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Revision 0

Tank 241-B-203 Tank Characterization Plan

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

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LIST OF ABBREVIATIONS

1C	first cycle waste
2C	second cycle waste
B-203	Tank 241-B-203
B1SLTCK	242-B evaporator saltcake
BL	B-Plant low level
BNW	Batelle Northwest waste
CW	cladding waste
CWP	cladding waste-Purex
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DQO	data quality objective
DST	double-shell tank
EB	evaporator bottoms waste
FIC	Food Instrument Corporation
HEPA	high efficiency particulate air filter
HLO	Hanford Laboratory Operations
IX	ion exchange waste
NCPLX	non-complexed waste
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
SAP	Sampling and Analysis Plan
SST	single-shell tank
TBP	tributyl phosphate
TCP	Tank Characterization Plan
TOC	total organic carbon
TWRS	Tank Waste Remediation System
WHC	Westinghouse Hanford Company
WTR	water

1.0 INTRODUCTION

The Defense Nuclear Facilities Safety Board (DNFSB) has advised the U. S. Department of Energy (DOE) to concentrate the near-term sampling and analysis activities on identification and resolution of safety issues (Conway 1993). The data quality objective (DQO) process was chosen as a tool to be used to identify the sampling and analytical needs for the resolution of safety issues. As a result, a revision in the Federal Facility Agreement and Consent Order (Tri-Party Agreement) milestone M-44 has been made, which states that "A Tank Characterization Plan (TCP) will be developed for each double-shell tank (DST) and single-shell tank (SST) using the DQO process . . . Development of TCPs by the DQO process is intended to allow users (e.g., Hanford Facility user groups, regulators) to ensure their needs will be met and that resources are devoted to gaining only necessary information" (Ecology et al. 1994). This document satisfies that requirement for tank 241-B-203 (B-203) sampling activity.

2.0 DATA QUALITY OBJECTIVES APPLICABLE TO TANK 241-B-203

The sampling and analytical needs associated with the Hanford Site underground storage tanks on one or more of the four Watch Lists (ferrocyanide, organic, flammable gas, and high heat) and the safety screening of all 177 tanks have been identified through the DQO process. A DQO identifies the information needed by a program group concerned with safety issues, regulatory requirements, tank waste processing, or the transport of tank waste. As of January 31, 1995, tank B-203 was classified as a non-Watch List tank. The DQOs that have been completed and that apply to tank B-203 are discussed in the following section(s).

2.1 SAFETY SCREENING DATA QUALITY OBJECTIVES

The *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994) describes the sampling and analytical requirements that are used to screen waste tanks for unidentified safety issues. Both Watch List and non-Watch List tanks will be sampled and evaluated to classify waste tanks into one of three categories (SAFE, CONDITIONALLY SAFE, or UNSAFE). The safety screening DQO identifies the guidelines to determine to which classification a tank belongs based on analyses that indicate if certain measurements are within established parameters. If a specified parameter is exceeded, further analysis of a second set of properties and a possible Watch List classification would be warranted. A tank can be removed from a Watch List if it is classified as SAFE.

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, or grab samples. The primary analytical requirements for the safety screening of a tank are energetics, total alpha activity, moisture content, and flammable gas concentration. These analyses shall be applied to all core samples, DST Resource Conservation and Recovery Act (RCRA) samples, and all auger samples, except those taken exclusively to assess the flammable gas crust burn issue.

3.0 TANK B-203 HISTORICAL INFORMATION

This section summarizes the available historical information on tank B-203. Included are the age of the tank, process history, and a discussion of any historical sampling events for the tank. The fill history information is available in *A History of the 200 Area Tank Farms* (Anderson 1990), and *Historical Tank Content Estimate for the Northeast Quadrant of the Hanford 200 East Area* (Brevick et al. 1994).

3.1 TANK CONFIGURATION

Tank B-203 was constructed between 1943 and 1944, and is located in the 200-East Area. The tank is a 200 series, 55,000 gallon, 20 foot diameter single-shell tank. Built as a first generation tank, it was designed for nonboiling waste with a maximum fluid temperature of 220° F. Tank B-203 is not in a cascade flow series, but was connected to tanks 241-B-202 and 241-B-204 with tie lines. The tie lines are at the same elevation which allow the tanks to equalize tank volumes. Tank B-203 has 9 risers. Three 12-inch risers (numbers 2, 3, and 6) and one 4-inch riser (number 5) are available for use. Tank B-203 does not have a liquid observation well or drywells (Brevick et al. 1994).

Tank B-203 surface level is monitored with a manual tape through riser 8. Liquid waste volume and solid waste volume are determined by a photographic evaluation and manual tape surface level gauge. The maximum allowable deviation from the baseline is ± 5 cm (± 2 inches).

3.2 AGE AND PROCESS HISTORY

Tank B-203 began filling with 224-U waste in 1952. The tank was receiving waste from tank 241-B-204 and transferring waste to tank 241-B-202 through the tie lines between the tanks. In the third quarter of 1976, tank use was restricted with no intention for reuse. In 1977, the tank was inactive and a level adjustment was made. In 1983, tank B-203 was declared an assumed leaker. A level adjustment was made in January 1984 and the tank was interim stabilized in June 1984. In June 1985, intrusion prevention was completed. An additional level adjustment was made in April 1990. Presently, the tank contains non-complexed waste. (Brevick et al. 1994).

Figure 1 shows the supernatant and solids waste levels of tank B-203 from 1952 to the present (Anderson 1990, Agnew 1994a). Solids and supernatant levels were taken on a quarterly basis as part of the overall surveillance effort in the tank farms. Zero on the vertical scale is at the knuckle bottom of the tank and the dish bottom is 0.15 m (0.5 ft) below the knuckle bottom. The solids level in the tank is indicated by the shaded area and the supernatant level is indicated by the thick line above the shaded area.

Figure 1: F111 History for Tank 241-B-203

3.3 HISTORICAL SAMPLING EVENTS

Three waste analyses for tank B-203 were conducted between December 1978 and January 1983. The 1978 sample was black with the consistency of soft grease. The complete analysis results for this sample can be found in "Characterization of 200 Series Tanks" (Horton 1978). The December 1982 sample contained approximately 10% brown settled solids when received. The solids were 25% by weight water soluble. After acid dissolution, analysis by X-ray emission indicated that the major solids components were bismuth, barium, lanthanum, and iron. Manganese was a minor component. Diffraction analysis indicated that the solids were non-crystalline in structure. The water soluble fraction was believed to be nitrates, and the acid-fraction was believed to be the oxide forms of metallic salts. The complete analysis results for this sample can be found in "Solids in Tank 203B" (Jansky 1982), and "Additional Data for Solids in Tank 203B" (Jansky 1983).

4.0 CURRENT TANK STATUS

4.1 1995 TANK STATUS

Tank B-203 is categorized as an assumed leaker and is interim stabilized with intrusion prevention completed. Tank B-203 entered service in 1952 and as of January 31, 1995, stored 193 kL (51 kgal) of waste, which corresponded to a waste height of 668 cm (263 inches). The waste was comprised of 3.8 kL (1 kgal) of supernatant, and 190 kL (50 kgal) of sludge with no saltcake or pumpable liquid (Brevick et al. 1994). This coincides with the current Hanlon document which states the same content volumes (Hanlon 1994).

The single thermocouple tree in tank B-203 has 12 thermocouple probes to record temperature data. The current temperature reading taken on January 24, 1995 from thermocouple 1 is 59° F. The average temperature for the tank is between 59° and 60° F.

4.2 EXPECTED TANK CONTENTS

Tank B-203 is expected to have one primary layer composed of 224 sludge waste. The 1986 photographic montage of tank B-203 shows a thin supernate surface with dark brown sludge underneath. Because of the high waste level and the flat dome, the photos were taken horizontally across the tank. A level adjustment was done in 1990 as a result of the photographs; therefore, the picture may not correspond with the current tank interior. An estimated inventory based on the Tank Layer Model (Agnew 1994b) is shown in Table 1. This estimate is based on the 127 kL (50 kgal) of solids in the tank.

Table 1: Tank 241-B-203 Solids Composite Inventory Estimate

Physical Properties			
Total Solid Waste	Mass = 2.13E+05 kg; Volume = 127 kL (50 kgal)		
Heat Load	0 kW (0 BTU/hr)		
Bulk Density	1.12 (g/cm ³)		
Void Fraction	0.98		
Water wt%	80.14		
TOC wt% C (wet)	0.46		
Chemical Constituents	moles/L	μg/g	kg
Na ⁺	1.91	3.90E+04	8.29E+03
Cr	2.31E-02	1.07E+03	2.27E+02
Bi	0.16	2.96E+04	6.29E+03
Mn ⁺⁴	0.12	5.77E+03	1.23E+03
K ⁺¹	0.26	9.01E+03	1.92E+03
OH	0.56	8.42E+03	1.79E+03
NO ₃ ⁻	1.29	7.13E+04	1.52E+04
PO ₄ ³⁻	0.20	1.70E+04	3.61E+03
F ⁻¹	0.30	5.13E+03	1.09E+03
oxalate ⁻²	0.21	1.68E+04	3.57E+03
Radiological Constituents		μCi/g	kg
Pu		0.96	3.41

5.0 STRATEGY FOR DATA QUALITY OBJECTIVE RESOLUTION

After a careful review of the historical information for tank B-203, it has been determined that it is necessary to sample the tank for general characterization needs following the relevant DQOs. The last sample analyses for tank B-203 was in 1983. Since then, the waste has been interim stabilized and a level adjustment has been made. Tank B-203 contains a substantial amount of solids which have not been characterized since the tank was interim stabilized.

Only one sampling event for tank B-203 is currently scheduled: a push core sample (Stanton 1995). The push mode core sampling system was chosen based on surface photographs taken of the waste. Although rotary mode core sampling could be performed, it would be substantially more expensive. In addition, auger sampling may not be appropriate due to the waste depth (see Section 4.1). Auger sampling would not allow a full vertical profile to be obtained, which would not satisfy the safety screening DQO requirements. The push mode core sampling shall be conducted in accordance with *Tank Safety Screening Data Quality Objective* (Babad and Redus 1994). Sampling and analytical requirements from this DQO are summarized in Table 2. Complete lists of sampling and analytical requirements are given, as an appended attachment, in the appropriate Sampling and Analysis Plan (SAP).

Table 2: Integrated DQO Requirements

Sampling Event	Applicable DQO's	Sampling Requirements	Analytical Requirements
Push Core Sampling	► Safety Screening DQO	Core samples from at least 2 risers separated radially to the maximum extent possible	Energetics, Moisture, Total Alpha

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