ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN № 618797

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 [] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	A. L. Boldt, LMHC, H5-49, 376-1003	[] Yes [X] No	7/22/97
	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
	Tank 241-B-101	NA	NA
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.)	10. Related ECN No(s).	11. Related PO No.
	WHC-SD-WM-ER-528, Rev. 0	NA	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-B-101.

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-101 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	R. D. Schreiber	R2-12
A. L. Boldt	H5-49		
M. J. Kupfer	H5-49		
M. D. LeClair (3)	H0-50		

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ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 618797

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		7-22-97	Design Agent		
Cog. Eng.	M. J. Kupfer	7-23-97	PE		
Cog. Mgr.	K. M. Hodgson		QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other	R. D. Schreiber	7/23/97	Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Single-Shell Tank 241-B-101

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-101 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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RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-528	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-B-101

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 4/1/96 on EDT 615367.	R. D. Schreiber	J. G. Kristofzski
0A RS	Incorporate per ECN-618797.	M. J. Kupfer	K. M. Hodgson
		M. J. Kupfer 7-22-97	K. M. Hodgson 7-23-97

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-B-101

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-B-101

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-101 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

Characterization results from the most recent sampling event for this tank are provided in Section 4.0. Two core samples (cores 90 and 91) were obtained in 1995 from two different risers for safety screening. Component concentrations determined from the 1995 sampling event were limited to anions in the bottom one-third to one-half of the tank solids inventory. Lithium and bromide analyses were requested to determine extent of sample contamination by hydrostatic head fluid (HHF) used during the sampling process. The analytical procedure for bromide results in the anion analyses.

The component anion concentrations for the best-basis inventory are based on segment means from the 1995 sampling event. Because of the limited analytical data for cations from the cores, the cations for 241-B-101 are estimated based on analytical data from core samples (tanks 241-B-104, 241-B-106, 241-B-108, and 241-B-109), which historically contain the same saltcake waste type as tank 241-B-101. The Hanford Defined Waste (HDW) model (Agnew et al. 1997a) also provides tank content estimates in terms of component concentrations and inventories.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Sample-based inventories derived from the analytical concentration data and HDW model inventories (Agnew et al. 1997a), are compared in Tables D2-1 and D2-2. The tank volume used to generate these inventories is 428 kL (113 kgal), Hanlon (1997). This volume is also used by Agnew et al. (1997a, 1997b). The density used to calculate the sample-based component inventories is the sample-based determination of 1.48 g/mL (Section 4.2). This value is lower than the value reported in Agnew et al. (1997a). The HDW model estimates the density to be 1.62 g/mL. Note that the sample-based and HDW model inventories differ significantly for virtually all components. (The chemical species are reported without charge designation per the best-basis inventory convention.)

A list of references used in this evaluation is provided in Section D5.0.

Table D2-1. Sample-based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-B-101.

Analyte	Sample-based inventory estimate (kg)	HDW model inventory estimate[a] (kg)	Analyte	Sample-based inventory estimate (kg)	HDW model inventory estimate[a] (kg)
Al	NR	7,000	NO_2	34,000	5,800
Bi	NR	1,210	NO_3	114,500	173,000
Ca	NR	1,740	PO_4	4,390	30,800
Cl	250	1,080	Pb	NR	0.00332
Cr	NR	94.4	Si	NR	6,090
F	< 156	626	SO_4	29,800	4,380
Fe	NR	12,600	Sr	NR	0
Hg	NR	1.28	TIC as CO_3	NR	6,890
K	NR	218	TOC	NR	311
La	NR	0	U_{TOTAL}	NR	9,770
Mn	NR	0	Zr	NR	4.40
Na	NR	108,000	H_2O (wt%)	34.9	42.4
Ni	NR	5,570			

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

Table D2-2. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Radioactive Components in Tank 241-B-101 (Curie Values Decayed to January 1, 1994).

Analyte	Sampling inventory estimate (Ci)	HDW model inventory estimate (Ci)
^{137}Cs	NR	15,900[a]
^{90}Sr	NR	724,000[a]
^{238}Pu	NR	79.8[a]
^{239}Pu	NR	760[a]
^{240}Pu	NR	221[a]
^{241}Am	NR	1,640[a]
Total alpha	1,840	2,701[b]

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

D3.0 COMPONENT INVENTORY EVALUATION

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

D3.1 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
CW	=	Aluminum cladding waste
B	=	B Plant high-level waste
BL	=	B Plant low-level waste

D3.1.1 Waste Transaction History

Tank 241-B-101 was initially filled with metal waste (MW) from the bismuth phosphate process (in B Plant) in 1945. The tank was nearly emptied in 1953 when the waste was sluiced for uranium recovery. In 1953 and 1954, tank 241-B-101 received 242-B evaporator bottoms from tank 241-B-105. In 1957 the supernatant was removed for ferrocyanide scavenging in the CR vault. The remaining solids were recorded as 1,190 kL (315 kgal).

In the period of 1961 through 1973, cladding waste supernatants, B Plant high-level waste supernatants, and B Plant low-level wastes were routed through tank 241-B-101 with observed reductions in the measured solids level to a final 428 kL (113 kgal). The effect of passing supernatants through tank 241-B-101 was likely to partially dissolve soluble components of saltcake leaving behind a fraction enriched in aluminum, iron, etc, and the simultaneous deposition of insoluble sludges contained in the B Plant high-level and low-level wastes.

Based on this process history, the majority of the solids expected in tank 241-B-101 included saltcake solids (EB or BSltCk) from the 242-B evaporator that have been partially redissolved and sludges from B Plant high-level and low-level wastes lying on top of the saltcake. Additional detail relevant to the waste transfer history is provided in Section 2.0 of this report.

D3.1.2 Predicted Current Waste Types and Volumes

Information concerning the waste types presently contained in tank 241-B-101 is inconsistent. The HDW model (Agnew et al. 1997b) predicts the following waste types.

Waste Type	Waste Volume - kL (kgal)
MW	11 (3)
BSltCk	322 (85)
B	19 (5)
BL	76 (20)
Total	428 (113)

The Sort on Radioactive Waste Type (SORWT) model (Hill et al. 1995) lists EB, CW, and BL as the primary, secondary, and tertiary waste types respectively. Hill et al. (1995), Hanlon (1997), and Agnew et al. (1997a, 1997b) report the total waste volume as 428 kL (113 kgal). Both Hill and Hanlon, however, report that the waste consists entirely of sludge, whereas Agnew et al. (1997b) credits at least 322 kL (85 kgal) to saltcake.

Evaluation of segment level core sample data indicates considerable vertical nonuniformity for concentrations of the limited components analyzed (Section 4.0).

Segment level analyses for the bottom portion of the both core samples indicate unexpectedly high concentrations of SO_4 that are a factor of 15-20 higher in concentration than the remainder of the core.

The vertical distribution of total alpha shows concentration varying by a factor of 100. This alpha concentration variation, with the high concentrations on the top sludge levels, is consistent with the deposition of B Plant high-level and low-level sludge layers on top of the saltcake with its lower concentration of insoluble transition metals and actinides.

D3.2 BASIS FOR ASSESSING INVENTORIES IN 241-B-101

BSltCk (the designation used by Agnew et al. [1997a]) is representative of salt waste supernatants that were evaporated and concentrated in the 242-B evaporator until they largely solidified upon cooling. Agnew et al. (1997a) provides a single average composition for the BSltCk defined waste assuming all of the supernatants were mixed together and then evaporated. 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 at different times 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 D3-1. The analytical results for these tanks were evaluated at the core segment level to identify the areas representing BSltCk. Tank 241-B-109 uses data for core 170. The core 169 data for 241-B-109 are not shown since this core is assumed to contain primarily 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 correcting for the reported segment volume percent recovery.

To provide a common basis for comparison of the data in Table D3-1, 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 D3-1 for comparison.

Table D3-1. Composition of Various 242-B Evaporator Saltcakes (Water-Free Basis).

Analyte	241-B-104	241-B-106	241-B-108	241-B-109	241-B-101	241-B-101	HDW model[e] BSltCk
	(μg/g)	(μg/g)	(μg/g)[a]	(μg/g)[b]	(μg/g)[c]	(μg/g)[d]	(μg/g)
Al	3,471	6,925	40,400	40,380	NR	NR	432
Bi	21,516	7,238	<3,130	6,808	NR	NR	3,818
Ca	618	4,499	<3,020	<2,950	NR	NR	2,894
Cr	966	666	355	1,420	NR	NR	290
Fe	19,857	35,011	<1,570	5,908	NR	NR	6,666
K	NR	315	1,900	NR	NR	NR	599
La	NR	<73	<1,570	<1,475	NR	NR	0
Mn	NR	403	<302	<295	NR	NR	0
Na	220,620	228,337	343,560	417,902	NR	NR	295,250
Ni	NR	129	NR	NR	NR	NR	500
Pb	NR	741	<3,020	<3,023	NR	NR	0
Si	10,729	4,092	2,051	2,236	NR	NR	1,170
Sr	NR	911	<302	<295	NR	NR	0
U	3,616	27,821	1,930	<14,750	NR	NR	NR
Zr	NR	<73	<302	<295	NR	NR	139
CO_3^{2-}	NR	1,625	6,925	NR	NR	NR	11,480
Cl^-	3,974	3,334	1,471	1,495	<1,032	476	3,030
F^-	6,516	5,632	61,280	79,614	<370	<362	1,979
NO_3^-	546,139	409,639	114,590	219,962	341,468	249,124	547,100
NO_2^-	4,614	16,044	19,275	7,907	27,184	90,736	11,150
PO_4^{3-}	43,879	66,436	182,070	125,628	<4,325	11,522	95,690
SO_4^{2-}	41,153	31,312	183,700	316,880	291,922	19,229	12,770
Radio-nuclide	μCi/g	μCi/g	μCi/g	μCi/g	μCi/g	μCi/g	μCi/g
^{137}Cs	NR	50.5	23.5	NR	NR	NR	29.3
^{90}Sr	NR	149	3.3	NR	NR	NR	7.5
$^{239/240}Pu$	NR	NR	NR	NR	0.140	7.13	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 are assumed to contain primarily CW
[b]Core 170. Core 169 data are not shown since this core contained primarily CW
[c]Segment 2B of core 90 and segment 2F of core 91
[d]Segment 2A of core 90 and segments 1B and 2A of core 91
[e]Agnew et al. (1997a).

As shown in Table D3-1, the concentrations of most components in tank 241-B-104 (with the exception of Bi 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 tank 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 evaporator bottoms from tank 241-B-105. Tank 241-B-105 was the active bottoms tank at that time. The records indicate that both evaporated 1C waste and probably evaporated UR waste was transferred from tank 241-B-105 to 241-B-109. The high concentrations of F^-, SO_4^{2-}, and PO_4^{3-} in tank 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 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. Perhaps earlier evaporator concentrates derived from 1C waste were placed in 241-B-108 and 241-B-109, and later concentrates derived from UR waste were placed in 241-B-104 and 241-B-106.

The inventory for nonradioactive BSltCk components in 241-B-101 is calculated in two stages. Anions and cations are calculated with two separate procedures.

The 241-B-101 anion component inventories are calculated using the analytical values presented in Table D3-1. The values in Table D3-1 show sulfate stratification in the bottom of the tank. High sulfate concentrations were analyzed for segment 2B of core 90 and segment 2F of core 91. Segment 2B/core 90 contains 17.3 wt% of the total core 90 on a water-free basis. Segment 2F/core 91 contains 13.1 wt% of the total core 91 on a water-free basis. The inventories of anion components is calculated assuming that one sixth (16.7 wt%) of tank 241-B-101 anion inventory is represented by the average of the analyses for segment 2B/core 90 and segment 2F/core 91. The remaining five sixths (83.3 wt%) of tank 241-B-101 anion inventory is represented by the average of the analyses for segment 2A/core 90, segment 1B/core 91, and segment 2A/core 91. These segments represent 19, 12, and 25 wt% of the cores on a water-free basis respectively. The other segments from cores 90 and 91 were not analyzed for nonradioactive components. The concentrations for the two resulting composite layers were converted to equivalent concentrations with water contents of 25.3 wt% for the bottom 1/6 and 33.4 wt% for the top 5/6. These water contents are the average analytical values for the inputs into the composite calculations. The total tank 241-B-101 average anion concentrations were calculated by combining the two composite concentrations with 1/6 and 5/6 weights for the bottom and top layers, respectively.

No cation analyses were performed on core samples from tank 241-B-101. The concentrations of cations, with the exception of sodium, are estimated using the average concentrations on a water-free basis for the four B Evaporator saltcake tanks presented in Table D3-1. The cation concentrations are adjusted for a water content of 34.9 wt%. Water contents were determined for all segments of cores 90 and 91. The value of 34.9 wt% is a mass weighted average of all segments for both cores.

The sodium value for tank 241-B-101 is determined by adjusting the sodium inventory in the charge balance calculation for the tank inventory. The inventories of analytes are calculated using the anion and cation concentrations determined as described in the previous two paragraphs, a volume of 428 m^3, and the average density of 1.48 g/cc determined in Section 4.0. In the charge balance calculation the sodium inventory is adjusted until the calculated hydroxide charge equivalents are slightly greater than the aluminum plus iron equivalents. Aluminum and iron are typically precipitated as hydroxides in tank waste. The adjusted sodium inventory of 80,000 kg results in an assumed average sodium concentration of 194,000 μg/g on a water-free basis and a calculated hydroxide inventory of 25,800 kg. This charge balance approach is consistent with that used by Agnew et al. (1997a).

There are no sample bases for mercury, carbonate, or total organic carbon in Table D3-1. The values provided by the HDW model (Agnew et al. 1997a) are used for the best-basis inventory for these analytes.

Radionuclide analyses for tank 241-B-101 samples was limited to total alpha measurements. The total alpha determinations were performed on all core segments. 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-101. The HDW model (Agnew et al. 1997a) inventories are used for radionuclides other than the alpha decay radionuclides.

D3.3 COMPARISON OF INVENTORY ESTIMATES

Estimated inventories from this evaluation are compared with the HDW model-based inventories (Agnew et al. 1997a) in Table D2-1. The inventories from this evaluation are generally within a factor of 2 of the HDW inventories. Table D3-1 shows the high variability of B Evaporator saltcake by comparison of analyses from four different tanks. The variability of analytes 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 D3-2. Engineering assessment-based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-B-101.

Analyte	Engineering assessment inventory estimate (kg)	HDW model inventory estimate[a] (kg)	Analyte	Engineering assessment inventory estimate (kg)	HDW model inventory estimate[a] (kg)
Al	9,400	7,000	NO_2	34,000[b]	5,800
Bi	3,990	1,210	NO_3	114,500[b]	173,000
Ca	1,140	1,740	PO_4	4,400[b]	30,800
Cl	250[b]	1,080	Pb	930	0.0033
Cr	350	94.4	Si	1,970	6,090
F	156[b]	626	SO_4	29,800[b]	4,380
Fe	6,420	12,600	Sr	207	0
Hg	1.28[a]	1.28	TIC as CO_3	6,890[a]	6,890
K	460	218	TOC	311[a]	311
La	<420	0	U_{TOTAL}	4,950	9,770
Mn	<137	0	Zr	<92	4.40
Na	80,000	108,000	H_2O (wt%)	34.9[S]	42.4
Ni	2,010	5,570			

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

The single tank 241-B-101 analyte that shows the greatest deviation from the average saltcake composition or the HDW model is phosphate. The analyzed phosphate concentration from tank 241-B-101 is approximately a factor of 10 lower than the average BSltCk concentrations or the predicted HDW value. No explanation is offered for this difference.

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D4.0 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 are 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-101 was performed, including the following:

- Data from two push mode 1995 core samples (Section 4.0)
- An inventory estimate generated by the HDW model (Agnew et al. 1997a)
- Comparing the summation of individual waste types and 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-101 (Tables D4-1 and D4-2). The evaluation used the sample-based data for anions and an engineering assessment-based analysis to define the best-basis inventory for the following reasons:

- No methodology is available to fully predict 242-B evaporator saltcake (BSltCk) content 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 engineering assessment-based data for tanks 242-B-108 and 241-B-109.

The inventories shown in Tables D4-1 and D4-2 are categorized as sample-based for anions and engineering assessment-based for cations. The analytical data from five tanks were the primary basis used for deriving the inventories in Table D4-1. Component concentrations for anion analytes for two solids layers are identified by 241-B-101 core segment analyses. Component concentrations from other tanks were used for cation analytes where there were no 241-B-101 sample analyses. HDW model bases were used as the 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.

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-B-101 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E or C)[1]	Comment
Al	9,400	E	
Bi	3,990	E	
Ca	1,140	E	
Cl	250	S	
TIC as CO_3	6,890	M	No sample basis
Cr	350	E	
F	156	S	
Fe	6,420	E	
Hg	1.28	M	No sample basis
K	460	E	
La	<420	E	
Mn	<137	E	
Na	80,000	E/C	Refer to Section D3.2 of best-basis documentation
Ni	2,010	E	
NO_2	34,000	S	
NO_3	114,500	S	
OH	25,800	E/C	Refer to Section D3.2 of best-basis documentation
Pb	930	E	
PO_4	4,400	S	
Si	1,970	E	
SO_4	29,800	S	
Sr	207	E	
TOC	311	M	No sample basis
U_{TOTAL}	4,950	E	

Table D4-1. Best-Basis Inventory Estimate for Nonradioactive Components in Tank 241-B-101 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E or C)[1]	Comment
Zr	<92	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 D4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-B-101 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	3.27	M	
^{14}C	0.546	M	
^{59}Ni	15.8	M	
^{60}Co	0.863	M	
^{63}Ni	1,570	M	
^{79}Se	4.92	M	
^{90}Sr	724,000	M	
^{90}Y	724,000	M	
^{93m}Nb	14.3	M	
^{93}Zr	21.5	M	
^{99}Tc	3.51	M	
^{106}Ru	0.706	M	
^{113m}Cd	106	M	
^{125}Sb	5.16	M	
^{126}Sn	7.79	M	
^{129}I	0.00675	M	
^{134}Cs	0.0315	M	
^{137m}Ba	15,100	M	
^{137}Cs	15,900	M	
^{151}Sm	14,200	M	
^{152}Eu	31.9	M	
^{154}Eu	1,570	M	
^{155}Eu	1,650	M	
^{226}Ra	7.04 E-04	M	
^{227}Ac	0.00316	M	
^{228}Ra	1.47 E-08	M	
^{229}Th	1.73 E-06	M	

Table D4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-B-101 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{231}Pa	1.98 E-04	M	
^{232}Th	1.95 E-10	M	
^{232}U	5.41 E-05	M	
^{233}U	2.78 E-06	M	
^{234}U	3.22	M	
^{235}U	0.144	M	
^{236}U	0.0256	M	
^{237}Np	0.0147	M	
^{238}Pu	50	E	Sample-based total alpha adjusted to HDW model alpha distribution.
^{238}U	3.26	M	
$^{239/240}Pu$	670	E	Sample-based total alpha adjusted to HDW model alpha distribution.
^{241}Am	1,120	M	Sample-based total alpha adjusted to HDW model alpha distribution.
^{241}Pu	5,540	M	
^{242}Cm	2.37	M	
^{242}Pu	0.0391	M	
^{243}Am	0.172	M	
^{243}Cm	0.281	M	
^{244}Cm	10.7	M	

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

D5.0 APPENDIX D REFERENCES

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