0050792

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 653785

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 []	Jim G. Field, Data Assessment and Interpretation, R2-12, 376-3753	[] Yes [X] No	05/24/99
	6. Project Title/No./Work Order No. Tank 241-S-106	7. Bldg./Sys./Fac. No. 241-S-106	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-SD-WM-ER-714, Rev. 1	10. Related ECN No(s). ECN-635598	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: 2-1, 2-2, 2-7, 2-8, 4-1 through 4-4, 5-3 and 5-4.

JUN 1999 RECEIVED EDMC

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 HANFORD RELEASE STA: 4 ID: 58

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

A-7900-013-1

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) ECN-653785

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.G. Field	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

S

Tank Characterization Report for Single-Shell Tank 241-S-106

Jim G. Field
Lockheed Martin Hanford Corp., Richland, WA 99352
U.S. Department of Energy Contract 8023764-9-K001

EDT/ECN: ECN-653785 UC: 2070
Org Code: 74B20 CACN/COA: 102217/EI00
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Key Words: Waste Characterization, Single-Shell Tank, SST, Tank 241-S-106, Tank S-106, S-106, S Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: N/A

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5/27/99

Release Approval Date

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RECORD OF REVISION	(1) Document Number HNF-SD-WM-ER-714	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-S-106

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 08/26/97 on EDT-621725.	M.J. Kupfer	K.M. Hodgson
RS 1	Incorporate per ECN-635598.	J.G. Field	K.M. Hall
		J.G. Field 4/15/98	Katalee M. Hall 6/16/98
1-A RS	Incorporate per ECN-653785.	J.G. Field	K.M. Hall
		J.G. Field 5/27/99	5/27/99

A-7320-005 (08/91) WEF168

2.0 RESPONSE TO TECHNICAL ISSUES

The following technical issues have been identified for tank 241-S-106 (Brown et al. 1997).

- **Safety screening**: Does the waste pose or contribute to any recognized potential safety problems?
- **Flammable gas**: Does a possibility exist for releasing flammable gases into the headspace of the tank or releasing chemical or radioactive materials into the environment?
- **Organic complexants**: Does the possibility exist for a point source ignition in the waste followed by a propagation of the reaction in the solid/liquid phase of the waste?
- **Hazardous vapor screening**: Do hazardous storage conditions exist associated with gases and vapors in the tank?
- **Organic solvents**: Does an organic solvent pool exist that may cause a fire or ignition of organic solvents in entrained waste solids?
- **Historical model**: Does the waste inventory generated by a model based on process knowledge and historical information (Agnew et al. 1997) represent the current tank waste inventory?

The sampling and analysis plan (SAP) (Buckley 1997) provides the types of sampling and analysis used to address the above issues. Data from the analysis of push core samples and headspace measurements, along with available historical information, provided the means to respond to the technical issues. Sections 2.1 through 2.7 present the responses. Data from the June 1996 vapor sample provided the means to address the vapor screening issue. See Appendix B for sample and analysis data for tank 241-S-106.

2.1 SAFETY SCREENING

The data needed to screen the waste in tank 241-S-106 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). These potential safety problems are exothermic conditions in the waste, flammable gases in the waste and/or tank headspace, and criticality conditions in the waste. Each condition is addressed separately below. One full core (core 183) was obtained. Core 184, riser 7, recovered only 6 of 10 segments because the push-core sampler could not penetrate beyond segment 6. Two of 10 segments were recovered in a second attempt (core 187, riser 14). Although two complete cores were not recovered, the samples recovered are expected to be representative of the tank. Therefore sufficient samples have been obtained to meet the intent of Safety Screening, and further sampling is not necessary (Reynolds et al. 1999).

2.1.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO (Dukelow et al. 1995) is to ensure there are not sufficient exothermic constituents (organic or ferrocyanide) in tank 241-S-106 to pose a safety hazard. Because of this requirement, energetics in tank 241-S-106 waste were evaluated. The safety screening DQO required that the waste sample profile be tested for energetics every 24 cm (9.5 in.) to determine whether the energetics exceeded the safety threshold limit. The threshold limit for energetics is 480 J/g on a dry weight basis. Results obtained using differential scanning calorimetry (DSC) indicated six samples exceeded the notification limit with exotherms, on a dry weight basis, ranging from 486 J/g to 1,688 J/g (see Appendix B). Because of high relative percent differences (RPDs), DSC analyses were rerun for two of the samples, but the rerun still exceeded the notification limits. However, the high DSC values were greater than total organic carbon (TOC) energy equivalent calculations (Table 2-1), and DSC results were suspect (Esch 1997). In addition, the water content of the samples was well above 17 percent.

As a result, it was concluded that a propogating reaction is highly unlikely.

Table 2-1. Tank 241-S-106 Energetics by Differential Scanning Calorimetry and Energy Equivalence by Total Organic Carbon.

Sample Location	DSC (Dry) Result J/g	DSC (Dry) Dup. J/g	Moisture %	TOC Dry (wt%)	TOC Energy Equivalent[1] (J/g)
183:1 Drainable liquid	1,688	557	54.0	0.496[2]	132
183:3 Drainable liquid	1,094	1,197	55.6	0.471[2]	126
183:5 Drainable liquid Rerun	311 387	876 683	52.7	0.499[2]	133
183:7 Drainable liquid Rerun	188 848	486 740	53.5	0.353[2]	94.1
183:7 solid	191	523	29.0	0.158[3]	42.1
183:4 solid	1,571	246	51.4	0.276[3]	73.6

Notes:

Dup. = duplicate
wt% = weight percent

[1]Conversion value used: 1,200 Joules per 4.5 grams = 1 TOC dry wt% (based on sodium acetate average energetics standard).
[2]TOC by furnace oxidation divided by (1- Moisture)
[3]TOC by sulfate divided by (1- Moisture)

2.7 OTHER TECHNICAL ISSUES

A factor in assessing tank safety is the heat generation and temperature of the waste. Heat is generated in the tanks from radioactive decay. The tank heat load estimate based on the 1997 sample event was 1,762 W (65.9 Btu/hr) (see Table 2-2). This estimate compares with a heat load estimate based on tank temperature of 3,875 Btu/hr (Kummerer 1995) and a heat load based on the tank process history of 3,660 W (12,500 Btu/hr) (Agnew et al. 1997). Both these estimates are below the limit of 11,700 W (400,000 Btu/hr) that separates high- and low-heat-load tanks (Smith 1986).

Table 2-2. Heat Load Estimate for Tank 241-S-106 Based on Radionuclide Inventory.

Radionuclide	Inventory[1] (Ci)	Decay Heat Rate (W/Ci)	Heat Load (W)
^{137}Cs	313,000	0.00472	1,477
^{90}Sr	42,500	0.00670	285
Total			**1,762**

Note:

[1]See Appendix D.

2.8 SUMMARY

The results of all analyses performed to address potential safety issues showed that only exothermic activity exceeded safety decision threshold limits. As discussed previously, the high exotherms were not consistent with TOC energy equivalent calculations. Total organic carbon results and high moisture content indicate that a propogating reaction is unlikely.

Retained gas sampler measurements showed a high volume of retained gases in the samples analyzed. The gas consists of 63 percent hydrogen and 24 percent nitrogen, with an estimated volume of 410 $\pm$130 m^2.

Historical DQO requirements were met, except that core composite samples were not analyzed because of the small amount of solids recovered in the upper half portion of the tank waste. In general, segment sample results were consistent with the S1 saltcake waste type.

Vapor samples were taken to meet the organic solvents and hazardous vapor safety screening DQO requirements.

Sample results are summarized in Table 2-3.

Table 2-3. Summary of Technical Issues.

Issue	Sub-issue	Result
Safety screening	Energetics	Six exotherms exceeded 480 J/g but had low TOC and high moisture. A propogating reaction is unlikely.
	Flammable gas	Vapor measurement reported <1 percent of the LFL .
	Criticality	All analyses were well below 46.6 μCi/g total alpha (within 95 percent confidence limit on each sample).
Flammable gas	Mechanisms for generation, retention and release Waste models	Ten% of the waste volume consisted of retained gases (410 $\pm$ 130 m^3) with 63% hydrogen content. Preliminary assessments of flammable gas generation, retention, and release mechanisms, and waste behavior modeling results are reported in Mahoney et al. (1997). Additional evaluations to assess potential impacts and waste behavior in tank 241-S-106 are in progress.
Organic complexants[1]	Safety categorization	Safe, low TOC, no visible layers
Hazardous vapor	Flammability	See safety screening - flammable gas
	Toxicity	All analytes were within the toxicity threshold limits except ammonia.
Organic solvents[1]	Solvent pool size	Total nonmethane organic compounds were 2.0 mg/m^3. The estimated organic solvent pool size was 0.13 m^2, below the 1 m^2 limit.
Historical (gateway analysis)	Total mass of gateway analytes	Greater than 85% by weight of the waste, except core 183, segments 5L and 9L.
	Selected segment comparison with $\geq$10% of DQO values	All segments and analytes passed.
	Core composite comparison with HDW	All segments and analytes $\geq$10% of HDW model estimates. Most values within 20% of HDW model estimates.

Note:

[1]The organic solvents and organic complexants safety issues are expected to be closed in fiscal year 1998.

4.0 RECOMMENDATIONS

Push-mode core samples and vapor samples were taken to satisfy applicable issues for tank 241-S-106. One complete core (core 183, riser 8) was obtained. Core 184, riser 7, and core 187, riser 14, were partially obtained. The samples obtained are expected to be representative of tank contents and analytical results showed that there are no safety screening issues or organic complexant issues of concern. Although exotherms exceeding 480 J/g were observed, the tank is classified as safe for the organic complexant issue because low levels of TOC were found by both the persulfate and furnace oxidation methods.

Retained gas samples were taken to evaluate flammable gas issues. Results of these tests are presented in Appendix B. The RGS results and gas bubble retention test results (not available at the time this TCR was written) are being evaluated to further address the flammable gas DQO.

Vapor samples showed that ammonia is the only toxic vapor that exceeds limits, and the LFL in the tank headspace is <1 percent. The organic solvent pool size was estimated to be well below 1 m^2.

The tank waste samples passed the historical evaluation for most segments. However, composite samples were not obtained because the top four segments of the tank were drainable liquid, and core 184 was not a full core.

Table 4-1 summarizes the Project Hanford Management Contractor (PHMC) TWRS Program review status and acceptance of the sampling and analysis results reported in this TCR. All issues required to be addressed by sampling and analysis are listed in column 1 of Table 4-1. Column 2 indicates by "yes" or "no" whether the requirements were met by the sampling and analysis activities performed. Column 3 indicates concurrence and acceptance by the program in PHMC/TWRS that is responsible for the issue that the sampling and analysis activities performed adequately. A "yes" or "no" in column 3 indicates acceptance or disapproval of the sampling and analysis information in the TCR.

Table 4-1. Acceptance of Tank 241-S-106 Sampling and Analysis.

Issue	Sampling and Analysis Performed	Program[1] Acceptance
Safety screening DQO	Yes	Yes
Flammable gas DQO	Yes	Yes
Organic complexant memorandum of understanding	Yes	Yes
Hazardous vapor screening DQO	Yes	Yes
Organic solvents DQO	Yes	Yes
Historical evaluation DQO	Yes	Yes

Note:

[1]PHMC TWRS Program Office

Table 4-2 summarizes the status of PHMC TWRS Program review and acceptance of the evaluations and other characterization information contained in this report. Column 1 lists the different evaluations performed in this report. Columns 2 and 3 are in the same format as Table 4-1. The manner in which concurrence and acceptance are summarized is also the same as that in Table 4-1. The safety program has determined that the samples obtained were representative of tank contents even though two full cores were not obtained. No additional sampling is required to resolve the safety screening issue. The flammable gas issue for this tank will be resolved concurrently with all other tanks in fiscal year 2001.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-S-106.

Issue	Evaluation Performed	TWRS[1] Program Acceptance
Safety screening DQO	Yes	Yes
Flammable gas DQO	(in progress)	NA
Organic complexant memorandum of understanding (Safe)	Yes	Yes
Organic solvents DQO	Yes	Yes
Historical evaluation DQO	Yes	Yes

Notes:

N/D = not decided

[1]PHMC TWRS Program Office

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Public Law 101-510, 1990, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation," Section 3137 of *National Defense Authorization Act for Fiscal Year 1991*.

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

Schreiber, R. D., 1997, *Memorandum of Understanding for the Organic Complexant Safety Issue Data Requirements*, HNF-SD-WM-RD-060, Rev. 0, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

Simpson, B. C., and D. J. McCain, 1997, *Historical Model Evaluation Data Requirements*, HNF-SD-WM-DQO-018, Rev. 2, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

Smith, D. A., 1986, *Single-Shell Tank Isolation Safety Analysis Report*, WHC-SD-WM-SAR-006, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Watrous, R. A., and D. W. Wootan, 1997, *Activity of Fuel Batches Processed Through Hanford Separations Plants, 1944 Through 1989,* HNF-SD-WM-TI-794, Rev. 0, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

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