0050800

ENGINEERING CHANGE NOTICE

1. ECN 653796

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 []	John M. Conner, Data Assessment and Interpretation, R2-12, 373-2711	[] Yes [X] No	05/25/99
	6. Project Title/No./Work Order No. Tank 241-SY-101	7. Bldg./Sys./Fac. No. 241-SY-101	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-WM-ER-409, Rev. 0-B	10. Related ECN No(s). ECNs: 643406, 644488	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-3, ES-4, 5-15, 5-16, 6-1, 6-2, 7-3, and 7-4

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: JUN 4 1999 STA: 4 HANFORD RELEASE ID: 58

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) ECN-653796

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.M. Conner	JM Conner	6/4/99	PE		
Cog. Mgr. K.M. Hall	for JM Hunt	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 Double-Shell Tank 241-SY-101

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

EDT/ECN: ECN-653796 UC: 2070
Org Code: 74B20 CACN/COA: 102217/EI00
B&R Code: EW 3120074 Total Pages: 243

Key Words: Waste Characterization, Double-Shell Tank, DST, Tank 241-SY-101, Tank SY-101, SY-101, SY Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: N/A

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Release Approval 6/4/99 Date

DATE STA: 4 HANFORD RELEASE ID: 58 JUN 4 1999 Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-409	Page 1

(2) Title
Tank Characterization Report for Double-Shell Tank 241-SY-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 08/03/95 on EDT 613104.	D. L. Herting	J. G. Kristofzski
0A RS	Incorporate per ECN-643406.	M. J. Kupfer	K. M. Hodgson
		[signature] 8-20-97	K.M. Hodgson 8-19-97
			K.M. Hodgson
0B RS	Incorporate per ECN-644488	M.J. Kupfer	K.M. Hodgson 7/20/98
		7/21/98 JW Cammann for	
0-C RS	Incorporate per ECN-653796.	J.M. Conner	K.M. Hall for
		JM Conner	[signature] 6/4/99

A-7320-005 (08/91) WEF168

The sampling of Tank 241-SY-101 occurred before the data quality objective (DQO) process was implemented. When the analytical results are compared with the *Tank Safety Screening Data Quality Objective*[2], the total fuel content limit (based on dry weight) of 481 joules per gram (J/g), measured by differential scanning calorimetry, is exceeded in about half the segments from the Window C sampling time frame and in 18 out of 21 segments from the Window E sampling time frame (see Section 3.1). A recent evaluation (Reynolds et al. 1999) of sampling and analytical data has concluded that the requirements of the current safety screening issue is now considered closed for this tank.

The tank heat load is 11,800 watts (40,300 British thermal units per hour [Btu/hr]), which is below the safety limit of 14,600 watts (50,000 Btu/hr) for this tank. The moisture content, total alpha, and total organic carbon levels also satisfy the safety criteria. The flammable gas concentrations in the tank dome space are presently below the lower flammability limit (LFL), and have exceeded the LFL in the past on only a few events of short duration. The gas inventory of Tank 241-SY-101 has been kept at historically low levels, as measured by slurry growth.

[2]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.

Table ES-1. Description and Status of Tank 241-SY-101.

TANK DESCRIPTION	
Type:	Double-Shell
Constructed:	1976
In-Service:	1977
Diameter:	23 m (75 ft)
Operating Depth:	11 m (35 ft)
Operating Capacity:	4,320 kL (1,140 kgal)
Bottom Shape:	Flat
Ventilation:	Operating Exhauster
TANK STATUS	
Total Waste Volume:	4,160 kL (1,100 kgal)
FIC Surface Level (12/14/94):	10.1 m (399 inches)
Temperature (12/15/94):	48.7 °C (120 °F)
Integrity Category:	Sound
Watch List:	Flammable Gas
SAMPLING DATES	
Window A	November 1990
Window C	May 1991
Window E	December 1991
SERVICE STATUS	
In-Service	

Notes:
m = meter.
ft = feet.
kL = kiloliter.
kgal = kilogallon.
C = Celsius.
F = Fahrenheit.
FIC = Food Instrument Corporation.

A second issue involving some of the tanks on the Flammable Gas Watch List is the potential of a "crust burn." A crust burn, or the secondary ignition of organic-nitrate/nitrite mixtures in the crust layer, can be initiated by two events: (1) the burning of flammable gases and (2) mechanical in-tank energy (e.g., friction during core sampling) (Johnson 1994). The investigation of a secondary crust burn for tank 241-SY-101 is discussed in Fox et al. (1992) and was the primary basis for establishing the criteria and requirements of the Crust Burn DQO. Results of this study indicate that a self-propagating reaction in the crust would not occur from a hydrogen burn. A very small quantity at the crust surface and at surface projections could react, but in a benign manner (Fox et al. 1992).

The *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994) uses notification limits for concentrations of analytes of concern to determine whether a tank is safe. The primary analytical requirements identified are energetics, total alpha activity, moisture content, and flammable gas concentration. The safety screening DQO was not in existence when the sampling occurred, so no notification thresholds were applied to the data assessment after the initial analysis. If the analytical results are now compared to the decision limits, it is found that the total fuel content threshold of 481 joules per gram (J/g), as measured by DSC, is exceeded in many of the segments. Approximately half of the segments from the Window C sampling time frame contain exotherms exceeding the decision criteria, while 18 out of 21 segments from the Window E sample exceed the 481 J/g limit. These dry weight values are converted from the wet weight results listed in Table 4-9. The conversion is done according to the following equation:

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

For example, the 320 J/g wet weight exotherm from segment 9 of Window E would convert into a dry weight exotherm of 498 J/g, using the segment 9 percent water result (from thermogravimetric analysis) of 35.7 percent.

The analytical results for total alpha and percent moisture were within the safety screening DQO limits. The flammable gas concentration was not analyzed in the Window A, C, and E time frames.

A recent evaluation (Reynolds et al. 1999) of the sampling and analytical data has concluded that the requirements of the current safety screening DQO (Dukelow et al. 1995) have been met for tank 241-SY-101. The safety screening issue is now considered closed for this tank.

Another factor in assessing the safety of the tank is the heat generation and temperature of the waste. Heat is generated in the tanks primarily from radioactive decay. Section 2.5.2 discussed temperature information for Tank 241-SY-101. The amount of heat resulting from radioactivity in the tank was calculated in Table 5-9. The estimated total curies for each analyte is listed in column 2 (from Table 4-3) and the number of watts is listed in column 3. The reported heat load for the tank is 11,800 watts (40,300 British thermal unit per hour [Btu/hr]), with an uncertainty estimate of 7 percent (assuming no uncertainty with the tank volume estimate). Taking the uncertainty into consideration, the heat load estimate is still

below the upper safety limit of 50,000 Btu/hr specified for this tank (Harris 1994). The temperature of the tank from March to November of 1994 ranged between 21.4 °C and 48.7 °C (70.5-120 °F). Since an upper temperature limit is exhibited, it may be concluded that any heat generated from radioactive sources throughout the year is dissipated.

Table 5-9. Tank 241-SY-101 Projected Heat Load.

Radionuclide	Ci	RSD (mean)	Watts
^{241}Am	635	11.8	20.8
^{137}Cs	2.31E+06	7.4	10,900
$^{239/240}Pu$	46.6	14.6	1.42
^{90}Sr	1.31E+05	11.5	878
^{99}Tc	1,460	6.2	0.731
Watts		**7.0**	**11,800**

Notes:
Ci = curie.
RSD = relative standard deviation.

6.0 CONCLUSIONS

The contents of Tank 241-SY-101 were sampled in 1990 and 1991 to address flammable gas safety concerns. Although the decision criteria listed in *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994) were not in force at the time of these sampling events, a comparison of the analytical results to the safety thresholds indicates that a majority of the segments contained exothermic reactions exceeding the 481 J/g limit. The percent water and total alpha concentrations were below the limits. In addition, the estimated tank heat load of 40,300 Btu/hr was below the critical level of 50,000 Btu/hr established for Tank 241-SY-101 (Harris 1994). A recent evaluation (Reynolds et al. 1999) of sampling and analytical data has concluded that the requirements of the current safety screening DQO (Dukelow et al. 1995) have been met for tank 241-SY-101. The safety screening issue is now considered closed for this tank.

Tank 241-SY-101 currently does not exhibit the historical phenomenon of a large buildup of gas within the slurry (and consequent slurry growth), followed by a gas release event (GRE). This situation has been relieved through the installation of a mixer pump. This pump allows small amounts of gas to be slowly released and prevents the episodic release of large volumes of gas.

The 1991 samplings were performed before the installation of the mixer pump. Prior to the mixer pump operation, three distinct layers existed in Tank 241-SY-101. It is unlikely that these layers remain today. Therefore, the data from 1990 and 1991 may not represent the current distribution of waste in the tank. It is also important to note that all three of the samplings occurred immediately after a GRE. When a gas release occurs, a sudden outburst of waste from the bottom of the tank accompanies the discharging gas, causing some mixing of the convective and non-convective layers. The extent of the mixing of the layers after a GRE is indeterminable. However, it is possible that, because of the mixing caused by a gas release, the data from the three samplings may resemble the current makeup of the waste to some extent. Regardless of the former or present distribution of the waste, the tank contents remain unchanged, and the analytical results from the 1990 and 1991 sampling events remain valid.

Tank 241-SY-101 currently consists mostly of double-shell slurry and saltcake. The analytes in the largest concentrations were sodium, nitrate, and nitrite, along with lesser quantities of aluminum, hydroxide, total organic carbon, and many smaller constituents. The major radionuclide was ^{137}Cs, and water comprised 35 percent of the waste.

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