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Preliminary Tank Characterization Report for Single-Shell Tank 241-TY-103: Best-Basis Inventory

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Abstract: An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities. As part of this effort, an evaluation of available information for single-shell tank 241-TY-103 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

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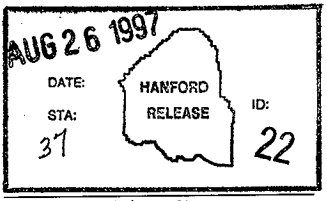

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PRELIMINARY TANK CHARACTERIZATION REPORT FOR SINGLE-SHELL TANK 241-TY-103: BEST-BASIS INVENTORY

July 1997

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PRELIMINARY TANK CHARACTERIZATION REPORT FOR SINGLE-SHELL TANK 241-TY-103: BEST-BASIS INVENTORY

This document is a preliminary Tank Characterization Report (TCR). It only contains the current best-basis inventory (Appendix D) for single-shell tank 241-TY-103. No TCRs has been previously issued for this tank, and current core sample analyses are not available. The best-basis inventory, therefore, is based on an engineering assessment of waste type, process flowsheet data, early sample data, and/or other available information.

The *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes* (Kupfer et al. 1997) describes standard methodology used to derive the tank-by-tank best-basis inventories. This preliminary TCR will be updated using this same methodology when additional data on tank contents become available.

REFERENCE

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-TY-103

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-TY-103

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for single-shell tank 241-TY-103 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available chemical and radiological inventory estimates for single shell tank 241-TY-103 include:

- 1985 composited core samples of the existing tank waste (Weiss and Mauss 1987)
- An inventory estimate generated by the Hanford Defined Waste (HDW) model (Agnew et al. 1997a)
- Estimates of the layers contained within 241-TY-103 based upon core samples of tanks 241-BX-109 (Field 1996) containing UR (Uranium Recovery waste), 241-TY-104 (Bell 1997) containing 1CFeCN (first cycle ferrocyanide treated waste), and 241-U-105 (Weiss 1988) containing 242-T evaporator salt cake wastes.

The best-basis inventory is primarily based upon the 1985 core samples, augmented by radionuclide and chemical component data from the HDW model.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The tank 241-TY-103 chemical and radionuclide inventory predicted by the HDW model (Agnew et al. 1997a) is presented in Tables D2-1 and D2-2. The chemical species are reported without charge designation per the best-basis inventory convention.

Table D2-1. Estimated Nonradioactive Analyte Inventories for Tank 241-TY-103 (Effective May 30, 1997). (2 Sheets)

Analyte	HDW model (kg)[a]	1985 Core Sample Basis Assessment (kg)[b]
Al	4,710	2,972
Bi	7,950	27,200
Ca	5,050	NR
Cl	1,460	1,158
TIC as CO_3	11,400	6,168
Cr	746	977
F	995	1,397
Fe	21,400	23,984
Hg	0.335	NR
K	389	NR
La	1.97 E-05	NR
Mn	19.6	168
Na	119,000	115,200
Ni	2,060	2,345
NO_2	17,800	42,204
NO_3	231,000	148,900
OH	46,400	164[c]
Pb	32.2	518
P as PO_4	10,200	80,053
P	3,327	26,108
Si	307	5,684
S as SO_4	4,850	9,591
S	1,619	3,201
Sr	0	0.693
TOC	1,915	1,154
Total U	23,600	18,034
Zr	253	248
Density (g/mL)	1.52	1.688
Heat load (kW)	0.705	1.056[d]

Table D2-1. Estimated Nonradioactive Analyte Inventories for Tank 241-TY-103 (Effective May 30, 1997). (2 Sheets)

Analyte	HDW model (kg)[a]	1985 Core Sample Basis Assessment (kg)[b]
Heat Load Calculated (kW)	0.71	0.71

[a] Hanford Defined Waste (Agnew et al. 1997a)
[b] Weiss and Mauss (1987)
[c] Free hydroxide
[d] Kummerer (1995).

Table D2-2. Estimated Radioactive Analyte Inventories for Tank 241-TY-103 Effective May 30, 1997 (Decayed to January 1, 1994). (2 Sheets)

Analyte	HDW model (Ci)[a]	1985 core sample basis inventory assessment (Ci)[b]
^{3}H	24.5	NR
^{14}C	3.51	1.038
^{59}Ni	0.441	NR
^{60}Co	3.72	1.531
^{63}Ni	42.0	NR
^{79}Se	0.364	NR
^{90}Sr	49,600	94,293
^{90}Y	49,600	94,293
^{93m}Nb	1.30	NR
^{93}Zr	1.78	NR
^{99}Tc	25.0	16.4
^{106}Ru	6.29 E-04	NR
^{113m}Cd	8.98	NR
^{125}Sb	15.6	NR
^{126}Sn	0.548	NR
^{129}I	0.0482	12,171
^{134}Cs	0.257	NR
^{137}Cs	79,200	14,947
^{137m}Ba	74,900	14,140
^{151}Sm	1,280	NR
^{152}Eu	0.552	NR
^{154}Eu	59.1	NR

Table D2-2. Estimated Radioactive Analyte Inventories for Tank 241-TY-103 Effective May 30, 1997 (Decayed to January 1, 1994). (2 Sheets)

Analyte	HDW model (Ci)[a]	1985 core sample basis inventory assessment (Ci)[b]
^{155}Eu	35.6	NR
^{226}Ra	2.18 E-05	NR
^{227}Ac	1.36 E-04	NR
^{228}Ra	0.0305	NR
^{229}Th	7.04 E-04	NR
^{231}Pa	5.41 E-04	NR
^{232}Th	0.00185	NR
^{232}U	0.152	NR
^{233}U	0.582	NR
^{234}U	7.75	NR
^{235}U	0.342	NR
^{236}U	0.0820	NR
^{237}Np	0.0923	NR
^{238}Pu	0.352	NR
^{238}U	7.90	NR
^{239}Pu	31.8	NR
^{240}Pu	3.42	NR
$^{239/240}Pu$	35.2	186
^{241}Am	5.99	33.5
^{241}Pu	18.4	NR
^{242}Cm	0.0173	NR
^{242}Pu	9.13 E-05	NR
^{243}Am	2.01 E-04	NR
^{243}Cm	0.00135	NR
^{244}Cm	0.0134	NR

HDW = Hanford Defined Waste
NR = Not reported
[a] Agnew et al. (1997a)
[b] Weiss and Mauss (1987), decayed to January 1, 1994.

D3.0 COMPONENT INVENTORY EVALUATION

D3.1 CONTRIBUTING WASTE TYPES

The HDW model (Agnew et al. 1997a), the Sort on Radioactive Waste Type (SORWT) model (Hill et al. 1995) and the waste tank summary report (Hanlon 1997) are not consistent as to the waste types present in tank 241-TY-103, but are consistent with regard to overall volume at 613 kL (162 kgal) of solids with 19 kL (5 kgal) of drainable liquor. Anderson (1990) is roughly consistent with each of these estimates.

The HDW model refers to uranium stripped tributyl phosphate (TBP) streams as uranium recovery (UR) waste, ferrocyanide treated first cycle waste as 1CFeCN waste, and 242-T Evaporator salt cakes or slurries formed from 1965 to 1976 as T2 SltCk on a global basis, or SMMT2 when calculated for an individual tank by the supernatant mixing model (SMM). The HDW model predicts 231 kL (61 kgal) of UR waste underlying 178 kL (47 kgal) of 1CFeCN waste and 204 kL (54 kgal) of SMMT2 waste, respectively.

The SORWT model (Hill et al. 1995) lists TBP (UR), first cycle bismuth phosphate ferrocyanide scavenged (1C-F 1CFeCN), cladding waste (CW), high-level reduction and oxidation (REDOX) waste, and miscellaneous wastes as being present within the tank at a total volume of 613 kL (162 kgal) and drainable liquid of 19 kL (5 kgal). Hanlon (1997) also indicates the same volumes as noncomplexed wastes within 241-TY-103. Anderson (1990) reports the accumulation of solids from first cycle scavenged waste and cladding waste while receiving supernatants from UR, 1C scavenged, dilute supernatants, plutonium-uranium extraction (PUREX) organic wash wastes (OWW), REDOX and REDOX ion exchange wastes, and B Plant low-level wastes.

D3.2 EVALUATION OF TECHNICAL FLOWSHEET INFORMATION

Waste transaction records (Agnew et al. 1997b) show that single-shell tank 241-TY-103 was the first receiver tank for UR wastes from the third quarter of 1953 through the fourth quarter of 1954 with total receipts of 8,108 kL (2,141 kgal). Tank 241-TY-104 received cascades of 5,326 kL (1,406 kgal) from 241-TY-103, and 2,373 kL (626 kgal) were transferred to tank 241-TX-111. The deposition of precipitates from the UR wastes is expected.

Waste transaction records (Agnew et al. 1997b) show that tank 241-TY-103 received 7,976 kL (2,106 kgal) of ferrocyanide treated first cycle waste again as the first receiver tank from the first quarter of 1955 through the third quarter of 1959 with the majority of inflows by the first quarter of 1956. Discharges of the 1CFeCN supernatants were to disposal cribs, including T-026 and the TY-1 cavern. The deposition of precipitates from the 1CFeCN wastes is expected.

Tank 241-TY-103 began receiving supernatant liquors in the fourth quarter of 1959 from tanks including 241-TY-106 (UR waste supernatants) and 241-TX-118 (evaporator bottom supernatants) through the third quarter of 1961. The tank volume remained static until the third quarter of 1967 when it was used for evaporation feeds and products. Total inflows of these supernatant liquors was approximately 46,000 kL (12,144 kgal) generally received from tanks 241-TX-118, 241-AX-102, 241-BX-102, 241-BX-103, T Tank Farm tanks including 241-T-103, 241-T-104, 241-T-106, 241-T-107, 241-T-109, and 241-T-112, as well as tanks 241-S-107, 241-S-104, 241-U-111, and 241-U-112. Transfers of the supernatant liquors were primarily to tank 241-TX-118. Final waste supernatant removal occurred in the fourth quarter of 1978 with salt well pumping to tank 241-SY-102 during the third and fourth quarters of 1982. Although moderately dilute, these evaporator bottom supernatants may have deposited a salt cake layer consistent with what Agnew et al. (1997a) terms Supernatant Mixing Model 242-T Evaporator salt cake generated from 1965 until 1976 (SMMT2) waste.

D3.3 TANK 241-TY-103 CORE SAMPLE ANALYSIS

Six cores, of three to four segments each, were withdrawn from six risers of tank 241-TY-103 during August and September 1985. Of these cores, two were prepared for analysis of composite material by equal fraction of recovered solids by segment (Weiss and Mauss 1987). Seven samples of individual segment or combined segment drainable liquids were incompletely analyzed due to small volumes of this liquid.

The composite solid samples were analyzed for metals, ionic species, and radionuclides directly, after water digestion of the original sample, after acid digestion of the water insoluble residue, and after fusion of the acid-insoluble fraction in HNO_3-HF-HCl. The fusion dissolved all but traces of the acid-insoluble residue. Metals were determined by inductively coupled plasma spectroscopy (ICP), ionic constituents were determined by ion chromatography, and free hydroxide determined by titration. Carbonate and total organic carbon analyses were conducted. Radionuclides were determined by total alpha, total beta, and total gamma with individual speciation for $^{239/240}Pu$, ^{14}C, ^{90}Sr, ^{99}Tc, ^{241}Am, ^{60}Co, ^{137}Cs, and ^{129}I.

Drainable liquor samples were generally analyzed by ion chromatography and total and speciated gamma energy. The samples were intermittently analyzed for $^{239/240}Pu$ and total alpha, free hydroxide, uranium, carbonate, total organic carbonate, and ^{99}Tc and total beta energy.

The 1985 core samples are considered to be generally representative of the overall sludge inventory, but cannot be used to confirm the stratification of reported solids deposition within the tank (Agnew et al. 1997a and 1997b) because of the composite nature of the analysis.

Table D3-1 provides data on the segment recoveries from the first two cores, together with the sludge depth as based on sample recovery. Apparent densities, derived from sample masses and core sample lengths for the 2.54 cm (1 in.) core sampler, were substantially lower than laboratory analyses which averaged 1.7 g/mL (Weiss and Mauss 1987). The average sludge depth from cores 1 and 2 (average radial distance 3 m from center), was determined to be 145.7 cm. (57.4 in.) with a resultant sludge volume estimate of 598.1 kL (158.0 kgal). This sludge volume estimate corresponds well with other sources at 613.2 kL (162.0 kgal) (Agnew et al. 1997a, Hanlon 1997, Anderson 1990) as the full volume of the tank dish of 45.4 kL (12 kgal) is not measured at the risers for these cores. Tank waste volume to be applied throughout the remainder of this document is that of 613.2 kL (162.0 kgal).

Table D3-1. Tank 241-TY-103 Core Segment Recoveries and Apparent Density. (2 Sheets)

Core[a]	Riser/Position/ Segment	Sample length (cm)	Date	Sample (g)	Drainable liq.(g) (est.)	Sample apparent density (g/mL)	Recovery (%)
1	8 / 90 / 1	5.08	08/21/85	38.73		1.505	61.5
	8 / 90 / 2	27.94	08/21/85	184.95		1.306	57.9
	8 / 90 / 3	48.26	08/21/85	272.37		1.114	100.0
	8 / 90 / 4	39.37	08/21/85	274.93		1.378	93.9
	Total	120.65		770.98	17.08	1.261	82.3
2	8 / 180 / 2	48.26	08/21/85	336.2		1.375	100.0
	8 / 180 / 3	48.26	08/21/85	336.2		1.375	100.0
	8 / 180 / 4	45.72	08/21/85	283.22	6.82	1.223	94.7
	Total	142.24		955.62		1.326	98.2

[a] Weiss and Mauss (1987).

The seven segments of solids from the first two cores were analyzed as two composite samples. The first 1985 core consisted of four segments which were combined to make up a composite sample of the waste. The second 1985 core consisted of three segments which were combined to make up a composite sample of the waste. Five percent of each segment mass was used to form the respective composite. The summary of the solids analysis is provided in Table D3-2. The high recoveries of these segments allow application of the segments to represent 100 percent of the sludge, but do not allow simple separation of historically present sludge layers attributed to UR, 1CFeCN, and SMMT2 wastes (Agnew et al. 1997a and 1997b).

Drainable liquors were recovered and analyzed as seven samples. Of particular interest, the combined drainable liquors from the segments of the first core were analyzed and reported (Weiss and Mauss 1987). The seven drainable liquor samples were analyzed for several common gamma emitting components and other materials. Their analysis is detailed in Table D3-3.

The constituents for which the liquors were analyzed were seen to be fairly uniform across the various locations and depths at which they were analyzed. The core solids and drainable liquor analyses are combined through application of the relative masses of core 1 solids and drainable liquor. These recovered masses indicate that the drainable liquor constituted 2.5% of the overall waste mass present in the tank. This assessment is consistent with estimates of drainable liquor (Brevick et al. 1997, Hanlon 1997). The composite

sample analysis where the constituent was analyzed in each medium was estimated by application of the mass percent assigned. Table D3-4 summarizes the composite core sample analysis for tank 241-TY-103.

Table D3-2. Tank 241-TY-103 1985 Core Sample Sludge Analysis Results. (2 Sheets)

Tank 241-TY-103 Sludge Analyses						Mean
Analyte	Sample	31XC0000		32XC0000		
	Unit	Total	Max Total[a]	Total	Max Total[a]	
Al	*M*	0.0936	0.0936	0.2656	0.2656	0.18
Ba	*M*	0.0072	0.0072	0.0062	0.0062	0.00668
Bi	*M*	0.1963	0.1965	0.2226	0.2280	0.212
Cd	*M*	4.60 E-05	8.65 E-05	7.36 E-05	1.15 E-04	1.01 E-04
Cr	*M*	0.0285	0.0285	0.0328	0.0328	0.0306
Fe	*M*	0.6761	0.6761	0.7245	0.7245	0.7
Pb	*M*	0.0042	0.0043	0.0036	0.0038	0.00408
Mn	*M*	0.0043	0.0050	0.0043	0.0049	0.00462
Ni	*M*	0.0570	0.0570	0.0733	0.0733	0.0651
P	*M*	1.60	1.60	1.15	1.15	1.37
Si	*M*	0.0908	0.0908	0.5692	0.5692	0.33
Ag	*M*	1.97 E-05	5.63 E-05	1.17 E-04	1.42E-04	8.37 E-05
Na	*M*	8.51	8.51	7.83	7.83	8.17
Zr	*M*	0.0078	0.0079	0.0008	0.0010	0.00437
U	*M*	0.1376	0.1376	0.1157	0.1157	0.1267
Cl	*M*	0.0532	0.0532	0.0532	0.0532	0.0532
F	*M*	0.1702	0.1702	0.0000	0.0744	0.104
NO_3	*M*	3.70	3.70	4.15	4.15	3.92
SO_4	*M*	0.138	0.153	0.175	0.175	0.164
NO_2	*M*	2.76	2.76	0.29	0.29	1.53
CO_3	*M*	0.2127	0.2127	0.1276	0.1276	0.1702
TOC	*M*	0.1016	0.1016	0.2116	0.2116	0.1566
OH	*M*	0.0213	0.0213	0.0106	0.0106	0.0160
W/L to 400 °C[b]	*M*	48.3	48.3	49.5	49.5	48.9
W/L to 1,000 °C	*M*	14.0	14.0	14.4	14.4	14.2
Tank vol.	L	613,223.46	NA	613,223.46	NA	613,000
Bulk density	g/mL	1.70	1.70	1.70	1.70	1.70
Part. Density	g/mL	0.689	0.689	0.754	0.754	0.722

Table D3-2. Tank 241-TY-103 1985 Core Sample Sludge Analysis Results. (2 Sheets)

Tank 241-TY-103 Sludge Analyses						Decay Date	
Radionuclides	Sample	31XC0000		32XC0000		9/30/85	1/1/94
	Unit	Total	Max Total[a]	Total	Max Total[a]	Mean	Mean
$^{239/240}Pu$	Ci/L	3.13 E-04	3.23 E-04	2.98 E-04	3.01 E-04	3.12 E-04	3.12 E-04
Total Alpha	Ci/L	NA	1.65 E-05	NA	1.69 E-05	1.67 E-05	NA
^{14}C	Ci/L	NA	1.29 E-06	NA	2.10 E-06	1.69 E-06	1.69 E-06
^{90}Sr	Ci/L	0.196	0.196	0.178	0.178	0.187	0.154
^{99}Tc	Ci/L	2.57 E-05	2.60 E-05	2.79 E-05	2.81 E-05	2.70 E-05	2.70 E-05
Total Beta	Ci/L	0.849	0.849	0.819	0.819	0.834	NA
^{241}Am	Ci/L	NA	6.71 E-05	NA	4.55 E-05	5.63 E-05	5.56 E-05
^{60}Co	Ci/L	2.02 E-06	6.27 E-06	NA	7.93 E-06	5.41 E-06	2.40 E-06
^{137}Cs	Ci/L	0.0183	0.0183	0.0420	0.0420	0.0301	0.0250
^{129}I	Ci/L	NA	8.33 E-05	NA	4.59 E-06	4.39 E-05	4.39 E-05
Total Gamma	Ci/L	1.87 E-02	1.87 E-02	4.18 E-02	4.18 E-02	3.03 E-02	NA

[a] Max Total denotes inclusion of "less-than" values while Total does not include "less-thans."

[b] W/L denotes water loss upon heating to stated temperature.

Table D3-3. Tank 241-TY-103 1985 Core Sample Drainable Liquor Analyses. (2 Sheets)

Tank 241-TY-103 Drainable Liquor Analyses									Mean (incl <)
Analyte	Sample	31XD0000	323D0000	33XD0000	34XD0000	353D0000	354D0000	363D0000	
	Unit	---	---	---	---	---	---	---	
U	*M*	NA	NA	1.64 E-04	NA	NA	NA	NA	1.64 E-04
Cl	*M*	NA	NA	0.0610	0.047	0.053	0.017	0.056	0.0576
F	*M*	NA	NA	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027
NO_3	*M*	NA	NA	3.53	2.89	3.64	4.49	3.71	3.652
SO_4	*M*	NA	NA	0.114	0.075	0.090	0.136	0.150	0.113
NO_2	*M*	0.268	NA	0.297	0.227	0.269	0.395	0.391	0.308
CO_3	*M*	0.067	NA	0.068	NA	NA	NA	NA	0.0675
TOC	*M*	NA	NA	0.1615	NA	NA	NA	NA	0.1615
OH	*M*	NA	NA	0.001	NA	0.017	0.001	NA	0.0063
pH		10	NA	10.9	10.4	12.2	11.1	9.48	10.7
W/L to 400 °C[a]	*M*	47.6	47.5	46.9	NA	NA	NA	NA	47.35
Volume	mL	15.6	14.8	NA	NA	44.5	14.0	35.0	NA
Radiation	mR/h	1.8	11.2	1.8	4	10	6	3	5.4
Bulk density	g/mL	1.22	1.24	1.24	NA	NA	NA	NA	1.233

Table D3-3. Tank 241-TY-103 1985 Core Sample Drainable Liquor Analyses. (2 Sheets)

Tank 241-TY-103 Drainable Liquor Analyses									Decay Date	
Radionuclides	Sample	31XD0000	323D0000	33XD0000	34XD0000	353D0000	354D0000	363D0000	09/30/85	01/01/94
	Unit	---	---	---	---	---	---	---	Mean (incl <)	Mean (incl <)
$^{239/240}Pu$	Ci/L	NA	<6.70 E-07	NA	NA	NA	NA	NA	<6.70 E-07	<6.70 E-07
Total Alpha	Ci/L	<4.07 E-07	NA	NA	NA	NA	NA	NA	<4.07 E-07	NA
^{99}Tc	Ci/L	NA	NA	1.62 E-05	NA	NA	NA	NA	1.62 E-05	1.62 E-05
Total Beta	Ci/L	2.19 E-04	NA	0.00517	NA	NA	NA	NA	0.00269	NA
^{241}Am	Ci/L	<3.96 E-07	<5.60 E-05	<4.15 E-06	<1.31 E-05	<1.55 E-05	<1.06 E-05	<2.24 E-06	<1.46 E-05	<1.44 E-05
^{60}Co	Ci/L	1.07 E-04	<1.10 E-05	1.67 E-06	4.04 E-07	<5.09 E-07	<1.98 E-06	4.14 E-06	<1.81 E-05	6.13 E-06
^{137}Cs	Ci/L	9.26 E-06	<1.50 E-05	2.96 E-03	0.00317	0.00454	0.00212	6.43 E-04	0.0019	0.0016
^{129}I	Ci/L	NA	NA	NA	NA	NA	NA	8.02 E-01	0.802	0.802
Total Gamma	Ci/L	1.10 E-05	<8.20 E-05	0.0030	0.0032	0.0045	0.0021	NR	0.0022	NA

[a] W/L denotes water loss upon heating to stated temperature.

Table D3-4. Tank 241-TY-103 1985 Core Sample Composite Inventory Estimate. (2 Sheets)

Decayed to	01/01/94	Solids	Drainable liquor	Composite
	Fraction	0.975	0.025	
Analyte	Unit	Mean	Mean	Inventory (kg/Ci)
Al	M	0.180	NR	2,972
Ba	M	0.007	NR	562.5
Bi	M	0.212	NR	27,200
Cd	M	1.01 E-04	NR	6.95
Cr	M	0.031	NR	977
Fe	M	0.700	NR	23,984
Pb	M	0.0041	NR	518
Mn	M	0.0050	NR	168
Ni	M	0.065	NR	2,345
P	M	1.375	NR	26,108
Si	M	0.330	NR	5,684
Ag	M	9.91 E-05	NR	6.55
Na	M	8.173	NR	115,200
Zr	M	0.0044	NR	248
U	M	0.127	1.64 E-04	18,034
Cl	M	0.053	0.0576	1,158
F	M	0.122	0.027	1,397
NO_3	M	3.923	3.652	148,900
SO_4	M	0.164	0.113	9,591
NO_2	M	1.526	0.308	42,204
CO_3	M	0.170	0.0675	6,168
TOC	M	0.157	0.162	1,154
OH	M	0.016	0.006	164
pH		NR	10.68	NR
W/L to 400 °C	M	48.9	47.3	540,100
W/L to 1,000 °C	M	14.2	NR	156,900
$^{239/240}Pu$	Ci/L	3.12 E-04	6.70 E-07	186
Total Alpha	Ci/L	NR	NR	NR
^{14}C	Ci/L	1.69 E-06	NR	1.038

Table D3-4. Tank 241-TY-103 1985 Core Sample Composite Inventory Estimate. (2 Sheets)

Decayed to	01/01/94	Solids	Drainable liquor	Composite
	Fraction	0.975	0.025	
Analyte	Unit	Mean	Mean	Inventory (kg/Ci)
^{90}Sr	Ci/L	1.54 E-01	NR	94,293
^{99}Tc	Ci/L	2.70 E-05	1.62 E-05	16.4
^{241}Am	Ci/L	5.56 E-05	1.44 E-05	33.5
^{60}Co	Ci/L	2.40 E-06	6.13 E-06	1.531
^{137}Cs	Ci/L	0.025	0.0016	14,947
^{129}I	Ci/L	4.39 E-05	0.802	12,171
Core 1 mass	g	751.9	19.0	771
Tank volume	L	6.132 E+05		613,200
Radiation	mR/h	NR	5.4	NR
Bulk density	g/mL	1.7	1.233	1.688
Part. Density	g/mL	0.722	NR	NR

NR = Not reported
W/L denotes water loss upon heating to stated temperature.

D3.4 COMPOSITION OF TANK 241-TY-103 WASTE

The waste history of this tank is provided in other references (Anderson 1990, Agnew et al. 1997a, Brevick et al. 1997). The tank entered service during the third quarter of 1953, was established as a leaking tank during 1973, and has been inactive since 1976. The tank is estimated to contain 613 kL (162 kgal) of sludge with 19 kL (5 kgal) of drainable interstitial liquors.

D3.4.1 Application of UR Waste Contribution Data

A survey of historical evidence of UR waste layers indicates that tanks 241-C-108, 241-TY-104, 241-TY-105, and 241-BX-109 should contain materials which can be used to provide compositional estimates of UR wastes contained within tank 241-TY-103. However, tank 241-C-108 analysis (Sederburg 1995) did not acquire samples of the UR wastes. The data from 241-TY-105 contained less than 5 percent UR waste in a mixture of other unknown wastes (Kupfer and Schulz 1997). A TCR developed for tank 241-BX-109 (Field 1996) did acquire and analyze core samples from this tank. Tank 241-BX-109 wastes were estimated to be 82 percent UR waste by the HDW model. However, detailed chemical analysis and multicomponent dendrite analysis was unable to determine the presence of

1C2 waste attributed to the tank. The resulting conclusion of the analysis of tank 241-BX-109 (Field 1996) is that the entire tank content is UR waste.

These analyses may and have been applied herein to estimate UR contributions to the inventory of tank 241-TY-103. Additionally UR waste compositions modeled by Agnew et al. (1997a) are applied for 231 kL (61 kgal) of waste to yield an inventory estimate of UR waste contributions within Tables D3-5 and D3-6.

D3.4.2 Application of 1CFeCN Waste Contribution Data

Tank 241-TY-103 is the first in the two tank cascade of tank 241-TY-103 and 241-TY-104. Tank 241-TY-103 first went into operation in the third quarter of 1953, with cascade of tributyl phosphate (TBP) waste to tank 241-TY-104 beginning during that quarter. In the first quarter of 1955, tank 241-TY-103 began receiving ferrocyanide-scavenged first cycle waste (1CFeCN), which was sent to tank 241-TY-104 through the cascade and the pump pit risers. During 1985, four core samples were taken of the 1CFeCN waste contained within tank 241-TY-104. This data may be applied to the tank 241-TY-103 inventory estimate.

Weiss (1988) reports that the core samples taken from tank 241-TY-104 only captured solids from the lower two thirds of the bottom segment. Historically (Agnew et al. 1997a), the entire content of these sampled solids should be 1CFeCN wastes, with no UR wastes. Actual sampling depths cannot be confirmed as continuity of the derived material (100 percent recovery) was incomplete, however, as no solids were derived from the upper segments it may be reasonably anticipated that all solids recovered were from the lower layers rather than collapsed material.

The presumed 1CFeCN layer at the bottom of the tank should be easy to differentiate from the UR waste. The UR waste type is predicted to contain more than ten times the concentrations of Fe and nitrate, and less than ten times the Bi, Si, Zr, U, and fluoride concentrations according to the HDW model. Analytical data from the 1985 core sampling suggests the tank layer model of tank 241-TY-104 is qualitatively correct.

Additionally, samples were withdrawn from tank 241-TY-101 with an expected composition of 61 percent 1CFeCN wastes. However, these samples were fully composited with the T1 salt cake before analysis.

With regard to 1CFeCN wastes, the only available discrete analysis is that derived from the sampling of tank 241-TY-104. The composition of these materials, with an inventory basis of 178 kL (47 kgal) has been applied, in parallel to the HDW model composition of 1CFeCN sludges, to yield inventory estimates of first cycle ferrocyanide scavenged wastes contained within tank 241-TY-103 as columns three and four of Tables D3-5 and D3-6.

With regard to nonradiological components, the tank 241-TY-104 and HDW estimates diverge significantly (greater than a factor of two) with regard to essentially all components with the sample based halides generally being closer than a factor of two of the HDW model. Similarly, the radiological constituents diverge significantly from that estimated by the HDW model, indicating much greater ^{90}Sr and much lower ^{137}Cs activities than anticipated by the HDW model.

D3.4.3 Application of SMMT2 Waste Contribution Data

A survey (Agnew et al. 1997a and 1997b) of identified locations of SMMT2 salt cakes identified twenty-five single-shell tanks containing minor to major quantities of SMMT2 salt cake. Of these, seven have been sampled recently (241-S-107, 241-U-102, 241-U-105, 241-U-107, 241-TX-107, 241-TY-115, and 241-TY-102). Of these seven tanks, only one tank (241-U-105) was sampled and analyzed in a fashion that did not composite all samples. Two core segments (each segment 8) of core 131 and 133 fell within the historical (Agnew et al. 1997a) layer heights to be expected to be entirely SMMT2 waste (Brown and Franklin 1997). An inventory of SMMT2 contributions to tank 241-TY-103 wastes based upon the composition of these samples (and the HDW model estimate) are presented as columns five and six of Tables D3-5 and D3-6.

Nonradiological components of the tank 241-U-105 core segment SMMT2 samples do generally agree within 15 percent of HDW model estimates of SMMT2 wastes which should be present within tank 241-TY-103. Nitrate diverges in this estimate as 155 percent that estimated by the HDW model. Among radiological constituents, only ^{137}Cs agrees well with the HDW model. The sample analysis indicates significantly greater concentrations of ^{60}Co, ^{154}Eu, ^{155}Eu, and ^{241}Am.

D3.4.4 Comparison of Contributions to Sample Analysis for Tank 241-TY-103

Tables D3-5 and D3-6 contain summary inventory estimates of nonradiological and radiological constituents of analysis for UR, 1CFeCN, and SMMT2 waste contributions to tank 241-TY-103 wastes. Columns seven and eight of these tables contain an inventory summation estimate based upon the HDW model and other pertinent tank samples and the inventory of tank 241-TY-103 based upon the full composite core samples of the tank.

In general, few of the summation estimates agree well with the sample data. Iron estimates appear high biased by UR contributions. Sodium estimates appear high biased by UR and 1CFeCN estimates. Nitrite is consistently underestimated and nitrate overestimated by bias in UR waste estimates. Uranium estimates appear to be modestly underestimated without a definable source of that underestimate.

Table D3-5. Tank 241-TY-103 Nonradiological Waste Type Comparison to Sample Basis (2 Sheets)

Analyte [kg]	Uranium recovery layer		1CFeCN waste layer basis		SMMT2 waste layer		Layer estimate summation		
	HDW estimate[a]	BX109 estimate of TY103[b]	HDW estimate[a]	TY104 estimate of TY103[c]	HDW estimate[a]	U105 estimate of TY103[d]	HDW estimate[c]	UR/ 1CFeCN / SMMT2[f]	TY103 sample[g]
Ag	NR	NR	NR	150	NR	NR	NR	150	6.55
Al	NR	848	NR	2,733	5,983	5,149	5,983	8,730	2,972
As	NR	<4.4	NR	NR	NR	16.8	NR	101	NR
B	NR	<84.4	NR	NR	NR	48.5	NR	133	NR
Ba	NR	<84.4	NR	133	NR	8.38	NR	226	563
Bi	NR	<169	7,895	5,338	738	16.8	7,969	5,523	27,200
Ca	3,182	1,035	1,698	NR	488	93.9	5,368	1,129	NR
Cd	NR	<16.9	NR	8.8	NR	5.13	NR	30.8	6.95
Cl	359	451	114	210	1,111	1,687	1,585	2,348	1,158
TIC as CO_3	5,921	NR	2,462	5,623	5,709	10,756	14,092	16,379	6,168
Cr	17.7	46.8	17.3	425	1,423	736	1,458	1,208	977
Cu	NR	<17.3	NR	NR	NR	3.53	NR	20.9	NR
F	NR	<180	722	1,609	311	528	1,033	2,318	1,397
Fe	20,290	7,484	1,055	9,793	207	1,008	21,552	18,285	23,984
Hg	NR	NR	NR	NR	0.379	NR	0.379	NR	NR
K	65.4	NR	27.4	NR	354	489	447	489	NR
La	NR	<84.4	NR	NR	3.34 E-05	11.4	3.34 E-05	95.8	NR
Mg	NR	256	NR	NR	NR	16.8	NR	272	NR
Mn	NR	50.9	NR	520	53.5	317	53.5	888	168
Na	74,521	35,883	8,682	28,915	64,384	75,133	147,587	139,931	115,229
Ni	10.0	1,760	1,998	449	136	29.7	2,144	2,238	2,345
NO_2	1,613	6,185	4,468	3,673	15,396	13,966	21,478	23,825	42,204
NO_3	191,560	65,956	1,361	14,012	89,578	138,828	282,499	218,795	148,923
OH	18,538	NR	390	388	22,739	NR	41,666	388	164
Pb	NR	228	NR	174	36.7	80.7	36.7	483	518
P as PO_4	1,311	8,612	7,415	15,763	2,574	6,083	11,301	30,458	80,053

Table D3-5. Tank 241-TY-103 Nonradiological Waste Type Comparison to Sample Basis (2 Sheets)

Analyte [kg]	Uranium recovery layer		1CFeCN waste layer basis		SMMT2 waste layer		Layer estimate summation		
	HDW estimate[a]	BX109 estimate of TY103[b]	HDW estimate[a]	TY104 estimate of TY103[c]	HDW estimate[a]	U105 estimate of TY103[d]	HDW estimate[e]	UR/ 1CFeCN / SMMT2[f]	TY103 sample[g]
P	427	7,108	2,418	7,876	840	1,828	3,686	16,812	26,108
Se	NR	<169	NR	NR	NR	16.8	NR	186	NR
Si as SiO_3	NR	684	586	6,591	607	574	1,193	7,850	15,397
S as SO_4	1,444	6,015	320	1,571	4,617	3,741	6,381	11,327	9,591
S	482	2,146	107	342	1,541	904	2,130	3,393	3,201
Sr	NR	202	2.76 E-04	0.345	NR	1.68	2.76 E-04	204	0.693
TOC	0.46	140	1,334	582	1,734	4,247	3,069	4,970	1,154
U_{TOTAL}	38.5	4,853	NR	5,852	726	239	NR	10,943	18,034
Zn	NR	51.3	NR	NR	NR	16.3	NR	67.5	NR
Zr	NR	<17.0	250	44.7	3.17	13.0	253.0	74.8	248
H_20	90,283	173,945	176,236	171,306	126,253	85,046	392,772	430,298	540,095
Volume (L)	230,905	230,905	177,911	177,911	204,408	204,408	613,223	613,223	613,223

NR = Not reported
[a] Agnew et al. (1997a)
[b] Field (1996)
[c] Bell (1997)
[d] Weiss (1988)
[e] Summation of HDW contributions
[f] Summation of Bell (1997), Field (1996), and Weiss (1988) for volumes of Agnew et al. 1997a (less-than values treated as true values)
[g] Weiss and Mauss (1987).

Table D3-6. Tank 241-TY-103 Radiological Waste Type Comparison to Sample Basis. (Decayed to January 1, 1994) (2 Sheets)

Analyte [Ci]	Uranium recovery layer		1CFeCN waste layer basis		SMMT2 waste layer		Layer estimate summation		
	HDW estimate[a]	BX109 estimate of TY103[b]	HDW estimate[a]	TY104 estimate of TY103[c]	HDW estimate[a]	U105 estimate of TY103[d]	HDW estimate[e]	UR/ 1CFeCN / SMMT2[f]	TY103 sample[g]
^{3}H	0.530	NR	0.096	NR	32.0	NR	32.6	NR	NR
^{14}C	0.073	NR	0.0302	0.048	6.05	NR	6.15	0.048	1.04
^{59}Ni	0.021	NR	0.158	NR	0.77	NR	0.95	NR	NR
^{60}Co	0.017	<53.5	0.0081	2.4	9.0	30.5	9.04	86.3	1.53
^{63}Ni	1.879	NR	14.4	NR	76.3	NR	93	NR	NR
^{79}Se	0.015	NR	6.38 E-03	NR	0.84	NR	0.86	NR	NR
^{90}Sr	1,192	62,905.7	37,579	71,992	31,801	NR	70,571	134,898	94,293
^{90}Y	1,192	62,905.7	37,579	71,992	31,801	NR	70,571	134,898	94,293
^{93}mNb	0.062	NR	0.0253	NR	2.9	NR	3.03	NR	NR
^{93}Zr	0.073	NR	0.0302	NR	4.04	NR	4.15	NR	NR
^{99}Tc	0.509	NR	0.210	0.93	37.6	NR	38.3	0.93	16.4
^{106}Ru	6.98 E-09	NR	4.14 E-09	NR	0.002	NR	0.0017	NR	NR
^{113}mCd	0.179	NR	0.080	NR	21.0	NR	21.2	NR	NR
^{125}Sb	0.016	NR	0.0083	NR	39.1	NR	39.1	NR	NR
^{126}Sn	0.023	NR	0.0097	NR	1.2	NR	1.27	NR	NR
^{129}I	9.59 E-04	NR	3.98 E-04	14.7	0.07	NR	0.068	14.7	12,171
^{134}Cs	1.95 E-04	NR	0.0047	NR	0.53	NR	0.54	NR	NR
^{137}Cs	2,390	4,906	42,788	11,358	54,523	50,126	99,701	66,391	14,947
^{137}mBa	2,261	4,642	40,478	10,745	51,578	47,419	94,317	62,806	14,140
^{151}Sm	57.3	NR	23.6	NR	2,903	NR	2,984	NR	NR
^{152}Eu	0.168	NR	0.0268	NR	1.0	NR	1.23	NR	NR
^{154}Eu	0.302	<60.1	0.155	NR	144	410	144	470	NR
^{155}Eu	12.6	<175	1.80	NR	61.8	346	76.2	522	NR
^{226}Ra	4.22 E-06	NR	1.29 E-06	NR	3 E-05	NR	3.89 E-05	NR	NR
^{227}Ac	2.15 E-05	NR	6.69 E-06	NR	2 E-04	NR	2.62 E-04	NR	NR
^{228}Ra	6.40 E-10	NR	7.40 E-11	NR	0.02	NR	0.017	NR	NR
^{229}Th	1.24 E-07	NR	1.44 E-08	NR	3 E-04	NR	3.34 E-04	NR	NR
^{231}Pa	4.68 E-05	NR	1.51 E-05	NR	0.001	NR	0.0011	NR	NR
^{232}Th	2.09 E-11	NR	8.26 E-12	NR	0.002	NR	0.0017	NR	NR
^{232}U	2.39 E-07	NR	1.83 E-04	NR	0.1	NR	0.10	NR	NR
^{233}U	1.18 E-08	NR	8.40 E-06	NR	0.43	NR	0.43	NR	NR
^{234}U	0.013	NR	7.6	NR	0.3	NR	7.9	NR	NR

Table D3-6. Tank 241-TY-103 Radiological Waste Type Comparison to Sample Basis. (Decayed to January 1, 1994) (2 Sheets)

Analyte [Ci]	Uranium recovery layer		1CFeCN waste layer basis		SMMT2 waste layer		Layer estimate summation		
	HDW estimate[a]	BX109 estimate of TY103[b]	HDW estimate[a]	TY104 estimate of TY103[c]	HDW estimate[a]	U105 estimate of TY103[d]	HDW estimate[e]	UR/ 1CFeCN / SMMT2[f]	TY103 sample[g]
^{235}U	5.64 E-04	NR	0.337	NR	0.01	NR	0.35	NR	NR
^{236}U	1.09 E-04	NR	0.078	NR	0.007	NR	0.085	NR	NR
^{237}Np	0.0031	NR	0.0013	NR	0.1	NR	0.138	NR	NR
^{238}Pu	0.0042	NR	0.212	NR	0.37	NR	0.58	NR	NR
^{238}U	0.013	NR	7.7	NR	0.3	NR	8.1	NR	NR
^{239}Pu	0.632	NR	26.3	NR	14.4	NR	41.4	NR	NR
^{240}Pu	0.054	NR	2.57	NR	2	NR	4.96	NR	NR
$^{239/240}Pu$	0.686	NR	28.9	54.3	17	NR	46.3	54.3	186
^{241}Am	0.141	<432	0.080	9.9	9.52	413	9.74	855	33.5
^{241}Pu	0.163	NR	9.3	NR	25.5	NR	34.9	NR	NR
^{242}Cm	0.0031	NR	5.32 E-04	NR	1 E-04	NR	0.0037	NR	NR
^{242}Pu	7.36 E-07	NR	4.25 E-05	NR	1 E-04	NR	1.77 E-04	NR	NR
^{243}Am	9.84 E-07	NR	5.77 E-07	NR	3 E-04	NR	3.02 E-04	NR	NR
^{245}Cm	6.28 E-05	NR	1.10 E-05	NR	2 E-06	NR	7.61 E-05	NR	NR
^{244}Cm	2.33 E-05	NR	1.37 E-05	NR	6 E-05	NR	1.04 E-04	NR	NR

[a] Agnew et al. (1997a)
[b] Field (1996)
[c] Bell (1997)
[d] Weiss (1988)
[e] Summation of HDW contributions
[f] Summation of Simpson (1996), Field (1996), and Weiss (1988) for volumes of Agnew et al. (1997a) (Less than values treated as true values)
[g] Weiss and Mauss (1987).

Significantly, only the summation estimate of ^{90}Sr appears to agree modestly with that of the sample basis. The sample basis ^{129}I estimate appears to be extreme in overestimating the activity, this would be primarily due to inclusion of "less-than" data.

In summary, although estimates of 1CFeCN and SMMT2 waste layers may be reasonable, these layers and their summation do not agree with the historical sampling efforts and results and should not be preferred over the sample data.

Evaluation and comparison of projected inventories based upon these analyses with those described by Agnew et al. (1997a) are provided in Tables D2-1 and D2-1 for nonradioactive and radioactive constituents, respectively. These analyses are each based upon the current tank volume of 613 kL (162 kgal); this volume is in agreement with all current information.

Comments and observations regarding these inventories are provided by component in the following text.

Heat Load. The radioactive heat load was calculated from the deposition analysis of the radioactive constituent inventory assessments. These heat loads vary from a low reported value in the HDW model (Agnew et al. 1997a) to the highest value as calculated from tank heat analysis (Kummerer 1995). Overall, the heat load varies in these assessments by little. Given the variance in chemical data, the heat load recommended for application is that estimated as 1.06 kW (Kummerer 1995) as this value was derived from tank operational data.

Bismuth. The bismuth inventory estimated by this evaluation is approximately three times that estimated by the HDW model. The HDW model assumes that a significant portion of the bismuth does not precipitate with the solids, with the soluble fraction being sent to cribs. The sample data shows significant bismuth concentrations are present.

Nitrite and Nitrate. The sample data demonstrate nitrite concentrations twice that of the HDW while indicating nitrate concentrations two-thirds those of the HDW model. In tank saturation and crystallization prior to crib deposition would appear to have been slightly less than that predicted by the model.

Phosphorus. Phosphorus and phosphate concentrations represented in the sample data are approximately eight times those represented in the HDW model. The high content of phosphate from the attributed T2 salt cake (SMMT2) tank contributions appear to have been underestimated in the HDW model in precipitation of sodium phosphate prior to crib deposition.

Strontium. The core sample data yield a projection of nearly twice the ^{90}Sr (and ^{90}Y daughter) predicted in the HDW model. The consistency of this data across the sludges supports the sample data in preference to the HDW model.

Iodine. The sample analysis for iodine, at the time of these core sample analyses, was tentative and not yet approved, procedurally. The only analytical value not displayed as a "less-than value was one drainable liquor analysis which displayed results of greater than ten thousand times the less-than values seen in the solids. The resulting inventory assessment based on these analyses is extremely suspect. It is recommended that the HDW model estimate for this waste be applied in preference over sample data.

Plutonium. The sample analyses project more than five times the plutonium described by the HDW model. The sample analysis, conducted for the core samples yielded results which were minor except in the acid dissolution portion of the solids analysis. Because this is the portion of the analysis which should show any significant plutonium contamination, and the other portions of the solids analysis do not demonstrate significant plutonium quantities, the sample analyses are self-supporting and should continue to be considered more representative than the HDW model.

Total Hydroxide. Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. In some cases, this approach requires that other analyte (e.g., sodium or nitrate) inventories be adjusted to achieve the charge balance. During such adjustments, the number of significant figures is not increased. This charge balance approach is consistent with that used by Agnew et al. (1997a).

D4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

The best-basis inventory estimates for tank 241-TY-103 are shown in tables D4-1 and D4-2 for nonradioactive and radioactive constituents, respectively. The inventory assessment, and the basis for the assessment are provided for these nonradioactive and radioactive constituents.

The waste in tank 241-TY-103 consists of 613 kL (162 kgal) of UR, first cycle ferrocyanide (1CFeCN) and T2 salt cake produced by the 242-T Evaporator. The best-basis inventory for tank 241-TY-103 is presented in Tables D4-1 and D4-2. The inventory values reported in Tables D4-1 and D4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997), all decayed to a common report date of January 1, 1994. Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}Pu$, and total uranium, or (total beta and total alpha) while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am, etc., have been infrequently reported. For this reason it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. (These computer models are described in Kupfer et al. 1997, Section 6.1 and in Watrous and Wootan 1997.) Model generated values for radionuclides in any of 177 tanks are reported in the Hanford Defined Waste Rev. 4 model results (Agnew et al. 1997a). The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result if available. (No attempt has been made to ratio or normalize model results for all 46 radionuclides when values for measured radionuclides disagree with the model.) For a discussion of typical error between model derived values and sample derived values, see Kupfer et al. 1997, Section 6.1.10.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-TY-103 (Effective May 30, 1997).

Analyte	Total inventory (kg)	Basis (S, M, E or C)[1]	Comment
Al	2,970	S	
Bi	27,200	S	
Ca	5,050	M	
Cl	1,160	S	
TIC as CO_3	6,170	S	
Cr	977	S	
F	1,400	S	
Fe	24,000	S	
Hg	0.335	M	
K	389	M	
La	1.97 E-05	M	
Mn	168	S	
Na	115,000	S	
Ni	2,340	S	
NO_2	42,200	S	
NO_3	149,000	S	
OH	18,600	C	Based on charge balance
Pb	518	S	
P as PO_4	80,100	S	
Si	5,680	S	
S as SO_4	9,590	S	
Sr	0.693	S	(^{90}Sr basis only)
TOC	1,150	S	
U_{TOTAL}	18,000	S	
Zr	248	S	

[1]S = Sample-based
M = Hanford Defined Waste model-based, Agnew et al. (1997a)
E = Engineering assessment-based
C = Calculated by charge balance; includes oxides as hydroxides, not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-TY-103 Effective May 31, 1997 (Decay to January 1, 1994). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, E)[1]	Comment
^{3}H	24.5	M	
^{14}C	1.04	S	
^{59}Ni	0.441	M	
^{60}Co	1.53	S	
^{63}Ni	42.0	M	
^{79}Se	0.364	M	
^{90}Sr	94,300	S	
^{90}Y	94,300	S	Referenced to ^{90}Sr
^{93}mNb	1.30	M	
^{93}Zr	1.78	M	
^{99}Tc	16.4	S	
^{106}Ru	6.29 E-04	M	
^{113m}Cd	8.98	M	
^{125}Sb	15.6	M	
^{126}Sn	0.548	M	
^{129}I	0.0482	M	
^{134}Cs	0.257	M	
^{135}Cs	NR	M	
^{137}Cs	14,900	S	
^{137m}Ba	14,100	S	Referenced to ^{137m}Ba
^{151}Sm	1,280	M	
^{152}Eu	0.552	M	
^{154}Eu	59.1	M	
^{155}Eu	35.6	M	
^{226}Ra	2.18 E-05	M	
^{227}Ac	1.36 E-04	M	
^{228}Ra	0.0305	M	
^{229}Th	7.04 E-04	M	
^{231}Pa	5.41 E-04	M	
^{232}Th	0.0085	M	

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-TY-103 Effective May 31, 1997 (Decay to January 1, 1994). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, E)[1]	Comment
^{232}U	0.152	M	
^{233}U	0.582	M	
^{234}U	7.75	M	
^{235}U	0.342	M	
^{236}U	0.0820	M	
^{237}Np	0.0923	M	
^{238}Pu	0.352	M	
^{238}U	7.90	M	
$^{239/240}Pu$	186	S	Decayed as ^{239}Pu
^{241}Am	33.5	S	
^{241}Pu	18.4	M	
^{242}Cm	0.0173	M	
^{242m}Am	NR	M	
^{242}Pu	9.13 E-05	M	
^{243}Am	2.01 E-04	M	
^{243}Cm	0.00135	M	
^{244}Cm	0.0134	M	

[1]S = Sample-based
M = Hanford Defined Waste model-based, Agnew et al. (1997a)
E = Engineering assessment-based
NR = Not reported.

D5.0 APPENDIX D REFERENCES

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