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ENGINEERING DATA TRANSMITTAL

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Page 1 of 2

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1	RPP-5417	N/A	0	Auto Tank Interpretive Report for Tank 241-AN-103	N/A	2	1	1
2	RPP-5418	N/A	0	Auto Tank Interpretive Report for Tank 241-AN-104	N/A	2	1	1
3	RPP-5419	N/A	0	Auto Tank Interpretive Report for Tank 241-AN-105	N/A	2	1	1
4	RPP-5420	N/A	0	Auto Tank Interpretive Report for Tank 241-AW-101	N/A	2	1	1

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		Design Authority									
		Design Agent									
2	1	Cog. Eng. M. R. Adams	M R Adams	11/18/99							
2	1	Cog. Mgr. J. W. Hunt	JW Hunt	11/18/99							
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Authorized Representative for Receiving Organization Date

20. John W. Hunt
JW Hunt 11/18/99
Cognizant Manager Date

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(CONTINUATION PAGE)

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5	RPP-5421	N/A	0	Auto Tank Interpretive Report for Tank 241-BY-105	N/A	2	1	1
6	RPP-5422	N/A	0	Auto Tank Interpretive Report for Tank 241-S-110	N/A	2	1	1
7	RPP-5423	N/A	0	Auto Tank Interpretive Report for Tank 241-S-111	N/A	2	1	1
8	RPP-5424	N/A	0	Auto Tank Interpretive Report for Tank 241-SX-102	N/A	2	1	1
9	RPP-5425	N/A	0	Auto Tank Interpretive Report for Tank 241-SX-105	N/A	2	1	1
10	RPP-5426	N/A	0	Auto Tank Interpretive Report for Tank 241-T-110	N/A	2	1	1
11	RPP-5427	N/A	0	Auto Tank Interpretive Report for Tank 241-U-107	N/A	2	1	1
12	RPP-5428	N/A	0	Auto Tank Interpretive Report for Tank 241-U-109	N/A	2	1	1
13	RPP-5429	N/A	0	Auto Tank Interpretive Report for Tank 241-U-112	N/A	2	1	1

Auto Tank Interpretive Report for Tank 241-U-107

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U.S. Department of Energy Contract DE-AC06-96RL13200

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This report prepared especially for Auto TIR on 11/09/99

Some of the reports herein may contain data that has not been reviewed or edited. The data will have been reviewed or edited as of the date that a Tank Interpretive Report (TIR) is prepared and approved. The TIR for this tank was approved on September 10, 1999.

Tank: 241-U-107

Sampling Events:
- 129
- 134
- 135
- 242
- 242R
- 245

Reports:
- Tank Interpretive Report

Constituent Groups:

Table of Contents

Data Dictionary to Reports in this Document

Report	Field	Description
Tank Interpretive Report		Interprets information about the tank answering a series of six questions covering areas such as information drivers, tank history, tank comparisons, disposal implications, data quality and quantity, and unique aspects of the tank.

Tank Interpretive Report For 241-U-107

Tank Information Drivers

Question 1: What are the information drivers applicable to this tank? What type of information does each driver require from this tank? (Examples of drivers are Data Quality Objectives, Mid-Level Disposal Logic, RPP Operation and Utilization Plan, test plans and Letters of Instruction.) To what extent have the information and data required in the driving document been satisfied to date by the analytical and interpretive work done on this tank?

The information drivers for tank 241-U-107 include the Safety Screening Data Quality Objective (DQO) (Dukelow et al. 1995), the Flammable Gas DQO (Bauer and Jackson 1998), the Organic Solvent Safety Issue DQO (Meacham et al. 1997), the Organic Complexant Safety Issue Memorandum of Understanding (MOU) (Schreiber 1997), the Historical DQO (Simpson and McCain 1997), the Compatibility DQO (Mulkey and Miller 1998 and Fowler 1995), the Hazardous Vapor Screening DQO (Osborne and Buckley), and the Pretreatment DQO (Slankas et al. 1995 and Kupfer et al. 1995). The extent to which these DQOs have been satisfied are discussed below.

Safety Screening DQO: Does the waste pose or contribute to any recognized potential safety problems?

The data needed to screen the waste in tank 241-U-107 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. A full vertical profile of the tank waste is required for the Safety Screening analysis. In 1996 the core sampling method used was push mode, and because of the solid nature of the waste the three cores taken were incomplete. The data used for evaluation of safety screening requirements were taken from the two more inclusive cores retrieved by rotary mode in June and July of 1998. However, significant results from that event with regards to the DQO are included in the discussion.

Results obtained using differential scanning calorimetry (DSC) indicated that none of the core samples obtained from tank 241-U-107 in 1998 exceeded the safety screening decision threshold of 480 J/g. The highest individual sample result was 198 J/g (dry weight) from core 242 segment R5. The highest one-sided 95 percent confidence interval upper limit on the mean was 213 J/g (dry weight).

Liquid samples from two of the thirteen core segments retrieved in 1996 had mean values that exceed the safety screening decision limit of 480 J/g. Core 135 segment 1 had drainable liquid DSC results of 540 J/g and 578 J/g, and Core 135 segment 1R had DSC results of 559 J/g and 516 J/g. However, more complete samples taken from the same risers in 1998 were below the decision level, and no further investigation into the exothermic behavior of the tank waste is warranted.

Flammable gas in the tank headspace was detected at up to 8 percent of the lower flammability limit (LFL) in January, February, and March 1996 (see "*IH Sniff Data*" standard report). Some of the

1996 measurements were taken during core sampling, and these results would not reflect tank steady state conditions. As requested in the *Tank 241-U-107 Rotary Mode Core Sampling and Analysis Plan* (Wilkins 1998), headspace vapor measurements were taken before obtaining the June through July 1998 rotary core samples, and combustible gas meter readings matched the results recorded in the "*IH Sniff Data*" standard report. Headspace vapor measurements were also taken in January, February and March of 1996, with flammability result values of up to 8 percent of the LFL. These results are well below the action level of 25 percent of the LFL.

The threshold limit for criticality, based on the total alpha activity, is 1 g/L. Assuming that all alpha is from ^{239}Pu, for a sample density of 1.88 g/mL, 1 g/L of ^{239}Pu is equivalent to 32.7 μCi/g of alpha activity. The maximum total alpha result was 2.19 μCi/g, with a 95 percent confidence interval of 2.91 μCi/g. Therefore, criticality is not a concern for this tank.

Flammable Gas DQO: Does a possibility exist for releasing flammable gases into the headspace of the tank or releasing chemical or radioactive materials into the environment?

The requirements to support the flammable gas issue are documented in the *Data Quality Objective to Support Resolution of the Flammable Gas Safety Issue* (Bauer and Jackson 1998). The Flammable Gas DQO has been extended to apply to all tanks. Analyses and evaluations will change according to program needs until this issue is resolved. Final resolution of the flammable gas safety issue is expected by September 30, 2001 (Johnson 1997).

As stated in the safety screening DQO section of the tank interpretive report, the three headspace vapor measurement events between 1995 and 1998 all show results well below the action limit of 25 percent of the LFL.

Retained gas samples (RGS) are commonly analyzed to address flammable gas issues, however, RGSs were not taken for any core segments obtained in 1996 or 1998.

As of June 8, 1999, the following gas analyses and evaluations have been completed. In 1995, samples of the tank 241-U-107 headspace vapor were collected and analyzed using the vapor sampling system (VSS). The results are documented in the *Tank 241-U-107 Headspace Gas and Vapor Characterization Results for Samples Collected in February 1995* (Huckaby and Bratzel, 1995). The following analytes were detected: ammonia, carbon dioxide, carbon monoxide, hydrogen, nitric oxide, nitrogen dioxide, nitrous oxide, and water vapor. The most abundant constituents detected were nitrous oxide, hydrogen and ammonia. None of the analytes contribute appreciably to the flammability of the headspace.

Tank 241-U-107 is equipped with a standard hydrogen monitoring system (SHMS) for the collection of vapor-phase data that support resolution of flammable gas issues. The SHMS monitors hydrogen continuously. From the installation date (March 1995) through June 1999, twelve hydrogen gas release events (GREs) were documented for tank 241-U-107 based upon SHMS data. The maximum concentration of hydrogen released was 1,900 ppm on December 28, 1996. This is well below the action level of 6,250 ppm of hydrogen. These releases are documented in the report *Results of Vapor Space Monitoring of Flammable Gas Watch List Tanks* (McCain and Bauer 1998).

Organic Solvents DQO: Does an organic solvent pool exist that may cause a fire or ignition of organic solvents in entrained waste solids?

The data needed to address the organic solvent screening issue are documented in *Data Quality Objective to Support Resolution of the Organic Solvent Safety Issue* (Meacham et al. 1997). The DQO requires that headspace samples be analyzed for total nonmethane organic compounds. Vapor samples were taken from tank 241-U-107 in February 1995, and the total nonmethane organic vapor concentration calculated from the concentration of individual compounds measured at a reference temperature of 0° C by gas chromatography/mass spectrometry was about 6.4 mg/m^3 (Huckaby and Bratzel 1995). The organic solvent surface area was estimated at 0.09 m^2 (Huckaby and Sklarew 1997), well below the 1 m^2 limit.

The organic program has determined that even if an organic solvent pool does exist, the consequence of a fire or ignition of organic solvents is below risk evaluation guidelines for all tanks (Brown et al. 1998). The organic solvent issue is expected to be closed for all tanks in 1999.

Organic Complexant Safety Issue MOU: 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?

The data required for the organic complexant issue are documented in *Memorandum of Understanding for the Organic Complexant Safety Issue Data Requirement* (Schreiber 1997). Differential scanning calorimetry and total organic carbon (TOC) analyses were performed to address the organic complexant issue.

Differential scanning calorimetry was applied to the 1996 and 1998 core samples. Two of the thirteen core segments drainable liquid samples retrieved in 1996 had mean values that exceed the action limit of 480 J/g. Core 135 segment 1 had a mean of 559 J/g (dry weight basis) with a 95 percent confidence limit of 678 J/g and core 135 segment 1R had a mean of 538 J/g with a 95 percent confidence limit of 674 J/g. However, both segments had TOC results that were well below the organic complexant action level of 45,000 μg/g (dry weight basis). The mean TOC values for segment 1 and 1R drainable liquid were 3,464 μg/g and 2,694 μg/g, respectively. The data suggest that a propagating reaction in the waste is unlikely.

The organic complexants safety issue was closed for all tanks in December, 1998 (Owendoff 1998).

Historical DQO: Is the waste inventory generated by a model based on process knowledge and historical information (Agnew et al. 1997a) representative of the current tank waste inventory?

The purpose of the historical evaluation is to determine whether the Hanford defined waste (HDW) model, based on process knowledge and historical information (Agnew et al. 1997a), agrees with current descriptions of tank inventories based on sampling. If the historical model accurately predicts the waste characteristics as observed through sample characterization, the possibility exists to reduce the amount of total sampling and analysis needed. Data requirements for this evaluation are documented in *Historical Model Evaluation Data Requirements* (Simpson and McCain 1997).

The historical DQO indicates a waste type of interest for tank 241-U-107 to be metal waste, but this waste was sluiced in the first quarter of 1957 (Agnew et al. 1997b). REDOX cladding waste (CWR1) was calculated to make up 76 kgal of the waste in tank 241-U-107 as well, but analytical data indicates a much smaller volume of this waste. Tank 241-U-107 is expected to contain a 242-S Evaporator salt slurry (SMMS2) layer thick enough to provide entire segments composed of this waste type (Agnew et al. 1997a). Therefore, tank 241-U-107 SMMS2 waste data was compared with the historical DQO SMMS2 waste inventory.

In the evaluation, analytical results are compared with DQO-defined concentration levels for the key analytes in SMMS2. The key analytes were sodium, aluminum, carbonate, nitrate, phosphate, sulfate, and weight percent water. If the analytical results are > 10 percent of the DQO defined levels and the sum of the analyte masses is > 85 percent of the sum for the historical waste stream, the waste type and layer identification are considered acceptable (Simpson and McCain 1997). According to Agnew et al. (1997a), segments 2 through 4 should be SMMS2 salt slurry. The analytical results from the segment solid samples for the key analytes were compared to the predicted concentrations for the SMMS2 salt slurry waste type in Table 1-1. Individual comparisons were made for each core.

Three of the five cores passed both the 85 percent and 10 percent criteria. Core 135R failed the 85 percent criterion and the 10 percent criterion for aluminum, weight percent water, and sulfate. The data for this core may have been biased due to the sampling technique. Core 135R is a retake push mode core retrieved from the same position as core 135, and the recovery was very small. The sulfate data from core 242 also failed the 10 percent criterion. All cores had low sulfate values, even the ones that passed the 10 percent criterion. The HDW model may be overestimating the sulfate concentration in SMMS2 waste.

Table 1-1. Comparison of Core Sample Data to Historical Waste Streams

Analyte	Unit	Mean Value Core 129 Seg. 2-3	Mean Value Core 134 Seg. 2-4	Mean Value Core 135R Seg. 2	Mean Value Core 242 Seg. 2	Mean Value Core 245 Seg. 3-4	SMMS2[1]
Na	ppm	188,000	198,875	227,000	208,000[2]	199,500[2]	215,100
Al	ppm	11,190	10,200	1,705	8,175[2]	17,900[2]	37,000
H_2O	ppm	274,000	206,000	8,000	506,000	322,000	299,000
NO_3	ppm	410,750	449,000	574,500	546,000	344,700	174,500
CO_3 [3]	ppm	11,215	28,620	9,775	10,550	not measured	20,200
PO_4	ppm	12,865	11,710	1965	10,800	26,200	18,000
SO_4	ppm	5,575	7565	1060	2,170	2,918	28,700
Totals	ppm	913,595	911,970	619,705	1,291,695	913,218	759,200

Notes: Seg = segment.
[1] Simpson and McCain (1997)
[2] Minimum average segment value for all fusion and acid digest analyses.
[3] Converted from the total inorganic carbon results.

Compatibility DQO: Will safety problems be created as a result of mixing waste in interim storage? Do operations issues exist which should be addressed before waste is transferred?

The requirements of the *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Mulkey and Miller 1998) include the safety considerations of criticality, corrosion, energetics, and flammable gas accumulation. The operational issues of heat generation of commingled waste, segregation of complexant waste, and high phosphate waste are addressed in Fowler (1995). Ammonia was added to the compatibility analyses per the *Addition of Ammonia to Suite of Compatibility Analyses* memo (Fowler 1998a), while assessment of the transuranic (TRU) constituent concentrations is now addressed by analysis of total alpha activity per the *Addition of Total Alpha to Suite of Compatibility Analyses* memo (Fowler 1998b).

Saltwell pumping of tank 241-U-107 is scheduled from June 2001 to February 2003. A formal compatibility assessment using the 1998 drainable liquid core sample results will be completed before saltwell pumping begins.

Hazardous Vapor Screening DQO: Do hazardous storage conditions exist associated with gases and vapors in the tank?

Tank 241-U-107 was vapor sampled in February 1995. Flammability results (Huckaby and Bratzel 1995) were well below action limits. According to *Tank 241-U-107 Vapor Sampling and Analysis Tank Characterization Report* (Huckaby 1995) two constituents, ammonia (577 ppmv) and nitrous oxide (701 ppmv), exceeded 8 hour recommended exposure limit of 25 ppmv set by the National Institute of Occupational Safety and Health (NIOSH 1995). The Tank Farm Health and Safety Plan dictates that if employees are to work in an area where the exposure limit is exceeded, they are to use supplied air. With the present work controls in place, an unacceptable inhalation risk to workers from tank farm vapors does not exist (Hewitt 1998).

Hazardous vapor screening is no longer an issue because headspace vapor (sniff) tests are required for the safety screening DQO (Dukelow et al. 1995), and the toxicity issue was closed for all tanks (Hewitt 1996).

Pretreatment DQO: What fraction of the waste is soluble when treated by sludge washing and leaching?

Samples were archived for future analyses and evaluation in accordance with *Strategy for Sampling Hanford Site Tanks for Development of Disposal Technology* (Kupfer et al. 1995).

Heat Load Estimate: 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 heat load estimate based on the process history was 2.82 kW (9,630 Btu/hr) (Agnew et al. 1997a). The heat load estimate based on the tank headspace temperature was 1.60 kW (5,475 Btu/hr) (Kummerer 1995). The tank heat load based on the Best-Basis Inventory (See Standard Report "*Best-Basis Inventory [Radioactive]*") was

2.06 kW (7,036 Btu/hr). These estimates are below the limit of 7.6 kW (26,000 Btu/hr) that separates high and low heat load single-shell tanks (LMHC 1999).

Table 1-2. Heat Load Estimate Based on the Best-Basis Radionuclide Inventory.

Radionuclide	Waste Inventory	Specific Activity[1]	Heat Load (W)
Strontium-90	1.60+E5 Ci	0.00670 W/Ci	1070
Cesium-137	2.10+E5 Ci	0.00472 W/Ci	990
Total	-	-	2060

Notes: [1]Includes daughter isotopes.

Tank History

Question 2: What is known about the history of this tank as it relates to waste behavior?

The 241-U Tank Farm was constructed during 1943 and 1944 in the 200 West Area. The U Tank Farm contains twelve 100-series tanks and four 200-series tanks. Built according to the first-generation design, the 241-U Tank Farm was designed for non-boiling waste with a maximum fluid temperature of 104 °C (220 °F). Tank 241-U-107 is the first in a cascade series of three tanks that include tanks 241-U-108 and 241-U-109. Each tank in the cascade series is set 0.305 m (1 ft) lower in elevation from the preceding tank. The cascade overflow height is approximately 4.9 m (16 ft) from the tank bottom and 0.61 m (2 ft) below the top of the steel liner. The 100-series tanks have a capacity of 2,010 kL (530 kgal), a diameter of 22.9 m (75.0 ft), and a liner height of 5.8 m (18 ft) as measured from the tank bottom centerline (Leach and Stahl 1993). Tank 241-U-107 currently contains 1,550 kL (408 kgal) of double-shell slurry feed and is listed as sound.

Agnew et al. (1997b) provide a history of the waste in tank 241-U-107. Tank 241-U-107 first received metal waste from T Plant in September 1948 and was full by December 1948. The waste cascaded from tank 241-U-107 until the third quarter of 1949 when tank 241-U-109 (the final tank in the series) was filled. The waste from tank 241-U-109 was then sent to U Plant for uranium recovery.

The tank 241-U-107 contents were sluiced and sent to tank 241-U-109 through a direct transfer for uranium recovery in the third quarter of 1953. Metal waste was again transferred from T Plant to tank 241-U-107 in 1954, a portion of which cascaded to tank 241-U-108. In 1955 waste was sluiced and sent directly to tank 241-U-109 for uranium recovery, and the heel was jet sluiced in 1956.

In the years 1957-1959, tank 241-U-107 received REDOX coating waste supernate from tank 241-S-107. There were no further transfers until 1968-1969 when supernate was received from tanks 241-S-107 and 241-SX-105, and waste was sent to tanks 241-U-108, 241-U-109, and 241-TX-101.

No transfer activity for tank 241-U-107 was recorded in 1970 or 1971. Beginning in 1972, activity in the tank resumed. From 1972 to 1976 the tank received N-reactor and T Plant decontamination wastes, laboratory waste from Pacific Northwest Laboratory, 204-4S, and 222-S, and supernate from 241-S-106, 241-S-107, 241-T-103, 241-T-112, and 241-U-110. Waste water was received from various uranium/thorium recovery tanks (tanks 241-TX-002, 241-UR-001, and 241-UR-002), and catch tank 241-TX-302C. Waste cascaded to 241-U-108, and supernate was sent to tanks 241-TX-101, 241-C-104, 241-S-101, 241-S-107, 241-S-110, and 241-U-103. Tank 241-U-107 received evaporator feed from, and sent evaporator feed back to, tank 241-S-102 in 1976 and 1977. Waste was sent to and received from tank 241-SY-102 in 1977.

Tank 241-U-107 received $HNO_3/KMnO_4$ solution, a partial neutralization/evaporation slurry, as a caustic addition via the 242-S evaporator in 1978 and again in 1980. Between these years, tank 241-U-107 also received supernate from tank 241-SY-102 and sent waste to tanks 241-U-102, 241-U-111, 241-SX-101, 241-SX-106, and 241-SY-102. Tank 241-U-107 was removed from service in November 1980.

Tank Comparisons

Question 3: What other tanks have similar waste types and waste behaviors, and how does knowledge of the similar tanks contribute to the understanding of this tank?

According to Agnew et al. (1997a) tank 241-U-107 currently contains 242-S Evaporator salt slurry (SMMS2), 242-T Evaporator saltcake (SMMT2), supernatant from REDOX cladding waste (CWR1), and a small CWR1 sludge heel. It is the first tank in a cascade of three that includes tanks 241-U-108 and 241-U-109. Because of the cascade, the contents of the three tanks were essentially the same until the mid-1950's. However, following the removal of metal waste from the 241-U Tank Farm, the tanks in the cascade operated individually to receive and transfer waste. Tanks 241-U-108 and 241-U-109 now contain 242-S Evaporator saltcake (SMMS1) and metal waste, and are no longer entirely similar to tank 241-U-107. Selected tanks in the S, T, SX, SY, TX, and U tank farms do have similar waste types as tank 241-U-107.

Analytical data from different segments from tanks 241-S-101, 241-S-102, 241-SX-106, 241-SY-103, 241-U-102, 241-U-103 and 241-U-105 were determined to be representative of SMMS2 waste. Analytical results from these tanks provide insight into the composition of the SMMS2 layer in tank 241-U-107. Analytical data from tank 241-U-107 also provides information about the SMMS2 layers in other tanks. This is of particular value for estimating the compositions of tanks such as 241-U-111, which is expected to contain significant quantities of SMMS2 waste, and for which limited core sample data are available.

Analytical data from different segments from tanks 241-U-109, 241-U-110, 241-U-204 and 241-S-107 were determined to be representative of CWR1 sludge. The CWR1 sludge layer was projected to appear in the bottom 15 kgal of waste in tank 241-U-107 and just the top two inches of the waste layer were retrievable during sampling. The data from this layer is not comprehensive enough to represent the waste type. The supernatant layer is thought to be primarily CWR1 waste from tank 241-S-107. The supernatant data from tanks 241-U-204, 241-S-101 and 241-S-107 should correspond to the tank 241-U-107 data.

The SMMT2 layer in tank 241-U-107 is small, comprising only a portion of segment 6. The composition of the other waste in the tank is similar to the composition in the SMMT2 saltcake, further complicating separation of the waste layers. Because of these problems, a specific portion of segment 6 could not be identified as solely SMMT2 waste. However, analytical data from tanks 241-U-102, 241-U-105, and 241-TX-116 may provide insight into the composition of the SMMT2 layer in 241-U-107.

Disposal Implications

Question 4: Given what is known about the waste properties and waste behaviors in this tank, what are the implications of the waste properties and behaviors to the waste retrieval/processing methodologies and equipment selection?

Given what is known about the waste types and behaviors in tank 241-U-107, several items should be considered in regard to waste retrieval. Tank 241-U-107 is on the Watch List for the flammable gas issue (Public Law 101-510), and the waste retains ammonia and other flammable gases. The waste is at ambient temperature, and consists of supernatant, salt slurry, dry to moist saltcake, and a small sludge heel.

Tank 241-U-107 has not yet been interim stabilized. A compatibility assessment will specify measures required to safely transfer drainable liquids to the double shell tank system. Localized high phosphate concentrations in the saltcake region immediately above the sludge layer may result in saturation of saltwell liquors with phosphate, and should be considered when assessing dilution and pumpability requirements. The low waste temperature reduces the likelihood of supersaturation and pluggage in the transfer line.

Supernatant makes up approximately the top 11 inches of waste in 241-U-107. The remaining waste in tank 241-U-107 is mostly a moist to dry saltcake. Rotary mode core methods were required to retrieve samples and poor recoveries were obtained. This indicates that the saltcake may require softening to be retrieved, or retrieval equipment should be designed to remove hard solids.

Sample results showed that the tank waste has low total alpha concentrations, alleviating criticality concerns during retrieval and processing. Organic solvent surface areas are also low compared to threshold limits. The flammable gas concentrations in the tank headspace are low (< 1 percent of the LFL). The vapors of tank 241-U-107 were within health hazard threshold limits for all analytes measured except ammonia and nitrous oxide (Huckaby 1995).

The primary concern for this tank is the retained gas in the liquid and solid waste layers. Standard Hydrogen Monitoring System data showed that the tank has experienced several gas release events in recent years. Flammable gas issues should be carefully considered before saltwell pumping or other waste retrieval methods are implemented. Assessments that could be conducted to better address disposal implications include: evaluating potential impediments to pretreatment and estimating the number of glass logs that tank 241-U-107 waste will make. These assessments are beyond the scope of the current effort.

Scientists Assessment of Data Quality and Quantity

Question 5: Given the current state of understanding of the waste in this tank on the one hand and the information drivers on the other; should additional tank data be sought via sampling/analysis from a strictly technical point-of-view? Can the waste behavior in this tank be adequately understood by other means (eg. archive samples, tank grouping studies, modeling) without additional sampling and analysis? If so, what characteristics of the tank waste lend themselves to a non-sample alternative? Is the quality of the data from this tank adequate from a field sampling and analytical laboratory point-of-view? Are there any clarifications or explanations needed for the data tables and figures?

Sampling and Analysis

All appropriate DQO and waste issues have been addressed for this tank and accepted by the Project Hanford Management Contract River Protection Project. No additional sampling and analyses are necessary to satisfy current safety issue requirements for this tank. Additional sampling may be necessary to better understand the physical characteristics of the waste from a disposal perspective. Issues related to permits, retrieval of the saltcake, and retrieval of the sludge are not completely understood by the current analytical information. Given the schedule for Phase II disposal, this additional analytical/physical information has a moderate priority from a strictly technical point of view. This additional information on the behavior of the waste may be adequately understood by sampling tanks with similar waste types. None of the Disposal DQOs have been applied to this tank.

Data Quality

The data collected in both the core and vapor sampling events were collected and analyzed with approved and recognized sampling and laboratory procedures and in accordance with sampling and analysis plans (Jo 1996 and Wilkins 1998). The laboratory procedures for the core sample analysis can be found in the standard report *"Analytical Methods and Procedures."* Quality Control (QC) parameters assessed in conjunction with tank 241-U-107 samples included standard recoveries, spike recoveries, duplicate analyses, and blanks. Appropriate QC footnotes were applied to data outside QC parameter limits. Analytical results and data quality are discussed in the tank 241-U-107 data packages (Hardy 1998 and Steen 1999).

The vast majority of QC results were within the boundaries specified in the sampling and analysis plans. Small discrepancies noted in the analytical reports and footnoted in the "*Analytical Results*" standard report should not impact the data validity or use.

Data anomalies were observed in the results for hexavalent chromium. The liquid composite values for Core 245 were < 1/100 of any other value obtained from the hexavalent chromium analyses. Because of the suspect nature of these data they were excluded from the calculated means for the tank.

Some of the samples were prepared for analysis using a potassium hydroxide fusion in a nickel crucible. This preparation method compromises the data for nickel and potassium. Therefore, means for these analytes from the fusion preparation were not included in the "*Means and Variances*" standard report.

Hydrostatic head fluid (HHF) was used during the 1996 core sampling event. This fluid was spiked with lithium bromide to aid in determining if the fluid is influencing sample data. A calculation is performed for segments with elevated lithium and bromide results to correct the weight percent water based on the lithium and bromide results. If the HHF intrusion is greater than fifty weight percent the data are considered not representative of the tank waste and are excluded from the "*Means and Variances*" standard report. Segment 6A from core 134 had a lithium concentration of 1,870 ug/g in the solids and 1,600 ug/mL in the drainable liquid, and a bromide concentration of 23,100 ug/g in the solids and 3,500 ug/mL in the drainable liquid. The weight percent water corrections for this sample were much greater than fifty percent, so the data from this segment were not included in the "*Means and Variances*" standard report.

Clarification and Explanation of Data Tables and Figures

"*Description of Tank*" standard report: The total volume of the tank shown in this standard report differs slightly from the Hanlon (1999) volume. The standard report volume is based on surface level measurements. For additional discussion, refer to question 7, "Best-Basis Derivation."

"*Core Profile*" standard report: The sludge layer identified by the "*Core Profile*" standard report in core 134 has analyte concentrations more representative of saltcake.

Unique Aspects of the Tank

Question 6: What are unique chemical, physical, historical, operational or other characteristics of this tank or its contents?

The waste types in this tank are relatively well defined and understood with the same waste types found in a number of other tanks. Based upon visual observations of the extrusion photographs, the waste is mostly a light gray to black salt with varying consistencies. There is a layer of yellow to dark brown/black supernatant above the saltcake. One segment, segment 6 of core 245, differs dramatically in that it is a collection of large white crystals. This segment was found to have very high levels of phosphate, and an elevated concentration of fluoride, calcium, and silicon. It is thought that the crystals formed from N Reactor phosphate waste that was transferred to the tank between 1972-1976.

The photographic montage of the tank 241-U-107 interior shows the waste surface to be liquid, with what appears to be a green-brown salt slurry floating on top of the liquid. The volume of waste in the tank, 1,544 kL (408 kgal), has changed little since the photographs were taken on October 27, 1988; therefore, the photographic montage likely represents the current appearance of the tank waste surface.

Best-Basis Inventory Derivation

Question 7: What is the source data used to derive this tank's Best-Basis inventories by mass (kg) and activity (Ci) for the standard list of 25 chemicals and 46 radionuclides?

The Best-Basis Inventory program is chartered to develop and maintain best-basis inventories of 25 chemical and 46 radionuclide components in the 177 Hanford Site underground storage tanks. These best-basis inventories now serve as waste composition data for the RPP process flowsheet modeling work, safety analyses, risk assessments, and waste retrieval, treatment, and disposal system design.

Development and maintenance of the best-basis inventory is an on-going effort. Since new sample data was recently made available for single-shell tank 241-U-107, a re-evaluation of the best-basis inventories was performed and is documented in the following text. The following information was used in this evaluation:

- Statistical means based on analytical data from the February 1996 push mode and June 1998 rotary mode core samples from tank 241-U-107 (See *"Means and Confidence Intervals"* Standard Report).
- The Hanford Defined Waste (HDW) model document (Agnew et al. 1997a) which provides tank content estimates in terms of component concentrations and inventories.
- Analytical data from S and U Farm tanks containing CWR1 sludge used in the CWR1 best-basis template.

The following table represents how the available data are used to derive Best-Basis Inventories for tank 241-U-107. Three waste phases were identified for the tank: liquid, saltcake, and sludge. Inventories were computed for each phase separately and then summed to obtain the overall inventory.

Table 7-1. Tank 241-U-107 Best-Basis Inventory Source Data

Waste Phase	Waste Type	Applicable Concentration Data	Associated Density	Associated Volume	Associated Hanlon[1] Volume
Drainable Liquid	SMMS2/ CWR1	1996 and 1998 segment liquid sample results.	1.41 g/ml	780 kL (206 kgal)	117 kL (31 kgal) supernatant
		1998 core liquid composite results.	1.41 g/ml[2]		1363 kL (360 kgal) saltcake interstitial liquid and saltcake solids
		HDW Model Rev. 4 S2-SltSlr Supernate[3]	1.83 g/ml		
Saltcake	SMMS2/ SMMT2	1996 and 1998 segment solid sample results.	1.70 g/ml	708 kL (187 kgal)	
		1996 and 1998 solid composite results.	1.69 g/ml		

		HDW Model Rev. 4 S2-SltSlr Sludge[3]	1.95 g/ml		
Sludge	CWR1	CWR1 Best Basis template	1.62 g/ml	57 kL (15 kgal)	57 kL (15 kgal)
		HDW Model Rev. 4 CWR1 Sludge[3]	1.77 g/ml		
Total Tank	Overall Tank Volume			1544 kL (408 kgal)	1537 kL (406 kgal)

[1] Hanlon (1999)

[2] Specific gravity analyses were not performed for liquid composite samples. Liquid composites were assumed to have a specific gravity equal to the mean specific gravity of the segment samples.

[3] The HDW model isotopic distribution was used to perform sample-based uranium and total alpha distribution.

Waste phases in Table 7-1 were based on the core sampling extrusion results, the analytical results, and the process history. Extrusion observations and segment analyte concentrations show a saltcake and drainable liquid. Although not sampled, sludge was added as a phase because it is expected based on past 241-U-107 waste transactions. Both segment solids results and solid composite results are available for the saltcake phase. Because the tank has been inactive since 1980, sample data from 1996 push mode and 1998 rotary mode core samples are both representative of the tank and were combined to generate the mean concentrations. Both 1996 and 1998 combined segment results and 1998 composite results are available for the liquid phase. Data were available from both the 1996 and 1998 sampling events for the saltcake segment and composite results. For all segment data, the means were derived by averaging the individual sample primary and duplicate results to obtain a sample mean. Sample means from the same segment were averaged together to obtain a segment mean, and finally the segment means were averaged to obtain the overall mean for the tank. Sample data are available for all of the 25 best-basis nonradioactive chemical species for the liquid and saltcake waste phases, but few radionuclide data are available. Hanford Defined Waste model SMMS2 supernatant values were used where liquid radionuclide data was unavailable, and HDW model SMMS2 solid values were utilized for the missing solid data. The CWR1 sludge template values were used to represent the CWR1 waste layer in tank 241-U-107 since there was no recovery of that waste type in either sampling event. The CWR1 sludge template is based on data from tanks 241-S-107, 241-U-109, 241-U-110, and 241–U-204.

The liquid phase corresponds with the CWR1 supernatant and SMMS2 liquid waste types cited in Agnew et al. (1997b). The saltcake phase represents the SMMS2 salt slurry and small SMMT2 saltcake layers expected to be in tank 241-U-107. The sludge phase is CWR1 cladding waste that was estimated to have precipitated from the supernatant received from tank 241-S-107 (Agnew et al. 1997a).

The segment density values for the liquid and saltcake portions of the tank were sample-based means. Specific gravity analyses were not performed for the liquid composite samples, so this vector was assumed to have the same density as the segments from the liquid waste phase. The HDW model (Agnew 1997a) total tank density was 1.67 g/mL.

The tank waste volume reported in both the HDW model (Agnew 1997a) and Hanlon (1999) is 1,537 kL (406 kgal)(Table 7-1). This volume is slightly below recent surface level and neutron surveillance level readings, corresponding to a tank volume of 1,544 kL (408 kgal). The best-basis inventory assessment assumes a tank volume of 1,544 kL (408 kgal). The volumes from the saltcake and liquid waste phases in Table 7-1 differ from Hanlon (1999). In Table 7-1 the saltcake phase represents drained solids which is separated from the drainable interstitial liquid whereas Hanlon (1999) combines the two. The Best-Basis Inventory does not include a volume for retained gas in any of the phases since there are no analytical data for retained gas in tank 241-U-107. A nine percent retained gas volume is expected based on 241-U-107 gas release events and comparison to other waste tanks (Barker et al. 1999).

Sample data were preferred for all waste phases, where available. Segment data were preferred over core composite data. However, when comparing means values below detection limits the lowest nondetect value was always selected, whether segment or composite data. When comparing acid digest and fusion results the higher value was chosen. When neither sample or template data were available for a given analyte, then HDW model results (Agnew 1997a) were used. The concentration for mercury was not measured, and the global inventory reconciliation contained in (Simpson 1998) was used for that inventory value.

All inventory calculations were performed using the Best-Basis Inventory Maintenance (BBIM) Tool. The updated best-basis inventory values for tank 241-U-107 can be found in the "*Best-Basis Inventory (Non-Radionuclides)*" and "*Best Basis Inventory (Radionuclides)*" Standard Reports. Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. This charge balance approach is consistent with that used by Agnew et al. (1997a).

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