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ENGINEERING CHANGE NOTICE

0050777

1. ECN 653812

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	Leela M. Sasaki, Data Assessment and Interpretation, R2-12, 373-1027	[] Yes [X] No	05/26/99
	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
	Tank 241-C-101	241-C-101	N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-WM-ER-473, Rev. 0-D	10. Related ECN No(s). ECNs: 625678, 625698, 612285, 649443	11. Related PO No. N/A

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)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

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

This ECN has been generated in order to update the document to reflect results of recent data/information evaluation.

Replace pages:

ES-5, ES-6, 5-5, 5-6, 6-1, 6-2, 7-1, and 7-2

14a. Justification (mark one)

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

14b. Justification Details

A tank characterization report page change revision is required to reflect the results of recent evaluation of data/information pertaining to adequacy of tank sampling for safety screening purposes (Reynolds et al., 1999, Evaluation of Tank Data for Safety Screening, HNF-4217, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington).

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

See attached distribution.

RELEASE STAMP

DATE: MAY 27 1999

STA: 4

HANFORD RELEASE

ID: 2

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) ECN-653812

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
N/A		

21. Approvals

Signature	Date	Signature	Date
Design Authority		Design Agent	
Cog. Eng. L.M. Sasaki L M Sasaki	5/27/99	PE	
Cog. Mgr. K.M. Hall	5/27/99	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other		Other	
		DEPARTMENT OF ENERGY	
		Signature or a Control Number that tracks the Approval Signature	
		ADDITIONAL	

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

Leela M. Sasaki
Lockheed Martin Hanford Corp., Richland, WA 99352
U.S. Department of Energy Contract 8023764-9-K001

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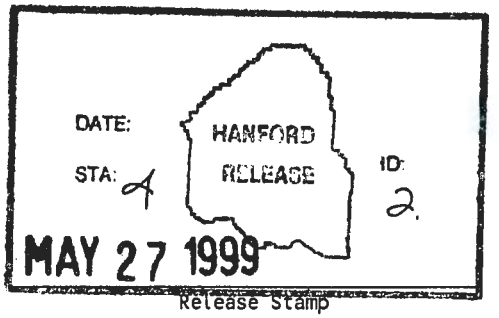
Abstract: N/A



5/27/99

Release Approval Date Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-473	Page #1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-C-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 08/09/95 on EDT-611439.	B.W. Hall	J.G. Kristofzski
RS 0-A	Incorporate per ECN-625678.	L.M. Sasaki LM Sasaki	J.G. Kristofzski 8/21/96
		L.M. Sasaki	9/12/95
0-B RS	Incorporate per ECN-625698.	L.M. Sasaki	J.G. Kristofzski
0-C RS	Incorporate per ECN-612285	M. J. Kupfer 8-24-97	K. M. Hodgson K.M. Hodgson 8-12-97
0-D RS	Incorporate per ECN-649443.	M.J. Kupfer 9-15-98	K.M. Hodgson K.M. Hodgson 9-16-98
0-E RS	Incorporate per ECN-653812.	L.M. Sasaki LM Sasaki	K.M. Hall 5/27/99

This report also summarizes two sampling events, an auger sample obtained in March 1995 and vapor samples obtained in September 1994. Total alpha activity, percent water, energetic properties, and vapor flammability were measured in accordance with WHC-SD-WM-SP-004, *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994). In addition, Characterization Plant Engineering and Characterization Process Control requested that measurements of pH, total organic carbon, total inorganic carbon, and bulk density be performed on the auger samples.

Tank 241-C-101 was sufficiently sampled to meet the requirements of the safety screening data quality objective. The waste subsamples, as measured by differential scanning calorimetry, exhibited no exothermic reactions. The percent water ranged from 15.4 to 33.9 percent for the solids phase of the waste. Values less than 17 percent are below the minimum required by the Tank Safety Screening Data Quality Objective. Proper notifications concerning the low percent water results were made on May 3, 1995 (Sasaki 1995). The total alpha activity ranged from 0.955 to 1.18 μCi/g, well below the maximum limit of 34.4 μCi/g. The maximum total organic carbon value from the drainable liquid phase of the auger sample was 3,990 μg C/g, well below the limit of 30,000 μg C/g specified in WHC-SD-WM-DQO-006, *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue* (Babad et al. 1994). The maximum weekly temperature readings in the tank since 1974 fluctuate between 13 °C (55 °F) and 44 °C (111 °F). The temperature readings indicate that the heat load in the tank is not excessive and is adequately dissipated. Vapor space analyses indicated flammable components at a concentration of 1.71 percent of the lower flammability limit, well below the notification

limit of 25 percent of the lower flammability limit. Details of the vapor sampling and analysis and its interpretation are included in a separate report.

5.4 COMPARISON OF ANALYTICAL AND HISTORICAL DATA

Because of the limited analytical requirements stipulated by the safety screening characterization (Babad and Redus 1994), few comparisons are possible between the analytical results from the 1995 sampling event and the historical transfers and estimated inventories. There are no TOC, pH or DSC data listed in the Historical Tank Content Estimate (Brevick et al. 1994); however, historical estimates for bulk density and percent water are available (see Table 2-5). Total alpha activity can also be estimated from the historical plutonium activity in Table 2-5. Table 5-2 compares the historical and analytical data for bulk density, water content, and total alpha. The analytical weight percent water value in Table 5-2 corresponds to the weight-weighted average of the results reported in Table 4-4 (transition 1) for the crust, upper half solids, and lower half solids, and drainable liquid samples. There was no Historical Tank Content Estimate (Brevick et al. 1994) available for the supernatant TIC, but the analytical result of 3,990 μg C/ml can be compared with the uranium recovery waste supernatant prediction of 10,500 μg C/ml in WHC-SD-WM-TI-629, *Hanford Defined Wastes: Chemical and Radionuclide Compositions* (Agnew 1995).

Table 5-2. Comparison of the Solids Analytical Results and Historical Tank Content Estimate Estimates.*

Analyte	Analytical result	HTCE result
Bulk density (g/ml)	1.79	1.45
Percent water (by weight)	33.8	61.1
Total alpha (μCi/g)	1.09	0.512 (Pu only)

Note: 1 Ci = 3.7 E+10 Bq.

*C. H. Brevick, L. A. Gaddis, and W. W. Pickett, 1994, *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Areas*, WHC-SD-WM-ER-349, Rev. 0, ICF Kaiser Hanford Company, Richland, Washington.

5.5 EVALUATION OF PROGRAM REQUIREMENTS

This section details the data needs as defined in the Tank Safety Screening DQO (Babad and Redus 1994) and investigates whether tank 241-C-101 has been appropriately categorized concerning safety issues. The DQO establishes decision criteria or notification limits for concentrations of analytes of concern. If results from one of the primary analyses exceed any of the decision criteria, the tank is not classified as "safe" and further analyses are conducted to ensure the safety of the tank (Babad and Redus 1994). There are insufficient data available to assess impacts on operational, environmental, or process development programs.

5.5.1 Safety Evaluation

The primary analytical requirements identified in the Tank Safety Screening DQO (Babad and Redus 1994) are energetics, total alpha activity, moisture content, and flammable gas concentration. TOC was analyzed on the drainable liquid sample for tank 241-C-101 at the request of Characterization Process Control. The 1995 auger sampling event did not provide samples from two locations as stated by the tank characterization plan (Schreiber 1995). One riser was sampled rather than two, because of a lack of riser availability. However, the sampling and analysis for this tank was reviewed and found to be sufficient to satisfy the requirements of the Tank Safety Screening DQO (Reynolds et al. 1999). Table 5-3 lists the DQO-required analytes, their notification limits, and their analytical results.

The waste fuel energy value was determined by DSC. No exotherms were observed on the 1995 auger sample. Another indicator of fuel content is TOC concentration. The analytical TOC result for the drainable liquid was 1,260 μg C/ml, which is well below the Organics Safety Program limit of 30,000 μg C/ml (Babad et al. 1994). The DSC and TOC results indicate that tank 241-c-101 waste does not contain excessive amounts of fuel.

Large amounts of moisture reduce the potential for propagating exothermic reactions in the waste. The percent water content of the waste was determined by TGA. All samples except the original sample of the crust material were above the notification limit of 17 percent. However, the implications for tank safety are probably minimal, given the endothermic DSC results. In addition, the average of the two crust sample analyses was above the notification limit indicating that the original crust analysis may be anomalous.

Another factor 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, but the Historical Tank Content Estimate of 11 W (38 British thermal units/hours [Btu/hr]) was well below the 40,000 Btu/hr threshold which separates high heat tanks from low heat tanks (Brevick et al. 1994). Thermocouple readings (Section 2.4.2) indicate that the radioactive decay heat in the tank is adequately dissipated throughout the year.

The potential for criticality can be assessed from the total alpha data. None of the individual subsamples from the 1995 auger sample contained alpha activity greater than 1.37 μCi/g, and the mean result was 1.09 μCi/g. This was well below the notification limit of 1 g/L (or 34.4 μCi/g) as specified in the Tank Safety Screening DQO (Babad and Redus 1994) (see footnote b of Table 5-2).

Tank vapor samples were collected for this tank on September 1, 1994. Details of the sampling and analysis are documented in Huckaby (1995a) and are not reproduced here. The hydrogen, organic vapor fuel, and ammonia represent a combined total of 1.71 percent of the

6.0 CONCLUSIONS AND RECOMMENDATIONS

Tank 241-C-101 is a non-watch list tank and is an assumed leaker that was removed from service in 1976. The only recorded sampling events for tank 241-C-101 are a single segment auger sample taken in March of 1995 and tank vapor samples taken in September 1994. The auger sampling event was governed by the Tank Safety Screening DQO (Babad and Redus 1994). A second intended auger sample could not be taken because of an unavailable riser. Analysis of the auger sample taken was directed primarily at safety screening criteria TIC, TOC, pH, and bulk density were also measured to help interpret the origin of high CO_2 concentrations found in the vapor space. The chemical and radiochemical composition of the waste must be estimated solely from tank waste history. However, adequate data are available from the 1995 sampling and analysis event to support the current non-watch list status of this tank. The vapor sampling event supports the gas flammability question of the Tank Safety Screening DQO (Babad and Redus 1994).

The sampling and analysis of tank 241-C-101 was reviewed and found to be sufficient to satisfy the requirements of the Tank Safety Screening DQO (Reynolds et al. 1999). The analytical results fell within the safety screening criteria with the exception of an individual result for percent water. However, the rerun of this sample met the criteria. No exothermic reactions were exhibited by the DSC analysis, indicating that the fuel content of the tank is not excessive. The TOC content of the drainable liquid from the 1995 auger sample was found to be well below the safety program limit of 30,000 µg c/mL. In addition, the historical estimate of the tank heat load and tank temperatures do not indicate that excessive heat is being generated in the waste. The DSC results, low TOC results, and tank temperature readings indicate that the potential for runaway reactions in the waste is remote. The single low wt% water result is of low concern given the DSC, TOC, and temperature measurements. The tank vapor flammability, as determined by vapor sample analysis, was found to be 1.71 percent of the LFL, considerably below the safety screening limit.

The tank history indicates that the major waste types present are metal waste uranium recovery waste, and PUREX cladding waste. These waste types are known to have high aluminum, iron, sodium, sulfate, hydroxide, and nitrate. The major radionuclides are cesium and strontium. The water content and bulk density of the waste as estimated from the 1995 analytical data do not compare well with the Historical Tank Content Estimate (Brevick et al. 1994a). The chemical and radiochemical content estimates in the HTCE cannot be validated with the 1995 sample analysis results.

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7.0 REFERENCES

Agnew, S. F., 1994a, *Tank Layer Model Spreadsheet: Northeast Quadrant, A, AX, B, BX, BY, C Farms*, WHC-SD-WM-TI-627, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Agnew, S. F., 1994b, *Waste Status and Transaction Record Summary for the Northeast Quadrant*, WHC-SD-WM-TI-615, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Agnew, S. F., 1995, *Hanford Defined Wastes: Chemical and Radionuclide Compositions*, WHC-SD-WM-TI-629, Rev. 0. Westinghouse Hanford Company, Richland, Washington.

Babad H., S. M. Blacker, and K. S. Redus, *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue*, WHC-SD-WM-DQO-006, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Babad, H., and K. S. Redus, 1994, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-SP-004, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Brevick, C. H., L. A. Gaddis, and W. W. Pickett, 1994, *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Areas*, WHC-SD-WM-ER-349, Rev. 0, ICF Kaiser Hanford Company, Richland, Washington.

Brevick, C. H., L. A. Gaddis, and E. D. Johnson, 1994b, *Supporting Document for the Northeast Quadrant Hanford Tank Content Estimate Report for C-Tank Farm*, WHC-SD-WM-ER-315, Westinghouse Hanford Company, Richland, Washington.

Campbell, J. A., R. M. Bean, K. L. Wahl, G. M. Wong, K. E. Bell, K. B. Wehner, A. D. Rice, R. J. Ray, D. B. Bechtold, B. R. Wels, R. W. Schroeder, J. W. Ball, B. D. Valenzuela, J. M. Frye, S. L. Fitzgerald, P. P. Bachelor, B. Griffin, R. K. Fuller, A. B. Benally, and S. M. Parong, 1995, *Analysis of Samples from Hanford Waste Tanks 241-C-102, 241-BY-108, and 241-C-103*, PNL-10531, UC-601, Pacific Northwest Laboratory, Richland, Washington.

Carothers, K. G., 1988, *Tank C-103 Transaction History - Post January 1976,* (internal memorandum 13331-88-600 to D. A. Dodd, G. L. Dunford, G. N. Hanson, A. W. Lilly, and R. E. Van der Cook, September 22), Westinghouse Hanford Company, Richland, Washington.

Conrad, R. B., 1994, *Engineering Evaluation of Alternatives for Treatment of Tank 241-C-103 Vapor Space*, WHC-SD-WM-ES-281, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

De Lorenzo, D. S., A. T. DiCenso, D. B. Hiller, K. W. Johnson, J. H. Rutherford, and D. J. Smith, 1994, *Tank Characterization Reference Guide*, WHC-SD-WM-TI-648, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Ecology, EPA, and DOE, 1994, *Hanford Facility Federal Facility Agreement and Consent Order*, fourth amendment, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Hanlon, B. M., 1995, *Waste Tank Summary Report for Month Ending April 30, 1995*, WHC-EP-0182-80, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Huckaby, J. L., 1994, *Tank 241-C-103 Headspace Flammability*, WHC-EP-0734, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Huckaby, J. L., 1995a, *Tank 241-C-101 Vapor Sampling and Analysis Tank Characterization Report*, Pacific Northwest Laboratory, Richland, Washington.

Huckaby, J. L., 1995b, *Waste Tank Headspace Gas and Vapor Characterization Reference Guide*, WHC-SD-WM-ER-430, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Pool, K. H., and R. M. Bean. 1994, *Analysis of Liquid Samples from Hanford Waste Tank 241-C-103*, PNL-9403 UC-601, Pacific Northwest Laboratory, Richland, Washington.

Reynolds, D. A., W. T. Cowley, J. A. Lechelt, and B. C. Simpson, and C. DeFigh-Price 1999, *Evaluation of Tank Data for Safety Screening*, HNF-4217, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

Sasaki, L. M., 1995, *45-Day Safety Screen Results for Tank 241-C-101, Auger Sample 95-AUG-019*, WHC-SD-WM-DP-111, Westinghouse Hanford Company, Richland, Washington.

Schreiber, R. D., 1995, *Tank 241-C-101 Tank Characterization Plan*, WHC-SD-WM-TP-285, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

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Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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