ENGINEERING CHANGE NOTICE

0050772

1. ECN 653791

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 []	Julie A. Johnston, Data Assessment and Interpretation, R2-12, 376-9889	[] Yes [X] No	05/24/99
	6. Project Title/No./Work Order No. Tank 241-U-105	7. Bldg./Sys./Fac. No. 241-U-105	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-WM-ER-617, Rev. 0-B	10. Related ECN No(s). ECNs: 638285, 647955	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-11, ES-12, 5-9, 5-10, 6-1, 6-2, 7-3, and 7-4

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: JUN 07 1999

STA: 4

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

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1. ECN (use no. from pg. 1) ECN-653791

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.	J.A. Johnston Julie A Johnston	6.4.99	PE		
Cog. Mgr.	K.M. Hall	6/4/99	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other			Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

S

Tank Characterization Report for Single-Shell Tank 241-U-105

Julie A. Johnston
Lockheed Martin Hanford Corp., Richland, WA 99352
U.S. Department of Energy Contract 8023764-9-K001

EDT/ECN: ECN-653791 UC: 2070
Org Code: 74B20 CACN/COA: 102217/EI00
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Key Words: Waste Characterization, Single-Shell Tank, SST, Tank 241-U-105, Tank U-105, U-105, U Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: N/A

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STA: 4 ID: 2
JUN 07 1999
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RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-617	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-U-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 9/26/96 on EDT-617550.	T. M. Brown	J. G. Kristofzski
0A RS	Incorporate per ECN-638285.	M. J. Kupfer 8-14-97	K. M. Hodgson 8-14-97
0B RS	Incorporate per ECN-647955.	M.J. Kupfer 9-21-98	K.M. Hodgson 9-21-98
0-C RS	Incorporate per ECN-653791.	J.A. Johnston 6.4.99	K.M. Hall 6/4/99

A-7320-005 (08/91) WEF168

These estimates are consistent and well below the 11,000 W (40,000 Btu/hr) limit that divides high- and low-heat tanks (Bergmann 1991).

According to the decision logic of the organic DQO, tank 241-U-105 cannot be classified as"safe," "unsafe," or "conditionally safe" until further data analysis is performed by the organic safety organization to determine whether the tank waste may dry out during interim storage.

However, recent technical evaluation of the data by a Senior Review Panel has determined that the sampling and analyses of tank 241-U-105 was sufficient to satisfy safety screening DQO requirements (Reynolds et al. 1999).

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In addition to analyses performed in accordance with the DQOs, the tank was screened for high-heat conditions. The heat load, modeled by the HTCE (Agnew et al. 1996a) and Kummerer (1994), was calculated for this report using analytical data from the 1996 core sampling event.

5.5.1 Tank 241-U-105 Heat Load

A factor in assessing tank safety is the heat generated from radioactive decay and the resulting temperature increase of the waste. The heat value, calculated using 1996 sampling data (Fritts 1996b), was 2,790 W (9,520 Btu/hr). The HTCE estimate of heat load was 3,230 W (11,000 Btu/hr), and the estimate by Kummerer (1994) was 1,870 W (6,380 Btu/hr). These estimates are well below the 11,700 W (40,000 Btu/hr) threshold differentiating high- from low-heat tanks (Bergmann 1991). Table 5-5 shows the concentrations and projected inventories of the two primary contributors to tank heat load.

Table 5-5. Tank 241-U-105 Projected Heat Load.

Radionuclide	Specific Activity[1] (μCi/g)	Projected Inventory[1] (Ci)	Heat Load from Radioactive Decay (W)
^{137}Cs	157	3.84E+05	1,810
$^{89/90}Sr$	59.7	1.46E+05	978
Total			2,790

Note:

[1]Fritts (1996b)

5.5.2 Safety Screening Evaluation

If safety issues are associated with a tank, the safety screening DQO (Dukelow et al. 1995) is used to 1) determine whether the safety screening data provide further information about the issues, and 2) determine whether the tank should have other issues associated with it.. Tank 241-U-105 is on the Organic Watch List and the Flammable Gas Watch List.

The safety screening DQO was applied to tank 241-U-105 to screen for uncontrolled exothermic chemical reactions, the presence of flammable gases in the tank headspace, and the potential for nuclear criticality. This section reports the results of this screening.

Flammable gas measurements, continuously monitored by SHMS, ranged between 0 percent and 7 percent of the LFL (Brown 1996). This was well below the decision threshold limit of 25 percent of the LFL outlined in the safety screening DQO. Hydrogen was not detected in a vapor sample taken on February 24, 1995 (Pool et al. 1995). The percent of the LFL was not calculated for the February 1995 sample. The vapor sampling data and the monitoring data indicate there is no flammability concern in the tank.

The sample with the highest total alpha measurement was the lower half of segment 9 of core 133 with an average result of 4.04 μCi/g and the upper limit to a one-sided 95 percent confidence interval on the mean of 7.13 μCi/g. This converts to an average result of 0.11 g/L and the upper limit to a one-sided 95 percent confidence interval on the mean of 0.20 g/L, assuming that all alpha is from ^{239}Pu (conservative). This is well below the criticality threshold limit of 1.0 g/L outlined in the safety screening DQO.

Ten of 34 subsamples submitted for DSC exceeded the decision threshold limit of -480 J/g (dry weight basis) in the sample, duplicate, or triplicate. Twelve of 34 subsamples had a one-sided 95 percent confidence limit that exceeded the decision threshold limit of -480 J/g (dry weight basis).

Because the energetics threshold was exceeded, the secondary analyses of TOC and the propagating reactive system screening test were run on tank samples. Because the organic DQO was applied to tank 241-U-105, TOC was run on every sample whether or not the sample exceeded the energetics threshold limit. Finally, the screening test was run on the sample that exhibited the highest enthalpy change from the DSC analysis.

The TOC analysis was performed on every sample. Only one solid sample had a TOC over 3.0 weight percent (dry basis). This sample was from the upper half of segment 7 of core 136. The TOC accounted for the measured change in energy for the samples in this tank; therefore, cyanide analyses are not necessary. (Cyanide analyses were run on the 10 samples that exceeded the energetics threshold limit as a precaution.)

The safety screening DQO requires that a reactive system screening test be performed on the sample that has the highest exothermic change in enthalpy during a DSC test. With the approval of the organic safety program, a propagating reactive systems screening test was performed in place of the reactive system screening test. The test was performed on the upper half of segment 5 of core 136. Results showed that the sample did not exhibit a tendency to propagate.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Tank 241-U-105 was core sampled during February and March 1996. Three push-mode core samples were obtained from the tank to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995), *Data Quality Objective to Support Resolution of the Organic Complexant Safety Issue* (Turner et al. 1995), *Test Plan for Samples from Hanford Waste Tanks 241-BY-103, BY-104, BY-105, BY-106, BY-108, BY-110, TY-103, U-105, U-107, U-108, and U-109* (Meacham 1995), and *Historical Model Evaluation Data Requirements* (Simpson and McCain 1995). The sampling and analyses were performed in accordance with the *Tank 241-U-105 Rotary Mode Core Sampling and Analysis Plan* (Bell 1996).

Vapor samples from the tank headspace were taken on February 24, 1995. The vapor samples were obtained to satisfy the requirements of the *Data Quality Objective for Tank Hazardous Vapor Safety Screening* (Osborne and Buckley 1995).

Three grab samples were taken from the tank supernatant layer on June 15, 1995. The grab samples were obtained to satisfy the requirements of the *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Fowler 1995).

The analyses required for the safety screening DQO were performed and compared to the decision threshold limits outlined in the DQO. Measurements of the tank flammable gas were well below the safety screening threshold limit of 25 percent of the LFL. The vapor sample taken in 1995 indicated that hydrogen gas is not present in the tank headspace. There is no flammability concern in the tank. Measurements of the total alpha activity in the tank were below the safety screening threshold of 1.0 g/L. Ten of 34 subsamples submitted for DSC analysis had exothermic enthalpy changes over the safety screening threshold of -480 J/g.

The analyses required for the organics DQO were performed and compared to the decision threshold limits outlined in the DQO. One solid sample, from the upper half of segment 7, core 136, exceeded the limit of 3.0 weight percent TOC as outlined in the organic DQO. The moisture of this sample was 29.9 percent water. The supernatant in the tank also exceeded the limit for TOC, at 3.07 weight percent (dry basis). The lowest measured moisture in the tank was 10.0 percent water in the upper half of segment 9, core 133. The energy equivalent of the measured TOC accounts for the DSC results. No propagation was observed when the sample, with the highest change in enthalpy as measured by DSC, was tested by the propagating reactive system screening test. Further analysis of the data is required to determine whether the tank waste will dry out during interim storage. However, further technical evaluation has shown that safety screening sampling is sufficient (Reynolds et al. 1999).

Information was obtained for the organic test plan (Meacham 1995). The plan attempts to confirm tank fuel content models through resolution of the organic complexant condensed phase propagating reaction issue. Data analysis for this issue will be performed by the organic safety program and is not reported in this report.

Comparing the analytical results to the HTCE model estimates showed good agreement. The largest discrepancy was that, although the TLM predicted metal waste in the tank bottom, no metal waste was indicated at that location. Therefore, other tanks predicted to have metal waste heels should be studied to determine whether metal waste was more thoroughly sluiced from tanks than predicted by the TLM.

Two analytes exceeded the noxious vapor threshold limits of the vapor safety screening DQO (Osborne and Buckley 1995). Ammonia had a concentration of 325 ppm (volume basis), well over the DQO threshold limit of 25 ppm (volume basis). Nitrous oxide had a concentration of 154 ppm (volume basis), over the threshold limit of 25 ppm (volume basis).

Tank 241-U-105 has not been interim stabilized. Before pumping the waste supernatant and other drainable liquids from tank 241-U-105 to a receiver double-shell receiver tank, a waste compatibility assessment will be performed by tank farm operations. Sampling and analysis has already been performed to the requirements of the waste compatibility DQO for tank 241-U-105. When the waste compatibility assessment is completed, the results will be published in a later revision of this report.

Based on analytical data from the 1996 sampling and analysis effort, a tank heat load was calculated at 2,790 W (9,520 Btu/hr). The HTCE prediction was 3,230 W (11,000 Btu/hr) (Agnew et al. 1996), and the estimate in Kummerer (1994) was 1,870 W (6,373 Btu/hr). These estimates are well below the 11,000 W (40,000 Btu/hr) limit dividing high- and low-heat tanks (Bergmann 1991).

According to the decision logic of the organic DQO, tank 241-U-105 cannot be classified as "safe," "unsafe," or "conditionally safe" until further analysis of the data is performed by the organic safety organization to determine whether the tank waste may dry out during interim storage. Even if enough water exists in the waste to quench an exothermic reaction, the possibility exists that the water may dry out or be removed from the tank by pumping. For this reason, a waste dry out analysis must be performed before classifying the tank.

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