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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-108.

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Tank Characterization Plan

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LIST OF ABBREVIATIONS

DQO	Data Quality Objective
HTCE	Historical Tank Content Estimate
NCPLX	Non-complexed
SUMMA®	Trademark of Molectrics, Inc.
SST	Single-Shell Tank
TCP	Tank Characterization Plan
TOC	Total Organic Carbon
U-108	Tank 241-U-108
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 and long-term safe storage and long-term management of Single-Shell Tank (SST) 241-U-108 (U-108). It should be understood that the various needs and issues surrounding tank U-108 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-108. As necessary, this Tank Characterization Plan will be revised to reflect those changes or deviations.

Tank U-108 was constructed between 1943 and 1944 and was put into service in January 1949. Initially tank U-108 received metal waste from the first quarter of 1949 until the fourth quarter of 1956. The tank was sluiced during the second quarter and third quarters and declared empty in the fourth quarter of 1956. The tank received coating waste from the first quarter of 1957 until the fourth quarter of 1968. Also, tank received REDOX cladding waste from the second quarter of 1964 until the third quarter of 1968. During the first quarter of 1969 the tank began to receive evaporator bottoms. From the third quarter of 1972 until the second quarter of 1976, the tank underwent numerous transfers of many waste types. Also, during the first quarter of 1974 the tank received wastewater. From the third quarter of 1976 until the first quarter of 1978, the tank contained evaporator feed, residual evaporator liquor and Hanford defense residual liquor. From the second quarter of 1978 until the third quarter of 1980, the tank received 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 1,771 kL (468 kgal), which is equivalent to 420.7 centimeters (165.6 inches) of waste as measured from the baseline of the tank. The waste is comprised of 874 kL (231 kgal) of saltcake; 697 kL (184 kgal) of saltslurry; 90,854 liters (24 kgal) of supernatant and 110 kL (29 kgal) of sludge with 659 kL (174 kgal) of pumpable liquid remaining (Brevick 1994).

The tank is sound, was removed from service and designated inactive in 1979. Tank U-108 is passively ventilated and was partially isolated in December 1982. The tank is awaiting interim stabilization and the last photo was taken on September 21, 1984 (Brevick 1994). The last solids volume update occurred on December 30, 1983 (Hanlon 1995).

Waste samples were obtained from tank U-108 in September 1971, January 1974 and September 1975. The January 1974 was a clear yellow liquid that yielded no solids even after cooling to 5 °C. The September 1975 sample consisted of sludge and contained sodium phosphate, aluminum oxide, sodium carbonate, sodium nitrate and sodium nitrite.

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-108

This section identifies the various program elements, and identifies which of these programs require characterization data from tank U-108.

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 and a potential problem 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-108 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 (as a consequence of the rotary sampling system); (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-108 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-108 are currently identified for this program element. However, if the general safety screening of tank U-108 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 confirm original ferrocyanide fuel distribution and waste aging and to support the ferrocyanide and organic safety issues. Organic solubility and distribution theories will be evaluated from both "Grab" and "Core" samples. Data from previous grab sample events combined with analyses of drainable liquid in the core sample will be used to address this need. No further grab samples are currently required.

2.3 CONTINUING OPERATIONS

2.3.1 Compatibility/Stabilization

Tank U-108 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, Total Organic Content (TOC), heat generation (by determining the amount of ^{90}Sr and ^{137}Cs) and measuring the "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-108 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-108.

2.5.2 Pretreatment/Vitrification

Tank U-108 is not 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-108 has NOT been identified as a primary bounding tank.

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-108 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-108 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 *Rotary Core Vapor Sampling Data Quality Objective* (Price 1994).

The best current estimate of the water content in tank U-108 solids, as determined from the process records, is 43%; based on the HTCE (Brevick 1994). Estimates (Toth et al 1995) of water content in tank U-108 saltcake and sludge are 21.6% and 45.6% respectively (generated from a model based on sample data from similar tanks). If the variance of water in tanks already sampled and a statistical power curve is used then a minimum of two cores are needed to demonstrate a water content above 17% at 95% confidence. Should the measured mean be lower than anticipated or the measured variance higher, additional samples may be required. The TOC contained within the saltcake is estimated (Toth et al 1995) to be 0.7% (wet basis), which is significantly lower than the level of concern. A minimum of two core samples will be requested for this tank and this should meet the requirements for the above parameters. Because this tank has been identified as a priority tank to evaluate organic safety issues, three core samples are requested. In addition, an auger sample will be obtained from riser R2 to gain additional information regarding waste surface variabilities.

The best current information indicates that 3 risers are available for sampling of tank U-108, 12" (30.5 cm) riser R2 and 4" (10.2 cm) risers R8 and R9. It is recommended that these risers be chosen because they are risers that are separated radially to the maximum extent possible and therefore, will provide a larger amount of data about the vertical and horizontal waste layers within the tank. Initial information will be taken from these 3 risers and assessed to determine if more samples are required. Two additional risers are available but, equipment will have to be removed from each individual riser to utilize these risers for sampling. Alternate

sampling methods, installation of a riser or removal of equipment from risers presently considered unavailable, 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 1997 (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	Core samples from a minimum of 2* risers separated radially to the maximum extent possible *see section 3	Energetics, Moisture, Total Alpha, Gas Composition
Auger	-Safety Screening DQO -Organics	Auger sample from 1 riser	Energetics, Moisture, Total Alpha
Grab Sampling	-Compatibility DQO	3 grab samples Complete 5/31/95	Energetics, Moisture, Major Anions, Cations & Radionuclides,SpG & pH, Separable Organics

5.0 WHEN INFORMATION IS NEEDED

Data are required for Tank U-108 during FY 1996 for safety screening and to prepare a Tank Characterization Report.

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