ENGINEERING CHANGE NOTICE

1. ECN 612294

Proj. ECN

2. ECN Category (mark one) Supplemental [X] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	3. Originator's Name, Organization, MSIN, and Telephone No. A. L. Boldt, LMHC, H5-49, 376-1003	4. USQ Required? [] Yes [X] No	5. Date 7/23/97
	6. Project Title/No./Work Order No. Tank 241-B-103	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-488, Rev. 0B	10. Related ECN No(s). NA	11. Related PO No. NA

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

13a. Description of Change

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

Add Appendix C, Evaluation to Establish Best-Basis Inventory for Single-Shell Tank 241-B-103.

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-B-103 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		
File	H5-49	J. M. Conner	R2-11
A. L. Boldt	H5-49		
M. J. Kupfer	H5-49		
M. D. LeClair (3)	H0-50		

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1. ECN (use no. from pg. 1)
612294

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		7-29-97	Design Agent		
Cog. Eng. M. J. Kupfer	M J Kupfer	7-28-97	PE		
Cog. Mgr. K. M. Hodgson	K.M. Hodgson		QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other J. M. Conner	JM Conner	7-28-97	Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Single-Shell Tank 241-B-103

A. L. Boldt
Lockheed Martin Hanford Corporation, Richland, WA 99352
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-B-103 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

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Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-B-103

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 08/07/95 on EDT-611435.	J.M. Conner	J.G. Kristofzski
0-A RS	Incorporate per ECN-625703.	S.E. Kelly	J.G. Kristofzski 9/19/95
RS 0-B	Incorporate per ECN-635336.	J.M. Conner	J.G. Kristofzski; JM Conner for JGK 8/21/96
0C RS	Incorporate per ECN-612294.	M. J. Kupfer 7-29-97	K. M. Hodgson 7/28/97

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APPENDIX C

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

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APPENDIX C

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

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

C1.0 CHEMICAL INFORMATION SOURCES

Results from the most recent sampling event for this tank are provided in Section C4.0. Two auger samples were obtained in 1995 for safety screening. Analytical determinations from the 1995 sampling event were limited to total alpha, inorganic carbon, organic carbon, percent water, and differential scanning calorimetry for safety screening.

Other component concentrations for the best-basis inventory are based on analytical data from core samples from tanks 241-B-104, 241-B-106, 241-B-108, and 241-B-109 that historically contain the same saltcake waste type as tank 241-B-103. The Hanford Defined Waste (HDW) model (Agnew et al. 1997a) also provides tank content estimates in terms of component concentrations and inventories.

C2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Inventories derived from the 241-B-103 analytical concentration data and HDW model inventories (Agnew et al. 1997a), are compared in Tables C2-1 and C2-2. Insufficient analyses were performed on the 1995 auger samples to allow a sample-based estimate of tank inventory of all analytes. The tank volume used to generate these inventories is 223 kL (59 kgal) (Hanlon 1997, Agnew et al. 1997b). The density used to calculate the sample-based component inventories is 1.65 g/mL, which is the value reported in Agnew et al. (1997a). (The chemical species are reported without charge designation per the best-basis inventory convention.)

Table C2-1. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-B-103.

Analyte	Sampling inventory estimate (kg)	HDW model inventory estimate[a] (kg)	Analyte	Sampling inventory estimate (kg)	HDW model inventory estimate[a] (kg)
Al	NR	90.1	NO_2	NR	2,330
Bi	NR	796	NO_3	NR	114,000
Ca	NR	642	PO_4	NR	20,400
Cl	NR	632	Pb	NR	0
Cr	NR	61.4	Si	NR	245
F	NR	412	SO_4	NR	2,760
Fe	NR	1,460	Sr	NR	0
Hg	NR	0.846	TIC as CO_3	3,360	3,680
K	NR	125	TOC	247	0.596
La	NR	0	U_{TOTAL}	NR	8,040
Mn	NR	0	Zr	NR	2.90
Na	NR	62,900	H_2O (wt%)	44.8	40.6
Ni	NR	105			

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

Table C2-2. Sampling-based and Hanford Defined Waste-Based Inventory Estimates for Radioactive Components in Tank 241-B-103 (Curie Values Decayed to January 1, 1994).

Analyte	Sampling inventory estimate (Ci)	HDW model inventory estimate[a] (Ci)
^{137}Cs	NR	10,200
^{90}Sr	NR	2,630
^{238}Pu	NR	0.057
^{239}Pu	NR	10.3
^{240}Pu	NR	0.798
^{241}Am	NR	0.196
Total alpha	79	11.4

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

C3.0 COMPONENT INVENTORY EVALUATION

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

C3.1 CONTRIBUTING WASTE TYPES

The following abbreviations were used to designate waste types:

MW	=	Metal waste from $BiPO_4$ process, operational 1944 to 1956
BSltCk	=	Saltcake from 242-B evaporator operation, 1951 to 1953
EB	=	Evaporator bottoms. Slurry product from the evaporators. Comparable to BSltCk
CWP	=	PUREX aluminum cladding waste
IX	=	B Plant ion exchange waste
SU	=	Supernatant

C3.1.1 Waste Transaction History

Tank 241-B-103 was initially filled with metal waste (MW) from the B Plant bismuth phosphate process in 1945. The tank was nearly emptied in 1953 when the waste was sluiced for uranium recovery. In 1953, tank 241-B-103 received evaporator bottoms from the 242-B evaporator. In 1957, the supernatant was removed for ferrocyanide scavenging. The remaining solids were recorded as 223 kL (59 kgal) in 1963.

In the period of 1963 through 1976, cladding waste supernatant, B Plant ion exchange wastes, and other SST supernatants were routed through tank 241-B-103 with observed increases and subsequent reductions in the measured solids level of 49 kL (13 kgal) increase and subsequent 49 kL (13 kgal) decrease to a final 223 kL (59 kgal). The effect of passing supernatants through tank 241-B-103 was to dissolve the soluble components of saltcake leaving behind a fraction enriched in aluminum, iron, etc., and the simultaneous deposition of insoluble sludges contained in the cladding wastes and supernatant wastes.

Based on this process history, the solids expected in tank 241-B-103 include saltcake solids from the 242-B evaporator (EB or BSltCk) that have been partially redissolved and overlaid with sludges from PUREX cladding waste and incidental sludges from tank farm supernatants on top of the saltcake. Additional detail relevant to the waste transfer history is provided in Section C2.0 of this report.

C3.1.2 Predicted Current Waste Types and Volumes

Information concerning the waste types presently contained in tank 241-B-103 is inconsistent. The HDW model (Agnew et al. 1997a) predicts the following waste types.

Waste Type	Waste Volume - kL (kgal)
MW	11 (3)
BSltCk	212 (56)
Total	223 (59)

The Sort on Radioactive Waste Type (SORWT) model (Hill et al. 1995) lists EB, CW, and IX as the primary, secondary, and tertiary waste types respectively. Hill et al. (1995), Hanlon (1997), and Agnew et al. (1997b) report the total waste volume as 223 kL (59 kgal). Hill et al. (1995) and Hanlon (1997) report that the waste consists entirely of sludge, whereas Agnew et al. (1997b) credits at least 212 kL (56 kgal) to saltcake.

C3.2 BASIS FOR ASSESSING INVENTORIES IN 241-B-103

Salt waste supernatants that were evaporated and concentrated in the 242-B Evaporator until they were largely solidified are referred to as BSltCk by Agnew et al. (1997a). Agnew et al. provides a single average composition for the BSltCk defined waste. However, historical records (Anderson 1990, Agnew et al. 1997b) indicate that supernatants from the first cycle Bismuth Phosphate process (1C waste), as well as supernatants from the uranium recovery (UR) process were evaporated in 242-B and transferred to several tanks in the 241-B Tank Farm. The chemical compositions of the dilute supernatants from these processes differed. Because the supernatants were not all blended together before evaporation, the saltcake compositions resulting from evaporation of these wastes are also expected to differ, both as a function of position within a tank, and as a function of which tank was used as a receiver at a particular time.

Because of the complicated waste supernatant transfer history of feed to the 242-B evaporator and the lack of a flowsheet basis for the waste, it is difficult to perform an independent assessment to estimate the saltcake composition that can be compared to the model-based BSltCk composition. However, waste samples from a limited number of B Tank Farm tanks expected to contain BSltCk have been analyzed and reported. The composition data for tanks 241-B-104 (Field 1996), 241-B-106 (McCain 1996), 241-B-108 (Schreiber 1997), and 241-B-109 (Benar 1997) are summarized in Table C3-1. The analytical results for these tanks were evaluated at the core segment level to identify the areas representing BSltCk. Also shown for comparison are data for core 170 from tank 241-B-109. The core 169 data are not shown since this core is assumed to primarily contain cladding waste. The analytical results for tank 241-B-109 were averaged based on the weight of a full core segment. The full core segment weight was derived by dividing the segment weight by the reported segment volume percent recovery.

To provide a common basis for comparison of the data in Table C3-1, the reported water mass was removed from the results, i.e., the results are all compared on a water-free basis. The HDW model composition for BSltCk (also on a water-free basis) is included in Table C3-1 for comparison.

Table C3-1. Composition of 242-B Evaporator Saltcake (Water-Free Basis). (2 Sheets)

Analyte	241-B-104	241-B-106	241-B-108	241-B-109	Average	HDW model[c] BSltCk
	(µg/g)	(µg/g)	(µg/g)[a]	(µg/g)[b]	(µg/g)	(µg/g)
Al	3,471	6,925	40,400	40,380	22,800	432
Bi	21,516	7,238	<3,130	6,808	<9,670	3,818
Ca	618	4,499	<3,020	<2,950	<2,770	2,894

Table C3-1. Composition of 242-B Evaporator Saltcake (Water-Free Basis). (2 Sheets)

Analyte	241-B-104	241-B-106	241-B-108	241-B-109	Average	HDW model[c] BSltCk
	(μg/g)	(μg/g)	(μg/g)[a]	(μg/g)[b]	(μg/g)	(μg/g)
Cr	966	666	355	1,420	852	290
Fe	19,857	35,011	<1,570	5,908	15,600	6,666
K	NR	315	1,900	NR	1,130	599
La	NR	<73	<1,570	<1,475	<1,020	0.00
Mn	NR	403	<302	<295	<333	0.00
Na	220,620	228,337	343,560	417,902	303,000	295,250
Ni	NR	129	8,961	5,544	4,880	500
Pb	NR	741	<3,020	<3,023	<2,260	0.00
Si	10,729	4,092	2,051	2,236	4,780	1,170
Sr	NR	911	<302	<295	<500	0.00
U	3,616	27,821	1,930	<14,750	12,000	NR
Zr	NR	<73	<302	<295	<223	139
CO_3^{2-}	NR	1,625	6,925	NR	-	11,480
Cl^-	3,974	3,334	1,471	1,495	2,570	3,030
F^-	6,516	5,632	61,280	79,614	38,300	1,979
NO_3^-	546,139	409,639	114,590	219,962	323,000	547,100
NO_2^-	4,614	16,044	19,275	7,907	12,000	11,150
PO_4^{3-}	43,879	66,436	182,070	125,628	105,000	95,690
SO_4^{2-}	41,153	31,312	183,700	316,880	143,000	12,770
Radionuclide	μCi/g	μCi/g	μCi/g	μCi/g	μCi/g	μCi/g
^{137}Cs	NR	50.5	23.5	NR	-	29.3
^{90}Sr	NR	149	3.3	NR	-	7.5
$^{239/240}Pu$	NR	NR	NR	NR	NR	0.029

HDW = Hanford Defined Waste
NR = Not reported
[a]Data from upper half segment 1 from cores 172 and 173 are not included since these partial segments contain primarily CW
[b]Core 170. Core 169 data are not shown since this core contained primarily CW
[c]Agnew et al. (1997a).

As shown in Table C3-1, the concentrations of most components in tank 241-B-104 (with the exception of Bi, Fe, Si, U, and PO_4^{3-}) agree quite well with those for tank 241-B-106. Similarly the concentration of components in tank 241-B-108 agree quite well with those for tank 241-B-109 (core 170). However, the component concentrations in tanks 241-B-104 and 241-B-106 differ markedly from those in tanks 241-B-108 and 241-B-109.

Transfer records (Agnew et al. 1997a) indicate that tank 241-B-109 was the last tank to receive 242-B evaporator bottoms. The records indicate that both evaporated 1C waste and probably evaporated UR waste was transferred to 241-B-109. The high concentrations of F^-, SO_4^{2-}, and PO_4^{3-} in tanks 241-B-108 and 241-B-109 may reflect precipitation of those components from highly concentrated residual liquors that resulted from the final pass through the 242-B evaporator.

The analyte concentrations for core 170 from tank 241-B-109 are considered an appropriate basis for estimating the inventory of chemical components for the fraction of BSltCk waste in 241-B-109. The component concentrations are not consistent with two other tanks (241-B-104 and 241-B-106) believed to contain BSltCk. However, they are consistent with those for tank 241-B-108 which (like tank 241-B-109) also received highly concentrated salt liquors from 242-B evaporator operations. This difference suggests a phasing and distribution issue. Earlier evaporator concentrates derived from 1C waste were placed in tanks 241-B-108 and 241-B-109, and later concentrates derived from UR waste may have been placed in tanks 241-B-104 and 241-B-106.

Analyses for tank 241-B-103 samples were limited to safety screening requirements. Analyses useful for the best-basis inventory are inorganic carbon, total organic carbon, water content and total alpha measurements. No other analyses were performed on samples from tank 241-B-103. The concentrations of analytes are estimated using the average concentrations on a water free basis for the four B Evaporator saltcake tanks presented in Table C3-1. The analyte concentrations are adjusted for a water content of 44.8 weight percent. The value of 44.8 wt percent is the average of the water results reported for the tank 241-B-103 sample (Section C4.0). The inventories of analytes are calculated using a volume of 223 m^3 (Hanlon 1997) and an density of 1.65 g/cc established by the HDW model (Agnew et al. 1997a).

There is no sample bases for mercury in Table C3-1. The value provided by the HDW model (Agnew et al. 1997a) is used for the best-basis inventory for mercury.

Radionuclide analyses for tank 241-B-103 samples was limited to total alpha measurements. The mean total alpha determination for 241-B-103 is 0.214 μCi/g. With an assumed total mass of 368 MT, the total alpha is calculated to be 79 Ci. For the best-basis inventory of individual alpha decay radionuclides, the total alpha determination was split between ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am by the fractional distribution predicted by the HDW model (Agnew et al. 1997a). There is not an adequate sample basis to determine the other radionuclide inventories in tank 241-B-103. The HDW model (Agnew et al. 1997a) inventories are used for radionuclides other than the alpha decay radionuclides.

C3.3 COMPARISON OF INVENTORY ESTIMATES

Estimated inventories from this evaluation are compared with the HDW model-based inventories (Agnew et al. 1997a) in Table C3-2. The inventories from the engineering assessment-based and HDW model inventories differ by a factor of 2 or more for most of the components. Table C3-1 shows the high variability of B Evaporator saltcake by comparison of analyses from four different tanks. The concentration of analytes determined by this evaluation are the average of sample based concentrations presented in Table C3-1. The variability of analytes (Al, Bi, Fe, F, PO_4, and SO_4) for BSltCk wastes is a function of the type of wastes being processed by the B Evaporator and if the salt produced was early or late in the evaporation campaign.

Table C3-2. Engineering Assessment-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-B-103.

Analyte	Engineering inventory estimate (kg)	HDW model inventory estimate[a] (kg)	Analyte	Engineering inventory estimate (kg)	HDW model inventory estimate[a] (kg)
Al	4,640	90.1	NO_2	2,430	2,330
Bi	1,970	796	NO_3	65,600	114,000
Ca	564	642	PO_4	21,300	20,400
Cl	522	632	Pb	460	0
Cr	173	61.4	Si	972	245
F	7,780	412	SO_4	29,000	2,760
Fe	3,170	1,460	Sr	102	0
Hg	0.8	0.846	TIC as CO_3	3,400[b]	3,680
K	230	125	TOC	247[b]	0.596
La	207	0	U_{TOTAL}	2,440	8,040
Mn	68	0	Zr	45	2.90
Na	61,500	62,900	H_2O (wt%)	44.8[b]	40.6
Ni	990	105			

HDW = Hanford Defined Waste
[a]Agnew et al. (1997a).
[b]Sample-based.

C4.0 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 those 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 results of sample analyses, (2) component inventories are estimated 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. The information derived from these different approaches is seldom completely consistent.

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 chemical information for tank 241-B-103 was performed, including the following:

- Data from two 1995 auger samples (Section C4.0)
- An inventory estimate generated by the HDW model (Agnew et al. 1997a)
- Comparing total waste concentrations with similar 241-B Tank Farm tank samples.

Based on this evaluation, a best-basis inventory was developed for tank 241-B-103 (Tables C4-1 and C4-2). The evaluation used the sample-based analytical data from tanks 241-B-104, -106, -108, and -109 which historically contain the same saltcake waste type as tank 241-B-103 to define the best-basis inventory for the following reasons:

- Comprehensive compositional data were not obtained from the 1995 auger samples.
- No methodology is available to fully predict 242-B evaporator saltcake from process flowsheets or historical records.
- Waste transfer records are not complete and not always accurate.

- The solubility data in Agnew et al. (1997a) for several chemical components in BSltCk are not consistent with the sample-based data for tanks 242-B-108 and 241-B-109.

The inventories shown in Table C4-1 are categorized as engineering assessment-based rather the sample-based. The analytical data from four tanks were the primary basis used for deriving the inventories in Table C4-1. Component concentrations from four other BSltCk tanks were used for analytes where there were no 241-B-103 sample analyses. Tank 241-B-103 composition may be closer to tanks 241-B-104 and 241-B-106 or tanks 241-B-108 and 241-B-109 but there is not sufficient historical evidence to state a preference. HDW model bases were used as best-basis where there is a poor (or no) sample basis.

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.

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

The inventory values reported in Tables C4-1 and C4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

The inventories shown in Table C4-1 are categorized as engineering assessment-based rather the sample-based. The analytical data from four tanks were the primary basis used for deriving the inventories in Table C4-1. Component concentrations from four other BSltCk tanks were used for analytes where there were no 241-B-103 sample analyses. Tank 241-B-103 composition may be closer to tanks 241-B-104 and 241-B-106 or tanks 241-B-108 and 241-B-109 but there is not sufficient historical evidence to state a preference. HDW model bases were used as best-basis where there is a poor (or no) sample basis.

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.

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

The inventory values reported in Tables C4-1 and C4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

Table C4-1. Best-Basis Inventory Estimate for Nonradioactive Components in Tank 241-B-103 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E or C)[1]	Comment
Al	4,640	E	
Bi	1,970	E	
Ca	564	E	
Cl	522	E	
TIC as CO_3	3,400	S	
Cr	173	E	
F	7,780	E	
Fe	3,170	E	
Hg	0.846	M	No sample basis
K	230	E	
La	207	E	
Mn	68	E	
Na	61,500	E	
Ni	990	E	
NO_2	2,430	E	
NO_3	65,600	E	
OH_{TOTAL}	9,200	C	
Pb	460	E	
PO_4	21,300	E	
Si	972	E	
SO_4	29,000	E	
Sr	102	E	
TOC	247	S	
U_{TOTAL}	2,440	E	

Table C4-1. Best-Basis Inventory Estimate for Nonradioactive Components in Tank 241-B-103 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E or C)[1]	Comment
Zr	45	E	

[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 C4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-B-103 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	0.767	M	
^{14}C	0.141	M	
^{59}Ni	0.134	M	
^{60}Co	0.0248	M	
^{63}Ni	12.1	M	
^{79}Se	0.024	M	
^{90}Sr	2,630	M	No sample basis
^{90}Y	2,630	M	
^{93m}Nb	0.0965	M	
^{93}Zr	0.114	M	
^{99}Tc	0.79	M	
^{106}Ru	9.51 E-09	M	
^{113m}Cd	0.273	M	
^{125}Sb	0.0222	M	
^{126}Sn	0.0361	M	
^{129}I	0.00149	M	
^{134}Cs	5.84 E-04	M	
^{137m}Ba	9,680	M	
^{137}Cs	10,200	M	
^{151}Sm	89.5	M	
^{152}Eu	0.017	M	
^{154}Eu	0.437	M	
^{155}Eu	1.36	M	
^{226}Ra	8.22 E-06	M	
^{227}Ac	3.79 E-05	M	
^{228}Ra	7.46 E-11	M	
^{229}Th	1.45 E-08	M	

Table C4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-B-103 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	7.71 E-05	M	
^{232}Th	3.28 E-11	M	
^{232}U	4.16 E-05	M	
^{233}U	2.21 E-06	M	
^{234}U	2.65	M	
^{235}U	0.118	M	
^{236}U	0.0201	M	
^{237}Np	0.00486	M	
^{238}Pu	0.04	E	Poor sample basis
^{238}U	2.68	M	
$^{239/240}Pu$	77	E	Poor sample basis.
^{241}Am	1.4	E	Poor sample basis.
^{241}Pu	1.96	M	
^{242}Cm	2.97 E-04	M	
^{242}Pu	8.66 E-06	M	
^{243}Am	1.35 E-06	M	
^{243}Cm	6.07 E-06	M	
^{244}Cm	3.18 E-05	M	

[1]S = Sample-based
M = Hanford Defined Waste model-based
E = Engineering assessment-based.

C5.0 APPENDIX C REFERENCES

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