 2001 (Reference 2.2.16 [DIRS 157559]). It is recommended that the radionuclide inventory of WVDP HLW glass remains the same (see Table 15) but that the reference is updated to reflect that listed in Table 15.

Table 15. Comparison of Total Activity of WVDP HLW Glass

Radionuclide	WVDP TBV Values (Ci) [a]	WVDP Revised Values (Ci) [b]	WVDP Recommended Values (Ci) [b]
Year of Inventory >>>>>>	1996	1996	1996
^{3}H	$5.87x10^{1}$	$5.87x10^{1}$	$5.87x10^{1}$
^{14}C	$1.37x10^{2}$	$1.37x10^{2}$	$1.37x10^{2}$
^{55}Fe	$1.42x10^{2}$	$1.42x10^{2}$	$1.42x10^{2}$
^{60}Co	$3.49x10^{2}$	$3.49x10^{2}$	$3.49x10^{2}$
^{59}Ni	$1.06x10^{2}$	$1.06x10^{2}$	$1.06x10^{2}$
^{63}Ni	$8.17x10^{3}$	$8.17x10^{3}$	$8.17x10^{3}$
^{79}Se	$6.02x10^{1}$	$6.02x10^{1}$	$6.02x10^{1}$
^{90}Sr	$5.81x10^{6}$	$5.81x10^{6}$	$5.81x10^{6}$
^{90}Y	$5.81x10^{6}$	$5.81x10^{6}$	$5.81x10^{6}$
^{93}Zr	$2.72x10^{2}$	$2.72x10^{2}$	$2.72x10^{2}$
^{93m}Nb	$2.07x10^{2}$	$2.07x10^{2}$	$2.07x10^{2}$
^{99}Tc	$1.70x10^{3}$	$1.70x10^{3}$	$1.70x10^{3}$
^{106}Ru	$2.31x10^{-1}$	$2.31x10^{-1}$	$2.31x10^{-1}$
^{106}Rh	$2.31x10^{-1}$	$2.31x10^{-1}$	$2.31x10^{-1}$
^{107}Pd	$1.10x10^{1}$	$1.10x10^{1}$	$1.10x10^{1}$
^{113m}Cd	$1.60x10^{3}$	$1.60x10^{3}$	$1.60x10^{3}$
^{121m}Sn	$1.61x10^{1}$	$1.61x10^{1}$	$1.61x10^{1}$
^{126}Sn	$1.04x10^{2}$	$1.04x10^{2}$	$1.04x10^{2}$
^{125}Sb	$1.62x10^{3}$	$1.62x10^{3}$	$1.62x10^{3}$
^{126m}Sb	$1.04x10^{2}$	$1.04x10^{2}$	$1.04x10^{2}$
^{126}Sb	$1.46x10^{1}$	$1.46x10^{1}$	$1.46x10^{1}$
^{125m}Te	$3.97x10^{2}$	$3.97x10^{2}$	$3.97x10^{2}$
^{129}I	$2.10x10^{-1}$	$2.10x10^{-1}$	$2.10x10^{-1}$
^{134}Cs	$6.87x10^{2}$	$6.87x10^{2}$	$6.87x10^{2}$
^{135}Cs	$1.61x10^{2}$	$1.61x10^{2}$	$1.61x10^{2}$
^{137}Cs	$6.29x10^{6}$	$6.29x10^{6}$	$6.29x10^{6}$

Table 15. Comparison of Total Activity of WVDP HLW Glass (Continued)

Radionuclide	WVDP TBV Values (Ci) [a]	WVDP Revised Values (Ci) [b]	WVDP Recommended Values (Ci) [b]
Year of Inventory >>>>>>	1996	1996	1996
^{137m}Ba	$5.95x10^{6}$	$5.95x10^{6}$	$5.95x10^{6}$
^{144}Ce	$3.11x10^{-3}$	$3.11x10^{-3}$	$3.11x10^{-3}$
^{144}Pr	$3.11x10^{-3}$	$3.11x10^{-3}$	$3.11x10^{-3}$
^{146}Pm	$5.11x10^{0}$	$5.11x10^{0}$	$5.11x10^{0}$
^{147}Pm	$1.80x10^{4}$	$1.80x10^{4}$	$1.80x10^{4}$
^{151}Sm	$8.05x10^{4}$	$8.05x10^{4}$	$8.05x10^{4}$
^{152}Eu	$2.69x10^{2}$	$2.69x10^{2}$	$2.69x10^{2}$
^{154}Eu	$5.91x10^{4}$	$5.91x10^{4}$	$5.91x10^{4}$
^{155}Eu	$1.03x10^{4}$	$1.03x10^{4}$	$1.03x10^{4}$
^{207}Tl	$9.40x10^{0}$	$9.40x10^{0}$	$9.40x10^{0}$
^{208}Tl	$3.09x10^{0}$	$3.09x10^{0}$	$3.09x10^{0}$
^{211}Pb	$9.43x10^{0}$	$9.43x10^{0}$	$9.43x10^{0}$
^{212}Pb	$8.62x10^{0}$	$8.62x10^{0}$	$8.62x10^{0}$
^{211}Bi	$9.43x10^{0}$	$9.43x10^{0}$	$9.43x10^{0}$
^{212}Bi	$8.62x10^{0}$	$8.62x10^{0}$	$8.62x10^{0}$
^{212}Po	$5.52x10^{0}$	$5.52x10^{0}$	$5.52x10^{0}$
^{215}Po	$9.43x10^{0}$	$9.43x10^{0}$	$9.43x10^{0}$
^{216}Po	$8.62x10^{0}$	$8.62x10^{0}$	$8.62x10^{0}$
^{219}Rn	$9.43x10^{0}$	$9.43x10^{0}$	$9.43x10^{0}$
^{220}Rn	$8.62x10^{0}$	$8.62x10^{0}$	$8.62x10^{0}$
^{223}Fr	$1.30x10^{-1}$	$1.30x10^{-1}$	$1.30x10^{-1}$
^{223}Ra	$9.43x10^{0}$	$9.43x10^{0}$	$9.43x10^{0}$
^{224}Ra	$8.62x10^{0}$	$8.62x10^{0}$	$8.62x10^{0}$
^{228}Ra	$1.58x10^{0}$	$1.58x10^{0}$	$1.58x10^{0}$
^{227}Ac	$9.43x10^{0}$	$9.43x10^{0}$	$9.43x10^{0}$
^{228}Ac	$1.58x10^{0}$	$1.58x10^{0}$	$1.58x10^{0}$
^{227}Th	$9.30x10^{0}$	$9.30x10^{0}$	$9.30x10^{0}$
^{228}Th	$8.62x10^{0}$	$8.62x10^{0}$	$8.62x10^{0}$
^{229}Th	$2.15x10^{-1}$	$2.15x10^{-1}$	$2.15x10^{-1}$
^{230}Th	$5.87x10^{-2}$	$5.87x10^{-2}$	$5.87x10^{-2}$
^{232}Th	$1.64x10^{0}$	$1.64x10^{0}$	$1.64x10^{0}$
^{231}Pa	$1.52x10^{1}$	$1.52x10^{1}$	$1.52x10^{1}$
^{232}U	$6.87x10^{0}$	$6.87x10^{0}$	$6.87x10^{0}$
^{233}U	$9.53x10^{0}$	$9.53x10^{0}$	$9.53x10^{0}$
^{234}U	$4.61x10^{0}$	$4.61x10^{0}$	$4.61x10^{0}$
^{235}U	$1.01x10^{-1}$	$1.01x10^{-1}$	$1.01x10^{-1}$
^{236}U	$2.96x10^{-1}$	$2.96x10^{-1}$	$2.96x10^{-1}$
^{238}U	$8.54x10^{-1}$	$8.54x10^{-1}$	$8.54x10^{-1}$
^{236}Np	$9.47x10^{0}$	$9.47x10^{0}$	$9.47x10^{0}$

Table 15. Comparison of Total Activity of WVDP HLW Glass (Continued)

Radionuclide	WVDP TBV Values (Ci) [a]	WVDP Revised Values (Ci) [b]	WVDP Recommended Values (Ci) [b]
Year of Inventory >>>>>>	1996	1996	1996
^{237}Np	$2.35x10^{1}$	$2.35x10^{1}$	$2.35x10^{1}$
^{239}Np	$3.47x10^{2}$	$3.47x10^{2}$	$3.47x10^{2}$
^{236}Pu	$8.43x10^{-1}$	$8.43x10^{-1}$	$8.43x10^{-1}$
^{238}Pu	$8.04x10^{3}$	$8.04x10^{3}$	$8.04x10^{3}$
^{239}Pu	$1.65x10^{3}$	$1.65x10^{3}$	$1.65x10^{3}$
^{240}Pu	$1.22x10^{3}$	$1.22x10^{3}$	$1.22x10^{3}$
^{241}Pu	$6.13x10^{4}$	$6.13x10^{4}$	$6.13x10^{4}$
^{242}Pu	$1.65x10^{0}$	$1.65x10^{0}$	$1.65x10^{0}$
^{241}Am	$5.35x10^{4}$	$5.35x10^{4}$	$5.35x10^{4}$
^{242m}Am	$2.89x10^{2}$	$2.89x10^{2}$	$2.89x10^{2}$
^{242}Am	$2.87x10^{2}$	$2.87x10^{2}$	$2.87x10^{2}$
^{243}Am	$3.47x10^{2}$	$3.47x10^{2}$	$3.47x10^{2}$
^{242}Cm	$2.38x10^{2}$	$2.38x10^{2}$	$2.38x10^{2}$
^{243}Cm	$1.16x10^{2}$	$1.16x10^{2}$	$1.16x10^{2}$
^{244}Cm	$6.07x10^{3}$	$6.07x10^{3}$	$6.07x10^{3}$
^{245}Cm	$8.81x10^{-1}$	$8.81x10^{-1}$	$8.81x10^{-1}$
^{246}Cm	$1.01x10^{-1}$	$1.01x10^{-1}$	$1.01x10^{-1}$
Sum (Ci)	$2.42x10^{7}$	$2.42x10^{7}$	$2.42x10^{7}$

[a] CRWMS M&O 2000 (Reference 2.2.2 [DIRS 151947]), Table 5-6

[b] WVNS 2001 (Reference 2.2.16 [DIRS 157559], WQR-1.2 Appendix 2, p. AP-2-3)

Justification

The data contained in Reference 2.2.16 [DIRS 157559] 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 2.2.8 [DIRS 104392]). The TBV value is used in Table 5-7 of Reference 2.2.2 [DIRS 151947].

Recommended Value

The TBV value for the mass of ANL-W ceramic is 144,000 kg (Reference 2.2.2 [DIRS 151947], Table 5-7). The same value is cited in DOE 2002 (Reference 2.2.4 [DIRS 155970], p. A-40). Therefore, it is recommended that the same value be used, as shown in Table 16, but that the reference is updated to DOE 2002 (Reference 2.2.4 [DIRS 155970], p. A-40).

Table 16. 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 2.2.2 [DIRS 151947]), Table 5-7

[b] DOE 2002 (Reference 2.2.4 [DIRS 155970]), p. A-40

Justification

The data is referenced by DOE 2002 (Reference 2.2.4 [DIRS 155970]). 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 2.2.20 [DIRS 104413]). The TBV values are used in Table 5-7 of Reference 2.2.2 [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 2.2.20 [DIRS 104413]). The TBV values are used in Table 5-8 of Reference 2.2.2 [DIRS 151947].

Recommended Values

The radionuclide inventory presented in Table 5-8 of Reference 2.2.2 [DIRS 151947] is as of year 2035. Data for INTEC HLW glass is presented for year 2035 and uses the source document Picha 1998 (Reference 2.2.20 [DIRS 104413], Table ID-II) as its basis. It is recommended that the radionuclide inventory be updated to reflect that of year 2035, as shown in Table 17.

For bounding source terms per canister basis, the maximum value from Picha 1998 (Reference 2.2.20 [DIRS 104413]), Table 1D-II, columns 3&4 should be used per Picha 1998 (Reference 2.2.20 [DIRS 104413]), p5, item 2.

Table 17. Comparison of Total Activity of INTEC HLW Glass

Nuclide	INEEL/INTEC TBV Values (Ci) [a]	INEEL/INTEC Estimated Values (Ci) [b]	INEEL/INTEC Recommended Values (Ci) [b]
Year of Inventory >>>>>>	2035	2035	2035
^{3}H	3.56×10^{3}	3.56×10^{3}	3.56×10^{3}
^{14}C	2.78×10^{-2}	2.78×10^{-2}	2.78×10^{-2}
^{60}Co	3.21×10^{1}	3.21×10^{1}	3.21×10^{1}
^{90}Sr	7.04×10^{6}	7.04×10^{6}	7.04×10^{6}
^{90}Y	7.04×10^{6}	7.04×10^{6}	7.04×10^{6}
^{93m}Nb	4.74×10^{2}	4.74×10^{2}	4.74×10^{2} [c]
^{94}Nb	5.36×10^{-3}	5.36×10^{-3}	5.36×10^{-3}
^{99}Tc	3.41×10^{3}	3.41×10^{3}	3.41×10^{3}
^{102}Rh	1.99×10^{-5}	1.99×10^{-5}	1.99×10^{-5}
^{126}Sn	8.91×10^{1}	8.91×10^{1}	8.91×10^{1}
^{125}Sb	1.03×10^{0}	1.03×10^{0}	1.03×10^{0}
^{129}I	5.64×10^{0}	5.64×10^{0}	5.64×10^{0}
^{134}Cs	3.28×10^{-2}	3.28×10^{-2}	3.28×10^{-2}
^{135}Cs	1.63×10^{2}	1.63×10^{2}	1.63×10^{2}
^{137}Cs	5.95×10^{6}	5.95×10^{6}	5.95×10^{6}
^{137m}Ba	5.60×10^{6}	5.60×10^{6}	5.60×10^{6}
^{147}Pm	2.67×10^{1}	2.67×10^{1}	2.67×10^{1}
^{154}Eu	5.98×10^{3}	5.98×10^{3}	5.98×10^{3}
^{155}Eu	7.55×10^{0}	7.55×10^{0}	7.55×10^{0}
^{226}Ra	------	------	9.69×10^{-3}
^{230}Th	3.95×10^{-1}	3.95×10^{-1}	3.95×10^{-1}
^{232}Th	9.89×10^{-8}	9.89×10^{-8}	9.89×10^{-8}
^{232}U	4.63×10^{-3}	4.63×10^{-3}	4.63×10^{-3}
^{233}U	1.33×10^{-3}	1.33×10^{-3}	1.33×10^{-3}
^{234}U	9.95×10^{1}	9.95×10^{1}	9.95×10^{1}

Table 17. Comparison of Total Activity of INTEC HLW Glass (Continued)

Nuclide	INEEL/INTEC TBV Values (Ci) [a]	INEEL/INTEC Estimated Values (Ci) [b]	INEEL/INTEC Recommended Values (Ci) [b]
Year of Inventory >>>>>>	**2035**	**2035**	**2035**
^{235}U	$5.90x10^{-1}$	$5.90x10^{-1}$	$5.90x10^{-1}$
^{236}U	$1.54x10^{0}$	$1.54x10^{0}$	$1.54x10^{0}$
^{238}U	$2.94x10^{-2}$	$2.94x10^{-2}$ [c]	$2.94x10^{-2}$ [c]
^{237}Np	$6.26x10^{0}$	$6.26x10^{0}$	$6.26x10^{0}$
^{238}Pu	$8.98x10^{4}$	$8.98x10^{4}$	$8.98x10^{4}$
^{239}Pu	$1.81x10^{3}$	$1.81x10^{3}$	$1.81x10^{3}$
^{240}Pu	$1.57x10^{3}$	$1.57x10^{3}$	$1.57x10^{3}$
^{241}Pu	$1.93x10^{4}$	$1.93x10^{4}$	$1.93x10^{4}$
^{242}Pu	$3.42x10^{0}$	$3.42x10^{0}$	$3.42x10^{0}$
^{241}Am	$1.27x10^{4}$	$1.27x10^{4}$	$1.27x10^{4}$
^{242}Am	------	$1.50x10^{-2}$	$1.50x10^{-2}$
^{243}Am	$1.39x10^{-2}$	$1.39x10^{-2}$	$1.39x10^{-2}$
^{242}Cm	------	$1.24x10^{-2}$	$1.24x10^{-2}$
^{243}Cm	$4.70x10^{-4}$	$4.70x10^{-4}$	$4.70x10^{-4}$
^{244}Cm	$1.03x10^{-2}$	$1.03x10^{-2}$	$1.03x10^{-2}$
^{245}Cm	------	$3.69x10^{-6}$	$3.69x10^{-6}$
^{246}Cm	------	$8.66x10^{-8}$	$8.66x10^{-8}$
^{247}Cm	------	$3.09x10^{-14}$	$3.09x10^{-14}$
^{248}Cm	------	$9.35x10^{-15}$	$9.35x10^{-15}$
Sum (Ci)	$2.58x10^{7}$	$2.58x10^{7}$	$2.58x10^{7}$

[a] CRWMS M&O 2000 (Reference 2.2.2 [DIRS 151947]), Table 5-8

[b] Picha 1998 (Reference 2.2.20 [DIRS 104413], Table ID-II)

[c] The recommended Ci content value for Nb93m was determined by multiplying the number of canisters times the average reported Ci concentration. See Excel file *HLW.xls*, Spreadsheet ICCP.

Justification

The data contained in Reference 2.2.20 [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 2.2.3 [DIRS 105155]). The TBV values are used in Table 5-4 of Reference 2.2.2 [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 2.2.2 [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 18 below provides a summary and overview of the resolution for each TBV.

Table 18. 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. 2.2.6 [DIRS 172092], Table 1
TBV-3841	Chemical composition of INTEC HLW glass	Section 6.2	Update TBV values to use the values in Ref. 2.2.4 [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. 2.2.16 [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. 2.2.6 [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. 2.2.6 [DIRS 164360], results
TBV-4597	Total activity of Hanford HLW glass	Section 6.9	Update TBV values to use the values in Ref. 2.2.6 [DIRS172092], 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 181690] , p.8 and values calculated in Section 6.10.
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 181690], p. 8
TBV-4601	Total mass and volume of the West Valley HLW glass	Section 6.13	Update TBV values to use the values in calculated in Section 6.13 (including references)

Table 18. Summary of TBV Resolution and Recommendations (Continued)

TBV No.	Description	Resolution/Values Description	Recommendations
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. 2.2.21 [DIRS 163863], p. 2
TBV-4604	Dimensions of INEEL HLW glass canister	Section 6.16	No change in TBV values but use Ref. Ref. 2.2.4 [DIRS 155970], p.A-40 instead
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. 2.2.4 [DIRS 155970], p. A-38 instead
TBV-4609	Total activity for SR-90 in Hanford HLW Glass	Section 6.20	Redundant TBV (same as TBV-4597)
TBV-4610	Total Activity for I-129 in Hanford HLW Glass	Section 6.21	Redundant TBV (same as TBV-4597)
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 181690], Table 2
TBV-4612	Activity of West Valley HLW glass	Section 6.23	Update TBV values to use the values Ref. 2.2.16 [DIRS 157559]
TBV-4615	Mass of the ANL-W HLW Ceramic	Section 6.24	No change in TBV values but use Ref. 2.2.4 [DIRS 155970], p. A-40
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. 2.2.20 [DIRS 104413], Table ID-II
TBV-4618	Total Activity of Hanford HLW Glass	Section 6.27	Redundant TBV (same as TBV 4597)

ATTACHMENT 1

LIST OF FILES ON ATTACHED CD (ATTACHMENT 2)

The Microsoft® Excel spreadsheet used to normalize isotopic compositions and for mass calculations is stored on the compact disc (CD).

```
Volume in drive D is 070731_1648
 Volume Serial Number is 0BD4-7752

 Directory of D:\

07/31/2007  04:46 PM            48,128 HLW.xls
               1 File(s)         48,128 bytes

     Total Files Listed:
               1 File(s)         48,128 bytes
               0 Dir(s)               0 bytes free
```

ATTACHMENT 3

E-MAIL PEARSON TO PRIVATE USER

MOD.19990511.0281

ETS: AR-GEN-35613 35614

william.pearson@srs.gov on 02/18/98 04:56:00 AM

QA: N/A

To: Private_User@srs.gov
cc: (bcc: Joseph Rivers)
Subject: Re: SRS Data Request Followup

This electronic message is to provide additional information on the Savannah River Defense Waste Processing Facility canistered, vitrified high level waste form:

(1) The target radionuclide inventory for the waste glass approximates the midpoint between the upper and lower bound numbers provided in the data call response (from discussions with the author of the Waste Qualification Report, S. L. Marra).

(2) The mass of glass waste being poured into the DWPF canisters is approximately 2,000 kg. (5500 lbs. total from current pour records - 1108 lbs. for canister = 4392 lbs. of glass).

(3) The current lack of ITP operation is not expected to impact either the total number of canisters or chemical composition of HLW product from DWPF.

W. D. Pearson