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Preliminary Tank Characterization Report for Single-Shell Tank 241-TX-115: 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-TX-115 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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PRELIMINARY TANK CHARACTERIZATION REPORT FOR SINGLE-SHELL TANK 241-TX-115: BEST-BASIS INVENTORY

July 1997

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PRELIMINARY TANK CHARACTERIZATION REPORT FOR SINGLE-SHELL TANK 241-TX-115: 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-TX-115. No TCRs have 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

Kupfer, M. J., A. L. Boldt, B. A. Higley, K. M. Hodgson, L. W. Shelton, B. C. Simpson, and R. A. Watrous (LMHC), S. L. Lambert, and D. E. Place (SESC), R. M. Orme (NHC), G. L. Borsheim (Borsheim Associates), N. G. Colton (PNNL), M. D. LeClair (SAIC), R. T. Winward (Meier Associates), and W. W. Schulz (W^{2}S Corporation), 1997, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-TX-115

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-TX-115

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-TX-115 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

There is no previous Tank Characterization Report (TCR) for tank 241-TX-115. Available waste (chemical) information for tank 241-TX-115 includes the following:

- The TCRs from tank 241-U-102 (Hu et al. 1997) and tank 241-U-105 (Brown and Franklin 1996) discuss waste layers within those tanks that are believed to contain Supernatant Mixing Model (SMM) 242-T Evaporator salt cake generated from 1965 until 1976 (SMMT2).
- Horton (1977) letter report on tank 241-TX-116.
- The inventory estimate for this tank were generated from the Hanford Defined Waste (HDW) model (Agnew et al. 1996).

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The HDW model inventories are shown in Tables D2-1 and D2-2. The nonradioactive components are listed in Table D2-1 on a kilogram (kg) basis. The radioactive component estimates are listed in Table D2-2 on a curie (Ci) basis. The HDW model document (Agnew et al. 1996) provide tank content estimates, derived from process records. No sample-based inventories are available for this tank. The chemical species are reported without charge designation per the best-basis inventory convention.

There are differing waste volume estimates for tank 241-TX-115. Hanlon (1996) lists the tank volume as 2,422 kL (640 kgal), whereas Agnew et al. (1996) reports the volume as 2,150 kL (568 kgal). According to Anderson (1990) the 2,422 kL (640 kgal) value dates back to the third quarter of 1977 when the tank was listed as inactive. However, according to Agnew et al. (1995), the tank was jet pumped in 1982 and 1983. Agnew et al. (1995) reports that 272.5 kL (72 kgal) were transferred to tank 241-SY-102 in that time frame. Hanlon does not account for the transfers out of tank 241-TX-115 during 1982 to 1983. Thus, the volume listed by Agnew et al. (1996) (2,150 kL [568 kgal]) is used in this engineering assessment of best-basis tank inventory values. Hanlon and Hill et al. (1995) list the waste type for this tank to be salt cake, whereas Agnew et al. (1996) reports the tank to contain 30.3 kL (8 kgal) of sludge and 2,120 kL (560 kgal) of salt cake. Based on the HDW model, the 30.3 kL (8 kgal) of sludge only makes a significant contribution to inventory values for uranium (approximately 15 percent) and iron (approximately 75 percent).

Table D2-1. Hanford Defined Waste Model Predicted Inventory Estimates for Nonradioactive Components in Tank 241-TX-115.

Analyte[a]	HDW[b] inventory estimate (kg)	Analyte[a]	HDW[b] inventory estimate (kg)
Al	68,000	Ni	751
Bi	919	NO_2	159,000
Ca	3,090	NO_3	579,000
Cl	12,500	OH	189,000
Cr	4,310	Pb	505
F	4,800	P as PO_4	22,200
Fe	3,480	Si	3,560
Hg	5.18	S as SO_4	44,700
K	3,890	Sr	9.31 E-05
Mn	288	TIC as CO_3	46,500
Na	453,000	TOC	10,300
NH_3	2,160	U_{TOTAL}	6,250
H_2O (wt%)	46.8	Zr	299
Density (kg/L)	1.43		

HDW = Hanford Defined Waste
[a] No sample-based inventory
[b] Agnew et al. (1996).

Table D2-2. Hanford Defined Waste Model Predicted Inventory Estimates for Radioactive Components in Tank 241-TX-115.

Analyte[a]	HDW[b] inventory estimate (Ci)
^{137}Cs	462,000
^{90}Sr	192,000

HDW = Hanford Defined Waste
[a] No sample-based inventory
[b] Agnew et al. (1996), decayed to January 1, 1994.

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation was conducted to assess various estimates of tank contents.

D3.1 WASTE HISTORY TANK 241-TX-115

Tank 241-TX-115 began receiving tributyl phosphate waste in the second quarter of 1952. From the second quarter of 1953 until the first quarter of 1957, the tank received metal wastes (MW). In 1957 the contents of tank 241-TX-115 were jetted to tank 241-TX-107 and the tank was declared empty. The tank began receiving high-level Reduction and Oxidation (REDOX) waste (R waste) that year. According to Anderson (1990), the tank held approximately 57 kL (15 kgal) of R waste from 1957 until 1966. From 1966 until 1968, the tank received decontamination waste and cladding waste from the 221-T Plant. In 1967, approximately 2,082 kL (550 kgal) of waste were transferred from tank 241-TX-115 to tank 241-TX-104. From 1968 until 1976, the tank received evaporator bottoms (EB) and recycle from the 242-T Evaporator. The tanks integrity was labeled as questionable and declared an assumed leaker in 1977. The tank was jet pumped and interim stabilized in September 1983, with intrusion prevention completed in August 1984. The tank is classified as an assumed leaker stabilized tank. For a more complete history of the waste in this tank see Brevick (1995).

D3.2 EXPECTED TYPE OF WASTE BASED ON THIS ASSESSMENT

Expected waste types in tank 241-TX-115, based on the various source documents, are as follows:

Agnew et al. (1996): SMMT2 and UR
Hanlon (1996): salt cake

Hill et al. (1995): EB, R, CW, and DW

MW	=	Metal waste
SMMT2	=	A mixture of concentrated supernatant coming from the 242-T Evaporator that are a blend of other waste types that upon cooling precipitated as a salt cake
UR	=	Uranium recovery waste. Also known as Tributylphosphate (TBP) waste
R	=	High-level REDOX waste
EB	=	Evaporator bottoms
CW	=	Cladding waste
DW	=	Decontamination waste

Agnew et al. (1996), Hanlon (1996), and Hill et al. (1995) agree that the predominate waste type in tank 241-TX-115 is salt cake from the 242-T Evaporator. Hanlon and Hill et al. identify the waste to be all salt cake. Agnew et al. lists the tank as containing 30.3 kL (8 kgal) of sludge and 2,120 kL (560 kgal) of salt cake. The sludge is believed to be uranium recovery (UR) waste. The 30.3 kL (8 kgal) of sludge represents approximately 1.5 percent of the waste volume. As shown by the HDW model data, the inclusion of 30.3 kL (8 kgal) of sludge in the tank inventory estimate is insignificant except for uranium and iron. Since the engineering assessment fails to define reasonable estimates for either of these analytes, the tank is assumed to contain all salt cake as Hanlon indicates.

D3.3 ASSUMPTIONS USED

The following evaluation provides an engineering assessment of tank 241-TX-115 contents. For this evaluation, the following assumptions and observations are made:

- Component inventories can be calculated by multiplying the average concentration of an analyte from similar tanks by the current tank volume and density estimate of the waste in tank 241-TX-115.

- Only salt cake from the 242-T Evaporator contributed to solids formation.

- The radiolysis of nitrate to nitrite is not factored into this evaluation.

There is limited chemical characterization data for tanks in the TX Tank Farm, and few currently sampled tanks are projected to contain salt cake similar to that expected to be found in tank 241-TX-115. The salt cake in this tank came from the 242-T Evaporator. Salt cake produced in that evaporator between 1965 and 1976 is identified as T2 salt cake. The HDW model refers to this salt cake as T2 SltCk on a global basis or as SMMT2 when calculated with the SMM for an individual tank. Thus, the HDW model identifies waste in tank 241-TX-115 to be SMMT2. The only chemical characterization data for SMMT2 waste appear to be from three tanks (241-U-102 [Hu et al. 1997], 241-U-105 [Brown and Franklin 1996], and 241-TX-116 [Horton 1977]). It is assumed that this material will adequately represent SMMT2 salt cake.

D3.4 BASIS FOR SALT CAKE CALCULATIONS USED IN THIS ENGINEERING EVALUATION

Table D3-1 shows the engineering approaches used for tank 241-TX-115.

Table D3-1. Engineering Approaches Used for Tank 241-TX-115.

Type of waste	How calculated	Check method
Supernatant	No supernatant	None
Salt cake Volume ≐ 2,150 kL (568 kgal) Density = 1.70 g/mL for SMMT2	Used sample-based concentrations from other tanks with SMMT2 salt cake waste.	None, no sample-based information available for this tank.
Sludge volume = assumed to be zero in this assessment	None expected	None

SMMT2 = Supernatant Mixing Model 242-T Evaporator salt cake generated from 1965 until 1976

The general approach in this engineering assessment is to utilize all available information to formulate the best-basis estimate of the tank's contents. The sources of information may include analytical data from samples taken from the tank of interest, analytical data from other tanks believed to contain waste types similar to those believed to be in the tank of interest, and data from models utilizing historical process records. The confidence level assigned to the best-basis inventory values then depends on the level of agreement among the various information sources. This approach is best suited for cases where extensive analytical data exist for multiple sampling events from the tank of interest and from a number of other tanks containing similar waste types. However, for tank 241-TX-115, no tank-specific analytical data are available and very little analytical data are available for the SMMT2 salt cake projected to be in that tank.

Agnew et al. (1996) identified the salt cake in tank 241-TX-115 as SMMT2. A review of existing TCRs identified two tanks (241-U-102 [Hu et al. 1997] and 241-U-105 [Brown and Franklin 1996]) that contained analytical characterization data that could be ascribed to layers of SMMT2 salt cake. In addition, limited characterization data were available from core samples taken from tank 241-TX-116 in the mid-1970's (Horton 1977).

Analytical data from segments 4 through 6 of tank 241-U-102 cores and segment 8 of tank 241-U-105 cores were selected as being representative of SMMT2 salt cake. For almost all selected analytes, there were 14 data points from tank 241-U-102 and 4 data points from tank 241-U-105.

The mean was calculated from selected data from each U Tank Farm tank after including a weighting factor to correct for material recovery during sampling. The weighted means for each tank are listed in Table D3-2, columns 2 and 3. The U Tank Farm means were calculated from each tank mean after including a factor to correct for material recovery during sampling and are listed in Table D3-2, column 4. The means from tank 241-TX-116 are also listed in Table D3-2, column 5. The tank 241-TX-116 means were calculated after removing high silica values resulting from the addition of diatomaceous earth to the tank.

Table D3-2. Composition of T2 Salt Cakes (2 Sheets).

Analyte	241-U-102 T2 salt cake wt. avg.[a,b] (μg/g)	241-U-105 T2 salt cake wt. avg.[a,c] (μg/g)	U Tank Farm T2 salt cake wt. avg.[a] (μg/g)	241-TX-116 T2 salt cake mean[d,e] (μg/g)	T2 salt cake prediction[f] (μg/g)	HDW T2 SltCk[g] (μg/g)
Ag	11.6	19.7	13.1	NR	13.1	NR
Al	18,000	12,900	17,100	38,000	27,500	17,912
Bi	<70.5	<47.2	<66.2	NR	<66.2	220.81
Ca	308	253	298	NR	298	1,462
Cd	<5.94	12.8	<7.21	NR	<7.21	NR
Cl	5,100	5,790	5,230	NR	5,230	3,327.8
CO_3	53,500	36,500	50,300	58,000	54,200	17,093
Cr	2,310	2,100	2,270	353	1,310	4259.6
F	<125	1,110	<307	3,540	<1,920	930.79
Fe	391	2,270	737	23,900	12,300	620.58
Hg	NR	NR	NA	NR	NA	1.1338
K	1750	1,470	1,700	NR	1,700	1060.7
La	<35.2	29.7	<34.2	NR	<34.2	0.0001
Mn	123	743	237	NR	237	160.31
Na	262,600	220,500	254,800	166,700	210,800	192,764
Ni	91.5	89.5	91.1	NR	91.1	405.82
NO_2	56,700	40,100	53,600	7,840	30,700	46,096
NO_3	284,700	395,700	305,200	308,700	306,946	268,197
OH	NR	NR	NA	NA	NA	68,079

Table D3-2. Composition of T2 Salt Cakes (2 Sheets).

Analyte	241-U-102 T2 salt cake wt. avg.[a,b] (μg/g)	241-U-105 T2 salt cake wt. avg.[a,c] (μg/g)	U Tank Farm T2 salt cake wt. avg.[a] (μg/g)	241-TX-116 T2 salt cake mean[d,e] (μg/g)	T2 salt cake prediction[f] (μg/g)	HDW T2 SltCk[g] (μg/g)
Pb	<119	214	<136	NR	<136	109.91
P as PO_4	5,050	14,100	6,720	8,620	7,670	7,707.9
Si	152	232	167	NR	167	1,817.7
S as SO_4	17,900	8,350	16,200	16,400	16,300	13,823
Sr	<7.04	<4.72	<6.61	NR	<6.61	0
TOC	8,810	11,000	9,210	NR	9,210	5,191
U	<353	545	<388	NR	<388	2,174.3
Zr	10.8	45.4	17.2	NR	17.2	14.707
Radionuclide[h] (μCi/g)						
^{241}Am	<37.0	<0.95	<30.3	NR	<30.3	0.0285
^{60}Co	<0.155	0.086	<0.142	NR	<0.142	0.027
^{134}Cs	NR	NR	NA	9.64 E-04	9.64 E-04	0.0016
^{137}Cs	197	145	188	34.8	111	163.24
^{154}Eu	<0.475	0.61	<0.499	NR	<0.499	0.431
^{155}Eu	<1.10	0.82	<1.05	NR	<1.05	0.1849
Density (g/mL)	1.66	1.73	1.70[i]	NR	1.70	1.634

HDW = Hanford Defined Waste
NA = Not applicable
NR = Not reported
[a] Weighted average based on the weight of each partial core segment analyzed
[b] Hu et al. (1997)
[c] Brown and Franklin (1996)
[d] Silica-free basis due to the addition of diatomaceous earth to this tank
[e] Horton (1977)
[f] Average of U Tank Farm and tank 241-TX-116 data
[g] Agnew et al. (1997)
[h] Decayed to January 1, 1994
[i] A simple average is used for the density.

Whenever both a U Tank Farm weighted mean and a tank 241-TX-116 mean were available, the predicted composition for the SMMT2 salt cake was calculated as the average of the two. However, when only one value was available it was used as the predicted SMMT2 composition. The predicted SMMT2 composition is listed in Table D3-2, column 6. The major impact of including characterization data from tank 241-TX-116 in the predicted SMMT2 salt cake composition is to significantly increase values for the Al and Fe.

In comparing the engineering estimates based on SMMT2 salt cake (Table D3-2, column 6) with the HDW model T2 SltCk estimates (Table D3-2, column 7), significant differences for Fe are noted. Less significant differences are noted for Al, Ca, carbonate, K, Mn, Na, and nitrate. The Fe values used in the developing the SMMT2 formulation exhibited large variations. There is close to an order of magnitude difference in Fe between the two U Tank Farm tanks. The Fe value for tank 241-TX-116 is an order of magnitude higher than the larger U Tank Farm tank value. The HDW model predicts an Fe value comparable with the lower U Tank Farm tank value. Since the analytical values span almost two orders of magnitude, there will be considerable uncertainty in the projected Fe value for tank 241-TX-115. The value developed through this evaluation appears unreasonably high. Since the value developed for Fe appears to be unreasonably high when tank 241-TX-116 data are included, this engineering assessment for tank 241-TX-115 utilizes the HDW model value for Fe.

The three analytically determined carbonate values used to develop the SMMT2 formulation are reasonably consistent. However, these values are significantly higher than the value determined by the HDW model. It is likely that the highly basic tank wastes have absorbed atmospheric carbon dioxide. Absorption of carbon dioxide would convert hydroxide to carbonate.

Table D3-3 lists the inventory estimates calculated using the predicted SMMT2 composition and the U Tank Farm composition. The HDW model estimates are also included. The bulk density value used in the engineering assessment estimates (1.70 g/mL) is approximately 20 percent higher than the value used in the HDW model estimates (1.43 g/mL). This leads to proportionally higher estimates in the engineering estimate.

Table D3-3. Tank 241-TX-115 Inventory Estimates (Volume = 2150 kL). (2 Sheets)

Analyte	Inventory estimates using T2 SltCk (kg)	Inventory estimates using U Tank Farm (kg)	HDW model values (kg)
Al	101,000	62,400	68,000
Bi	<242	<242	919
Ca	1,090	1,090	3,090
Cd	26	26	NR
Cl	19,100	19,100	12,500
CO_3	198,000	184,000	46,500

Table D3-3. Tank 241-TX-115 Inventory Estimates (Volume = 2150 kL). (2 Sheets)

Analyte	Inventory estimates using T2 SltCk (kg)	Inventory estimates using U Tank Farm (kg)	HDW model values (kg)
Cr	4,800	8,300	4,310
F	<7,030	<1,120	4,800
Fe	45,000	2,700	3,480
K	6,210	6,210	3,890
La	<125	<125	4.43 E-04
Mn	867	867	288
Na	770,000	931,000	453,000
Ni	333	333	751
NO_2	112,000	196,000	159,000
NO_3	1.12 E+06	1.12 E+06	579,000
OH	120,000	NR	189,000
Pb	<499	<499	505
P as PO_4	28,000	24,600	22,200
Si	611	611	3,560
S as SO_4	59,600	59,100	44,700
Sr	<24	<24	9.31 E-05
TOC	33,700	33,700	10,300
U	<1,400	<1,400	6,250
Zr	63	63	299
Radionuclides (Ci)			
^{137}Cs	407,000	686,000	462,000
^{90}Sr	NR	NR	192,000

HDW = Hanford Defined Waste, Agnew et al. (1996)
NR = Not reported.

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

Key waste management activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank wastes. Disposal activities involve designing equipment, processes, and facilities for retrieving wastes and processing them into a form that is suitable for long-term storage/disposal. Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with these activities.

Chemical and radiological inventory information are generally derived using three approaches: (1) component inventories are estimated using the results of sample analyses, (2) component inventories are predicted using the HDW model, process knowledge, and historical information, or (3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material usage, and other operating data.

An assessment of available chemical information for tank 241-TX-115 was performed, including the following:

- An inventory estimate generated by the HDW model (Agnew et al. 1996)
- Evaluation of SMMT2 data from two U Tank Farm tanks (241-U-102 [Hu et al. 1997] and 241-U-105 [Brown and Franklin 1996]) and older characterization data from tank 241-TX-116 (Horton 1977).

Based on this engineering assessment, an engineering assessment-based inventory was developed for tank 241-TX-115 (for which sample information was not available). Where available, the engineering assessment-based inventory was chosen as the best basis inventory for the following reasons:

- No analytical data were available for tank 241-TX-115
- No methodology is available to fully predict SMMT2 salt cake from process flowsheets or historical records

For those analytes where no values could be calculated from the engineering assessment-based inventory the HDW model values were used.

The SMMT2 salt cake formulation was extrapolated from limited characterization data available from two U Tank Farm tanks containing similar wastes and older data from a TX Tank Farm tank. However, since no post-1989 analytical data were available from this tank or any other tank with similar wastes within the TX Tank Farm, one would have little confidence in either this engineering assessment or the HDW model inventory estimate.

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with valences of other analytes. In some cases, this approach required that other analyte (e.g., sodium or nitrate) inventories be adjusted to achieve the charge balance. No adjustments were required in this best-basis estimate. This charge balance approach is consistent with that used by Agnew et al. (1997).

Best-basis tank inventory values were 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 were only reported for total beta, total alpha, ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and total uranium, while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu and ^{241}Am, etc., were 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 HDW Rev. 4 model results (Agnew et al. 1997). 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 nuclides 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.

Best-basis tables for chemicals and only four radionuclides (^{90}Sr, ^{137}Cs, Pu and U) were being generated in 1996, using values derived from an earlier version (Rev. 3) of the HDW model (Agnew et al. 1996). When values for all 46 radionuclides became available in Rev. 4 of the HDW model (Agnew et al. 1997), they were merged with draft best-basis chemical inventory documents. Defined scope of work in FY 1997 did not permit HDW Rev. 3 chemical values to be updated to HDW Rev. 4 chemical values.

The best-basis values are listed 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.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-TX-115 (Effective January 31, 1997).

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	101,000	E	
Bi	<242	M	
Ca	1,090	E	
Cl	19,100	E	
TIC as CO_3	198,000	E	
Cr	4,800	E	
F	<7,030	E	
Fe	3,480	M	
Hg	5.18	M	
K	6,210	E	
La	<125	E	
Mn	867	E	
Na	770,000	E	
Ni	333	E	
NO_2	112,000	E	
NO_3	1.12 E+06	E	
OH_{TOTAL}	247,000	C	
Pb	<499	E	
PO_4	28,000	E	
Si	611	E	
SO_4	59,600	E	
Sr	< 24	E	
TOC	33,700	E	
U_{TOTAL}	6,250	M	
Zr	63	E	

[1]S = Sample-based
M = Hanford Defined Waste model-based, Agnew et al. (1996)
E = Engineering assessment-based
C = Calculated by charge balance; includes oxides as "hydroxide" 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-TX-115 Decayed to January 1, 1994 (Effective January 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	330	M	
^{14}C	47.0	M	
^{59}Ni	3.58	M	
^{60}Co	51.5	M	
^{63}Ni	351	M	
^{79}Se	4.85	M	
^{90}Sr	157,000	M	
^{90}Y	157,000	M	
^{93}Zr	23.8	M	
^{93m}Nb	17.3	M	
^{99}Tc	335	M	
^{106}Ru	0.00924	M	
^{113m}Cd	123	M	
^{125}Sb	219	M	
^{126}Sn	7.32	M	
^{129}I	0.646	M	
^{134}Cs	3.84	M	
^{137}Cs	407,000	E	
^{137m}Ba	388,000	E	Based on ^{137}Cs
^{151}Sm	17,100	M	
^{152}Eu	5.34	M	
^{154}Eu	831	M	
^{155}Eu	317	M	
^{226}Ra	2.31 E-04	M	
^{227}Ac	0.00151	M	
^{228}Ra	0.380	M	
^{229}Th	0.00881	M	
^{231}Pa	0.00668	M	
^{232}Th	0.0233	M	

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-TX-115 Decayed to January 1, 1994 (Effective January 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{232}U	1.90	M	
^{233}U	7.28	M	
^{234}U	1.56	M	
^{235}U	0.0625	M	
^{236}U	0.0504	M	
^{237}Np	1.21	M	
^{238}Pu	1.95	M	
^{238}U	1.89	M	
^{239}Pu	70.4	M	
^{240}Pu	11.7	M	
^{241}Am	88.2	M	
^{241}Pu	129	M	
^{242}Cm	0.206	M	
^{242}Pu	7.00 E-4	M	
^{243}Am	0.00298	M	
^{243}Cm	0.0191	M	
^{244}Cm	0.197	M	

[1]S = Sample-based
M = Hanford Defined Waste model-based, Agnew et al. (1997)
E = Engineering assessment-based.

D5.0 APPENDIX D REFERENCES

Agnew, S. F., R. A. Corbin, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1995, *Waste Status and Transaction Record Summary (WSTRS Rev. 2)*, WHC-SD-WM-TI-615, -614, -669, -689, Rev. 2, Los Alamos National Laboratory, Los Alamos, New Mexico.

Agnew, S. F., J. Boyer, R. A. Corbin, T. B. Duran, J. R. FitzPatrick, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1996, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 3*, LA-UR-96-858, Los Alamos National Laboratory, Los Alamos, New Mexico.

Agnew, S. F., J. Boyer, R. A. Corbin, T. B. Duran, J. R. FitzPatrick, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4*, LA-UR-96-3860, Los Alamos National Laboratory, Los Alamos, New Mexico.

Anderson, J. D., 1990, *A History of 200 Area Tank Transfers*, WHC-MR-0132, Westinghouse Hanford Company, Richland, Washington

Brevick, C. H., 1995, *Supporting Document for the Historical Tank Content Estimate for TX Tank Farm*, WHC-SD-WM-ER-321, Westinghouse Hanford Company, Richland, Washington

Brown, T. M., and J. D. Franklin, 1996, *Tank Characterization Report for Single-Shell Tank 241-U-105*, WHC-SD-WM-ER-617, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Hanlon, B. M., 1996, *Waste Tank Summary Report for Month Ending June 30, 1996*, WHC-EP-0182-99, Westinghouse Hanford Company, Richland, Washington.

Hill, J. G., G. S. Anderson, and B. C. Simpson, 1995, *The Sort on Radioactive Waste Type Model: A Method to Sort Single-Shell Tanks into Characteristic Groups*, PNL-9814, Rev. 2, Pacific Northwest Laboratory, Richland, Washington.

Hodgson, K. M., and M. D. LeClair, 1996, *Work Plan for Defining a Standard Inventory Estimate for Wastes Stored in Hanford Site Underground Tanks*, WHC-SD-WM-WP-311, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.

Horton, J. E., 1977, *Physical and Chemical Characterization of 116-TX*, Letter Report to G. K. Allen, Atlantic Richfield Hanford Company, Richland, Washington.

Hu, T. A., L. C. Amato, R. T. , Winward, and R. D. Cromar, 1996, *Tank Characterization Report for Single-Shell Tank 241-U-102,* HNF-SD-WM-ER-618, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

Kupfer, M. J., A. L. Boldt, B. A. Higley, K. M. Hodgson, L. W. Shelton, B. C. Simpson, and R. A. Watrous (LMHC), S. L. Lambert, and D. E. Place (SESC), R. M. Orme (NHC), G. L. Borsheim (Borsheim Associates), N. G. Colton (PNNL), M. D. LeClair (SAIC), R. T. Winward (Meier Associates), and W. W. Schulz (W^2S Corporation), 1997, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

Watrous, R. A., and D. W. Wootan, 1997, *Activity of Fuel Batches Processed Through Hanford Separations Plants, 1944 Through 1989,* HNF-SD-WM-TI-794, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.