START 9613456.1353

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PAGE

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN № 625679

Proj. ECN

2. ECN Category (mark one) Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	3. Originator's Name, Organization, MSIN, and Telephone No. L. M. Sasaki/Characterization Plans, Coordination and Reports/R2-12/373-1027	3a. USQ Required? [] Yes [X] No	4. Date 09/01/95
	5. Project Title/No./Work Order No. Tank 241-C-105	6. Bldg./Sys./Fac. No. N/A	7. Approval Designator N/A
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-WM-ER-489, Rev. 0	9. Related ECN No(s). N/A	10. Related PO No. N/A

11a. Modification Work [] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	11b. Work Package No. N/A	11c. Modification Work Complete N/A Cog. Engineer Signature & Date	11d. Restored to Original Condition (Temp. or Standby ECN only) N/A Cog. Engineer Signature & Date

12. Description of Change

Results of tank vapor sampling are being incorporated into the document.

13a. Justification (mark one)

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

13b. Justification Details

Tank vapor flammability assessment is required to satisfy the safety screening requirements for this tank.

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

See attached distribution sheet.

123456789101112131415161718192021222324252627282930 31

SEP 1995

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DATE SEP 01 1995

Sta 4.

A-7900-013-2 (11/94) GEF095

A-7900-013-1

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) ECN-625679

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

18. 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 12. Enter the affected document number in Block 19.

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	[]		[]

19. 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
N/A		

20. Approvals

Signature		Date	Signature	Date
OPERATIONS AND ENGINEERING			ARCHITECT-ENGINEER	
Cog. Eng. L.M. Sasaki	LMSasaki	8/31/95	PE	
Cog. Mgr. J.G. Kristofzski	SGEhol- for JK	9/1/95	QA	
QA			Safety	
Safety			Design	
Environ.			Environ.	
Other			Other	
			DEPARTMENT OF ENERGY	
			Signature or a Control Number that tracks the Approval Signature	
			ADDITIONAL	

9613456.1361

INFORMATION RELEASE REQUEST
PUBLIC DOCUMENT CHANGE/REVISION
(Short Form No. 1)

1. Base Document ID Number:	WHC-SD-WM-ER-489
2. Base Document Title:	Tank Characterization Report for Single-Shell Tank 241-C-105
3. Change/Revision Number:	0-A
4. Change/Revision Date:	09/01/95
5. Unclassified Category:*	UC - 2070
6. Budget & Reporting Code:*	B&R - EW 3120074

I verify this change/revision to the base document indicated above:

- Complies with the provisions of WHC-CM-3-4
- Contains no Limited-Use information
- Contains no classified or Applied Technology references
- Does not change the intent or meaning of the base document
- And, the base document itself is approved for public release.

7. Responsible Manager: John G. Kristofzski

MSIN: R2-12 Telephone Number: 373-4225

SJ Eberlein for JK 9/1/95

(Signature) (Date)

8. Information Release Administration Specialist:**

(Signature) (Date)

*Required only for full revisions transmitted to OSTI.
**Required only for full revisions.

A-6001-401.1 (07/94)

9613456.1362

SUPPORTING DOCUMENT

1. Total Pages 101

2. Title	3. Number	4. Rev No.
Tank Characterization Report for Single-Shell Tank 241-C-105	WHC-SD-WM-ER-489	0-A

5. Key Words

Waste Characterization, Single-Shell Tank, C-105, Tank Characterization Report, C Farm, Waste Inventory, TPA Milestone M-44

6. Author

Name: Leela M. Sasaki

LMSasaki

Signature

Organization/Charge Code 75310/N4162

7. Abstract

N/A

8. RELEASE STAMP

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DATE SEP 01 1995

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A-6400-073 (08/94) WEF124

9613456.1363

RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-489	Page A

(2) Title
Tank Characterization Report for Single-Shell Tank 241-C-105

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 08/08/95 on EDT-612677.	L.A. Tusler	J.G. Kristofzski
RS 0-A	Incorporate per ECN-625679.	L.M. Sasaki LMSasaki	J.G. Kristofzski SJ[illegible] for JK 9/1/95

A-7320-005 (08/91) WEF168

screening DQO were all less than the notification limit, with the exception of the bromide analyses, which corroborated the results of the lithium analyses. Organic Watch List controls are being applied to tank 241-C-105, pending final evaluation of the secondary analyte results (WHC 1995). The total alpha activity ranged from 0.177 to 2.00 microcuries/gram, well below the notification limit of 40.5 microcuries/gram. The temperature of the tank waste has ranged from 24.2 degrees Celsius (°C) (76.5 degrees Fahrenheit [°F]) to 35.6 °C (96.1 °F) during the period from April 1994 to July 1995. The headspace vapor is analyzed in *Tank 241-C-105 Vapor Sampling and Analysis Tank Characterization Report.*[10] The vapor analyses indicated flammable components at concentrations of less than 0.07 percent of the lower flammability limit, well below the notification limit of 25 percent of the lower flammability limit.

The waste characteristics, physical properties, best estimates for the chemical and radiochemical composition, and the total tank inventory are summarized in Table ES-1 and Table ES-2. These estimates are a summary of the 1995 and 1986 sampling events as shown in Table 4-2. The sludge contains high concentrations of aluminum, iron, nitrate, silicon, sodium, and uranium. These observations are consistent with the operating history of the tank, which includes receipt of aluminum cladding waste from PUREX, uranium recovery waste, and metal waste from the bismuth phosphate process.

[10]Huckaby, J. L., 1995, *Tank 241-C-105 Vapor Sampling and Analysis Tank Characterization Report*, WHC-SD-WM-ER-443, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

underwent a safety screening analysis, which includes differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and measurement of the total alpha activity, in accordance with the tank characterization plan (Schreiber 1995). Also included in the safety screening DQO is analysis of the flammable gas in the tank. In addition, lithium analyses by inductively coupled plasma atomic emission spectroscopy were performed to determine if the samples contained hydrostatic head fluid. Bromide analyses were performed on the samples that exceeded the lithium notification limit of 100 micrograms per gram (μg/g). Total organic carbon and cyanide analyses were required for the solids of one sample segment, because an exotherm exceeding the notification limit of 481 joules/gram (dry basis) as specified in the tank characterization plan was found in that segment (Schreiber 1995). Samples were also archived for the Pretreatment Program.

The vapor analyses indicated very low concentrations of flammable components. The vapor space sampling results are reported in *Tank 241-C-105 Vapor Sampling and Analysis Tank Characterization Report* (Huckaby 1995).

Table 5-6. Safety Screening DQO Primary Decision Variables and Criteria for Tank 241-C-105.

Safety issue	Primary decision variable	Decision criteria threshold	Sample location	Analytical value
Ferrocyanide/ organic	Total fuel content	> 481 J/g (> 115 cal/g)	72:2 upper 1/2	524 J/g[1]
			All other exothermic reactions were less than the decision criteria threshold.	
Organic	Percent Moisture	< 17 wt%	72:3 upper 1/2	13.5 % (mean)
			76:2 upper 1/2	12.5 % (dupl.)
			76:2 lower 1/2	4.44 % (mean)
			All other moisture measurements were greater than the decision criteria threshold[2].	
Criticality	Total alpha	> 40.5 μCi/g (> 1 g/L)[3]	76:2 lower 1/2	2.00 μCi/g
Flammable gas	Flammable gas	25% of LFL	tank vapor space	<0.07% of LFL

Notes:

cal/g = calories per gram
g/L = grams per liter
J/g = joules per gram
μCi/g = microcuries per gram

[1]Any exothermic reaction determined by DSC must be reported on a dry-weight basis as shown in the following equation, using the weight percent water for that sample point from the thermogravimetric analysis.

$$\text{Exotherm (dry wt)} = \frac{[\text{exotherm (wet wt) x } 100]}{(100 - \%\text{ water})}$$

[2]The percent water results which failed to meet the DQO limit are reported. See Table 4-4 for all TGA results.

[3]Although the actual decision criterion listed in the DQO is 1 g/L, total alpha activity is measured in μCi/g rather than g/L. To convert the notification limit for total alpha into a number more readily usable by the laboratory, it was assumed that all alpha decay originates from ^{239}Pu. Using the average bulk density value from Brevick et al. (1994) of 1.52 g/ml, the decision criterion may be converted to 40.5 μCi/g as shown:

$$\left(\frac{1\ \text{g}}{\text{L}}\right)\left(\frac{1\ \text{L}}{10^3\ \text{mL}}\right)\left(\frac{1}{\text{density}}\ \frac{\text{mL}}{\text{g}}\right)\left(\frac{0.0615\ \text{Ci}}{1\ \text{g}}\right)\left(\frac{10^6\ \mu\text{Ci}}{1\ \text{Ci}}\right) = \frac{61.5}{\text{density}}\ \frac{\mu\text{Ci}}{\text{g}}$$

(Sasaki 1995b). There is no agreed-upon method of back-calculating the percent water if lithium bromide contamination is found. A method of doing this is being developed and will be incorporated in a revision of this document.

The potential for criticality can be assessed from the total alpha data. None of the individual samples from the 1995 data contained alpha activity greater than 2.00 μCi/g, and the mean result was 1.33 μCi/g. This was well below the notification limit of 40.5 μCi/g, or 1 g/L, as specified in the safety screening DQO (see footnote 3 of Table 5-6).

Tank vapor samples were collected for this tank on February 16, 1994. Details of the sampling and analysis are documented in Huckaby (1995) and are not reproduced here. The hydrogen concentration was found to be 22 ppm. Given that the lower flammability limit of hydrogen is 4 volume percent (40,000 ppm), the measured 22 ppm of hydrogen corresponds to 0.06 percent of its lower flammability limit (LFL). The total organic vapor concentration was estimated to 1.5 mg/m^3. Given it is reasonably conservative to assume that the LFL of the organic vapor mixture is that of the semivolatile alkanes, or about 46,000 mg/m^3 (Huckaby 1994), the 1.5 mg/m^3 corresponds to an estimated 0.003 percent of the LFL. The hydrogen and organic vapor fuel represent a combined total of less than 0.07 percent of the LFL, well below the safety screening limit of 25 percent of the LFL. At the reported concentrations, organic vapors and hydrogen do not individually or collectively represent a flammability hazard.

The results of the secondary analyses were well below the detection limits. Table 5-8 lists the limits and results of the secondary analyses. As statistical analysis was done on the TOC results. An UL of 7,568 μg/g was calculated with 90 percent confidence that the average is below this limit.

Table 5-8. Safety Screening DQO Secondary Decision Variables and Criteria for Tank 241-C-105.

Safety issue	Secondary decision variable	Decision criteria threshold	Sample location	Analytical value
Organic	Total organic carbon	> 30,000 μg/g	72:2 upper 1/2	6,520 μg/g
Ferrocyanide	Cyanide	> 39,000 μg/g	72:2 upper 1/2	46.8 μg/g

Note:

μg/g = micrograms per gram

Another factor used in assessing the safety of tank waste is the heat generation and temperature of the waste. Heat is generated in the tanks primarily from radioactive decay. No radiological results were obtained for the 1995 sampling event, but Bander and Stevens (1993) estimates a heat generation rate of 5,860 W (20,000 Btu/hr) with an upper-bound heat generation rate in tank 241-C-105 of 7,320 W (25,000 Btu/hr). This is well below the high-heat load tank criteria of 11,700 W (40,000 Btu/hr). If the cesium and strontium results from the 1986 analyses (Table 4-2) are used, a heat generation rate can be calculated as shown below.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This report is based on a sampling events that took place in March of 1995. The sampling event and subsequent analyses were based on the requirements of the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994), and the *Tank 241-C-105 Tank Characterization Plan* (Schreiber 1995).

Two of the segments exhibited moisture content less than the notification limit, and one sample of one segment exhibited energetic values more than the notification limit as listed in Babad and Redus (1994) and Schreiber (1995). Subsequent reanalyses (duplicate and triplicate) of energetics resulted in values that were well within specification. The average energetics of this segment was within the notification limit with 87.5 percent confidence. The 90 percent confidence interval upper limit on the mean for all of the solids DSC data was 397 J/g. The analyses of cyanide and total organic carbon as secondary analytes, as required by Schreiber (1995), showed no out-of-specification results. A statistical analysis of the TOC data shows a 90 percent upper confidence level of 7,568 μg/g which is well below the notification limit of 30,000 μg/g. The moisture results were not reanalyzed, due to the small relative percent difference between the original and the duplicate results. Analysis of lithium to detect hydrostatic head fluid contamination showed lithium above the notification limit in five of the samples. Analysis of bromide as a secondary analyte corroborated the lithium analysis. The contamination was severe enough to bias the percent water results for these segments above their actual values (Sasaki 1995b), but the magnitude of the bias was not specified. The samples that were contaminated by hydrostatic head fluid did not exhibit low percent water results. There is no agreed-upon method of back-calculating the percent water if lithium bromide contamination is found. A method of doing this is being developed and will be incorporated in a revision of this document. The tank vapor flammability, as determined by vapor sample analysis (Huckaby 1995), was found to be less than 0.07 percent of the LFL, considerably below the safety screening limit.

The large differences in the percent water results and the differences in the physical description of the segments imply a high degree of heterogeneity of the waste. Additional sampling and analysis may show a distinctly varied waste form.

Organic Watch List controls were applied to tank 241-C-105 as a result of the high energetic value and pending final evaluation of the secondary analyte results (WHC 1995). Because there is a high confidence that the DSC is below the safety screening limit, and the TOC results support the conclusion that this tank is safe, it is suggested that the organic Watch List controls be taken off tank 241-C-105.

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DISTRIBUTION SHEET

To	From	Page 1 of 4
Distribution	Characterization Plans, Coordination and Reports	Date 09/01/95
Project Title/Work Order		**EDT No.** EDT-612677
Tank Characterization Report for Single-Shell Tank 241-C-105, WHC-SD-WM-ER-489, Rev. 0-A		**ECN No.** ECN-625679

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D. A. Reynolds	R2-11	X	
L. M. Sasaki (10)	R2-12	X	
F. A. Schmittroth	H0-35	X	
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L. W. Shelton, Jr.	H5-49	X	
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G. L. Smith	H4-62		X
G. L. Troyer	T6-50	X	
D. A. Turner	S7-15	X	
D. J. Washenfelder	H5-27	X	
M. S. Waters	S6-30	X	
W. I. Winters (3)	T6-50	X	
TFIC (Tank Farm Information Center)	R1-20	X	

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Central Files	A3-88	X
EDMC	H6-08	X
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TCRC	R2-12	X