0049755

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 644477

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	M. J. Kupfer, LMHC, H5-49, 376-6631	[] Yes [X] No	7/15/98
	6. Project Title/No./Work Order No. Tank 241-AN-102	7. Bldg./Sys./Fac. No. NA	8. Approval Designator NA
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-WM-ER-545, Rev. ~~1B~~ 1A	10. Related ECN No(s).	11. Related PO No. NA

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	NA	NA Design Authority/Cog. Engineer Signature & Date	NA Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? [] Yes [X] No

This ECN compiles all reconciliation changes to the Best-Basis Inventory made in FY98. Revisions were made to Appendix C, Evaluation to Establish Best-Basis Inventory for Double-Shell Tank 241-AN-102. Changes were made to both text and tables. The inventory estimates of several waste components were revised. The reconciliation process involved correction of errata, reassessment of data outlyers, verification of uranium isotopic distribution and other alpha isotope distribution, and removal of "less than" values, etc.

14a. Justification (mark one)

Criteria Change	[]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[X]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

Tank waste inventory estimates are being provided as standard source term for the various waste management activities. FY 1997 evaluation of available information for all 177 underground storage tanks was performed and published in TCRs, preliminary TCRs, or revisions to existing TCRs. In FY 1998, a reconciliation process is being performed to update the best-basis inventories. This process ensures that the latest inventory estimates are available as a consistent source-term to support the activities of TWRS disposal and other users.

15. Distribution (include name, MSIN, and no. of copies)

Central Files	B1-07
DIMC	~~H6-15~~ R1-41
DOE Reading Room	H2-53
TCSRC	R1-10
K. M. Hall	R2-12
K. M. Hodgson	R2-11
M. J. Kupfer	H5-49
M. D. LeClair (3)	H5-49
J. Jo	R2-12

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A-7900-013-1

ENGINEERING CHANGE NOTICE

ORIGINAL

1. ECN (use no. from pg. 1): 644477

16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]	Other	[X]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng. M. J. Kupfer	J Cammann for	8/5/98	PE		
Cog. Mgr. K. M. Hodgson	K. M. Hodgson	8-3-98	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other			Other		
J. Jo R2-12	J M Comer for J Jo	8-3-98			

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Double-Shell Tank 241-AN-102

S. L. Lambert
COGEMA Engineering Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 644477 UC: 721
Org Code: 7A110 Charge Code: N4G3A
B&R Code: EW3120074 Total Pages: 156

Key Words: TCR, best-basis inventory, standard inventory

Abstract: The best-basis inventory provides waste inventory estimates that serve as standard characterization source terms for the various waste management activities. To establish a best-basis inventory for double-shell tank 241-AN-102, an evaluation of available information was performed. This work follows the methodology established in *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0A (Kupfer et al. 1997).

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RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-545	Page 1

(2) Title
Tank Characterization Report for Double-Shell Tank 241-AN-102

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initially released 03/21/96 on EDT-615356.	J. Jo	J.G. Kristofzski
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1A RS	Incorporate per ECN-640361.	M.J. Kupfer 8-27-97	K.M. Hodgson 8/27/97
1B RS	Incorporated per ECN-644477	M. J. Kupfer 8/5/98	K. M. Hodgson 8/3/98

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APPENDIX C

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AN-102

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APPENDIX C

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AN-102

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 double-shell tank 241-AN-102 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.

C1.0 CHEMICAL INFORMATION SOURCES

Available composition information for tank 241-AN-102 is as follows:

- This Tank Characterization Report (TCR) provides characterization results for the sludge from the 1990 core sampling event, and supernatant from the 1994 and 1995 grab sampling events. Table 4-2 in this TCR summarizes the results from the statistical analysis of data from the supernate grab samples. Table B-3 summarizes the results from the analysis of data from the 1990 sludge core sampling event.

- The 242-A Evaporator Campaign 84-4 Post-Run Document (Pontious 1984) provides characterization data for the waste in tank 241-AW-101 before it was sent to tank 241-AN-102.

- The Hanford Defined Waste (HDW) document (Agnew et al. 1997) provides tank content estimates derived from the Los Alamos National Laboratory (LANL) model, in terms of component concentrations and inventories.

- Bratzel (1985) provides supernatant and interstitial liquid results for the 1985 sampling event.

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C2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Sample-based inventories derived from analytical concentration data, and Hanford Defined Waste (HDW) model inventories, are compared in Tables C2-1 and C2-2. (The chemical species are reported without charge designation per the best-basis inventory convention.) The tank volume used to generate these inventories is 4,092 kL (1,081 kgal) of which 3,755 kL (992 kgal) is supernatant, 337 kL (89.0 kgal) is sludge (Hanlon 1996).

Table C2-1. Sample-based and Hanford Defined Waste Model-Based Inventory Estimates for Nonradioactive Components in Tank 241-AN-102. (2 Sheets)

Analyte	Sampling inventory estimate[a] (MT)	HDW model inventory estimate[b] (MT)	Analyte	Sampling inventory estimate[a] (MT)	HDW model inventory estimate[b] (MT)
Ag	<8.05 E-04	NR	NO_2	330	600
Al	62.9	236	NO_3	902	1,440
As	<84.0	NR	OH	13.6	860
Ba	0.0129	NR	oxalate	NR	0.0119
Be	<3.60 E-04	NR	Pb	<0.138	1.33
Bi	NR	1.29	P as PO_4	19.6	48.5
Ca	2.68	6.34	Rh	0.149	NR
Ce	<0.204	NR	Ru	<0.114	NR
Cd	<0.0157	NR	Sb	<0.261	NR
Cl	15.3	44.7	Si	0.764	11.7
Co	<0.287	NR	SO_4	64.9	145
Cr	1.81	33.7	Sr	0.010	0
Cu	0.030	NR	Te	<0.099	NR
F	7.43	6.29	TIC as CO_3	279	174
Fe	1.04	3.03	TOC	107	106
Hg	NR	0.000967	U_{TOTAL}	<1.56	11.2
K	15.5	13.8	V	<0.0076	NR
La	<0.0149	0.0143	Zn	0.0411	NR
Mg	0.206	NR	Zr	0.280	0.077
Mn	0.242	1.63			

Table C2-1. Sample-based and Hanford Defined Waste Model-Based Inventory Estimates for Nonradioactive Components in Tank 241-AN-102. (2 Sheets)

Analyte	Sampling inventory estimate[a] (MT)	HDW model inventory estimate[b] (MT)	Analyte	Sampling inventory estimate[a] (MT)	HDW model inventory estimate[b] (MT)
Na	1,020	1,680			
NH_3	NR	5.86			
Ni	1.65	1.76			

HDW = Hanford Defined Waste
NR = Not reported.
[a] Table 4-2 and Table B-5 in the TCR
[b] Agnew et al. (1997) .

Table C2-2. Sample-based and Hanford Defined Waste Model-based Inventory Estimates for Radioactive Components.

Analyte	Sampling inventory estimate[a] (Ci)	HDW model inventory estimate[b] (Ci)	Analyte	Sampling inventory estimate[a] (Ci)	HDW model inventory estimate[b] (Ci)
^{14}C	0.648	220	^{237}Np	<0.477	5.72
^{90}Sr	366,000	656,000	$^{239/240}Pu$	57.5	341
^{99}Tc	49.7	1640	^{241}Am	813	350
^{129}I	NR	3.17	Total α	612	NR
^{137}Cs	1.46 E+06	1.40 E+06	Total β	6.98 E+05	NR
^{154}Eu	497	4,220			

HDW = Hanford Defined Waste
NR = Not reported
[a]Table 4-2 in the TCR
[b]Agnew et al. (1997), radionuclides decayed to January 1, 1994.

C3.0 COMPONENT INVENTORY EVALUATION

The following evaluation of tank contents is performed in order to identify potential errors and/or missing information that would influence the sample-based and HDW model component inventories.

C3.1 CONTRIBUTING WASTE TYPES

Tank 241-AN-102 began service in September 1981. It periodically received dilute wastes that were later sent to the 242-A Evaporator. Tank 242-AN-102 also received noncomplexed double-shell slurry feed (DSSF) that was later transferred to other waste tanks. In 1984, complexed concentrate (CC) waste concentrated earlier in the 242-A Evaporator was transferred from tank 241-AW-101 to tank 241-AN-102. This transfer event filled the tank to 4,088 kL (1,080 kgal). Since that time tank 241-AN-102 has received small amounts of miscellaneous waste from the plutonium-uranium extraction (PUREX) Plant and waste water.

The 337 kL (89.0 kgal) of solids in tank 241-AN-102 were precipitated primarily from the CC waste added after 1984 although there may have been some solids formation from the noncomplexed DSSF added earlier.

C3.2 PREDICTED WASTE INVENTORIES

Because of the many observed differences among the inventory values an evaluation was performed to help identify potential errors and/or missing information that could influence the sample-based inventories and/or the inventories estimated by the HDW model. Reference inventories, based on a set of simplified assumptions, were established and compared with the sample- and HDW-based inventories.

The following assumptions and observations were used to generate these reference inventories:

- All solid and liquid wastes in tank 241-AN-102 are CC wastes transferred from tank 241-AW-101 in 1984. Any contributions from other waste additions are assumed to be negligible.

- Component concentrations provided in Pontious (1984) were used for the evaluation (see Table C3-1).

- Tank waste mass is calculated using the tank volumes listed in Hanlon (1996). Volume changes since the addition of the CC waste in 1984 are assumed to be negligible.

- No radiolysis of NO_3 to NO_2 and no additions of NO_2 to the waste for corrosion purposes are factored into this independent assessment.

The waste composition for the product of the 84-4 242-A Evaporator Campaign is provided in Table C3-1. This waste was temporarily stored in tank 241-AW-101 before being pumped to tank 241-AN-102. The compositions shown are the arithmetic average of samples T3641 and T3642 taken in May 1984 (Pontious 1984). Little is known about the procedures used to analyze these samples such as whether complete digestion was achieved and if analysis of solids in the sample were conducted. Sample T3641 was taken near the top of the tank and sample T3642 was taken four feet from the bottom of the tank. The samples indicate that the waste was not stratified.

A comparison of sample-based bulk concentrations (sludge plus supernatant) and the HDW model-based concentrations for tank 241-AN-102 is also provided in Table C3-1. Concentrations for both compositions were calculated by dividing the total mass or activity by the total tank volume indicated by Hanlon (1996). Radionuclide values were back-decayed to May 21, 1984, the day the evaporator post-run data were received by the laboratory as shown in Table C3-1. As shown in Table C3-1, the sample-based composition is in much closer agreement with the evaporator data than the HDW model-based composition.

Table C3-1. Comparison of Sample-Based and 242-A Evaporator 84-4 Campaign Product Compositions.

Analyte	Evaporator post-run data[a] (M)	1990/1994 Sample-based composition[b] (M)	HDW model-based estimate[c] (M)
Al	0.621	0.563	2.12
OH	1.85	0.196	12.3
CO_3	0.677	1.14	0.701
K	0.0415	0.0971	0.0856
Na	8.60	10.8	17.7
NO_2	1.50	1.75	3.16
NO_3	4.08	3.56	5.65
PO_4	0.0517	0.0504	0.125
Radionuclides		(μCi/L)	
^{241}Am	228	199	84.9
^{137}Cs	518,000	454,000	340,000
^{90}Sr	133,000	113,000	159,000
^{237}Np	0.966	<0.117	1.39
$^{239/240}Pu$ (g/L)	3.33 E-04	2.27 E-04	7.98 E-04

HDW = Hanford Defined Waste
[a] Pontius (1984)
[b] From Table 4-2
[c] Agnew et al. (1997).

The close comparison with samples T3641 and T3642 and the recent data for tank 241-AN-102 is a useful check on the accuracy of the data. There is a general trend toward higher concentrations in the sample data. This can be explained in part by the 3.5 percent decrease in waste volume due presumably to in-tank evaporation. However, the concentration increases are not proportional for all components; some concentrations, like Al, decreased between the 1984 and 1990/1994 sampling events.

A better understanding of these differences can be gained by comparing further results from a February 1985, sampling event of the supernatant in tank 241-AN-102 (Bratzel 1985) with the evaporator post-run data and the TCR results in Table C3-2.

Table C3-2. Comparison of Selected Component Concentrations for Tank 241-AN-102.

Analyte	Evaporator post-run data[a] (*M*)	1985 supernatant composition[b] (*M*)	1990/1994 Sample-based composition[c] (*M*)
Al	0.621	0.537	0.563
OH	1.85	0.201	0.196
CO_3	0.677	0.840	1.14
K	0.0415	0.0531	0.0971
Na	8.60	10.4	10.8
NO_2	1.50	1.32	1.75
NO_3	4.08	3.61	3.56
PO_4	0.0517	0.0473	0.0504
Radionuclides		(μCi/L)	
^{241}Am	228	147	199
^{137}Cs	518,000	316,000	454,000
^{90}Sr	133,000	127,000	113,000
^{237}Np	0.966	NR	<0.117
$^{239/240}Pu$ (g/L)	3.33 E-04	2.23 E-04	2.27 E-04

NR = Not reported
[a]Pontius (1984)
[b]Bratzel (1985)
[c]From Table 4-2.

By 1985, some solids had accumulated in tank 241-AN-102. There may have been as much as 125 kL (33.0 kgal) of solids in the tank at that time (Figure 2-4). Nevertheless, these supernatant data are compared to the bulk composition from the 1990/1994 data - not the supernatant data. This is because a much higher volume of solids precipitated from the supernatant between 1985 and the 1990 core sampling event and these solids must be accounted for.

There is good agreement between the 1985 supernatant samples and the 1990/1994 data. When compared to the evaporator post-run data, some important trends can be discerned. These trends and other observations regarding differences in composition are discussed by component.

Aluminum. The 1990/1994 bulk aluminum concentration is 9 percent lower than the evaporator data which is very good considering the uncertainties involved. It is not known whether complete solids digestion was achieved. The mass balance for the 1990 core

sample, however, was only approximately 84 percent. If some solids were left undissolved, then perhaps some aluminum was unaccounted for in the analysis. This may be true of the 1985 supernatant analyses as well which shows a concentration very similar to the 1990/1994 result. Yet, because of this close agreement and the lack of other information, the 1990/1994 result is assumed to be correct.

Hydroxide. Hydroxide is depleted by the absorption of CO_2 from the air. This would explain some of the 89 percent drop in hydroxide concentration from the evaporator data to the 1990/1994 concentrations. The 1985 supernatant data corroborates the 1990/1994 and the 1990/1994 value is assumed to be correct.

Carbonate. Carbonate is being formed in the waste tanks due to CO_2 absorption which explains much of the 68 percent increase. The 1990/1994 valued is assumed to be correct.

Total Organic Carbon. Degradation of organic chemicals is expected for the waste tanks. This accounts for much of the 21 percent decrease in concentration. The 1990/1994 is assumed to be correct in regard to this component.

Potassium. The 134 percent increase in potassium concentration, from the evaporator data to the 1990/1994 data, is difficult to explain. Table C3-2 suggests a trend in which potassium concentrations were increasing, but not enough data exist to make a clear cut conclusion. The 1985 supernatant concentration supports the 1990/1994 value. The 1990/1994 result is assumed to be accurate.

Sodium. The 1990/1994 concentration is 26 percent higher than the evaporator data and 14 percent higher than the 1985 supernatant data. The extra sodium alone could not have come from the heel present in tank 241-AN-102 before the transfer from tank 241-AW-101, nor could it have come from subsequent additions. These additions amount only to 121 kL (32.0 kgal) (Koreski 1995). To account for the extra sodium, these streams combined would have to be 52*M* Na. There have also been no NaOH additions for anti-corrosion purposes. The 1990/1994 result is assumed to be accurate based on the fact that the 1985 supernatant data are in fairly close agreement.

Nitrite. The 1990/1994 concentration is 17 percent higher than the evaporator data which is in reasonably good agreement. Perhaps $NaNO_2$ added as an anti-corrosive accounts for a small fraction of the increase. The 1990/1994 value is assumed to be accurate.

Nitrate. The 1990/1994 value compares extremely well with the evaporator data. The nitrate concentration in the 1990/1994 is 13 percent lower than the evaporator value. The 1990/1994 value is assumed to be accurate.

Phosphate. The 1990/1994 value compares extremely well with the evaporator data, being only 3 percent higher. The 1990/1994 value is assumed to be accurate.

Cesium/Strontium. The 1990/1994 results for Cs and Sr are, respectively, 12 percent and 15 percent lower than the evaporator data. All values are decayed/back-decayed to May 21, 1984. Given the uncertainties involved, there is fairly good agreement. The 1990/1994 results are assumed to be accurate.

Americium/Plutonium. The 1990/1994 results for americium is 13 percent lower than the evaporator concentration; plutonium results are 32 percent lower in the 1990/1884 results. Americium and plutonium concentrations are difficult to obtain in matrices containing high organic content because organic compounds interfere with the counting method. Since procedures to assess actinide contents have improved, the 1990/1994 results are assumed to be accurate.

Total Hydroxide. Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valence of other analytes. This charge balance approach is consistent with that used by Agnew et al. (1997).

Following are additional comments and observations regarding the inventories of other components in Tank 241-AN-102.

Bismuth. The SMM (HDW Model) indicates significant contributions to 241-AN-102 from 1C and 2C waste (1290 kg). This contribution is considered erroneously high due to the assumption that the solubility of Bi is high in 1C and 2C HDW supernatants. Sample analysis for other wastes indicate nearly zero Bi solubility. Since 241-AN-102 contains organic complexants, slight amounts of Bi may exist; however, over 1 MT seems inordinately high. This engineering assessment assumes no Bi in 241-AN-102. Unfortunately no Bi analyses were performed on this tank sample.

Lead. There are no analyses for lead in the 241-AN-102 supernatant. Lead can have significant solubility in alkaline solutions, particularly in the presence of complexants. Since the analytical data for a similar Tank 241-AN-107 show high concentrations of lead, the HDW model was chosen to likely best represent the lead content in 241-AN-102.

Mercury. Addition of mercury to waste streams was quite specific. It was performed during fuel decladding to control loss of radioiodine. HDW inventory estimate is typically higher than found in DSTs by more than an order of magnitude, since most mercury was sent to SSTs and an insoluble compound. The engineering estimate is zero kg rather than the HDW estimates of 9.67 kg (Simpson 1997).

C4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

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 chemical information for tank 241-AN-102 was performed, and a best basis inventory was established. This work, follows the methodology that was established by the standard inventory task.

The results from this evaluation support using the sampling data for the best-estimate inventory to tank 241-AN-102 for the following reasons:

1. The bulk of the waste is supernatant. Supernatant analyses are considered to be accurate descriptions of the waste because supernatants are usually homogenous. Tables A-1 through A-33 demonstrate that there is little stratification in the supernatant layer.

2. Data from the 1990 sludge core sample show good precision. The core sample recovery was adequate although the mass balance was only approximately 84 percent.

3. The results from the independent assessment evaluation compare more favorably with the sample-based data.

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. 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. 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 inventory estimates for tank 241-AN-102 are presented in Tables C4-1 through C4-6. The inventory values reported in Tables C4-1 through C4-6 are subject to change. Refer to the Tank Characterization Database (TCD) (LMHC 1998) for the most current inventory values. Radionuclide values are decayed to January 1, 1994. Sample analysis concentrations reported as "less-than values" (below detection limit) were often used as actual values in Tables C4-5 and C4-6 if the concentrations were significantly lower than

the corresponding HDW model values. Model generated values were used if the sample analytical data were based on high detection limits.

Table C4-1. Supernatant Inventory Estimates for Nonradioactive Components in Tank 241-AN-102 (Effective May 31, 1997). (2 Sheets)

Analyte	Supernatant inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	56,700	S	
Bi	NR		
Ca	1,630	S	
Cl	14,300	S	
TIC as CO_3	248,000	S	
Cr	1,120	S	
F	6,980	S	
Fe	191	S	
Hg	NR		
K	14,600	S	
La	NR		
Mn	147	S	
Na	901,000	S	
Ni	1,430	S	
NO_2	310,000	S	
NO_3	845,000	S	
OH_{TOTAL}	210,000	C	
Pb	NR		
PO_4	18,100	S	IC analysis
Si	<76.0	S	
SO_4	51,800	S	IC analysis
Sr	NR		
TOC	98,400	S	

Table C4-1. Supernatant Inventory Estimates for Nonradioactive Components in Tank 241-AN-102 (Effective May 31, 1997). (2 Sheets)

Analyte	Supernatant inventory (kg)	Basis (S, M, E, or C)[1]	Comment
U_{TOTAL}	<751	S	
Zr	NR		

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

Table C4-2. Supernatant Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Supernatant inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	NR		
^{14}C	NR		
^{59}Ni	NR		
^{60}Co	670	S	
^{63}Ni	NR		
^{79}Se	NR		
^{90}Sr	290,000	S	
^{90}Y	290,000	S	Referenced to ^{90}Sr
^{93}Zr	NR		
^{93m}Nb	NR		
^{99}Tc	112.65	S	Based on 1990 centrifuged liquid
^{106}Ru	NR		
^{113m}Cd	NR		
^{125}Sb	NR		
^{126}Sn	NR		
^{129}I	NR		
^{134}Cs	NR		
^{137}Cs	1.36 E+06	S	
^{137m}Ba	1.29 E+06	S	Referenced to ^{137}Cs
^{151}Sm	NR		
^{152}Eu	NR		
^{154}Eu	NR		
^{155}Eu	NR		
^{226}Ra	NR		
^{227}Ac	NR		
^{228}Ra	NR		
^{229}Th	NR		
^{231}Pa	NR		

Table C4-2. Supernatant Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Supernatant inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{232}Th	NR		
^{232}U	NR		
^{233}U	NR		
^{234}U	NR		
^{235}U	NR		
^{236}U	NR		
^{237}Np	NR		
^{238}Pu	NR		
^{238}U	NR		
$^{239/240}Pu$	21.8	S	
^{240}Pu	NR		
^{241}Am	519	S	
^{241}Pu	NR		
^{242}Cm	NR		
^{242}Pu	NR		
^{243}Am	NR		
^{243}Cm	NR		
^{244}Cm	NR		

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

Table C4-3. Sludge Inventory Estimates for Nonradioactive Components in Tank 241-AN-102 (Effective May 31, 1997). (2 Sheets)

Analyte	Sludge inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	6,170	S	
Bi	NR		
Ca	1,050	S	
Cl	1,040	S	
TIC as CO_3	31,100	S	
Cr	693	S	
F	<450	S	
Fe	845	S	
Hg	NR		
K	<880	S	
La	<14.9	S	
Mn	242	S	
Na	118,000	S	
Ni	215	S	
NO_2	19,900	S	
NO_3	56,700	S	
OH_{TOTAL}	50,900	C	
Pb	<138	S	
PO_4	1,530	S	IC analysis
Si	688	S	
SO_4	13,100	S	IC analysis
Sr	10.1	S	
TOC	8,250	S	

Table C4-3. Sludge Inventory Estimates for Nonradioactive Components in Tank 241-AN-102 (Effective May 31, 1997). (2 Sheets)

Analyte	Sludge inventory (kg)	Basis (S, M, E, or C)[1]	Comment
U_{TOTAL}	805	S	
Zr	280	S	

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

Table C4-4. Sludge Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994, (Effective May 31, 1997). (2 Sheets)

Analyte	Sludge inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	1.27	S	
^{14}C	0.648	S	
^{59}Ni	NR		
^{60}Co	89.3	S	
^{63}Ni	NR		
^{79}Se	1.01	S	
^{90}Sr	78,400	S	
^{90}Y	78,400	S	Referenced to ^{90}Sr
^{93}Zr	NR		
^{93m}Nb	NR		
^{99}Tc	49.7	S	
^{106}Ru	NR		
^{113m}Cd	NR		
^{125}Sb	159	S	
^{126}Sn	NR		
^{129}I	NR		
^{134}Cs	19.7	S	
^{137}Cs	133,000	S	
^{137m}Ba	126,000	S	Referenced to ^{137}Cs
^{151}Sm	NR		
^{152}Eu	<40.7	S	
^{154}Eu	375	S	
^{155}Eu	322	S	
^{226}Ra	NR		
^{227}Ac	NR		
^{228}Ra	NR		
^{229}Th	NR		
^{231}Pa	NR		

Table C4-4. Sludge Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994, (Effective May 31, 1997). (2 Sheets)

Analyte	Sludge inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{232}Th	NR		
^{232}U	NR		
^{233}U	NR		
^{234}U	NR		
^{235}U	NR		
^{236}U	NR		
^{237}Np	<0.477	S	
^{238}Pu	11.7	S	
^{238}U	NR		
$^{239/240}Pu$	35.7	S	
^{240}Pu	NR		
^{241}Am	294	S	
^{241}Pu	NR		
^{242}Cm	0.513	S	
^{242}Pu	NR		
^{243}Am	NR		
^{243}Cm	0.00139	S	
^{244}Cm	15.4	S	

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

Table C4-5. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AN-102 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	62,900	S	
Bi	0	E	HDW model assumes 1290 kg due to erroneous solubility assumption
Ca	2,680	S	
Cl	15,300	S	
TIC as CO_3	279,000	S	
Cr	1,810	S	
F	7,430	S	
Fe	1,040	S	
Hg	0	E	Majority of Hg in cladding waste (Simpson 1998).
K	15,500	S	
La	0	E	La is relatively insoluble in the supernates added to tank 241-AN-102
Mn	389	S	
Na	1.02 E+06	S	
Ni	1,650	S	
NO_2	330,000	S	
NO_3	902,000	S	
OH_{TOTAL}	262,000	C	
Pb	1,330	M	Insufficient analytical data
PO_4	19,600	S	IC analysis
Si	764	S	
SO_4	64,900	S	IC analysis
Sr	10.1	S	
TOC	107,000	S	

Table C4-5. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AN-102 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
U_{TOTAL}	1,560	S	At least 52% of the U in the sludge
Zr	280	S	

[1]S = Sample-based
M = Hanford Defined Waste model-based, Agnew et al. (1997)
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 C4-6. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	1370	M	No analytical data available
^{14}C	220	M	Analytical data not available
^{59}Ni	11.5	M	
^{60}Co	759	S	
^{63}Ni	1,140	M	
^{79}Se	20.9	M	Analytical data unavailable
^{90}Sr	368,000	S	
^{90}Y	368,000	S	Referenced to ^{90}Sr
^{93}Zr	103	M	
^{93m}Nb	73.8	M	
^{99}Tc	162	S	Based on 1990 core sample
^{106}Ru	0.0485	M	
^{113m}Cd	565	M	
^{125}Sb	1260	M	Insufficient analytical data available
^{126}Sn	31.5	M	
^{129}I	3.17	M	
^{134}Cs	61.9	M	Analytical data is missing
^{137}Cs	1.49 E+06	S	
^{137m}Ba	1.40 E+06	S	Referenced to ^{137}Cs
^{151}Sm	73,400	M	
^{152}Eu	27.3	M	No analytical data available
^{154}Eu	4220	M	Analytical data not available
^{155}Eu	1640	M	No analytical data
^{226}Ra	7.95 E-04	M	
^{227}Ac	0.00490	M	
^{228}Ra	1.72	M	
^{229}Th	0.0399	M	
^{231}Pa	0.0235	M	

Table C4-6. Best-Basis Total Inventory Estimates for Radioactive Components in Tank 241-AN-102 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{232}Th	0.183	M	
^{232}U	0.746	M/S	Based on U (Total); Used HDW Isotopic Ratios
^{233}U	2.86	M/S	Based on U (Total); Used HDW Isotopic Ratios
^{234}U	0.590	M/S	Based on U (Total); Used HDW Isotopic Ratios
^{235}U	0.0235	M/S	Based on U (Total); Used HDW Isotopic Ratios
^{236}U	0.0210	M/S	Based on U (Total); Used HDW Isotopic Ratios
^{237}Np	0.477	S	
^{238}Pu	11.7	S	
^{238}U	0.521	M/S	Based on U Total.
^{239}Pu	48.9	M/S	Used HDW isotopic ratios
^{240}Pu	8.62	M/S	Used HDW isotopic ratios
^{241}Am	813	S	
^{241}Pu	113	S/M	Based on ^{239}Pu: Used HDW isotopic ratios
^{242}Cm	0.513	S	
^{242}Pu	6.06E-04	S/M	Based on ^{239}Pu: Used HDW isotopic ratios
^{243}Am	0.0320	S/M	Based on ^{241}Am: Used HDW isotopic ratios
^{243}Cm	0.00139	S	
^{244}Cm	15.4	S	

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

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C5.0 APPENDIX C REFERENCES

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