INVENTORY DATA PACKAGE FOR THE 2005 INTEGRATED DISPOSAL FACILITY PERFORMANCE ASSESSMENT

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EXECUTIVE SUMMARY

Inventory is a key parameter in assessing the environmental impact from a proposed disposal action. The estimated environmental impacts are directly proportional to the inventory of key radioactive and hazardous chemicals. Therefore it is important to provide not only the best estimate for the inventory, but also to provide an understanding of the uncertainties in this estimate.

A Record of Decision (ROD) (DOE 2004b) has been issued by the Department of Energy (DOE) that documents their decision to proceed with the preferred alternative described in the *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement* (HSW EIS) (DOE 2004a). This preferred alternative includes the construction and operation of a lined, combined use disposal facility, i.e., the IDF, in Hanford's 200 East Area for the disposal of low-level waste (LLW) and mixed low-level waste (MLLW).

Waste to be disposed in the IDF will consist of low-level solid waste traditionally buried in DOE's low-level burial grounds (including mixed low-level waste), immobilized low-activity waste (ILAW), and spent immobilization/treatment equipment (such as melters). The solid waste will come from the Hanford Site as well as other DOE sites. Under the current ROD (DOE 2004b) DOE will limit the volume of LLW and MLLW receipts at Hanford from other sites. The ILAW and spent immobilization/treatment equipment will come from the processing of the retrieved Hanford tank wastes.

Two approaches for processing the Hanford tank wastes have been considered in the development of this report, differing primarily in the disposition of the low-activity waste (LAW) portion of the waste. These two approaches, described below, are called "Reference Case A" and "Reference Case B". Reference Case A uses a strategy developed by ORP for system planning purposes that would utilize other supplemental technologies to augment the current Waste Treatment and Immobilization Plant (WTP) and support a more timely and cost effective closure of the Hanford waste tanks. A mission scenario based on that strategy using updated and more detailed process assumptions is captured in Kirkbride et al. (2005a). Although a final decision on which supplemental technologies may be used at Hanford has not been made, the mission scenario assumed in Kirkbride et al. (2005a) is a bulk vitrification (BV) process and limited packaging of TRU waste from the waste tanks. Under this scenario, the WTP ILAW glass waste form, the BV waste form, the secondary waste streams from WTP and BV processing, including spent immobilization/treatment equipment from WTP and secondary wastes from TRU packaging and 242-A Evaporator operations would be disposed in the IDF. WTP immobilized high-level waste (IHLW) and packaged TRU waste would be disposed offsite.

Reference Case B uses a strategy based on the assumption that would utilize the WTP process to immobilize the Hanford tank wastes (consistent with the current historical baseline). A mission scenario based on that strategy using updated and more detailed process assumptions is captured in Kirkbride et al. (2005b). Under this scenario, the WTP ILAW glass waste form, the secondary waste streams from WTP, including spent immobilization/treatment equipment from WTP and secondary wastes from TRU packaging and 242-A Evaporator operations would be disposed in the IDF. Under this scenario a limited amount of waste from the Demonstration Bulk

Vitrification System (DBVS) would also be disposed in the IDF. WTP immobilized high-level waste (IHLW) and packaged TRU waste would be disposed offsite.

The development of both Reference Case inventories from the processing of Hanford tanks waste depends on the latest tank inventory and the Hanford Tank Waste Operations Simulator (HTWOS) modeling documented in Kirkbride et al. (2005a and 2005b). The latest tank inventory is based on a best-basis inventory (BBI) data set as fixed in April 2004. This inventory has been updated for future Hanford waste tank receipts (Kirkbride et al. 2005a and 2005b). This inventory (including future Hanford waste tank receipts) is summarized for key radionuclides and chemicals in Table ES-1. The key radionuclides and chemicals were chosen because of their mobility through the Hanford soils, their impact to intruder risks and interest to regulators.

Table ES-1. Hanford Waste Tank Inventory

Tank Contaminant	Tank Inventory [a] (Ci) [b]	Tank Contaminant	Tank Inventory [a] (kg) [b]
H-3 [c]	4.40E+03	Cr (Total)	6.09E+05
C-14 [c]	8.38E+02	Hg	1.81E+03
Sr-90+D [c,d]	4.33E+07	NO_3^-	5.49E+07
Tc-99 [c]	2.68E+04	U	6.22E+05
Sn-126+D [d]	4.51E+02		
I-129	4.39E+01		
Cs-137+D [d]	4.31E+07		
U-233	7.23E+02		
U-234	2.26E+02		
U-235+D [c,d]	9.33E+00		
Np-237+D [d]	1.27E+02		
U-238+D [c,d]	2.08E+02		
Pu-239 [c]	5.53E+04		
Am-241 [c]	1.42E+05		

[a] Tank inventory taken from Kirkbride et al. (2005a) and includes estimate for future tank waste receipts; tank inventory based on TWINS data from April 2004

[b] Radionuclide inventories in units of Ci decayed to January 1, 2004; chemical inventories in units of kg.

[c] Inventory includes estimate for future Hanford tank waste receipts (Kirkbride et al. 2005a)

[d] Short-lived progeny in equilibrium with parent

Revision 0 of this report (Puigh et al. 2004) examined the potential range in the I-129 inventory that could be in the Hanford waste tanks. The approach started with the latest calculated estimate for the total I-129 produced (49.4 Ci) (Watrous 2002). The process flowsheets for the different separations plants were used to develop mass balance equations. A significant effort in separation plant operations was made to control I-131 emissions. Operational measurements were made for I-131 to understand and control emissions. The range in efficiencies of the different systems within the separations plants to trap I-129 was estimated from the I-131 plant measurements where available. Based on this analysis the estimated range for the I-129 in the

Hanford waste tanks is between 3.6 and 36.2 Ci. This lower bound estimate may be too low based on limited measurements for I-129 in the Hanford waste tanks. The April 2004 BBI estimate for the I-129 inventory in the Hanford waste tanks is 43.9 Ci (TWINS 2004). This estimate is based on a methodology (Bowen 2005) that is dependent on sample data measurements when samples exist and supplemented using process knowledge and Hanford defined waste model estimates. This estimate is bounded by the total production estimate of 49.4 Ci (Watrous 2002) based on reactor physics calculations. The details of this analysis are provided in Puigh et al. (2004).

The Reference Case inventories are developed for the two major sources of waste: 1) different waste forms from the processing of Hanford waste tanks (including secondary wastes from the processing of the Hanford tank wastes) and 2) other solid wastes from the Hanford site and other DOE solid waste generators. Reference Case A assumes the Hanford tank waste is processed through the following waste processing systems or facilities:

- supplemental TRU treatment system,
- supplemental LAW treatment system, and
- WTP.

Under Reference Case A the following waste forms associated with the Hanford tank waste would be disposed in the IDF: WTP ILAW glass, supplemental technology waste form (assumed to be the BV waste form), spent melters from WTP and secondary wastes from all associated Hanford tank waste processing facilities. The supplemental technology process is currently assumed to be the bulk vitrification process (in-container vitrification). The WTP supplemental process assumes the waste feed is from either the WTP plant after pretreatment, directly from the tanks or from another pretreatment facility. The solid waste inventory associated with the other solid wastes from the Hanford site and other DOE solid waste generators must be added to the Hanford waste tank inventories for Reference Case A to define the total IDF inventory for this case.

The Reference Case A inventory associated with the Hanford tank waste was developed from an HTWOS run that is documented in Kirkbride et al. (2005a). This inventory estimate assumes no retrieval losses and includes an estimate for the tank residuals. The contaminant inventories associated with the WTP glass, spent WTP melters, the BV waste from the DBVS and the supplemental treatment plant, and secondary waste streams from WTP, the DBVS, the supplemental LAW treatment system, the supplemental TRU treatment system and 242-A Evaporator, are explicitly calculated in the HTWOS run (Kirkbride et al. 2005a).

Table ES-2. Reference Case A Inventory – Utilizes Supplemental LAW Treatment System per Kirkbride et al. (2005a)

Does not include other solid waste (see Table ES-4)

Contaminant	WTP ILAW glass [(a)] (Ci or kg) [(g)]	Spent LAW Melters [(b)] (Ci or kg) [(g)]	Spent HLW Melters [(c)] (Ci or kg) [(g)]	BV Product [(d)] (Ci or kg) [(g)]	Total Secondary Waste [(e)] (Ci or kg) [(g)]	TOTAL IDF Inventory [(f)] (Ci or kg) [(g)]
H-3	0.00E+00	0.00E+00	0.00E+00	3.39E+02	0.00E+00	3.39E+02
C-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.28E+00	5.28E+00
Sr-90+D [(h)]	3.29E+05	1.40E+03	4.04E+05	2.36E+05	3.27E+01	9.70E+05
Tc-99	1.08E+04	2.18E+01	1.18E+01	1.17E+04	2.34E+02	2.28E+04
Sn-126+D [(h)]	1.45E+02	5.07E-01	1.09E+00	8.59E+01	2.19E-01	2.33E+02
I-129	7.15E+00	1.64E-02	7.75E-03	2.09E+01	1.29E+01	4.09E+01
Cs-137+D [(h)]	2.13E+04	4.56E+01	2.03E+05	4.91E+05	1.95E+02	7.16E+05
U-233	5.15E+00	1.03E-02	3.94E+00	4.41E+00	2.99E-02	1.35E+01
U-234	3.66E+00	7.32E-03	1.09E+00	2.82E+00	2.13E-02	7.60E+00
U-235+D [(h)]	1.55E-01	3.09E-04	4.49E-02	1.19E-01	9.00E-04	3.20E-01
U-236	1.07E-01	2.13E-04	2.35E-02	8.94E-02	6.86E-04	2.20E-01
Np-237+D [(h)]	2.00E+01	2.83E-02	1.41E-01	2.34E+01	9.32E-02	4.37E+01
U-238+D [(h)]	3.87E+00	7.73E-03	1.01E+00	2.73E+00	2.32E-02	7.64E+00
Pu-239	4.04E+02	1.42E+00	2.11E+02	5.09E+02	2.48E-03	1.12E+03
Am-241+D [(h)]	2.89E+03	1.11E+01	3.05E+02	2.20E+03	1.17E-01	5.41E+03
Cr	2.87E+05	5.13E+02	3.00E+02	1.94E+05	1.69E+02	4.82E+05
Hg	0.00E+00	0.00E+00	0.00E+00	4.04E+02	1.31E+03	1.72E+03
NO_3^-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.75E+06	3.75E+06
U	1.16E+04	2.65E+01	1.88E+03	8.19E+03	6.94E+01	2.17E+04

(a) Total WTP ILAW glass produced = $2.04 \times 10^{+8}$ kg

(b) Assumes two melters, each with a 5-year minimum design life per 24590-LAW-3PS-AE00-T0001. Volume of glass in the melter (6,900 gal) does not include an allowance for increased volume due to corrosion of refractory and reflects the set point of 6,891 gallons per 24590-WTP-MDD-PR-01-002, Appendix D; other contributions to source term such as plenum deposits are neglected. Total LAW glass in one spent melter = $4.66 \times 10^{+5}$ kg.

(c) Assumes two melters, each with a 5-year minimum design life per 24590-HLW-3PS-AE00-T0001. Volume of glass in the melter (1,800 gal) includes an allowance for increased volume due to corrosion of refractory per 24590-HLW-M5C-HMP-00002, Table 2; other contributions to source term such as plenum deposits are neglected. Total HLW glass in one spent melter = $1.23 \times 10^{+5}$ kg.

(d) Inventory estimate for BV product includes inventory for DBVS. Total BV waste form produced = $1.61 \times 10^{+8}$ kg.

(e) All secondary waste from processing of Hanford tank wastes is assumed to be MLLW and includes estimates for the following waste streams (Kirkbride et al. 2005a): Spent Resin PT, LAW-HEPA1, LAW-HEPA2, LAW-VOC Beds, HLW-HEPA1, HLW-HEPA2, HLW-VOC Beds, Spent Ag-Mordinite and ETF Solid Waste from WTP process, BV process, DBVS process, CH/RH TRU packaging process, and 242-A Evaporator.

Contaminant	WTP ILAW glass [a]	Spent LAW Melters [b]	Spent HLW Melters [c]	BV Product [d]	Total Secondary Waste [e]	TOTAL IDF Inventory [f]
	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]

[f] Total IDF inventory from processing of Hanford Tank Waste; must add other solid waste inventory to get total IDF inventory.

[g] Radionuclide inventory in Ci decayed to January 1, 2004; chemical inventory in kg.

[h] Short-lived progeny in equilibrium with parent.

Reference Case B assumes the Hanford tank waste is processed through the following waste processing systems or facilities:

- supplemental TRU treatment system,
- supplemental LAW treatment system, and
- WTP.

Reference Case B assumes all the Hanford tank waste is processed through the WTP except for approximately 300 MT of Na from Tank S-109 liquids that are processed through the Demonstration Bulk Vitrification System (DBVS) (Kirkbride et al. 2005b). Under Reference Case B the following waste forms associated with the Hanford tank waste would be disposed in the IDF: WTP ILAW glass, alternate ILAW product from S-109 processing (DBVS product), spent melters and secondary waste from the WTP, DBVS, supplemental TRU treatment system and 242-A Evaporator.

The Reference Case B inventory associated with the Hanford tank waste was developed from an HTWOS run that is documented in Kirkbride et al. (2005b). The main difference between this case and Reference Case A is all ILAW is produced in WTP except for a small amount produced in the DBVS process. The contaminant inventories associated with the WTP glass, spent LAW and HLW WTP melters, the BV waste form from the DBVS, and secondary waste streams from the WTP, DBVS, supplemental TRU treatment system and 242-A Evaporator are explicitly calculated in the HTWOS run (Kirkbride et al. 2005b).

Table ES-3. Reference Case B Inventory - 100% WTP Processing of Hanford Tank Waste per Kirkbride et al. (2005b)

Does not include other solid waste (see Table ES-4)

Contaminant	WTP ILAW glass [a]	Spent LAW Melters [b]	Spent HLW Melters [c]	DBVS Product [d]	Total Secondary Waste [e]	TOTAL IDF Inventory [f]
	(Ci or kg)[g]	(Ci or kg)[g]	(Ci or kg)[g]	(Ci or kg)[g]	(Ci or kg)[g]	(Ci or kg)[g]
H-3	0.00E+00	0.00E+00	0.00E+00	5.10E+00	0.00E+00	5.10E+00
C-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E+02	1.41E+02
Sr-90+D [h]	6.57E+05	2.43E+03	5.29E+05	1.31E+03	1.13E+01	1.19E+06
Tc-99	2.22E+04	4.72E+01	3.11E+01	1.04E+02	3.88E+02	2.27E+04
Sn-126+D [h]	2.31E+02	5.86E-01	1.47E+00	1.57E-01	2.11E-01	2.34E+02
I-129	1.63E+01	3.57E-02	1.31E-02	1.09E-02	2.50E+01	4.13E+01

Contaminant	WTP ILAW glass [(a)]	Spent LAW Melters [(b)]	Spent HLW Melters [(c)]	DBVS Product [(d)]	Total Secondary Waste [(e)]	TOTAL IDF Inventory [(f)]
	(Ci or kg)[(g)]	(Ci or kg)[(g)]	(Ci or kg)[(g)]	(Ci or kg)[(g)]	(Ci or kg)[(g)]	(Ci or kg)[(g)]
Cs-137+D [(h)]	3.89E+04	8.83E+01	3.09E+05	5.92E+03	2.10E+02	3.54E+05
U-233	9.59E+00	2.29E-02	4.68E+00	7.77E-04	3.02E-02	1.43E+01
U-234	6.44E+00	1.54E-02	1.30E+00	1.48E-03	2.19E-02	7.77E+00
U-235+D [(h)]	2.72E-01	6.51E-04	5.34E-02	6.33E-05	9.29E-04	3.27E-01
U-236	1.95E-01	4.67E-04	2.80E-02	3.27E-05	6.63E-04	2.24E-01
Np-237+D [(h)]	4.32E+01	6.75E-02	5.32E-01	1.58E-01	8.84E-02	4.41E+01
U-238+D [(h)]	6.55E+00	1.57E-02	1.19E+00	1.48E-03	3.40E-02	7.79E+00
Pu-239	8.97E+02	1.99E+00	3.66E+02	5.65E-01	3.71E-03	1.27E+03
Am-241+D[(h)]	4.96E+03	1.91E+01	8.04E+02	1.53E-01	1.66E-01	5.78E+03
Cr	4.80E+05	9.30E+02	5.26E+02	5.21E+02	2.16E+02	4.83E+05
Hg	0.00E+00	0.00E+00	0.00E+00	5.48E-01	1.72E+03	1.72E+03
NO_3^-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.16E+05	4.16E+05
U	1.96E+04	4.29E+01	3.19E+03	4.43E+00	1.02E+02	2.30E+04

(a) Total WTP ILAW glass produced = $3.97 \times 10^{+8}$ kg.
(b) Assumes two melters, each with a 5-year minimum design life per 24590-LAW-3PS-AE00-T0001. Volume of glass in the melter (6,900 gal) does not include an allowance for increased volume due corrosion of refractory and reflects the set point of 6,891 gallons per 24590-WTP-MDD-PR-01-002, Appendix D; other contributions to source term such as plenum deposits are neglected. Total LAW glass in one spent melter = $4.66 \times 10^{+5}$ kg.
(c) Assumes two melters, each with a 5-year minimum design life per 24590-HLW-3PS-AE00-T0001. Volume of glass in the melter (1,800 gal) includes an allowance for increased volume due to corrosion of refractory per 24590-HLW-M5C-HMP-00002, Table 2; other contributions to source term such as plenum deposits are neglected. Total HLW glass in one spent melter = $1.23 \times 10^{+5}$ kg.
(d) Inventory estimate for BV product includes inventory for DBVS. Total BV waste form produced = $1.76 \times 10^{+6}$ kg.
(e) All secondary waste from processing of Hanford tank wastes is assumed to be MLLW and includes estimates for the following waste streams (Kirkbride et al. 2005b): Spent Resin PT, LAW-HEPA1, LAW-HEPA2, LAW-VOC Beds, HLW-HEPA1, HLW-HEPA2, HLW-VOC Beds, Spent Ag-Mordinite and ETF Solid Waste.
(f) Total IDF inventory from processing of Hanford Tank Waste; must add other solid waste inventory to get total IDF inventory.
(g) Radionuclide inventory in Ci decayed to January 1, 2004; chemical inventory in kg.
(h) Short-lived progeny in equilibrium with parent.

The solid waste inventory from the Hanford site generators (excluding secondary waste from Hanford tank waste processing), currently approved other generators and potential future other solid waste generators are given in Table ES-4 for key contaminants. The solid waste inventory was developed from the SWIFT forecast (Barcot 2003), data from the HSW EIS (DOE 2004a) and the Technical Information Document (Fritz et al. 2003) and associated electronic databases.

The ROD (DOE 2004b) currently limits the volume of LLW and MLLW to be received at Hanford from other sites for disposal to 62,000 m^3 of LLW and 20,000 m^3 of MLLW.

Currently approved generators are authorized to send solid waste to the Hanford Low-Level Waste Burial Grounds (LLBG). The inventory from Hanford site generators and currently approved generators was developed from the Solid Waste Integrated Forecast Technical (SWIFT) report (Barcot 2003). The Reference Case inventory for solid waste from future solid waste generators was derived from the Hanford Solid Waste Environmental Impact Statement (HSW EIS) (DOE 2004a) and its backup documentation (Fritz et al. 2003 and supporting electronic database), and as modified by the associated Record of Decision (ROD) (DOE 2004b). The latest revision to the estimated solid waste inventory from Hanford approved generators has been recently issued (Barcot 2005) just prior to the publication of this inventory data package. These new inventory estimates indicate a smaller contaminant inventory than indicated in Table ES-4 are planned for IDF (except for ^{14}C, ^{90}Sr, ^{240}Pu and ^{241}Am as MLLW).

Table ES-4. Inventory Associated with Solid Waste from Hanford and Other DOE Generators

(Does not include solid waste from processing of Hanford waste tanks see Tables ES-2 and ES-3)

Contaminant [c]	Hanford Generators (SWIFT) [a]			Other Generators [b]	
	Cat 1 (Ci or kg) [g]	Cat 3 (Ci or kg) [g]	MLLW (Ci or kg) [g]	LLW (Ci or kg) [g]	MLLW (Ci or kg) [g]
H-3	1.80E+05	5.66E+02	4.75E-02	6.77E+05	1.31E+05
C-14	3.40E+00	1.01E+03	1.96E-02	3.38E+01	3.85E-01
C-14 (A)	3.96E-04	4.23E+03	0.00E+00	4.64E-08	NR
Sr-90+D [e]	1.27E+01	4.96E+03	3.32E+02	5.56E+03	1.85E+00
Tc-99	5.32E-01	2.97E+00	6.15E+00	1.00E+00	5.13E+01
Sn-126+D [e]	NR	NR	NR	NR	NR
I-129	1.08E-02	6.90E-03	1.01E-01	2.49E-02	2.74E-04
Cs-137+D [e]	2.26E+01	1.98E+02	1.03E+03	3.00E+04	3.39E+02
U-233	2.88E-03	8.48E+00	1.70E-10	2.62E-01	2.63E-01
U-234	1.40E-01	4.49E-01	1.32E-03	2.10E+01	9.43E+01
U-235+D [e]	1.90E+00	3.64E-02	4.13E-05	1.37E+00	4.21E+01
Np-237+D [e]	7.64E-02	1.17E-02	1.11E-02	2.21E-01	7.91E+00
U-238+D [e]	2.66E-01	2.68E+00	6.10E-01	3.49E+01	9.88E+01
Pu-239	2.43E+00	1.98E+00	1.86E-01	6.93E+01	4.50E+01
Am-241	1.51E+00	6.64E+00	3.19E-01	9.96E+00	1.13E+01
Cr (Total) [d]	0	0	7.73E+03	0	1.00E+04
Hg	NR	NR	NR	NR	NR
NO_3^- [d]	0	0	2.57E+05	0	3.32E+05
U (Total) [f]	1.67E+03	7.99E+03	1.81E+03	1.04E+05	3.13E+05

NR = not reported; (A) = isotope contained within activated metal matrix

[a] Inventory estimates for approved generators are from Barcot (2003) and supporting electronic database. Estimated waste volumes projected by approved Hanford generators (onsite plus offsite) are 24,974, 2,740 and 15,467 m^3 for Category 1 (LLW), Category 3 (LLW) and MLLW, respectively.

Contaminant [c]	Hanford Generators (SWIFT) [a]			Other Generators [b]	
	Cat 1	Cat 3	MLLW	LLW	MLLW
	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]

[b] All wastes except Category 1 waste are assumed to be grouted. Inventory estimates for potential generators are derived from Fritz et al. (2003) in the Technical Information Database (TID) and supporting electronic database. Because lower disposal volumes are allowed by the ROD (62,000 and 20,000 m^3 for LLW and MLLW, respectively) compared to disposal assumptions in Fritz et al. 2003 (198,845 and 140,337 m^3 for LLW and MLLW, respectively), inventory values are reduced proportionately. Available LLW volumes are further reduced by the projected disposal volumes (13,931 m^3) estimated by approved offsite generators (Barcot 2003) leaving an available LLW volume of 48,069 m^3.

[c] Radionuclides present in Other group consist primarily of short-lived fission products (e.g., Fe-55, Co-58) and, in the case of the SWIFT forecasting data, longer-lived activation products (e.g., Ni-63) generated by the activation of metal.

[d] Inventory estimate based on Hanford generator MLLW volume (15,467 m^3) and potential generators MLLW volume (20,000 m^3) times estimated average concentration of 0.5 kg/m^3 for Cr and 16.6 kg/m^3 for NO_3^-.

[e] Short-lived progeny in equilibrium with parent.

[f] U (Total) based on conversion of radionuclide inventories into kg.

[g] Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg.

The sum of the inventories in Tables ES-2 and ES-4 comprise the Reference Case A IDF inventory. Similarly, the sum of the inventories in Tables ES-3 and ES-4 comprise the Reference Case B IDF inventory. The total inventories associated with Reference Case A (Table ES-2), Reference Case B (Table ES-3) and the other solid waste (Table ES-4) are compared in Table ES-5. For the mobile and semi-mobile contaminants (H-3, Tc-99, I-129, Cr, and NO_3^-), the contribution to the IDF inventory from the tank processing is higher for Tc-99, I-129, Cr (Total) and potentially NO_3^- than the contribution from the other solid waste generators. The estimated H-3 inventory in the other solid waste is significantly higher than the inventory from the processing of Hanford tank wastes. For the other key contaminants the contribution to the IDF inventory from the tank processing is higher for Sr-90, Cs-137, U-233, Np-237, Pu-239, and Am-241 than the contribution from the other solid waste generators; and the contribution to the IDF inventory from the other solid waste generators is higher for H-3, U-235 and U-238 than the contribution from the tank processing.

Table ES-5. Comparison of Hanford Tank and Other Solid Waste Inventory Contributions to the Reference IDF Inventory

Contaminant	Tank Farm Inventory to IDF		Solid Waste Inventory to IDF [c]
	Reference Case A [a]	Reference Case B [b]	
	(Ci or kg) [d]	(Ci or kg) [d]	(Ci or kg) [e]
H-3	3.39E+02	5.1E+00	9.89E+05
C-14 [f]	5.26E+00	1.41E+02	5.28E+03
Sr-90+D [g]	9.70E+05	1.19E+06	1.09E+04
Tc-99	2.28E+04	2.27E+04	6.20E+01
Sn-126+D [g]	2.33E+02	2.34E+02	NR

Contaminant	Tank Farm Inventory to IDF		Solid Waste Inventory to IDF [c]
	Reference Case A [a]	Reference Case B [b]	
	(Ci or kg) [d]	(Ci or kg) [d]	(Ci or kg) [e]
I-129	4.09E+01	4.13E+01	1.44E-01
Cs-137+D [g]	7.16E+05	3.54E+05	3.16E+04
U-233	1.35E+01	1.43E+01	9.01E+00
U-234	7.60E+00	7.70E+00	1.16E+02
U-235+D [g]	3.20E-01	3.27E-01	4.54E+01
Np-237+D [g]	4.37E+01	4.41E+01	8.23E+00
U-238+D [g]	7.64E+00	7.79E+00	1.37E+02
Pu-239	1.12E+03	1.27E+03	1.19E+02
Am-241	5.41E+03	5.78E+03	2.97E+01
Cr (Total)	4.82E+05	4.83E+05	1.77E+04
Hg^{+2}	1.72E+03	1.72E+03	NR
NO_3^-	3.75E+06	4.16E+05	5.89E+05
U	2.17E+04	2.3E+04	4.29E+05

NR = not recorded
[a] Processing strategy includes use of alternate ILAW processing (Kirkbride et al. 2005a).
[b] All Hanford tank waste processed through the WTP (Kirkbride et al. 2005b).
[c] Other solid waste from Hanford site and other DOE generators (Barcot 2003) and HSW EIS (DOE 2004a).
[d] Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg.
[e] Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg.
[f] Solid waste inventory to IDF includes sum from C-14 and C-14 (activated metal).
[g] Short-lived progeny in equilibrium with parent.

Inventory sensitivity cases have been defined to increase the IDF inventory and explore uncertainties associated with current inventory estimates for the different waste streams. The following inventory sensitivity cases have been defined:

- Bounding inventory corresponding to the bounding Hanford tank inventory being processed per the mission scenario outlined in Kirkbride et al. (2005a) (Table ES-6),
- Increased inventory estimate from solid waste generators based on maximum waste volume estimates for Hanford and other generators (Table ES-7),
- Solid waste inventory based on HSW EIS, and
- Solid waste inventory equivalent to 10% of the ERDF waste generated between 1996 and 2003.

The current inventory estimates for the IDF are based on the latest and best information available from the Tank Farm contractor and the WTP contractor. However, the inventory contains uncertainties that are being minimized as new information is gathered. The major areas of uncertainty that impact the IDF inventory are:

- Hanford waste tank inventory,
- Design and operations of the WTP,
- Design and operations of supplemental technology processes,
- Tank retrieval methods, and
- Plans for solid waste receipts.

The specific areas that impact IDF inventory include:

- a better understanding of wash/leach factors for tank retrieval,
- a better understanding of the contaminant split factors between WTP ILAW glass, WTP IHLW glass and secondary waste streams,
- a better understanding of supplemental technology processes, including their secondary waste streams,
- operational plans for the use of a suite of technologies to immobilize tank waste for disposal on the site, and
- a better understanding of the Hanford waste tank inventory.

Table ES-6. Bounding IDF Inventory from Processing Hanford Tank Wastes

Contaminant	WTP ILAW Glass (Ci of kg) [f]	Spent LAW Melters [a] (Ci of kg) [f]	Spent HLW Melters [b] (Ci of kg) [f]	BV Product [c] (Ci of kg) [f]	Total Secondary Waste [d] (Ci of kg) [f]	Total IDF Inventory [e] (Ci of kg) [f]
3-H	0.00E+00	0.00E+00	0.00E+00	7.16E+04	0.00E+00	7.16E+04
14-C	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.62E+01	2.61E+01
90-Sr+D [g]	6.20E+05	2.64E+03	7.61E+05	4.44E+05	6.16E+01	1.83E+06
99-Tc	1.39E+04	2.79E+01	1.51E+01	1.49E+04	3.00E+02	2.92E+04
126-Sn+D [g]	1.45E+02	5.07E-01	1.09E+00	8.59E+01	2.19E-01	2.33E+02
129-I	8.04E+00	1.84E-02	8.72E-03	2.34E+01	1.45E+01	4.60E+01
137-Cs+D [g]	4.80E+04	1.03E+02	4.57E+05	1.11E+06	4.39E+02	1.61E+06
233-U	5.15E+00	1.03E-02	3.94E+00	4.41E+00	2.99E-02	1.35E+01
234-U	4.35E+01	8.69E-02	1.29E+01	3.35E+01	2.54E-01	9.03E+01
235-U+D [g]	1.99E+00	3.98E-03	5.78E-01	1.53E+00	1.16E-02	4.11E+00
236-U	6.57E-01	1.31E-03	1.45E-01	5.50E-01	4.22E-03	1.36E+00
237-Np+D [g]	2.07E+01	2.93E-02	1.46E-01	2.43E+01	9.65E-02	4.53E+01
238-U+D [g]	5.07E+01	1.01E-01	1.32E+01	3.58E+01	3.04E-01	1.00E+02

Contaminant	WTP ILAW Glass (Ci of kg) [f]	Spent LAW Melters [a] (Ci of kg) [f]	Spent HLW Melters [b] (Ci of kg) [f]	BV Product [c] (Ci of kg) [f]	Total Secondary Waste [d] (Ci of kg) [f]	Total IDF Inventory [e] (Ci of kg) [f]
239-Pu	2.46E+04	8.65E+01	1.28E+04	3.10E+04	1.51E-01	6.85E+04
241-Am+D [g]	2.89E+03	1.11E+01	3.05E+02	2.20E+03	1.17E-01	5.41E+03
Cr	3.70E+05	6.61E+02	3.86E+02	2.50E+05	2.18E+02	6.22E+05
Hg	0.00E+00	0.00E+00	0.00E+00	4.69E+02	1.52E+03	1.99E+03
NO_3^- [h]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.75E+06	3.75E+06
U	1.52E+05	3.03E+02	3.95E+04	1.07E+05	9.09E+02	3.00E+05

[a] Assumes two melters, each with a 5-year minimum design life per 24590-LAW-3PS-AE00-T0001. Volume of glass in the melter does not include an allowance for increased volume due to corrosion of refractory and reflects the set point of 6,891 gallons per 24590-WTP-MDD-PR-01-002, Appendix D; other contributions to source term such as plenum deposits are neglected.

[b] Assumes two melters, each with a 5-year minimum design life per 24590-HLW-3PS-AE00-T0001. Volume of glass in the melter includes an allowance for increased volume due to corrosion of refractory per 24590-HLW-M5C-HMP-00002, Table 2; other contributions to source term such as plenum deposits are neglected.

[c] Inventory estimate includes contribution from DBVS,

[d] All secondary waste assumed to be MLLW. Sum of the following secondary waste streams from Kirkbride et al. (2005a): HTWOS Spent Resins + solids portion of WTP-to-LERF + LAW HEPA1 + LAW HEPA2 + LAW VOC-SCRUB + HLW HEPA1 + HLW HEPA2 + HLW VOC-SCRUB + HLW AG MORDINITE + solids portion of BV-to-LERF + solids portion of DBVS-to-LERF + solids portion of TRU-packaging-to-LERF + solids portion of 242-A Evaporator waste-to-LERF.

[e] Bounding inventory based on ratioing inventory splits from HTWOS run by the maximum tank inventory estimate.

[f] Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg.

[g] Short-lived progeny in equilibrium with parent.

[h] Shaded values in table reflect adjustments to the HTWOS values based on Kirkbride et al. (2005a). Specifically, small negative values from the model (due to back-decaying corrections) were set equal to zero for 93m-Nb, and 228-Ra; inventory values for NH_3, NO_2, and NO_3^- were adjusted based on newer processing split data for the BV (DBVS) system.

Table ES-7. Bounding IDF Inventory from Solid Waste Generators (Excluding Secondary Waste from Processing of Hanford Tank Wastes)

Contaminant	Generator Types and Waste Categories [a]				
	Approved Generators (SWIFT)			Potential Generators (HSW EIS/TID) [b]	
	Cat 1 [b] (Ci of kg) [g]	Cat 3 [b] (Ci of kg) [g]	MLLW [b] (Ci of kg) [g]	LLW [b] (Ci of kg) [g]	MLLW [b] (Ci of kg) [g]
H-3	2.97E+05	1.20E+03	5.60E-02	6.76+05	1.31E+05
C-14	5.62E+00	2.13E+03	2.31E-02	1.52E+02	1.40E+00
C-14 Act Metal	6.54E-04	8.93E+03	0.00E+00	4.64E-08	NR
Sr-90+D [e]	2.09E+01	1.05E+04	3.91E+02	5.56E+03	1.85E+00
Tc-99	8.78E-01	6.26E+00	7.26E+00	1.00E+00	1.70E+02
I-129	1.77E-02	1.46E-02	1.19E-01	2.49E-02	1.00E-02
Cs-137+D [e]	3.72E+01	4.19E+02	1.21E+03	2.99E+04	3.39E+02
U-233	4.75E-03	1.79E+01	2.01E-10	4.50E-01	2.63E-01
U-234	2.31E-01	9.46E-01	1.55E-03	2.10E+01	3.24E+02
U-235+D [e]	3.13E+00	7.68E-02	4.87E-05	1.36E+00	4.21E+01
U-236	1.93E-06	4.07E-05	0.00E+00	1.80E-02	5.34E-02
Np-237+D [e]	1.26E-01	2.46E-02	1.31E-02	2.21E-01	7.91E+00
U-238+D [e]	4.40E-01	5.65E+00	7.19E-01	3.49E+01	3.36E+02
Pu-239	4.00E+00	4.19E+00	2.19E-01	6.93E+01	4.50E+01
Am-241+D [e]	2.49E+00	1.40E+01	3.76E-01	9.95E+00	1.13E+01
Cr (total) [d]	NA	NA	9.09E+03	NA	3.12E+04
NO_3^- [d]	NA	NA	3.03E+05	NA	1.03E+06
U [f]	2.76E+03	1.68E+04	2.14E+03	1.04E+05	1.02E+06

NR = not recorded; NA = not applicable

[a] Inventory estimates for approved generators are from Barcot (2003) and supporting electronic database. Estimated waste volumes projected by approved Hanford generators are 24,313, 1,165 and 26,085 m^3 for Category 1, Category 3 and MLLW, respectively; inventories for potential generators based on HSW EIS and (Fritz et al. 2003); shaded values based on difference between upper and lower bounds from HSW EIS (DOE 2004a).

[b] All wastes except Category 1 waste are assumed to be grouted.

[c] Radionuclides present in Other group consist primarily of short-lived fission products (e.g., Fe-55, Co-58) and, in the case of the SWIFT forecasting data, longer-lived activation products (e.g., Ni-63) generated by the activation of metal.

[d] Inventory estimates are based on total MLLW volume for Hanford and offsite generators (31,223 and 62,336 m^3, respectively) times estimated average concentration of 0.5 kg/m^3 for Cr and 16.6 kg/m^3 for NO_3^-.

Contaminant	Generator Types and Waste Categories [a]				
	Approved Generators (SWIFT)			Potential Generators (HSW EIS/TID) [b]	
	Cat 1 [b]	Cat 3 [b]	MLLW [b]	LLW [b]	MLLW [b]
	(Ci of kg) [g]	(Ci of kg) [g]	(Ci of kg) [g]	(Ci of kg) [g]	(Ci of kg) [g]

[e] Short-lived progeny in equilibrium with parent.

[f] Based on activity of U isotope inventories provided above.

[g] Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg

[h] Shaded inventory values are based on the difference between inventory estimates associated with upper bound and lower bound volumes from the HSW EIS (DOE 2004a). Upper and lower bound volume inventories were taken from Table B-19 of the HSW-EIS (for LLW, the values found in the Near PUREX Category 3 LLW column and for MLLW, the values in the 200 E 2008-2046 MLLW column).

[i] Act Metal = contaminant is contained within an activated metal matrix.

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ACRONYMS

BBI	best-basis inventory
BV	bulk vitrification
CH	contact handled
DBVS	demonstration bulk vitrification system
DOE	Department of Energy
DST	double shell tank
EIS	Environmental Impact Statement
ERDF	Environmental Restoration Disposal Facility
ETF	Liquid Effluent Treatment Facility
HDW	Hanford Defined Waste Model
HEPA	high effluent particulate air (filter)
HLW	High-level waste
HSW EIS	Hanford Solid Waste Environmental Impact Statement
HTWOS	Hanford Tank Waste Operations Simulator
IDB	Integrated Data Base
IDF	Integrated Disposal Facility
IHLW	immobilized high-level waste
ILAW	immobilized low-activity waste
LAW	low-activity waste
LDRs	Land Disposal Restrictions
LERF	Liquid Effluent Retention Facility
LLBG	Low-Level Waste Burial Grounds
LLW	low-level waste
MLLW	mixed low-level waste
ORP	Office of River Protection
PA	Performance Assessment
PEIS	Programmatic Environmental Impact Statement
PT	pretreatment
RH	remote handling
ROD	Record of Decision
SR	steam reformer
SST	single shell tank
SWIFT	solid waste integrated forecast technical
SWITS	Solid Waste Information Tracking System
TFCO&UP	Tank Farm Contractor Operation and Utilization Plan
TID	Technical Information Database
TRU	transuranic
WAC	Washington Administrative Code
WIPP	Waste Isolation Pilot Plant
WTP	Waste Treatment and Immobilization Plant

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1.0 INTRODUCTION

Estimates for the anticipated radionuclide and hazardous chemical inventories to be disposed in the Integrated Disposal Facility (IDF) are needed for the long-term environmental performance assessment (PA) supporting the proposed disposal action. The 2003 annual summary (Mann 2003) identified the Department of Energy (DOE) Office of River Protection (ORP) planning to replace the ILAW disposal facility with an IDF. The IDF disposal action would include not only ILAW glass waste form from the Waste Treatment and Immobilization Plant (WTP), but also for the waste originally destined for Hanford's Solid Waste Burial Grounds after October 2007. Also discussed in the PA annual update (Mann 2003) was the DOE-ORP decision to eliminate technetium separations at the WTP (Schepens 2003). Finally, this annual summary documented the DOE-ORP decision to explore the possible use of supplemental ILAW technologies (IMAP 2003) to immobilize some of the low activation waste from the Hanford tank farms.

As noted in the 2004 PA annual summary (Mann 2004), the *Hanford Site Solid (Hazardous and Radioactive) Waste Environmental Impact Statement* (HSW EIS) (DOE 2004a*)* has been issued. The HSW EIS has identified the IDF as the preferred disposal action for future Hanford disposal of low-level waste (LLW) and mixed low-level waste (MLLW). The disposal action considered the disposal of ILAW from the Hanford tank waste, and solid wastes from Hanford, currently approved Hanford off-site and other DOE off-site (as identified in the DOE complex Programmatic EIS [DOE 1997]) solid waste generators. A Record of Decision (ROD) (DOE 2004b) has been issued by the Department of Energy (DOE) that documents their decision to proceed with the preferred alternative. Under the current ROD (DOE 2004b) DOE will limit the volume of LLW and MLLW receipts at Hanford from other sites.

Three supplemental technology waste forms were initially considered for the supplemental treatment of Hanford tank wastes: cast stone (cement/grout waste form), steam reformer waste form and a bulk vitrification waste form. Based on an early assessment of these three candidate waste forms (Mann et al. 2003) the bulk vitrification (BV) (in container vitrification) process and steam reformer (SR) process were selected for further investigation. Testing and analyses for this supplemental ILAW technology is at a preliminary stage. Additional process development, testing and analyses are being conducted to assess the viability of using this supplemental technology for the disposal of some of the Hanford tank wastes. Whether all ILAW will be produced by WTP or a combination of WTP and other supplemental technology processes will be decided as part of the TPA milestones M-62-08 and M-62-11.

1.1 SCOPE

Under the current planning, the IDF may receive wastes from the following sources:

- Hanford waste tanks, and
- Solid waste generators as defined in the HSW EIS (DOE 2004a).

The scope of this report is to provide inventory estimates for the potential waste forms that may be disposed of in the IDF. The inventory estimates will include not only best estimates for the inventories for the different waste forms, but also contaminant concentration estimates needed for intruder analyses. Bounding estimates and sensitivity cases will also be identified, where appropriate, to reflect inventory uncertainty.

Since a decision on the potential use of supplemental technologies to support tank closure will not be made until after 2006, two Hanford tank waste reference inventory cases will be developed for this report. One reference case (Reference Case A) is based on the current DOE planning to utilize WTP and supplemental technology processes to produce acceptable waste forms for the disposal of Hanford tank waste. This case results in the following waste forms from the processing of Hanford tank wastes: WTP ILAW glass, WTP IHLW glass (sent off-site for ultimate disposal), failed WTP melters (both ILAW and IHLW), BV waste packages (from in-container vitrification), TRU waste (sent off-site for ultimate disposal) and secondary waste forms from the different processes (WTP, BV, TRU packaging and 242-A Evaporator) that will be disposed as solid waste under current Hanford solid waste practices. The second reference case (Reference Case B) will assume nearly all the waste retrieved from the Hanford waste tanks is processed through the WTP resulting in the following waste forms: WTP ILAW glass, WTP IHLW glass (sent off-site for ultimate disposal), failed WTP melters (both ILAW and IHLW), BV waste packages (from the DBVS in-container vitrification), TRU waste (sent off-site for ultimate disposal) and secondary waste forms from the different processes (WTP, DBVS, TRU packaging and 242-A Evaporator) that will be disposed as solid waste under current Hanford solid waste practices.

Inventory information for the solid waste identified for potential disposal in the IDF will be separated into two major sources: Hanford solid waste generators, and other DOE solid waste generators. To avoid the double counting of waste inventory, the solid waste inventory estimates from the Hanford solid waste generators will not include the secondary solid waste streams associated with the retrieval and processing of the Hanford waste tanks since these estimates are already included in the inventory estimates captured under Reference Case A or Case B inventories from the Hanford waste tanks. The solid waste inventory associated with other DOE solid waste generators has been taken from the *Hanford Site Solid (Hazardous and Radioactive) Waste Environmental Impact Statement (HSW EIS)* (DOE 2004a). The current HSW EIS ROD (DOE 2004b) limits the volumes of LLW and MLLW received at Hanford from other sites to 62,000 m^3 LLW and 20,000 m^3 MLLW.

1.2 BACKGROUND

The inventory estimates for the IDF currently depend on the estimates associated with the Hanford waste tanks and projections for future solid waste receipts from Hanford generators, currently approved solid waste generators and other potential solid waste generators as defined in the DOE complex Programmatic EIS (DOE 1997).

Inventory estimates for the Hanford tanks have evolved as new information and understanding have been developed. Because of the mobility of Tc-99 and I-129 through the Hanford vadose zone, these two radionuclides are the major contaminants of concern when considering the protection of the groundwater at Hanford. The estimated inventories for these two contaminants of concern have varied over the past ten years. The following discussion describes the historical evolution of the Hanford tank waste inventory estimates for these two contaminants.

Table 1-1 summarizes the recent evolution for the inventory estimates for Tc-99 and I-129 in the Hanford waste tanks. The table lists the inventory estimates beginning with the inventory estimates from *Tank Waste Remediation System, Hanford Site, Richland Washington Final Environmental Impact Statement (TWRS EIS)* (DOE 1996). This inventory estimate was based on the 1994 inventory estimate (Powell 1994). The most recent inventory estimate for the Hanford tank wastes was developed for the latest revision to the Hanford Defined Waste Model (HDW) (Higley et al. 2004). Also shown in Table 1-1 are brief descriptions for the bases for these inventory estimates.

The inventory estimates fall into two general types: 1) based on reactor production calculations (with estimated processing losses in some cases) and 2) based on tank sampling, the latest HDW model, and engineering judgment. The estimates based on reactor production calculations used ORIGEN2 software (Croft 1980). Modeling improvements and new reactor cross-sections are responsible for the evolution in the production calculations. As seen in Table 1-1 the estimates for the total Tc-99 based on reactor production calculations range between 3.0E+04 and 3.4E+04 Ci (neglecting any losses from the separations plants). The one Tc-99 inventory estimate based on the earliest tank measurements (Kirkbride et al. 1999) had an estimated inventory of 4.7E+04 Ci. The remaining Tc-99 estimates from the BBI methodology all fall in the range of 2.9 to 3.4E+04 Ci. Estimates for process losses have been incorporated into the Hanford waste tank inventories within some referenced inventories (Schmittroth et al. 1995, Higley et al. 2004). Approximately 20-23% of the Tc-99 produced in the reactors was shipped off-site with the recovered uranium (Schmittroth et al. 1995, Higley et al. 2004) and was not sent to the Hanford waste tanks.

The estimates for the total I-129 produced in the production reactors that are based on reactor production calculations range between 49.4 and 66 Ci (Higley et al. 2004 and Schmittroth et al. 1995) (neglecting any losses from the separations plants). Most of the difference in these estimates is based on a recent reduction in the I-129 fission cross-section by approximately 23%. The corresponding estimate for the I-129 inventory in the tanks based on measurement data (BBI) has ranged between 47 and 101 Ci. The current estimated I-129 process losses are approximately 23% and are due predominately to not flushing the silver reactors on the PUREX plant during operations between 1967 and 1988 (Higley et al. 2004).

The inventory estimates based on tank sampling, the latest HDW model, and engineering judgment have evolved into the Best Basis Inventory (BBI) for the tank farms. This estimate is currently the reference inventory for the Hanford tank waste. As new inventory measurements have been taken for these two contaminants the estimated tank inventories from the two different approaches have become more similar. The BBI estimates for Tc-99 and I-129 tend to be higher than production estimates because the BBI estimates are based, in part, on earlier HDW models that have not included the most recent estimates for process losses.

Figures 1-1a and 1-1b show the trend in the tank inventory estimates for Tc-99 and I-129, respectively, as a function of the year in which the inventory information has published. The estimated inventories shown in the figure includes estimated losses during processing in general (except for the Tc-99 inventory published in 1997). As seen in the figure the Tc-99 estimate has remained relatively constant over this time period (except for the Tc-99 inventory published in 1997). The I-129 inventory has demonstrated a higher degree of variability.

Table 1-1. Hanford Waste Tank Inventory Estimates for Tc-99 and I-129

Author(s)	Key Radio-nuclide	Tank Inventory (Ci) [(a)]	Basis
Schmittroth et al. (1995)	Tc-99	2.72E+04 [3.4E+04]	ORIGEN2 [(b)] calculation for single pass and N-reactor production (minus K basin fuels and minus 20% Tc-99 loss from the waste stream [predominately co-processed with UO_3 and sent off-site]).
	I-129	6.62E+01	ORIGEN2 [(b)] calculation for single pass and N-reactor production (minus K basin fuels).
Kupfer et al. (1997)	Tc-99	3.26E+04	ORIGEN2 [(b)] production and DKPRO separations processing - no Tc-99 losses during separations (HDW Model - conservative).
	I-129	6.30E+01	ORIGEN2 [(b)] production and DKPRO separations processing - no I-129 losses during separations (HDW Model - conservative).
DOE/EIS-0189 (1996)	Tc-99	3.21E+04	TRAC [(c)] data base adjusted to the 1994 Integrated Data Base (IDB) [(d)].
	I-129	3.83E+01	
Kirkbride et al. (1997)	Tc-99	4.70E+04	Limited DST analytical results, TRAC [(c)] data base, and HDW Rev. 1 [(e)] normalized to Kupfer et al. (1997) [No Tc-99 losses during separation process].
	I-129	na	No I-129 losses during separation process.
Kirkbride et al. (1999)	Tc-99	2.83E+04	BBI as of October 1, 1998
	I-129	9.91E+01	BBI as of October 1, 1998
Wootan (1999)	Tc-99	2.89E+04	BBI as of October 1998
	I-129	1.01E+02	BBI as of October 1998
Kirkbride et al. (2000)	Tc-99	3.00E+04	BBI/BBIM as of January 11, 2000
	I-129	6.29E+01	BBI/BBIM as of January 11, 2000
Kirkbride et al. (2001)	Tc-99	3.10E+04	BBI/BBIM as of June 2001
	I-129	6.86E+01	BBI/BBIM as of June 2001
DOE/ORP-2003-02 (2003)	Tc-99	2.97E+04	BBI/BBIM as of December 1, 2002
	I-129	4.82E+01	BBI/BBIM as of December 1, 2002
Kirkbride et al. (2003a)	Tc-99	2.88E+04	BBI/BBIM as of June 2002
	I-129	4.88E+01	BBI/BBIM as of June 2002
Kirkbride et al. (2003b)	Tc-99	2.91E+04	BBI/BBIM as of October 2003
	I-129	4.74E+01	BBI/BBIM as of October 2003

Author(s)	Key Radio-nuclide	Tank Inventory (Ci) [a]	Basis
Higley et al. (2004)	Tc-99	2.51E+04 [3.3E+04]	ORIGEN2 production [f]; included process losses 23% with respect to Rev. 4.
	I-129	3.18E+01 [4.94E+01]	ORIGEN2 production [f]; included process losses 23% with respect to Rev. 4, and reduction in fission cross-section 23% .
TWINS (2004)	Tc-99	2.68E+04	BBI/BBIM as of Sept. 22, 2004
	I-129	4.39E+01	BBI/BBIM as of Sept. 22, 2004

[a] Numbers in brackets represent total reactor production.
[b] ORIGEN2 – software code used to estimate reactor production of radionuclides (Croft 1980).
[c] TRAC – (Jungfleisch and Simpson 1993).
[d] IDB – Integrated Data Base for Hanford Waste tanks (Powell 1994).
[e] HDW Hanford Defined Waste Model Rev. 1 documented in Agnew (1997).
[f] Production calculations documented in Watrous (2002).

Figure 1-1a. Hanford Tank Waste Inventory Estimates for Tc-99

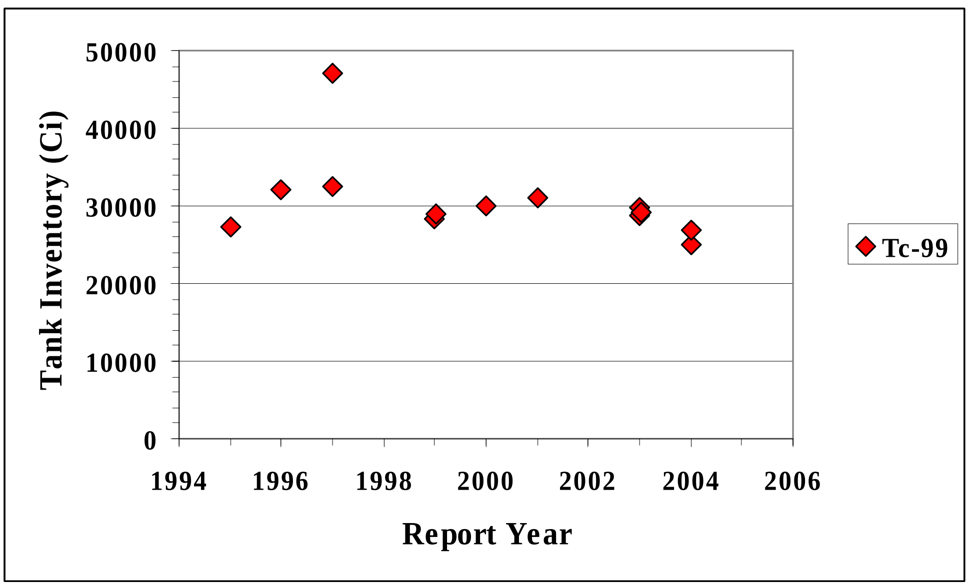
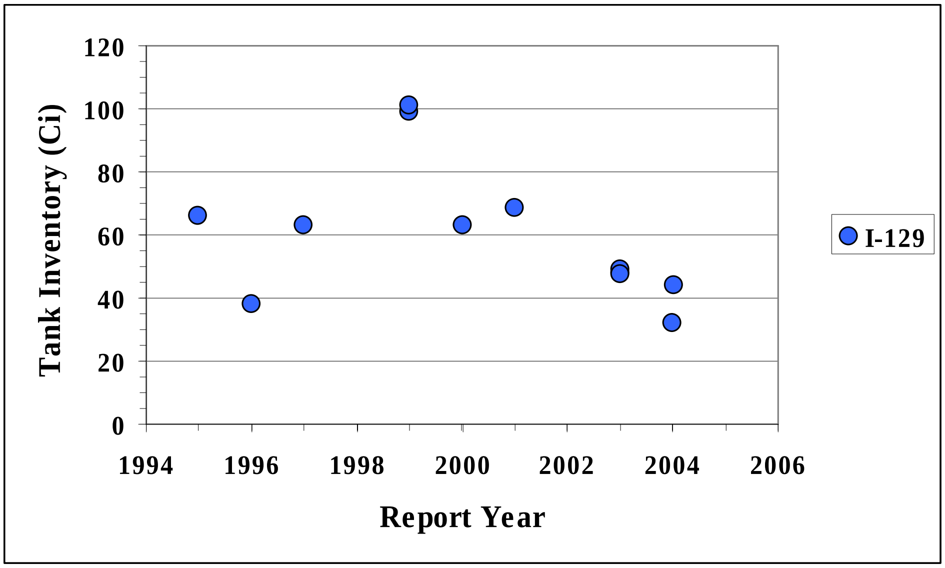


Figure 1-1b. Hanford Tank Waste Inventory Estimates for I-129



1.3 ORGANIZATION OF REPORT

Section 2 describes the approach used to develop the different inventory estimates for the IDF waste forms from the Hanford waste tanks, explains the underlying assumptions, defines the reference inventory, explains the basis for the sensitivity cases developed for each inventory and describes the different sensitivity cases. Section 3 describes the approach used to develop the IDF inventory estimates for the solid waste from other (non-tank waste) Hanford operations, other approved non-Hanford solid waste generators, and other DOE solid waste generators. Section 4 lists future work needed to develop better inventory estimates, Section 5 lists the references and Section 6 contains the Appendices supporting the inventory estimates.

2.0 IDF INVENTORY ASSOCIATED WITH HANFORD TANK WASTE RETRIEVAL

The IDF inventory estimate associated with the Hanford tank waste retrieval includes immobilized waste form(s) processed from the retrieved tank waste; the secondary waste streams associated with these processes; and failed melters from WTP. The immobilized waste form(s) and their associated secondary waste streams are based on two possible strategies for the immobilization of Hanford tanks wastes in preparation for Hanford tank closure. The supplemental treatment mission strategy (Reference Case A) would use a suite of supplemental technologies in addition to the WTP to produce waste forms from the retrieved Hanford tank wastes. The current strategy (Reference Case B) is based on the TPA planning to process all the retrieved Hanford tank wastes through the WTP. This strategy includes a follow-on glass production plant with ILAW melters similar to WTP.

The approach used to develop the Reference Case A inventory estimate assumes the retrieval and processing strategy based on a set of preliminary assumptions for the Refined Target Case (see Kirkbride et al. 2005a). The approach has been incorporated into the HTWOS model run documented in Kirkbride et al. (2005a). From the HTWOS model run documented in Kirkbride et al. (2005a) inventories for the following waste forms associated with the Hanford tank waste are provided: WTP glass, spent WTP melters, the BV waste form, and secondary waste streams from the WTP process, DBVS process, BV process, and TRU packaging process. The total Reference Case A inventory is given by combining the Reference Case A inventory from the Hanford tank wastes with the reference from other solid waste inventory described in Section 3.

The approach used to develop the Reference Case B inventory estimate assumes nearly all the Hanford tank waste is processed through WTP. The estimate assumes a quantity of low activity S-109 tank liquids containing ~260 MT Na are processed through the DBVS resulting in both BV waste and a secondary waste stream from the DBVS that is sent to ETF for processing. This waste stream will also be disposed in the IDF. The Hanford Tank Waste Operations Simulator (HTWOS) run based on these assumptions is documented in Kirkbride et al. (2005b). From the HTWOS model run documented in Kirkbride et al. (2005b) inventories for the following waste forms associated with the Hanford tank waste are provided: WTP ILAW glass, supplemental ILAW product from S-109 processing (BV demonstration product), spent melters and the secondary waste from the WTP and DBVS processing. The HTWOS run also includes the processing of a small quantity of tank waste by the TRU packaging process. The longer processing period for Reference Case B (until 2044 based on Kirkbride et al. [2005b]) is neglected because it was assumed that additional WTP processing capability was added to meet TPA milestone dates for emptying the waste tanks. Therefore, the reference other solid waste inventory is not impacted. The total Reference Case B inventory is given by combining the Reference Case B inventory from the Hanford tank wastes with the reference other solid waste inventory described in Section 3.

This section is organized in the following manner. Section 2.1 describes the latest inventory for the Hanford waste tanks. Section 2.2 describes the approach used to develop the inventory estimate for Reference Case A and describes the resulting reference inventory associated with the Hanford tank wastes. Section 2.3 describes the approach used to develop the inventory estimate for Reference Case B and describes the resulting reference inventory associated with the

Hanford tank wastes. Section 2.4 describes the different sensitivity cases for IDF waste inventories from the Hanford waste tanks that have been developed for this inventory data package.

2.1 HANFORD TANK WASTE INVENTORY

This section describes the source for the nominal Hanford tank waste inventory used as the starting point for the development of the Reference Case A and B inventories for the IDF. Also provided is an estimate for the uncertainty in this inventory and a discussion of the uncertainty in the I-129 estimate. Special attention has been given to I-129 inventory because of its potential impact to groundwater (Mann et al. 2003).

2.1.1 Nominal Hanford Waste Tank Inventory Estimate

The inventory developed for the two HTWOS model runs (Kirkbride et al. 2005a and 2005b) provides the nominal Hanford Waste Tank inventory estimate. This inventory is based on the BBI-based DST and SST inventories and estimates for the Hanford waste tank receipts that will come from future Hanford operations. The BBI-based DST and SST inventories include 46 radionuclides and 25 chemicals. This tank inventory estimate is based on the tank-by-tank best basis inventory (BBI) data as of April 2004 and accounts for waste transfers made after the effective date through July 2004. Inventory estimates were added for non-BBI analytes that are in the WTP contract, and the BBI radionuclide inventories were adjusted to the common decay date of January 1, 2004. The tank inventory estimates also include an estimate for Hanford waste receipts that will come from future Hanford operations.

Table 2-1 summarizes the starting tank inventories, with radionuclides decayed to the BBI reference date of January 1, 2004. The starting tank inventory, listed under “Nominal Hanford Waste Tank Inventory,” and future tank additions were taken from Kirkbride et al. 2005a. Also provided in Table 2-1 are the latest estimates for the Hanford waste tank inventory from the Hanford Defined Waste model (Higley et al. 2004) and the inventory estimates for the total radionuclides produced from Watrous (2002). Both of these inventories have been adjusted to a decayed date of January 1, 2004 for comparative purposes.

Table 2-1. Nominal Hanford Waste Tank Inventory Compared to Other Inventory Estimates

Contaminant	Hanford Waste Tank Inventory [b]	Future Tank Additions [b]	HDW (Rev. 5) [c]	Total Produced [d]
	(Ci or kg) [a]	(Ci or kg) [a]	(Ci or kg) [a]	(Ci or kg) [a]
H-3	4.40E+03	2.51E-02	8.04E+03	9.29E+05
C-14	6.25E+02	2.13E+02	8.51E+02	3.94E+03
Ni-59	1.56E+03	0.00E+00	1.32E+03	1.33E+03
Co-60	6.43E+03	3.52E-03	1.08E+04	1.09E+04
Ni-63	1.44E+05	0.00E+00	1.23E+05	1.24E+05

Contaminant	Hanford Waste Tank Inventory [b] (Ci or kg) [a]	Future Tank Additions [b] (Ci or kg) [a]	HDW (Rev. 5) [c] (Ci or kg) [a]	Total Produced [d] (Ci or kg) [a]
Se-79	9.23E+01	0.00E+00	7.70E+01	7.90E+01
Sr-90+D [e]	4.33E+07	7.65E+03	4.68E+07	8.16E+07
Nb-93m	2.97E+03	0.00E+00	3.78E+03	3.85E+03
Zr-93	3.69E+03	0.00E+00	4.64E+03	4.72E+03
Tc-99	2.68E+04	2.49E-04	2.51E+04	3.43E+04
Ru-106+D [e]	1.73E+02	5.01E+02	1.37E+02	1.37E+02
Cd-113m	4.81E+03	0.00E+00	4.94E+03	5.00E+03
Sb-125	9.38E+03	2.01E-03	8.87E+03	8.87E+03
Sn-126+D [e]	4.51E+02	0.00E+00	3.21E+02	3.29E+02
I-129	4.39E+01	1.71E-14	3.18E+01	4.94E+01
Cs-134	2.80E+03	1.46E+01	3.06E+03	3.12E+03
Cs-137+D [e]	4.31E+07	2.82E+04	3.45E+07	9.70E+07
Sm-151	3.75E+06	0.00E+00	3.15E+06	3.22E+06
Eu-152	1.55E+03	2.21E-01	9.15E+02	9.15E+02
Eu-154	6.00E+04	4.29E-01	7.20E+04	7.21E+04
Eu-155	3.70E+04	1.10E-01	3.28E+04	3.30E+04
Ra-226+D [e]	4.17E+02	0.00E+00	9.13E-03	1.76E-02
Ac-227+D [e]	4.06E+00	0.00E+00	4.85E+00	4.89E+00
Ra-228+D [e]	6.24E+00	0.00E+00	2.97E+00	2.97E+00
Th-229+D [e]	1.49E+00	0.00E+00	1.54E+00	1.54E+00
Pa-231	6.08E+00	0.00E+00	7.09E+00	7.16E+00
Th-232	8.51E+00	0.00E+00	2.80E+00	2.80E+00
U-232	7.10E+00	0.00E+00	7.23E+00	7.26E+00
U-233	7.23E+02	0.00E+00	4.49E+02	4.49E+02
U-234	2.26E+02	6.96E-06	3.22E+02	2.69E+03
U-235+D [e]	9.33E+00	6.13E-04	1.38E+01	1.20E+02
U-236	5.73E+00	5.49E-06	8.25E+00	3.53E+01
Np-237+D [e]	1.27E+02	0.00E+00	1.27E+02	1.32E+02
Pu-238	1.96E+03	5.03E+00	1.93E+03	1.94E+03
U-238+D [e]	2.07E+02	5.80E-01	3.04E+02	2.72E+03
Pu-239	5.37E+04	1.67E+03	3.23E+04	3.37E+06
Pu-240	1.16E+04	5.37E+01	7.96E+03	8.11E+03

Contaminant	Hanford Waste Tank Inventory [b]	Future Tank Additions [b]	HDW (Rev. 5) [c]	Total Produced [d]
	(Ci or kg) [a]	(Ci or kg) [a]	(Ci or kg) [a]	(Ci or kg) [a]
Am-241	1.42E+05	1.29E+01	8.26E+04	8.29E+04
Pu-241+D [e]	9.81E+04	2.58E+02	1.10E+05	1.10E+05
Cm-242 [g]	3.03E+02	0.00E+00	7.33E-01	7.22E-01
Pu-242	7.83E-01	1.79E-03	7.92E-01	5.25E+01
Am-243+D [e]	6.25E+01	0.00E+00	4.22E+01	4.22E+01
Cm-243	2.37E+01	0.00E+00	7.20E+00	7.20E+00
Cm-244	5.51E+02	0.00E+00	1.70E+02	1.71E+02
Ag	5.67E+03	1.24E-01	8.93E+03	nr
Al	8.29E+06	3.98E+03	7.85E+06	nr
As	4.83E+03	6.58E-02	nr	nr
B	1.76E+04	1.00E-01	nr	nr
Ba	1.24E+04	1.61E-01	nr	nr
Be	9.43E+02	2.83E-04	nr	nr
Bi	5.63E+05	3.32E+04	5.80E+05	nr
Ca	2.69E+05	2.25E+03	2.14E+02	nr
Cd	7.57E+03	5.97E-02	8.20E+03	nr
Ce	8.53E+03	3.05E-01	8.80E+03	nr
Cl	8.62E+05	1.10E+03	5.00E+05	nr
CN	4.79E+03	0.00E+00	nr	nr
Co	1.69E+03	0.00E+00	nr	nr
CO_3	9.83E+06	1.40E+03	4.83E+03	nr
Cr	6.09E+05	9.13E-01	7.85E+05	nr
Cs	1.63E+03	0.00E+00	nr	nr
Cu	3.32E+03	3.46E-01	nr	nr
F	1.11E+06	2.21E+02	1.36E+06	nr
Fe	1.25E+06	1.17E+04	1.23E+06	nr
Hg	1.81E+03	5.25E-03	2.10E+03	nr
K	9.45E+05	8.26E-01	4.81E+05	nr
La	3.29E+04	1.03E+04	5.10E+04	nr
Li	2.07E+03	7.85E-04	nr	nr
Mg	2.44E+04	2.36E+03	nr	nr

Contaminant	Hanford Waste Tank Inventory [b]	Future Tank Additions [b]	HDW (Rev. 5) [c]	Total Produced [d]
	(Ci or kg) [a]	(Ci or kg) [a]	(Ci or kg) [a]	(Ci or kg) [a]
Mn	1.61E+05	1.61E+04	1.05E+05	nr
Mo	7.17E+03	1.65E+02	nr	nr
Na	4.81E+07	3.15E+04	5.42E+07	nr
Nd	1.01E+04	0.00E+00	nr	nr
NH_3	9.49E+03	0.00E+00	nr	nr
Ni	1.01E+05	2.18E+04	1.11E+05	nr
NO_2	1.20E+07	0.00E+00	nr	nr
NO_3	5.49E+07	0.00E+00	nr	nr
OH(BOUND)	2.24E+07	0.00E+00	nr	nr
OH	2.93E+06	0.00E+00	nr	nr
Pb	8.18E+04	6.79E-01	2.79E+05	nr
Pd	3.64E+02	0.00E+00	nr	nr
PO_4	5.08E+06	7.92E+03	6.00E+06	nr
Pr	7.78E+02	0.00E+00	nr	nr
Rb	4.64E+02	0.00E+00	nr	nr
Rh	5.43E+02	0.00E+00	nr	nr
Ru	2.22E+03	0.00E+00	nr	nr
Sb	3.54E+03	0.00E+00	nr	nr
Se	5.38E+03	9.53E-02	nr	nr
Si	7.72E+05	6.75E+03	5.70E+05	nr
SO_4	3.63E+06	1.76E+03	5.00E+06	nr
Sr	3.84E+04	2.69E-03	3.13E+04	nr
Ta	9.12E+01	0.00E+00	nr	nr
Te	4.15E+02	0.00E+00	nr	nr
Th	7.75E+04	0.00E+00	2.56E+04	2.55E+04 [h]
Ti	1.81E+03	1.38E-03	nr	nr
Tl	6.16E+03	0.00E+00	nr	nr
TOC	8.58E+05	2.18E+02	4.00E+06	nr
U [f]	6.20E+05	1.73E+03	9.11E+05 [h]	+++8.15E+06 [h]
V	2.84E+03	0.00E+00	nr	nr
W	2.14E+03	0.00E+00	1.59E+04	nr

Contaminant	Hanford Waste Tank Inventory [b] (Ci or kg) [a]	Future Tank Additions [b] (Ci or kg) [a]	HDW (Rev. 5) [c] (Ci or kg) [a]	Total Produced [d] (Ci or kg) [a]
Y	6.73E+02	0.00E+00	nr	nr
Zn	7.31E+03	2.32E-03	nr	nr
Zr	4.00E+05	1.68E-03	4.40E+05	nr

(a) Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg; elemental inventories include all chemical and radionuclide elemental mass in kg.

(b) HTWOS tank inventory and estimated future tank additions from Kirkbride et al. (2005a) Table C-1.

(c) Radionuclide and Hg inventory from Higley et al. (2004); other chemical inventory from Kupfer et al. 1999. Radionuclide inventory adjusted to decay date of January 1, 2004 and includes daughter ingrowth.

(d) Total inventory produced based on Watrous (2002) Table 3-4 (corrected for product removals and adjusted to decay date of January 1, 2004 and includes daughter ingrowth).

(e) Short-lived progeny are in equilibrium with parent.

(f) Total U mass based on sum of activities for U isotopes.

(g) Half-life correction discussed in text

(h) Chemical mass based on conversion of radionuclide mass given in Ci for the different isotopes.

nr = not reported

Radionuclide half-life values are taken from the Chart of the Nuclides 15th Edition with the exception of Cm-242. The secular equilibrium parent of Cm-242 is Am-242m and is not included in the BBI. Cm-242 was assigned an apparent half-life equal to the half-life of Am-242m. The Chart of the nuclides 15th Edition contains an apparent typographical error in stating Am-242m half-life as 1,141 years. The half-life assigned to Cm-242 was 141 years.

The nominal Hanford waste tank inventory estimated in Table 2-1 is greater than the estimate for the total produced for twenty radionuclides. This difference is due to the different approaches used to establish these two estimates. The nominal Hanford waste tank inventory depends on tank measurements when samples exist and supplemented using process knowledge and Hanford defined waste model estimates (Bowen 2005) whereas the total production estimates are based on nuclear physics calculations.

2.1.2 Uncertainty in the I-129 Hanford Tank Inventory

The uncertainty in the radionuclide and chemical inventory estimates for the Hanford waste tanks depends on the specific contaminant and whether one is considering the global estimates or the estimates for individual tanks. Contaminant specific uncertainties are associated with uncertainty in the process losses (from the time the contaminant is generated, through the separation processes, and losses during tank operations) and uncertainties associated with extrapolating sample measurements to tank inventories. Global inventory estimates tend to have less overall uncertainty when compared to specific tank inventories. For the performance assessment the approach has been to develop bounding inventories based on global tank inventories (see Section 2.4). Special attention has been given to I-129 inventory because of its potential impact to groundwater (Mann et al. 2003).

The estimate for the I-129 inventory to be disposed in the IDF has been shown to be important in the supplemental technology assessment (Mann et al. 2003). This risk assessment used the 2001 ILAW PA inventory estimate for I-129 (101 Ci) and assumed nearly all of the I-129 went into the secondary waste stream. This secondary waste stream was assumed to be disposed as a grouted mixed low-level waste. The resulting estimated impacts for disposal of 22.3 Ci of I-129 inventory into the different waste forms resulted in estimated drinking water doses of 0.6 to 0.7 mrem per year. The April 2004 TWINS estimates for I-129 in the Hanford waste tanks indicate the best estimate is 43.9 Ci (TWINS 2004 and Kirkbride et al. 2005a). An understanding of the potential range of I-129 inventories is important to effectively bound the I-129 inventory that may be in the IDF.

A mass balance approach has been used to determine a range for the I-129 inventory currently in the Hanford waste tanks. The approach is discussed in more detail in Puigh et al. (2004) Appendix B. The I-129 inventory in the Hanford waste tanks has been estimated by adjusting the total I-129 produced by various losses during separation plant operations and subsequent Hanford tank farm operations. The total I-129 produced in the Hanford production reactors has been estimated by Watrous (2002). This represents a conservatively bounding estimate for the total I-129 that could be in the Hanford waste tanks today. The processing information for these fuels through the different separation plants was investigated to identify potential pathways for I-129 into the Hanford waste tanks, Hanford cribs and French drains or into the atmosphere. Various I-129 "loss paths" from the tanks have been identified. These potential Hanford waste tank operational "loss paths" include ventilation losses (primarily from self-boiling tanks), uranium recovery processing, Cs/Sr recovery processing, evaporator campaigns to reduce tank waste volumes, and unanticipated tank waste releases (including tank leaks). Quantification of the I-129 "losses" to the different pathways is estimated only for past tank leaks.

Table 2-2 summarizes the results for the calculated minimum and maximum I-129 into the Hanford waste tanks from each separation plant. The estimated maximum I-129 inventories in B- and T-Plants are approximately half the I-129 processed through the plant. The major loss pathways from these plants are through the gas pathway. The maximum I-129 inventory into the Hanford waste tanks from the REDOX plant is approximately equal to the amount processed. This high fraction is based on the assumption that the silver reactor system flush returned effectively all the trapped I-129 to the tanks and essentially no I-129 gas was released from the remaining process systems.

Measurable I-129 was detected in 23 Hanford waste tanks and incorporated directly into the BBI estimates for 19 tanks. The estimated I-129 inventory in these 19 tanks is 7.4 Ci and is based on 196 sample (including duplicate) measurements where only 88 measurements were above the detectability limit for I-129. The tank inventory estimate assumes that the measurements are representative of the average inventory concentration in each tank. Based on these measurements the lower bound estimate for I-129 in the tanks shown in Table 2-2 may be too low and a minimum (7.4 Ci) based on measurements above the minimum detection limit may be a better lower bound estimate for I-129 in the tanks.

The April 2004 BBI estimate for the I-129 inventory in the Hanford waste tanks is 43.9 Ci (TWINS 2004). This estimate is based on a methodology (Bowen 2005) that is dependent on sample data measurements when samples exist and supplemented using process knowledge and Hanford defined waste model estimates. This estimate is bounded by the total production estimate of 49.4 Ci (Watrous 2002) based on reactor physics calculations.

Table 2-2. Estimated I-129 Inventory Range (Based on 49.4 Ci of I-129 Produced in the Production Reactors)

Separation Plant	I-129 Processed Through Separation Plant [(a)] (Ci)	Estimated I-129 Inventory in Hanford Waste Tanks (Ci)	
		Minimum	Maximum
T-Plant	1.0	0.1	0.4
B-Plant	0.6	0.1	0.3
REDOX Plant	9.2	2.1	9.2
PUREX Plant	38.6	1.3	26.3
Totals	49.4	3.6 [7.4[(b)]]	36.2

[(a)] Production estimate from Watrous 2002
[(b)] Minimum estimate based on direct tank measurements above the minimum detection limit

2.2 REFERENCE CASE A - HANFORD TANK WASTE PROCESSING INCLUDES SUPPLEMENTAL TREATMENT SYSTEMS

The process strategy for Reference Case A (based on preliminary planning documented in Kirkbride et al. 2005a) results in the disposal of the following Hanford tank waste forms in the IDF:

- WTP ILAW glass,
- Bulk Vitrification (BV) waste from the DBVS,
- BV waste from the BV production process,
- secondary wastes from WTP processes,
- secondary wastes from the DBVS process,
- secondary waste from the BV production process,
- secondary waste from TRU packaging,
- secondary waste from the 242-A Evaporator, and
- spent LAW and HLW melters from WTP.

The other wastes generated under this process strategy include WTP IHLW glass and TRU packages. The WTP IHLW glass will ultimately be shipped off-site to an approved HLW disposal site. The TRU packages will ultimately be shipped off-site for disposal in Waste Isolation Pilot Plant (WIPP).

2.2.1 HTWOS Modeling Approach

The inventory estimate for the waste from the Hanford tank waste processing assumed under Reference Case A is based upon the results of the HTWOS model run documented in Kirkbride et al. (2005a). The results from the Hanford Tank Waste Operations Simulator (HTWOS) model run (tracked internally as "Development_Run_RTC back-decayed_1-5-2005") were performed to support the IDF performance assessment and other data needs of the Tank Farm Contractor.

The HTWOS model simulates the dynamic operation of the tank farm systems and all interfacing systems including new waste generators, the 242-A Evaporator, the Waste Treatment and Immobilization Plant (WTP), supplemental treatment of waste using bulk vitrification, Transuranic (TRU) waste packaging, and other facilities within the 200 East and 200 West Areas. CH2M HILL Hanford Group, Inc. (CH2M HILL)'s version of the HTWOS model is documented in detail in Appendix A of the Tank Farm Contractor Operation and Utilization Plan (TFCO&UP) (Kirkbride et al. 2003b). This version of the HTWOS model was modified for the Developmental Run for the Refined Target Case (Kirkbride et al. 2005a) by adding detail to the WTP processes to estimate secondary waste streams, adding partition factors to the 242-A Evaporator, adding a process to simulate TRU packaging (including partition factors and secondary waste streams), adding a process to simulate the BV process (including partition factors and secondary waste streams), and adding a process to simulate Liquid Effluent Retention Facility (LERF) and Effluent Treatment Facility (ETF) operations.

Figure 2-1 schematically shows the system modeled in the HTWOS Developmental Run for the Refined Target Case. This system model was also used for the 100% WTP Case. The HTWOS model provides inventory estimates for each node indicated by a circled number in the Figure. The IDF inventory for Reference Case A was broken down into the following waste products and waste streams:

- WTP ILAW glass (stream number 40),
- WTP spent LAW melters (stream number 41E),
- WTP spent HLW melters (stream number 43F),
- DBVS waste form (stream number 12),
- BV production waste form (stream number 50),
- WTP pretreatment secondary waste (stream number 26 minus stream number 27A),
- WTP LAW secondary waste (sum of stream numbers 41A through 41D plus stream number 27A),
- WTP HLW secondary waste (sum of stream numbers 43A through 43E),
- DBVS process secondary waste (stream number 13),
- BV production secondary waste (stream number 52),
- TRU packaging secondary waste (stream number 20), and
- 242-A Evaporator secondary waste (stream number 22).

The final inventories associated with the HLW and LAW melters are not known. These inventories will depend on the number of melters of each type disposed, the quantity of glass left in each melter, the composition of this glass, and any other contaminants that remain with the melter at the time of disposal. The approach used to obtain nominal inventory estimates for the WTP spent melters is based on the following assumptions from Kirkbride et al. (2005a):

- On average 2 spent LAW and 2 spent HLW melters are disposed of every 5 years from WTP operations, and
- The glass pool volume in the LAW melter is 11.9 m^3 and in the HLW melter is 6.8 m^3 (see Appendix A, Kirkbride et al. 2005a).

The secondary waste streams from WTP have been combined into secondary waste streams associated with the major processes in the WTP (specifically, pretreatment [PT], the LAW process [leading to the production of ILAW glass], and the HLW process [leading to the production of HLW glass]).

The inventories for each of these waste products and waste streams listed above are provided in Table C-1 of Kirkbride et al. (2005a). The secondary waste stream inventories that are processed through the Liquid Effluent Retention Facility (LERF) and the Effluent Treatment Facility (namely, stream numbers 13, 20, 22, 26, and 52) must be adjusted for the partitioning of the LERF waste stream into solids and liquids at ETF. The solids from each of these streams are disposed in the IDF. These partitioning factors from Kirkbride et al. (2005a) are provided in Table 2-3. The estimated inventories are calculated to be negative for several short-lived radionuclides with small inventories (e.g., Nb-93m, Ra-228, Ac-227 and Am-241) for selected streams within the HTWOS calculation. This effect is due in part to back-decaying the results to a specific date. The ETF partitioning fractions for Nb-93m, Ra-228 and Ac-227 have been assumed to be 0.999990. The ETF partitioning fraction for Am-241 has been assumed to be 0.9990.

Figure 2-1. Primary and Secondary Waste Streams in the HTWOS Developmental Run for the Refined Target Case
(Kirkbride et al. 2005a)

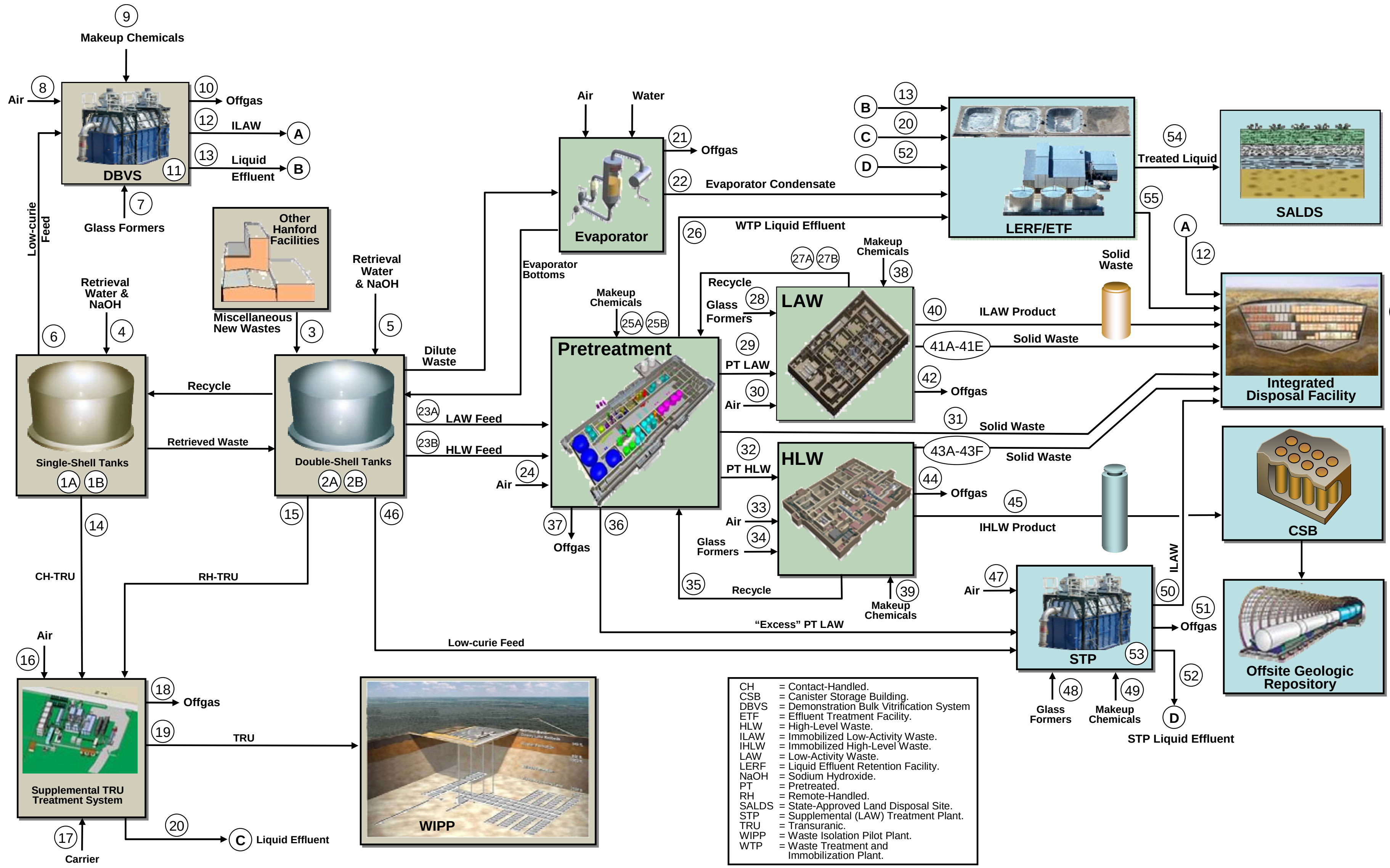


Table 2-3. ETF Partitioning Fractions

Contaminant	Total ETF Solid [a] (Ci or kg) [d]	Total ETF Liquid [b] (Ci or kg) [d]	ETF Partitioning Fraction [c]
H-3	0.00E+00	4.00E+03	0.00000E+00
C-14	5.26E+00	5.26E-05	9.99990E-01
Ni-59	6.72E-02	6.72E-05	9.99000E-01
Co-60	2.28E+00	2.28E-05	9.99990E-01
Ni-63	5.60E+00	5.60E-05	9.99990E-01
Se-79	3.92E-02	3.92E-07	9.99990E-01
Sr-90+D [e]	3.11E+01	3.11E-05	9.99999E-01
Nb-93m	-2.32E+00	-2.32E-05	9.99990E-01
Zr-93	4.94E+00	4.94E-05	9.99990E-01
Tc-99	5.94E+01	5.94E-04	9.99990E-01
Ru-106+D [e]	1.28E-01	1.28E-06	9.99990E-01
Cd-113m	2.26E+00	2.26E-05	9.99990E-01
Sb-125	1.09E+01	1.09E-04	9.99990E-01
Sn-126+D [e]	2.17E-01	2.17E-06	9.99990E-01
I-129	1.60E+00	1.60E-05	9.99990E-01
Cs-134	6.76E-05	6.76E-10	9.99990E-01
Cs-137+D [e]	2.15E+00	2.15E-05	9.99990E-01
Sm-151	3.37E+02	3.37E-03	9.99990E-01
Eu-152	1.26E-01	1.26E-06	9.99990E-01
Eu-154	1.68E+00	1.68E-05	9.99990E-01
Eu-155	1.91E+00	1.91E-05	9.99990E-01
Ra-226+D [e]	6.56E-03	6.56E-08	9.99990E-01
Ac-227+D [e]	7.32E-05	-6.60E-08	9.99990E-01
Ra-228+D [e]	-1.65E-03	-3.91E-06	9.99990E-01
Th-229+D [e]	3.49E-04	3.49E-09	9.99990E-01
Pa-231	4.44E-04	4.44E-07	9.99000E-01
Th-232	1.07E-03	1.07E-06	9.99000E-01
U-232	7.71E-04	7.72E-07	9.99000E-01
U-233	2.98E-02	2.98E-05	9.99000E-01
U-234	2.13E-02	2.13E-05	9.99000E-01
U-235+D [e]	8.99E-04	9.00E-07	9.99000E-01
U-236	6.85E-04	6.86E-07	9.99000E-01
Np-237+D [e]	9.31E-02	9.32E-05	9.99000E-01
Pu-238	3.64E-05	3.64E-08	9.99000E-01
U-238+D [e]	2.17E-02	2.18E-05	9.99000E-01

Table 2-3. ETF Partitioning Fractions

Contaminant	Total ETF Solid [a] (Ci or kg) [d]	Total ETF Liquid [b] (Ci or kg) [d]	ETF Partitioning Fraction [c]
Pu-239	6.97E-04	6.97E-07	9.99000E-01
Pu-240	1.24E-01	1.24E-04	9.99000E-01
Am-241	-2.55E-03	-2.56E-06	9.99000E-01
Pu-241+D [e]	1.88E+00	1.88E-03	9.99000E-01
Cm-242	4.33E-02	4.34E-05	9.99000E-01
Pu-242	1.40E-05	1.40E-08	9.99000E-01
Am-243+D [e]	5.60E-06	5.60E-09	9.99000E-01
Cm-243	2.85E-03	2.85E-06	9.99000E-01
Cm-244	6.57E-02	6.57E-05	9.99000E-01
Ag	2.11E+00	2.11E-03	9.99000E-01
Al(OH)	1.68E+04	1.68E+01	9.99000E-01
Al	5.90E+03	5.91E+00	9.99000E-01
As	1.27E+02	1.27E-01	9.99000E-01
B	6.48E+00	6.48E-03	9.99000E-01
Ba	2.69E+00	2.70E-03	9.99000E-01
Be	2.68E-02	2.68E-05	9.99000E-01
Bi	5.18E+00	5.19E-03	9.99000E-01
Ca	9.80E+01	9.81E-02	9.99000E-01
Cd	1.01E+02	1.01E-01	9.99000E-01
Ce	2.33E+00	2.33E-03	9.99000E-01
Cl	1.82E+05	1.82E+02	9.99000E-01
CN	0.00E+00	4.91E-01	0.00000E+00
Co	8.01E-01	8.01E-04	9.99000E-01
CO_3	7.98E+06	7.99E+03	9.99000E-01
$Cr(OH)_4$	4.48E+01	4.48E-02	9.99000E-01
Cr	1.65E+01	1.65E-02	9.99000E-01
Cs	7.50E-01	7.50E-04	9.99000E-01
Cu	8.77E-01	8.78E-04	9.99000E-01
F	8.00E+04	8.01E+01	9.99000E-01
Fe	8.26E+01	8.27E-02	9.99000E-01
Hg	5.54E+00	5.54E-03	9.99000E-01
K+	6.82E+02	6.83E-01	9.99000E-01
La	7.02E-01	7.02E-04	9.99000E-01
Li	4.95E-02	4.95E-05	9.99000E-01
Mg	3.35E+00	3.35E-03	9.99000E-01
Mn	7.37E+00	6.43E+01	1.02837E-01

Table 2-3. ETF Partitioning Fractions

	Total ETF Solid [a]	Total ETF Liquid [b]	ETF Partitioning Fraction [c]
Contaminant	(Ci or kg) [d]	(Ci or kg) [d]	
Mo	3.26E+00	3.26E-03	9.99000E-01
Na	5.42E+05	5.42E+02	9.99000E-01
Nd	2.58E-01	2.58E-04	9.99000E-01
NH_3	1.98E+06	1.98E+03	9.99000E-01
Ni	4.18E+00	4.18E-03	9.99000E-01
NO_2	4.92E+06	4.93E+03	9.99000E-01
NO_3	3.02E+07	3.02E+04	9.99000E-01
OH(BOUND)	7.69E+03	7.70E+00	9.99000E-01
OH	4.23E+05	4.23E+02	9.99000E-01
Pb	3.71E+02	3.72E-01	9.99000E-01
Pd	1.58E-01	1.58E-04	9.99000E-01
PO_4	1.09E+04	1.09E+01	9.99000E-01
Pr	0.00E+00	2.85E-03	0.00000E+00
Rb	8.78E-02	8.79E-05	9.99000E-01
Rh	1.79E-01	1.79E-04	9.99000E-01
Ru	7.75E-01	7.76E-04	9.99000E-01
Sb	8.30E-01	8.31E-04	9.99000E-01
Se	2.98E+01	2.98E-02	9.99000E-01
Si	8.13E+02	8.14E-01	9.99000E-01
SO_4	2.06E+06	2.06E+03	9.99000E-01
Sr	1.25E+03	1.25E+00	9.99000E-01
Ta	2.92E-03	2.92E-06	9.99000E-01
Te	1.50E-02	1.50E-05	9.99000E-01
Th	1.11E-02	1.12E-05	9.99000E-01
Ti	4.02E-01	4.02E-04	9.99000E-01
Tl	4.49E-01	4.50E-04	9.99000E-01
TOC	1.74E+05	1.31E+04	9.30000E-01
U	6.51E+01	6.52E-02	9.99000E-01
V	0.00E+00	1.24E-01	0.00000E+00
W	0.00E+00	1.00E+00	0.00000E+00
Y	0.00E+00	1.06E-02	0.00000E+00
Zn	1.03E+00	1.04E-03	9.99000E-01
Zr	4.57E+01	4.57E-02	9.99000E-01

[a] ETF Solid inventory from stream number 55 in Table C-1 (Kirkbride et al. 2005a).
[b] ETF Liquid inventory from stream number 54 in Table C-1 (Kirkbride et al. 2005a).
[c] ETF Partitioning Fraction = ETF solid / (ETF solid + ETF liquid).

Table 2-3. ETF Partitioning Fractions

Contaminant	Total ETF Solid [a] (Ci or kg) [d]	Total ETF Liquid [b] (Ci or kg) [d]	ETF Partitioning Fraction [c]

[d] Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg.
[e] Short-lived progeny are in equilibrium with parent.

2.2.2 Reference Case A Inventory

The inventory estimate for Reference Case A was developed from the inventories for the different waste product and secondary waste streams documented in Table C-1 in Kirkbride et al. (2005a). The inventories for the major waste products and associated waste streams to be disposed in the IDF are provided in Table 2-4.

The secondary waste streams from the processing of the Hanford tank waste have been partitioned into the following contributors: WTP (PT), WTP (LAW), BV, and Other. WTP (PT) is the secondary waste streams associated with the pretreatment process (stream number 31 plus a portion of stream 26) and does not include the recycle from the LAW process (stream number 27A). The WTP (LAW) includes the recycle waste stream from LAW (stream 27A), the HEPA filters, and the LAW VOC scrubber. The BV includes all secondary waste from the BV process and is currently assumed to include only liquid wastes that are sent to LERF. The solids portion processed through ETF is assumed to go to IDF. The Other secondary wastes include: secondary waste from WTP HLW process (HEPA filters, VOC scrubbers, and Ag mordenite columns) and ETF solids from the 242-A Evaporator and TRU packaging waste streams. Table 2-5 provides an additional breakdown for the secondary waste streams for the different processes.

Under the processing assumptions associated with Reference Case A, most of the Tc-99 is incorporated into the WTP ILAW and BV glasses in approximately equal amounts (10,760 Ci into WTP ILAW and 11,700 Ci into BV). A total of 232 Ci of Tc-99 is estimated to go into the secondary waste streams that are assumed to be grouted before their waste products are disposed in the IDF. The remaining Tc-99 from the starting tank inventory resides predominantly in the HLW glass, the tank residuals and the TRU packaged wastes that will not go into the IDF.

Under the processing assumptions associated with Reference Case A, most of the I-129 is incorporated into the BV waste form. Of the initial tank inventory of 43.9 Ci, approximately 20.9 Ci is estimated to be incorporated into the BV glass, and 7.2 Ci incorporated into the WTP ILAW glass. A total of 12.9 Ci of I-129 is estimated to go into the secondary waste streams and is assumed to be incorporated into a grouted waste form prior to disposal in the IDF. The remaining I-129 inventory from the tanks resides predominantly in the HLW glass, tank residuals, and TRU packages that will not be disposed in the IDF.

2.2.3 Waste Form Volume Estimates for Reference Case A

Waste form volume estimates can be used to understand the trench volume needed for disposal of the planned waste in the IDF and for estimating the environmental risks associated with an inadvertent intruder. Waste form volume estimates for WTP glass, the spent melters and the BV waste form are provided in Kirkbride et al. (2005a). Waste form volume estimates for the secondary waste streams are developed from WTP contractor and ETF contractor estimates for the solid waste volumes from the different secondary waste streams from these facilities. These estimates are discussed in Appendix A. Table 2-6 provides estimated waste package volumes for the different waste forms associated with the Reference Case A inventory.

Table 2-4. Reference Case A Inventory - Utilizing Supplemental LAW Treatment System per Kirkbride et al. (2005a)

Contaminant	WTP ILAW Glass (Ci or kg) [g]	Spent LAW Melters [a] (Ci or kg) [g]	Spent HLW Melters [b] (Ci or kg) [g]	BV Product [c] (Ci or kg) [g]	BV Secondary Solid Waste [d] (Ci or kg) [g]	Other Secondary Solid Waste [e] (Ci or kg) [g]	WTP (LAW) Secondary Solid Waste [f] (Ci or kg) [g]	Total IDF Inventory (Ci or kg) [g]
3-H	0.00E+00	0.00E+00	0.00E+00	3.39E+02	0.00E+00	0.00E+00	0.00E+00	3.39E+02
14-C	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.81E-01	4.50E+00	0.00E+00	5.26E+00
59-Ni	1.58E+02	4.60E-01	4.17E+00	1.11E+02	3.77E-03	6.34E-02	0.00E+00	2.74E+02
60-Co	7.13E+02	2.89E+00	1.64E+01	3.80E+02	4.15E-01	4.12E+00	5.68E-03	1.12E+03
63-Ni	1.31E+04	3.82E+01	3.90E+02	1.02E+04	3.47E-01	5.25E+00	0.00E+00	2.38E+04
79-Se	4.78E+01	1.39E-01	1.80E-02	4.13E+01	0.00E+00	3.92E-02	0.00E+00	8.93E+01
90-Sr+D [h]	3.29E+05	1.40E+03	4.04E+05	2.36E+05	2.46E+01	7.42E+00	6.73E-01	9.70E+05
93-Zr	9.41E+02	5.81E+00	9.11E+00	8.04E+02	7.97E-01	4.15E+00	0.00E+00	1.76E+03
93m-Nb [j]	7.24E+02	1.76E+00	4.16E+00	6.01E+02	0.00E+00	7.55E-01	0.00E+00	1.33E+03
99-Tc	1.08E+04	2.18E+01	1.18E+01	1.17E+04	1.23E+01	7.94E+01	1.42E+02	2.28E+04
106-Ru+D [h]	4.17E+02	2.68E-01	4.59E-01	1.86E+02	0.00E+00	1.28E-01	3.40E-03	6.04E+02
113m-Cd	1.39E+03	5.10E+00	3.58E+00	1.27E+03	5.73E-02	2.20E+00	0.00E+00	2.67E+03
125-Sb	1.73E+03	5.70E+00	1.59E+01	3.00E+03	7.49E-01	1.01E+01	7.27E-02	4.76E+03
126-Sn+D [h]	1.45E+02	5.07E-01	1.09E+00	8.59E+01	2.15E-02	1.95E-01	2.58E-03	2.33E+02
129-I	7.15E+00	1.64E-02	7.75E-03	2.09E+01	4.74E-01	2.92E+00	9.50E+00	4.09E+01
134-Cs	9.69E-01	2.07E-03	1.34E+01	3.12E+00	3.34E-08	1.07E-02	2.31E-04	1.75E+01
137-Cs+D [h]	2.13E+04	4.56E+01	2.03E+05	4.91E+05	1.48E+00	1.88E+02	5.06E+00	7.16E+05
151-Sm	2.00E+05	3.20E+02	1.48E+04	1.60E+05	4.27E-02	3.37E+02	0.00E+00	3.76E+05
152-Eu	5.10E+01	2.01E-01	3.44E+00	5.20E+01	3.69E-05	1.26E-01	1.02E-04	1.07E+02
154-Eu	2.97E+03	1.17E+01	1.46E+02	1.26E+03	1.27E-01	1.56E+00	5.81E-03	4.39E+03
155-Eu	1.69E+03	6.67E+00	9.00E+01	1.36E+03	9.64E-04	1.91E+00	3.32E-03	3.15E+03
226-Ra	5.57E-01	1.28E-03	3.78E-05	8.54E-01	0.00E+00	6.56E-03	1.94E-05	1.42E+00

Table 2-4. Reference Case A Inventory - Utilizing Supplemental LAW Treatment System per Kirkbride et al. (2005a)

Contaminant	WTP ILAW Glass (Ci or kg) [g]	Spent LAW Melters [a] (Ci or kg) [g]	Spent HLW Melters [b] (Ci or kg) [g]	BV Product [c] (Ci or kg) [g]	BV Secondary Solid Waste [d] (Ci or kg) [g]	Other Secondary Solid Waste [e] (Ci or kg) [g]	WTP (LAW) Secondary Solid Waste [f] (Ci or kg) [g]	Total IDF Inventory (Ci or kg) [g]
227-Ac+D [h]	4.43E-02	1.26E-04	8.37E-03	1.07E-02	0.00E+00	7.31E-05	0.00E+00	6.36E-02
228-Ra+D [h,j]	1.87E+00	4.27E-03	9.99E-03	1.34E+00	0.00E+00	1.65E-03	9.45E-05	3.22E+00
229-Th+D [h]	6.60E-02	1.29E-04	3.24E-03	4.93E-02	4.88E-05	3.02E-04	0.00E+00	1.19E-01
231-Pa	1.14E+00	2.62E-03	1.10E-02	7.89E-01	0.00E+00	4.44E-04	0.00E+00	1.95E+00
232-Th	1.91E-01	3.74E-04	1.93E-02	1.34E-01	1.32E-04	9.35E-04	0.00E+00	3.46E-01
232-U	1.41E-01	2.81E-04	3.67E-02	1.12E-01	1.11E-04	6.62E-04	2.80E-07	2.90E-01
233-U	5.15E+00	1.03E-02	3.94E+00	4.41E+00	4.37E-03	2.55E-02	1.03E-05	1.35E+01
234-U	3.66E+00	7.32E-03	1.09E+00	2.82E+00	2.79E-03	1.85E-02	7.36E-06	7.60E+00
235-U+D [h]	1.55E-01	3.09E-04	4.49E-02	1.19E-01	1.18E-04	7.82E-04	3.11E-07	3.20E-01
236-U	1.07E-01	2.13E-04	2.35E-02	8.94E-02	8.85E-05	5.97E-04	2.13E-07	2.20E-01
237-Np+D [h]	2.00E+01	2.83E-02	1.41E-01	2.34E+01	2.32E-02	7.00E-02	3.96E-05	4.37E+01
238-Pu	2.71E+01	9.55E-02	7.07E+00	2.01E+01	5.37E-06	6.37E-05	5.38E-05	5.44E+01
238-U+D [h]	3.87E+00	7.73E-03	1.01E+00	2.73E+00	2.71E-03	2.05E-02	7.85E-06	7.64E+00
239-Pu	4.04E+02	1.42E+00	2.11E+02	5.09E+02	1.51E-04	1.52E-03	8.08E-04	1.12E+03
240-Pu	8.41E+01	2.96E-01	4.43E+01	1.07E+02	2.86E-05	1.24E-01	1.68E-04	2.36E+02
241-Am+D [h]	2.89E+03	1.11E+01	3.05E+02	2.20E+03	1.57E-03	3.20E-02	8.34E-02	5.41E+03
241-Pu+D [h]	9.36E+02	3.29E+00	3.55E+02	1.09E+03	2.91E-04	1.88E+00	1.86E-03	2.39E+03
242-Cm	8.73E+00	1.62E-02	1.65E-01	6.37E+00	6.31E-03	3.70E-02	1.57E-05	1.53E+01
242-Pu	6.64E-03	2.34E-05	2.91E-03	8.23E-03	2.20E-09	1.40E-05	1.32E-08	1.78E-02
243-Am	1.39E+00	5.37E-03	1.40E-01	1.04E+00	7.34E-07	4.86E-06	3.99E-05	2.57E+00
243-Cm	4.94E-01	9.17E-04	1.38E-02	4.38E-01	4.34E-04	2.42E-03	9.92E-07	9.50E-01
244-Cm	1.13E+01	2.10E-02	3.21E-01	1.00E+01	9.95E-03	5.58E-02	2.28E-05	2.18E+01

Table 2-4. Reference Case A Inventory - Utilizing Supplemental LAW Treatment System per Kirkbride et al. (2005a)

Contaminant	WTP ILAW Glass	Spent LAW Melters [(a)]	Spent HLW Melters [(b)]	BV Product [(c)]	BV Secondary Solid Waste [(d)]	Other Secondary Solid Waste [(e)]	WTP (LAW) Secondary Solid Waste [(f)]	Total IDF Inventory
	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]
Ag	1.58E+02	5.15E-01	1.64E+01	1.29E+02	1.43E+00	6.82E-01	9.37E-03	3.07E+02
Al	7.61E+06	1.54E+04	7.00E+03	2.44E+06	1.61E+03	9.09E+03	1.09E+00	1.01E+07
$Al(OH)_4$[(i)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E+03	1.47E+04	0.00E+00	1.68E+04
As	5.16E+02	1.04E+00	1.75E+01	2.91E+02	1.25E+02	2.06E+00	4.29E-02	9.52E+02
B	6.23E+06	1.44E+04	3.56E+03	2.31E+06	9.66E-01	5.52E+00	5.68E-03	8.56E+06
Ba	2.24E+02	5.13E-01	3.78E+01	1.60E+02	1.78E+00	9.23E-01	1.81E-03	4.25E+02
Be	3.11E+01	6.81E-02	2.97E+00	2.54E+01	0.00E+00	2.70E-02	9.04E-04	5.95E+01
Bi	2.92E+03	6.73E+00	9.29E+02	2.17E+03	5.42E-01	4.73E+00	4.44E-02	6.04E+03
Ca	2.93E+06	6.74E+03	7.50E+02	1.83E+04	1.83E+01	7.98E+01	3.30E-02	2.96E+06
Cd	6.66E+02	1.53E+00	2.25E+01	2.36E+02	1.01E+02	2.52E-01	9.96E-02	1.03E+03
Ce	5.22E+02	2.00E+00	2.55E+01	3.49E+02	3.45E-01	1.98E+00	2.88E-04	9.00E+02
Cl	4.87E+05	9.91E+02	3.67E+01	1.78E+05	1.79E+05	3.84E+03	0.00E+00	8.48E+05
CN^-[(i)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.31E-01	1.21E+00	1.94E+00
Co	1.48E+02	3.40E-01	4.32E+00	1.18E+02	1.17E-01	6.85E-01	1.18E-03	2.72E+02
Cr	2.87E+05	5.13E+02	3.00E+02	1.94E+05	5.47E+00	1.10E+02	5.37E+01	4.82E+05
$Cr(OH)_4$[(i)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.04E+00	2.22E+02	7.47E+01	3.03E+02
Cs	8.11E+02	1.86E+00	2.32E+00	6.32E+02	2.37E-05	7.54E-01	3.08E-01	1.45E+03
Cu	2.67E+02	1.02E+00	1.18E+01	9.78E+01	9.68E-02	7.82E-01	3.23E-04	3.79E+02
F	3.45E+05	1.22E+03	4.81E+02	4.36E+05	8.02E+04	2.58E+02	1.01E+03	8.64E+05
Fe	7.92E+06	1.83E+04	4.81E+03	1.28E+04	1.27E+01	7.00E+01	9.71E-03	7.95E+06
Hg	0.00E+00	0.00E+00	0.00E+00	4.04E+02	4.00E-01	9.88E+02	3.22E+02	1.72E+03
I	4.05E+01	9.28E-02	4.39E-02	1.18E+02	2.68E+00	1.65E+01	5.38E+01	2.32E+02
K	4.84E+05	1.11E+03	2.80E+02	3.90E+05	1.10E+02	6.35E+02	3.33E+01	8.76E+05

Table 2-4. Reference Case A Inventory - Utilizing Supplemental LAW Treatment System per Kirkbride et al. (2005a)

Contaminant	WTP ILAW Glass (Ci or kg) [g]	Spent LAW Melters [a] (Ci or kg) [g]	Spent HLW Melters [b] (Ci or kg) [g]	BV Product [c] (Ci or kg) [g]	BV Secondary Solid Waste [d] (Ci or kg) [g]	Other Secondary Solid Waste [e] (Ci or kg) [g]	WTP (LAW) Secondary Solid Waste [f] (Ci or kg) [g]	Total IDF Inventory (Ci or kg) [g]
La	2.11E+02	1.10E+00	2.58E+01	6.36E+01	6.30E-02	6.41E-01	3.02E-03	3.02E+02
Li	6.01E+03	8.06E-01	1.73E+03	8.71E+01	2.87E-03	4.67E-02	5.05E-04	7.83E+03
Mg	1.83E+06	4.22E+03	1.24E+02	5.38E+02	5.33E-01	2.82E+00	5.18E-04	1.83E+06
Mn	5.90E+04	2.94E+02	1.10E+03	1.84E+03	1.88E-01	7.25E+00	1.22E-01	6.23E+04
Mo	1.92E+03	3.97E+00	1.38E+01	1.69E+03	0.00E+00	3.28E+00	8.21E-01	3.63E+03
Na	2.92E+07	6.88E+04	1.25E+04	2.69E+07	5.39E+05	2.75E+04	5.00E+03	5.67E+07
Nd	8.14E+02	4.12E+00	2.69E+01	4.44E+02	0.00E+00	2.58E-01	3.83E-03	1.29E+03
NH_3 [i,j]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.39E+03	0.00E+00	4.39E+03
Ni	7.81E+03	1.79E+01	3.78E+02	3.75E+03	1.27E-01	4.06E+00	4.01E-02	1.20E+04
NO_2 [i,j]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E+03	1.15E+04	0.00E+00	1.35E+04
NO_3 [i,j]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.48E+06	2.52E+05	2.59E+04	3.75E+06
OH^- [i]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.02E+05	2.16E+04	2.18E+03	4.25E+05
OH(BOUND)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E+03	6.30E+03	0.00E+00	7.69E+03
P	7.11E+05	1.29E+03	3.79E+02	7.03E+05	6.96E+02	2.88E+03	1.72E+01	1.42E+06
PO_4 [i]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E+03	8.84E+03	5.26E+01	1.10E+04
Pb	5.25E+03	1.89E+01	2.85E+02	2.29E+03	2.54E+02	1.18E+02	6.59E-01	8.21E+03
Pd	8.29E+01	3.01E-03	4.82E-01	7.95E+01	2.69E-03	1.55E-01	1.65E-04	1.63E+02
Pr	2.54E+00	4.92E-03	2.58E+00	1.90E+00	0.00E+00	2.36E-04	7.73E-05	7.03E+00
Rb	4.08E+01	2.69E-02	9.20E-01	4.42E+01	0.00E+00	8.82E-02	3.07E-03	8.60E+01
Rh	1.35E+02	7.63E-01	1.10E+00	5.27E+01	0.00E+00	1.81E-01	3.99E-02	1.89E+02
Ru	2.00E+02	4.58E-01	5.86E+00	1.90E+02	0.00E+00	9.36E-01	1.15E+00	3.99E+02
S	4.48E+05	1.03E+03	1.07E+02	5.50E+02	6.87E+05	2.61E+03	1.33E+04	1.15E+06
SO_4 [i]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.06E+06	4.85E+03	4.12E+00	2.06E+06

Table 2-4. Reference Case A Inventory - Utilizing Supplemental LAW Treatment System per Kirkbride et al. (2005a)

Contaminant	WTP ILAW Glass (Ci or kg) [g]	Spent LAW Melters [a] (Ci or kg) [g]	Spent HLW Melters [b] (Ci or kg) [g]	BV Product [c] (Ci or kg) [g]	BV Secondary Solid Waste [d] (Ci or kg) [g]	Other Secondary Solid Waste [e] (Ci or kg) [g]	WTP (LAW) Secondary Solid Waste [f] (Ci or kg) [g]	Total IDF Inventory (Ci or kg) [g]
Sb	4.97E+02	1.14E+00	7.08E+00	4.51E+02	1.58E-01	6.75E-01	2.05E-02	9.57E+02
Se	1.92E+03	4.40E+00	8.39E-01	2.78E+03	2.80E+01	1.88E+00	2.87E+00	4.73E+03
Si	4.23E+07	9.72E+04	2.60E+04	4.66E+07	1.19E+02	6.96E+02	5.99E-02	8.90E+07
Sn	1.28E+01	2.94E-02	6.35E-02	7.57E+00	1.89E-03	1.72E-02	2.27E-04	2.05E+01
Sr	5.22E+03	1.20E+01	8.42E+02	2.97E+00	1.26E+03	3.69E-01	1.04E-02	7.32E+03
Ta	7.15E+01	6.81E-01	2.39E-02	3.92E+00	0.00E+00	2.92E-03	2.02E-03	7.61E+01
Te	3.73E+00	4.93E-03	2.23E+00	3.70E+00	0.00E+00	2.02E-02	2.88E-03	9.70E+00
Th	1.74E+03	3.98E+00	2.56E+02	1.22E+03	1.20E+00	8.50E+00	5.10E-06	3.23E+03
Ti	2.45E+06	5.66E+03	6.70E+00	7.27E+01	7.20E-02	3.32E-01	1.17E-04	2.45E+06
Tl	3.54E+02	4.66E-01	1.66E+01	4.43E+02	0.00E+00	6.18E-01	1.30E+00	8.16E+02
TOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E+05	2.73E+02	0.00E+00	1.74E+05
U	1.16E+04	2.65E+01	1.88E+03	8.19E+03	8.11E+00	6.13E+01	2.35E-02	2.17E+04
V	2.23E+02	6.42E-01	8.13E+00	1.99E+02	0.00E+00	4.83E-03	2.25E-02	4.31E+02
W	5.51E+02	5.50E-01	7.41E+00	4.73E+02	0.00E+00	3.04E-04	1.65E-02	1.03E+03
Y	9.01E+01	2.06E-01	1.67E+00	5.53E+01	2.44E-13	4.58E-05	8.48E-04	1.47E+02
Zn	4.85E+06	1.12E+04	2.38E+01	1.53E+02	1.51E-01	8.85E-01	4.47E-04	4.86E+06
Zr	4.41E+06	1.03E+04	7.31E+02	7.71E+06	4.66E+00	4.30E+01	5.04E-04	1.21E+07

[a] Assumes two melters, each with a 5-year minimum design life per 24590-LAW-3PS-AE00-T0001. Volume of glass in the melter does not include an allowance for increased volume due to corrosion of refractory and reflects the set point of 6,891 gallons per 24590-WTP-MDD-PR-01-002, Appendix D; other contributions to source term such as plenum deposits are neglected.

[b] Assumes two melters, each with a 5-year minimum design life per 24590-HLW-3PS-AE00-T0001. Volume of glass in the melter includes an allowance for increased volume due to corrosion of refractory per 24590-HLW-M5C-HMP-00002, Table 2; other contributions to source term such as plenum deposits are neglected.

[c] Inventory estimate includes contribution from DBVS.

Table 2-4. Reference Case A Inventory - Utilizing Supplemental LAW Treatment System per Kirkbride et al. (2005a)

Contaminant	WTP ILAW Glass	Spent LAW Melters [(a)]	Spent HLW Melters [(b)]	BV Product [(c)]	BV Secondary Solid Waste [(d)]	Other Secondary Solid Waste [(e)]	WTP (LAW) Secondary Solid Waste [(f)]	Total IDF Inventory
	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]	(Ci or kg) [(g)]

[(d)] BV Secondary Solid Waste = solids portion of BV-to-LERF + solids portion of DBVS-to-LERF.

[(e)] Other Secondary Solid Waste = WTP (PT) + WTP (HLW) + solids portion of 242-A-to-LERF + TRU-packaging-to-LERF; where WTP (PT) Secondary Solid Waste = Waste of from HTWOS Spent Resins + solids portion of WTP-to-LERF minus solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass, WTP (HLW) Secondary Solid Waste = HLW HEPA1 + HLW HEPA2 + HLW VOC-SCRUB + HLW AG MORDINITE.

[(f)] WTP (LAW) Secondary Solid Waste = LAW HEPA1 + LAW HEPA2 + LAW VOC-SCRUB + solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass (part of WTP-to-LERF stream).

[(g)] Units for inventories provided in this Table. Radionuclide contaminant inventories are in units of Ci decayed to January 1, 2004; chemical contaminant inventories are in units of kg and include the mass associated with radionuclides.

[(h)] Short-lived progeny in equilibrium with parent.

[(i)] mass of chemical compound.

[(j)] Shaded values in table reflect adjustments to the HTWOS values from Kirkbride et al. (2005a). Specifically, small negative values from the model (due to back-decaying corrections) were set equal to zero for 93m-Nb, and 228-Ra; inventory values for NH_3, NO_2, and NO_3 were adjusted based on newer processing split data for the BV (and DBVS) system.

Table 2-5. Detailed Inventory for Reference Case A Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [(a)] (Ci or kg) [(i)]	WTP (LAW) Secondary Solid Waste [(b)] (Ci or kg) [(i)]	WTP (PT) Secondary Solid Waste [(c)] (Ci or kg) [(i)]	WTP (HLW) Secondary Solid Waste [(d)] (Ci or kg) [(i)]	TRU Packaging Secondary Waste [(e)] (Ci or kg) [(j)]	242-A Evaporator Secondary Waste [(f)] (Ci or kg) [(i)]	Other Secondary Waste [(g)] (Ci or kg) [(i)]	Total Secondary Waste [(h)] (Ci or kg) [(i)]
3-H	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
14-C	7.81E-01	0.00E+00	3.97E+00	0.00E+00	7.09E-04	5.30E-01	4.50E+00	5.28E+00
59-Ni	3.77E-03	0.00E+00	1.51E-02	0.00E+00	6.53E-05	4.83E-02	6.34E-02	6.72E-02
60-Co	4.15E-01	5.68E-03	4.12E+00	6.99E-04	6.41E-04	7.63E-05	4.12E+00	4.54E+00
63-Ni	3.47E-01	0.00E+00	1.30E+00	0.00E+00	3.62E-03	3.95E+00	5.25E+00	5.60E+00
79-Se	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.04E-05	3.91E-02	3.92E-02	3.92E-02
90-Sr+D [(j)]	2.46E+01	6.73E-01	5.86E+00	8.29E-01	2.32E-03	7.29E-01	7.42E+00	3.27E+01
93-Zr	7.97E-01	0.00E+00	3.12E+00	0.00E+00	1.15E-07	1.03E+00	4.15E+00	4.94E+00
93m-Nb [(l)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-03	7.54E-01	7.55E-01	7.55E-01
99-Tc	1.23E+01	1.42E+02	7.94E+01	0.00E+00	4.51E-02	1.08E-03	7.94E+01	2.34E+02
106-Ru+D [(j)]	0.00E+00	3.40E-03	0.00E+00	0.00E+00	9.87E-10	1.28E-01	1.28E-01	1.31E-01
113m-Cd	5.73E-02	0.00E+00	2.05E-01	0.00E+00	2.49E-03	2.00E+00	2.20E+00	2.26E+00
125-Sb	7.49E-01	7.27E-02	2.04E+00	3.14E-03	2.11E-07	8.09E+00	1.01E+01	1.10E+01
126-Sn+D [(j)]	2.15E-02	2.58E-03	1.07E-01	3.96E-05	1.45E-08	8.87E-02	1.95E-01	2.19E-01
129-I	4.74E-01	9.50E+00	1.75E-01	2.73E+00	1.06E-02	3.23E-04	2.92E+00	1.29E+01
134-Cs	3.34E-08	2.31E-04	2.61E-05	1.06E-02	0.00E+00	4.15E-05	1.07E-02	1.09E-02
137-Cs+D [(j)]	1.48E+00	5.06E+00	2.49E+01	1.63E+02	0.00E+00	2.55E-01	1.88E+02	1.95E+02
151-Sm	4.27E-02	0.00E+00	1.67E-01	0.00E+00	5.37E-05	3.37E+02	3.37E+02	3.37E+02
152-Eu	3.69E-05	1.02E-04	1.27E-04	2.66E-05	1.46E-08	1.26E-01	1.26E-01	1.26E-01
154-Eu	1.27E-01	5.81E-03	5.50E-03	1.13E-03	1.69E-07	1.55E+00	1.56E+00	1.69E+00
155-Eu	9.64E-04	3.32E-03	3.90E-03	6.93E-04	1.58E-07	1.91E+00	1.91E+00	1.92E+00

Table 2-5. Detailed Inventory for Reference Case A Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [a] (Ci or kg) [i]	WTP (LAW) Secondary Solid Waste [b] (Ci or kg) [i]	WTP (PT) Secondary Solid Waste [c] (Ci or kg) [i]	WTP (HLW) Secondary Solid Waste [d] (Ci or kg) [i]	TRU Packaging Secondary Waste [e] (Ci or kg) [j]	242-A Evaporator Secondary Waste [f] (Ci or kg) [i]	Other Secondary Waste [g] (Ci or kg) [i]	Total Secondary Waste [h] (Ci or kg) [i]
226-Ra	0.00E+00	1.94E-05	0.00E+00	0.00E+00	1.17E-12	6.56E-03	6.56E-03	6.58E-03
227-Ac+D [j]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.21E-12	7.31E-05	7.31E-05	7.31E-05
228-Ra+D [j,l]	0.00E+00	9.45E-05	0.00E+00	0.00E+00	5.29E-10	1.65E-03	1.65E-03	1.74E-03
229-Th+D [,]	4.88E-05	0.00E+00	1.98E-04	0.00E+00	3.21E-11	1.03E-04	3.02E-04	3.50E-04
231-Pa	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.10E-11	4.44E-04	4.44E-04	4.44E-04
232-Th	1.32E-04	0.00E+00	5.65E-04	0.00E+00	1.72E-10	3.71E-04	9.35E-04	1.07E-03
232-U	1.11E-04	2.80E-07	4.28E-04	0.00E+00	2.03E-07	2.34E-04	6.62E-04	7.73E-04
233-U	4.37E-03	1.03E-05	1.66E-02	1.48E-05	6.52E-06	8.94E-03	2.55E-02	2.99E-02
234-U	2.79E-03	7.36E-06	1.17E-02	0.00E+00	3.36E-05	6.85E-03	1.85E-02	2.13E-02
235-U+D [j]	1.18E-04	3.11E-07	4.93E-04	1.69E-07	1.34E-06	2.88E-04	7.82E-04	9.00E-04
236-U	8.85E-05	2.13E-07	3.42E-04	0.00E+00	7.35E-07	2.55E-04	5.97E-04	6.86E-04
237-Np+D [j]	2.32E-02	3.96E-05	6.99E-02	1.65E-06	7.28E-05	7.66E-06	7.00E-02	9.32E-02
238-Pu	5.37E-06	5.38E-05	2.16E-05	3.26E-05	1.45E-07	9.32E-06	6.37E-05	1.23E-04
238-U+D [j]	2.71E-03	7.85E-06	1.36E-02	0.00E+00	2.95E-05	6.83E-03	2.05E-02	2.32E-02
239-Pu	1.51E-04	8.08E-04	3.93E-04	9.75E-04	4.25E-06	1.49E-04	1.52E-03	2.48E-03
240-Pu	2.86E-05	1.68E-04	8.34E-05	2.05E-04	7.87E-07	1.24E-01	1.24E-01	1.24E-01
241-Am+D [j]	1.57E-03	8.34E-02	7.93E-03	3.61E-02	5.70E-05	-1.21E-02	3.20E-02	1.17E-01
241-Pu+D [k]	2.91E-04	1.86E-03	9.68E-04	1.64E-03	7.12E-06	1.88E+00	1.88E+00	1.88E+00
242-Cm	6.31E-03	1.57E-05	3.16E-02	0.00E+00	7.78E-05	5.35E-03	3.70E-02	4.34E-02
242-Pu	2.20E-09	1.32E-08	6.72E-09	1.34E-08	5.51E-11	1.40E-05	1.40E-05	1.40E-05
243-Am	7.34E-07	3.99E-05	4.01E-06	0.00E+00	1.66E-08	8.41E-07	4.86E-06	4.55E-05

Table 2-5. Detailed Inventory for Reference Case A Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [(a)] (Ci or kg) [(i)]	WTP (LAW) Secondary Solid Waste [(b)] (Ci or kg) [(i)]	WTP (PT) Secondary Solid Waste [(c)] (Ci or kg) [(i)]	WTP (HLW) Secondary Solid Waste [(d)] (Ci or kg) [(i)]	TRU Packaging Secondary Waste [(e)] (Ci or kg) [(j)]	242-A Evaporator Secondary Waste [(f)] (Ci or kg) [(i)]	Other Secondary Waste [(g)] (Ci or kg) [(i)]	Total Secondary Waste [(h)] (Ci or kg) [(i)]
243-Cm	4.34E-04	9.92E-07	1.76E-03	4.51E-07	1.28E-06	6.57E-04	2.42E-03	2.85E-03
244-Cm	9.95E-03	2.28E-05	4.04E-02	1.05E-05	2.93E-05	1.53E-02	5.58E-02	6.57E-02
Ag	1.43E+00	9.37E-03	5.49E-01	2.30E-03	5.06E-08	1.31E-01	6.82E-01	2.12E+00
Al	1.61E+03	1.09E+00	8.27E+03	1.01E-02	2.06E+00	8.18E+02	9.09E+03	1.07E+04
$Al(OH)_4^-$ [(k)]	2.18E+03	0.00E+00	1.47E+04	0.00E+00	0.00E+00	0.00E+00	1.47E+04	1.69E+04
As	1.25E+02	4.29E-02	1.70E+00	5.77E-03	4.84E-08	3.60E-01	2.06E+00	1.27E+02
B	9.66E-01	5.68E-03	4.08E+00	5.48E-04	1.64E-03	1.43E+00	5.52E+00	6.49E+00
Ba	1.78E+00	1.81E-03	7.00E-01	9.20E-04	7.89E-04	2.22E-01	9.23E-01	2.70E+00
Be	0.00E+00	9.04E-04	0.00E+00	2.14E-04	8.21E-09	2.68E-02	2.70E-02	2.79E-02
Bi	5.42E-01	4.44E-02	2.32E+00	8.64E-02	3.22E-04	2.33E+00	4.73E+00	5.32E+00
Ca	1.83E+01	3.30E-02	5.52E+01	3.93E-03	1.72E+01	7.40E+00	7.98E+01	9.81E+01
Cd	1.01E+02	9.96E-02	8.30E-02	1.63E-02	1.85E-03	1.51E-01	2.52E-01	1.01E+02
Ce	3.45E-01	2.88E-04	1.59E+00	3.78E-05	1.68E-07	3.93E-01	1.98E+00	2.33E+00
Cl	1.79E+05	0.00E+00	3.24E+03	0.00E+00	1.09E+01	5.91E+02	3.84E+03	1.82E+05
CN-	0.00E+00	1.21E+00	0.00E+00	7.31E-01	0.00E+00	0.00E+00	7.31E-01	1.94E+00
Co	1.17E-01	1.18E-03	4.85E-01	1.69E-04	2.73E-03	1.97E-01	6.85E-01	8.03E-01
Cr	5.47E+00	5.37E+01	1.07E+02	0.00E+00	7.95E-02	3.18E+00	1.10E+02	1.69E+02
$Cr(OH)_4^-$ [(k)]	6.04E+00	7.47E+01	2.22E+02	0.00E+00	0.00E+00	0.00E+00	2.22E+02	3.03E+02
Cs	2.37E-05	3.08E-01	3.16E-04	3.95E-03	0.00E+00	7.50E-01	7.54E-01	1.06E+00
Cu	9.68E-02	3.23E-04	6.58E-01	2.79E-05	1.67E-04	1.24E-01	7.82E-01	8.79E-01
F	8.02E+04	1.01E+03	4.95E+01	1.82E+02	1.39E+00	2.48E+01	2.58E+02	8.15E+04
Fe	1.27E+01	9.71E-03	6.05E+01	4.96E-03	1.00E+00	8.49E+00	7.00E+01	8.27E+01

Table 2-5. Detailed Inventory for Reference Case A Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [(a)] (Ci or kg) [(i)]	WTP (LAW) Secondary Solid Waste [(b)] (Ci or kg) [(i)]	WTP (PT) Secondary Solid Waste [(c)] (Ci or kg) [(i)]	WTP (HLW) Secondary Solid Waste [(d)] (Ci or kg) [(i)]	TRU Packaging Secondary Waste [(e)] (Ci or kg) [(j)]	242-A Evaporator Secondary Waste [(f)] (Ci or kg) [(i)]	Other Secondary Waste [(g)] (Ci or kg) [(i)]	Total Secondary Waste [(h)] (Ci or kg) [(i)]
Hg	4.00E-01	3.22E+02	1.58E+00	9.85E+02	8.50E-04	1.41E+00	9.88E+02	1.31E+03
I	2.68E+00	5.38E+01	9.91E-01	1.55E+01	5.99E-02	1.83E-03	1.65E+01	7.30E+01
K	1.10E+02	3.33E+01	5.01E+02	8.66E-02	2.65E+00	1.32E+02	6.35E+02	7.79E+02
La	6.30E-02	3.02E-03	4.94E-01	2.39E-03	9.73E-06	1.45E-01	6.41E-01	7.07E-01
Li	2.87E-03	5.05E-04	1.21E-02	1.10E-04	2.57E-08	3.45E-02	4.67E-02	5.01E-02
Mg	5.33E-01	5.18E-04	2.16E+00	1.85E-04	1.15E-02	6.53E-01	2.82E+00	3.36E+00
Mn	1.88E-01	1.22E-01	7.08E+00	6.79E-02	4.65E-02	5.07E-02	7.25E+00	7.56E+00
Mo	0.00E+00	8.21E-01	0.00E+00	2.22E-02	1.78E-03	3.25E+00	3.28E+00	4.10E+00
Na	5.39E+05	5.00E+03	2.68E+04	1.30E+02	1.21E+01	5.02E+02	2.75E+04	5.72E+05
Nd	0.00E+00	3.83E-03	0.00E+00	3.86E-04	5.64E-08	2.58E-01	2.58E-01	2.62E-01
NH_3^{-} [(k,l)]	0.00E+00	0.00E+00	9.32E+02	0.00E+00	0.00E+00	3.46E+03	4.39E+03	4.39E+03
Ni	1.27E-01	4.01E-02	7.36E-01	6.12E-03	1.12E-02	3.31E+00	4.06E+00	4.23E+00
NO_2^{-} [(k,l)]	1.97E+03	0.00E+00	9.21E+03	0.00E+00	3.43E+01	2.28E+03	1.15E+04	1.35E+04
NO_3 [(k,l)]	3.48E+06	2.59E+04	2.30E+05	0.00E+00	4.44E+02	2.11E+04	2.52E+05	3.75E+06
OH^{-} [(k)]	4.02E+05	2.18E+03	1.91E+04	0.00E+00	4.76E+01	2.45E+03	2.16E+04	4.26E+05
OH(BOUND) [(k)]	1.41E+03	0.00E+00	5.14E+03	0.00E+00	2.25E-04	1.16E+03	6.30E+03	7.71E+03
P	6.96E+02	1.72E+01	2.36E+03	4.59E-02	4.15E+01	4.84E+02	2.88E+03	3.59E+03
PO_4^{-} [(k)]	2.13E+03	5.26E+01	7.23E+03	1.41E-01	1.27E+02	1.48E+03	8.84E+03	1.10E+04
Pb	2.54E+02	6.59E-01	3.67E+00	1.36E-01	1.95E+00	1.12E+02	1.18E+02	3.73E+02
Pd	2.69E-03	1.65E-04	1.05E-02	3.95E-06	0.00E+00	1.44E-01	1.55E-01	1.58E-01
Pr	0.00E+00	7.73E-05	0.00E+00	2.36E-04	0.00E+00	0.00E+00	2.36E-04	3.13E-04
Rb	0.00E+00	3.07E-03	0.00E+00	4.26E-04	2.18E-09	8.78E-02	8.82E-02	9.13E-02

Table 2-5. Detailed Inventory for Reference Case A Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [(a)] (Ci or kg) [(i)]	WTP (LAW) Secondary Solid Waste [(b)] (Ci or kg) [(i)]	WTP (PT) Secondary Solid Waste [(c)] (Ci or kg) [(i)]	WTP (HLW) Secondary Solid Waste [(d)] (Ci or kg) [(i)]	TRU Packaging Secondary Waste [(e)] (Ci or kg) [(j)]	242-A Evaporator Secondary Waste [(f)] (Ci or kg) [(i)]	Other Secondary Waste [(g)] (Ci or kg) [(i)]	Total Secondary Waste [(h)] (Ci or kg) [(i)]
Rh	0.00E+00	3.99E-02	0.00E+00	1.70E-03	1.47E-09	1.79E-01	1.81E-01	2.21E-01
Ru	0.00E+00	1.15E+00	0.00E+00	1.61E-01	2.57E-07	7.75E-01	9.36E-01	2.09E+00
S	6.87E+05	1.33E+04	1.28E+03	9.92E+02	8.35E+00	3.31E+02	2.61E+03	7.03E+05
SO_4^{-} [(k)]	2.06E+06	4.12E+00	3.84E+03	0.00E+00	2.50E+01	9.90E+02	4.85E+03	2.06E+06
Sb	1.58E-01	2.05E-02	4.44E-01	1.52E-03	4.00E-07	2.30E-01	6.75E-01	8.53E-01
Se	2.80E+01	2.87E+00	0.00E+00	3.49E-03	5.63E-05	1.87E+00	1.88E+00	3.27E+01
Si	1.19E+02	5.99E-02	6.21E+02	1.13E-03	6.91E+00	6.77E+01	6.96E+02	8.15E+02
Sn	1.89E-03	2.27E-04	9.39E-03	3.49E-06	1.27E-09	7.81E-03	1.72E-02	1.93E-02
Sr	1.26E+03	1.04E-02	3.63E-02	4.93E-03	2.58E-04	3.27E-01	3.69E-01	1.26E+03
Ta	0.00E+00	2.02E-03	0.00E+00	3.24E-06	3.33E-10	2.92E-03	2.92E-03	4.94E-03
Te	0.00E+00	2.88E-03	0.00E+00	5.28E-03	3.33E-10	1.50E-02	2.02E-02	2.31E-02
Th	1.20E+00	5.10E-06	5.14E+00	5.28E-06	1.57E-06	3.37E+00	8.50E+00	9.71E+00
Ti	7.20E-02	1.17E-04	2.85E-01	1.91E-05	6.37E-09	4.65E-02	3.32E-01	4.04E-01
Tl	0.00E+00	1.30E+00	0.00E+00	1.69E-01	7.14E-08	4.49E-01	6.18E-01	1.92E+00
TOC	1.74E+05	0.00E+00	0.00E+00	0.00E+00	9.89E+01	1.74E+02	2.73E+02	1.74E+05
U	8.11E+00	2.35E-02	4.07E+01	7.97E-05	8.85E-02	2.05E+01	6.13E+01	6.94E+01
V	0.00E+00	2.25E-02	0.00E+00	4.83E-03	0.00E+00	0.00E+00	4.83E-03	2.73E-02
W	0.00E+00	1.65E-02	0.00E+00	3.04E-04	0.00E+00	0.00E+00	3.04E-04	1.68E-02
Y	2.44E-13	8.48E-04	5.81E-14	4.58E-05	7.31E-15	5.72E-08	4.58E-05	8.94E-04
Zn	1.51E-01	4.47E-04	7.75E-01	1.32E-04	2.45E-04	1.10E-01	8.85E-01	1.04E+00
Zr	4.66E+00	5.04E-04	1.95E+01	1.22E-04	1.45E-05	2.35E+01	4.30E+01	4.76E+01

[(a)] BV Secondary Solid Waste = solids portion of BV-to-LERF + solids portion of DBVS-to-LERF.

Table 2-5. Detailed Inventory for Reference Case A Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [(a)]	WTP (LAW) Secondary Solid Waste [(b)]	WTP (PT) Secondary Solid Waste [(c)]	WTP (HLW) Secondary Solid Waste [(d)]	TRU Packaging Secondary Waste [(e)]	242-A Evaporator Secondary Waste [(f)]	Other Secondary Waste [(g)]	Total Secondary Waste [(h)]
	(Ci or kg) [(i)]	(Ci or kg) [(i)]	(Ci or kg) [(i)]	(Ci or kg) [(i)]	(Ci or kg) [(j)]	(Ci or kg) [(i)]	(Ci or kg) [(i)]	(Ci or kg) [(i)]

[(b)] WTP (LAW) Secondary Solid Waste = LAW HEPA1 + LAW HEPA2 + LAW VOC-SCRUB + solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass (part of WTP-to-LERF stream).

[(c)] WTP (PT) Secondary Solid Waste = Waste of from HTWOS Spent Resins + solids portion of WTP-to-LERF minus solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass.

[(d)] WTP (HLW) Secondary Solid Waste = HLW HEPA1 + HLW HEPA2 + HLW VOC-SCRUB + HLW AG MORDINITE.

[(e)] TRU Packaging Secondary Waste = solids portion of TRU-Packaging-to-LERF.

[(f)] 242-A Evaporator Secondary Waste = solids portion of 242A-to-LERF.

[(g)] Other Secondary Solid Waste = WTP (PT) Secondary Solid Waste + WTP (HLW) Secondary Solid Waste + TRU Packaging Secondary Waste + 242-A Evaporator Secondary Waste.

[(h)] Total Secondary Solid Waste = BV Secondary Solid Waste + WTP (LAW) Secondary Solid Waste + Other Secondary Solid Waste

[(i)] Units for inventories provided in this Table. Radionuclide contaminant inventories are in units of Ci decayed to January 1, 2004; chemical contaminant inventories are in units of kg include the mass associated with radionuclides.

[(j)] Short-lived progeny in equilibrium with parent.

[(k)] mass of chemical compound.

[(l)] Shaded values in table reflect adjustments to the HTWOS values based on Kirkbride et al. 2005a. Specifically, small negative values from the model (due to back-decaying corrections) were set equal to zero for 93m-Nb, and 228-Ra; inventory values for NH_3, NO_2, and NO_3 were adjusted based on newer processing split data for the BV (DBVS) system.

Table 2-6. Volume Estimates for Waste and Waste Packages Disposed in the IDF - Reference Case A Inventory

HTWOS Stream [a]	Stream number [b]	Volume Factor [c]	Waste Package Volume Factor Units [d]	Product/Feed Masses (kg) [e]	Waste Package Volumes [f] (m^3)
HTWOS-LAW-CANISTERS	40	4.53E-04	m^3/kg (LAW glass mass)	2.04E+08	9.22E+04
BV-PRODUCT	50	1.31E-03	m^3/kg (BV product)	1.61E+08	2.12E+05
HTWOS-SPENT-RESIN	31	2.59E-06	m^3/kg (LAW+HLW+BV glass [g])	3.52E+08	9.09E+02
LAW-HEPA1 + LAW-HEPA2	43A +43B	5.11E-07	m^3/kg (LAW glass)	2.04E+08	1.04E+02
LAW-VOC-SCRUB	41C	5.43E-07	m^3/kg (LAW glass)	2.04E+08	1.11E+02
HLW-HEPA1 + HLW-HEPA2)	43A +43B	7.60E-07	m^3/kg (HLW glass)	3.48E+07	2.64E+01
HLW-VOC-SCRUB	43C	2.10E-06	m^3/kg (HLW glass)	3.48E+07	7.29E+01
HLW-AG-MORDENITE-COL	43E	1.07E-06	m^3/kg (HLW glass)	3.48E+07	3.72E+01
WTP to LERF contribution to ETF Solids (node 26)	55 part	9.94E-06	m^3/kg (LAW+HLW+BV glass [g])	3.52E+08	3.50E+03
BV - Solid Waste contribution to ETF Solids (nodes 13+52)	54 part	2.03E-02	m^3/kg (BV process feed)	1.40E+05	2.84E+03

Table 2-6. Volume Estimates for Waste and Waste Packages Disposed in the IDF - Reference Case A Inventory

HTWOS Stream [(a)]	Stream number [(b)]	Volume Factor [(c)]	Waste Package Volume Factor Units [(d)]	Product/Feed Masses (kg) [(e)]	Waste Package Volumes [(f)] (m^3)
Total TRU Packaging contribution to ETF Liquids (node 20)	54 part	3.19E-03	m^3/kg (TRU Packaging feed)	1.61E+04	5.14E+01
242-A Evaporator to LERF contribution to ETF Solids (node 22)	54 part	3.44E-03	m^3/kg (242A to LERF feed)	1.01E+05	3.47E+02
FAILED-LAW-MELTERS	41F	9.97E-06	m^3/kg (LAW glass mass)	2.04E+08	2.03E+03
FAILED-HLW-MELTERS	43F	2.69E-05	m^3/kg (HLW glass mass)	3.48E+07	9.34E+02

[(a)] Name assignment from HTWOS (Kirkbride et al. 2005a).
[(b)] From Figure C-1 (in Kirkbride et al. 2005a).
[(c)] Factor used to convert HTWOS mass/volume data into waste package disposed volume.
[(d)] Units for waste package volume factor.
[(e)] Product or feed mass from HTWOS model run used to calculate waste package volume.
[(f)] Product of volume factor times product/feed mass.
[(g)] Sum of WTP ILAW and HLW glass mass + mass of BV glass produced from WTP pretreatment feed.

2.3 REFERENCE CASE B – 100% HANFORD TANK WASTE PROCESSING THROUGH WTP

The process strategy where 100% of the Hanford tank wastes would be processed through WTP results in the disposal of the following waste forms in the IDF:

- WTP ILAW glass,
- Bulk Vitrification waste form from DBVS,
- secondary wastes from WTP,
- secondary waste from DBVS,
- secondary waste from supplemental TRU treatment system,
- secondary waste from 242-A Evaporator, and
- spent LAW and HLW melters from WTP.

The other waste forms generated under this strategy are WTP IHLW glass, CH TRU packages and RH TRU packages that will ultimately be shipped off-site for disposal.

2.3.1 HTWOS Model Calculation

The inventory estimate for the waste from the Hanford tank waste processing assumed under Reference Case B is based upon the results of the HTWOS model run documented in Kirkbride et al. (2005b). The results from the Hanford Tank Waste Operations Simulator (HTWOS) model run (tracked internally as "Development_Run_RTC back-decayed_1-5-2005") were performed to support the IDF performance assessment.

The HTWOS model developed for the Reference Case B run (no low-activity waste supplemental treatment variation of the developmental run) was used for this case. The same assumptions were made concerning the process splitting factors, except the DBVS which was assumed to be available and was used only for the initial demonstration of the technology. The remainder of the Hanford tank waste was assumed to be processed through the WTP.

Figure 2-1 schematically shows the system modeled in the 100% WTP Run (where no waste was processed through the Supplemental Treatment Plant). The HTWOS model provides inventory estimates for each node indicated by a circled number in the Figure. The IDF inventory for Reference Case B was broken down into the following waste products and waste streams:

- WTP ILAW glass (stream number 40),
- WTP spent LAW melters (stream number 41E),
- WTP spent HLW melters (stream number 43F),
- DBVS waste form (stream number 12),
- WTP pretreatment secondary waste (stream number 26 minus stream number 27A),

- WTP LAW secondary waste (sum of stream numbers 41A through 41D plus stream number 27A),
- WTP HLW secondary waste (sum of stream numbers 43A through 43E),
- DBVS process secondary waste (stream number 13),
- TRU packaging secondary waste (stream number 20), and
- 242-A Evaporator secondary waste (stream number 22).

The final inventories associated with the HLW and LAW melters are not known. These inventories will depend on the number of melters of each type disposed, the quantity of glass left in each melter, the composition of this glass, and any other contaminants that remain with the melter at the time of disposal. The approach used to obtain nominal inventory estimates for the WTP spent melters is based on the following assumptions from Kirkbride et al. (2005b):

- On average 2 spent LAW and 2 spent HLW melters are disposed of every 5 years from WTP operations, and
- The glass pool volume in the LAW melter is 11.9 m^3 and in the HLW melter is 6.8 m^3 (see Appendix A, Kirkbride et al. 2005a).

The secondary waste streams have been combined into secondary waste streams associated with the major processed in the WTP (specifically, pretreatment [PT] and the LAW process [leading to the production of ILAW glass], the secondary wastes from the DBVS and the Other processes (including WTP HLW process, 242-A Evaporator and TRU packaging).

The inventories for each of these waste products and waste streams listed above are provided in Table C-1 of Kirkbride et al. (2005b). The secondary waste streams that are processed through the Liquid Effluent Retention Facility (LERF) and the Effluent Treatment Facility (namely, stream numbers 13, 20, 22, 26, and 52) must be adjusted for the partitioning of the LERF waste stream into solids and liquids at ETF. The solids from each of these streams are disposed in the IDF. These partitioning factors from Kirkbride et al. (2005a) are provided in Table 2-3.

2.3.2 Reference Case B Inventory

The inventory estimate for Reference Case B was developed from the inventories for the different waste product and secondary waste streams documented in Table C-1 in Kirkbride et al. (2005b). The inventories for the major waste products and associated waste streams to be disposed in the IDF are provided in Table 2-7. Table 2-8 provides an additional breakdown for the secondary waste streams for the different processes.

Under the processing assumptions associated with Reference Case B, most of the Tc-99 is incorporated into the WTP ILAW (22,200 Ci into WTP ILAW). Approximately 104 Ci is incorporated into the DBVS glass waste form. A total of 388 Ci of Tc-99 is estimated to go into the secondary waste streams that are assumed to be grouted before their waste products are disposed in the IDF. The remaining Tc-99 from the starting tank inventory resides predominantly in the HLW glass, the tank residuals and the TRU packaged wastes that will not go into the IDF.

Under the processing assumptions associated with Reference Case A, most of the I-129 is incorporated into the secondary waste streams. Of the initial tank inventory of 43.9 Ci, approximately 16.3 Ci is estimated to be incorporated into the WTP ILAW glass, and 0.01 Ci incorporated into the BV glass (produced in the DBVS). A total of 25 Ci of I-129 is estimated to go into the secondary waste streams and is assumed to be incorporated into a grouted waste form prior to disposal in the IDF. The remaining I-129 inventory from the tanks resides in the HLW glass, tank residuals, and TRU packages that will not be disposed in the IDF.

The differences in the ^{99}Tc and ^{129}I inventories shown in Tables 2-4 and 2-7 arise from the process assumptions incorporated into the HTWOS model runs for these two cases (outlined in Kirkbride et al. [2005a]). For ^{99}Tc approximately 99.1% of the ^{99}Tc in the BV feed is incorporated into the BV product and 0.1% is incorporated into the secondary waste stream sent to IDF. Approximately 73.4% of the ^{99}Tc in the tank feed is incorporated into the WTP ILAW product and 1.3% is in the secondary waste stream sent to IDF. Since the BV process is estimated to incorporate proportionally more ^{99}Tc than the WTP process, the 100% WTP case will result in more ^{99}Tc in the secondary waste stream. As seen in Tables 2-4 and 2-7 the ^{99}Tc in the MLLW increases from 234 to 388 Ci as the fraction of waste processed through the WTP increases from ~50% to 100% of the tank waste inventory.

For ^{129}I the HTWOS model constrains the fraction of ^{129}I incorporated into the glass to 20% (Kirkbride et al. 2005a Appendix A). However, with recycle, the BV process is estimated to incorporate more total ^{129}I into the BV product (~95%) when compared to the WTP process (~33%). Since the BV process is estimated to incorporate proportionally more ^{129}I than the WTP process, the 100% WTP case will result in more ^{129}I in the secondary waste stream. As seen in Tables 2-4 and 2-7 the ^{129}I in the MLLW increases from 12.9 to 25 Ci as the fraction of waste processed through the WTP increases from ~50% to 100% of the tank waste inventory. Kirkbride et al. (2005a) indicate there are known issues with the ^{129}I recycle assumptions for the BV process in the HTWOS model calculations. Specifically, the recycle estimate is too high and more ^{129}I should be going into the secondary waste stream.

The differences in the partitioning of ^{99}Tc and ^{129}I (and other contaminants) between the product and secondary waste streams reflect the current understanding of the BV and WTP processes. At this time no concerted effort has been made to ensure consistent assumptions for the flowsheets associated with these two treatment systems. From the PA perspective more ^{129}I and ^{99}Tc in the secondary waste streams is covered by an inventory sensitivity case described in Section 2.4.

2.3.3 Waste Form Volume Estimates for Reference Case B

Waste form volume estimates can be used to understand the trench volume needed for disposal of the planned waste in the IDF and for estimating the environmental risks associated with an inadvertent intruder. Waste form volume estimates for WTP glass, the spent melters and the BV waste form are provided in Kirkbride et al. (2005b). Waste form volume estimates for the secondary waste streams are developed from WTP contractor and ETF contractor estimates for the solid waste volumes from the different secondary waste streams from these facilities. These estimates are discussed in Appendix A. Table 2-9 provides estimated waste package volumes for the different waste forms associated with the Reference Case B inventory.

Table 2-7. Reference Case B Inventory Assuming All Hanford Tank Waste Processed through WTP

Contaminant	WTP ILAW Glass (Ci or kg) [g]	Spent LAW Melters [a] (Ci or kg) [g]	Spent HLW Melters [b] (Ci or kg) [g]	DBVS Product [c] (Ci or kg) [g]	BV Secondary Solid Waste [d] (Ci or kg) [g]	Other Secondary Solid Waste [e] (Ci or kg) [g]	WTP (LAW) Secondary Solid Waste [f] (Ci or kg) [g]	Total IDF Inventory (Ci or kg) [g]
3-H	0.00E+00	0.00E+00	0.00E+00	5.10E+00	0.00E+00	0.00E+00	0.00E+00	5.10E+00
14-C	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.26E-03	1.48E+02	0.00E+00	1.41E+02
59-Ni	2.68E+02	7.02E-01	6.99E+00	8.99E-01	3.04E-05	6.90E-02	0.00E+00	2.76E+02
60-Co	1.09E+03	2.15E+00	3.39E+01	9.65E-02	1.05E-04	6.38E+00	8.85E-03	1.13E+03
63-Ni	2.32E+04	6.09E+01	6.53E+02	8.37E+01	2.83E-03	5.74E+00	0.00E+00	2.40E+04
79-Se	8.86E+01	2.21E-01	2.35E-02	3.47E-01	0.00E+00	4.36E-02	0.00E+00	8.92E+01
90-Sr+D [h]	6.57E+05	2.43E+03	5.29E+05	1.31E+03	1.37E-01	9.83E+00	1.37E+00	1.19E+06
93-Zr	1.74E+03	5.05E+00	1.97E+01	3.87E+00	3.83E-03	4.61E+00	0.00E+00	1.77E+03
93m-Nb [j]	1.31E+03	3.02E+00	1.16E+01	2.24E+00	0.00E+00	7.89E-01	0.00E+00	1.33E+03
99-Tc	2.22E+04	4.72E+01	3.11E+01	1.04E+02	1.10E-01	9.46E+01	2.94E+02	2.27E+04
106-Ru+D [h]	6.00E+02	5.64E-01	4.12E-01	1.02E-06	0.00E+00	1.69E+00	4.78E-03	6.03E+02
113m-Cd	2.64E+03	7.99E+00	1.47E+01	1.10E+01	4.96E-04	2.30E+00	0.00E+00	2.68E+03
125-Sb	4.72E+03	1.05E+01	3.16E+01	8.14E-01	2.03E-04	1.06E+01	1.99E-01	4.77E+03
126-Sn+D [h]	2.31E+02	5.86E-01	1.47E+00	1.57E-01	3.93E-05	2.07E-01	4.22E-03	2.34E+02
129-I	1.63E+01	3.57E-02	1.31E-02	1.09E-02	2.47E-04	2.99E+00	2.20E+01	4.13E+01
134-Cs	2.72E+00	6.17E-03	2.02E+01	5.43E-02	5.80E-10	1.08E-02	6.56E-04	2.29E+01
137-Cs+D [h]	3.89E+04	8.83E+01	3.09E+05	5.92E+03	1.78E-02	2.00E+02	9.33E+00	3.54E+05
151-Sm	3.59E+05	6.61E+02	2.54E+04	6.08E+01	1.62E-05	3.44E+02	0.00E+00	3.86E+05
152-Eu	1.03E+02	3.04E-01	8.38E+00	8.71E-03	6.17E-09	1.28E-01	2.08E-04	1.12E+02
154-Eu	4.24E+03	1.25E+01	3.56E+02	6.93E-01	6.98E-05	1.63E+00	8.53E-03	4.61E+03
155-Eu	3.05E+03	9.01E+00	2.19E+02	2.19E-01	1.55E-07	1.96E+00	6.19E-03	3.28E+03
226-Ra	1.40E+00	3.06E-03	1.16E-04	1.04E-05	0.00E+00	6.56E-03	4.80E-05	1.41E+00
227-Ac+D [h]	3.43E-03	9.23E-06	3.31E-02	2.92E-05	0.00E+00	7.61E-05	0.00E+00	3.66E-02

Table 2-7. Reference Case B Inventory Assuming All Hanford Tank Waste Processed through WTP

Contaminant	WTP ILAW Glass (Ci or kg) [g]	Spent LAW Melters [a] (Ci or kg) [g]	Spent HLW Melters [b] (Ci or kg) [g]	DBVS Product [c] (Ci or kg) [g]	BV Secondary Solid Waste [d] (Ci or kg) [g]	Other Secondary Solid Waste [e] (Ci or kg) [g]	WTP (LAW) Secondary Solid Waste [f] (Ci or kg) [g]	Total IDF Inventory (Ci or kg) [g]
228-Ra+D [h,j]	4.82E+00	1.05E-02	8.15E-03	9.45E-04	0.00E+00	1.71E-03	4.76E-04	4.84E+00
231-Pa	1.93E+00	4.21E-03	1.88E-02	9.01E-04	0.00E+00	4.78E-04	0.00E+00	1.95E+00
232-Th	3.24E-01	7.34E-04	7.91E-02	2.89E-06	2.86E-09	1.01E-03	0.00E+00	4.05E-01
232-U	2.53E-01	6.06E-04	4.37E-02	1.26E-05	1.24E-08	7.46E-04	5.19E-07	2.98E-01
233-U	9.59E+00	2.29E-02	4.68E+00	7.77E-04	7.69E-07	3.02E-02	1.98E-05	1.43E+01
234-U	6.44E+00	1.54E-02	1.30E+00	1.48E-03	1.47E-06	2.19E-02	1.32E-05	7.77E+00
235-U+D [h]	2.72E-01	6.51E-04	5.34E-02	6.33E-05	6.26E-08	9.29E-04	5.58E-07	3.27E-01
236-U	1.95E-01	4.67E-04	2.80E-02	3.27E-05	3.24E-08	6.63E-04	3.94E-07	2.24E-01
237-Np+D [h]	4.32E+01	6.75E-02	5.32E-01	1.58E-01	1.57E-04	8.82E-02	8.84E-05	4.41E+01
238-Pu	4.68E+01	1.04E-01	1.23E+01	1.15E-02	3.06E-09	7.59E-05	9.57E-05	5.92E+01
238-U+D [h]	6.55E+00	1.57E-02	1.19E+00	1.48E-03	1.46E-06	3.40E-02	1.35E-05	7.79E+00
239-Pu	8.97E+02	1.99E+00	3.66E+02	5.65E-01	1.67E-07	1.84E-03	1.86E-03	1.27E+03
240-Pu	1.88E+02	4.16E-01	7.69E+01	1.11E-01	2.96E-08	2.56E-01	3.90E-04	2.66E+02
241-Am+D [h]	4.96E+03	1.91E+01	8.04E+02	1.53E-01	1.09E-07	1.57E-02	1.50E-01	5.78E+03
241-Pu+D [h]	1.99E+03	4.40E+00	6.18E+02	3.80E-01	1.01E-07	3.25E+00	4.09E-03	2.61E+03
242-Cm	1.48E+01	3.46E-02	5.96E-01	3.90E-03	3.86E-06	4.71E-02	2.76E-05	1.55E+01
242-Pu	1.46E-02	3.23E-05	5.05E-03	3.79E-06	1.01E-12	2.47E-05	3.01E-08	1.97E-02
243-Am	2.36E+00	9.09E-03	3.69E-01	7.24E-05	5.12E-11	6.31E-06	7.08E-05	2.74E+00
243-Cm	9.23E-01	2.16E-03	4.97E-02	1.27E-04	1.26E-07	2.85E-03	1.92E-06	9.78E-01
244-Cm	2.12E+01	4.95E-02	1.16E+00	2.97E-03	2.94E-06	6.57E-02	4.40E-05	2.25E+01
229-Th+D [h]	1.15E-01	2.60E-04	1.33E-02	8.43E-07	8.35E-10	3.20E-04	0.00E+00	1.29E-01
Ag	2.89E+02	5.70E-01	3.42E+01	3.64E-01	4.05E-03	7.14E-01	1.74E-02	3.24E+02
Al	1.25E+07	2.71E+04	1.40E+04	7.87E+03	5.18E+00	9.89E+03	2.04E+00	1.25E+07

Table 2-7. Reference Case B Inventory Assuming All Hanford Tank Waste Processed through WTP

Contaminant	WTP ILAW Glass	Spent LAW Melters [a]	Spent HLW Melters [b]	DBVS Product [c]	BV Secondary Solid Waste [d]	Other Secondary Solid Waste [e]	WTP (LAW) Secondary Solid Waste [f]	Total IDF Inventory
	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]
$Al(OH)_4^-$ [i]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E+04	0.00E+00	1.49E+04
As	9.29E+02	2.15E+00	2.87E+01	6.05E-01	2.60E-01	2.25E+00	7.86E-02	9.63E+02
B	1.23E+07	2.69E+04	7.13E+03	2.64E+04	1.52E-03	5.84E+00	1.03E-02	1.24E+07
Ba	3.85E+02	8.40E-01	6.41E+01	4.29E-01	4.77E-03	1.00E+00	3.21E-03	4.51E+02
Be	5.63E+01	1.13E-01	4.88E+00	4.31E-02	0.00E+00	2.77E-02	1.70E-03	6.14E+01
Bi	4.95E+03	1.47E+01	8.19E+02	6.95E-01	1.74E-04	7.96E+00	7.58E-02	5.80E+03
Ca	5.80E+06	1.26E+04	1.34E+03	2.58E+01	2.58E-02	1.09E+02	6.70E-02	5.81E+06
Cd	9.99E+02	2.18E+00	3.81E+01	1.40E+00	6.01E-01	2.98E-01	1.52E-01	1.04E+03
Ce	8.70E+02	1.57E+00	4.56E+01	8.64E-01	8.56E-04	2.12E+00	4.95E-04	9.20E+02
Cl	8.41E+05	1.74E+03	6.32E+01	3.34E+02	3.36E+02	4.21E+03	0.00E+00	8.48E+05
CN^- [i]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.30E-01	2.80E+00	3.53E+00
Co	2.63E+02	5.75E-01	7.31E+00	2.36E-01	2.33E-04	8.44E-01	2.13E-03	2.72E+02
Cr	4.80E+05	9.30E+02	5.26E+02	5.21E+02	1.47E-02	1.25E+02	9.08E+01	4.83E+05
$Cr(OH)_4^-$ [i]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.51E+02	1.14E+02	3.63E+02
Cs	1.44E+03	3.13E+00	3.96E+00	6.77E-01	2.12E-07	7.94E-01	5.49E-01	1.44E+03
Cu	3.65E+02	1.14E+00	1.60E+01	8.64E-02	8.56E-05	8.30E-01	4.56E-04	3.83E+02
F	8.67E+05	1.75E+03	6.03E+02	2.08E+02	3.83E+01	3.61E+02	2.29E+03	8.72E+05
Fe	1.57E+07	3.42E+04	9.30E+03	6.89E+01	6.83E-02	8.40E+01	1.62E-02	1.57E+07
Hg	0.00E+00	0.00E+00	0.00E+00	5.48E-01	5.43E-04	9.98E+02	7.24E+02	1.72E+03
I	9.26E+01	2.02E-01	7.42E-02	6.16E-02	1.40E-03	1.69E+01	1.24E+02	2.34E+02
K	8.71E+05	1.83E+03	4.47E+02	4.01E+02	1.13E-01	7.16E+02	6.08E+01	8.75E+05
La	2.75E+02	7.99E-01	6.31E+01	2.31E-03	2.29E-06	9.25E-01	4.06E-03	3.39E+02
Li	6.29E+03	7.90E-01	3.29E+03	0.00E+00	0.00E+00	5.19E-02	9.25E-04	9.58E+03

Table 2-7. Reference Case B Inventory Assuming All Hanford Tank Waste Processed through WTP

Contaminant	WTP ILAW Glass (Ci or kg) [(g)]	Spent LAW Melters [(a)] (Ci or kg) [(g)]	Spent HLW Melters [(b)] (Ci or kg) [(g)]	DBVS Product [(c)] (Ci or kg) [(g)]	BV Secondary Solid Waste [(d)] (Ci or kg) [(g)]	Other Secondary Solid Waste [(e)] (Ci or kg) [(g)]	WTP (LAW) Secondary Solid Waste [(f)] (Ci or kg) [(g)]	Total IDF Inventory (Ci or kg) [(g)]
Mg	3.62E+06	7.90E+03	1.41E+02	8.64E-01	8.57E-04	3.00E+00	9.48E-04	3.63E+06
Mn	5.93E+04	2.54E+02	1.93E+03	1.30E-01	1.32E-05	7.32E+00	1.58E-01	6.15E+04
Mo	3.60E+03	7.21E+00	2.47E+01	1.78E+00	0.00E+00	3.33E+00	1.56E+00	3.64E+03
Na	5.43E+07	1.23E+05	2.40E+04	2.92E+05	4.49E+04	3.15E+04	9.32E+03	5.48E+07
Nd	1.26E+03	2.54E+00	5.93E+01	8.65E-01	0.00E+00	2.66E-01	6.10E-03	1.32E+03
NH_3 [(i,j)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.43E+03	0.00E+00	4.43E+03
Ni	1.16E+04	2.52E+01	6.41E+02	4.01E+00	1.36E-04	4.20E+00	6.07E-02	1.22E+04
NO_2 [(i,j)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.11E+00	1.29E+04	0.00E+00	1.29E+04
NO_3 [(i,j)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.60E+04	3.11E+05	2.96E+04	4.16E+05
OH^- [(i)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.32E+04	2.57E+04	3.81E+03	6.22E+04
OH(BOUND) [(i)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E+00	6.65E+03	0.00E+00	6.54E+03
P	1.41E+06	2.94E+03	4.57E+02	3.67E+03	3.64E+00	3.96E+03	3.43E+01	1.42E+06
PO_4^- [(i)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E+01	1.21E+04	1.05E+02	1.21E+04
Pb	7.77E+03	1.92E+01	3.88E+02	1.80E+00	2.00E-01	1.36E+02	9.91E-01	8.31E+03
Pd	1.62E+02	1.09E-01	3.31E-01	0.00E+00	0.00E+00	1.56E-01	3.29E-04	1.63E+02
Pr	4.45E+00	3.17E-03	3.87E+00	0.00E+00	0.00E+00	2.37E-04	1.29E-04	8.32E+00
Rb	8.48E+01	1.10E-01	3.29E+00	0.00E+00	0.00E+00	8.91E-02	6.42E-03	8.83E+01
Rh	1.87E+02	3.41E-01	3.26E+00	0.00E+00	0.00E+00	1.82E-01	5.64E-02	1.91E+02
Ru	3.88E+02	8.47E-01	9.92E+00	3.43E-14	0.00E+00	9.38E-01	2.24E+00	4.02E+02
S	1.11E+06	2.32E+03	1.96E+02	2.26E+00	2.83E+03	3.46E+03	3.30E+04	1.15E+06
SO_4^- [(i)]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.47E+03	7.24E+03	1.02E+01	1.56E+04
Sb	9.41E+02	2.06E+00	1.20E+01	5.11E+00	1.79E-03	7.61E-01	3.95E-02	9.61E+02
Se	4.63E+03	1.01E+01	1.44E+00	6.37E+01	6.43E-01	2.27E+00	7.08E+00	4.72E+03

Table 2-7. Reference Case B Inventory Assuming All Hanford Tank Waste Processed through WTP

Contaminant	WTP ILAW Glass (Ci or kg) [g]	Spent LAW Melters [a] (Ci or kg) [g]	Spent HLW Melters [b] (Ci or kg) [g]	DBVS Product [c] (Ci or kg) [g]	BV Secondary Solid Waste [d] (Ci or kg) [g]	Other Secondary Solid Waste [e] (Ci or kg) [g]	WTP (LAW) Secondary Solid Waste [f] (Ci or kg) [g]	Total IDF Inventory (Ci or kg) [g]
Si	8.50E+07	1.84E+05	4.78E+04	5.31E+05	2.57E-01	8.11E+02	9.81E-02	8.58E+07
Sn	2.04E+01	4.45E-02	1.08E-01	2.41E-01	3.46E-06	1.82E-02	3.72E-04	2.06E+01
Sr	6.60E+03	1.44E+01	1.40E+03	9.51E-03	7.42E-01	1.15E+00	1.37E-02	8.02E+03
Ta	7.60E+01	1.61E-01	5.86E-02	0.00E+00	0.00E+00	2.97E-03	2.23E-03	7.62E+01
Te	7.42E+00	6.72E-03	1.99E+00	0.00E+00	0.00E+00	2.03E-02	5.65E-03	9.45E+00
Th	2.95E+03	6.45E+00	4.34E+02	2.62E-02	2.60E-05	9.22E+00	9.11E-06	3.40E+03
Ti	4.85E+06	1.06E+04	9.98E+00	8.64E-02	8.56E-05	3.57E-01	2.21E-04	4.86E+06
Tl	7.90E+02	1.52E+00	3.21E+01	0.00E+00	0.00E+00	6.22E-01	2.98E+00	8.27E+02
TOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E+01	3.15E+02	0.00E+00	3.41E+02
U	1.96E+04	4.29E+01	3.19E+03	4.43E+00	4.39E-03	1.02E+02	4.03E-02	2.30E+04
V	4.22E+02	7.87E-01	1.56E+01	4.34E-01	0.00E+00	4.84E-03	4.29E-02	4.38E+02
W	1.02E+03	9.85E-01	7.81E+00	0.00E+00	0.00E+00	3.05E-04	3.07E-02	1.03E+03
Y	1.45E+02	3.18E-01	2.82E+00	0.00E+00	5.31E-16	4.60E-05	1.36E-03	1.49E+02
Zn	9.60E+06	2.09E+04	4.18E+01	1.30E-01	1.28E-04	9.10E-01	7.41E-04	9.63E+06
Zr	8.86E+06	1.91E+04	1.75E+03	8.79E+04	1.76E-03	4.50E+01	8.74E-04	8.96E+06

[a] Assumes two melters, each with a 5-year minimum design life per 24590-LAW-3PS-AE00-T0001. Volume of glass in the melter does not include an allowance for increased volume due to corrosion of refractory and reflects the set point of 6891 gallons per 24590-WTP-MDD-PR-01-002, Appendix D; other contributions to source term such as plenum deposits are neglected.

[b] Assumes two melters, each with a 5-year minimum design life per 24590-HLW-3PS-AE00-T0001. Volume of glass in the melter includes an allowance for increased volume due to corrosion of refractory per 24590-HLW-M5C-HMP-00002, Table 2; other contributions to source term such as plenum deposits are neglected.

[c] Inventory estimate includes contribution from only DBVS.

[d] BV Secondary Solid Waste = solids portion of DBVS-to-LERF.

[e] Other Secondary Solid Waste = WTP (PT) + WTP (HLW) + solids portion of 242-A-to-LERF + Tru-packaging-to-LERF; where WTP (PT)

Table 2-7. Reference Case B Inventory Assuming All Hanford Tank Waste Processed through WTP

Contaminant	WTP ILAW Glass	Spent LAW Melters [a]	Spent HLW Melters [b]	DBVS Product [c]	BV Secondary Solid Waste [d]	Other Secondary Solid Waste [e]	WTP (LAW) Secondary Solid Waste [f]	Total IDF Inventory
	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]	(Ci or kg) [g]

Secondary Solid Waste = Waste of from HTWOS Spent Resins + solids portion of WTP-to-LERF minus solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass, WTP (HLW) Secondary Solid Waste = HLW HEPA1 + HLW HEPA2 + HLW VOC-SCRUB + HLW AG MORDINITE.

(f) WTP (LAW) Secondary Solid Waste = LAW HEPA1 + LAW HEPA2 + LAW VOC-SCRUB + solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass (part of WTP-to-LERF stream).

(g) Units for inventories provided in this Table. Radionuclide contaminant inventories are in units of Ci decayed to January 1, 2004; chemical contaminant inventories are in units of kg and include the mass associated with radionuclides.

(h) Short-lived progeny in equilibrium with parent.

(i) mass of chemical compound.

(j) Shaded values in table reflect adjustments to the HTWOS values from Kirkbride et al. (2005a). Specifically, small negative values from the model (due to back-decaying corrections) were set equal to zero for 93m-Nb, and 228-Ra; inventory values for NH_3, NO_2, and NO_3 were adjusted based on newer processing split data for the BV (and DBVS) system.

Table 2-8. Detailed Inventory for Reference Case B Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [a] (Ci or kg) [i]	WTP (LAW) Secondary Solid Waste [b] (Ci or kg) [i]	WTP (PT) Secondary Solid Waste [c] (Ci or kg) [i]	WTP (HLW) Secondary Solid Waste [d] (Ci or kg) [i]	TRU Packaging Secondary Waste [e] (Ci or kg) [j]	242-A Evaporator Secondary Waste [f] (Ci or kg) [i]	Other Secondary Waste [g] (Ci or kg) [i]	Total Secondary Waste [h] (Ci or kg) [i]
3-H	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
14-C	3.26E-03	0.00E+00	1.47E+02	0.00E+00	1.83E-03	6.82E-01	1.48E+02	1.48E+02
59-Ni	3.04E-05	0.00E+00	1.91E-02	0.00E+00	7.22E-05	4.98E-02	6.90E-02	6.90E-02
60-Co	1.05E-04	8.85E-03	6.38E+00	7.03E-04	1.11E-03	7.82E-05	6.38E+00	6.39E+00
63-Ni	2.83E-03	0.00E+00	1.68E+00	0.00E+00	4.26E-03	4.06E+00	5.74E+00	5.74E+00
79-Se	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E-04	4.35E-02	4.36E-02	4.36E-02
90-Sr+D [j]	1.37E-01	1.37E+00	7.77E+00	8.30E-01	2.39E-03	1.23E+00	9.83E+00	1.13E+01
93-Zr	3.83E-03	0.00E+00	3.54E+00	0.00E+00	1.35E-07	1.06E+00	4.61E+00	4.61E+00
93m-Nb [l]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-03	7.88E-01	7.89E-01	7.89E-01
99-Tc	1.10E-01	2.94E+02	9.45E+01	0.00E+00	8.19E-02	1.28E-03	9.46E+01	3.88E+02
106-Ru+D [j]	0.00E+00	4.78E-03	0.00E+00	0.00E+00	1.67E-09	1.69E+00	1.69E+00	1.70E+00
113m-Cd	4.96E-04	0.00E+00	2.37E-01	0.00E+00	2.73E-03	2.06E+00	2.30E+00	2.30E+00
125-Sb	2.03E-04	1.99E-01	2.38E+00	3.17E-03	2.27E-07	8.21E+00	1.06E+01	1.08E+01
126-Sn+D [j]	3.93E-05	4.22E-03	1.14E-01	3.96E-05	1.56E-08	9.28E-02	2.07E-01	2.11E-01
129-I	2.47E-04	2.20E+01	2.49E-01	2.72E+00	1.81E-02	3.47E-04	2.99E+00	2.50E+01
134-Cs	5.80E-10	6.56E-04	3.09E-05	1.07E-02	0.00E+00	4.56E-05	1.08E-02	1.15E-02
137-Cs+D [j]	1.78E-02	9.33E+00	3.44E+01	1.66E+02	0.00E+00	2.69E-01	2.00E+02	2.10E+02
151-Sm	1.62E-05	0.00E+00	1.81E-01	0.00E+00	5.62E-05	3.43E+02	3.44E+02	3.44E+02
152-Eu	6.17E-09	2.08E-04	1.40E-04	2.67E-05	1.52E-08	1.28E-01	1.28E-01	1.29E-01
154-Eu	6.98E-05	8.53E-03	5.71E-03	1.13E-03	2.48E-07	1.62E+00	1.63E+00	1.64E+00
155-Eu	1.55E-07	6.19E-03	4.20E-03	6.96E-04	1.97E-07	1.96E+00	1.96E+00	1.97E+00

Table 2-8. Detailed Inventory for Reference Case B Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [a] (Ci or kg) [i]	WTP (LAW) Secondary Solid Waste [b] (Ci or kg) [i]	WTP (PT) Secondary Solid Waste [c] (Ci or kg) [i]	WTP (HLW) Secondary Solid Waste [d] (Ci or kg) [i]	TRU Packaging Secondary Waste [e] (Ci or kg) [j]	242-A Evaporator Secondary Waste [f] (Ci or kg) [i]	Other Secondary Waste [g] (Ci or kg) [i]	Total Secondary Waste [h] (Ci or kg) [i]
226-Ra	0.00E+00	4.80E-05	0.00E+00	0.00E+00	1.31E-12	6.56E-03	6.56E-03	6.61E-03
227-Ac+D [j]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.18E-12	7.61E-05	7.61E-05	7.61E-05
228-Ra+D [j,l]	0.00E+00	4.76E-04	0.00E+00	0.00E+00	5.59E-10	1.71E-03	1.71E-03	2.19E-03
231-Pa	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.09E-11	4.78E-04	4.78E-04	4.78E-04
232-Th	2.86E-09	0.00E+00	6.19E-04	0.00E+00	2.16E-10	3.95E-04	1.01E-03	1.01E-03
232-U	1.24E-08	5.19E-07	5.01E-04	0.00E+00	2.92E-07	2.44E-04	7.46E-04	7.47E-04
233-U	7.69E-07	1.98E-05	2.06E-02	1.49E-05	1.17E-05	9.55E-03	3.02E-02	3.02E-02
234-U	1.47E-06	1.32E-05	1.37E-02	0.00E+00	6.16E-05	8.13E-03	2.19E-02	2.19E-02
235-U+D [j]	6.26E-08	5.58E-07	5.78E-04	1.70E-07	2.55E-06	3.47E-04	9.29E-04	9.29E-04
236-U	3.24E-08	3.94E-07	3.85E-04	0.00E+00	1.39E-06	2.77E-04	6.63E-04	6.63E-04
237-Np+D [j]	1.57E-04	8.84E-05	8.81E-02	1.66E-06	8.77E-05	7.66E-06	8.82E-02	8.84E-02
238-Pu	3.06E-09	9.57E-05	2.56E-05	3.29E-05	2.61E-07	1.71E-05	7.59E-05	1.72E-04
238-U+D [j]	1.46E-06	1.35E-05	1.55E-02	0.00E+00	5.63E-05	1.84E-02	3.40E-02	3.40E-02
239-Pu	1.67E-07	1.86E-03	5.46E-04	9.80E-04	6.72E-06	3.11E-04	1.84E-03	3.71E-03
229-Th+D [j]	8.35E-10	0.00E+00	2.14E-04	0.00E+00	4.06E-11	1.07E-04	3.20E-04	3.20E-04
240-Pu	2.96E-08	3.90E-04	1.14E-04	2.06E-04	1.32E-06	2.56E-01	2.56E-01	2.56E-01
241-Am+D [j]	1.09E-07	1.50E-01	8.54E-03	3.66E-02	1.09E-04	-2.95E-02	1.57E-02	1.66E-01
241-Pu+D [j]	1.01E-07	4.09E-03	1.19E-03	1.65E-03	1.28E-05	3.25E+00	3.25E+00	3.26E+00
242-Cm	3.86E-06	2.76E-05	3.64E-02	0.00E+00	1.39E-04	1.05E-02	4.71E-02	4.71E-02
242-Pu	1.01E-12	3.01E-08	8.76E-09	1.35E-08	9.78E-11	2.47E-05	2.47E-05	2.47E-05
243-Am	5.12E-11	7.08E-05	4.29E-06	0.00E+00	3.12E-08	1.98E-06	6.31E-06	7.72E-05

Table 2-8. Detailed Inventory for Reference Case B Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [(a)] (Ci or kg) [(i)]	WTP (LAW) Secondary Solid Waste [(b)] (Ci or kg) [(i)]	WTP (PT) Secondary Solid Waste [(c)] (Ci or kg) [(i)]	WTP (HLW) Secondary Solid Waste [(d)] (Ci or kg) [(i)]	TRU Packaging Secondary Waste [(e)] (Ci or kg) [(j)]	242-A Evaporator Secondary Waste [(f)] (Ci or kg) [(i)]	Other Secondary Waste [(g)] (Ci or kg) [(i)]	Total Secondary Waste [(h)] (Ci or kg) [(i)]
243-Cm	1.26E-07	1.92E-06	2.10E-03	4.53E-07	2.30E-06	7.49E-04	2.85E-03	2.85E-03
244-Cm	2.94E-06	4.40E-05	4.82E-02	1.06E-05	5.25E-05	1.74E-02	6.57E-02	6.57E-02
Ag	4.05E-03	1.74E-02	5.75E-01	2.31E-03	6.39E-08	1.37E-01	7.14E-01	7.36E-01
Al	5.18E+00	2.04E+00	8.94E+03	1.01E-02	3.10E+00	9.50E+02	9.89E+03	9.90E+03
$Al(OH)_4^{-}$ [(k)]	0.00E+00	0.00E+00	1.52E+04	0.00E+00	0.00E+00	0.00E+00	1.52E+04	1.52E+04
As	2.60E-01	7.86E-02	1.88E+00	5.79E-03	6.02E-08	3.64E-01	2.25E+00	2.59E+00
B	1.52E-03	1.03E-02	4.36E+00	5.52E-04	2.05E-03	1.47E+00	5.84E+00	5.85E+00
Ba	4.77E-03	3.21E-03	7.70E-01	9.21E-04	1.02E-03	2.29E-01	1.00E+00	1.01E+00
Be	0.00E+00	1.70E-03	0.00E+00	2.14E-04	1.12E-08	2.75E-02	2.77E-02	2.94E-02
Bi	1.74E-04	7.58E-02	2.70E+00	8.66E-02	3.29E-04	5.17E+00	7.96E+00	8.03E+00
Ca	2.58E-02	6.70E-02	7.72E+01	3.94E-03	1.82E+01	1.32E+01	1.09E+02	1.09E+02
Cd	6.01E-01	1.52E-01	9.60E-02	1.64E-02	2.55E-03	1.83E-01	2.98E-01	1.05E+00
Ce	8.56E-04	4.95E-04	1.71E+00	3.79E-05	1.80E-07	4.09E-01	2.12E+00	2.12E+00
Cl	3.36E+02	0.00E+00	3.52E+03	0.00E+00	1.24E+01	6.78E+02	4.21E+03	4.54E+03
CN^{-} [(k)]	0.00E+00	2.80E+00	0.00E+00	7.30E-01	0.00E+00	0.00E+00	7.30E-01	3.53E+00
Co	2.33E-04	2.13E-03	5.22E-01	1.69E-04	5.08E-03	3.17E-01	8.44E-01	8.47E-01
Cr	1.47E-02	9.08E+01	1.21E+02	0.00E+00	8.99E-02	4.02E+00	1.25E+02	2.16E+02
$Cr(OH)_4^{-}$ [(k)]	0.00E+00	1.14E+02	2.51E+02	0.00E+00	0.00E+00	0.00E+00	2.51E+02	3.65E+02
Cs	2.12E-07	5.49E-01	4.28E-04	3.98E-03	0.00E+00	7.89E-01	7.94E-01	1.34E+00
Cu	8.56E-05	4.56E-04	7.04E-01	2.80E-05	2.08E-04	1.26E-01	8.30E-01	8.30E-01
F	3.83E+01	2.29E+03	7.85E+01	2.52E+02	1.56E+00	2.88E+01	3.61E+02	2.69E+03
Fe	6.83E-02	1.62E-02	7.12E+01	4.98E-03	1.09E+00	1.17E+01	8.40E+01	8.41E+01

Table 2-8. Detailed Inventory for Reference Case B Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [a] (Ci or kg) [i]	WTP (LAW) Secondary Solid Waste [b] (Ci or kg) [i]	WTP (PT) Secondary Solid Waste [c] (Ci or kg) [i]	WTP (HLW) Secondary Solid Waste [d] (Ci or kg) [i]	TRU Packaging Secondary Waste [e] (Ci or kg) [j]	242-A Evaporator Secondary Waste [f] (Ci or kg) [i]	Other Secondary Waste [g] (Ci or kg) [i]	Total Secondary Waste [h] (Ci or kg) [i]
Hg	5.43E-04	7.24E+02	2.18E+00	9.94E+02	1.16E-03	1.46E+00	9.98E+02	1.72E+03
I	1.40E-03	1.24E+02	1.41E+00	1.54E+01	1.03E-01	1.97E-03	1.69E+01	1.41E+02
K	1.13E-01	6.08E+01	5.72E+02	8.68E-02	2.82E+00	1.41E+02	7.16E+02	7.77E+02
La	2.29E-06	4.06E-03	5.18E-01	2.39E-03	9.78E-06	4.05E-01	9.25E-01	9.29E-01
Li	0.00E+00	9.25E-04	1.28E-02	1.10E-04	2.83E-08	3.90E-02	5.19E-02	5.28E-02
Mg	8.57E-04	9.48E-04	2.30E+00	1.85E-04	1.24E-02	6.88E-01	3.00E+00	3.00E+00
Mn	1.32E-05	1.58E-01	7.14E+00	6.81E-02	4.68E-02	7.08E-02	7.32E+00	7.48E+00
Mo	0.00E+00	1.56E+00	0.00E+00	2.22E-02	2.10E-03	3.31E+00	3.33E+00	4.89E+00
Na	4.49E+04	9.32E+03	3.08E+04	1.33E+02	1.43E+01	6.05E+02	3.15E+04	8.58E+04
Nd	0.00E+00	6.10E-03	0.00E+00	3.87E-04	7.01E-08	2.66E-01	2.66E-01	2.72E-01
NH_3^- [k,l]	0.00E+00	0.00E+00	9.73E+02	0.00E+00	0.00E+00	3.46E+03	4.43E+03	4.43E+03
Ni	1.36E-04	6.07E-02	8.13E-01	6.12E-03	1.39E-02	3.37E+00	4.20E+00	4.26E+00
NO_2 [k,l]	3.11E+00	0.00E+00	9.94E+03	0.00E+00	3.98E+01	2.88E+03	1.29E+04	1.29E+04
NO_3 [k]	7.60E+04	2.96E+04	2.85E+05	0.00E+00	5.25E+02	2.51E+04	3.11E+05	4.16E+05
OH^- [k,l]	3.32E+04	3.81E+03	2.26E+04	0.00E+00	5.11E+01	3.04E+03	2.57E+04	6.28E+04
OH(BOUND) [k]	2.09E+00	0.00E+00	5.49E+03	0.00E+00	2.58E-04	1.17E+03	6.65E+03	6.66E+03
P	3.64E+00	3.43E+01	3.13E+03	4.68E-02	4.73E+01	7.81E+02	3.96E+03	3.99E+03
PO_4^- [k]	1.12E+01	1.05E+02	9.59E+03	1.44E-01	1.45E+02	2.39E+03	1.21E+04	1.22E+04
Pb	2.00E-01	9.91E-01	3.97E+00	1.36E-01	2.27E+00	1.29E+02	1.36E+02	1.37E+02
Pd	0.00E+00	3.29E-04	1.16E-02	3.97E-06	0.00E+00	1.45E-01	1.56E-01	1.57E-01
Pr	0.00E+00	1.29E-04	0.00E+00	2.37E-04	0.00E+00	0.00E+00	2.37E-04	3.66E-04
Rb	0.00E+00	6.42E-03	0.00E+00	4.30E-04	2.18E-09	8.87E-02	8.91E-02	9.55E-02

Table 2-8. Detailed Inventory for Reference Case B Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [a] (Ci or kg) [i]	WTP (LAW) Secondary Solid Waste [b] (Ci or kg) [i]	WTP (PT) Secondary Solid Waste [c] (Ci or kg) [i]	WTP (HLW) Secondary Solid Waste [d] (Ci or kg) [i]	TRU Packaging Secondary Waste [e] (Ci or kg) [j]	242-A Evaporator Secondary Waste [f] (Ci or kg) [i]	Other Secondary Waste [g] (Ci or kg) [i]	Total Secondary Waste [h] (Ci or kg) [i]
Rh	0.00E+00	5.64E-02	0.00E+00	1.71E-03	1.47E-09	1.80E-01	1.82E-01	2.38E-01
Ru	0.00E+00	2.24E+00	0.00E+00	1.61E-01	6.52E-07	7.77E-01	9.38E-01	3.18E+00
S	2.83E+03	3.30E+04	2.03E+03	1.04E+03	1.23E+01	3.77E+02	3.46E+03	3.93E+04
SO_4^{-} [k]	8.47E+03	1.02E+01	6.08E+03	0.00E+00	3.69E+01	1.13E+03	7.24E+03	1.57E+04
Sb	1.79E-03	3.95E-02	4.92E-01	1.53E-03	5.00E-07	2.67E-01	7.61E-01	8.02E-01
Se	6.43E-01	7.08E+00	0.00E+00	3.54E-03	6.42E-05	2.27E+00	2.27E+00	9.99E+00
Si	2.57E-01	9.81E-02	7.05E+02	1.13E-03	7.68E+00	9.82E+01	8.11E+02	8.11E+02
Sn	3.46E-06	3.72E-04	1.00E-02	3.49E-06	1.38E-09	8.18E-03	1.82E-02	1.86E-02
Sr	7.42E-01	1.37E-02	4.48E-02	4.90E-03	2.60E-04	1.10E+00	1.15E+00	1.90E+00
Ta	0.00E+00	2.23E-03	0.00E+00	3.23E-06	3.34E-10	2.97E-03	2.97E-03	5.20E-03
Te	0.00E+00	5.65E-03	0.00E+00	5.27E-03	3.34E-10	1.50E-02	2.03E-02	2.59E-02
Th	2.60E-05	9.11E-06	5.63E+00	5.35E-06	1.96E-06	3.59E+00	9.22E+00	9.22E+00
Ti	8.56E-05	2.21E-04	3.12E-01	1.91E-05	1.16E-08	4.48E-02	3.57E-01	3.57E-01
Tl	0.00E+00	2.98E+00	0.00E+00	1.70E-01	8.76E-08	4.53E-01	6.22E-01	3.60E+00
TOC	2.56E+01	0.00E+00	0.00E+00	0.00E+00	1.10E+02	2.05E+02	3.15E+02	3.41E+02
U	4.39E-03	4.03E-02	4.65E+01	8.01E-05	1.69E-01	5.50E+01	1.02E+02	1.02E+02
V	0.00E+00	4.29E-02	0.00E+00	4.84E-03	0.00E+00	0.00E+00	4.84E-03	4.78E-02
W	0.00E+00	3.07E-02	0.00E+00	3.05E-04	0.00E+00	0.00E+00	3.05E-04	3.10E-02
Y	5.31E-16	1.36E-03	3.01E-14	4.59E-05	5.79E-15	1.64E-08	4.60E-05	1.41E-03
Zn	1.28E-04	7.41E-04	7.96E-01	1.32E-04	3.24E-04	1.14E-01	9.10E-01	9.11E-01
Zr	1.76E-03	8.74E-04	1.98E+01	1.23E-04	2.24E-05	2.52E+01	4.50E+01	4.50E+01

[a] BV Secondary Solid Waste = solids portion of DBVS-to-LERF.

Table 2-8. Detailed Inventory for Reference Case B Secondary Waste Streams

Contaminant	BV Secondary Solid Waste [(a)]	WTP (LAW) Secondary Solid Waste [(b)]	WTP (PT) Secondary Solid Waste [(c)]	WTP (HLW) Secondary Solid Waste [(d)]	TRU Packaging Secondary Waste [(e)]	242-A Evaporator Secondary Waste [(f)]	Other Secondary Waste [(g)]	Total Secondary Waste [(h)]
	(Ci or kg) [(i)]	(Ci or kg) [(i)]	(Ci or kg) [(i)]	(Ci or kg) [(i)]	(Ci or kg) [(j)]	(Ci or kg) [(i)]	(Ci or kg) [(i)]	(Ci or kg) [(i)]

[(b)] WTP (LAW) Secondary Solid Waste = LAW HEPA1 + LAW HEPA2 + LAW VOC-SCRUB + solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass (part of WTP-to-LERF stream).

[(c)] WTP (PT) Secondary Solid Waste = Waste of from HTWOS Spent Resins + solids portion of WTP-to-LERF minus solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass.

[(d)] WTP (HLW) Secondary Solid Waste = HLW HEPA1 + HLW HEPA2 + HLW VOC-SCRUB + HLW AG MORDINITE.

[(e)] TRU Packaging Secondary Waste = solids portion of TRU-Packaging-to-LERF.

[(f)] 242-A Evaporator Secondary Waste = solids portion of 242A-to-LERF.

[(g)] Other Secondary Solid Waste = WTP (PT) Secondary Solid Waste + WTP (HLW) Secondary Solid Waste + TRU Packaging Secondary Waste + 242-A Evaporator Secondary Waste.

[(h)] Total Secondary Solid Waste = BV Secondary Solid Waste + WTP (LAW) Secondary Solid Waste + Other Secondary Solid Waste.

[(i)] Units for inventories provided in this Table. Radionuclide contaminant inventories are in units of Ci decayed to January 1, 2004; chemical contaminant inventories are in units of kg include the mass associated with radionuclides.

[(j)] Short-lived progeny in equilibrium with parent.

[(k)] mass of chemical compound.

[(l)] Shaded values in table reflect adjustments to the HTWOS values based on Kirkbride et al. 2005a. Specifically, small negative values from the model (due to back-decaying corrections) were set equal to zero for 93m-Nb, and 228-Ra; inventory values for NH_3, NO_2, and NO_3 were adjusted based on newer processing split data for the BV (DBVS) system.

Table 2-9. Volume Estimates for Waste and Waste Packages Disposed in the IDF - Reference Case B Inventory

HTWOS Stream [(a)]	Stream number [(b)]	Volume Factor [(c)]	Waste Package Volume Factor Units [(d)]	100% WTP Product/Feed Masses (kg) [(e)]	Waste Package Volumes [(f)] (m^3)
HTWOS-LAW-CANISTERS	40	4.53E-04	m^3/kg (LAW glass mass)	3.97E+08	1.79E+05
BV-PRODUCT	50	1.31E-03	m^3/kg (BV product)	1.76E+06	2.31E+03
HTWOS-SPENT-RESIN	31	2.59E-06	m^3/kg (LAW+HLW+BV glass [(g)])	4.34E+08	1.12E+03
LAW-HEPA1 + LAW-HEPA2	43A +43B	5.11E-07	m^3/kg (LAW glass)	3.97E+08	2.03E+02
LAW-VOC-SCRUB	41C	5.43E-07	m^3/kg (LAW glass)	3.97E+08	2.15E+02
HLW-HEPA1 + HLW-HEPA2)	43A +43B	7.60E-07	m^3/kg (HLW glass)	3.78E+07	2.87E+01
HLW-VOC-SCRUB	43C	2.10E-06	m^3/kg (HLW glass)	3.78E+07	7.92E+01
HLW-AG-MORDENITE-COL	43E	1.07E-06	m^3/kg (HLW glass)	3.78E+07	4.04E+01
WTP to LERF contribution to ETF Solids (node 26)	55 part	9.94E-06	m^3/kg (LAW+HLW+BV glass [(g)])	4.34E+08	4.32E+03
BV - Solid Waste contribution to ETF Solids (nodes 13+52)	54 part	2.03E-02	m^3/kg (BV process feed)	1.53E+03	3.10E+01
Total TRU Packaging contribution to ETF Solids (node 20)	54 part	3.19E-03	m^3/kg (TRU Packaging feed)	1.61E+04	5.14E+01

Table 2-9. Volume Estimates for Waste and Waste Packages Disposed in the IDF - Reference Case B Inventory

HTWOS Stream [a]	Stream number [b]	Volume Factor [c]	Waste Package Volume Factor Units [d]	100% WTP Product/Feed Masses (kg) [e]	Waste Package Volumes [f] (m^3)
242-A Evaporator to LERF contribution to ETF Solids (node 22)	54 part	3.44E-03	m^3/kg (242A to LERF feed)	1.01E+05	3.47E+02
FAILED-LAW-MELTERS	41F	9.97E-06	m^3/kg (LAW glass mass)	3.97E+08	3.95E+03
FAILED-HLW-MELTERS	43F	2.69E-05	m^3/kg (HLW glass mass)	3.78E+07	1.02E+03

[a] Name assignment from HTWOS (Kirkbride et al. 2005a).

[b] From Figure C-1 (in Kirkbride et al. 2005a).

[c] Factor used to convert HTWOS mass/volume data into waste package disposed volume.

[d] Units for waste package volume factor.

[e] Product or feed mass from HTWOS model run used to calculate waste package volume.

[f] Product of volume factor times product/feed mass..

[g] Sum of WTP ILAW and HLW glass mass + mass of BV glass produced from WTP pretreatment feed.

2.4 SENSITIVITY CASES ASSOCIATED WITH HANFORD TANK WASTES

Inventory sensitivity cases have been developed to assess the impact of different inventory assumptions on the proposed disposal action. For some cases the inventory sensitivity cases reflect bounding estimates for the inventories and concentrations for the different waste forms. Other sensitivity cases reflect uncertainty in our understanding of the final disposition of the specific contaminants into the different waste forms. This suite of sensitivity cases has been selected to ensure the potential range of inventories disposed in the IDF is adequately assessed.

This section describes the sensitivity cases developed for the waste forms associated with the retrieval, processing, and disposal of Hanford tank wastes. The inventory sensitivity cases associated with the retrieval, processing, and disposal of Hanford tank wastes can be grouped into the following major categories:

- Bounding inventories, and
- Uncertainties in the partitioning of contaminants between different waste forms.

A bounding inventory sensitivity case has been developed assuming a bounding inventory for the Hanford waste tanks and assuming all the Hanford tank waste is processed into one of the major waste forms or waste streams associated with the Hanford tank waste retrieval, processing, and disposal planning associated with the Development Run for the Refined Target Case (Reference Case A). These major waste forms or streams include: WTP ILAW glass, BV and DBVS ILAW product, and secondary waste streams. Other bounding inventory cases assume selected contaminants of concern are all captures in only one of the waste forms.

Inventory sensitivity cases reflecting the uncertainties in the partitioning of contaminants between different waste forms are based on the Reference Case A and Reference Case B inventories. The Reference Case A inventory (Section 2.3) is based on a specific partitioning of the Hanford tank wastes following the current retrieval processing and segregation into the proposed waste forms (Developmental Run for the Refined Target Case as documented in Kirkbride et al. [2005a]). This partitioning and retrieval sequence may change. The sensitivity cases identified for this category have been chosen to represent what may happen if the current strategy is changed.

2.4.1 Bounding Inventories

The bounding inventories are based on qualitative considerations and conservative assumptions since consistent quantitative uncertainty information on the tank inventories, separation factors, and process losses are not available at this time. The major sources of uncertainty for the inventory associated with a specific waste form or waste stream are the uncertainties in the tank inventories, the splitting factors between IHLW and the remaining waste destined for the IDF, and offgas losses of volatile and semi-volatile components. Therefore, the following approach was taken to estimate bounding inventories for the major waste forms and secondary waste streams. A bounding inventory estimate for the Reference Case A processing assumption assumes an upper bound inventory for the tank waste and the split factors determined by the HTWOS run (Kirkbride et al. 2005a). Separate bounding case inventories for Tc-99 and I-129 assume the entire tank inventory is processed into the grouted waste form. This bounding case was selected since it would lead to the highest contaminant fluxes for these contaminants from the IDF.

Table 2-10 provides the upper bound inventory assuming a bounding Hanford tank waste inventory was processed using the mission planning assumed for Reference Case A. The upper bound inventory was estimated by taking the maximum of the HTWOS inventory, HDW model inventory and total reactor production inventory given in Table 2-2. We have also neglected in this bounding estimate that some radionuclide concentrations are limited by the contract specifications (Cs-137, Sr-90, and TRU). The Cs-137 and Sr-90 inventories in the ILAW are constrained by the WTP contract specifications (DOE/ORP 2000). The WTP contract limits the average concentration of Sr-90 to < 20 Ci/m^3. The WTP contract limits the average concentration of Cs-137 to < 3 Ci/m^3. The WTP contract limits the average concentration of total TRU isotopes to < 100 nCi/g.

The bounding Tc-99 inventory, 3.43E+04 Ci, was based on the total reactor production. This is very conservative, since it neglects the losses that occurred during fuel separation operations. There is good evidence that 20% or more of the technetium produced was separated from the waste stream during initial fuel reprocessing, mainly co-processed with the uranium oxide and sent off-site. Other minor losses to the environment have also been neglected (Schmittroth et al. 1995).

The bounding I-129 tank inventory, 49.4 Ci, was based on the total reactor production (see Table 2-2). This is very conservative since it neglects the losses that occurred during fuel separation operations (see Appendix B in Puigh et al. 2004).

Table 2-10. Upper Bound Inventory Estimate – Reference Case A

Contaminant	WTP ILAW Glass (Ci of kg) [j]	Spent LAW Melters [a] (Ci of kg) [j]	Spent HLW Melters [b] (Ci of kg) [j]	BV Product [c] (Ci of kg) [j]	BV Secondary Solid Waste [g] (Ci of kg) [j]	Other Secondary Waste [] (Ci of kg) (j)	WTP (LAW) Secondary Solid Waste [e] (Ci of kg) [j]	Total IDF Inventory (Ci of kg) [j]
3-H	0.00E+00	0.00E+00	0.00E+00	7.16E+04	0.00E+00	0.00E+00	0.00E+00	7.16E+04
14-C	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.87E+00	2.23E+01	0.00E+00	2.61E+01
59-Ni	1.58E+02	4.60E-01	4.17E+00	1.11E+02	3.77E-03	6.34E-02	0.00E+00	2.74E+02
60-Co	1.20E+03	4.87E+00	2.76E+01	6.41E+02	6.99E-01	6.95E+00	9.59E-03	1.88E+03
63-Ni	1.31E+04	3.82E+01	3.90E+02	1.02E+04	3.47E-01	5.25E+00	0.00E+00	2.38E+04
79-Se	4.78E+01	1.39E-01	1.80E-02	4.13E+01	0.00E+00	3.92E-02	0.00E+00	8.93E+01
90-Sr+D [k]	6.20E+05	2.64E+03	7.61E+05	4.44E+05	4.63E+01	1.40E+01	1.27E+00	1.83E+06
93-Zr	1.20E+03	7.43E+00	1.16E+01	1.03E+03	1.02E+00	5.30E+00	0.00E+00	2.26E+03
93m-Nb [n]	9.38E+02	2.28E+00	5.40E+00	7.79E+02	0.00E+00	9.79E-01	0.00E+00	1.72E+03
99-Tc	1.39E+04	2.79E+01	1.51E+01	1.49E+04	1.58E+01	1.02E+02	1.82E+02	2.92E+04
106-Ru+D [k]	4.17E+02	2.68E-01	4.59E-01	1.86E+02	0.00E+00	1.28E-01	3.40E-03	6.04E+02
113m-Cd	1.44E+03	5.30E+00	3.72E+00	1.32E+03	5.96E-02	2.29E+00	0.00E+00	2.77E+03
125-Sb	1.73E+03	5.70E+00	1.59E+01	3.00E+03	7.49E-01	1.01E+01	7.27E-02	4.76E+03
126-Sn+D [k]	1.45E+02	5.07E-01	1.09E+00	8.59E+01	2.15E-02	1.95E-01	2.58E-03	2.33E+02
129-I	8.04E+00	1.84E-02	8.72E-03	2.34E+01	5.33E-01	3.28E+00	1.07E+01	4.60E+01
134-Cs	1.08E+00	2.31E-03	1.49E+01	3.48E+00	3.72E-08	1.19E-02	2.58E-04	1.95E+01
137-Cs+D [k]	4.80E+04	1.03E+02	4.57E+05	1.11E+06	3.33E+00	4.24E+02	1.14E+01	1.61E+06
151-Sm	2.00E+05	3.20E+02	1.48E+04	1.60E+05	4.27E-02	3.37E+02	0.00E+00	3.76E+05
152-Eu	5.10E+01	2.01E-01	3.44E+00	5.20E+01	3.69E-05	1.26E-01	1.02E-04	1.07E+02
154-Eu	3.58E+03	1.41E+01	1.76E+02	1.52E+03	1.53E-01	1.87E+00	6.99E-03	5.28E+03
155-Eu	1.69E+03	6.67E+00	9.00E+01	1.36E+03	9.64E-04	1.91E+00	3.32E-03	3.15E+03

Table 2-10. Upper Bound Inventory Estimate – Reference Case A

Contaminant	WTP ILAW Glass	Spent LAW Melters [a]	Spent HLW Melters [b]	BV Product [c]	BV Secondary Solid Waste [g]	Other Secondary Waste []	WTP (LAW) Secondary Solid Waste [e]	Total IDF Inventory
	(Ci of kg) [j]	(Ci of kg) [j]	(Ci of kg) [j]	(Ci of kg) [j]	(Ci of kg) [j]	(Ci of kg) (j)	(Ci of kg) [j]	(Ci of kg) [j]
226-Ra	5.57E-01	1.28E-03	3.78E-05	8.54E-01	0.00E+00	6.56E-03	1.94E-05	1.42E+00
227-Ac+D [k]	5.32E-02	1.51E-04	1.01E-02	1.29E-02	0.00E+00	8.79E-05	0.00E+00	7.64E-02
228-Ra+D [k,n]	1.87E+00	4.27E-03	9.99E-03	1.34E+00	0.00E+00	1.65E-03	9.45E-05	3.22E+00
229-Th+D [k]	6.80E-02	1.33E-04	3.34E-03	5.07E-02	5.03E-05	3.10E-04	0.00E+00	1.23E-01
231-Pa	1.34E+00	3.08E-03	1.29E-02	9.27E-01	0.00E+00	5.21E-04	0.00E+00	2.29E+00
232-Th	1.91E-01	3.74E-04	1.93E-02	1.34E-01	1.32E-04	9.35E-04	0.00E+00	3.46E-01
232-U	1.44E-01	2.88E-04	3.76E-02	1.15E-01	1.13E-04	6.78E-04	2.87E-07	2.97E-01
233-U	5.15E+00	1.03E-02	3.94E+00	4.41E+00	4.37E-03	2.55E-02	1.03E-05	1.35E+01
234-U	4.35E+01	8.69E-02	1.29E+01	3.35E+01	3.32E-02	2.20E-01	8.75E-05	9.03E+01
235-U+D [k]	1.99E+00	3.98E-03	5.78E-01	1.53E+00	1.51E-03	1.01E-02	4.01E-06	4.11E+00
236-U	6.57E-01	1.31E-03	1.45E-01	5.50E-01	5.45E-04	3.68E-03	1.31E-06	1.36E+00
237-Np+D [k]	2.07E+01	2.93E-02	1.46E-01	2.43E+01	2.40E-02	7.25E-02	4.10E-05	4.53E+01
238-Pu	2.71E+01	9.55E-02	7.07E+00	2.01E+01	5.37E-06	6.37E-05	5.38E-05	5.44E+01
238-U+D [k]	5.07E+01	1.01E-01	1.32E+01	3.58E+01	3.55E-02	2.68E-01	1.03E-04	1.00E+02
239-Pu	2.46E+04	8.65E+01	1.28E+04	3.10E+04	9.20E-03	9.27E-02	4.92E-02	6.85E+04
240-Pu	8.41E+01	2.96E-01	4.43E+01	1.07E+02	2.86E-05	1.24E-01	1.68E-04	2.36E+02
241-Am+D [k]	2.89E+03	1.11E+01	3.05E+02	2.20E+03	1.57E-03	3.20E-02	8.34E-02	5.41E+03
241-Pu+D [k]	1.05E+03	3.69E+00	3.98E+02	1.22E+03	3.26E-04	2.11E+00	2.08E-03	2.67E+03
242-Cm	8.73E+00	1.62E-02	1.65E-01	6.37E+00	6.31E-03	3.70E-02	1.57E-05	1.53E+01
242-Pu	4.45E-01	1.56E-03	1.94E-01	5.51E-01	1.47E-07	9.37E-04	8.86E-07	1.19E+00
243-Am	1.39E+00	5.37E-03	1.40E-01	1.04E+00	7.34E-07	4.86E-06	3.99E-05	2.57E+00
243-Cm	4.94E-01	9.17E-04	1.38E-02	4.38E-01	4.34E-04	2.42E-03	9.92E-07	9.50E-01

Table 2-10. Upper Bound Inventory Estimate – Reference Case A

Contaminant	WTP ILAW Glass (Ci of kg)[j]	Spent LAW Melters[a] (Ci of kg)[j]	Spent HLW Melters[b] (Ci of kg)[j]	BV Product[c] (Ci of kg)[j]	BV Secondary Solid Waste[g] (Ci of kg)[j]	Other Secondary Waste[] (Ci of kg) (j)	WTP (LAW) Secondary Solid Waste[e] (Ci of kg)[j]	Total IDF Inventory (Ci of kg)[j]
244-Cm	1.13E+01	2.10E-02	3.21E-01	1.00E+01	9.95E-03	5.58E-02	2.28E-05	2.18E+01
Ag	2.49E+02	8.10E-01	2.59E+01	2.03E+02	2.26E+00	1.07E+00	1.48E-02	4.83E+02
Al	7.61E+06	1.54E+04	7.00E+03	2.44E+06	1.61E+03	9.09E+03	1.09E+00	1.01E+07
$Al(OH)_4$	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E+03	1.47E+04	0.00E+00	1.68E+04
As	5.16E+02	1.04E+00	1.75E+01	2.91E+02	1.25E+02	2.06E+00	4.29E-02	9.52E+02
B	6.23E+06	1.44E+04	3.56E+03	2.31E+06	9.66E-01	5.52E+00	5.68E-03	8.56E+06
Ba	2.24E+02	5.13E-01	3.78E+01	1.60E+02	1.78E+00	9.23E-01	1.81E-03	4.25E+02
Be	3.11E+01	6.81E-02	2.97E+00	2.54E+01	0.00E+00	2.70E-02	9.04E-04	5.95E+01
Bi	3.01E+03	6.92E+00	9.55E+02	2.23E+03	5.58E-01	4.87E+00	4.56E-02	6.21E+03
Ca	2.93E+06	6.74E+03	7.50E+02	1.83E+04	1.83E+01	7.98E+01	3.30E-02	2.96E+06
Cd	7.22E+02	1.65E+00	2.44E+01	2.56E+02	1.09E+02	2.73E-01	1.08E-01	1.11E+03
Ce	5.38E+02	2.06E+00	2.63E+01	3.60E+02	3.57E-01	2.05E+00	2.98E-04	9.29E+02
Cl	4.87E+05	9.91E+02	3.67E+01	1.78E+05	1.79E+05	3.84E+03	0.00E+00	8.48E+05
CN	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.31E-01	1.21E+00	1.94E+00
Co	1.48E+02	3.40E-01	4.32E+00	1.18E+02	1.17E-01	6.85E-01	1.18E-03	2.72E+02
Cr	3.70E+05	6.61E+02	3.86E+02	2.50E+05	7.05E+00	1.42E+02	6.92E+01	6.22E+05
$Cr(OH)_4$	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.04E+00	2.22E+02	7.47E+01	3.03E+02
Cs	8.11E+02	1.86E+00	2.32E+00	6.32E+02	2.37E-05	7.54E-01	3.08E-01	1.45E+03
Cu	2.67E+02	1.02E+00	1.18E+01	9.78E+01	9.68E-02	7.82E-01	3.23E-04	3.79E+02
F	4.25E+05	1.50E+03	5.91E+02	5.36E+05	9.86E+04	3.17E+02	1.25E+03	1.06E+06
Fe	7.92E+06	1.83E+04	4.81E+03	1.28E+04	1.27E+01	7.00E+01	9.71E-03	7.95E+06
Hg	0.00E+00	0.00E+00	0.00E+00	4.69E+02	4.64E-01	1.15E+03	3.74E+02	1.99E+03
I	4.05E+01	9.28E-02	4.39E-02	1.18E+02	2.68E+00	1.65E+01	5.38E+01	2.32E+02

Table 2-10. Upper Bound Inventory Estimate – Reference Case A

Contaminant	WTP ILAW Glass (Ci of kg) [j]	Spent LAW Melters [a] (Ci of kg) [j]	Spent HLW Melters [b] (Ci of kg) [j]	BV Product [c] (Ci of kg) [j]	BV Secondary Solid Waste [g] (Ci of kg) [j]	Other Secondary Waste [] (Ci of kg) (j)	WTP (LAW) Secondary Solid Waste [e] (Ci of kg) [j]	Total IDF Inventory (Ci of kg) [j]
K	4.84E+05	1.11E+03	2.80E+02	3.90E+05	1.10E+02	6.35E+02	3.33E+01	8.76E+05
La	3.00E+02	1.57E+00	3.66E+01	9.04E+01	8.95E-02	9.11E-01	4.30E-03	4.30E+02
Li	6.01E+03	8.06E-01	1.73E+03	8.71E+01	2.87E-03	4.67E-02	5.05E-04	7.83E+03
Mg	1.83E+06	4.22E+03	1.24E+02	5.38E+02	5.33E-01	2.82E+00	5.18E-04	1.83E+06
Mn	5.90E+04	2.94E+02	1.10E+03	1.84E+03	1.88E-01	7.25E+00	1.22E-01	6.23E+04
Mo	1.92E+03	3.97E+00	1.38E+01	1.69E+03	0.00E+00	3.28E+00	8.21E-01	3.63E+03
Na	3.29E+07	7.75E+04	1.40E+04	3.03E+07	6.07E+05	3.09E+04	5.63E+03	6.39E+07
Nd	8.14E+02	4.12E+00	2.69E+01	4.44E+02	0.00E+00	2.58E-01	3.83E-03	1.29E+03
NH_3 [n]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.39E+03	0.00E+00	4.39E+03
Ni	8.42E+03	1.93E+01	4.08E+02	4.04E+03	1.37E-01	4.38E+00	4.32E-02	1.29E+04
NO_2 [n]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E+03	1.15E+04	0.00E+00	1.35E+04
NO_3 [n]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.48E+06	2.52E+05	2.59E+04	3.75E+06
OH	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.02E+05	2.16E+04	2.18E+03	4.25E+05
OH(BOUND)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E+03	6.30E+03	0.00E+00	7.69E+03
P	7.11E+05	1.29E+03	3.79E+02	7.03E+05	6.96E+02	2.88E+03	1.72E+01	1.42E+06
PO_4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.28E+03	3.01E+04	1.79E+02	3.75E+04
Pb	5.25E+03	1.89E+01	2.85E+02	2.29E+03	2.54E+02	1.18E+02	6.59E-01	8.21E+03
Pd	9.79E+01	3.55E-03	5.69E-01	9.38E+01	3.18E-03	1.83E-01	1.94E-04	1.92E+02
Pr	2.54E+00	4.92E-03	2.58E+00	1.90E+00	0.00E+00	2.36E-04	7.73E-05	7.03E+00
Rb	4.08E+01	2.69E-02	9.20E-01	4.42E+01	0.00E+00	8.82E-02	3.07E-03	8.60E+01
Rh	1.35E+02	7.63E-01	1.10E+00	5.27E+01	0.00E+00	1.81E-01	3.99E-02	1.89E+02
Ru	2.00E+02	4.58E-01	5.86E+00	1.90E+02	0.00E+00	9.36E-01	1.15E+00	3.99E+02
S	4.48E+05	1.03E+03	1.07E+02	5.50E+02	6.87E+05	2.61E+03	1.33E+04	1.15E+06

Table 2-10. Upper Bound Inventory Estimate – Reference Case A

Contaminant	WTP ILAW Glass (Ci of kg)[j]	Spent LAW Melters[a] (Ci of kg)[j]	Spent HLW Melters[b] (Ci of kg)[j]	BV Product[c] (Ci of kg)[j]	BV Secondary Solid Waste[g] (Ci of kg)[j]	Other Secondary Waste () (Ci of kg) (j)	WTP (LAW) Secondary Solid Waste[e] (Ci of kg)[j]	Total IDF Inventory (Ci of kg)[j]
SO_4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.06E+06	4.85E+03	4.12E+00	2.06E+06
Sb	4.97E+02	1.14E+00	7.08E+00	4.51E+02	1.58E-01	6.75E-01	2.05E-02	9.57E+02
Se	1.92E+03	4.40E+00	8.39E-01	2.78E+03	2.80E+01	1.88E+00	2.87E+00	4.73E+03
Si	4.23E+07	9.72E+04	2.60E+04	4.66E+07	1.19E+02	6.96E+02	5.99E-02	8.90E+07
Sn	1.77E+01	4.05E-02	8.75E-02	1.04E+01	2.61E-03	2.37E-02	3.13E-04	2.83E+01
Sr	5.22E+03	1.20E+01	8.42E+02	2.97E+00	1.26E+03	3.69E-01	1.04E-02	7.32E+03
Ta	7.15E+01	6.81E-01	2.39E-02	3.92E+00	0.00E+00	2.92E-03	2.02E-03	7.61E+01
Te	3.73E+00	4.93E-03	2.23E+00	3.70E+00	0.00E+00	2.02E-02	2.88E-03	9.70E+00
Th[m]	1.74E+03	3.40E+00	1.76E+02	1.22E+03	1.21E+00	8.53E+00	5.10E-06	3.15E+03
Ti	2.45E+06	5.66E+03	6.70E+00	7.27E+01	7.20E-02	3.32E-01	1.17E-04	2.45E+06
Tl	3.54E+02	4.66E-01	1.66E+01	4.43E+02	0.00E+00	6.18E-01	1.30E+00	8.16E+02
TOC	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E+05	2.73E+02	0.00E+00	1.74E+05
U[m]	1.52E+05	3.03E+02	3.95E+04	1.07E+05	1.06E+02	8.03E+02	3.08E-01	3.00E+05
V	2.23E+02	6.42E-01	8.13E+00	1.99E+02	0.00E+00	4.83E-03	2.25E-02	4.31E+02
W	5.51E+02	5.50E-01	7.41E+00	4.73E+02	0.00E+00	3.04E-04	1.65E-02	1.03E+03
Y	6.71E+02	1.54E+00	1.24E+01	4.12E+02	1.81E-12	3.41E-04	6.32E-03	1.10E+03
Zn	4.85E+06	1.12E+04	2.38E+01	1.53E+02	1.51E-01	8.85E-01	4.47E-04	4.86E+06
Zr	4.41E+06	1.03E+04	7.31E+02	7.71E+06	4.66E+00	4.30E+01	5.04E-04	1.21E+07

[a] Assumes two melters, each with a 5-year minimum design life per 24590-LAW-3PS-AE00-T0001. Volume of glass in the melter does not include an allowance for increased volume due to corrosion of refractory and reflects the set point of 6891 gallons per 24590-WTP-MDD-PR-01-002, Appendix D; other contributions to source term such as plenum deposits are neglected.

[b] Assumes two melters, each with a 5-year minimum design life per 24590-HLW-3PS-AE00-T0001. Volume of glass in the melter includes an allowance for increased volume due to corrosion of refractory per 24590-HLW-M5C-HMP-00002, Table 2; other contributions to source term such as plenum deposits are neglected.

Table 2-10. Upper Bound Inventory Estimate – Reference Case A

Contaminant	WTP ILAW Glass	Spent LAW Melters [a]	Spent HLW Melters [b]	BV Product [c]	BV Secondary Solid Waste [g]	Other Secondary Waste ()	WTP (LAW) Secondary Solid Waste [e]	Total IDF Inventory
	(Ci of kg) [j]	(Ci of kg) [j]	(Ci of kg) [j]	(Ci of kg) [j]	(Ci of kg) [j]	(Ci of kg) (j)	(Ci of kg) [j]	(Ci of kg) [j]

[c] Inventory estimate includes contribution from DBVS.

[d] WTP (PT) Secondary Solid Waste = Waste of from HTWOS Spent Resins + solids portion of WTP-to-LERF minus solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass.

[e] WTP (LAW) Secondary Solid Waste = LAW HEPA1 + LAW HEPA2 + LAW VOC-SCRUB + solids portion of the HTWOS-LAW-caustic-scrubber-totalizer-total mass (part of WTP-to-LERF stream).

[f] WTP (HLW) Secondary Solid Waste = HLW HEPA1 + HLW HEPA2 + HLW VOC-SCRUB + HLW AG MORDINITE.

[g] BV Secondary Solid Waste = solids portion of BV-to-LERF + solids portion of DBVS-to-LERF.

[h] TRU Packaging Waste = solids portion of TRU-packaging-to-LERF.

[i] 242-A Evaporator Waste = solids portion of 242-A Evaporator waste-to-LERF.

[j] Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg.

[k] Short-lived progeny in equilibrium with parent.

[l] Bounding inventory based on ratioing inventory splits from HTWOS run by the maximum tank inventory estimate.

[m] Bounding inventory based on converting radionuclide inventories for the isotopes into mass (kg).

[n] Shaded values in table reflect adjustments to the HTWOS values based on Kirkbride et al. (2005a). Specifically, small negative values from the model (due to back-decaying corrections) were set equal to zero for 93m-Nb, and 228-Ra; inventory values for NH_3, NO_2, and NO_3 were adjusted based on newer processing split data for the BV (DBVS) system

2.4.2 Uncertainties in the Partitioning Of Contaminants between Different Waste Forms

Significant uncertainty exists in the current planning with respect to the potential partitioning of the Hanford tank waste into different waste forms currently under consideration for disposal within the IDF. This uncertainty exists not only with the uncertainty in planning but also with the ability of different processes to incorporate specific contaminants into its waste form. This section describes specific inventory cases associated with these assumptions. Specifically, the following sensitivity cases are developed:

- Split between WTP and BV waste forms, and
- Contaminant-specific splits.

2.4.2.1 Split between WTP and BV Waste Forms

The bounding inventories and concentrations discussed in Section 2.4.1 cover the partitioning case where all of the Hanford tank waste is processed according to the mission scenario documented in Kirkbride et al. (2005a). Reference Case B assumes 100% of the Hanford tank waste is processed into WTP ILAW and IHLW glass. Reference Case B also assumes that a quantity of S-109 tank liquids containing ~260 MT Na is processed through the DBVS. Reference Case A assumes approximately 50% of the LAW feed is processed into WTP ILAW glass and the remaining 50% is processed into the bulk vitrification waste form using the supplemental LAW treatment system. These two cases provide an indication of the ranges of Hanford tank waste inventories that may be processed into WTP glass and the BV waste form.

2.4.2.2 Contaminant Specific Splits

Specific contaminant splits have been identified as inventory sensitivity cases because of their potential impacts of environmental risk. The following specific sensitivity cases have been identified for consideration:

- All of the Hanford tank waste inventory for Tc-99 is routed to the secondary waste stream and is disposed as MLLW (Tc-99 inventory = 2.68E+04 Ci [from Table 2-1]),
- All of the Hanford tank waste inventory for I-129 is routed to the secondary waste stream and is disposed as MLLW (I-129 inventory = 43.9 Ci [from Table 2-1]), and
- All of the Hanford tank waste inventory for uranium, 6.20E+05 kg, is routed to the secondary waste stream and is disposed as MLLW (uranium inventory from Table 2-1).

3.0 IDF INVENTORY ASSOCIATED WITH LOW-LEVEL AND MIXED LOW-LEVEL WASTE

Two types of generators are assumed to be providing low-level and mixed-low-level wastes (LLW and MLLW) for disposal at the IDF. The first type is the approved generator who currently sends LLW waste to the Hanford Low-Level Burial Grounds (LLBG) and will be sending waste to the IDF once disposal operations begin there. These generators provide forecast data to the Solid Waste Integrated Forecast Technical (SWIFT) report as described in Section 2.1.3 for WTP and ETF. That is, these generators estimate the time span over which they will send waste to the facility and provide contaminant-specific inventory and volumes for each year they expect to send waste. This set of inventory estimates does not include the WTP waste, reported by WTP or ETF, because this waste inventory is already included in the inventory estimates discussed in Chapter 2. Types of waste materials include debris waste (e.g., personal protective equipment, tools, failed equipment, offgas treatment media [HEPA filters]), analytical laboratory waste, ion exchange resins and metals.

The second set of generators is assumed to provide waste in the future but do not send waste currently to Hanford. These are additional generators in the DOE complex that may send waste to Hanford if it becomes a regional waste disposal center. The rationale for a regional disposal center is the fact that other sites in the DOE complex generate wastes that cannot be disposed at that site in a manner that is environmentally protective, hence requiring another disposal location. Establishment of Hanford as a regional disposal center for LLW and MLLW disposal required the completion and approval of an environmental impact statement for solid waste disposal at Hanford. This process has been completed with the approval of the document, the *Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement (HSW EIS)* (DOE 2004a) which resulted in a record of decision (ROD), *Record of Decision for the Solid Waste Program, Hanford Site, Richland, WA: Storage and Treatment of Low-Level Waste and Mixed Low-Level Waste; Disposal of Low-Level Waste and Mixed Low-Level Waste, and Storage, Processing, and Certification of Transuranic Waste for Shipment to the Waste Isolation Pilot Plant* (DOE 2004b). This ROD authorizes the installation and operation of the IDF at which time other generators may begin the approval process to send their waste to Hanford.

A request for waste forecast information from Hanford to potential generators resulting from the ROD has not been made. However, DOE has compiled complex-wide waste volume and inventory estimates by major generators that are the basis for inventory estimates used in the HSW EIS. Specific generators and the waste volumes (20 yr projections) are based on the DOE Programmatic Environmental Impact Statement (PEIS) (DOE 1997) that defined sites requiring future off-site disposal capacity. In a separate study, radionuclide-specific average concentration values have also been compiled for waste categories at major sites in a document prepared to evaluate the disposal capacity of the DOE system for DOE-generated LLW and MLLW (DOE 2000). From these sources, radionuclide-specific inventories were generated by taking the product of averaged radionuclide-specific concentrations and volume estimates for each site-specific waste stream (Fritz et al. 2003). Risk evaluations were then generated in the HSW EIS assuming disposal of all these wastes at various Hanford locations. The ROD limits the allowable waste volume to be sent to Hanford to a fraction of the volume assumed in the HSW EIS calculations. Downward adjustments have been made in these inventory estimates to reflect these volume disposal limits.

3.1 REFERENCE INVENTORY

For the nominal case, inventory estimates from currently approved generators provided in a recent SWIFT forecast (Barcot 2003 and the electronic database) and a volume-corrected fraction of the HSW EIS inventory estimate are combined. The SWIFT data are from the compiled forecast in late calendar year 2003. The HSW EIS data are found in the HSW EIS (DOE 2004a) and a supporting database document (Fritz el al. 2003). Volume and inventory information are described in Chapter 3. Both LLW and MLLW are projected to be disposed.

Two inventory estimates are provided in this section for LLW and MLLW that may be provided by all known and potential generators with the exception of the wastes originating at WTP.

Radionuclide inventory estimates for LLW and MLLW other than WTP-generated secondary waste are listed in Table 3-1 for approved generators and potential generators. Approved generator waste forecasts are taken from a recent SWIFT report (Barcot 2003) and associated electronic database. Waste estimates from potential generators are taken from the HSW EIS (DOE 2004a) and its backup documentation (Fritz et al. 2003 and associated electronic database). Specific radionuclide inventory estimates have been reduced proportionately to reflect the reduced volume of off-site waste permitted by the ROD (39 FR 39449 [DOE 2004b]) for disposal at Hanford facilities (see footnote in Table 3-1). The radionuclides listed in Table 3-1 are specified in routine data calls requested by Fluor Hanford that approved generators must consider in their waste characterization report. These radionuclides are those that make up large fractions of the total inventory by activity or are known to be potential contributors to dose estimates.

Table 3-1. Reference Case Radionuclide Inventory of LLW and MLLW Excluding WTP-Generated Secondary Solid Waste

Radio-nuclide	Generator Types and Waste Categories [a]							
	Approved Generators [b] (SWIFT)			Potential Generators[b] (HSW EIS/TID)		Total Activity		
	Cat 1	Cat 3	MLLW	LLW	MLLW	Not Grouted	Grouted	Total
C-14	3.40E+00	1.01E+03	1.96E-02	3.38E+01	3.85E-01	3.40E+00	1.04E+03	1.05E+03
C-14 Act Metal	3.96E-04	4.23E+03	0.00E+00	4.64E-08	NR	3.96E-04	4.23E+03	4.23E+03
Se-79	1.79E-05	4.97E-05	4.32E-08	1.80E-04	1.75E-06	1.79E-05	2.31E-04	2.49E-04
Sr-90+D [e]	1.27E+01	4.96E+03	3.32E+02	5.56E+03	1.85E+00	1.27E+01	1.09E+04	1.09E+04
Mo-93	0.00E+00	1.12E+00	0.00E+00	3.66E-01	6.59E-03	0.00E+00	1.49E+00	1.49E+00
Tc-99	5.32E-01	2.97E+00	6.15E+00	1.00E+00	5.13E+01	5.32E-01	6.14E+01	6.20E+01

Table 3-1. Reference Case Radionuclide Inventory of LLW and MLLW Excluding WTP-Generated Secondary Solid Waste

Radio-nuclide	Generator Types and Waste Categories [a]							
	Approved Generators [b] (SWIFT)			Potential Generators[b] (HSW EIS/TID)		Total Activity		
	Cat 1	Cat 3	MLLW	LLW	MLLW	Not Grouted	Grouted	Total
I-129	1.08E-02	6.90E-03	1.01E-01	2.49E-02	2.74E-04	1.08E-02	1.33E-01	1.44E-01
Cs-137+D [e]	2.26E+01	1.98E+02	1.03E+03	3.00E+04	3.39E+02	2.26E+01	3.16E+04	3.16E+04
Ra-226	2.67E+00	9.34E-04	4.84E-06	8.74E+00	3.62E-02	2.67E+00	8.78E+00	1.14E+01
U-233	2.88E-03	8.48E+00	1.70E-10	2.62E-01	2.63E-01	2.88E-03	9.01E+00	9.01E+00
U-234	1.40E-01	4.49E-01	1.32E-03	2.10E+01	9.43E+01	1.40E-01	1.16E+02	1.16E+02
U-235+D [e]	1.90E+00	3.64E-02	4.13E-05	1.37E+00	4.21E+01	1.90E+00	4.35E+01	4.54E+01
U-236	1.17E-06	1.93E-05	NR	1.60E-02	5.34E-02	1.17E-06	6.94E-02	6.94E-02
Np-237+D [e]	7.64E-02	1.17E-02	1.11E-02	2.21E-01	7.91E+00	7.64E-02	8.15E+00	8.23E+00
Pu-238	8.45E+00	2.11E+00	2.33E+00	7.84E-01	8.48E-02	8.45E+00	5.31E+00	1.38E+01
U-238+D [e]	2.66E-01	2.68E+00	6.10E-01	3.49E+01	9.88E+01	2.66E-01	1.37E+02	1.37E+02
Pu-239	2.43E+00	1.98E+00	1.86E-01	6.93E+01	4.50E+01	2.43E+00	1.16E+02	1.19E+02
Pu-240	1.41E+00	4.35E+00	4.11E-02	2.00E+00	1.96E-01	1.41E+00	6.59E+00	8.00E+00
Am-241	1.51E+00	6.64E+00	3.19E-01	9.96E+00	1.13E+01	1.51E+00	2.82E+01	2.97E+01
Pu-241+D [e]	1.49E+01	160.55	8.29E+02	6.57E+00	1.88E-01	1.49E+01	9.96E+02	1.01E+03
Pu-242	5.83E-03	6.92E-06	1.09E-05	4.75E-04	3.34E-05	5.83E-03	5.26E-04	6.36E-03
Am-243+D [e]	5.54E-03	9.30E-03	7.44E-06	7.65E-01	2.26E-05	5.54E-03	7.74E-01	7.80E-01
Cm-244	NR	NR	NR	2.90E+02	4.08E-04	NR	2.90E+02	2.90E+02
H-3	1.80E+05	5.66E+02	4.75E-02	6.77E+05	1.31E+05	1.80E+05	8.09E+05	9.89E+05
Ni-59	NR	NR	NR	4.11E+03	7.27E+01	NR	4.18E+03	4.18E+03
Co-60	3.07E+04	4.07E+08	1.80E+00	7.74E+05	1.37E+04	3.07E+04	4.08E+08	4.08E+08
Co-60 Act Metal	3.96E-03	1.10E+05	0.00E+00	NR	NR	3.96E-03	1.10E+05	1.10E+05
Ni-63	NR	NR	NR	2.13E+05	2.57E+03	NR	2.16E+05	2.16E+05
Other[c]	1.63E+03	1.89E+08	1.41E-03	3.56E+06	5.71E+04	1.63E+03	1.93E+08	1.93E+08
Cr (Total) [d]	NR	NR	7.73E+03	NR	1.00E+04	NR	1.77E+04	1.77E+04
NO_3^- [d]	NR	NR	2.57E+05	NR	3.32E+05	NR	5.89E+05	5.89E+05
U (Total)	1.67E+03	7.99E+03	1.81E+03	1.04E+05	3.13E+05	1.67E+03	4.27E+05	4.28E+05

NR = not reported

[a] Inventory estimates for approved generators are from Barcot 2003 and supporting electronic database. Estimated waste volumes projected by approved Hanford generators are 24,974, 2,740 and 15,467 m^3 for Category 1, Category 3 and MLLW, respectively.

Table 3-1. Reference Case Radionuclide Inventory of LLW and MLLW Excluding WTP-Generated Secondary Solid Waste

Radio-nuclide	Generator Types and Waste Categories [a]							
	Approved Generators [b] (SWIFT)			Potential Generators[b] (HSW EIS/TID)		Total Activity		
	Cat 1	Cat 3	MLLW	LLW	MLLW	Not Grouted	Grouted	Total

[b] All wastes except Category 1 waste are assumed to be grouted. Inventory estimates for potential generators are derived from Fritz et al 2003 in the Technical Information Database (TID) and supporting electronic database. Because lower disposal volumes are allowed by the ROD (62,000 and 20,000 m^3 for LLW and MLLW, respectively) compared to disposal assumptions in Fritz et al 2003 (198,845 and 140,337 m^3 for LLW and MLLW, respectively), inventory values are reduced proportionately. Available LLW volumes are further reduced by the projected disposal volumes (13,931 m^3) estimated by approved offsite generators (Barcot 2003) leaving an available LLW volume of 48,069 m^3.

[c] Radionuclides present in Other group consist primarily of short-lived fission products (e.g., Fe-55, Co-58) and, in the case of the SWIFT forecasting data, longer-lived activation products (e.g., Ni-63) generated by the activation of metal.

[d] Inventory estimate based on Hanford generator MLLW volume (15,467 m^3) and potential generators MLLW volume (20,000 m^3) times estimated average concentration of 0.5 kg/m^3 for Cr and 16.6 kg/m^3 for NO_3^-.

[e] Short-lived progeny in equilibrium with parent.

[f] U (Total) based on conversion of radionuclide inventories into kg.

The majority of projected activity in disposed waste (separated at the bottom of the table) consists of short-lived radionuclides. Intermediate radionuclide activity is dominated by Cs-137 and Sr-90.

A list of specific non radioactive constituents is identified in the Solid Waste Information Tracking System (SWITS) for currently stored and disposed MLLW at the Hanford Low-Level Waste Burial Grounds (LLBG). Also, current generators have provided a very limited description of constituents in future MLLW in the SWIFT forecast report. However, the forecast descriptions only quantify the mass of individual constituents indirectly and may or may not be a good indicator of future waste characteristics.

Given these information sources, it appears that MLLW will contain a wide variety of metals, inorganic and organic compounds. Crude mass estimates of individual species from current record data (e.g., the product of container volumes and weight percents for specific constituents found in the record and an assumed average density) indicate the more prevalent constituents among metals to be nickel, mercury, chromium and cadmium, among inorganic compounds to be sodium nitrate, sodium hydroxide and sodium sulfate, and among organic compounds to be polycholorinated biphenyls, tatrachloroethylene, xylene, 1,1,1-trichloroethane and carbon tetrachloride. The final inventory of disposed non radioactive constituents will also be influenced by treatment required to satisfy land disposal restrictions (LDRs). In particular, organic inventories will be largely destroyed. Estimated average concentrations for nitrate and chromium from currently disposed and stored MLLW are 16.6 and 0.5 kg/m^3, respectively.

The latest revision to the estimated solid waste inventory from Hanford approved generators has been recently issued (Barcot 2005) just prior to the publication of this inventory data package.

These new inventory estimates indicate a smaller contaminant inventory than indicated in Table 3-1 are planned for IDF (except for ^{14}C, ^{90}Sr, ^{240}Pu and ^{241}Am as MLLW).

3.2 SENSITIVITY CASES FOR SOLID WASTE IDF INVENTORY

The high uncertainty of waste forecast information described for WTP waste in Section 2.2.2 is generally applicable to many other reported waste streams. That is, facility processes or waste remediation activities projected to generate waste have not been fully designed or planned, have not been initiated or are subject to change as they proceed. Therefore, differences in waste inventory eventually disposed versus that projected for disposal are guaranteed. Because risk estimates are proportional to the inventory a sensitivity analysis that assumes a range of inventory values is needed to get a sense of potential variability in end state risk. Of the two primary sources of waste (approved versus potential generators) potential generators (HSW EIS [DOE 2004a] and Fritz et al. 2003) have provided estimates that are generic in the sense that numerous sources at a given site were lumped together for estimating purposes. These conditions make the estimates highly uncertain to the point that estimating a variance from the given estimate has little meaning. The SWIFT forecast is more often waste-stream specific and the generators provide a minimum, baseline (generally intermediate) and maximum volume estimates. For the nominal case, the reported inventories and the baseline waste volumes were assumed.

An alternate inventory case estimate is provided (Table 3-2) that increases the forecasted waste estimates from Hanford approved generators by determining the average concentration for the nominal case (generator-specific ratio of radionuclide-specific inventory to baseline volume) and then taking the product of the average concentration and estimated generator-specific maximum volume provided in the latest SWIFT forecast. Specifically, estimated median volume estimates from the Hanford approved generators are 24,974, 2,740 and 15,476 m^3 for Category 1, Category 3 and MLLW, respectively. The estimated maximum waste volumes projected by approved Hanford generators are 41,182, 5,768 and 18,245 m^3 for Category 1, Category 3 and MLLW, respectively. The bounding inventories for the approved generators in Table 3-2 is estimated multiplying the inventories in Table 3-1 by the ratio of the median to maximum volumes for each waste type (Cat. 1, Cat. 3, and MLLW). For potential generators, a change in LLW and MLLW inventories for some radionuclides from the nominal case are taken from the HSW EIS (DOE 2004a). The HSW EIS (DOE 2004a) lists inventories associated with upper and lower bound volumes for a subset of the radionuclides provided in Fritz et al. (2003). Increased inventories for these radionuclides are calculated in Table 3-2 that are the difference between inventory estimates associated with upper bound and lower bound volumes. Upper and lower bound volume inventories were taken from Table B-19 of the HSW-EIS (for LLW, the values found in the Near PUREX Category 3 LLW column and for MLLW, the values in the 200 E 2008-2046 MLLW column).

Table 3-2. Bounding Inventory Estimate for Other Solid Waste

Contaminant	Generator Types and Waste Categories [a]				
	Approved Generators (SWIFT)			Potential Generators (HSW EIS/TID) [b]	
	Cat 1 [b]	Cat 3 [b]	MLLW [b]	LLW [b]	MLLW [b]
	(Ci of kg) [g]	(Ci of kg) [g]	(Ci of kg) [g]	(Ci of kg) [g]	(Ci of kg) [g]
241-Am+D [e]	2.49E+00	1.40E+01	3.76E-01	9.95E+00	1.13E+01
243-Am	9.13E-03	1.96E-02	8.78E-06	7.65E-01	2.26E-05
14-C [h]	5.62E+00	2.13E+03	2.31E-02	1.52E+02	1.40E+00
14-C Act Metal [i]	6.54E-04	8.93E+03	0.00E+00	4.64E-08	NR
137-Cs+D [e]	3.72E+01	4.19E+02	1.21E+03	2.99E+04	3.39E+02
I-129 [h]	1.77E-02	1.46E-02	1.19E-01	2.49E-02	1.00E-02
93-Mo	0.00E+00	2.36E+00	0.00E+00	3.66E-01	6.59E-03
244-Cm	NR	NR	NR	2.90E+02	4.08E-04
237-Np+D [e]	1.26E-01	2.46E-02	1.31E-02	2.21E-01	7.91E+00
238-Pu	1.39E+01	4.45E+00	2.75E+00	7.84E-01	8.48E-02
239-Pu	4.00E+00	4.19E+00	2.19E-01	6.93E+01	4.50E+01
240-Pu	2.32E+00	9.17E+00	4.85E-02	2.00E+00	1.96E-01
241-Pu+D [e]	2.46E+01	3.39E+02	9.79E+02	6.57E+00	1.88E-01
242-Pu	9.62E-03	1.46E-05	1.28E-05	4.75E-04	3.34E-05
226-Ra+D [e]	4.41E+00	1.97E-03	5.72E-06	8.74E+00	3.62E-02
79-Se	2.95E-05	1.05E-04	5.10E-08	1.80E-04	1.75E-06
90-Sr+D [e]	2.09E+01	1.05E+04	3.91E+02	5.56E+03	1.85E+00
Tc-99 [h]	8.78E-01	6.26E+00	7.26E+00	1.00E+00	1.70E+02
233-U [h]	4.75E-03	1.79E+01	2.01E-10	4.50E-01	2.63E-01
234-U [h]	2.31E-01	9.46E-01	1.55E-03	2.10E+01	3.24E+02
235-U+D [e]	3.13E+00	7.68E-02	4.87E-05	1.36E+00	4.21E+01
236-U [h]	1.93E-06	4.07E-05	0.00E+00	1.80E-02	5.34E-02
238-U+D [e,h]	4.40E-01	5.65E+00	7.19E-01	3.49E+01	3.36E+02
3-H	2.97E+05	1.20E+03	5.60E-02	6.76+05	1.31E+05
60-Co	5.07E+04	8.59E+08	2.12E+00	7.73E+05	1.37E+04
60-Co Act Metal [i]	6.54E-03	2.31E+05	0.00E+00	NR	NR
Other[c]	2.70E+03	3.99E+08	1.67E-03	3.55E+06	5.71E+04
59-Ni	NR	NR	NR	4.11E+03	7.27E+01
63-Ni	NR	NR	NR	2.13E+05	2.57E+03
Cr (total) [d]	NA	NA	9.09E+03	NA	3.12E+04
NO_3^- [d]	NA	NA	3.03E+05	NA	1.03E+06
U [f]	2.76E+03	1.68E+04	2.14E+03	1.04E+05	1.02E+06

NR = not recorded; NA = not applicable

[a] Inventory estimates for approved generators are from Barcot 2003 and supporting electronic database. Inventory estimates are based on maximum rather than median volume estimates provided in Barcot (2003). Estimated maximum waste volumes projected by approved Hanford generators are 41,182, 5,768 and 18,245 m^3 for Category 1, Category 3 and MLLW, respectively. Estimated median volume estimates are 24,974, 2,740 and 15,476 m^3 for Category 1, Category 3 and MLLW, respectively. Inventories for potential generators based on HSW EIS (DOE 2004a)and (Fritz et al. 2003); shaded values based on difference between upper and lower bounds from HSW EIS.

[b] All wastes except Category 1 waste are assumed to be grouted.

[c] Radionuclides present in Other group consist primarily of short-lived fission products (e.g., 55-Fe, 58-Co) and, in the case of the SWIFT forecasting data, longer-lived activation products (e.g., 63-Ni) generated by the activation of metal.

[d] Inventory estimates are based on total MLLW volume for Hanford and offsite generators (31,223 and 62,336 m^3, respectively) times estimated average concentration of 0.5 kg/m^3 for Cr and 16.6 kg/m^3 for NO_3^-.

[e] Short-lived progeny in equilibrium with parent

[f] Based on activity of U isotope inventories provided above.

[g] Radionuclide inventories in Ci decayed to January 1, 2004; chemical inventories in kg.

[h] Shaded inventory values are based on the difference between inventory estimates associated with upper bound and lower bound volumes from the HSW EIS (DOE 2004a). Upper and lower bound volume inventories were taken from Table B-19 of the HSW-EIS (for LLW, the values found in the Near PUREX Category 3 LLW column and for MLLW, the values in the 200 E 2008-2046 MLLW column).

[i] Act Metal = contaminant is contained within an activated metal matrix.

3.2.1 ERDF Waste

There are currently no plans to dispose of Environmental Restoration Disposal Facility (ERDF) waste in the IDF. Nevertheless, a sensitivity case solid waste inventory was developed assuming LLW having compositions similar to ERDF were identified for disposal within the IDF.

Hilderbrand et al. (2004) has provided inventory estimates for the ERDF for its operation between January 1996 and September 2003. Table 3-3 provides the total inventory that is disposed in the ERDF between these years of operations. Also provided in Table 3-3 is an inventory estimate assuming the IDF were to receive 10% of the ERDF inventory disposed between January 1996 and September 2003.

Table 3-3. Representative ERDF Inventory

Radionuclide	ERDF Inventory [a] (Ci)	Representative IDF Inventory Addition [b] (Ci)
H-3	2.78E+01	2.78E+00
C-14	1.17E-01	1.17E-02
C-14 (A)	3.50E+01	3.50E+00
Na-22	4.16E+01	4.16E+00
Co-58	9.63E+00	9.63E-01
Co-60	3.77E+03	3.77E+02
Ni-63	7.85E-01	7.85E-02
Ni-63 (A)	2.17E+03	2.17E+02
Sr-90+D [c]	5.51E+03	5.51E+02
Nb-94	1.59E+03	1.59E+02
Tc-99	1.29E+02	1.29E+01
Cs-134	3.01E+03	3.01E+02
Cs-137+D [c]	3.37E-01	3.37E-02
Eu-152	3.06E+03	3.06E+02
Eu-154	3.07E+00	3.07E-01
Eu-155	3.60E-02	3.60E-03
Ra-226+D [c]	1.40E+01	1.40E+00
Ra-228	9.79E+01	9.79E+00
Th-228	3.61E+01	3.61E+00
Th-232	2.37E+03	2.37E+02
U-233/234	1.13E-01	1.13E-02
U-235+D [c]	8.40E-02	8.40E-03
Np-237+D [c]	1.70E-02	1.70E-03
Pu-238	1.02E+01	1.02E+00
U-238+D [c]	3.12E+03	3.12E+02
Pu-239	5.94E+01	5.94E+00
Pu-240	3.29E-01	3.29E-02
Am-241	2.96E-01	2.96E-02
Pu-241+D [c]	4.35E+01	4.35E+00
Pu-242	1.65E+01	1.65E+00
Am-243+D [c]	1.59E+02	1.59E+01

[a] Based on ERDF inventory estimates between January 1996 and September 2003 (Hilderbrand et al. 2004).
[b] Assumes 10% of ERDF inventory is sent to IDF for disposal.
[c] Short-lived progeny in equilibrium with parent.
(A) = contaminant in activated metal

3.2.2 Estimated Quantity of Cementitious Grout in IDF

The IDF will contain significant quantities of cementitious grout contained in several waste forms that may impact contaminant release from the ILAW waste forms in the IDF. The cementitious grout waste forms include Category 3 LLW, MLLW, and the spent melters. From Table 3-1 the volume estimates for the Category 3 LLW and MLLW inventories are 50,809 m^3 and 35,467 m^3, respectively for the reference case. The Category 3 LLW volume estimate is based on current projections for solid waste receipts from Hanford approved generators (neglecting material from processing of Hanford waste tanks) (2,740 m^3) and the other potential generator DOE sites providing waste for disposal per the ROD (48,069 m^3). The MLLW solid waste volume estimate includes the 15,467 m^3 of MLLW from Hanford plus the 20,000 m^3 of MLLW allowed by the ROD (DOE 2004b).

The volume estimates for the cementitious grout waste forms from the processing of Hanford waste tanks will depend on the extent that alternate technologies are used to process the Hanford tank wastes during their retrieval. For Reference Case A the MLLW inventories associated with the secondary waste streams from the processing of Hanford tank wastes are estimated to be contained within 8,000 m^3 by volume of grouted waste packages (see Table 2-6). Most of the grouted waste package volume is associated with ETF solids whose volume is predominantly grout. The spent melter packages may also contain cementitious grout. From Table 2-6 the estimated spent LAW melter waste package volume is 2,030 m^3 and the spent HLW melter waste package volume is 934 m^3. If we assume only one-half the package volume is occupied by the spent melter, then the other half of the volume is assumed to be filled with grout (neglects volume of overpack materials). Therefore, the total grout volume associated with Hanford tank wastes for Reference Case A is approximately $8{,}000 + 2{,}030/2 + 934/2 = 9{,}482\ m^3$.

For Reference Case B the MLLW inventories associated with the secondary waste streams from the processing of Hanford tank wastes are estimated to be contained within 6,436 m^3 by volume of grouted waste packages (see Table 2-9). Most of the grouted waste package volume is associated with ETF solids whose volume is predominantly grout. The spent melter packages may also contain cementitious grout. From Table 2-6 the estimated spent LAW melter waste package volume is 3,950 m^3 and the spent HLW melter waste package volume is 1,020 m^3. If we assume only one-half the package volume is occupied by the spent melter, then the other half of the volume is assumed to be filled with grout (neglects volume of overpack materials). Therefore, the total grout volume associated with Hanford tank wastes for Reference Case B is approximately $6{,}436 + 3{,}950/2 + 1{,}020/2 = 8{,}921\ m^3$.

The other grouted waste forms planned for disposal in the IDF are associated with the Category 3 and MLLW associated with the other solid waste (see Table 3-1). The waste package volume estimate for Category 3 waste is 2,740 m^3 for Hanford approved generators and 48,069 m^3 for potential generators. The waste package volume for MLLW waste is 15,467 m^3 for Hanford generators and 20,000 m^3 for potential generators.

Combining the estimates for the secondary waste streams from each reference case with the volume estimates for the other solid waste planed for disposal in the IDF the following estimates for the volume of cementitious grout waste are:

- Reference Case A – 9.48E+03 + 5.08E+04 +3.55E+04 = 9.58E+04 m^3, and
- Reference Case B – 8.92E+03 + 5.08E+04 +3.55E+04 = 9.52E+04 m^3.

4.0 FUTURE WORK

The current inventory estimates for the IDF are based on the latest and best information available from the Tank Farm contractor and the WTP Contractor. However, the inventory contains uncertainties that are being minimized as new information is gathered. The major areas of uncertainty that impact the reference IDF inventory are:

- Hanford waste tank inventory,
- Design of the WTP,
- Design of supplemental technology processes,
- Tank retrieval methods, and
- Plans for solid waste receipts.

The specific areas that impact IDF inventory include:

- a better understanding of wash leach factors for tank retrieval,
- a better understanding of the contaminant split factors between WTP ILAW glass, WTP IHLW glass and secondary waste streams,
- a better understanding of supplemental technology processes including their secondary waste streams,
- operational plans for use of a suite of technologies to immobilizes tank waste for disposal on the site,
- a better understanding of the Hanford waste tank inventory, and
- development of more accurate and complete solid waste forecasts for all sources.

As these areas for inventory are addressed, the uncertainty in the planned inventory for the IDF can be reduced.

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APPENDIX A - DETAILS OF WASTE VOLUME ANALYSIS

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Volume Factor Analysis for HTWOS Output Processing

The Tank Farm Contractor used a computer simulation by the HTWOS code to generate estimates of tank waste retrieval and processing volumes and inventories (Kirkbride 2005). The HTWOS files contain some information on stream volumes, but these data are not necessarily the "as disposed" volume and are not adequate for the definition of the disposed waste volumes. Volume factors have been generated using available information from the HTWOS annual files and other process information to estimate the actual disposal volume for each waste stream. The generation of these volume factors is described in this Appendix.

The product and secondary waste streams are listed in Table A-1, which also lists the volume factors and the basis for each factor. The basis for each volume factor and the method for evaluation are provided in the following sections.

Table A-1. Volume Factors for HTWOS Products and Secondary Waste Streams

HTWOS Stream [a]	Stream number [b]	Volume Factor [c]	Volume Factor Units [d]	Basis for Factor [e]
HTWOS-SPENT-RESIN	31	2.585E-06	m^3/kg (LAW+HLW+BV glass [f])	Gibbs (2004)
LAW-HEPA1 + LAW-HEPA2	43A +43B	5.108E-07	m^3/kg (LAW glass)	Gibbs 2004; Knauss (2005)
LAW-VOC-SCRUB	41C	5.428E-07	m^3/kg (LAW glass)	Gibbs 2004; Knauss (2005)
HLW-HEPA1 + HLW-HEPA2)	43A +43B	7.599E-07	m^3/kg (HLW glass)	Gibbs 2004; Knauss (2005)
HLW-VOC-SCRUB	43C	2.095E-06	m^3/kg (HLW glass)	Gibbs 2004; Knauss (2005)
HLW-AG-MORDENITE-COL	43E	1.07E-06	m^3/kg (HLW glass)	Gibbs 2004; Knauss (2005)
BV - Liquid Effluent contribution to ETF Liquids	55 part	5.9	m^3/m^3 (BV process feed)	Boomer 2004; Lueck 2005
BV – Solid Waste contribution to ETF Solids	54 part	2.03E-02	m^3/m^3 (BV process feed)	Boomer 2004; Lueck 2005
242-A Evaporator to LERF contribution to ETF Liquids	55 part	0.999	m^3/m^3 (242A to LERF feed)	Boomer 2004; Lueck 2005
242-A Evaporator to LERF contribution to ETF Solids	54 part	3.44E-03	m^3/m^3 (242A to LERF feed)	Boomer 2004; Lueck 2005
Total TRU Packaging contribution to ETF Liquids	55 part	0.927	m^3/m^3 (TRU Packaging feed)	Boomer 2004; Lueck 2005
Total TRU Packaging contribution to ETF Solids	54 part	3.19E-03	m^3/m^3 (TRU Packaging feed)	Boomer 2004; Lueck 2005
PT liquids to LERF contribution to ETF Solids	26	9.945E-06	m3/kg (LAW+HLW glass)	Gibbs (2004), Lueck 2005
PT liquids to LERF contribution to ETF Liquids	26	2.89E-03	m3/kg (LAW+HLW glass)	Gibbs (2004), Lueck 2005
BV-PRODUCT	50	1.3146E-		Boomer 2004;

Table A-1. Volume Factors for HTWOS Products and Secondary Waste Streams

HTWOS Stream [(a)]	Stream number [(b)]	Volume Factor [(c)]	Volume Factor Units [(d)]	Basis for Factor [(e)]
		03	m^3/kg (BV product mass)	Lueck 2005
FAILED-HLW-MELTERS	43F	2.6853E-05	m^3/kg (HLW glass mass)	Puigh 2004; Kirkbride et al. 2005
FAILED-LAW-MELTERS	41F	9.9690E-06	m^3/kg (LAW glass mass)	Puigh 2004; Kirkbride et al. 2005
HTWOS-LAW-CANISTERS	40	4.525E-04	m^3/kg (LAW glass mass)	Kirkbride et al. 2005

[(a)] Name assignment from HTWOS (Kirkbride et al. 2005)
[(b)] From Figure C-1 (in Kirkbride et al. 2005)
[(c)] Factor used to convert HTWOS mass/volume data into waste product/stream disposed volume
[(d)] Units for volume factor
[(e)] Reference source for data used to determine volume factors

Volume Factor for HTWOS-SPENT-RESIN

The spent resin secondary stream is generated during production of HLW glass and ILAW glass in the Waste Treatment Plant, and ILAW glass from the Supplemental Treatment Plant. The volume of spent resin disposed is based on the sum of the mass of the three glass streams, and information on the average annual glass production and estimated annual volume of spent resin waste package generation. The spent resin waste package annual volume is 1200 cubic feet for a total glass generation rate of 36 metric tons per day (Gibbs 2004). The volume factor is calculated as follows:

Volume factor (spent resin)

$$= 1200 \text{ ft}^3\text{/yr x } 0.02832 \text{ m}^3\text{/ft}^3 \text{ / (36 MT/d x 365.25 d/yr x 1000 kg/MT)}$$
$$= 2.585\text{E-06 m}^3 \text{ (spent resin)/kg glass}$$

The volume factor is multiplied by the sum of the three glass product total mass quantities to estimate the volume of spent resin disposed.

Volume Factor for LAW HEPA1 and LAW HEPA2

These two HTWOS streams are summed and treated as one secondary stream. The activity associated with processing for the year of interest is the sum of the amounts for the two streams. The volume factor for the summed stream is based on generation of 97.4 ft^3 of LAW HEPA secondary waste for a processing period of 4320 hours (Knauss 2005), and a daily ILAW production rate of 30 MT/day (Gibbs 2004). The volume factor is calculated as follows:

Volume factor (LAW HEPAs)

$$= 97.4 \text{ ft}^3\text{/yr x } 0.02832 \text{ m3/ ft}^3 \text{ x 8766 hr/yr / 4320 operating hr/yr}$$
$$\text{/ (30 MT/d x 365.25 d/yr x 1000 kg/MT)}$$

= 5.108E-07 m^3 (LAW HEPA)/kg ILAW glass

The volume factor is multiplied by the quantity of ILAW glass product mass (HTWOS stream "HTWOS-LAW-CANISTERS") to estimate the volume of LAW HEPAs disposed.

Volume Factor for Used LAW Volatile Organic Carbon Beds

The volume factor for the used volatile organic carbon bed solid waste is based on generation of 420 ft^3 of waste every 2 years (Knauss 2005), and an ILAW glass production rate of 30 MT per day (Gibbs 2004). The volume factor is calculated as follows:

Volume factor (LAW Volatile Organic Carbon Beds)

= 420 ft^3 x 0.02832 m3/ ft^3 / 2 yr / (30 MT/d x 365.25 d/yr x 1000 kg/MT)
= 5.428E-07 m^3 (VOC)/kg ILAW glass

The volume factor is multiplied by the quantity of ILAW glass product mass (HTWOS stream "HTWOS-LAW-CANISTERS") to estimate the volume of used LAW Volatile Organic Carbon Beds sent to solid waste disposal.

Volume Factor for HLW HEPA1 and HLW HEPA2

These two HTWOS streams are summed and treated as one secondary stream. The activity associated with processing for the year of interest is the sum of the amounts for the two streams. The volume factor for the summed stream is based on generation of 294 ft^3 of HLW HEPA secondary waste for a processing period of 5 years (Knauss 2005), and a daily HLW production rate of 6 MT/day (Gibbs 2004). The volume factor is calculated as follows:

Volume factor (HLW HEPAs)

= 294 ft^3 x 0.02832 m3/ ft^3 / 5 yr / (6 MT/d x 365.25 d/yr x 1000 kg/MT)
= 7.599E-07 m^3 (HLW HEPA)/kg HLW glass

The volume factor is multiplied by the quantity of HLW glass product mass (HTWOS stream "HTWOS-HLW-CANISTERS") to estimate the volume of HLW HEPAs disposed.

Volume Factor for Used HLW Volatile Organic Carbon Beds

The volume factor for the used volatile organic carbon bed solid waste is based on generation of 454 ft3 of waste every 2.8 years (Knauss 2005), and an HLW glass production rate of 6 MT per day (Gibbs 2004). The volume factor is calculated as follows:

Volume factor (HLW Volatile Organic Carbon Beds)

= 454 ft^3 x 0.02832 m3/ ft^3 / 2.8 yr / (6 MT/d x 365.25 d/yr x 1000 kg/MT)
= 2.095E-06 m^3 (VOC)/kg HLW glass

The volume factor is multiplied by the quantity of HLW glass product mass (HTWOS stream "HTWOS-HLW-CANISTERS") to estimate the volume of used HLW Volatile Organic Carbon Beds sent to solid waste disposal.

Volume Factor for Spent I/Ag Mordenite Beds

The volume factor for the used spent iodine/silver mordenite beds solid waste is based on generation of 414 ft^3 of solid waste in a 5 year period (Knauss 2005) and a HLW glass generation rate of 6 MT per day (Gibbs 2004). The volume factor is calculated as follows:

Volume factor (Spent I/Ag Mordenite Beds)

= 414 ft^3 x 0.02832 m3/ ft^3 / 5 yr / (6 MT/d x 365.25 d/yr x 1000 kg/MT)
= 1.070E-06 m^3 (spent I/Ag beds)/kg HLW glass

The volume factor is multiplied by the quantity of HLW glass product mass (HTWOS stream "HTWOS-HLW-CANISTERS") to estimate the volume of used Volatile Organic Carbon Beds sent to solid waste disposal.

Volume of ETF solid and liquid Effluent

The volume of ETF solid and liquid waste stream was generated from process stream estimates for the BV and TRU packaging processes and the 242-A Evaporator waste stream to LERF generated by the HTWOS simulation, the pretreatment liquid effluent stream to the ETF and other process information. The annual waste stream feed volumes for BV, TRU packaging and 242-A Evaporator are presented in Table A-2.

Table A-2. Annual Waste Feed Stream Volumes

	BV Waste Feed (m^3)		CH/RH TRU Packaging Waste Feed (m^3)		242-A Evaporator Feed to LERF (m^3)	
Year	Liquid	Solid	Liquid	Solid	Liquid	Solid
2004	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.13E+02	0.00E+00
2005	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2006	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E+04	0.00E+00
2007	0.00E+00	0.00E+00	1.01E+03	7.46E+01	6.41E+03	0.00E+00
2008	2.27E-07	0.00E+00	2.93E+03	1.38E+02	5.96E+03	0.00E+00
2009	0.00E+00	0.00E+00	1.59E+03	7.15E+01	1.55E+03	0.00E+00
2010	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E+02	0.00E+00
2011	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E+02	0.00E+00
2012	9.54E+03	0.00E+00	0.00E+00	0.00E+00	6.31E+04	0.00E+00
2013	3.93E+03	0.00E+00	2.98E+03	1.16E+02	3.20E+03	0.00E+00
2014	2.44E+03	0.00E+00	3.03E+03	2.34E+02	4.55E+03	0.00E+00
2015	3.07E+03	0.00E+00	3.72E+03	2.36E+02	3.10E+02	0.00E+00
2016	1.02E+03	0.00E+00	0.00E+00	0.00E+00	4.28E+02	0.00E+00
2017	1.71E+03	0.00E+00	0.00E+00	0.00E+00	3.10E+02	0.00E+00
2018	5.77E+03	0.00E+00	0.00E+00	0.00E+00	3.10E+02	0.00E+00

Table A-2. Annual Waste Feed Stream Volumes

Year	BV Waste Feed (m^3)		CH/RH TRU Packaging Waste Feed (m^3)		242-A Evaporator Feed to LERF (m^3)	
	Liquid	Solid	Liquid	Solid	Liquid	Solid
2019	1.10E+04	0.00E+00	0.00E+00	0.00E+00	3.49E+02	0.00E+00
2020	1.14E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2021	1.67E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2022	1.57E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2023	1.48E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2024	1.47E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2025	1.01E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2026	4.61E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2027	6.25E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2028	1.08E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2029	5.25E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2030	8.36E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Totals	1.40E+05	0.00E+00	1.53E+04	8.70E+02	1.01E+05	0.00E+00

Volume Factor for BV Secondary Waste Stream Contribution to ETF Waste Stream

The volume factor for the BV secondary waste stream contribution to the ETF waste stream is based on an estimate of 5.91 m^3 of ETF feed volume per m^3 of BV feed volume (Boomer 2004). The conversion factors of ETF feed volume to liquid and solid waste volumes are from Lueck (2005).

Volume factor (liquid waste stream from ETF)

= 5.91 m^3 * 0.999 / m^3 (BV feed volume)
= 5.90 m^3 (ETF liquids)/ m^3 (BV feed volume)

Volume factor (solid waste from ETF)

= 5.91 m^3 * 0.0034375 / m^3 (BV feed volume)
= 2.03E-02 m^3 (ETF solids)/ m^3 (BV feed volume)

Volume Factor for TRU Packaging Secondary Waste Stream Contribution to ETF Waste Stream

The volume factor for the TRU packaging secondary waste stream contribution to the ETF waste stream is based on an estimate of 0.928 m^3 of ETF feed volume per m^3 of TRU packaging feed volume (Honeyman 2004). The conversion factors of ETF feed volume to liquid and solid waste volumes are from Lueck (2005).

Volume factor (liquid waste stream from ETF)

= 0.928 m^3 * 0.999 / m3 (BV feed volume)
= 0.927 m^3 (ETF liquids)/ m^3 (BV feed volume)

Volume factor (solid waste from ETF)

= 0.928 m^3 * 0.0034375 / m3 (BV feed volume)
= 3.19E-03 m^3(ETF solids)/ m^3 (BV feed volume)

Volume Factor for 242-A Evaporator Secondary Waste Stream Contribution to ETF Waste Stream

The volume factor for the 242-A Evaporator secondary waste stream contribution to the ETF waste stream is based on the conversion factors of ETF feed volume to liquid and solid waste volumes are from Lueck (2005).

Volume factor (liquid waste stream from ETF)

= 0.999 m^3 (ETF liquids)/ m^3 (242-A Evaporator feed volume to LERF)

Volume factor (solid waste from ETF)

= 0.0034375 m^3 (ETF solids)/ m^3 (242-A Evaporator feed volume to LERF)

The result of the above analysis yields the total disposal volumes for ETF liquid and solid waste streams as shown in Table A-3.

Table A-3. ETF Annual Disposal Volumes for Liquid and Solid Effluents

Year	Disposal Volume (m^3)	
	ETF Liquid	ETF Solid
2004	5.12E+02	1.76E+00
2005	0.00E+00	0.00E+00
2006	1.31E+04	4.51E+01
2007	7.41E+03	2.55E+01
2008	8.80E+03	3.03E+01
2009	3.09E+03	1.06E+01
2010	3.09E+02	1.06E+00
2011	3.09E+02	1.06E+00
2012	1.19E+05	4.11E+02
2013	2.93E+04	1.01E+02
2014	2.20E+04	7.57E+01
2015	2.21E+04	7.60E+01
2016	6.47E+03	2.23E+01
2017	1.04E+04	3.59E+01
2018	3.44E+04	1.18E+02
2019	6.54E+04	2.25E+02
2020	6.73E+04	2.32E+02
2021	9.85E+04	3.39E+02
2022	9.26E+04	3.19E+02
2023	8.75E+04	3.01E+02
2024	8.69E+04	2.99E+02
2025	5.96E+04	2.05E+02
2026	2.72E+04	9.37E+01
2027	3.69E+04	1.27E+02
2028	6.38E+03	2.20E+01
2029	3.10E+04	1.07E+02
2030	4.94E+03	1.70E+01
Totals	9.41E+05	3.24E+03

<u>Volume Factor for PT liquids to LERF contribution to ETF Solids</u>

The volume factor for pre-treatment liquid stream to LERF as a contributor to ETF Solid is based on generation of 2,255 gallons per month of pre-treatment liquid waste (Lueck 2005) and 28.2 MT glass (ILAW and HLW) (Gibbs 2004).

The volume factor is calculated as follows:

Volume factor (PT Liquids to ETF)

= 2,255 gal/ month * 0.0037854 m^3/gal. / (28.2 MT/d * 1000 kg/MT * 365.25/12)

= 9.944E-6 m^3/kg glass

The volume factor is multiplied by the quantity of ILAW and HLW glass product from the HTWOS streams to estimate the volume of ETF solid generated by processing the Pre-treatment facility liquid effluents to LERF each year.

Volume Factor for PT liquids to LERF contribution to ETF Liquids

The volume factor for pre-treatment liquid stream to LERF as a contributor to ETF liquid is based on generation of 655,000 gallons per month of pre-treatment liquid waste (Lueck 2005) and 28.2 MT glass (ILAW and HLW) (Gibbs 2004).

The volume factor is calculated as follows:
Volume factor (PT Liquids to ETF)

= 656,000 gal/ month * 0.999 * 0.0037854 m^3/gal. / (28.2 MT/d * 1000 kg/MT * 365.25/12)
= 2.890E-3 m^3/kg glass

The volume factor is multiplied by the quantity of ILAW and HLW glass product from the HTWOS streams to estimate the volume of ETF liquid generated by processing the Pre-treatment facility liquid effluents to LERF each year.

Volume Factor for Bulk Vitrification Product

The volume factor for bulk vitrification product is based on placing 42.6 MT of product in a package of 56 m^3 in volume (Nikkhah 2005). The volume factor is calculated as follows:

Volume factor (Bulk Vitrification Product)

= 56 m^3 / 42.6 MT / 1000 kg/MT
= 1.315E-3 m^3/kg BV Product

The volume factor is multiplied by the quantity of BV product from the HTWOS stream ("BV PRODUCT") to estimate the volume of bulk vitrification product generated each year.

Volume Factor for HLW Failed Melters

The failed HLW melters are assumed to be packaged in overpack containers of dimension 4.38 m high x 5.29 m long x 5.29 m wide (Puigh et al. 2004), for a volume of 122.6 m^3 per container. The rate of melter failure is assumed to be 2 melters in 5 years under an HLW glass production rate of 5 MTG/d (Kirkbride et al. 2005 – pg A-16, footnote 18). The volume factor is calculated as follows:

Volume factor (HLW failed melters)

= (122.6 m3/melter x 2 melters/5 yrs)
/ (5 MT/d * 365.25d/yr * 1000 kg/MT)
= 2.685E-5 m^3/kg HLW glass

The volume factor is multiplied by the quantity of HLW glass product from the HTWOS stream (“HTWOS-HLW-CANISTERS”) to estimate the volume of HLW failed melters generated each year. Note this approach leads to a fraction of a waste package per year and so represents the average volume loading into the IDF trench.

Volume Factor for LAW Failed Melters

The failed LAW melters are assumed to be packaged in overpack containers of dimension 4.86 m high x 6.79 m long x 9.38 m wide (Puigh, R.J. 2004), for a volume of 309.5 m^3 per container. The rate of melter failure is assumed to be 2 melters in 5 years under an LAW glass production rate of 34 MTG/d (Kirkbride et al. 2005 – pg A-14, footnote 11). The volume factor is calculated as follows:

Volume factor (HLW failed melters)

= (309.5 m^3/melter x 2 melters/5 yrs)
/ (34 MT/d * 365.25d/yr * 1000 kg/MT)
= 9.969E-6 m^3/kg LAW glass

The volume factor is multiplied by the quantity of LAW glass product from the HTWOS stream (“HTWOS-LAW-CANISTERS”) to estimate the volume of LAW failed melters generated each year. Note this approach leads to a fraction of a waste package per year and so represents the average volume loading into the IDF trench.

Volume Factor for LAW Canisters

The volume factor for LAW glass canisters is based on a total ILAW glass waste mass of 203,850 MT, an ILAW glass density of 2.6 MT/m^3 and a fill fraction of 85% glass into the waste package (Kirkbride et al. 2005). (The volume associated with the metal canister is small relative to the waste volume and has been ignored in the package volume factor estimate.) The volume factor is calculated as follows:

Volume factor (LAW glass canisters)

= {[203,850 MT/ 2.6 MT/m^3]/0.85} / 203,850 MT*1000 MT/kg
= 4.525E-4 m^3/kg LAW glass

The volume factor is multiplied by the quantity of LAW glass product from the HTWOS stream (“HTWOS-LAW-CANISTERS”) to estimate the volume of LAW canisters generated each year.

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APPENDIX B - PEER REVIEW CHECKLIST

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Page__1__ of __2__

Subject: Inventory Data Package for the 2005 Integrated Disposal Facility Performance Assessment

The subject document has been reviewed by the undersigned.

The reviewer reviewed and verified the following items as applicable.

(see attached checklist on next page)

Documents Reviewed: RPP-20692, Revision 1

Analysis Performed By: R.J. Puigh and Marc Wood

- Design Input
- Basic Assumptions
- Approach/Design Methodology
- Consistency with item or document supported by the calculation
- Conclusion/Results Interpretation
- Impact on existing requirements
- ____

Reviewer (printed name, signature, and date) Paul Rittman Paul Rittman 7-8-05

Organizational Manager (printed name, signature and date) Raymond Puigh Raymond J Puigh 7/8/05

Practice 134 290 1112

Publication Date 22Nov99

Attachment 02 - Sheet 1 of 1

FLUOR DANIEL NORTHWEST

TECHNICAL PEER REVIEWS

CHECKLIST FOR TECHNICAL PEER REVIEW

Document Reviewed: RPP-20692, Revision 1

Title: Inventory Data Package for the 2005 Integrated Disposal Facility Performance Assessment

Author: R.J. Puigh and M.I. Wood

Date: 7-7-05

Scope of Review: Entire document

Yes No* NA

[X] [ ] [ ] ** Previous reviews complete and cover analysis, up to scope of this review, with no gaps.
[X] [ ] [ ] Problem completely defined.
[ ] [ ] [X] Accident scenarios developed in a clear and logical manner.
[X] [ ] [ ] Necessary assumptions explicitly stated and supported.
[X] [ ] [ ] Computer codes and data files documented.
[ ] [ ] [X] Data used in calculations explicitly stated in document.
[X] [ ] [ ] Data checked for consistency with original source information as applicable.
[ ] [ ] [X] Mathematical derivations checked including dimensional consistency of results.
[X] [ ] [ ] Models appropriate and used within range of validity, or use outside range of established validity justified.
[X] [ ] [ ] Hand calculations checked for errors. Spreadsheet results should be treated exactly the same as hand calculations.
[ ] [ ] [X] Software input correct and consistent with document reviewed.
[ ] [ ] [X] Software output consistent with input and with results reported in document reviewed.
[ ] [ ] [X] Limits/criteria/guidelines applied to analysis results are appropriate and referenced. Limits/criteria/guidelines checked against references.
[X] [ ] [ ] Safety margins consistent with good engineering practices.
[X] [ ] [ ] Conclusions consistent with analytical results and applicable limits.
[X] [ ] [ ] Results and conclusions address all points required in the problem statement.
[X] [ ] [ ] Format consistent with applicable guides or other standards.
[ ] [X]** Review calculations, comments, and/or notes are attached.
[X] [ ] [ ] Document approved (for example, the reviewer affirms the technical accuracy of the document).

Paul Rittmann Paul Rittmann — 7-7-05

Reviewer (printed name and signature) — Date

* All "no" responses must be explained below or on an additional sheet.

** Any calculations, comments, or notes generated as part of this review should be signed, dated, and attached to this checklist. The material should be labeled and recorded in such a manner as to be intelligible to a technically qualified third party.

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