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Preliminary Tank Characterization Report for Single-Shell Tank 241-TX-114: Best-Basis Inventory

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U.S. Department of Energy Contract DE-AC06-96RL13200

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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-114 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-114: BEST-BASIS INVENTORY

August 1997

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PRELIMINARY TANK CHARACTERIZATION REPORT FOR SINGLE-SHELL TANK 241-TX-114: 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-114. 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 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-TX-114

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-TX-114

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-114 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 tank 241-TX-114 consist only of the inventory estimate generated by the Hanford Defined Waste (HDW) model (Agnew et al. 1997a). No Tank Characterization Report (TCR) has been previously issued for this tank, and current core sample analyses are not available. The best-basis inventory, therefore, is based on the waste types contained in tank 241-TX-114 and composition data from other Hanford Site tanks containing similar waste types.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The tank 241-TX-114 chemical and radionuclide inventory predicted by the HDW model (Agnew et al. 1997a) is provided in Table D2-1. The chemical species are reported without charge designation per the best-basis inventory convention. The HDW model inventory is based on 15 kL (4 kgal) of sludge and 2,010 kL (531 kgal) of salt cake.

Table D2-1. Hanford Defined Waste Model Prediction of Tank 241-TX-114 Inventory. (2 Sheets)

Analyte	Hanford Defined Waste model inventory[a] (kg)
Al	52,800
Bi	1,520
Ca	2,880
Cl	12,300

Table D2-1. Hanford Defined Waste Model Prediction of Tank 241-TX-114 Inventory. (2 Sheets)

Analyte	Hanford Defined Waste model inventory[a] (kg)
CO_3	41,200
Cr	7,950
F	3,250
Fe	2,640
Hg	4.00
K	3,500
La	2.10 E-04
Mn	213
Na	492,000
Ni	716
NO_2	131,000
NO_3	583,000
OH	195,000
Pb	335
PO_4	44,300
Si	3,070
SO_4	37,500
Sr	0
TOC	14,800
U	7,710
Zr	67.3
Radionuclide[b] (Ci)	
^{137}Cs	408,000
^{90}Sr	142,000

[a] Agnew et al. (1997a)

[b] Revision 4 of the HDW model (Agnew et al. 1997a) contains estimates for 46 radionuclides. Only the two most prevalent, ^{90}Sr, and ^{137}Cs, are listed in this table. The HDW model radionuclide predictions are baselined 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 1996) are not entirely consistent as to the waste types present in tank 241-TX-114. The HDW model includes a sludge layer that is not reported by the other two documents.

The HDW model (Agnew et al. 1997a) predicts that the tank contains 15 kL (4 kgal) of 1C (first decontamination cycle $BiPO_4$ waste) sludge, 220 kL (58 kgal) of defined waste T1SltCk, and 1,790 kL (473 kgal) of Supernatant Mixing Model from 242-T Evaporator salt cake generated from 1965 until 1976 (SMMT2). The 1C wastes sent to this tank cascade were generated prior to 1955, therefore the coating wastes associated with the aluminum-clad reactor fuel being processed were combined with the 1C waste in the underground storage tank (Anderson 1990).

The HDW model (Agnew et al. 1997a) refers to 242-T Evaporator salt cakes formed during 1951 to 1955 as T1SltCk. The HDW model refers to 242-T Evaporator salt cakes formed during 1965 to 1976 as T2SltCk on a global basis, or SMMT2 when calculated for an individual tank by the Supernatant Mixing Model (SMM).

The SORWT model (Hill et al. 1995) lists EB (evaporator bottoms) and 1C as the primary and secondary waste types respectively, but credits the entire tank 241-TX-114 volume (2,025 kL [535 kgal]) to salt cake with 57 kL (15 kgal) of interstitial liquid. Hanlon (1996) also indicates that the entire tank inventory is salt cake.

D3.2 EVALUATION OF TECHNICAL FLOWSHEET INFORMATION

Waste transaction records (Agnew et al. 1997b) show that the cascade (tanks 241-TX-113 through 241-TX-115) received 1C wastes between the fourth quarter of 1950 and the fourth quarter of 1951. Waste transaction records indicate that a total of 8,418 kL (2,224 kgal) of combined 1C/CW waste was received into tank 241-TX-113. T Plant fuel processing during these periods consisted of approximately 466 MTU. The estimated 1C/CW waste volume based on the $BiPO_4$ flowsheet (Schneider 1951) would be 6,881 kL (1,818 kgal). This is 18 percent less than that indicated by the waste transaction records, which is reasonable agreement considering the uncertainties in the fuel processing and waste transaction data.

The waste transaction records indicate that the 1C/CW supernates were pumped to the evaporator feed tank (tank 241-TX-118) in the second and third quarters of 1952. Later in the third quarter of 1952, tank 241-TX-114 received 2,510 kL (663 kgal) of metal waste

(MW) supernate from tank 241-TX-106. Tank 241-TX-114 was used to store sluicing solutions (MW supernates and water) for the retrieval of metal waste sludges in T, TX, and U Tank Farms through the second quarter of 1954 (Anderson 1990). Anderson also indicates that the remaining supernates were pumped to tank 241-TX-104 at that time, although waste transactions records (Agnew et al. 1997b) do not show this transfer. However, it is likely that the transfer to tank 241-TX-104 did occur because: (1) the tank 241-TX-104 supernates were used for blending of U Plant feeds for several quarters thereafter (Anderson), and (2) it is unlikely that evaporator bottoms would have been mixed with MW supernates containing high concentrations of recoverable uranium.

The waste transaction records show that tank 241-TX-114 received 2,332 kL (616 kgal) of 242-T Evaporator bottoms supernate via tanks 241-TX-116 and 241-TX-117 in the third quarter of 1954. Agnew et al. (1997b) indicates that an overflow to tank 241-TX-115 via the cascade piping occurred as the result of this transfer. This overflow would not occur if the MW supernates had been transferred to tank 241-TX-104 as stated by Anderson (1990). It will be assumed that Anderson is correct and that tank 241-TX-114 was filled with evaporator bottom supernates. The deposition of a salt cake layer would normally be expected.

Tank 241-TX-114 again received concentrated evaporator bottoms from the 242-T Evaporator and recycled supernates to the evaporator beginning in the fourth quarter of 1967 and continuing intermittently until the third quarter of 1974 (Anderson 1990). Agnew et al. (1997b) reported that these operations occurred between the first quarter of 1968 and the first quarter of 1976. Regardless of the exact time frame, salt cake would have formed as the concentrated salt solutions cooled and a large salt cake layer would have been deposited on top of previously existing salt cake. The tank had been retro-fitted with three airlift circulators to facilitate evaporative cooling and prevent the formation of a crust that would have impeded evaporative heat removal.

Supernate remaining in tank 241-TX-114 was transferred to tank 241-SY-102 in the third quarter of 1977 (Agnew et al. 1997b). Anderson (1990) indicates that the supernate was removed earlier (first quarter of 1975) and that salt well pumping occurred in the third quarter of 1976 through the second quarter of 1977. Additional salt well pumping of the interstitial liquid apparently occurred in 1982 and in the first quarter of 1985 (Agnew et al.). Anderson does not report on events beyond 1980.

D3.3 DETERMINATION OF WASTE TYPES

The 1C/CW volumes routed to the tank 241-TX-113 through 241-TX-115 cascade would result in 905 kL (239 kgal) of sludge based on a concentration factor of 9.3 observed for tank 241-T-104 (Sasaki et al. 1997). Most of this sludge volume should have been retained in the first 750,000-gallon tank of the cascade (241-TX-113), however, some carry-over of entrained solids to tank 241-TX-114 would be expected. The HDW model estimates the 1C/CW sludge inventory in tank 241-TX-114 primarily from a solids measurement in the third quarter of 1953 (15 kL [4 kgal]), before tank 241-TX-114 received evaporator bottoms. This low 1C/CW sludge volume appears reasonable considering the long residence time available in tank 241-TX-113 for solids settling.

The HDW model similarly estimates the T1 salt cake volume based on a solids volume measurement made in the first quarter of 1965 (235 kL [62 kgal] of combined 1C/CW sludge and T1 salt cake). A total of 2,332 kL (616 kgal) of T1 salt cake supernate was transferred to tank 241-TX-114, which is sufficient to have produced the 220 kL (58 kgal) of T1 SltCk.

The HDW volume of T2 salt cake is based on the 2,025 kL (535 kgal) final volume of solids measured in May 1983 as reported in Hanlon (1996). By difference, the tank 242-TX-114 T2 salt cake inventory is 1,790 (473 kgal). Waste transaction records show that tank 241-TX-114 received only 2,491 kL (658 kgal) of concentrated 242-T Evaporator waste between 1968 and 1976. This volume is insufficient to account for T2 salt cake accumulated in tank 241-TX-114 since only a fraction of the evaporator bottoms volume precipitates as salt cake. Agnew et al. (1997a) indicates that the volume fraction of precipitated solids is about 0.55 for T2 SltCk. Either the tank 241-TX-114 waste transactions records (Agnew et al. 1997b) are incomplete for this time period or the waste volume measurements are in error.

D3.4 COMPOSITION OF TANK 241-TX-114 WASTE

3.4.1 Composition of 1C Sludges

Several tanks received 1C/CW waste directly from T Plant including tanks 241-T-104, 241-T-107, 241-TX-109, 241-TX-113, 241-U-110, 241-TY-101, and 241-TY-103. Sample data are not available for solid layers in tanks 241-TX-109 or 241-TX-113. The 1C waste was mixed with substantial quantities of other wastes in tanks 241-TY-101, 241-TY-103, and 241-U-110, making it difficult to accurately determine the composition of the 1C/CW waste sludge. Two tanks (241-T-104 and 241-T-107) provide the best examples of T Plant 1C/CW sludge composition. The composition of these two tanks, based on the corresponding tank characterization reports (Sasaki et al. 1997 and Valenzuela and Jensen 1994), is provided in Table D3-1.

The average of these two compositions will be used for estimating the sludge composition of tank 241-TX-114 with the exception of iron. Higher uranium and iron concentrations have been noted in several tanks (including tank 241-T-107) which stored Uranium Recovery (UR) wastes on top of 1C sludges. Tank 241-TX-114 did not receive UR waste, but did store MW supernate. The average uranium concentration will be used for calculating the best basis, but only the iron concentration in tank 241-T-104 will be used since most of iron in TBP waste was added during U Plant processing and was not originally present in the MW waste. The HDW model composition for 1C2 sludge (Agnew et al. 1997a) is included in Table D3-1 for comparison.

Table D3-1. Tank Characterization Report Concentrations for Tanks 241-T-104 and 241-T-107. (2 sheets)

Analyte	Tank 241-T-104 concentration[a,b] (μg/g)	Tank 241-T-107 concentration[c] (μg/g)	Predicted 1C sludge concentration (μg/g)	HDW Model 1C2 sludge concentration (μg/g)
Ag	<1.09	7.37	<4.2	NR
Al	16,200	16,300	16,200	8,633
Bi	18,900	12,000	15,400	9,245
Ca	1,450	760	1,100	2,172
Cd	5.44	6.94	6.19	NR
Cl	670	540	605	834
CO_3	<500	14,800	7,680	3,252
Cr	901	360	631	191
F	8,570	11,400	9,980	1,997
Fe	9,020	29,200	9,020[e]	13,917
Hg	<0.125	0.14	<0.13	13.8
K	89.0	234	162	200
La	<10.2	<2	<10	0
Mn	61.8	213	137	0
Na	64,500	130,200	97,400	85,045
Ni	11.3	267	139	53.1
NO_2	4,080	11,700	7,890	10,148
NO_3	58,000	74,500	66,200	45,104
OH	NR	NR	NR	42,977
Pb	49.8	649	349	0
P as PO_4	75,700	98,400	87,100	77,726
Si	6,520	6,050	6,280	3,455
S as SO_4	3,830	9,810	6,820	3,779
Sr	99.1	878	489	0
TOC	<570	963	<767	0
U	897	26,400	13,600[e]	32,786
Zr	67.5	93	80	16.5

Table D3-1. Tank Characterization Report Concentrations for Tanks 241-T-104 and 241-T-107. (2 sheets)

Radionuclide	Tank 241-T-104 concentration (μCi/g)	Tank 241-T-107 concentration (μCi/g)	Predicted 1C sludge concentration[d] (μCi/g)	HDW Model 1C2 sludge concentration (μCi/g)
^{241}Am	0.0173	0.0141	0.0157	2.7 E-04
^{14}C	<4.5 E-05	1.81 E-04	<1.1 E-04	1.02 E-04
^{60}Co	<2.56 E-04	<0.00199	<9.85 E-04	2.76 E-05
^{134}Cs	NR	<0.00164	<0.0011	1.25 E-06
^{137}Cs	0.199	12.0	5.96	11.4
^{154}Eu	0.00326	<0.00463	<0.0036	5.27 E-04
^{155}Eu	0.00342	<0.0149	<0.0080	0.00266
^{3}H	<3.36 E-04	0.00124	<7.4 E-04	5.31 E-04
^{129}I	<0.0184	NR	<0.0184	1.35 E-06
^{237}Np	0.0326	NR	0.0.0326	4.45 E-06
^{238}Pu	<0.018	0.144	<0.080	3.3 E-04
$^{239/240}$Pu	0.14	0.131	0.136	0.0450
^{106}Ru	NR	<0.0757	<0.038	1.4 E-11
^{79}Se	<1.52 E-04	NR	<1.52 E-04	2.16 E-05
^{90}Sr	2.63	108	54.0	10.0
^{99}Tc	<6.3 E-04	NR	6.3 E-04	7.12 E-04
Density (g/mL)	1.29	1.51	1.40	1.36
H_2O wt%	70.5%	56.0%	63.2%	65.6

[a] Sasaki et al. (1997)

[b] Some differences occur in this column compared to a similar table in the 241-TX-113 best-basis document (Place 1997). This is because the Tank Characterization Report (TCR) for tank 241-T-104 was reissued after the tank 241-TX-113 analysis was complete and the differences reflect changes in the TCR

[c] Valenzuela and Jensen (1994), Table 5-23

[d] Decayed to January 1, 1994 to match Hanford Defined Waste model

[e] Since tank 241-TX-114 did not receive uranium recovery (UR) wastes, the higher iron concentrations for tank 241-T-107 was ignored. Higher uranium and iron concentrations have been noted in several tanks (including tanks 241-T-107, 241-BX-107 and 241-B-106) which stored UR wastes on top of 1C sludges. The higher uranium concentration of 241-T-107 will be included in the average since metal waste supernates containing significant uranium concentrations were stored in tank 241-TX-114.

D3.4.2 Composition of T1 Salt Cake

Operation of the 242-T Evaporator between 1951 and 1955 resulted in 2,903 kL (767 kgal) of salt cake, which is contained in 10 underground storage tanks in the T, TX, and TY Tank Farms (Agnew et al. 1997a). The evaporator feeds during this time period consisted largely of 1C and TBP waste supernates. The HDW model refers to this salt cake as T1 SltCk on a global basis. The HDW model uses this average T1 SltCk composition to calculate the T1 salt cake inventories for individual tanks rather than its Supernatant Mixing Model (SMM) because of the lack of detailed evaporator feed composition data. The salt cake produced by the 242-T Evaporator from 1951 through 1955 will be referred to as T1 salt cake hereafter in this report. Seventy-nine percent of the T1 salt cake is contained in the TX Tank Farm. With the exception of tank 241-T-109, all tanks containing T1 salt cake also contain other waste types. Five of the tanks containing T1 salt cake have been core or auger sampled (tanks 241-T-108, 241-T-109, 241-TX-116, 241-TY-101, and 241-TY-102).

The auger samples for tanks 241-T-108 and 241-T-109 are recent (1995) and laboratory analyses should meet all *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1994) requirements. Tank 241-T-108 is expected to contain 1C/CW sludge as well as T1 salt cake (Agnew et al. 1997a); however, the analytical results indicate that the tank 241-T-108 sample retrieved was primarily salt cake as evidenced by the high sodium concentration (223,000 $\mu g/g$) reported for the composite (Baldwin 1996). Tank 241-T-109 contains only T1 salt cake generated from the 242-T Evaporator concentration of TBP and 1C/CW supernates. The composition of the tank 241-T-109 salt cake is somewhat unusual in that it is primarily sodium phosphate rather than sodium nitrate. The composition reported by the TCRs for tank 241-T-108 (Baldwin et al. 1996) and for tank 241-T-109 (Brown et al. 1996) are included in Table D3-1.

T1 salt cake was deposited in tank 241-TX-116 between 1951 and 1955. The tank 241-TX-116 core sample was taken with the initial prototype of a rotary core sampler in 1976 to 1977 (Allen 1977). Sample recoveries were relatively poor and no material was recovered from several segments. Additionally, analytical methods and quality assurance requirements differed significantly from current practices. The analytical data are provided in a letter report (Horton 1977). Core segments 6, 7, 9, and 10 are expected to be T1 salt cake based on the HDW model layer volumes, and this is confirmed by differences in the core sample results as compared to segments 1 through 4 (T2 salt cake). No material was recovered in segments 5 and 8. The analytical results were corrected to a silica-free basis since diatomaceous earth (92 percent SiO_2) was added to tank 241-TX-116 in November 1970 (Buckingham and Metz 1974). The analytical results are included in Table D3-1.

Tanks 241-TY-101 and 241-TY-102 were core sampled in 1985. As with the tank 241-TX-116 core sample, the analytical methods and quality assurance differed from current practices. Tank 241-TY-101 contains ferrocyanide scavenging wastes as well as salt cake. The relatively low sodium concentration reported for the composite (121,000 μg/g, Weiss and Mauss 1987a) indicates that the sample was primarily sludge and that the data are not appropriate examples of T1 salt cake. Tank 241-TY-102 contains both T1 and T2 salt cakes (about 45 percent T1 salt cake). Since only composite analyses were performed, the results can not be used as an example of T1 salt cake.

However, it should be noted that the phosphate concentration for tank 241-TY-102 is relatively low (29,000 μg/g, Weiss and Mauss 1987b), indicating that the phosphate concentration of the T1 salt cake added to tank 241-TY-102 could not have been comparable to concentrations measured for tanks 241-T-108 and 241-T-109 (125,000 and 246,000 μg/g respectively, Table D3-1). Phosphate concentrations exceeding 100,000 μg/g are not necessarily typical of T1 salt cakes based on the analytical results for tanks 241-TY-102 and 241-TX-116. The reason for this wide variation in phosphate concentration is not known, but supernates recycled from salt receiving tanks to the 242-T Evaporator might have been depleted in phosphate, and consequently the salt cakes formed from recycled supernates would have a lower phosphate concentration.

The analytical data for tanks 241-T-108, 241-T-109, and 241-TX-116 are tabulated in Table D3-1. The relative standard deviation of the mean for all components except sodium are extremely high, indicating that the composition of the waste type is extremely variable. Any model which assumes that T1 salt cake has a relatively consistent composition, including the prediction in Table D3-2 or the HDW model (Agnew et al. 1997a), will have very limited usefulness in predicting the inventory of a tank containing T1 salt cake. The composition predicted by the HDW model for the global composition of T1 salt cake is included in Table D3-2 for comparison. With the exception of sodium and nitrate, the predicted T1 salt cake composition differs significantly from the HDW model T1 SltCk concentrations for most chemical analytes. The predicted T1 salt cake concentrations used to calculate the tank 241-TX-114 inventory for this evaluation will be based on the average of the concentrations in tanks 241-T-108, 241-T-109, and 241-TX-116.

Table D3-1. Composition of T1 Salt Cakes (2 Sheets).

Analyte	Tank 241-T-108[a] (μg/g)	Tank 241-T-109[b] (μg/g)	Tank 241-TX-116 (μg/g)[c,d]	Relative std dev of mean (%)	Average - predicted T1 salt cake (μg/g)	HDW model T1 SltCk[e] (μg/g)
Ag	<7.96	18.6	NR	NA	<13.3	NR
Al	2,290	1,250	1,720	17.2%	1,750	140.1128
Bi	605	170	NR	56.1%	388	1,806.784
Ca	177	324	NR	29.3%	251	2,116.939
Cd	<7.96	<5	NR	NA	<5[f]	NR
Cl	<905	341	NR	NA	341[f]	1,376.542
CO_3	NR	10,400	32,800	67.2%	21,600	6,832.004
Cr	19.2	40	150	58.3%	69.9	128.6514
F	10,700	13,000	3,140	33.3%	8,950	948.0084
Fe	6,110	5,490	16,000	37.0%	9,200	4,040.613
Hg	NR	NR	NR	NA	NR	0.601441
K	<239	<500	NR	NA	<239[f]	270.302
La	<39.8	<50	NR	NA	<39.8[f]	0
Mn	182	1,030	NR	70.0%	606	0
Na	223,000	181,000	246,600	8.85%	216,900	185,809.8
Ni	<15.9	<20	NR	NA	<18	396.1703
NO_2	6,210	492	210	84.8%	2,300	5,525.867
NO_3	392,000	20,800	574,700	49.5%	329,200	333,726.3
OH	NR	NR	NR	NA	NR	8,933.119
Pb	533	303	NR	27.5%	418	0
P as PO_4	125,000	246,000	13,500	52.4%	128,200	70,614.37
Si	1,500	889	NA	25.6%	1,200	287.0366
S as SO_4	1,110	516	34,200	93.2%	11,900	5,974.895
Sr	21.6	<10	NR	NA	<15.8	0

Table D3-1. Composition of T1 Salt Cakes (2 Sheets).

Analyte	Tank 241-T-108[a] (μg/g)	Tank 241-T-109[b] (μg/g)	Tank 241-TX-116 (μg/g)[c,d]	Relative std dev of mean (%)	Average - predicted T1 salt cake (μg/g)	HDW model T1 SltCk[e] (μg/g)
TOC	NR	NR	NR	NA	NR	1.34 E-06 (wt%)
U	1,130	<500	0.0052	NA	<543	9,724.072
Zr	10.9	12.2	NR	5.63%	11.6	19.18255
Radio-nuclide	μCi/g	μCi/g	μCi/g	%	μCi/g	μCi/g
^{241}Am	<0.123	NR	NR	NA	<0.123[g]	4.67 E-04
^{60}Co	<0.0133	NR	NR	NA	<0.0162[g]	5.77 E-05
^{134}Cs	NR	NR	2.44	NA	0.0080[g]	2.43 E-06
^{137}Cs	2.00	NR	4.74	40.7%	2.63[g]	34.44064
^{154}Eu	<0.0455	NR	NR	NA	<0.0514[g]	0.001026
^{155}Eu	<0.0407	NR	NR	NA	<0.0503[g]	0.004959
Density (g/mL)	2.35	1.55[h]	NR	NA	1.95	1.742038
% H_2O	19.5%	47.70%	NR	NA	33.6%	37.7268%

HDW = Hanford Defined Waste
NA = Not applicable
NR = Not reported
[a] Baldwin (1996)
[b] Brown et al. (1996)
[c] Horton (1977)
[d] Silica-free basis due to the addition of diatomaceous earth to this tank
[e] Agnew et al. (1997a)
[f] Since these analytes were not expected in this waste, the lower value was used instead of an average
[g] Predicted T1 salt cake radionuclides are decayed to January 1, 1994. The radionuclides for tanks 241-T-108, 241-T-109, and 241-TX-116 are reported as of the date analyzed, therefore, the average predicted values may not match the reported values
[h] The density reported by the 241-T-109 TCR (Brown et al. 1996) was not actually measured, but based on a HDW model Rev. 3 estimate (Agnew et al. 1996).

The density reported for tank 241-T-108 is relatively high and may reflect compaction of the salt cake sample during laboratory analysis. However, T1 salt cake constitutes only 10.9 vol% of the tank salt cake inventory, so the overall impact on the tank 241-TX-114 inventory estimate will be small.

D3.4.3 Composition of T2 Salt Cake

Post-1965 operation of the 242-T Evaporator resulted in 22,672 kL (5,990 kgal) of salt cake that is contained in 26 underground storage tanks in the S, SX, U, T, TX, and TY Tank Farms (Agnew et al. 1997a). The HDW model refers to this salt cake as T2 SltCk on a global basis or as SMMT2 when calculated by the Supernatant Mixing Model (SMM) for an individual tank. The salt cake produced by the 242-T Evaporator from 1965 to 1976 will be referred to as T2 salt cake, hereafter, in this report. Ninety one percent of the T2 salt cake is contained in the TX Tank Farm. All tanks containing T2 salt cake also contain other waste types.

Eight tanks containing T2 salt cake have been core sampled, 241-S-107, 241-U-102, 241-U-105, 241-U-107, 241-TX-107, 241-TX-116, 241-TY-102, and 241-TY-103. Only three of these tanks (241-U-102, 241-U-105, and 241-TX-116) have T2 salt cake layers large enough to differentiate it from other waste types in core sample data at the segment level.

T2 salt cake was formed in tanks 241-U-102 and 241-U-105 from 1975 through 1976 (Agnew et al. 1997a). Core sampling of tanks 241-U-102 and 241-U-105 was performed in early 1996. Based on the HDW model, segments 4, 5, and 6 for the two cores from tank 241-U-102 and segment 8 of two cores from tank 241-U-105 are expected to be representative of the T2 salt cake waste type. An independent determination of these levels is not possible because of due a lack of solids volume measurements in this time period. Furthermore, a significant composition change between the expected S2 salt cake and T2 salt cake layers can not be seen in the core sample data. The recent analytical data should meet all Tri-Party Agreement requirements. Descriptions of the core sampling events and analytical data are available in the respective Tank Characterization Reports (Hu et al. 1997 and Brown and Franklin 1996).

T2 salt cake was deposited in tank 241-TX-116 between 1966 and 1971. The tank 241-TX-116 core sample was taken with the initial prototype of a rotary core sampler from 1976 to 1977 (Allen 1977). Sample recoveries were relatively poor. Additionally, analytical methods and quality assurance differed from current practices. However, this sample event provides the only composition data for early production of the T2 salt cake waste type. Inclusion of an early T2 salt cake type is important since 242-T Evaporator feeds and operating practices changed over time.

The analytical data for tank 241-TX-116 are provided in a letter report (Horton 1977). Core segments 1 through 4 are expected to be representative T2 salt cake from the HDW model, and this is confirmed by vertical differences in the core sample results. It was necessary to correct the analytical results to a silica-free basis since diatomaceous earth (92 percent SiO_2) was added to tank 241-TX-116 in November of 1970 (Buckingham and Metz 1974). The silica from the diatomaceous earth had migrated into the top four core segments (approximately 203 cm [80 in.]) of the salt cake.

The composition data for tanks 241-U-102, 241-U-105, and 241-TX-116 are summarized in Table D3-3. The analytical results for tanks 241-U-102 and 241-U-105 are mass-weighted averages based on the mass of the partial core segment corresponding to each analytical result. Mass-weighted averages, rather than simple arithmetic averages, were calculated because the core segments were not of equal length and the mass of the partial core segments analyzed varied from approximately 30 g to 250 g. Similarly, a mass-weighted average was created for the combination of the T2 salt cake in the two U Farm tanks (81.5% tank 241-U-102 and 18.5 % tank 241-U-105). The analytical results for tank 241-TX-116 core segments were simply averaged since the core segments were of equal length. The T2 salt cake prediction is the arithmetic average of the U Tank Farm and tank 241-TX-116 concentrations. The data for tank 241-TX-116 were intentionally given more emphasis (50 percent of the predicted concentration) in the generalized T2 salt cake prediction as it represents an operating period that is more applicable to the TX Tank Farm. The global HDW model composition for T2 salt cake (T2 SltCk) is included in the Table D3-3 for comparison.

The use of the composition data from tanks 241-U-102, 241-U-105, and 241-TX-116 to represent the composition of other T2 salt cakes should be viewed only as an approximation. None of these three tanks had undergone salt well pumping at the time of the respective core samples. In the case of tank 241-TX-114, these data are being applied to a salt cake which has been salt well pumped and has collapsed to a reduced volume as the result of the removal of interstitial liquid. Additionally, the T2 salt cake projected by the HDW model in tanks 241-U-102 and 241-U-105 could be erroneous if the transfers were TX Tank Farm supernates (i.e., saturated salt solutions that had already cooled and would not form additional salt cake) rather than actual evaporator bottoms.

Table D3-3. 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
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

Table D3-3. 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)
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.

D3.5 PREDICTED INVENTORY FOR TANK 241-TX-114

The chemical and radionuclide inventory of tank 241-TX-114 can be estimated from the 1C sludge, T1 salt cake, and T2 salt cake volumes (15 kL [4 kgal], 220 kL [58 kgal], and 1,790 kL [473 kgal] respectively), densities (1.40, 1.95, and 1.7 g/mL respectively) and the average of chemical/radionuclide concentrations calculated for the 1C sludges and 242-T salt cake wastes that have been analyzed. The resulting inventories are provided in Table D3-4. The inventories estimated by the HDW model (Agnew et al. 1997a) are included in the table for comparison.

Table D3-4. Estimated Chemical and Radionuclide Inventory for Tank 241-TX-114. (2 sheets)

Analyte	1C/CW sludge layer inventory[a] (kg)	T1 salt cake layer inventory[b] (kg)	T2 salt cake layer inventory[c] (kg)	Predicted 241-TX-114 inventory (kg)	HDW model inventory (kg)
Ag	<0.090	<5.68	39.9	<45.7	NR
Al	344	750	83,800	84,900	52,800
Bi	327	166	<201	<695	1,520
Ca	23.4	107	906	1,040	2,880
Cd	0.131	<2.14	<21.9	<24.2	NR
Cl	12.8	146	15,900	16,100	12,300
CO_3	163	9,240	164,900	174,300	41,200
Cr	13.4	29.9	4,000	4,040	7,950
F	212	3,830	<5,850	<9,890	3,250
Fe	191	3,940	37,504	41,600	2,640
Hg	<0.00281	NR	NR	NA	4
K	3.43	<102	5,170	5,280	3,500
La	<0.21	<17.0	<104	<121	2.10 E-04
Mn	2.91	259	722	985	213
Na	2,060	92,800	641,500	736,400	492,000
Ni	2.95	<7.68	277	288	716
NO_2	167	986	93,600	94,700	131,000
NO_3	1,400	140,900	934,200	1.077 E+06	583,000
OH	NR	NR	NR	NR	195,000
Pb	7.41	179	<415	<602	335
PO_4	1,850	54,900	23,300	80,000	44,300
Si	133	511	509	1,150	3,070
SO_4	145	5,120	49,600	54,900	37,500
Sr	10.4	<6.76	<20.1	<37.2	0
TOC	<16.2	NR	28,000	28,000	14,800
U	289	<233	<1,180	<1,700	7,710
Zr	1.43	4.94	52.4	59.0	67.3

Table D3-4. Estimated Chemical and Radionuclide Inventory for Tank 241-TX-114. (2 sheets)

Radionuclide[d]	1C/CW sludge layer (Ci)	T1 salt cake layer (Ci)	T2 salt cake layer (Ci)	Predicted 241-TX-114 inventory (Ci)	HDW model inventory (Ci)
^{241}Am	0.332	<52.7	<92,300	<92,400	76.5
^{14}C	<0.00239	NR	NR	NA	38.6
^{60}Co	<0.0209	<6.93	<432	<439	43.0
^{134}Cs	<0.0243	3.44	2.93	6.40	4.14
^{137}Cs	126	1,130	338,500	339,800	408,000
^{154}Eu	<0.0771	<22.0	<1,520	<1,540	719
^{155}Eu	<0.169	<21.5	<3,180	<3,200	304
^{3}H	<0.0158	NR	NR	NA	274
^{129}I	<0.39	NR	NR	NA	0.530
^{237}Np	0.69	NR	NR	NA	0.992
^{238}Pu	<1.70	NR	NR	NA	1.81
$^{239/240}Pu$	2.87	NR	NR	NA	86.8
^{106}Ru	<0.807	NR	NR	NA	8.12 E-03
^{79}Se	<0.00322	NR	NR	NA	4.16
^{90}Sr	1,145	NR	NR	NA	142,000
^{99}Tc	<0.0134	NR	NR	NA	275

HDW = Hanford Defined Waste, Agnew et al. (1997a)
NA = Not applicable
NR = Not reported
[a] Based on the 1C/CW sludge prediction in Table D3-1.
[b] Based on the T1 salt cake prediction in Table D3-2.
[c] Based on the T2 salt cake prediction in Table D3-3.
[d] Radionuclides decayed to January 1, 1994.

D3.6 COMPARISON OF TANK 241-TX-114 INVENTORY ESTIMATES

The lack of sample-based inventory data adds considerable uncertainty to estimation of chemical and radionuclide inventories for tank 241-TX-114. The use of waste composition data from tanks 241-T-104, 241-T-107, 241-T-108, 241-T-109, 241-TX-116, 241-U-102, and 241-U-105 to represent the wastes in tank 241-TX-114 is a reasonable approach in the absence of analytical data. However, it should be noted that the operating history of tank 241-TX-114 is different from any other Hanford Site tank containing similar waste types. Estimation based on compositions measured in other tanks should be regarded as only an approximation.

The tank 241-TX-114 inventories predicted by the HDW model and the estimate based on waste analyses in other tanks are generally of the same order of magnitude, although the HDW generally somewhat lower. Part of the explanation for this difference may be that the HDW model calculated density for the tank 241-TX-114 T2 salt cake is 1.43 g/cc based on the sodium, aluminum, and hydroxide concentrations. This HDW calculated density is often much lower than is generally found when salt cakes are analyzed. The calculated density is used in determining the HDW model inventory for all analytes. It is also appears that T2 salt cake feed inputs were missing from the waste transaction records. The reported volumes of T2 evaporator bottoms routed to tank 241-TX-114 are not adequate to generate the quantity of T2 salt cake produced.

Aluminum. The estimated aluminum inventory is 61 percent higher than that predicted by the HDW model. Part of this difference is due to the low T2 salt cake density calculated by the HDW model (1.43 g/cc), as compared to the 1.7 g/mL estimated from analytical data for T2 salt cakes. Additionally, the tank 241-TX-116 analytical results show a much higher aluminum concentration and Anderson (1990) indicates processing of a substantial volume of aluminum coating wastes in 1967 to 1968.

Carbonate and Hydroxide. The estimated tank 241-TX-114 carbonate inventory is 4.2 times the HDW model inventory. The hydroxide ion in Hanford Site waste tanks is converted to carbonate by the absorption of carbon dioxide from the ambient air. One mole of absorbed carbon dioxide will react with two moles of hydroxide ion to form one mole of carbonate ion. The rate is difficult to model at best, and is accelerated by use of airlift circulators such as those installed in tank 241-TX-114. Conversion of 75,400 kg of hydroxide to carbonate would account for the difference. The HDW model does not account for the absorption of carbon dioxide from the atmosphere.

Fluoride . The estimated fluoride inventory is 3 times that predicted by the HDW model. This is likely the result of the HDW model assumptions that sodium fluoride is the only chemical compound containing fluoride and that it does not precipitate. The formation of insoluble fluoride compounds (such as sodium fluorophosphate) may be causing some fluoride to precipitate and remain in the tank.

Iron. The estimated iron inventory is skewed by the high iron concentration (2.4 wt%) reported for tank 241-TX-116 T2 salt cake. A later analysis of the tank 241-TX-116 salt cake (Schulz 1980) indicated very little insoluble material. The high iron concentration is not likely for a salt cake since iron is insoluble in alkaline solutions and significant iron concentration would not be expected in the evaporator feed solutions. Therefore, the HDW model iron inventory will be used for the best-basis.

Nitrate. The estimated nitrate inventory is 1.8 times that predicted by the HDW model. The HDW model salt cake inventory is predicted by the SMM, and it is, therefore, difficult to determine the cause of this discrepancy. The global HDW model T1 and T2 salt cake concentrations (see Tables D3-2 and D3-3) are very reasonable, indicating that either the problem lies within the SMM model or that some feed inputs have been missed.

Sodium. The predicted HDW sodium inventory is about 67 percent that predicted from analytical data for other T1 and T2 salt cake tanks. The density calculated by the HDW model for the T2 salt slurry is 1.43 g/cc, which is at least 15 percent below that normally expected for a salt cake but this would explain only part of the difference in the sodium inventory. The global HDW model T1 and T2 salt cake sodium concentrations are very reasonable (see Tables D3-2 and D3-3). Either there is an internal problem in the SMM model calculations or some feed inputs have been missed.

Total Hydroxide. Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of the 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. The charge balance approach is consistent with that used by Agnew et al. (1997a). The revised total hydroxide inventory based on core sample analyses is 194,000 kg, which is very close to the HDW model estimate.

Cesium-137 and Strontium-90. The heat load for tank 241-TX-114 was not estimated (Kummerer 1995) due to a lack of waste and vapor space temperature data. The lack of a heat load estimate makes evaluation of validity of ^{137}Cs and ^{90}Sr inventories difficult. The HDW ^{137}Cs inventory 20 percent higher than predicted from analytical data from other waste tanks. To be conservative, the higher HDW model inventory will be used as the best-basis. The HDW model inventory for ^{90}Sr will also be used for the best-basis as insufficient ^{90}Sr analytical data for the T2 salt cake. Tank 241-TX-114 did store complexed wastes (designated as EVT, Agnew et al. 1997b) containing relatively high ^{90}Sr concentrations during 1974 to 1976, so the 142,000 Ci ^{90}Sr HDW inventory is not unreasonable.

4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with waste management activities, as well as regulatory issues. These 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.

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 based on 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 effort is underway to provide waste inventory estimates that will serve as the standard characterization for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for tank 241-TX-114 was performed including the following:

- T Plant $BiPO_4$ reactor fuel reprocessing to confirm 1C/CW waste volumes transferred into the tanks 241-TX-113 through the tank 241-TX-115 cascade.

- Waste transactions and operating data to confirm that 1C/CW sludge and 242-T Evaporator salt cakes were expected in this tank.

- Composition data from two waste tanks (241-T-104 [DiCenso et al 1994] and 241-T-107 [Valenzuela and Jensen 1994]) which are expected to have similar sludge compositions, three waste tanks (241-T-108 [Baldwin et al. 1996], 241-T-109 [Brown et al. 1996], and 241-TX-116 [Horton 1977]) which are expected to have a similar T1 salt cake compositions, and three waste tanks (241-U-102 [Hu et al. 1997], 241-U-105 [Brown and Franklin 1996], and 241-TX-116 [Horton 1977]) that are expected to have similar T2 salt cake compositions.

- An inventory estimate generated by the HDW model (Agnew et al. 1997a)

Based on this evaluation, a best-basis inventory was developed. No analytical data are available for the salt cake remaining in tank 241-TX-114 because no samples have been taken. The estimated inventory was, therefore, based on the composition of: the 1C/CW wastes in tanks 241-T-104 and 241-T-107, the T1 salt cakes in tanks 241-T-108, 241-T-109, and 241-TX-116, and the T2 salt cakes in tanks 241-U-102, 241-U-105, and 241-TX-116 since the wastes in these tanks have actually been analyzed. The HDW model inventories were used when no other data were available or when analytical data were suspect.

The waste in tank 241-TX-114 consists of 15 kL (4 kgal) of 1C/CW sludge, and 2,010 kL (531 kgal) of T1 and T2 salt cake produced by the 242-T Evaporator. The best-basis inventory for tank 241-TX-114 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 HDW 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-TX-114 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	84,900	E	
Bi	<695	E	
Ca	1,040	E	
Cl	16,100	E	
TIC as CO_3	174,000	E	
Cr	4,040	E	
F	<9,890	E	
Fe	2,640	M	
Hg	4	M	
K	5,280	E	
La	2.1 E-04	M	
Mn	985	E	
Na	736,000	E	
Ni	288	E	
NO_2	94,700	E	
NO_3	1.08 E+06	E	Concentration varies significantly between T1 salt cakes.
OH_{TOTAL}	194,000	C	Estimated by ion charge balance.
Pb	335	M	
P as PO_4	80,000	E	Concentration varies significantly between T1 salt cakes.
Si	1,150	E	
S as SO_4	54,900	E	
Sr	<37	E	
TOC	28,000	E	

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-TX-114 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
U_{TOTAL}	<1,700	E	
Zr	59	E	

[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-TX-114 Decayed to January 1, 1994 (Effective May 31, 1997). (2 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	274	M	
^{14}C	38.6	M	
^{59}Ni	3.10	M	
^{60}Co	43.0	M	
^{63}Ni	302	M	
^{79}Se	4.16	M	
^{90}Sr	142,000	M	
^{90}Y	142,000	M	
^{93}Zr	20.4	M	
^{93m}Nb	14.8	M	
^{99}Tc	275	M	
^{106}Ru	0.00812	M	
^{113m}Cd	105	M	
^{125}Sb	185	M	
^{126}Sn	6.28	M	
^{129}I	0.530	M	
^{134}Cs	6.4	E	Based on analyses of 242-T evaporator salt cakes in other tanks.
^{137}Cs	408,000	M	
^{137m}Ba	386,000	M	
^{151}Sm	14,600	M	
^{152}Eu	5.10	M	
^{154}Eu	719	M	
^{155}Eu	304	M	
^{226}Ra	2.00 E-04	M	
^{227}Ac	0.00129	M	
^{228}Ra	0.302	M	
^{229}Th	0.00701	M	

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-TX-114 Decayed to January 1, 1994 (Effective May 31, 1997). (2 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{231}Pa	0.00565	M	
^{232}Th	0.0186	M	
^{232}U	1.51	M	
^{233}U	5.80	M	
^{234}U	2.69	M	
^{235}U	0.114	M	
^{236}U	0.0542	M	
^{237}Np	0.992	M	
^{238}Pu	1.81	M	
^{238}U	2.98	M	
^{239}Pu	75.4	M	
^{240}Pu	11.4	M	
^{241}Am	76.5	M	
^{241}Pu	118	M	
^{242}Cm	0.196	M	
^{242}Pu	6.42 E-04	M	
^{243}Am	0.00264	M	
^{243}Cm	0.0181	M	
^{244}Cm	0.172	M	

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

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D5.0 APPENDIX D REFERENCES

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