OSR 45-24 (Rev 1-20-2009)

Calculation Cover Sheet

Project/Task N/A	Calculation No. X-CLC-Z-00027	Project/Task No. N/A
Title Inventory Determination of PODD Radionuclides in Saltstone Vaults 1 and 4	Functional Classification PS	Sheet 1 of 35
	Discipline X - Chemical Process	
Calculation Type ☒ Type 1 ☐ Type 2	Type 1 Calc Status ☐ Preliminary ☒ Confirmed	
Computer Program No. Microsoft Excel ☐ N/A	Version/Release No. 2002 SP3	
Purpose and Objective The purpose of this calculation is to determine the current radiolgical inventory being stored in Vaults 1 and 4 at the Saltstone Disposal Facility. This data will be used for comparison against the inventories given in the Saltstone Performance Objectives Demonstration Document (PODD)	DC/RO Date	

Summary of Conclusion

A summary table has been created which shows the Vault 1 and Vault 4 inventories of the 64 radionuclides described in the PODD as of 3/31/09.

Revisions

Rev #	Revision Description
0	Original Issue
1	Corrected Title Block

Sign Off

Rev #	Originator (Print) Sign/Date	Verification/Checking Method	Verifier/Checker (Print) Sign/Date	Manager (Print) Sign/Date
1	Aaron V. Staub 6/11/09	☐ Design Check (GS/PS only) ☒ Document Review ☐ Qualification Testing ☐ Alternate Calculation ☐ Operational Testing	Rick Fowler 6/11/09	Dave Sherburne 6/11/09
		☐ Design Check (GS/PS only) ☐ Document Review ☐ Qualification Testing ☐ Alternate Calculation ☐ Operational Testing		

Additional Reviewer (Print) Bob Petras — INDEPENDENT VERIFICATION	Signature	Date 6/11/09
Design Authority (Print) Aaron V. Staub	Signature	Date 6/11/09
Release to Outside Agency (Print) N/A	Signature N/A	Date N/A
Security Classification of the Calculation U		

Open Items:

None.

References:

1. Crapse, K. P., et. al., FY 2007 Annual Review -Saltstone Disposal Facility (Z-Area) Performance Assessment (Covering the Performance Period FY 2007), WSRC-RP-2008-00390, Rev. 0, March 11, 2008.
2. Staub, A. V., "Saltstone Facility Basis Information for Consent Order of Dismissal Section III.7 Website Data – Fourth Quarter 2007," LWO-WSE-2008-00012.
3. Staub, A. V., "Saltstone Facility Basis Information for Consent Order of Dismissal Section III.7 Website Data – First Quarter 2008," LWO-WSE-2008-00067.
4. Staub, A. V., "Saltstone Facility Basis Information for Consent Order of Dismissal Section III.7 Website Data – Second Quarter 2008," LWO-WSE-2008-00135.
5. Staub, A. V., "Saltstone Facility Basis Information for Consent Order of Dismissal Section III.7 Website Data – First Quarter 2009," LWO-WSE-2009-00095.
6. Badheka, N. P., "Characterization of Tank 50H Sample Waste- 2006," WSRC-TR-2007-00133, Rev. 0, June 2007.
7. Zeigler, K. E., Bibler, N. E., "Results for the Third Quarter 2007 Tank 50H WAC Slurry Sample: Chemical and Radionuclide Contaminant Results," WSRC-TR-2008-00080, Rev. 1, July 2008.
8. DiPrete, C. C., Bibler, N. E., "Results for the First Quarter 2008 Tank 50H WAC Slurry Sample: Chemical and Radionuclide Contaminant Results," WSRC-TR-2008-00184, Rev. 0, June 2008.
9. DiPrete, C. C., Bibler, N. E., "Results for the Third Quarter 2008 Tank 50H WAC Slurry Sample: Chemical and Radionuclide Contaminant Results," WSRC-TR-2008-00328, Rev. 1, December 2008.
10. Waste Characterization System, \\Wg17\WCS1.5PROD\WCS 1.5.xls.
11. Bannochie, C. J., "Radioactive Decay Calculations for Saltstone Vault 1 and 4 Inventories," SRNL-L3100-2009-00144, Rev. 0, June 1, 2009.
12. Badheka, N. P., "Characterization of Tank 50H Waste Sample- 2007," WSRC-TR-2007-00253, Rev. 0, July 25, 2007.
13. Rosenberger, K. H., et. al., "Saltstone Performance Objective Demonstration Document," CBU-PIT-2005-00146, Rev. 0, June 2005.
14. Le, T. A., "Alternative Determination of Saltstone Disposal Facility (SDF) Radionuclides Inventory as of March 31, 2009," X-ESR-H-00188, Rev. 0, June 2009.

Input and Assumptions:

1. Existing inventory as of 9/30/07 in Saltstone Vaults 1 and 4 is given in Reference 1.
2. New radionuclide receipts are provided in References 2 through 10, and 12. References 2 through 5 detail the volumes of salt solution transferred from Tank 50 into Saltstone. References 6 through 10 and 12 give the radionuclide concentrations in the salt solution transferred. All inventories are accounted on a salt solution basis.
3. Existing inventory is decay-corrected from 9/30/07 to 9/30/08 and reported in Reference 11.
4. FY08 receipts are not decay-corrected regardless of date of production and are assumed to be input as a single point on 9/30/08.

5. No new waste was received into Vault 1. The data from Reference 11 shows the current decay-corrected inventory for Vault 1.
6. Waste receipts in calendar year 2009 are inventoried using sample data from the 3rd quarter of 2008. The 1st quarter 2009 sample has been taken but analytical results are not yet available. These data are subject to change upon receipt of additional characterization information.

Analytical Methods and Computations:

The Saltstone Performance Objective Demonstration Document (PODD, Ref. 13) details projected final disposal inventories for 64 different radionuclides. The purpose of this calculation is to determine the radionuclide inventory in Saltstone Vaults 1 and 4 as of 3/31/2009 for each of the nuclides discussed in the PODD.

Table 1 provides the inventory in Vault 4 as of 9/30/2007. This data is calculated using the previous Vault 4 inventory (decay-corrected to 9/30/2007) from Reference 1 and then accounts for all additions during FY2007. A similar calculation was performed in Table 5 of Reference 1, but the newest available sample data is used below for new waste receipts. The results of Table 1 are then used as an input to decay-correct the 9/30/2007 inventory to 9/30/2008. This methodology is consistent with previous Performance Assessment Annual Reviews, which assumes that all inventory added during a given year is added on the last day of this fiscal year with no decay of new inventory during the course of that year.

The results of the decay correction from 9/30/07 to 9/30/08 are input to Table 2 and taken from Reference 11. New waste receipts during FY2008 are then added in Table 2 to provide Vault 4 inventory as of 9/30/08.

The inventory as of 9/30/08 is used in Table 3 with new waste receipts that have occurred through 3/31/09. No decay correction for new or existing inventory is applied to the data in Table 3. Additionally, the sample data used to calculate inventory of the new waste is the most current available, but subsequent sample analysis has not yet been completed. Additional data may become available at a later date which would improve the accuracy of Table 3.

Total radionuclide inventories for all of the Saltstone Disposal Facility are calculated in Table 4 by adding the contribution from Vault 1 to the values previously determined for Vault 4. The Vault 1 inventory is included in Reference 11 and represents only decay-correction to 9/30/08 from previously reported values in Reference 1. No new waste transfers into Vault 1 have occurred during the reporting period.

Some radionuclides are present in the waste streams at concentrations below the detection limits of currently available analytical methods – e.g., Na-22, Al-26, Nb-94, Sb-126, Sb-126m, Eu-152, Ac-227, Ra-226, Ra-228, Pa-231, Th-229, Th-230, U-233, U-234, Pu-242, Pu-244, Cm-243, Cm-245, Cm-247, Cm-248, Bk-249, Cf-249, Cf-251, Cf-252 and Am-243. The inventory for these 25 radionuclides has instead been estimated based on Tank Farm history and process knowledge. The results for these radionuclides are provided in Reference 14 (and are attached), and those results are used as input into Table 3. The month-by-month inventories for these radionuclides are not reported in the tables, no decay correction has been applied, and their contribution is assumed to occur on 3/31/09. The lack of decay correction does not significantly alter the final inventories due to the relatively long half-lives associated with each radionuclide.

Results:

The total radionuclide inventories for Vault 4 as of 9/31/2007 are shown in Table 1. The total radionuclide inventories for Vault 4 as of 9/31/2008 are shown in Table 2. The total radionuclide inventories for Vault 4 as of 3/31/2009 are shown in Table 3. Total SDF inventory is reported in Table 4.

Conclusion:

The radionuclide inventories for Saltstone Disposal Vaults 1 and 4 have been updated as of 3/31/09.

Table 1: Vault 4 Inventory as of 9/30/07

Nuclide	Existing Ci/Vault (Ref. 1, Table 5)	Dec 2006 Additions (pCi/mL) (Refs. 6, 10 [bold], 12 [italics])	Dec 2006 Additions (Ci) (Note 1)	Feb 2007 Additions (pCi/mL) (Refs. 6, 10 [bold], 12 [italics]) (Note 6)	Feb 2007 Additions (Ci) (Note 2)	Mar 2007 Additions (pCi/mL) (Refs. 6, 10 [bold], 12 [italics])	Mar 2007 Additions (Ci) (Note 3)	Total as of 9/30/07 (Ci) (Note 4)
H-3	2.38E+01	**2.30E+03**	5.65E-01	**2.15E+03**	6.47E-01	**2.17E+03**	8.22E-01	**2.58E+01**
C-14	2.35E-01	**5.93E+00**	1.46E-03	**1.22E+01**	3.66E-03	**3.56E+01**	1.35E-02	**2.54E-01**
Na-22		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Al-26		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Co-60	4.17E-03	4.86E+00	1.19E-03	4.86E+00	1.46E-03	4.86E+00	1.84E-03	**8.67E-03**
Ni-59	9.09E-03	<3.32E+00	8.16E-04	<3.32E+00	9.97E-04	<3.32E+00	1.26E-03	**1.22E-02**
Ni-63	5.86E-02	**8.67E+02**	2.13E-01	**3.69E+00**	1.11E-03	**5.14E+00**	1.95E-03	**2.75E-01**
Se-79	2.57E-02	<1.48E-03	3.64E-07	<1.48E-03	4.44E-07	<1.48E-03	5.61E-07	**2.57E-02**
Sr-90	2.90E-01	**5.12E+03**	1.26E+00	**1.60E+03**	4.82E-01	**2.14E+03**	8.13E-01	**2.84E+00**
Y-90		**5.12E+03**	1.26E+00	**1.60E+03**	4.82E-01	**2.14E+03**	8.13E-01	**2.55E+00**
Nb-94	9.91E-04	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**9.91E-04**
Tc-99	2.35E+01	**2.45E+02**	6.01E-02	**3.46E+02**	1.04E-01	**6.58E+02**	2.49E-01	**2.39E+01**
Ru-106	4.66E-04	<1.65E+02	4.06E-02	<1.65E+02	4.96E-02	<1.65E+02	6.26E-02	**1.53E-01**
Rh-106		<1.65E+02	4.06E-02	<1.65E+02	4.96E-02	<1.65E+02	6.26E-02	**1.53E-01**
Sb-125	3.68E-01	4.78E+04	1.17E+01	4.78E+04	1.44E+01	4.78E+04	1.81E+01	**4.46E+01**
Sb-126		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Sb-126m		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Te-125m		4.78E+04	1.17E+01	4.78E+04	1.44E+01	4.78E+04	1.81E+01	**4.42E+01**
Sn-126	5.66E-02	6.12E+01	1.50E-02	6.12E+01	1.84E-02	6.12E+01	2.32E-02	**1.13E-01**
I-129	8.16E-02	**6.29E+00**	1.54E-03	**4.11E+00**	1.24E-03	**4.10E+00**	1.55E-03	**8.59E-02**
Cs-134	3.74E-03	<1.01E+01	2.48E-03	<1.01E+01	3.03E-03	<1.01E+01	3.83E-03	**1.31E-02**
Cs-135		<1.70E+01	4.18E-03	<1.70E+01	5.11E-03	<1.70E+01	6.45E-03	**1.57E-02**
Cs-137	1.53E+01	**1.49E+04**	3.67E+00	**1.93E+05**	5.80E+01	**8.33E+05**	3.16E+02	**3.93E+02**
Ba-137m		**1.41E+04**	3.47E+00	**1.83E+05**	5.49E+01	**7.88E+05**	2.99E+02	**3.57E+02**
Ce-144		<2.60E+02	6.39E-02	<2.60E+02	7.81E-02	<2.60E+02	9.86E-02	**2.41E-01**
Pr-144		<2.60E+02	6.39E-02	<2.60E+02	7.81E-02	<2.60E+02	9.86E-02	**2.41E-01**
Pm-147		<2.09E+01	5.14E-03	<2.09E+01	6.28E-03	<2.09E+01	7.93E-03	**1.93E-02**
Sm-151	<9.03E-04	<1.17E+01	2.88E-03	<1.17E+01	3.51E-03	<1.17E+01	4.44E-03	**1.17E-02**
Eu-152	<4.25E-03	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**4.25E-03**

Table 1: Vault 4 Inventory as of 9/30/07 cont'd

Eu-154	<6.72E-03	<1.56E+01	3.83E-03	<1.56E+01	4.68E-03	<1.56E+01	5.92E-03	**2.12E-02**
Eu-155	<9.31E-04	<1.07E+02	2.63E-02	<1.07E+02	3.21E-02	<1.07E+02	4.06E-02	**9.99E-02**
Ra-226		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Ac-227		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Ra-228		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Th-229		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Th-230		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Pa-231		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Th-232		<2.44E-03	6.00E-07	<2.44E-03	7.33E-07	<2.44E-03	9.25E-07	**2.26E-06**
Np-237	<4.87E-03	<1.57E+01	3.86E-03	<1.57E+01	4.71E-03	<1.57E+01	5.95E-03	**1.94E-02**
U-232	9.19E-03	<3.21E-01	7.89E-05	<3.21E-01	9.64E-05	<3.21E-01	1.22E-04	**9.49E-03**
U-233	3.52E+00	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**3.52E+00**
U-234	3.52E+00	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**3.52E+00**
U-235	6.81E-02	*<8.63E-01*	2.12E-04	*<8.63E-01*	2.59E-04	*<8.63E-01*	3.27E-04	**6.89E-02**
U-236	6.81E-02	8.60E+00	2.11E-03	<8.60E+00	2.58E-03	<8.60E+00	3.26E-03	**7.61E-02**
U-238	<1.10E-01	1.95E+00	4.79E-04	1.95E+00	5.86E-04	1.95E+00	7.40E-04	**1.12E-01**
Pu-238	6.58E-01	8.67E+02	2.13E-01	8.67E+02	2.60E-01	8.67E+02	3.29E-01	**1.46E+00**
Pu-239	1.33E-01	3.37E+01	8.28E-03	3.37E+01	1.01E-02	3.37E+01	1.28E-02	**1.64E-01**
Pu-240	1.33E-01	<5.06E+03	1.24E+00	<5.06E+03	1.52E+00	<5.06E+03	1.92E+00	**4.82E+00**
Pu-241	1.36E-02	**3.01E+02**	7.41E-02	**1.40E+02**	4.21E-02	**1.73E+02**	6.58E-02	**1.96E-01**
Pu-242	<8.03E-03	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**8.03E-03**
Pu-244		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Am-241	6.43E-02	2.41E+02	5.92E-02	2.41E+02	7.24E-02	2.41E+02	9.14E-02	**2.87E-01**
Am-242m		<8.96E-02	2.20E-05	<8.96E-02	2.69E-05	<8.96E-02	3.40E-05	**8.29E-05**
Am-243	1.30E-03	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**1.30E-03**
Cm-242		<7.41E-02	1.82E-05	<7.41E-02	2.23E-05	<7.41E-02	2.81E-05	**6.86E-05**
Cm-243	7.36E-02	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**7.36E-02**
Cm-244	7.18E-02	1.91E+01	4.69E-03	<1.91E+01	5.74E-03	<1.91E+01	7.24E-03	**8.95E-02**
Cm-245		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Cm-247		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Cm-248		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Bk-249		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Cf-249		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**

Table 1: Vault 4 Inventory as of 9/30/07 cont'd

Cf-251	2.47E-01	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**2.47E-01**
Cf-252		N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Volume		64935		79344		100201		

Note 1: Value in the fourth column equals value in the third column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 64935 gal (Dec 2006 volume of salt solution processed).

Note 2: Value in the sixth column equals value in the fifth column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 79344 gal (Feb 2007 volume of salt solution processed).

Note 3: Value in the eighth column equals value in the seventh column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 100201 gal (Mar 2007 volume of salt solution processed).

Note 4: Value in the ninth column equals sum of second, fourth, sixth, and eighth columns.

Note 5: Radionuclides listed as N.R. were not reported due to high analytical limits of detection. Total inventory additions (see attachment 1) were determined by calculation using the methodology documented in CBU-PIT-2005-00146, Saltstone Performance Objective Demonstration Document.

Note 6: The input for U-235 comes from Ref. 12 instead of Ref 6. due to an artificially high detection limit in Ref. 6. SRNL substituted a less sensitive analytical method in Ref. 6 which had a minimum sensitivity that is an order of magnitude higher than previous and subsequent samples. The concentration of U-235 is not expected to have significantly changed between samples based on processing history.

Table 2: Vault 4 Inventory as of 9/30/08

Nuclide	Existing Ci/Vault as of 9/30/08 (Ref. 11, Note 1)	Oct 2007 Additions (pCi/mL) (Refs. 7, 10 [bold&ital])	Oct 2007 Additions (Ci) (Note 2)	Nov 2007 Additions (pCi/mL) (Refs. 7, 10 [bold&ital])	Nov 2007 Additions (Ci) (Note 3)	Dec 2007 Additions (pCi/mL) (Refs. 7, 10 [bold&ital])	Dec 2007 Additions (Ci) (Note 4)	Feb 2008 Additions (pCi/mL) (Refs. 8, 10 [bold&ital])	Feb 2008 Additions (Ci) (Note 5)	Mar 2008 Additions (pCi/mL) (Refs. 8, 10 [bold&ital])	Mar 2008 Additions (Ci) (Note 6)	April 2008 Additions (pCi/mL) (Refs. 8, 10 [bold&ital])	April 2008 Additions (Ci) (Note 7)	Total as of 9/30/08 (Ci) (Note 8)
H-3	2.44E+01	***1.87E+03***	1.29E+00	***1.83E+03***	2.27E+00	***1.10E+03***	1.16E+00	***2.26E+03***	8.83E-01	***8.44E+02***	9.51E-01	***8.64E+02***	5.03E-01	**3.14E+01**
C-14	2.54E-01	***2.12E+01***	1.46E-02	***2.06E+01***	2.56E-02	***3.48E+01***	3.65E-02	***4.25E+02***	1.66E-01	***4.82E+02***	5.43E-01	***4.67E+02***	2.72E-01	**1.31E+00**
Na-22	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Al-26	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Co-60	7.60E-03	2.03E+01	1.40E-02	2.03E+01	2.52E-02	2.03E+01	2.13E-02	1.06E+01	4.15E-03	1.06E+01	1.19E-02	1.06E+01	6.18E-03	**9.04E-02**
Ni-59	1.22E-02	<3.59E+01	2.48E-02	<3.59E+01	4.46E-02	<3.59E+01	3.77E-02	<6.71E+01	2.63E-02	<6.71E+01	7.56E-02	<6.71E+01	3.91E-02	**2.60E-01**
Ni-63	2.73E-01	***1.75E+02***	1.21E-01	***1.70E+02***	2.12E-01	***5.23E+01***	5.48E-02	***1.43E+02***	5.60E-02	***1.97E+02***	2.22E-01	***1.91E+02***	1.12E-01	**1.05E+00**
Se-79	2.57E-02	1.49E+03	1.03E+00	1.49E+03	1.85E+00	1.49E+03	1.56E+00	4.73E+02	1.85E-01	4.73E+02	5.33E-01	4.73E+02	2.76E-01	**5.46E+00**
Sr-90	2.77E+00	***5.30E+05***	3.67E+02	***5.16E+05***	6.40E+02	***6.75E+04***	7.08E+01	***2.23E+05***	8.74E+01	***2.89E+05***	3.26E+02	***2.80E+05***	1.63E+02	**1.66E+03**
Y-90	2.77E+00	***5.30E+05***	3.67E+02	***5.16E+05***	6.40E+02	***6.75E+04***	7.08E+01	***2.23E+05***	8.74E+01	***2.89E+05***	3.26E+02	***2.80E+05***	1.63E+02	**1.66E+03**
Nb-94	9.91E-04	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**9.91E-04**
Tc-99	2.39E+01	***4.47E+02***	3.09E-01	***4.35E+02***	5.40E-01	***1.09E+02***	1.14E-01	***3.13E+04***	1.23E+01	***2.52E+04***	2.84E+01	***2.44E+04***	1.42E+01	**7.97E+01**
Ru-106	7.68E-02	<1.15E+02	7.95E-02	<1.15E+02	1.43E-01	<1.15E+02	1.21E-01	<9.50E+01	3.72E-02	<9.50E+01	1.07E-01	<9.50E+01	5.53E-02	**6.19E-01**
Rh-106	7.68E-02	<1.15E+02	7.95E-02	<1.15E+02	1.43E-01	<1.15E+02	1.21E-01	<9.50E+01	3.72E-02	<9.50E+01	1.07E-01	<9.50E+01	5.53E-02	**6.19E-01**
Sb-125	3.47E+01	3.79E+04	2.62E+01	3.79E+04	4.71E+01	3.79E+04	3.97E+01	8.69E+03	3.40E+00	8.69E+03	9.79E+00	8.69E+03	5.06E+00	**1.66E+02**
Sb-126	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Sb-126m	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Te-125m	8.82E+00	3.79E+04	2.62E+01	3.79E+04	4.71E+01	3.79E+04	3.97E+01	8.69E+03	3.40E+00	8.69E+03	9.79E+00	8.69E+03	5.06E+00	**1.40E+02**
Sn-126	1.13E-01	<8.15E+01	5.64E-02	<8.15E+01	1.01E-01	<8.15E+01	8.55E-02	6.52E+01	2.55E-02	6.52E+01	7.35E-02	6.52E+01	3.80E-02	**4.93E-01**
I-129	8.59E-02	***2.93E+00***	2.02E-03	***2.85E+00***	3.54E-03	***8.29E-01***	8.69E-04	***8.34E+00***	3.26E-03	***7.08E+00***	7.98E-03	***6.86E+00***	4.00E-03	**1.08E-01**
Cs-134	9.35E-03	<7.25E+01	5.01E-02	<7.25E+01	9.00E-02	<7.25E+01	7.60E-02	<5.90E+03	2.31E+00	<5.90E+03	6.65E+00	<5.90E+03	3.44E+00	**1.26E+01**
Cs-135	1.57E-02	6.45E+01	4.46E-02	6.45E+01	8.01E-02	6.45E+01	6.76E-02	1.65E+02	6.46E-02	1.65E+02	1.86E-01	1.65E+02	9.61E-02	**5.55E-01**
Cs-137	3.84E+02	***5.93E+05***	4.10E+02	***5.77E+05***	7.17E+02	***1.17E+05***	1.23E+02	***3.02E+07***	1.18E+04	***2.80E+07***	3.16E+04	***2.71E+07***	1.58E+04	**6.09E+04**
Ba-137m	3.63E+02	***5.61E+05***	3.88E+02	***5.46E+05***	6.78E+02	***1.11E+05***	1.16E+02	***2.86E+07***	1.12E+04	***2.65E+07***	2.99E+04	***2.57E+07***	1.50E+04	**5.76E+04**
Ce-144	9.87E-02	<2.07E+02	1.43E-01	<2.07E+02	2.57E-01	<2.07E+02	2.17E-01	<1.34E+02	5.25E-02	<1.34E+02	1.51E-01	<1.34E+02	7.81E-02	**9.98E-01**
Pr-144	9.87E-02	<2.07E+02	1.43E-01	<2.07E+02	2.57E-01	<2.07E+02	2.17E-01	<1.34E+02	5.25E-02	<1.34E+02	1.51E-01	<1.34E+02	7.81E-02	**9.98E-01**
Pm-147	1.48E-02	1.76E+03	1.22E+00	1.76E+03	2.19E+00	1.76E+03	1.85E+00	<1.47E+03	5.75E-01	<1.47E+03	1.66E+00	<1.47E+03	8.56E-01	**8.35E+00**
Sm-151	1.16E-02	1.23E+03	8.51E-01	1.23E+03	1.53E+00	1.23E+03	1.29E+00	<9.86E+02	3.86E-01	<9.86E+02	1.11E+00	<9.86E+02	5.74E-01	**5.75E+00**
Eu-152	4.25E-03	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**4.25E-03**
Eu-154	1.96E-02	7.16E+02	4.95E-01	7.16E+02	8.89E-01	7.16E+02	7.51E-01	3.62E+02	1.42E-01	3.62E+02	4.08E-01	3.62E+02	2.11E-01	**2.92E+00**
Eu-155	8.68E-02	<2.28E+02	1.58E-01	<2.28E+02	2.83E-01	<2.28E+02	2.39E-01	<7.25E+01	2.84E-02	<7.25E+01	8.17E-02	<7.25E+01	4.22E-02	**9.19E-01**
Ra-226	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Ac-227	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Ra-228	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Th-229	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Th-230	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Pa-231	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Th-232	2.26E-06	1.29E-02	8.92E-06	1.29E-02	1.60E-05	1.29E-02	1.35E-05	1.06E-02	4.15E-06	1.06E-02	1.19E-05	1.06E-02	6.18E-06	**6.30E-05**
Np-237	1.94E-02	<1.21E+01	8.37E-03	<1.21E+01	1.50E-02	<1.21E+01	1.27E-02	<3.16E+01	1.24E-02	<3.16E+01	3.56E-02	<3.16E+01	1.84E-02	**1.22E-01**
U-232	9.40E-03	<8.74E-01	6.05E-04	<8.74E-01	1.09E-03	<8.74E-01	9.17E-04	7.33E-01	2.87E-04	7.33E-01	8.26E-04	7.33E-01	4.27E-04	**1.35E-02**
U-233	3.52E+00	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**3.52E+00**
U-234	3.52E+00	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**3.52E+00**

Table 2: Vault 4 Inventory as of 9/30/08 cont'd

U-235	6.89E-02	7.31E-01	5.06E-04	7.31E-01	9.08E-04	7.31E-01	7.67E-04	1.46E-01	5.72E-05	1.46E-01	1.65E-04	1.46E-01	8.51E-05	**7.14E-02**
U-236	7.61E-02	5.67E+00	3.92E-03	5.67E+00	7.04E-03	5.67E+00	5.95E-03	5.08E+00	1.99E-03	5.08E+00	5.73E-03	5.08E+00	2.96E-03	**1.04E-01**
U-238	1.12E-01	2.24E+00	1.55E-03	2.24E+00	2.78E-03	2.24E+00	2.35E-03	7.91E-01	3.10E-04	7.91E-01	8.91E-04	7.91E-01	4.61E-04	**1.20E-01**
Pu-238	1.45E+00	1.33E+04	9.20E+00	1.33E+04	1.65E+01	1.33E+04	1.39E+01	3.18E+04	1.24E+01	3.18E+04	3.58E+01	3.18E+04	1.85E+01	**1.08E+02**
Pu-239	1.64E-01	9.17E+02	6.34E-01	9.17E+02	1.14E+00	9.17E+02	9.62E-01	1.05E+03	4.11E-01	1.05E+03	1.18E+00	1.05E+03	6.12E-01	**5.10E+00**
Pu-240	4.82E+00	9.17E+02	6.34E-01	9.17E+02	1.14E+00	9.17E+02	9.62E-01	1.05E+03	4.11E-01	1.05E+03	1.18E+00	1.05E+03	6.12E-01	**9.76E+00**
Pu-241	1.87E-01	***2.06E+04***	1.43E+01	***2.00E+04***	2.49E+01	***2.63E+03***	2.76E+00	***1.02E+04***	4.01E+00	***1.90E+04***	2.14E+01	***1.84E+04***	1.07E+01	**7.82E+01**
Pu-242	8.03E-03	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**8.03E-03**
Pu-244	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Am-241	2.87E-01	1.70E+03	1.18E+00	1.70E+03	2.11E+00	1.70E+03	1.78E+00	1.08E+03	4.23E-01	1.08E+03	1.22E+00	1.08E+03	6.29E-01	**7.63E+00**
Am-242m	8.25E-05	2.03E+00	1.40E-03	2.03E+00	2.52E-03	2.03E+00	2.13E-03	1.68E+00	6.58E-04	1.68E+00	1.89E-03	1.68E+00	9.79E-04	**9.67E-03**
Am-243	1.30E-03	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**1.30E-03**
Cm-242	6.81E-05	1.68E+00	1.16E-03	1.68E+00	2.09E-03	1.68E+00	1.76E-03	1.39E+00	5.44E-04	1.39E+00	1.57E-03	1.39E+00	8.10E-04	**8.00E-03**
Cm-243	7.36E-02	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R	N.R.	N.R.	N.R.	**7.36E-02**
Cm-244	8.61E-02	4.46E+03	3.08E+00	4.46E+03	5.54E+00	4.46E+03	4.68E+00	2.81E+03	1.10E+00	2.81E+03	3.17E+00	2.81E+03	1.64E+00	**1.93E+01**
Cm-245	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Cm-247	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Cm-248	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Bk-249	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Cf-249	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R	N.R.	**N.R.**
Cf-251	2.47E-01	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**2.47E-01**
Cf-252	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	**N.R.**
Volume		182737		328012		277082		103421		297754		153924		

Note 1: The highlighted cells have results in Reference 11 which were initially developed assuming production data during FY07 that used minimum detection limits from Tank 50 analysis. This led to significant overestimation for the inventory of these radionuclides. The affected radionuclides have had their inventories since Dec 2006 estimated in Reference 14. These radionuclides are not decay corrected from 2007 and take their input directly from the results of Table 1 instead of Reference 11.

Note 2: Value in the fourth column equals value in the third column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 182737 gal (Oct 2007 volume of salt solution processed).

Note 3: Value in the sixth column equals value in the fifth column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 328012 gal (Nov 2007 volume of salt solution processed).

Note 4: Value in the eighth column equals value in the seventh column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 277082 gal (Dec 2007 volume of salt solution processed).

Note 5: Value in the tenth column equals value in the ninth column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 103421 gal (Feb 2008 volume of salt solution processed).

Note 6: Value in the twelfth column equals value in the eleventh column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 297754 gal (Mar 2008 volume of salt solution processed).

Table 2: Vault 4 Inventory as of 9/30/08 cont'd

Note 7: Value in the fourteenth column equals value in the thirteenth column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 153924 gal (Apr 2008 volume of salt solution processed).

Note 8: Value in the fifteenth column equals sum of second, fourth, sixth, eighth, tenth, twelfth, and fourteenth columns.

Note 9: Radionuclides listed as N.R. were not reported due to high analytical limits of detection. Total inventory additions (see attachment 1) were determined by calculation using the methodology documented in CBU-PIT-2005-00146, Saltstone Performance Objective Demonstration Document.

Table 3: Vault 4 Inventory as of 3/31/09

Nuclide	Existing Ci/Vault as of 9/30/08 (Table 2)	Jan 2009 Additions (pCi/mL) (Refs. 9, 10 [bold])	Jan 2009 Additions (Ci) (Note 1)	March 2009 Additions (pCi/mL) (Refs. 9, 10 [bold])	March 2009 Additions (Ci) (Note 2)	Additions Since Dec 2006 (Ci) (Note 5, Att. 1)	Total as of 3/31/09 (Ci) (Note 3, 4)
H-3	3.14E+01	**1.59E+03**	1.75E+00	**1.50E+03**	4.01E-01		**3.36E+01**
C-14	1.31E+00	**5.20E+02**	5.74E-01	**4.95E+02**	1.32E-01		**2.02E+00**
Na-22	N.R.	N.R.	N.R.	N.R.	N.R.	1.38E+01	**1.38E+01**
Al-26	N.R.	N.R.	N.R.	N.R.	N.R.	5.07E-02	**5.07E-02**
Co-60	9.04E-02	6.65E+00	7.34E-03	6.65E+00	1.78E-03		**9.95E-02**
Ni-59	2.60E-01	<1.36E+02	<1.50E-01	<1.36E+02	<3.63E-02		**4.47E-01**
Ni-63	1.05E+00	**1.18E+02**	1.31E-01	**1.22E+02**	3.25E-02		**1.21E+00**
Se-79	5.46E+00	5.32E+02	5.87E-01	5.32E+02	1.42E-01		**6.19E+00**
Sr-90	1.66E+03	**2.60E+05**	2.87E+02	**2.48E+05**	6.63E+01		**2.01E+03**
Y-90	1.66E+03	**2.60E+05**	2.87E+02	**2.48E+05**	6.63E+01		**2.01E+03**
Nb-94	9.91E-04	N.R.	N.R.	N.R.	N.R.	3.00E-07	**9.91E-04**
Tc-99	7.97E+01	**3.39E+04**	3.73E+01	**3.58E+04**	9.57E+00		**1.27E+02**
Ru-106	6.19E-01	<9.19E+01	<1.01E-01	<9.19E+01	<2.45E-02		**7.45E-01**
Rh-106	6.19E-01	<9.19E+01	<1.01E-01	<9.19E+01	<2.45E-02		**7.45E-01**
Sb-125	1.66E+02	7.12E+03	7.85E+00	7.12E+03	1.90E+00		**1.76E+02**
Sb-126	N.R.	N.R.	N.R.	N.R.	N.R.	2.70E-02	**2.70E-02**
Sb-126m	N.R.	N.R.	N.R.	N.R.	N.R.	1.93E-01	**1.93E-01**
Te-125m	1.40E+02	7.12E+03	7.85E+00	7.12E+03	1.90E+00		**1.50E+02**
Sn-126	4.93E-01	5.16E+01	5.69E-02	5.16E+01	1.38E-02		**5.64E-01**
I-129	1.08E-01	**9.67E+00**	1.07E-02	**1.86E+01**	4.97E-03		**1.23E-01**
Cs-134	1.26E+01	<7.21E+02	<7.95E-01	<7.21E+02	<1.93E-01		**1.36E+01**
Cs-135	5.55E-01	1.68E+02	<1.85E-01	1.68E+02	<4.49E-02		**7.85E-01**
Cs-137	6.09E+04	**2.24E+07**	2.47E+04	**2.47E+07**	6.59E+03		**9.22E+04**
Ba-137m	5.76E+04	**2.12E+07**	2.34E+04	**2.33E+07**	6.23E+03		**8.72E+04**
Ce-144	9.98E-01	<1.20E+02	<1.32E-01	<1.20E+02	<3.21E-02		**1.16E+00**
Pr-144	9.98E-01	<1.20E+02	<1.32E-01	<1.20E+02	<3.21E-02		**1.16E+00**
Pm-147	8.35E+00	<3.31E+03	3.65E+00	<3.31E+03	8.84E-01		**1.29E+01**
Sm-151	5.75E+00	<2.23E+03	2.46E+00	<2.23E+03	5.96E-01		**8.81E+00**
Eu-152	4.25E-03	N.R.	N.R.	N.R.	N.R.	8.93E-03	**1.32E-02**
Eu-154	2.92E+00	2.82E+02	3.11E-01	2.82E+02	7.53E-02		**3.30E+00**
Eu-155	9.19E-01	<5.72E+01	<6.31E-02	<5.72E+01	<1.53E-02		**9.97E-01**
Ra-226	N.R.	N.R.	N.R.	N.R.	N.R.	5.35E+00	**5.35E+00**
Ac-227	N.R.	N.R.	N.R.	N.R.	N.R.	3.32E-07	**3.32E-07**
Ra-228	N.R.	N.R.	N.R.	N.R.	N.R.	1.45E-06	**1.45E-06**

Table 3: Vault 4 Inventory as of 3/31/09 cont'd

Th-229	N.R.	N.R.	N.R.	N.R.	N.R.	1.60E-05	**1.60E-05**
Th-230	N.R.	N.R.	N.R.	N.R.	N.R.	1.41E-02	**1.41E-02**
Pa-231	N.R.	N.R.	N.R.	N.R.	N.R.	9.22E-07	**9.22E-07**
Th-232	6.30E-05	1.13E-02	1.25E-05	1.13E-02	3.02E-06		**7.85E-05**
Np-237	1.22E-01	<1.63E+01	<1.80E-02	<1.63E+01	<4.35E-03		**1.44E-01**
U-232	1.35E-02	1.34E+00	1.48E-03	1.34E+00	3.58E-04		**1.54E-02**
U-233	3.52E+00	N.R.	N.R.	N.R.	N.R.	5.59E-03	**3.53E+00**
U-234	3.52E+00	N.R.	N.R.	N.R.	N.R.	2.64E-02	**3.55E+00**
U-235	7.14E-02	1.70E-01	1.88E-04	1.70E-01	4.54E-05		**7.16E-02**
U-236	1.04E-01	1.49E+00	1.64E-03	1.49E+00	3.98E-04		**1.06E-01**
U-238	1.20E-01	7.79E-01	8.59E-04	7.79E-01	2.08E-04		**1.21E-01**
Pu-238	1.08E+02	3.41E+04	3.76E+01	3.41E+04	9.11E+00		**1.55E+02**
Pu-239	5.10E+00	1.07E+03	1.18E+00	1.07E+03	2.86E-01		**6.57E+00**
Pu-240	9.76E+00	1.07E+03	1.18E+00	1.07E+03	2.86E-01		**1.12E+01**
Pu-241	7.82E+01	**2.82E+04**	3.12E+01	**4.12E+04**	1.10E+01		**1.20E+02**
Pu-242	8.03E-03	N.R.	N.R.	N.R.	N.R.	1.99E-03	**1.00E-02**
Pu-244	N.R.	N.R.	N.R.	N.R.	N.R.	2.41E-05	**2.41E-05**
Am-241	7.63E+00	7.75E+02	8.55E-01	7.75E+02	2.07E-01		**8.69E+00**
Am-242m	9.67E-03	8.29E-01	9.14E-04	8.29E-01	2.21E-04		**1.08E-02**
Am-243	1.30E-03	N.R.	N.R.	N.R.	N.R.	1.03E-01	**1.05E-01**
Cm-242	8.00E-03	6.89E-01	7.60E-04	6.89E-01	1.84E-04		**8.94E-03**
Cm-243	7.36E-02	N.R.	N.R.	N.R.	N.R.	1.74E-05	**7.36E-02**
Cm-244	1.93E+01	2.23E+03	2.46E+00	2.23E+03	5.96E-01		**2.23E+01**
Cm-245	N.R.	N.R.	N.R.	N.R.	N.R.	6.15E-06	**6.15E-06**
Cm-247	N.R.	N.R.	N.R.	N.R.	N.R.	3.36E-15	**3.36E-15**
Cm-248	N.R.	N.R.	N.R.	N.R.	N.R.	3.51E-15	**3.51E-15**
Bk-249	N.R.	N.R.	N.R.	N.R.	N.R.	2.56E-22	**2.56E-22**
Cf-249	N.R.	N.R.	N.R.	N.R.	N.R.	1.94E-14	**1.94E-14**
Cf-251	2.47E-01	N.R.	N.R.	N.R.	N.R.	6.65E-16	**2.47E-01**
Cf-252	N.R.	N.R.	N.R.	N.R.	N.R.	2.15E-17	**2.15E-17**
Volume		291436		70565			

Note 1: Value in the fourth column equals value in the third column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 291436 gal (Jan 2009 volume of salt solution processed).

Note 2: Value in the sixth column equals value in the fifth column, multiplied by 3785 mL/gal, divided by 1E+12 pCi/Ci, and multiplied by 70565 gal (Mar 2009 volume of salt solution processed).

Table 3: Vault 4 Inventory as of 3/31/09 cont'd

Note 3: Value in the eighth column equals sum of second, fourth, sixth and seventh columns.

Note 4: The salt solution composition data used in this table represents the most current data at the time of this revision. However, additional samples are undergoing analysis and may be used in a future revision to this calculation to improve the accuracy of the results.

Note 5: Radionuclides listed as N.R. were not reported due to high analytical limits of detection. Total inventory additions (see Table 2, Attachment 1) were determined by calculation using the methodology documented in CBU-PIT-2005-00146, Saltstone Performance Objective Demonstration Document.

Table 4: Total Radionuclide Inventory in SDF as of 3/31/09

Nuclide	Vault 1 Inventory (Ci) (Note 1)	Vault 4 Inventory (Ci) (Table 3)	Total (Ci) (Note 2)	PODD limit (Ci) (Ref. 13, Table 3-2)	Percent of PODD Total (%) (Note 3)
H-3	2.09E+01	3.36E+01	**5.45E+01**	9.43E+03	0.6%
C-14	1.28E+00	2.02E+00	**3.30E+00**	5.20E+02	0.6%
Na-22		1.38E+01	**1.38E+01**	5.05E+03	0.3%
Al-26		5.07E-02	**5.07E-02**	2.35E+01	0.2%
Co-60	1.48E-03	9.95E-02	**1.01E-01**	1.10E+02	0.1%
Ni-59	3.46E-02	4.47E-01	**4.81E-01**	2.85E+00	16.9%
Ni-63	9.07E-01	1.21E+00	**2.12E+00**	2.51E+02	0.8%
Se-79	3.02E-01	6.19E+00	**6.49E+00**	8.94E+01	7.3%
Sr-90	1.17E-02	2.01E+03	**2.01E+03**	7.43E+03	27.1%
Y-90	1.17E-02	2.01E+03	**2.01E+03**	7.43E+03	27.1%
Nb-94	2.51E-03	9.91E-04	**3.50E-03**	4.22E-03	83.0%
Tc-99	1.08E+02	1.27E+02	**2.35E+02**	3.31E+04	0.7%
Ru-106	4.34E-04	7.45E-01	**7.46E-01**	2.28E+03	0.0%
Rh-106	4.34E-04	7.45E-01	**7.46E-01**	2.28E+03	0.0%
Sb-125	3.93E+01	1.76E+02	**2.15E+02**	9.24E+03	2.3%
Sb-126	1.40E-01	2.70E-02	**1.67E-01**	6.30E+01	0.3%
Sb-126m	9.97E-01	1.93E-01	**1.19E+00**	4.50E+02	0.3%
Te-125m	9.99E+00	1.50E+02	**1.60E+02**	2.26E+03	7.1%
Sn-126	9.97E-01	5.64E-01	**1.56E+00**	4.51E+02	0.3%
I-129	1.12E-01	1.23E-01	**2.35E-01**	1.80E+01	1.3%
Cs-134		1.36E+01	**1.36E+01**	2.71E+03	0.5%
Cs-135		7.85E-01	**7.85E-01**	4.67E+00	16.8%
Cs-137	7.13E+00	9.22E+04	**9.22E+04**	1.35E+06	6.8%
Ba-137m	6.75E+00	8.72E+04	**8.72E+04**	1.28E+06	6.8%
Ce-144		1.16E+00	**1.16E+00**	6.27E+00	18.5%
Pr-144		1.16E+00	**1.16E+00**	6.27E+00	18.5%
Pm-147		1.29E+01	**1.29E+01**	4.14E+03	0.3%
Sm-151		8.81E+00	**8.81E+00**	4.55E+03	0.2%
Eu-152	5.43E-03	1.32E-02	**1.86E-02**	2.20E+01	0.1%
Eu-154	1.39E-03	3.30E+00	**3.30E+00**	9.74E+02	0.3%
Eu-155		9.97E-01	**9.97E-01**	2.57E+02	0.4%
Ra-226	5.58E-10	5.35E+00	**5.35E+00**	1.30E+01	41.2%
Ac-227	1.05E-09	3.32E-07	**3.33E-07**	1.91E-05	1.7%
Ra-228	9.10E-15	1.45E-06	**1.45E-06**	1.04E-01	0.0%
Th-229	2.70E-05	1.60E-05	**4.30E-05**	7.53E-03	0.6%
Th-230		1.41E-02	**1.41E-02**	3.53E-02	39.9%
Pa-231	6.69E-08	9.22E-07	**9.89E-07**	5.32E-05	1.9%
Th-232		7.85E-05	**7.85E-05**	1.04E-01	0.1%
Np-237	4.49E-03	1.44E-01	**1.49E-01**	2.12E+00	7.0%
U-232		1.54E-02	**1.54E-02**	3.09E-02	49.8%
U-233	2.85E-01	3.53E+00	**3.81E+00**	2.22E+00	171.6%
U-234	2.85E-01	3.55E+00	**3.83E+00**	7.72E+00	49.6%
U-235	3.17E-03	7.16E-02	**7.48E-02**	1.35E-01	55.4%
U-236	3.17E-03	1.06E-01	**1.09E-01**	3.03E-01	35.9%

Table 4: Total Radionuclide Inventory in SDF as of 3/31/09 cont'd

U-238	7.36E-03	1.21E-01	**1.29E-01**	5.19E+00	2.5%
Pu-238	9.28E-03	1.55E+02	**1.55E+02**	1.36E+04	1.1%
Pu-239	1.23E-02	6.57E+00	**6.58E+00**	6.55E+02	1.0%
Pu-240	1.23E-02	1.12E+01	**1.12E+01**	1.75E+02	6.4%
Pu-241	2.85E-02	1.20E+02	**1.20E+02**	7.03E+03	1.7%
Pu-242	9.03E-04	1.00E-02	**1.09E-02**	1.81E-01	6.0%
Pu-244		2.41E-05	**2.41E-05**	7.96E-04	3.0%
Am-241	5.83E-04	8.69E+00	**8.69E+00**	9.50E+01	9.1%
Am-242m		1.08E-02	**1.08E-02**	5.27E-02	20.5%
Am-243		1.05E-01	**1.05E-01**	2.18E-02	480.4%
Cm-242		8.94E-03	**8.94E-03**	1.05E-01	8.5%
Cm-243		7.36E-02	**7.36E-02**	2.67E-02	275.7%
Cm-244		2.23E+01	**2.23E+01**	8.72E+01	25.6%
Cm-245		6.15E-06	**6.15E-06**	8.58E-03	0.1%
Cm-247		3.36E-15	**3.36E-15**	5.15E-12	0.1%
Cm-248		3.51E-15	**3.51E-15**	5.36E-12	0.1%
Bk-249		2.56E-22	**2.56E-22**	6.31E-19	0.0%
Cf-249		1.94E-14	**1.94E-14**	4.79E-11	0.0%
Cf-251		2.47E-01	**2.47E-01**	2.47E-01	99.9%
Cf-252		2.15E-17	**2.15E-17**	5.32E-14	0.0%

Note 1: Values come from decay data in Reference 11.

Note 2: Value in the fourth column equals sum of second and third columns.

Note 3: Value in the sixth column equals fourth column divided by fifth column, multiplied by 100.

ATTACHMENT 1

X-ESR-H-00188
Revision 0

Alternative Determination of Saltstone Disposal Facility (SDF) Radionuclides Inventory as of March 31, 2009

T. A. Le. Author. Sludge & Salt Technical Planning — Date: 6/3/2009

Technical Review

Q. L. Nguyen. LWO Process Chemistry — Date: 06/03/2009

Independent Verification

Petras. R. J., Environmental Compliance & Waste MGMT — Date: 6/3/2009

Management Review

D. J. Martin, ETP Lead Engineer — Date: 6/3/2009

Introduction

A Saltstone Disposal Facility (SDF) inventory calculation is being prepared to evaluate the radiological inventory as of 3/31/09 against the Performance Objectives Demonstration Document (PODD) [1] values. This evaluation provides an alternative means of determining Tank 50 composition utilizing basis documents that provided input to the PODD. This paper will determine the curie inventory during the time of interest of a subset of radionuclides in the PODD where either a) sample results include only less than detection values and inventory projections exceeded or were very near the PODD end-of-life values, b) no analyses were performed for the radionuclide and for c) Am-243, where an enhanced analysis was performed using a combination of sample results and PODD basis methodology.
The concerned radionuclides are: Na-22, Al-26, Nb-94, Sb-126, Sb-126m, Eu-152, Ac-227, Ra-226, Ra-228, Pa-231, Th-229, Th-230, U-233, U-234, Pu-242, Pu-244, Am-243, Cm-243, Cm-245, Cm-247, Cm-248, Bk-249, Cf-249, Cf-251, and Cf-252.

Inputs and Assumptions

Unless otherwise specified, the curies input and assumptions in this section are only for the concerned radionuclides listed and not applicable for other radionuclides.

1. The original tank radionuclide concentrations are derived from reference 2 [2] to be consistent with the basis for the Performance Objective Demonstration Document (PODD) [1 & 3].
2. The original tank activity of Sb-126m is equal to activity of Sn-126, and Sb-126 activity is 14% of the Sb-126m [2].
3. DDA Batch 0 started in December 2006 [4]
4. It is assumed that before interstitial liquid (IL) removal and before salt dissolution, Tank 41 and 25 salt cake contain a void fraction of 40 volume %, with 30 volume % liquid and 10 % gas [5]. These values were used to determine salt dissolution results in the two tanks to be consistent with the basis for the PODD values.
5. For salt dissolution in Tanks 25 and Tank 41, 1 gallons water added would dissolve 0.52 gallon salt and result in 1.45 gallons salt solution [6]. These factors also mean that 1 gallon of salt would need 1.92 gallons of water for salt dissolution to create 2.79 gallons of salt solution. These values were used to determine salt dissolution results in the two tanks to be consistent with the basis for the PODD values [3].
6. Tank 41 to 49 salt dissolution inputs & assumptions:
    a. Tank 41 Salt volume 1,090,000 gallons [2]
    b. 152,000 gallons IL was removed from Tank 41 before salt dissolution [7].
    c. 519,000 gallons inhibited water (IW) added to Tank 41[7].
    d. 661,000 gallons salt solution transferred from Tank 41 to Tank 49 [7].
7. Consistent with Reference 3 Appendix A, non-salt processing influents into Tank 50 such as Effluent Treatment Project and Highly Enriched Uranium waste receipts after Batch 0 are very low in activity and are not included in the analysis. However, contrary to Reference 5 Appendix A, this analysis does include the volume effect from these sources to better align batch volumes throughout the analysis.

8. The LLW volume to Tank 50 (e.g. Canyon waste receipts. ETP waste receipt. flush water additions) was determined by subtracting the salt processing influents (DDA. ARP/MCU. Tank 50 heel and chemical additions) from the Tank 50 level at the applicable time for each salt batch. Radionuclide additions from these LLW sources are assumed insignificant in accordance with input assumption 7

9. For ISDP B1 and B2. the curies for those concerned radionuclides transferred to Tank 50 from ARP/MCU are equal to the curies transferred from Tank 49 to ARP/MCU. The subset radionuclides determined in this document does not include Cs-137. For conservatism. it is assumed that the ARP/MCU did not remove any of the soluble actinide curies. and the other radionuclides were not affected by MST.

10. For conservatism. it is assumed that Na-22. Al-26. Ac-227. and Pa-231in the saltcake are 100% soluble in the resultant salt solution.

11. Tank 41 to Tank 49 salt dissolution was in progress when reference 2 was issued. When the dissolution campaign completed in the end of May 2005 [7]. Tank 49 would contain mostly Tank 41 salt solution. Therefore. the curies concentration of Tank 49 at the starting time for this calculation (12/1/2006) would be the result of Tank 41salt solution.

12. For Am-243 isotope. actual sample results curie concentration would be used for total in Tank 50 of DDA Batch 2 (23.9 pCi/mL) [8] and ISDP Batch 2 (20.5 pCi/mL) [9]. The alternative method was used to determine Am -243 of the other batches because their sample results for Am-243 in Tank 50 reported at LDL.

The detail input volumes for DDA and Salt batches to Saltstone are listed in Table 1.

Table 1: Batch volumes to Saltstone up to 3/31/2009

Salt Batch to Salt Stone	Time Line
DDA Batch 0 - Tank 50 – Z area : 150 Kgal [4]	**12/1/2006-2/28/2007**
DDA Batch 1 - Tank 41 – Tank 49 : 661 Kgal [7] - Tank 49 – Tank 50 : 3.2 Kgal [10] - Tank 23 – Tank 50 : 6.5 Kgal [11] - LLW – Tank 50 : ~10 Kgal - Tank 50 – Z area : 100 Kgal [4]	**3/1/2007 – 3/31/2007**
DDA Batch 2 - Tank 23 – Tank 50 : 120 Kgal [12] - LLW – Tank 50 : ~120 Kgal - Caustic – Tank 50 : 13 Kgal [4] - Tank 50 – Z area : 788 Kgal [13]	**4/1/2007 – 12/21/2007**
DDA Batch 3 - Tank 23 – Tank 49 : 450 Kgal [a] - Tank 23 – Tank 50 : 390 Kgal - Tank 49 – Tank 50 : 420 Kgal - LLW – Tank 50 : ~125 Kgal - Tank 50 – Z area : 401 Kgal [14]	**12/22/2007 – 3/31/2008**
ISDP Batch 1 - Tank 49 – ARP/MCU : 142 Kgal [15] - ARP/MCU – Tank 50 : 170 Kgal [b] - LLW – Tank 50 : ~140 Kgal - Tank 50 – Z area : 154 Kgal [16]	**4/1/2008 -10/31/2008**
ISDP Batch 2 - Tank 25/41 – Tank 49 : 123 Kgal [17] - Tank 22 – Tank 49 : 197 Kgal [17] - Caustic to Tank 49 : ~ 80 Kgal [17] - Tank 49 – ARP/MCU : 74 Kgal [c] - ARP/MCU – Tank 50 : 85 Kgal [4] - LLW – Tank 50 : ~80 Kgal - Tank 50 – Z area : 362 Kgal [18]	**11/1/2008 – 3/31/2009**

[a] The different in Tank 23 level before transfer (Morning report on 11/30/07) and after transfer (12/7/07) was 440 kgal. but Tank 49 received more (about 457 kgal) due to flush water. 450 kgal is used here for conservatism on Ci perspective.

[b] This volume was determined using 1.15 factor of dilution in ARP/MCU (the same as ISDP batch 2. 85kgal / 74 Kgal). This is justified because the curies to Tank 50 was what came in with 142 kgal to Tank 49 and did not change with this volume.

[c] The different in Tank 49 level between 12/31/08 and 3/31/09

Calculations Approach

In order to come up with new estimate for each concerned radionuclide. the original radionuclide concentrations for Tanks 22. 23. 25. 41. and 50 must be known. These values were derived from reference 2.

For Tanks 25 and 41. since these tanks went through the salt removal campaigns. the amount of interstitial liquid removed and the salt dissolution process were factored into the calculations for the concerned radionuclides. Using transfers history from Table 1. the concerned radionuclides for each Tank 50 batch and Saltstone inventory were estimated.

Discussion of Results

For the concerned radionuclides. the new estimated values for each Tank 50 batch and current Saltstone total curies are shown in Table 2.

Calculation details for Tank 25 salt dissolution are presented in Appendix A.

Detailed results for each batch are shown in Appendix B

An example calculation for Nb-94 is provided in the next section. Other radionuclides are calculated similar to Nb-94. except for the calculation of total Am-243 in Tank 50 for DDA Batch 2 and total Am-243 in Tank 50 ISDP Batch 2. Since there were actual available Tank 50 sample results available for the two batches [8 and 9]. the actual values were used. The calculations for Am-243 in Tank 50 for DDA Batch 2 and ISDP Batch 2 are shown following the Nb-94 calculation. Am-243 in other batches is estimated similar to Nb-94 because their sample results report as lower than detection limit (LDL). so the alternative method is used.

Table 2: Alternative Determination of Curies Transferred to Saltstone

	DDA B0	DDA B1	DDA B2	DDA B3	ISDP B1	ISDP B2	Total to Z
Volume (gal)	150.000	100.000	788.000	401.000	154.000	362.000	1.955.000
Radionuclides	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)
Na-22	6.79E-05	2.57E-02	1.44E-01	5.88E−00	2.35E−00	5.39E−00	1.38E−01
Al-26	4.35E-07	9.44E-05	5.32E-04	2.16E-02	8.62E-03	1.99E-02	5.07E-02
Nb-94	2.35E-11	5.60E-10	3.28E-09	1.25E-07	4.98E-08	1.22E-07	3.00E-07
Sb-126	2.12E-06	5.03E-05	2.94E-04	1.12E-02	4.48E-03	1.09E-02	2.70E-02
Sb-126m	1.51E-05	3.59E-04	2.10E-03	8.02E-02	3.20E-02	7.81E-02	1.93E-01
Eu-152	7.00E-07	1.66E-05	9.74E-05	3.72E-03	1.48E-03	3.62E-03	8.93E-03
Ac-227	9.34E-09	6.58E-09	3.89E-08	1.21E-07	4.76E-08	1.09E-07	3.32E-07
Ra-226	7.04E-15	8.98E-03	1.13E+00	2.21E−00	6.58E-01	1.34E−00	5.35E−00
Ra-228	2.48E-07	1.61E-07	9.17E-07	7.08E-08	1.94E-08	3.86E-08	1.45E-06
Pa-231	2.59E-08	1.83E-08	1.08E-07	3.36E-07	1.32E-07	3.02E-07	9.22E-07
Th-229	6.30E-11	2.33E-08	2.93E-06	5.73E-06	1.71E-06	5.58E-06	1.60E-05
Th-230	8.60E-13	2.36E-05	2.97E-03	5.82E-03	1.73E-03	3.53E-03	1.41E-02
U-233	2.21E-08	8.16E-06	1.02E-03	2.01E-03	5.97E-04	1.96E-03	5.59E-03
U-234	3.12E-09	4.76E-05	1.83E-03	1.11E-02	4.12E-03	9.23E-03	2.64E-02
Pu-242	2.18E-10	3.34E-06	4.19E-04	8.22E-04	2.44E-04	4.99E-04	1.99E-03
Pu-244	6.93E-07	4.84E-07	6.79E-06	8.47E-06	2.51E-06	5.13E-06	2.41E-05
Cm-243	1.37E-09	3.25E-08	1.90E-07	7.24E-06	2.89E-06	7.06E-06	1.74E-05
Cm-245	4.81E-10	1.15E-08	6.71E-08	2.56E-06	1.02E-06	2.49E-06	6.15E-06
Cm-247	2.64E-19	6.27E-18	3.67E-17	1.40E-15	5.58E-16	1.36E-15	3.36E-15
Cm-248	2.75E-19	6.54E-18	3.83E-17	1.46E-15	5.82E-16	1.42E-15	3.51E-15
Bk-249	2.01E-26	4.78E-25	2.80E-24	1.07E-22	4.26E-23	1.04E-22	2.56E-22
Cf-249	1.52E-18	3.62E-17	2.12E-16	8.07E-15	3.22E-15	7.86E-15	1.94E-14
Cf-251	5.20E-20	1.24E-18	7.25E-18	2.76E-16	1.10E-16	2.69E-16	6.65E-16
Cf-252	1.69E-21	4.01E-20	2.35E-19	8.96E-18	3.57E-18	8.73E-18	2.15E-17
Am-243	2.34E-09	5.55E-08	7.13E-02	3.22E-03	8.28E-04	2.81E-02	1.03E-01

Example Calculation: Estimation of Nb-94 for Waste Transferred to Saltstone

Using reference 2, the original soluble Nb-94 in Tanks 22, 23, 25, 41, and 50 is 1.05E-08 Ci, 1.62E-09 Ci, 8.52E-06 Ci, 2.26E-06 Ci, and 6.65E-11 Ci, respectively. The total supernate volumes are 1.18E+06 gallons for Tank 22, 1.30E−06 gallons for Tank 23, 3.66E+05 gallons for Tank 25, 3.46E+05 gallons for Tank 41, and 4.24E+05 gallons for Tank 50 [2]. The original Tank 41 Nb-94 concentration was used to calculate Tank 41 to Tank 49 salt dissolution. At the time of interest Tank 49 content was mostly salt solution from Tank 41 first salt dissolution campaign. It is assumed the Tank 49 Nb-94 concentration is similar to Tank 41 resultant salt solution.

The original Tank 25 supernate Nb-94 concentration was used to calculate the Nb-94 resultant salt solution in Tank 25 to Tank 41 salt dissolution.

The soluble Nb-94 concentration (Ci/gal) in supernate in each tank was calculated by dividing the total soluble Nb-94 curies by the total supernate volume.

$$\text{Nb-94 concentration in Tank 22 supernate} = \frac{1.05E-08\,Ci}{1.18E-06\,gal} = 8.93E-15\frac{Ci}{gal}$$

$$\text{Nb-94 concentration in Tank 23 supernate} = \frac{1.62E-09\,Ci}{1.30E+06\,gal} = 1.25E-15\frac{Ci}{gal}$$

$$\text{Nb-94 concentration in Tank 50 supernate} = \frac{6.65E-11\,Ci}{4.24E-05\,gal} = 1.57E-16\frac{Ci}{gal}$$

$$\text{Nb-94 concentration in Tank 25 supernate} = \frac{8.52E-06\,Ci}{3.66E+05\,gal} = 2.33E-11\frac{Ci}{gal}$$

Tank 25 Nb-94 concentration was used to determine the concentration of Tank 25 salt dissolution.

$$\text{Nb-94 concentration in Tank 41, supernate} = \frac{2.26E-06\,Ci}{3.46E-05\,gal} = 6.53E-12\frac{Ci}{gal}$$

The original Tank 41 Nb-94 concentration was used to calculate Tank 41 to Tank 49 salt dissolution. At the time of interest Tank 49 content was mostly salt solution from Tank 41 first campaign salt dissolution. It is assumed the Tank 49 Nb-94 concentration is similar to Tank 41 resultant salt solution.

Tank 41 first campaign salt dissolution :

- Volume IL left in Tank 41 = (1.090.000 gal *0.3) − 152.000 = 175.000 gal
- Total liquid in Tank 41 after salt dissolution = (519.000 gal*1.45) + 175.000 = 927.550 gal
- Nb-94 concentration of Tk 41 after salt dissolution = Nb-94 Concentration of Tank 49 =

$$6.53E-12Ci * \frac{175.000\,gal}{927.550\,gal} = 1.23E-12\frac{Ci}{gal}$$

Using transfer histories from Table 1, the total Nb-94 curies for each Tank 50 batch transferred to Saltstone were estimated.

For Tank 50 DDA Batch 0 to Saltstone

Approximately 150 Kgal of Tank 50 supernate was transferred to Saltstone: therefore, the total Nb-94 curies in Saltstone Batch 0 were calculated as follows:

$$\text{Total Nb-94 to Saltstone DDA B 0} = 1.57E-16\frac{Ci}{gal} * 150.000 gal = 2.35E-11 Ci$$

For Tank 50 DDA Batch 1 to Saltstone

Tank 50 DDA Batch 1 consists of approximately 706.000 gallons of Tank 50 heel, 3.200 gallons of Tank 49 (Tank 41 salt solution), 6.500 gallons of Tank 23, and 10.000 gallons of LLW. The total volume in Tank 50 prior to transferring to Saltstone is approximately 725.700 gallons. Approximately 100.000 gallons were transferred from Tank 50 to Saltstone.

$$\text{Nb-94 for Tank 50 Heel} = 1.57E-16\frac{Ci}{gallon} * 706.000 gallons = 1.11E-10 Ci$$

$$\text{Nb-94 for Tank 49 to Tank 50} = 1.23E-12\frac{Ci}{gallon} * 3.200 gallons = 3.94E-09 Ci$$

$$\text{Nb-94 for Tank 23 to Tank 50} = = 1.25E-15\frac{Ci}{gallon} * 6.500 gallons = 8.12E-12 Ci$$

Total Nb-94 in Tank 50 = 1.11E-10 Ci + 3.94E-09 Ci – 8.12E-12 Ci = 4.06E-09 Ci

$$\text{Total Nb-94 to Saltstone DDA B1} = 4.06E-09 Ci * \frac{100.000 gallons}{725.700 gallons} = 5.60E-10 Ci$$

For Tank 50 DDA Batch 2 to Saltstone

Tank 50 DDA Batch 2 consists of approximately 625.700 gallons of Tank 50 heel, 120.000 gallons of Tank 23, 13.000 gallons of caustic addition, and 120.000 gallons of LLW. The total volume in Tank 50 prior to transferring to Saltstone is approximately 878.700 gallons. Approximately 788.000 gallons were transferred from Tank 50 to Saltstone.

$$\text{Nb-94 for Tank 50 Heel} = (4.06E-09 Ci) - (5.60E-10 Ci) = 3.50E-09 Ci$$

$$\text{Nb-94 for Tank 23} = 1.25E-15\frac{Ci}{gallons} * 120.000 gallons = 1.50E-10 Ci$$

Total Nb-94 in Tank 50 = 3.50E-09 Ci + 1.50E-10 Ci = 3.65E-09 Ci

$$\text{Total Nb-94 to Saltstone DDA B2} = 3.65E-09 Ci * \frac{788.000 gal}{878.700 gal} = 3.28E-09 Ci$$

Total Am-243 in Tank 50 for DDA Batch 2

$$\text{Am-243 concentration Tank 50} \quad 23.9 pCi/mL * \frac{1 Ci}{1.0E-12 pCi} * \frac{3785 mL}{gal} = 9.05E-08\frac{Ci}{gal}$$

Total Am-243 in Tank 50 for DDA B2 $= 9.05E-08 \frac{Ci}{gal} \cdot 878{,}700 gal = 7.95E-02 Ci$

For Tank 50 DDA Batch 3 to Saltstone

To prepare DDA Batch 3, Tank 49 received 450,000 gallons of Tank 23 material into 720,000 gallons heel for adjustment.

Nb-94 for Tank 23 to Tank 49 $= 1.25E-15 \frac{Ci}{gal} * 450{,}000 gal = 5.62E-10 Ci$

Nb-94 for Tank 49 heel $= 1.23E-12 \frac{Ci}{gal} * 720{,}000 gal = 8.87E-07 Ci$

Nb-94 for the new Tank 49 = 8.87E-07 Ci + 5.62E-10 Ci = 8.88E-07 Ci

Total volume in Tank 49 = 720,000 gal − 450,000 gal = 1,170,000 gal

Tank 50 DDA Batch 3 consists of approximately 90,700 gallons of Tank 50 heel, 390,000 gallons of Tank 23, 420,000 gallons of Tank 49, and 125,000 gallons of LLW. The total volume in Tank 50 prior to transferring to Saltstone is approximately 1,025,700 gallons. Approximately 401,000 gallons were transferred from Tank 50 to Saltstone.

Nb-94 for Tank 50 Heel $= (3.65E-09 Ci) - (3.28E-09 Ci) = 3.77E-10 Ci$

Nb-94 for Tank 23 to Tank 50 $= 1.25E-15 \frac{Ci}{gal} * 390{,}000 gal = 4.87E-10 Ci$

Nb-94 for Tank 49 to Tank 50 $= 8.87E-07 Ci * \frac{420{,}000 gal}{1{,}170{,}000 gal} = 3.19E-07 Ci$

Total Nb-94 in Tank 50 = Total of the three above = 3.20E-07 Ci

Total Nb-94 to Saltstone DDA B3 $= 3.20E-07 Ci * \frac{401{,}000 gal}{1{,}025{,}700 gal} = 1.25E-07$ Ci

For Tank 50 ISDP Batch 1 to Saltstone

Tank 50 ISDP Batch 1 consists of approximately 624,700 gallons of Tank 50 heel, 170,000 gallons from ARP/MCU, and 140,000 gallons of LLW. The total volume in Tank 50 prior to transferring to Saltstone is approximately 934,700 gallons. Approximately 154,000 gallons were transferred from Tank 50 to Saltstone. The 170,000 gallons from ARP/MCU are the result of 142,000 gallons of Tank 49 processed through ARP/MCU.

Nb-94 for Tank 50 Heel $= (3.20E-07 Ci) - (1.25E-07 Ci) = 1.95E-07 Ci$

Nb-94 for Tank 49 to ARP/MCU $= 8.87E-07 Ci * \frac{142{,}000 gal}{1{,}170{,}000 gal} = 1.08E-07 Ci$

Nb-94 for ARP/MCU to Tank 50 = Nb-94 for Tank 49 to ARP/MCU = 1.08E-07Ci

Total Nb-94 in Tank 50 = 1.95E-07 Ci + 1.08E-07 Ci = 3.02E-07 Ci

Total Nb-94 to Saltstone ISDP B1 = $3.02E-07Ci * \frac{154.000gal}{934.700gal} = 4.98E-08Ci$

For Tank 50 ISDP Batch 2 to Saltstone up to 3/31/2009

Details calculation of Tank 25 to Tank 41 salt dissolution are shown in Appendix A. The result is that Nb-94 concentration in 123.000 gal of transfer from Tank 41 to Tank 49 is 3.46E-12 Ci/gal.

To prepare ISDP Batch 2, Tank 49 received 123.000 gallons of Tank 25 salt solution via Tank 41, 197.000 gallons Tank 22, and approximately 80.000 caustic into 608.000 gallons heel to a total of 1.008.000 gallons.

Nb-94 in Tank 49 Heel = $8.87E-07Ci * \frac{608.000gal}{1.170.000gal} = 4.61E-07Ci$

Nb-94 for Tank 25/41 to Tank 49 = 3.46E-12 Ci/gal * 123.000 gal = 4.26E-07Ci

Nb-94 for Tank 22 to Tank 49 = $8.93E-15\frac{Ci}{gal} * 197.000gal = 1.76E-09Ci$

Total Nb-94 in Tank 49 = 4.61E-07 Ci + 4.26E-07 Ci − 1.76E-09 Ci = 8.89E-07 Ci

Tank 50 ISDP Batch 2 consists of approximately 780.700 gallons of Tank 50 heel, 85.000 gallons from ARP/MCU, and 80.000 gallons of LLW. The total volume in Tank 50 prior to transferring to Saltstone is approximately 945.700 gallons. Approximately 362.000 gallons were transferred from Tank 50 to Saltstone. The 85.000 gallons from ARP/MCU are the result of 74.000 gallons of Tank 49 processed through ARP/MCU.

Nb-94 for Tank 50 Heel = $(3.02E-07Ci) - (4.98E-08Ci) = 2.53E-07Ci$

Nb-94 for Tank 49 to ARP/MCU = $8.89E-07Ci * \frac{74.000gal}{1.008.000gal} = 6.53E-08Ci$

Nb-94 for ARP/MCU to Tank 50 = Nb-94 for Tank 49 to ARP/MCU = 5.63E-08Ci

Total Nb-94 in Tank 50 = 2.53E-07 Ci + 6.53E-08 Ci = 3.18E-07 Ci

Total Nb-94 to Saltstone ISDP B2 = $3.18E-07Ci * \frac{362.000gal}{945.700gal} = 1.22E-07Ci$

Total Am-243 in Tank 50 for ISDP Batch 2

Am-243 concentration Tank 50 $20.5pCi/mL * \frac{1Ci}{1.0E+12pCi} * \frac{3785mL}{gal} = 7.76E-08\frac{Ci}{gal}$

Total Am-243 in Tank 50 for ISDP B2 = $7.76E-08\frac{Ci}{gal} \times 945.700gal = 7.34E-02Ci$

Conclusion

This evaluation provides the alternative determination for SPF inventories on certain radionuclides as of 3/31/09. It is recommended that the alternative method be utilized to determine the SPF inventories for these radionuclides where either a) sample results include only less than detection values and inventory projections exceeded or were very near the PODD end-of-life values. b) no analyses were performed for the radionuclide and for c) Am-243, where an enhanced analysis was performed using a combination of sample results and PODD basis methodology.

Appendix A

Calculation for Tank 25 to Tank 41 Salt Dissolution

Before receiving Tank 25 salt solution. Tank 41 underwent another campaign of salt dissolution. and the resultant salt solution was transfer to Tank 23. An example to calculate Nb-94 is show below.

1. Tank 41 to Tank 23 Salt dissolution:

a. Tank 41 at the end of salt dissolution:

- Total liquid in Tank 41 = 927.550 gal – 661.000 gal[d] = 266.550 gal
- Nb-94 concentration in Tank 41 = 1.23E-12 Ci/gal [e]

b. Tank 41 to 23 salt dissolution

- 245.000 IW added gal [f]
- Volume salt dissolved = 245.000gal / 1.92 = 127.604 gal
- Resultant salt solution = 245.000 * 1.45 = 355.250 gal
- Total Liquid in Tank 41 = 355.250 gal + 266.550 gal = 621.800 gal
- Curies for each isotope = Ci in 266.500 gal beginning liquid + Ci in 127.600 gal salt dissolved
- Nb-94 concentration after salt dissolution =

$$1.23E-12 Ci/gal \frac{266.550 gal}{621.800 gal} = 5.28E-13 \frac{Ci}{gal}$$

- 398.000 gal transfer to Tank 23 [g]
- Total liquid left in Tank 621.800 gal – 398.000 gal = 223.800gal

2. Tank 25 to 41 Salt dissolution

Before receiving Tank 25 salt solution. a new pump was installed in Tank 41 at the level of 113.5 inches [h]. It is assumed that only the liquid above this level was mixed with Tank 25 salt solution when Tank 41 received salt solution.

a. Tank 41 after Tank 41 to 23 salt dissolution campaign

- 80.000 gal of IW added [i]
- Volume salt dissolved = 80.000 gal / 1.92 = 41.667 gal
- Resultant salt solution = 80.000 gal * 1.45 = 116.000 gal

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[d] Strohmeier, S. J., Tank 25 Deliquification Summary. LWO-PIT-2007-00039. Revision 1. January 2008
[e] From previously calculated
[f] Total from summary transfer in the HDH Morning Report: From 3 14 08 – 3 20 08 and from 5 2 08 – 5 19 08
[g] Input from table 1
[h] Transfer Jet Pump Waste Downcomer Levels and Adjustments Data Sheet. SW11.1-WTE. Section 7.2. Rev. 43. May 14. 2009
[i] Total from summary transfer in the HDH Morning Report: From 6 2 08 – 6 7 08

- Total liquid in Tank 41 = 116.000 gal + 223.800 gal = 339.800 gal
- Nb-94 concentration in Tank 41= $5.28E-13 Ci/gal \frac{223.800 gal}{339.800 gal} = 3.48E-13 \frac{Ci}{gal}$

b. Tank 25 salt dissolution

- Salt volume: 1.100.000 gal [j]
- Nb-94 in supernate: 2.33E-11 Ci/gal (previously calculated)
- 118.000 gal IL removed [k]
- IL left in Tank = (1.100.000 gal * 0.3) -118.000 gal = 212.000 gal
- 256.000 gal IW added for salt dissolution [l]
- Volume salt dissolved = 256.000 gal / 1.92 = 133.333 gal
- Volume resultant salt solution = 256.000 gal * 1.45 = 371.200 gal
- Total liquid in Tank = 371.200 gal + 212.000 gal = 583.200 gal
- Resultant Nb-94 in salt solution = $2.33E-11 Ci/gal * \frac{212.000 gal}{583.200 gal} = 8.45E-12 \frac{Ci}{gal}$

c. Tank 25 to 41 transfer

- Tank 41 liquid level 217.7 inches [m]
- Tank 41 salt level 191.45 inches [n]
- Pump suction at 113.35 inches [n]
- Mixable liquid =
  - [(217.7" – 191.45") + (191.45" – 113.35")*0.4]*3510gal/in = 201.790 gal
- 126.000 gal transferred from Tank 25
- Total mixable liquid = 126.000 gal + 201.790 gal = 327.790gal
- Nb-94 in mixable liquid =
  $8.45E-12 Ci/gal * 126.000 gal + 3.48E-13 Ci/gal * 201.790 gal = 1.14E-06 Ci$
- Nb-94 concentration for Tank 25/41 to 49 transfer =

$$\frac{1.14E-06 Ci}{327.790 gal} = 3.46E-12 \frac{Ci}{gal}$$

This is the input for Tank 25 salt dissolution to Tank 49 via Tank 41.

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[j] Tran, H. Q., Tank Radionuclide Inventories, CBU-PIT-2005-00138, Revision 0, October 5, 2005
[k] Strohmeier, S. J., Tank 25 Deliquification Summary, LWO-PIT-2007-00039, Revision 1, January 2008
[l] Total IW added to Tank 25 from Transfer summary in the HDH Morning Report from 7/17/08 to 7/21/08
[m] HDH Morning Report Summary on 7/23/2008
[n] Transfer Jet Pump Waste Downcomer Levels and Adjustments Data Sheet, SW11.1-WTE, Section 7.2, Rev. 43, May 14, 2009

Appendix B

Radionuclide Results for Each DDA and ISDP Batch

Table 3: Tank Supernate Radionuclide Concentration

Soluble Ci/gal	Tank 22	Tank 23	Tank 25 [o]	Tank 41 [p]	Tank 49 [q]	Tank 50
Radionuclide	(Ci/gal)	(Ci/gal)	(Ci/gal)	(Ci/gal)	(Ci/gal)	(Ci/gal)
Na-22	2.58E-08	3.61E-09	6.71E-05	1.89E-05	5.81E-05	4.53E-10
Al-26	1.66E-10	2.30E-11	4.31E-07	1.21E-07	2.13E-07	2.90E-12
Nb-94	8.93E-15	1.25E-15	2.33E-11	6.53E-12	1.23E-12	1.57E-16
Sb-126	8.06E-10	1.12E-10	2.09E-06	5.87E-07	1.11E-07	1.41E-11
Sb-126m	5.76E-09	8.02E-10	1.50E-05	4.19E-06	7.91E-07	1.01E-10
Eu-152	2.66E-10	3.71E-11	6.90E-07	1.94E-07	3.67E-08	4.67E-12
Ac-227	1.67E-13	1.84E-14	2.95E-18	1.10E-12	1.14E-12	6.23E-14
Ra-226	1.08E-13	1.00E-05	9.82E-26	9.37E-13	1.77E-13	4.69E-20
Ra-228	0.00E-00	1.37E-13	0.00E-00	0.00E+00	0.00E+00	1.65E-12
Pa-231	4.66E-13	5.11E-14	8.19E-18	3.04E-12	3.17E-12	1.73E-13
Th-229	3.80E-10	2.60E-11	3.90E-23	0.00E+00	0.00E+00	4.20E-16
Th-230	1.33E-11	2.64E-08	1.20E-23	1.14E-10	2.16E-11	5.73E-18
U-233	1.33E-07	9.10E-09	1.37E-20	0.00E+00	0.00E+00	1.47E-13
U-234	4.80E-08	1.45E-08	4.37E-20	4.16E-07	7.85E-08	2.08E-14
Pu-242	0.00E-00	3.72E-09	5.76E-14	0.00E+00	0.00E+00	1.45E-15
Pu-244	0.00E-00	3.79E-11	2.63E-16	0.00E+00	0.00E+00	4.62E-12
Cm-243	5.21E-13	7.26E-14	1.35E-09	3.79E-10	7.14E-11	9.13E-15
Cm-245	1.84E-13	2.55E-14	4.75E-10	1.34E-10	2.53E-11	3.21E-15
Cm-247	1.00E-22	1.40E-23	2.61E-19	7.31E-20	1.38E-20	1.76E-24
Cm-248	1.05E-22	1.46E-23	2.72E-19	7.63E-20	1.44E-20	1.83E-24
Bk-249	7.63E-30	1.06E-30	1.98E-26	5.58E-27	1.05E-27	1.34E-31
Cf-149	5.80E-22	8.09E-23	1.51E-18	4.22E-19	7.96E-20	1.02E-23
Cf-251	1.98E-23	2.77E-24	5.16E-20	1.45E-20	2.73E-21	3.47E-25
Cf-252	6.44E-25	8.94E-26	1.67E-21	4.68E-22	8.84E-23	1.13E-26
Am-243	8.93E-13	1.24E-13	2.31E-09	6.48E-10	1.22E-10	1.56E-14

[o] Tank 25 original curies concentrations were used to calculate the concentration of Tank 25 to tank 41 salt dissolution.
[p] Tank 41 original curies concentrations were used to calculate the concentration of Tank 41 salt dissolution campaign.
[q] Tank 49 curies concentrations were calculated from the first Tank 41 salt dissolution campaign.

Table 4: Radionuclides in Tank 50 to SPF for DDA Batch 0 and Batch 1

DDA B0	50 - Z
Volume (gal)	150.000
	(Ci)
Na-22	6.79E-05
Al-26	4.35E-07
Nb-94	2.35E-11
Sb-126	2.12E-06
Sb-126m	1.51E-05
Eu-152	7.00E-07
Ac-227	9.34E-09
Ra-226	7.04E-15
Ra-228	2.48E-07
Pa-231	2.59E-08
Th-229	6.30E-11
Th-230	8.60E-13
U-233	2.21E-08
U-234	3.12E-09
Pu-242	2.18E-10
Pu-244	6.93E-07
Cm-243	1.37E-09
Cm-245	4.81E-10
Cm-247	2.64E-19
Cm-248	2.75E-19
Bk-249	2.01E-26
Cf-249	1.52E-18
Cf-251	5.20E-20
Cf-252	1.69E-21
Am-243	2.34E-09

DDA B1	Tank 50 heel	49 - 50	23 - 50	Total Tk 50 [1]	50 - Z
Volume (gal)	706.000	3.200	6.500	725.700	100.000
	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)
Na-22	3.20E-04	1.86E-01	2.35E-05	1.86E-01	2.57E-02
Al-26	2.05E-06	6.83E-04	1.50E-07	6.85E-04	9.44E-05
Nb-94	1.11E-10	3.94E-09	8.12E-12	4.06E-09	5.60E-10
Sb-126	9.98E-06	3.54E-04	7.30E-07	3.65E-04	5.03E-05
Sb-126m	7.13E-05	2.53E-03	5.21E-06	2.61E-03	3.59E-04
Eu-152	3.30E-06	1.17E-04	2.41E-07	1.21E-04	1.66E-05
Ac-227	4.40E-08	3.65E-09	1.20E-10	4.77E-08	6.58E-09
Ra-226	3.31E-14	5.65E-10	6.51E-02	6.51E-02	8.98E-03
Ra-228	1.17E-06	0.00E+00	8.92E-10	1.17E-06	1.61E-07
Pa-231	1.22E-07	1.01E-08	3.32E-10	1.33E-07	1.83E-08
Th-229	2.96E-10	0.00E+00	1.69E-07	1.69E-07	2.33E-08
Th-230	4.05E-12	6.91E-08	1.71E-04	1.71E-04	2.36E-05
U-233	1.04E-07	0.00E+00	5.91E-05	5.92E-05	8.16E-06
U-234	1.47E-08	2.51E-04	9.42E-05	3.46E-04	4.76E-05
Pu-242	1.02E-09	0.00E+00	2.42E-05	2.42E-05	3.34E-06
Pu-244	3.26E-06	0.00E+00	2.46E-07	3.51E-06	4.84E-07
Cm-243	6.44E-09	2.29E-07	4.72E-10	2.36E-07	3.25E-08
Cm-245	2.26E-09	8.08E-08	1.66E-10	8.32E-08	1.15E-08
Cm-247	1.24E-18	4.42E-17	9.07E-20	4.55E-17	6.27E-18
Cm-248	1.29E-18	4.61E-17	9.47E-20	4.75E-17	6.54E-18
Bk-249	9.46E-26	3.37E-24	6.91E-27	3.47E-24	4.78E-25
Cf-249	7.18E-18	2.55E-16	5.26E-19	2.63E-16	3.62E-17
Cf-251	2.45E-19	8.73E-18	1.80E-20	8.99E-18	1.24E-18
Cf-252	7.96E-21	2.83E-19	5.81E-22	2.91E-19	4.01E-20
Am-243	1.10E-08	3.91E-07	8.07E-10	4.03E-07	5.55E-08

[1] This total includes ~10,000 gallons transferred to Tank 50 in March 2007

Table 5: Radionuclides in Tank 50 to SPF for DDA Batch 2

DDA B2	Tank 50 heel	23 - 50	Total 50 [5]	50 - Z
Volume (gal)	625.700	120.000	878.700	788.000
	(Ci)	(Ci)	(Ci)	(Ci)
Na-22	1.61E-01	4.33E-04	1.61E-01	1.44E-01
Al-26	5.91E-04	2.77E-06	5.94E-04	5.32E-04
Nb-94	3.50E-09	1.50E-10	3.65E-09	3.28E-09
Sb-126	3.15E-04	1.35E-05	3.28E-04	2.94E-04
Sb-126m	2.25E-03	9.62E-05	2.34E-03	2.10E-03
Eu-152	1.04E-04	4.45E-06	1.09E-04	9.74E-05
Ac-227	4.11E-08	2.21E-09	4.34E-08	3.89E-08
Ra-226	5.62E-02	1.20E-00	1.26E+00	1.13E+00
Ra-228	1.01E-06	1.65E-08	1.02E-06	9.17E-07
Pa-231	1.14E-07	6.13E-09	1.20E-07	1.08E-07
Th-229	1.46E-07	3.12E-06	3.26E-06	2.93E-06
Th-230	1.48E-04	3.16E-03	3.31E-03	2.97E-03
U-233	5.11E-05	1.09E-03	1.14E-03	1.02E-03
U-234	2.98E-04	1.74E-03	2.04E-03	1.83E-03
Pu-242	2.09E-05	4.47E-04	4.68E-04	4.19E-04
Pu-244	3.03E-06	4.54E-06	7.57E-06	6.79E-06
Cm-243	2.03E-07	8.71E-09	2.12E-07	1.90E-07
Cm-245	7.18E-08	3.06E-09	7.48E-08	6.71E-08
Cm-247	3.92E-17	1.67E-18	4.09E-17	3.67E-17
Cm-248	4.09E-17	1.75E-18	4.27E-17	3.83E-17
Bk-249	2.99E-24	1.28E-25	3.12E-24	2.80E-24
Cf-249	2.26E-16	9.71E-18	2.36E-16	2.12E-16
Cf-251	7.75E-18	3.32E-19	8.08E-18	7.25E-18
Cf-252	2.51E-19	1.07E-20	2.62E-19	2.35E-19
Am-243	3.47E-07	1.49E-08	7.95E-02	7.13E-02

[5] This total contains ~120.000 gallons transferred from other streams to Tank 50 4 1 07 to 12 21 07

Table 6: Radionuclides in Tank 50 to SPF for DDA Batch 3

DDA B3	Tk 49	23-49	Total 49	TK 50 Heel	23 - 50	49 - 50	Total 50 [1]	50 - Z
Volume (gal)	720.000	450.000	1.170.000	90.700	390.000	420.000	1.025.700	401.000
	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)
Na-22	4.18E+01	1.62E-03	4.18E-01	1.66E-02	1.41E-03	1.50E-01	1.50E-01	5.88E+00
Al-26	1.54E-01	1.04E-05	1.54E-01	6.13E-05	8.99E-06	5.52E-02	5.52E-02	2.16E-02
Nb-94	8.87E-07	5.62E-10	8.88E-07	3.77E-10	4.87E-10	3.19E-07	3.20E-07	1.25E-07
Sb-126	7.97E-02	5.05E-05	7.98E-02	3.39E-05	4.38E-05	2.86E-02	2.87E-02	1.12E-02
Sb-126m	5.69E-01	3.61E-04	5.70E-01	2.42E-04	3.13E-04	2.05E-01	2.05E-01	8.02E-02
Eu-152	2.64E-02	1.67E-05	2.64E-02	1.12E-05	1.45E-05	9.48E-03	9.50E-03	3.72E-03
Ac-227	8.21E-07	8.29E-09	8.29E-07	4.48E-09	7.19E-09	2.98E-07	3.09E-07	1.21E-07
Ra-226	1.27E-07	4.51E+00	4.51E+00	1.30E-01	3.91E+00	1.62E+00	5.66E+00	2.21E+00
Ra-228	0.00E+00	6.17E-08	6.17E-08	1.06E-07	5.35E-08	2.22E-08	1.81E-07	7.08E-08
Pa-231	2.28E-06	2.30E-08	2.30E-06	1.24E-08	1.99E-08	8.27E-07	8.59E-07	3.36E-07
Th-229	0.00E+00	1.17E-05	1.17E-05	3.37E-07	1.01E-05	4.20E-06	1.47E-05	5.73E-06
Th-230	1.56E-05	1.19E-02	1.19E-02	3.42E-04	1.03E-02	4.26E-03	1.49E-02	5.82E-03
U-233	0.00E+00	4.09E-03	4.09E-03	1.18E-04	3.55E-03	1.47E-03	5.13E-03	2.01E-03
U-234	5.65E-02	6.52E-03	6.31E-02	2.10E-04	5.65E-03	2.26E-02	2.85E-02	1.11E-02
Pu-242	0.00E+00	1.68E-03	1.68E-03	4.83E-05	1.45E-03	6.01E-04	2.10E-03	8.22E-04
Pu-244	0.00E+00	1.70E-05	1.70E-05	7.81E-07	1.48E-05	6.11E-06	2.17E-05	8.47E-06
Cm-243	5.14E-05	3.27E-08	5.15E-05	2.19E-08	2.83E-08	1.85E-05	1.85E-05	7.24E-06
Cm-245	1.82E-05	1.15E-08	1.82E-05	7.72E-09	9.95E-09	6.53E-06	6.55E-06	2.56E-06
Cm-247	9.94E-15	6.28E-18	9.94E-15	4.22E-18	5.44E-18	3.57E-15	3.58E-15	1.40E-15
Cm-248	1.04E-14	6.56E-18	1.04E-14	4.40E-18	5.68E-18	3.72E-15	3.73E-15	1.46E-15
Bk-249	7.58E-22	4.79E-25	7.58E-22	3.22E-25	4.15E-25	2.72E-22	2.73E-22	1.07E-22
Cf-249	5.73E-14	3.64E-17	5.74E-14	2.44E-17	3.16E-17	2.06E-14	2.07E-14	8.07E-15
Cf-251	1.96E-15	1.25E-18	1.96E-15	8.34E-19	1.08E-18	7.05E-16	7.07E-16	2.76E-16
Cf-252	6.36E-17	4.02E-20	6.37E-17	2.70E-20	3.49E-20	2.29E-17	2.29E-17	8.96E-18
Am-243	8.80E-05	5.59E-08	8.80E-05	8.20E-03	4.84E-08	3.16E-05	8.24E-03	3.22E-03

[1] This total contains ~ 125.000 gallons waste from other streams transfer to Tank 50 from 12/22/07 – 3/31/08

Table 7: Radionuclides in Tank 50 to SPF for ISDP Batch 1

ISDP B1	49 - ARP/MCU	MCU - 50	Tk 50 Heel	Total 50	50 - Z
Volume (gal)	142.000	170.000	624.700	934.700 [a]	154.000
	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)
Na-22	5.08E-00	5.08E-00	9.16E+00	1.42E-01	2.35E-00
Al-26	1.87E-02	1.87E-02	3.36E-02	5.23E-02	8.62E-03
Nb-94	1.08E-07	1.08E-07	1.95E-07	3.02E-07	4.98E-08
Sb-126	9.68E-03	9.68E-03	1.75E-02	2.72E-02	4.48E-03
Sb-126m	6.92E-02	6.92E-02	1.25E-01	1.94E-01	3.20E-02
Eu-152	3.20E-03	3.20E-03	5.79E-03	8.99E-03	1.48E-03
Ac-227	1.01E-07	1.01E-07	1.88E-07	2.89E-07	4.76E-08
Ra-226	5.47E-01	5.47E-01	3.45E+00	3.99E-00	6.58E-01
Ra-228	7.49E-09	7.49E-09	1.10E-07	1.18E-07	1.94E-08
Pa-231	2.79E-07	2.79E-07	5.23E-07	8.03E-07	1.32E-07
Th-229	1.42E-06	1.42E-06	8.93E-06	1.04E-05	1.71E-06
Th-230	1.44E-03	1.44E-03	9.07E-03	1.05E-02	1.73E-03
U-233	4.97E-04	4.97E-04	3.13E-03	3.62E-03	5.97E-04
U-234	7.65E-03	7.65E-03	1.74E-02	2.50E-02	4.12E-03
Pu-242	2.03E-04	2.03E-04	1.28E-03	1.48E-03	2.44E-04
Pu-244	2.07E-06	2.07E-06	1.32E-05	1.53E-05	2.51E-06
Cm-243	6.25E-06	6.25E-06	1.13E-05	1.75E-05	2.89E-06
Cm-245	2.21E-06	2.21E-06	3.99E-06	6.20E-06	1.02E-06
Cm-247	1.21E-15	1.21E-15	2.18E-15	3.39E-15	5.58E-16
Cm-248	1.26E-15	1.26E-15	2.27E-15	3.53E-15	5.82E-16
Bk-249	9.20E-23	9.20E-23	1.66E-22	2.58E-22	4.26E-23
Cf-249	6.96E-15	6.96E-15	1.26E-14	1.95E-14	3.22E-15
Cf-251	2.38E-16	2.38E-16	4.31E-16	6.69E-16	1.10E-16
Cf-252	7.73E-18	7.73E-18	1.40E-17	2.17E-17	3.57E-18
Am-243	1.07E-05	1.07E-05	5.02E-03	5.03E-03	8.28E-04

[a] This total in Tank 50 includes 140.000 gallons from other streams transferred to Tank 50 from 4 1 08 to 10 31 08

Table 8: Radionuclides in Tank 50 to SPF for ISDP Batch 2 Up to 3/31/2009

ISDP B2	TK 49 heel	25/41 - 49	22 - 49	Total Tk 49	MCU - 50	Tk 50 Heel	Total 50	50 - Z
Volume (gal)	608.000	123.000	197.000	1.008.000	85.000 (v)	780.700	945.700 (w)	362.000
	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)
Na-22	2.17E-01	8.06E-00	5.09E-03	2.98E+01	2.19E+00	1.19E-01	1.41E+01	5.39E-00
Al-26	7.99E-02	3.18E-02	3.27E-05	1.12E-01	8.20E-03	4.37E-02	5.19E-02	1.99E-02
Nb-94	4.61E-07	4.26E-07	1.76E-09	8.89E-07	6.53E-08	2.53E-07	3.18E-07	1.22E-07
Sb-126	4.15E-02	3.84E-02	1.59E-04	8.00E-02	5.87E-03	2.27E-02	2.86E-02	1.09E-02
Sb-126m	2.96E-01	2.74E-01	1.13E-03	5.71E-01	4.19E-02	1.62E-01	2.04E-01	7.81E-02
Eu-152	1.37E-02	1.26E-02	5.24E-05	2.64E-02	1.94E-03	7.51E-03	9.45E-03	3.62E-03
Ac-227	4.31E-07	1.21E-07	3.30E-08	5.85E-07	4.30E-08	2.41E-07	2.84E-07	1.09E-07
Ra-226	2.34E-00	3.78E-09	2.13E-08	2.34E+00	1.72E-01	3.33E-00	3.51E+00	1.34E-00
Ra-228	3.21E-08	0.00E-00	0.00E+00	3.21E-08	2.36E-09	9.84E-08	1.01E-07	3.86E-08
Pa-231	1.20E-06	3.37E-07	9.18E-08	1.63E-06	1.19E-07	6.70E-07	7.90E-07	3.02E-07
Th-229	6.08E-06	6.71E-19	7.49E-05	8.09E-05	5.94E-06	8.65E-06	1.46E-05	5.58E-06
Th-230	6.17E-03	4.62E-07	2.61E-06	6.18E-03	4.53E-04	8.78E-03	9.23E-03	3.53E-03
U-233	2.13E-03	2.35E-16	2.63E-02	2.84E-02	2.09E-03	3.03E-03	5.11E-03	1.96E-03
U-234	3.28E-02	1.68E-03	9.46E-03	4.39E-02	3.22E-03	2.09E-02	2.41E-02	9.23E-03
Pu-242	8.71E-04	9.90E-10	0.00E+00	8.71E-04	6.39E-05	1.24E-03	1.30E-03	4.99E-04
Pu-244	8.85E-06	4.53E-12	0.00E+00	8.85E-06	6.50E-07	1.27E-05	1.34E-05	5.13E-06
Cm-243	2.67E-05	2.48E-05	1.03E-07	5.16E-05	3.79E-06	1.46E-05	1.84E-05	7.06E-06
Cm-245	9.45E-06	8.70E-06	3.62E-08	1.82E-05	1.34E-06	5.18E-06	6.51E-06	2.49E-06
Cm-247	5.17E-15	4.77E-15	1.98E-17	9.96E-15	7.31E-16	2.83E-15	3.56E-15	1.36E-15
Cm-248	5.39E-15	4.97E-15	2.06E-17	1.04E-14	7.62E-16	2.95E-15	3.71E-15	1.42E-15
Bk-249	3.94E-22	3.63E-22	1.50E-24	7.59E-22	5.57E-23	2.16E-22	2.71E-22	1.04E-22
Cf-249	2.98E-14	2.76E-14	1.14E-16	5.75E-14	4.22E-15	1.63E-14	2.05E-14	7.86E-15
Cf-251	1.02E-15	9.45E-16	3.90E-18	1.97E-15	1.45E-16	5.59E-16	7.04E-16	2.69E-16
Cf-252	3.31E-17	3.06E-17	1.27E-19	6.38E-17	4.69E-18	1.81E-17	2.28E-17	8.73E-18
Am-243	4.57E-05	4.23E-05	1.76E-07	8.82E-05	6.48E-06	4.20E-03	7.34E-02	2.81E-02

[v] This is the result of 74.000 gal of salt solution from Tank 49 processed through ARP MCU
[w] Total in Tank 50 includes 80.000 gallons of other streams transferred to Tank 50 from 11 1 08 to 3 31 09.

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