0049731

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN № 618800

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ~~[x]~~ Direct Revision [X] KN Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	M. J. Kupfer, LMHC, H5-49, 376-6631	[] Yes [x] No	7/28/97
	6. Project Title/No./Work Order No. Tank 241-C-108	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-503, Rev. 0	10. Related ECN No(s). NA	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

Add Appendix D, Evaluation to Establish Best-Basis Inventory for Single-Shell Tank 241-C-108.

SEP 1998 RECEIVED EDMC

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

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-C-108 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

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

Central Files	A3-88	K. M. Hall	R2-12
DOE Reading Room	H2-53	K. M. Hodgson	R2-11
TCSRC	R1-10	J. H. Baldwin	R2-12
File	H5-49		
R. E. Stout	H5-49	R. T. Winward	H5-49
M. J. Kupfer	H5-49		
M. D. LeClair (3)	H0-50		

RELEASE STAMP

AUG 25 1997

DATE: HANFORD RELEASE

STA: 34 ID: 21

A-7900-013-2 (05/96) GEF095

A-7900-013-1

ENGINEERING CHANGE NOTICE	Page 2 of 2	1. ECN (use no. from pg. 1) 618800

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	[]		[]
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
NA		

21. Approvals

Signature	Date	Signature	Date
Design Authority		Design Agent	
Cog. Eng. M. J. Kupfer *[signature]*	7-30-97	PE	
Cog. Mgr. K. M. Hodgson *[signature]*	7-30-97	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other J. H. Baldwin *[signature]*	7-30-97	Other	

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Single-Shell Tank 241-C-108

R. E. Stout (Meier Associates), R. T. Winward (Meier Associates), and M. J. Kupfer
Lockheed Martin Hanford Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 618800 UC: 712
Org Code: 74610 KN Charge Code: N4G3A KN
B&R Code: EW3120074 Total Pages: 153

Key Words: TCR, best-basis inventory

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-C-108 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

Karen G. Noland 8/25/97
Release Approval Date

AUG 25 1997
DATE:
STA: 34
HANFORD RELEASE
ID: 21
Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-503	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-C-108

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 9/29/95 on EDT 613122.	J. P. Sederburg	J. G. Kristofzski
0A RS	Incorporate per ECN-618800.	M. J. Kupfer M J Kupfer 7-30-97	K. M. Hodgson K. M. Hodgson 7-30-97

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-C-108

This page intentionally left blank.

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-C-108

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-C-108 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 information for tank 241-C-108 includes the following:

- Sample data from three 1994 auger sample events on August 12, 14, and 15 (Esch 1995)
- The Hanford Defined Waste (HDW) model document (Agnew et al. 1997) provides tank content estimates in terms of component concentrations and inventories.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

HDW model inventories and sample-based inventories are shown for comparison in Tables D2-1 and D2-2. The tank volume used to generate the HDW inventory is 250 kL (66 kgal) waste which is all sludge (Agnew et al 1997). Hanlon (1997) also reports 250 kL (66 kgal) of waste which is reported as all non-complexed sludge. The HDW model density for the sludge waste is estimated to be 1.52 g/ml. The sample data used a density of 1.4 g/ml. (The chemical species are reported without charge designation per the best-basis inventory convention.)

Table D2-1. Sample-Based and Hanford Defined Waste Model-Based Inventory Estimates for Nonradioactive Components in Tank 241-C-108.

Analyte	Sample-based[a] inventory estimate (kg)	HDW[b] inventory estimate (kg)	Analyte	Sample-based[a] inventory estimate (kg)	HDW[b] inventory estimate (kg)
Al	18,200	1,770	NO_2	8,650	6,570
Bi	NR	1,430	NO_3	15,600	85,600
Ca	4,450	3,090	PO_4	28,200	13,000
Cl	254	346	Si	NR	689
Cr	NR	35	SO_4	NR	1,200
F	1,320	290	CO_3	4,170	5,100
Fe	2,510	11,400	TOC	1,250	117,000
FeCN/CN	941	4,390	U_{TOTAL}	147	5,340
Hg	NR	2.33	Zr	NR	2.39
K	NR	74.4	H_2O (Wt%)	38.8	46.1
Na	32,900	47,300	Density (kg/L)	1.4	1.52
Ni	2,940	1,750			

HDW = Hanford Defined Waste
NR = Not reported
[a]See Appendix A
[b]Agnew et al. (1997).

Table D2-2. Sample and Hanford Defined Waste Model-Based Inventory Estimates for Radioactive Components in Tank 241-C-108.[a]

Analyte	Sample-based[b] inventory estimate (Ci)	HDW-based[c] inventory estimate (Ci)
^{90}Sr	9,450	37,000
^{137}Cs	90,700	42,000
^{239}Pu	3.28	2.34

HDW = Hanford Defined Waste
[a]Radionuclides decayed to January 1, 1994
[b]See Appendix A
[c]Agnew et al. (1997).

D3.0 COMPONENT INVENTORY EVALUATION

D3.1 WASTE HISTORY TANK 241-C-108

First-cycle decontamination (1C) waste from the bismuth phosphate process began cascading from tank 241-C-107 during the third quarter of 1947 (Agnew et al. 1995). Tank 241-C-108 was filled, and waste began overflowing via the cascade line to tank 241-C-109 during the second quarter of 1948.

Supernate was pumped from tank 241-C-108 during the second quarter of 1952, leaving behind about 129 kL (34 kgal) of waste. The tank began receiving uranium recovery (UR) waste via the cascade line from tank 241-C-107 during the fourth quarter of 1952. During the first quarter of 1953, the tank was filled and the waste began cascading to tank 241-C-109. After the second quarter of 1953, the tank received no further transfers of UR waste.

UR waste from tank 241-C-108 was transferred to tanks 241-C-109 and 241-C-111 for in-farm ferrocyanide scavenging during the first quarter of 1956. A layer of UR would have been added to another layer of 1C solids predicted to have settled on the bottom of the tank during its early history.

Beginning in May 1955, UR was routed to the 244-CR Vault for scavenging with nickel ferrocyanide (Borsheim and Simpson 1991). The scavenged waste was returned to tanks to allow the waste to settle; was then sampled and decanted to a crib. Tank 241-C-108 was used as a primary settling tank from the first quarter of 1956 through 1957, receiving scavenged waste from tanks in the C, B, and BX Tank Farms. During this time, the tank received more than 7,570 kL (2,000 kgal) of in-farm ferrocyanide scavenging (TFeCN) waste; about 662 kL (175 kgal) of waste remained in the tank in early 1958 following the conclusion of the scavenging campaign (Agnew et al. 1995).

During 1960 and 1961, the tank received supernate (most likely Plutonium-Uranium Extraction [Facility] [PUREX] cladding waste [CWP] supernate) from tank 241-C-105 and CWP directly from PUREX. A sludge layer of CWP waste would have settled on top of any settled TFeCN waste not remove from the tank.

During 1970 and 1973, tank 241-C-108 received supernatant wastes from tanks 241-C-110 and 241-C-104. Records indicate these supernatant were likely a mixture of wastes, including PUREX organic wash waste, ion exchange waste, reduction oxidation waste, N Reactor waste, decontamination waste, and laboratory waste (Agnew et al. 1995).

The presence of organic wash waste may be suggested by an increase in the manganese concentration because permanganate was used to wash the PUREX solvent. The CWP, hot semi-works waste, and organic wash wastes are not identified as significant contributors in the Waste Status Transaction Record Summary (WSTRS, Agnew et al. 1995) for this tank. Table 2-4 contains an estimate of the concentrations of waste constituents.

D3.2 CONTRIBUTING WASTE TYPES

The HDW model (Agnew et al. 1997) predicts that tank 241-C-108 contains 110 kL (29 kgal) of first cycle decontamination (1C) waste, 95 kL (25 kgal) of uranium recovery (UR) waste, and 45 kL (12 kgal) of in-farm ferrocyanide scavenging (TFeCN) waste. WSTRS also shows supernatant additions of PUREX cladding waste and hot semi-works waste added after the TFeCN additions but does not account for any sludge formation to these two waste types.

The Sort on Radioactive Waste Type (SORWT) model (Hill et al. 1995) lists a Primary waste type of tri-butyl phosphate (TBP-F), a Secondary waste type of first cycle decontamination waste (1C), a tertiary waste type of PUREX cladding waste (CW), and organic wash waste (OWW) as an other waste type.

Hanlon (1997) reports 250 kL (66 kgal) of waste that is all sludge. No description of types of sludge waste differences are given.

Major analyte contributions from each waste type:

- The bottom waste layer (1C waste) should contain large amounts of bismuth.
- The UR waste above the 1C waste should be richer in sulfate and uranium.
- Large quantities of nickel and iron should be present in the TFeCN.
- The PUREX cladding waste, if present, would be near the top of the waste and rich in aluminum.
- If significant quantities of HS waste were present, the total organic carbon, ^{90}Sr, and possible levels of lead should be higher.

D3.3 EVALUATION OF TANK WASTE VOLUME

Tank 241-C-108 is not considered to have leaked or to be leaking. Recent surveillance data indicate surface level readings of 49.5 cm (19.5 in.) or 250 kL (66 kgal) measured by an ENRAF (not an acronym, but the capitalized name of the manufacturer) gauge on January 6, 1997, which corroborates the volumes Agnew et al. (1997) and Hanlon (1997) estimate.

D3.4 ASSUMPTIONS USED FOR THIS EVALUATION

For this evaluation, the following assumptions and observations are made:

- Tank volume listed in Agnew (et al. 1997), 250 kL (66 kgal) and the sample density, 1.4 g/ml, is used in converting concentrations to mass inventory for the engineering assessment.

- Sample data are assumed homogeneous to calculate a total inventory from analyte concentrations.

- Sludge waste types, UR, first decontamination cycle wash in the bismuth phosphate process (1C1), and TFeCN, are assumed to be the waste types contributing to the solids formation in tank 241-C-108.

D3.5 BASIS FOR ENGINEERING ASSESSMENT

To help evaluate data for tank 241-C-108, tanks with similar sludge types and sample data were evaluated. To match the predicted 1C1 waste, tank 241-C-110 was evaluated (Amato et al. 1994). Tank 241-C-110 is predicted to contain 609 kL (187 kgal) of sludge all of which is 1C1 (Agnew et al. 1997). The UR waste was taken from 241-TY-105 (Weiss and Mauss 1987), a tank consisting of 874 kL (231 kgal) of sludge of which 73 is an unknown waste type and the rest is UR (for this comparison the unknown waste was assumed to be UR waste). TFeCN was taken from tank 241-C-109 (Simpson 1994) sample data. Tank 241-C-109 (DiCenso et al. 1995) contained small amounts of Hot Semiworks waste and 1C1 waste along with the TFeCN waste. Segment data for the sample in tank 241-C-109 were used to evaluate only the TFeCN waste in the tank. This evaluation is not used for any component best basis but is used as a check against the analytes with major differences between tank 241-C-108 sample data and the HDW model data.

D3.5.1 Assessment of Uranium Recovery Sample Data

Tank 241-TY-105 was a primary receiver of UR waste and is estimated to contain 874 kL of sludge which is over 95 percent UR sludge (Agnew et al. 1997). Tank 241-C-108 was also a primary receiver for UR waste in 1953 (Agnew et al. 1995). Sample data from tank 241-TY-105 were analyzed to determine the mass inventory of selected analytes in the tank. The mass of each component was then multiplied by a volume ratio of UR waste predicted in tank 241-C-108 versus the UR waste in tank 241-TY-105 (0.0909 = 79.5 kL / 874 kL). Table D3-1 shows the values obtained from this procedure. Also in Table D3-1 is a predicted mass inventory of 1C1 and TFeCN waste in tank 241-C-108 and the predicted inventory from the HDW model for all three waste types for comparison.

D3.5.2 Assessment of 1C1 Sample Data

Tank 241-C-110 is estimated to contain only 1C1 waste. The same method described for the UR waste in section D3.5.1 was used to determine the mass of selected analytes in tank 241-C-108. The volume ratio used for the 1C1 waste was 0.155 (= 95 kL / 609 kL). The results of selected components are shown in Table D3-1. It should be noted that tank 241-C-110 was a primary receiver of 1C1 waste while tank 241-C-108 received 1C1 waste via a tank cascade from tank 241-C-107.

D3.5.3 Assessment of TFeCN Sample Data

Tank 241-C-109 contained mainly TFeCN waste. Sample data for tank 241-C-109 are broken into quarter segments that allow separation of the concentrations of the expected TFeCN waste location from the rest of the expected waste types in the tank. This allows for a comparison to be made of the TFeCN waste with other tanks expected to contain TFeCN waste. Tank 241-C-108 is reported by Agnew et al. (1997) to contain approximately 45 kL (12 kgal) of TFeCN. The kilograms of TFeCN waste in tank 241-C-109 were calculated and then multiplied by a volume ratio of tank 241-C-108 (45 kL) versus 241-C-109 (159 kL). (The volume ratio = 0.283 = 45 kL / 159 kL of TFeCN waste).

Table D3-1. Selected Component Waste Inventory in Tank 241-C-108 Based on Given Waste Types. (2 Sheets)

Component	UR sludge (kg) based on tank 241-TY-105	HDW model predicted UR sludge (kg)	1C1 sludge (kg) based on tank 241-C-110	HDW model predicted 1C1 sludge (kg)	TFeCN sludge (kg) based on tank 241-C-109	HDW model predicted TFeCN sludge (kg)
Al	280	0	1,870	1,770	3,770	0
Bi	60	0	2,160	1,430	NR	0
Cr	19	0	61	0	14	0
F	NR	0	980	290	40	0
Fe	3,030	8,330	1,420	2,170	1,050	900
Mn	24	0	7	0	7	0
Na	16,700	30,600	10,600	13,200	4,910	3,500
Ni	12	6	3	10	788	1,730
NO_3	25,800	18,500	14,300	7,070	2,250	37
NO_2	NR	660	890	1,190	2,270	4,720

Table D3-1. Selected Component Waste Inventory in Tank 241-C-108 Based on Given Waste Types. (2 Sheets)

Component	UR sludge (kg) based on tank 241-TY-105	HDW model predicted UR sludge (kg)	1C1 sludge (kg) based on tank 241-C-110	HDW model predicted 1C1 sludge (kg)	TFeCN sludge (kg) based on tank 241-C-109	HDW model predicted TFeCN sludge (kg)
PO_4	NR	540	3,620	12,000	1,150	500
Si	53	0	923	0	378	0
SO_4	NR	590	1,900	550	430	62
U_{TOTAL}	780	16	190	5,310	720	15
H_2O	NR	22	59.8	64	36	67.9
^{90}Sr (Ci)	27,700		600		42,900	
^{137}Cs (Ci)	11,200		2,500		45,800	
^{241}Am (Ci)	46		NR		8	
^{239}Pu (Ci)	4		10		19	

1C1 = First decontamination cycle wash in the bismuth phosphate process
HDW = Hanford Defined Waste
NR = Not reported (no analytical data were available for the anions, except for NO_3, tank 241-TY-105)
UR = Uranium recovery.

D3.6 ESTIMATED COMPONENT INVENTORIES

The resulting inventories from the sample data, the engineering assessment and the HDW model are provided in Table D3-2 for comparison. A summary of conclusions and observations by component follows.

Table D3-2. Comparison of Selected Component Inventory Estimates for Tank 241-C-108.

Component	Engineering evaluation (kg)	Sample-based inventory estimate[a] (kg)	HDW-based inventory estimate[b] (kg)
Al	5,920	18,200	1,770
Bi	2,220	NR	1,430
Cr	94	NR	35
F	1,020	1,320	290
Fe	5,500	2,510	11,400
Mn	38	NR	0
Na	32,200	32,900	47,300
Ni	797	2,940	1,750
NO_3	42,300	15,600	85,600
PO_4	5,310	28,200	13,000
Si	1,350	NR	689
SO_4	2,920	NR	1,200
U_{TOTAL}	1,690	147	5,340
H_2O (wt%)	47.7	38.8	46.1
^{90}Sr (Ci)	71,200	9,450	37,000
^{137}Cs (Ci)	59,500	90,700	42,000

HDW = Hanford Defined Waste
NR = Not reported
[a]Appendix A
[b]Agnew et al. (1997).

Aluminum. The HDW model under predicts the amount of Al in tank 241-C-108 by an order of magnitude compared to the sample data. The HDW model indicates three waste types contributing to the sludge in 241-C-108 and disregards PUREX cladding waste (CWP1) added to the tank during 1960 on top of the TFeCN waste. CWP1 is high in aluminum and could be the reason for the large discrepancy. The engineering evaluation is also lower than the sample data, but the engineering evaluation does not include any contributions from CWP waste.

Bismuth. Since no sample data are available for Bi the engineering assessment is used for the best-basis inventory. The HDW model assumes that only 68 percent of the bismuth precipitates with the solids from 1C waste. However, flowsheet data show that nearly 100 percent precipitates.

Sodium. The engineering assessment estimate and the HDW model prediction of the sodium content of tank 241-C-108 are in good agreement with that calculated for the sample data. The sample data are used as the best-basis inventory values.

Iron. Iron is seen in all the waste types added to tank 241-C-108. The HDW model is four times the sample inventory. The reason for this difference is not clear at this time. The low level of Fe may indicate a smaller volume of TFeCN in the sludge than predicted by the HDW model. The sample data are not broken down to the segment level so the distribution of Fe in the tank is not known.

Nitrate. Sample data indicate low amounts of nitrate in the tank compared to that predicted by the HDW model. The engineering evaluation predicts a nitrate inventory in between the HDW model and the sample data. The reasons for the discrepancy of all three evaluations is not clear at the present time.

Sulfate. No sample data are available for comparison with the HDW model or the engineering evaluation. The engineering assessment (2,340 kg) sulfate inventory is almost twice that of the HDW model (1,200 kg). Sulfate was added in 1C and UR flowsheets. Analysis of sludge waste for these waste types shows some SO_4 partitions to the solids whereas the HDW model assumes all SO_4 is soluble, i.e., remains in the interstitial liquids. The engineering assessment is used as the best basis.

Phosphate. Sample data inventory (28,200 kg) for tank 241-C-108 indicate over twice the phosphate predicted by the HDW model (13,000 kg). The major contributor of PO_4 is 1C waste. Analysis of other 1C sludge wastes shows more PO_4 partitions to the solids than assumed by the HDW model. The sample data are used as the best-basis inventory.

Uranium. Uranium values from HDW model indicate a U inventory almost forty times the amount reported in the sample data. The engineering evaluation agrees with the lower sample inventory which suggests the possibility of less TFeCN waste in the tank than reported in the HDW model. The slightly lower sample inventory compared to the engineering evaluation infers that the U is deposited in the primary receiver and not the second tank in a cascade.

Fluoride. The sample data (1,320 kg) are over 4.5 times that of the HDW model (290 kg). The major contributor to fluoride is from 1C waste. Analysis of other 1C sludge wastes shows more fluoride partitions to the solids than assumed by the HDW model. The sample data are used as the best-basis inventory.

^{90}Strontium and ^{137}Cesium. ^{90}Sr and ^{137}Cs inventories show large differences between the sample data and the HDW model. Nearly all the ^{90}Sr and ^{137}Cs in this tank results from NiFeCN scavenging ^{137}Cs and Ca/Sr phosphate scavenging for ^{90}Sr. Evidently, the concentrations of ^{90}Sr and ^{137}Cs in supernatants before scavenging are not as predicted by the HDW model. The sample data are used for the best-basis inventory.

TOC. The HDW model prediction of the TOC content of tank 241-C-108 is in excellent agreement with that calculated for the sample data (1,170 kg versus 1,250 kg). The sample data are used as the best-basis inventory value.

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. In some cases, this approach requires that other analyte (e.g., sodium or nitrate) inventories be adjusted to achieve the charge balance. During such adjustments, the number of significant figures is not increased. This charge balance approach is consistent with that used by Agnew et al. (1997).

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

An evaluation of available chemical information for tank 241-C-108 was performed, including the following:

- The inventory estimate generated by the HDW model (Agnew et al. 1997)
- Sample data from a 1994 Auger sample through risers 4 and 7.
- An engineering assessment based on sample data from tanks containing similar waste types as predicted to be present in tank 241-C-108. Tank 241-TY-105 was analyzed for UR waste, tank 241-C-109 TFeCN waste, and tank 241-C-110 for 1C waste.

Based on this evaluation, a best-basis inventory was developed for tank 241-C-108. The sample-based inventory was chosen as the best basis for those analytes where available, for the following reasons:

- Sample data indicate the TFeCN layer predicted by Agnew et al. (1997) is not present or in a smaller volume then reported by the HDW model.
- The sample-based inventory agrees with the tank history waste types (from WSTRS) for major analytes.

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997), all decayed to a common report date of January 1, 1994. Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}Pu$, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am, etc., have been infrequently reported. For this reason it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. (These computer models are described in Kupfer et al. 1997, Section 6.1 and in Watrous and Wootan 1997.) Model generated values for radionuclides in any of 177 tanks are reported in the Hanford Defined Waste Rev. 4 model results (Agnew et al. 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 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.

The best-basis inventory estimate for tank 241-C-108 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.

Table D4-1. Best-Basis Inventory Estimate for Nonradioactive Components in Tank 241-C-108 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	18,200	S	
Bi	2,220	E	
Ca	4,450	S	
Cl	254	S	
TIC as CO_3	5,100	M	
Cr	94	E	
F	1,320	S	
Fe	2,510	S	
Hg	2.33	M	
K	74.4	M	
La	0	M	
Mn	38	E	
Na	32,900	S	
Ni	2,940	S	
NO_2	8,650	S	
NO_3	15,600	S	
OH_{TOTAL}	37,900	C	
Pb	0	M	
PO_4	28,200	S	
Si	1,350	E	
SO_4	2,920	E	
Sr	0	M	
TOC	1,250	S	
U_{TOTAL}	147	S	

Table D4-1. Best-Basis Inventory Estimate for Nonradioactive Components in Tank 241-C-108 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Zr	2.39	M	

[1]S = Sample-based
M = Hanford Defined Waste model-based
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 Estimate for Radioactive Components in Tank 241-C-108 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, E, or C)[1]	Comment
^{3}H	0.412	M	
^{14}C	0.0678	M	
^{59}Ni	0.535	M	
^{60}Co	0.0147	M	
^{63}Ni	48.2	M	
^{79}Se	0.0143	M	
^{90}Sr	9,450	S	
^{90}Y	9,450	S	Referenced to ^{90}Sr
^{93m}Nb	0.0575	M	
^{93}Zr	0.068	M	
^{99}Tc	0.47	M	
^{106}Ru	5.58 E-09	M	
^{113m}Cd	0.162	M	
^{125}Sb	0.0131	M	
^{126}Sn	0.0215	M	
^{129}I	8.85 E-04	M	
^{134}Cs	0.00336	M	
^{137m}Ba	85,800	S	Referenced to ^{137}Cs
^{137}Cs	90,700	S	
^{151}Sm	53.3	M	
^{152}Eu	0.136	M	
^{154}Eu	0.258	M	
^{155}Eu	10.3	M	
^{226}Ra	4.21 E-06	M	
^{227}Ac	2.14 E-05	M	
^{228}Ra	5.27 E-10	M	
^{229}Th	1.02 E-07	M	

Table D4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-C-108 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, E, or C)[1]	Comment
^{231}Pa	4.62 E-05	M	
^{232}Th	1.96 E-11	M	
^{232}U	2.09 E-05	M	
^{233}U	1.25 E-06	M	
^{234}U	1.76	M	
^{235}U	0.0792	M	
^{236}U	0.0113	M	
^{237}Np	0.00289	M	
^{238}Pu	0.00919	M	
^{238}U	3.08	M	
^{239}Pu	3.28	S	
^{240}Pu	0.152	M	
^{241}Am	0.115	M	
^{241}Pu	0.199	M	
^{242}Cm	0.00247	M	
^{242}Pu	7.98 E-07	M	
^{243}Am	7.92 E-07	M	
^{243}Cm	5.05 E-05	M	
^{244}Cm	1.86 E-05	M	

[1]S = Sample-based
M = Hanford Defined Waste model-based
E = Engineering assessment-based
NR = Not Reported.

This page intentionally left blank.

D.5 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, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4*, LA-UR-96-3860, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

Amato, L. C., G. L. Nuttall, K. W. Johnson, R. W. Lambie, and A. T. DiCenso, 1994, *Tank Characterization Report for Single-Shell Tank 241-C-110*, WHC-SD-WM-ER-367, Rev. 0, Los Alamos Technical Associates, Kennewick, Washington.

Borsheim, G. L., and B. C. Simpson, 1991, *An Assessment of the Inventories of the Ferrocyanide Watchlist Tanks*, WHC-SD-WM-ER-133, Rev. 0, Westinghosue Hanford Company, Richland, Washington.

DiCenso, A. T., L. C. Amato, R. W. Lambie, J. D. Franklin, B. J. Seymour, K. W. Johnson, R. G. Stevens, K. M. Remund, L. M. Sasaki, B. C. Simpson, 1995, *Tank Characterization Report for Single-Shell Tank 241-C-109*, WHC-SD-WM-ER-402, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Esch, R. A., 1995, *216-Day Final Report for Tank 241-C-108, Auger Samples 94-AUG-012, 94-AUG-014, 94-AUG-015 and Push Mode, Core 61*, WHC-SD-WM-DP-082, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hanlon, B. M., 1997, *Waste Tank Summary Report for Month Ending January 31, 1997*, WHC-EP-0182-106, 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.

Kupfer, M. J., A. L. Boldt, B. A. Higley, K. M. Hodgson, L. W. Shelton, 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.

Simpson, B. C., 1994, *Tank Characterization Report for Tank C-109*, HNF ~~WHC~~-SD-WM-ER-402, Rev. 0, Westinghouse Hanford Company, 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.

Weiss, R. L., and B. M. Mauss, 1987, *Data Transmittal Package for 241-TY-105 Waste Tank Characterization*, SD-RE-TI-186, Rev. 0, Rockwell Hanford Operations, Richland, Washington.