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7. Abstract

This document is a plan identifies the information needed to address relevant issues concerning short-term and long-term safe storage and long-term management of Single-Shell Tank (SST) 241-U-109.

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Tank 241-U-109
Tank Characterization Plan

C. S. Homi
Westinghouse Hanford Company

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LIST OF ABBREVIATIONS

DQO	Data Quality Objective
NCPLX	Non-complexed
SUMMA®	Trademark of Molectrics, Inc.
SST	Single-Shell Tank
TCP	Tank Characterization Plan
TOC	Total Organic Carbon
U-109	Tank 241-U-109
USQ	Unreviewed Safety Question
WHC	Westinghouse Hanford Company

1.0 INTRODUCTION

This Tank Characterization Plan (TCP) identifies the information needed to address relevant issues concerning short-term safe storage and long-term management of Single-Shell Tank (SST) 241-U-109 (U-109). It should be understood that the various needs and issues surrounding tank U-109 are evolving as new information about the tank is uncovered. As a result of this progression, this Tank Characterization Plan addresses only the issues that, to this date, have been identified. It is expected that deviations from this plan may occur as additional issues or needs arise which impact the management of SST U-109. As necessary, this Tank Characterization Plan will be revised to reflect those changes or deviations.

Tank U-109 was constructed between 1943 and 1944 and was put into service in January 1949. Initially tank U-109 received metal waste from the first quarter of 1949 until the fourth quarter of 1956. The tank was heel-jet sluiced during the second quarter of 1956. Also, the tank received wastewater from the third quarter of 1956 until the first quarter of 1974. From the first quarter of 1957 until the third quarter of 1975, the tank also received and/or contained coating waste. From the first quarter of 1969 until the second quarter of 1976, the tank received and/or evaporator bottoms waste. The tank received REDOX waste from the fourth quarter of 1974 until the third quarter of 1975. In the fourth quarter of 1975, the tank began to receive 242-S bottoms and recycle and residual liquor. From the second quarter of 1978 until the third quarter of 1980, the tank contained partial neutralized feed waste. In the fourth quarter of 1980, the contents of the tank was classified as non-complexed. This tank currently contains waste with a total waste volume of 1,753 kL (463 kgal), which is equivalent to 446.58 centimeters (175.82 inches) of waste as measured from the baseline of the tank. The waste is comprised of 814 kL (215 kgal) of saltcake; 685 kL (181 kgal) of saltslurry; 72 kL (19 kgal) of supernatant and 182 kL (48 kgal) of sludge with 606 kL (160 kgal) of pumpable liquid remaining (Brevick 1994a).

The tank is sound and is partially ventilated. It was removed from service and labeled inactive in 1980, and was partially isolated in December 1982. The tank is awaiting interim stabilization and the last photo was taken on September 21, 1984 (Brevick 1994b). The last solids update was obtained on November 13, 1977 (Hanlon 1995).

A sample of tank U-109 waste was received in the laboratory on November 12, 1975. This sample was subsequently analyzed and found to be made up of small white crystals intermixed with a coarse gray material that resembled sand. The sample contained sludge and supernatant and both constituents were made up of sodium salts along with other compounds in lesser amounts.

This tank is on the Flammable Gas Watch list. The tank has an Unreviewed Safety Question (USQ) because the potential consequences of a radiological release resulting from a flammable gas burn. Near-term sampling and analysis activities are focused on verification of the watchlist tank status, identification of any new safety issues, changing the Watch List status, or resolving the USQ. Should any safety issues be identified further analyses will be directed consistent with the identified issue.

In addition to the resolution of the safety issues, it is intended that all tank waste will be subject to pretreatment and retrieval to prepare for final storage or disposal.

2.0 PROGRAM ELEMENTS REQUIRING INFORMATION FOR TANK 241-U-109

This section identifies the various program elements, and identifies which of these programs require characterization data from tank U-109.

2.1 GENERAL SAFETY ISSUES

The *Tank Safety Screening Data Quality Objective* (Babad et al. 1995a) describes the sampling and analytical requirements that are used to screen waste tanks for unidentified safety issues. The primary analytical requirements for the safety screening of a tank are energetics, total alpha activity, moisture content, and flammable gas concentration.

2.2 SPECIFIC SAFETY ISSUES

2.2.1 Ferrocyanide

This tank is not on the Ferrocyanide Watch List and; therefore, no information needs are currently identified for this program element.

2.2.2 Organic

This tank is not on the Organics Watch List, but recent work by the Organic Safety Program revealed a question regarding organic complexant salts. A potential problem with regard to the complexed salts exists if all the drainable liquid is pumped from the tank (Webb et al 1995). Sampling and analysis requirements must be performed as per *Data Quality Objective to Support Resolution of the Organic Fuel Rich Tank Safety Issue* (Babad et al 1994b). The analyses employed will determine the TOC, presence of a free organic liquid phase, moisture content and tank temperature.

2.2.3 High Heat

This tank is not on the High Heat Watch List and; therefore, no information needs are currently identified for this program element.

2.2.4 Flammable Gas

Tank U-109 is on the Flammable Gas Watch List. Data from core samples are needed to provide an understanding of the mechanisms for gas generation, conditions which cause gas retention, the source terms for dose consequence calculations, and to support tank behavior models. Clarification of tank behavior using models is needed to 1) develop appropriate mitigation methods and 2) make rational safety analysis decisions on future operations to prevent the creation of additional flammable gas tanks. In order to achieve these objectives, many chemical and radionuclide composition and physical property analyses are needed along with supporting operational data. The most reliable information can be obtained from complete core samples. The applicable DQO is: *Flammable Gas Safety Program: Data Requirements for Core Sample Analysis Developed through the Data Quality Objectives (DQO) Process* (McDuffie et al. 1995).

2.2.5 Vapor

The tanks currently scheduled to be vapor sampled may be classified into four categories: (1) those tanks which are to be rotary mode core sampled (a prerequisite to rotary sampling); (2) tanks on the Organic or Ferrocyanide Watch Lists; (3) tanks

in C farm; and (4) tank BX-104, due to vapor exposure. Since tank U-109 is categorized in one of the above four groups, information needs must satisfy *Data Quality Objectives for Generic In-Tank Health and Safety Vapor Issue Resolution* (Osborne et al. 1995) and *Rotary Sampling Core Vapor Sampling Data Quality Objective* (Price 1994). Characterization of the tank headspace is needed to: 1) identify those tanks which can be sampled safely with intrusive equipment without risk of gas ignition; 2) identify and estimate concentrations of toxicologically significant compounds present in the tank headspace to establish worker safety precautions; and 3) support the startup and operation of the portable exhauster used during rotary-mode core sampling.

2.2.6 Criticality

No information separate from that for the general safety issue of tank U-109 are currently identified for this program element. However, if the general safety screening of tank U-109 identifies a potential criticality concern, analyses for fissile materials and neutron absorbers and poisons will be performed as identified in the safety screening data quality objective.

2.2.7 Screening Approach Evaluation

The safety screening approach is currently under review. Information is required from key tanks to determine if a revised approach to screening may be adopted, as proposed in Meacham, 1995. Sampling of this tank is required to support the organic safety issue. Organic solubility and distribution theories will be evaluated from both "Grab" and "Core" samples. Data from the completed vapor sampling will help confirm the relationship of tank headspace vapor sampling to basic information on organic solvents.

2.3 CONTINUING OPERATIONS

2.3.1 Compatibility/Stabilization

Tank U-109 waste will be sampled to determine compatibility. Sampling and analysis requirements must be performed as per *Data Quality Objectives for the Waste Compatibility Program* (Fowler 1995). The analyses employed will be used to quantify transuranics (TRUs) such as ^{239}Pu and ^{241}Am, ^{90}Sr and ^{137}Cs) and measuring the Total Organic Content (TOC), heat generation (by determining the amount of "pumpability" of the waste (i.e. density, viscosity, percent of volume composed of solids...etc).

2.3.2 Evaporator

No information needs are currently identified for this program element.

2.4 DOUBLE-SHELL TANK WASTE ANALYSIS PLAN

This section does not apply because Tank U-109 is a single shell tank.

2.5 DISPOSAL

2.5.1 Retrieval

Current retrieval needs (Bloom 1995) do not call for test samples to be taken from tank U-109.

2.5.2 Pretreatment/Vitrification

Tank U-109 is identified as a bounding tank for pretreatment/disposal process development (Kupfer el al. 1995).

2.6 HISTORICAL MODEL EVALUATION

Bounding tanks and data requirements for historical model evaluations are found in DQO *Historical Model Evaluation Data Requirements* (Simpson et al. 1995). Tank U-109 has been identified as a primary bounding tank for salt slurry and salt cake waste types. Spatial and salt cake variability will be assessed via the core samples.

3.0 HOW INFORMATION WILL BE OBTAINED

The safety screening DQO requires that a vertical profile of the tank waste be obtained from at least two widely spaced risers. This vertical profile may be obtained using core, auger (for shallow tanks), or grab samples. Several sampling events of tank U-109 are scheduled: two vapor sampling events, a grab sampling and a rotary sampling event. No other sampling is scheduled through fiscal year 1998 (Stanton 1995). The rotary mode sampling type has been chosen over other sampling modes due to both the depth of the tank (making auger sampling inadequate) and the fact that the surface of tank U-109 is comprised of saltcake (which is not conducive to good push mode core sampling recovery). Prior to rotary sampling it is necessary to vapor sample the tank as per requirements of (Price 1994).

The best current estimate of the water content in tank U-109 solids as determined from process records is 16.8%, based the Historical Tank Contents Estimate (Brevick 1994a). Estimates (Toth et al 1995) of water content in tank U-109 saltcake and sludge are 30% and 45% respectively. The variance of water in tanks already sampled has been used to generate a statistical power curve. This curve is used to determine that three cores are needed to demonstrate a water content above 17% at 95% confidence for the sludge if the sludge moisture content is measured near 30%. Should the measured mean be lower than anticipated or measured variance higher, additional samples may be required. The saltcake TOC is estimated (Toth et al 1995) to be 0.7% (wet basis) which is significantly lower than the level of concern.

The best current information indicates that 5 risers are available for sampling of tank U-109, 12" riser R2, 12" riser R7, 4" riser R8, 4" riser R10, and 4" riser R19. Since 5 risers are available, initial core samples will be taken from 3 risers and assessed to determine if more samples are required. Auger samples will be taken as well to provide additional information about waste surface variability. Alternate sampling methods, installation of a riser, or removal of equipment from other risers are possible future options.

4.0 PRIORITY OF INFORMATION REQUIREMENTS

Characterization of flammable and toxic vapors is a high priority for this tank. Vapor sampling is expected to be performed in fiscal year 1995 and fiscal 1996 (Stanton 1995). Rotary mode sampling is scheduled for FY 1996 (Stanton 1995). Grab sampling is completed (Stanton 1995).

Table 4-1: Integrated DQO Requirements

Sampling Event	Applicable DQO	Sampling Requirements	Analytical Requirements
Vapor Sampling	-Health & Safety Vapor Issue Resolution DQO -Rotary Sampling Core Vapor Sampling DQO	3 SUMMA® canisters 12 Triple Sorbent Traps 6 Sorbent Trap Systems	Gas Flammability Gas Toxicity -Organic Vapors -Permanent Gases
Rotary Core Sampling	-Safety Screening DQO -Flammable Gas DQO -Organic Fuel-Rich DQO -Historical Model DQO	Core samples from 3 risers separated radially to the maximum extent possible	Energetics, Moisture, Total Alpha, Organic composition
Auger	-Safety Screening DQO -Organics	Auger samples from 2 or 3 risers	Energetics, Moisture, Total Alpha
Grab Sampling	-Compatibility DQO	3 grab samples Completed 6/9/95	Energetics, Moisture, Major Anions, Cations & Radionuclides,SpG & pH, Separable Organics

5.0 WHEN INFORMATION IS NEEDED

Data are required for Tank U-109 during FY 1996 for safety screening and to prepare a Tank Characterization report.

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