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PAGE

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN № 625687

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	3a. USQ Required?	4. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	L. M. Sasaki/Characterization Plans, Coordination and Reports/R2-12/373-1027	[] Yes [X] No	09/11/95
	5. Project Title/No./Work Order No. Tank 241-TY-106	6. Bldg./Sys./Fac. No. N/A	7. Approval Designator N/A
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12. Description of Change

Vapor sampling and gas flammability sections are being incorporated into Sections 3 and 4 of this document. Pages missing from the previous revision are provided. Editorial changes to other sections are also being made.

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.

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[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.

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Cog. Eng. L.M. Sasaki *L.M. Sasaki*	9/19/95	PE	
Cog. Mgr. J.G. Kristofzski *John Kristofzski*	9/19/95	QA	
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INFORMATION RELEASE REQUEST
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2. **Base Document Title:**
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I verify this change/revision to the base document indicated above:

- Complies with the provisions of WHC-CM-3-4
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7. **Responsible Manager:** John G. Kristofzski

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This report summarizes three sampling and analysis events. Sludge composition and properties are based on two core samples taken from the tank in 1985 and two auger samples taken in March 1995. The tank was also vapor sampled in August 1995. The data from the 1985 sampling event are considered to be highly representative of the waste currently because there have been no transfers to or from the tank since 1977. Because these samples were taken before the data quality objective (DQO) process was implemented, the resulting data do not fully satisfy the recent requirements for safety screening. The 1995 samples were taken and analyzed in accordance with the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994).

The energetic behavior of the waste is quite low, as determined by differential scanning calorimetry (DSC) on the 1995 auger samples. They exhibited no exotherms. The total organic carbon (TOC) derived from the 1985 samples is 2,290 microgram of carbon per gram, which is approximately 0.2 percent wet weight or 0.4 percent dry weight. These concentrations are well below the 5 percent TOC (dry weight) criterion established by the organic safety program (Babad et al. 1994). The waste is estimated to be 30.3 percent to 39.2 percent water by weight, as determined by thermogravimetric analyses of the 1995 auger samples; and 55.5 percent based on the *Historical Tank Content Estimate for the Northwest Quadrant of the Hanford 200 West Areas* (Brevick et al. 1995). Both these percent water values are above the 17 percent criterion specified in the safety screening DQO. Based on results from the 1985 sampling event, the heat generated by the radioactivity in the tank is estimated to be 306 Btu/hr (89.8 watts) which is below the

40,000 Btu/hr (10,000 watts) criterion for a high-heat load tank classification. The temperature of the tank has ranged from 12.2 and 30 °C (54 and 86 °F) during the period from June 1975 to January 1995. The total alpha activity in the tank is less than 0.03 microcuries per gram, which is four orders of magnitude lower than the criticality safety criterion. The flammable gas concentration measurement in the tank vapor space was 0 percent of the lower flammability limit, which satisfies the safety screening criterion. Based on this information, the waste does not appear to have immediate safety concerns.

The characteristics of tank 241-TY-106, physical properties, best estimates for the chemical and radiochemical composition, and the total tank inventory of the sludge in the tank are summarized in Table E-1 and Table E-2. These estimates are from 1995 and 1985 sampling events. The sludge contains high concentrations of iron, sodium, silicon, and uranium. Concentrations of nitrate and sulfate are also high. These results are consistent with the expected composition of the waste based on its history, which included transfers of uranium recovery waste and additions of diatomaceous earth (SiO_2).

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APPENDIX

A 1985 CORE SAMPLE RESULTS A-1

1.0 INTRODUCTION

This tank characterization report overviews single-shell tank 241-TY-106 and its waste contents. It estimates concentrations and inventories for waste components based upon the latest sampling and analysis activities and background tank information. The results of the three most recent sampling events associated with Tank 241-TY-106 are presented. In March 1995, two auger samples were taken for analysis in accordance with the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994). In 1985, an attempt was made to take seven core samples from Tank 241-TY-106 in 1985; however, a quantity of waste sufficient for analysis was obtained from only two of these cores. In August 1995, vapor sampling was performed in support of the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994).

Tank 241-TY-106 was filled to near capacity in 1954 with uranium recovery waste; no more transfers occurred until 1959. In 1959, it was discovered that the tank was leaking and supernatant waste was pumped to other tanks in the 241-TY Tank Farm. From 1959 to 1972, no transfer activities were conducted. In 1972, diatomaceous earth was added to the tank to stabilize any remaining liquid. The tank is no longer in active service and presently contains sludge left behind by the uranium recovery waste. The diatomaceous earth most likely exists as a thin layer covering the sludge. The concentration and inventory estimates reported in this document reflect the current composition of the waste based upon available data. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order*, milestone M-44-08 (Ecology et al. 1994).

1.1 PURPOSE

The purpose of this report is to summarize the information about the use and contents of tank 241-TY-106. When possible, this information will be used to assess issues associated with safety, operations, environmental, and process development activities. This report is also a reference point for more detailed information about Tank 241-TY-106.

1.2 SCOPE

The 1985 core samples were taken as part of the development testing of sampling equipment designed to take full-depth samples (cores) from single-shell tanks (SSTs). Following extended testing with simulated SST waste, initial testing and application of the equipment to actual SST waste was undertaken in the 241-TY Tank Farm. The 241-TY Tank Farm also was sampled to provide waste characterization to support the proposed dome-fill test. This was based on the idea of filling SSTs with suitable material to minimize the effects of eventual dome collapse (Weiss 1986). The samples were analyzed for metals, anions, and radiochemical constituents.

The auger and vapor samples taken in 1995 were obtained in accordance with the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994). Sampling and analysis activities are focused on either verification of the non-Watch List tank status or identification of any unknown safety issues associated with the tank.

3.0 TANK SAMPLING OVERVIEW

This section describes the three sampling and analysis events associated with tank 241-TY-106. The most recent sampling events took place in August 1995 when the tank was vapor sampled, and in early March 1995 when two auger samples were taken and analyzed, in accordance with the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994) and the *Tank 241-TY-106 Characterization Plan* (Schreiber 1995). Two core samples were taken from the tank in 1985, and the waste material was analyzed for chemical and radiological constituents.

3.1 DESCRIPTION OF SAMPLING EVENT (1995)

Two samples were taken from the tank by using a 20-inch auger. The first auger sample was removed from riser 6 (sample # 95-AUG-011) on March 2, 1995 and consisted of 84.55 grams of sample. No drainable or liner liquid was recovered, and most of the sample was contained on flutes 11 through 19. The second auger sample was removed from riser 7 (sample # 95-AUG-010) on March 3, 1995 and consisted of 68.97 grams of sample. No drainable or liner liquid was recovered, and most of the sample was contained on flutes 17 through 10, with a thin coating of what appeared to be the same material on the outside of flutes 1 through 16. The drill string dose rate for riser 6 was 250 milliroentgens per hour (mR/hr) and for riser 7 the dose rate was 175 mR/hr. Recoveries were less than 100 percent; otherwise, no problems related to the sampling event were noted. The auger has 19 flutes with flute 1 being located at the shaft and flute 19 at the tip.

3.1.1 Sample Handling (1995)

The two samples were received at the 222-S laboratory on March 3, 1995; extrusion took place on March 8, 1995. Photographs were taken of the extrusion but were not provided with the data package. The subsampling scheme and visual observations of the samples are given in Table 3-1. The material from riser 6 was split into upper and lower subsamples based on an observed change in the color of the waste. The three subsamples were homogenized prior to analysis. Each subsample was analyzed for differential scanning calorimetry (DSC), percent water, and total alpha. A flow diagram of the entire process is shown in Figure 3-1.

Table 3-3. Segment Breakdown for Tank 241-TY-106[1].

Core	ID Number	Subsample ID	Matrix	Description
1	111	NA	NA	Insufficient sample for analysis. A very small amount of waste was stuck to the sampler bottom. The white and brown waste resembled diatomaceous earth.
2	121	NA	NA	Insufficient sample for analysis. A small amount of material was stuck to the sampler bottom. It was a white, yellow, crumbly solid with brown flecks.
3	131	NA	solid	The sample was very soft at the bottom, grading to quite firm at the top. Two distinct solid phases were discernible. The top portion appeared gray in the hot cell. When removed, it was light brown, dry, and flaky. The bottom portion was dark reddish brown and "mushy." Some "chunks" were noted in the bottom portion.
3	NA	111D	drainable liquid	Insufficient sample for complete analysis. A light yellow aqueous solution.
3	NA	111C	core composite	The extrusion was split lengthwise, and one side was blended for the composite. A smooth, medium brown material with small chunks resulted.
5	141	NA	solid	Insufficient sample for analysis. The sample was grayish and hard with what appeared to be a brown leaf imbedded in it.
6	151	NA	solid	Insufficient sample for analysis. Similar material to sample number 141.
7	161	NA	solid	The waste appeared very similar to sample number 131: top portion gray, bottom brownish. The phases were more smeared together than in sample 131. The two solid phases were not separated. When removed from the hot cell, the gray portion appeared light brown in color and was dry. The lower portion appeared brown with black flecks in it. One 5/8 inch by 1/2 inch dark gray "rock" was removed from the lower section (4.7 g).
7	NA	161C	core composite	The blended sample (all of both solid phases) appeared medium brown, contained black grit, and was fairly dry.

Note:

[1]Weiss, R. L. and B. M. Mauss, 1987, *Data Transmittal Package for 241-TY-106 Waste Tank Characterization*, SD-RE-TI-181, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

3.3 DESCRIPTION OF VAPOR SAMPLING EVENT (1995)

The tank vapor space was sampled on August 28, 1995, using a combustible gas meter in accordance with work package WS-95-00184. Sampling was performed through riser 7 at approximately 3 ft above the waste surface (40 ft below the top of the riser). Tubing was lowered into the tank vapor space to the specified sampling depth, the tubing was purged, and the combustible gas meter reading was recorded.

4.0 ANALYTICAL RESULTS

4.1 OVERVIEW

This section summarizes the analytical results from the sampling events and provides concentration and inventory estimates for measured analytes. The data used for these estimates were obtained from the 1985 and 1995 sampling events (Weise and Mauss 1987 and Jo 1995, respectively). Material has not been transferred to, or pumped from, the tank since 1977; therefore, the data obtained in 1985 are considered to be best estimates of tank contents.

The samples collected from tank 241-TY-106 in 1995 were taken and evaluated according to the *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994); therefore, only thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), total alpha analyses, and vapor flammability measurements were performed. Individual chemical and radiochemical constituents were evaluated at the completion of the 1985 sampling event; these results provided concentration and inventory estimates. The analytical data are shown in Table 4-1.

Table 4-1. Analytical Data Tables for Tank 241-TY-106.

Analysis	Location
Total Alpha (1995)	Table 4-2
Tank 241-TY-106 Characterization Summary	Table 4-3
Thermogravimetric Analysis (1995)	Table 4-4
Differential Scanning Calorimetry (1995)	Table 4-5
1985 Sample Results	Appendix A

4.2 DATA PRESENTATION

Table 4-2 shows the data for total alpha. The table lists the sample numbers and locations from which the samples were taken. The result column lists the value detected in the original sample in the laboratory; duplicate lists the sample's duplicate analysis value. A less than symbol (<) indicates that the analyte was noted but was below the analytical instrument's calibrated detection limit for the sample. The mean, which is a simple average of the results and their duplicates, was derived by adding all results (detected and nondetected) and dividing by the total number of sampling points. When the data were lower

Table 4-5. Tank 241-TY-106 Differential Scanning Calorimetry Results.

Sample	Run	Transition 1		Transition 2	
		ΔH J/g	Temp. Range °C	ΔH J/g	Temp. Range °C
Riser 7 S95T000286	1	935	Amb to 174	47.3	254 to 313
	2	834	Amb to 192	22.5	276 to 308
Riser 6 S95T000299	1	802	Amb to 164	33.6	253 to 307
	2	938	Amb to 174	24.0	277 to 307
Riser 6 S95T000301	1	1,020	Amb to 188	32.2	280 to 312
	2	927	Amb to 199	28.4	279 to 312

4.4 VAPOR FLAMMABILITY

A combustible gas meter reading was taken through riser 7 at approximately 3 ft above the waste surface. The combustible gas meter reading was 0 percent of the lower flammability limit (LFL) indicating no flammability concerns with this tank.

The potential for criticality can be assessed from total alpha data. The average total alpha activity in the tank based on 1995 data was estimated at 0.0183 μCi/g, with the highest possible value being 0.0270 μCi/g. The result from the 1985 sampling was 0.196 μCi/g. These are approximately 200 to 2,000 times below the level of concern and the established criteria of 1 grams per liter (g/L) specified in the *Tank Safety Screening Data Quality Objective*. Using the equation below and the 1985 density result of 1.37 g/ml, the 1 g/L criteria translates into 45 μCi/g.

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

The flammability of the gas in the tank head space of the tank is another safety screening consideration. The combustible gas meter reading was 0 percent of the LFL, indicating no flammability concerns with this tank. Although the safety screening DQO at the time of sampling specified the determination of gas composition to estimate the percent of LFL, the Safety Program has since determined that a combustible gas meter reading will satisfy the requirements of the DQO for concentrations less than 10 percent of the LFL (Dukelow et al. 1995).

5.5.2 Operational Evaluation

The tank was sampled to evaluate safety concerns and to confirm its non-Watch List status. There are currently no liquids in the tank, and because it is an assumed leaker, liquid waste will not be transferred into it in the future. Therefore, waste compatibility issues do not apply to this tank.

5.5.3 Environmental Evaluation

Tank 241-TY-106 was not characterized to evaluate environmental compliance issues. No specific organic (volatile or semi-volatile) analyses have been performed on the tank; therefore, no environmental assessment of these compounds can be made.

The 1985 analysis did indicate that the waste contained high concentrations of environmentally sensitive metals such as cadmium, chromium, and lead. However, the metals are in an immobile precipitate and are unlikely to migrate in their present state.

5.5.4 Process Development Evaluation

The metal and anion analysis of waste from the 1985 sampling is important for evaluating the disposal waste form (glass) formulations and identifying potential components that may affect

the treatment and disposal process. Because waste sludges may be blended, washed, and treated before disposal, there are no specific criteria for the parameters measured. Extensive rheological analyses have yet to be conducted on the waste. The only information on rheology available from the 1985 sampling event indicates that the viscosity of the waste is > 10,000 centipoise (cP) (Weiss and Mauss 1987). When evaluations are performed, the results will assist retrieval and pretreatment programs to determine equipment needs.

The metal analyses information for the water-digested solids yields solubility information that may be useful in the retrieving tank waste. The solubility of several metals and radionuclides was examined by comparing the water-digested results with total concentration results (see Section 3.2.2). Tables 5-10 and 5-11 list the percent solubility for several analytes from core 3 and core 7, respectively. Only those analytes detected in the leachate resulting from the water digestion were considered.

The data demonstrate that sodium and ^{99}Tc are relatively soluble species and that approximately 73 to 77 percent of the sodium and 38 to 89 percent of the ^{99}Tc will dissolve in an aqueous medium. Phosphorus and ^{137}Cs display limited solubility. About 17 to 24 percent of the phosphorus in the tank will enter solution as the phosphate ion or one of its hydrogenated derivations depending upon the pH. The solubility of ^{137}Cs is expected to approach that of sodium, but the data indicate otherwise.

The remaining metals and ^{90}Sr are relatively insoluble. With respect to chromium, these observations indicate that chromium is present as the Cr(III) species rather than the soluble Cr(VI) species.

Table 5-10. Percent Water Solubility for Core 3 Analytes.

Analyte	Water Digestion	Total Analyte Concentration	Percent Soluble
METALS	μg/g	μg/g	%
Barium	15.3	1,330	1.2
Chromium	1.64	206	0.80
Iron	8.13	39,900	0.02
Phosphorus	6,050	24,900	24
Silicon	67.5	66,500	0.10
Sodium	103,000	134,000	77
Uranium	5.05	10,500	0.05
RADIONUCLIDES	μCi/g	μCi/g	%
^{137}Cs	4.69	21.5	22
^{90}Sr	0.0415	107	0.04
^{99}Tc	0.206	0.232	89

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