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Tank 241-B-106
Tank Characterization Plan

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

by

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LIST OF ABBREVIATIONS

1C	first cycle waste
2C	second cycle waste
B-106	Tank 241-B-106
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
HLO	Hanford Laboratory Operations
IX	ion exchange waste
NCPLX	non-complexed waste
RCRA	Resource Conservation and Recovery Act
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 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-106 (B-106) sampling activity.

2.0 DATA QUALITY OBJECTIVES APPLICABLE TO TANK 241-B-106

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-106 was classified as a non-Watch List tank. The DQOs that have been completed and that apply to tank B-106 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 (flammable gas concentration is determined by vapor space monitoring, which in not addressed in this TCP). 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-106 HISTORICAL INFORMATION

This section summarizes the available historical information on tank B-106. 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-106 was constructed between 1943 and 1944, and is located in the 200-East Area. The tank is a 100 series, 530,000 gallon, 75 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-106 is the third in a cascade flow series consisting of tanks 241-B-104, 241-B-105, and B-106. A cascade flow system consists of tanks connected in a series by pipes. When the primary tank in the system became full, the waste would then flow to the secondary tanks in the system. Tank B-106 has 10 risers, and three 12 inch risers (numbers 2, 3, and 7) are available for use.

Tank B-106 surface level is monitored with a Food Instrument Corporation (FIC) gauge through riser 1. If the FIC gauge failed, manual field measurements will be conducted daily. The maximum allowable increase from the baseline is 2 inches, and the maximum allowable decrease is 3 inches. The surface level for the past 3 years has remained steady.

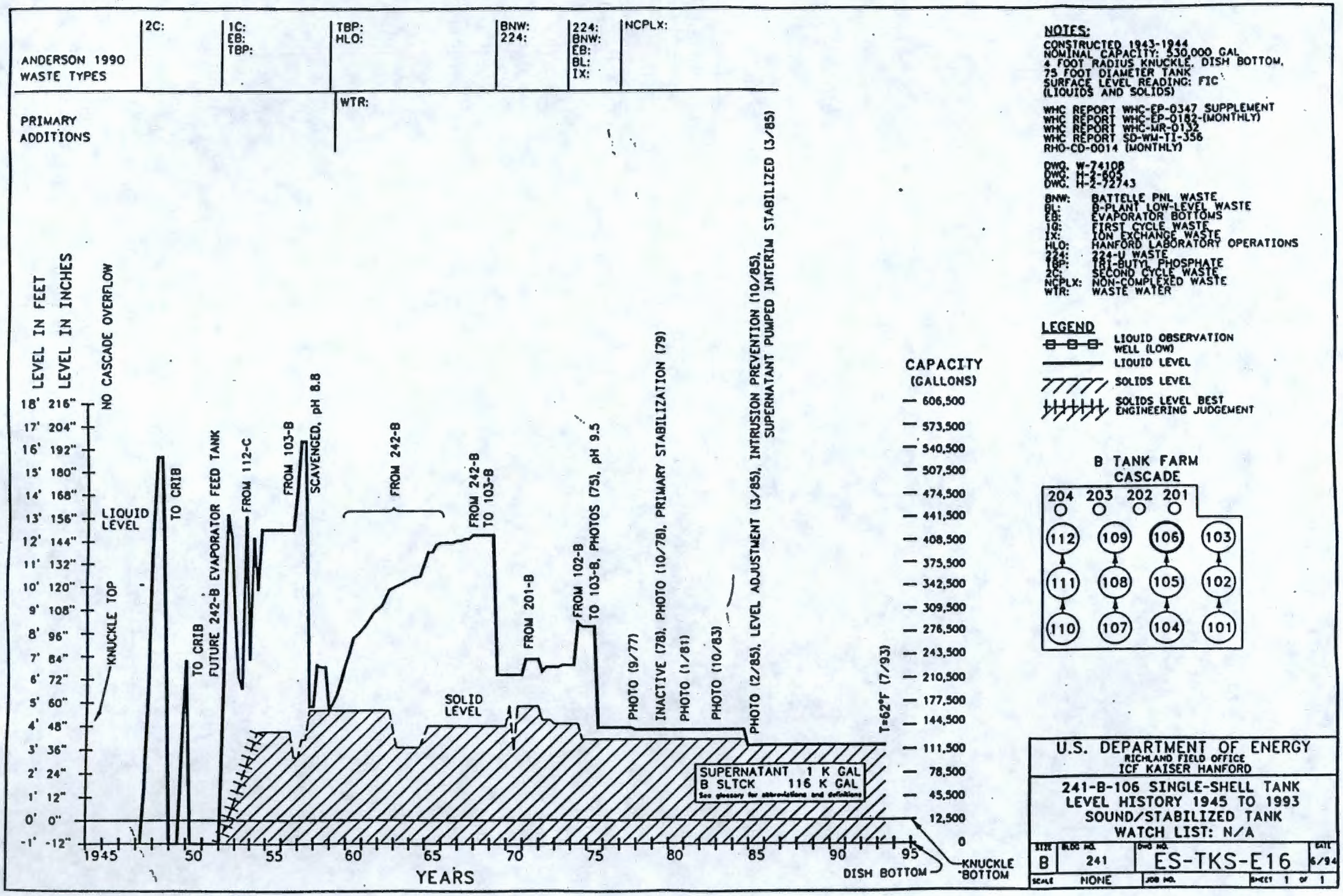
Tank B-106 does not have a liquid observation well. Four drywells are identified for the tank. Drywell 22-06-06 had activity prior to 1990 with readings greater than 200 c/s (counts/second).

3.2 AGE AND PROCESS HISTORY

Activity began in tank B-106 when it was filled with second cycle waste between August 1947 to May 1948. In 1978, the tank was declared inactive and in the fourth quarter of 1978, the P-10 pump was removed. A level adjustment was made in December 1978, and in 1979 the tank was determined to be primary stabilized. In March 1985, interim stabilization was completed by pumping supernatant from the tank, and a level adjustment was also made. In October 1985, intrusion prevention was completed. Presently, the tank contains non-complexed waste (Brevick et al. 1994).

Figure 1 shows the supernatant and solids waste levels of tank B-106 from 1945 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 0.3 m (1 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: Fill History for Tank 241-B-106



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3.3 HISTORICAL SAMPLING EVENTS

Tank farm samples were received from tank B-106 on October 6, 1975. The results from this analysis can be found in *Analysis of Tank Farm Samples* (Wheeler 1975).

4.0 CURRENT TANK STATUS

4.1 1995 TANK STATUS

Tank B-106 is identified as a non-Watch List tank, that is categorized as sound and is interim stabilized with intrusion prevention completed. It entered service in September 1947 and currently stores 443 kL (117 kgal) of non-complexed waste, which corresponds to a waste depth of approximately 97 cm (38 inches). The waste is comprised of 439 kL (116 kgal) of saltcake, and 3.8 kL (1 kgal) of supernatant with no pumpable liquid remaining (Brevick et al. 1994). However, this contradicts with the current Hanlon document which states that there are 0 kL (0 kgal) of saltcake, 439 kL (116 kgal) of sludge, with no pumpable liquid remaining (Hanlon 1995).

The single thermocouple tree in tank B-106 has 13 thermocouple probes to record temperature data in riser 4. The mean temperature of the first recorded readings was 64° F. From September 1974 to the present, the median temperature is 66° F with a minimum of 43° F and a maximum of 107° F (Brevick et al. 1994).

4.2 EXPECTED TANK CONTENTS

Tank B-106 is expected to have one primary layer. It is listed as a saltcake layer in the Brevick document (Brevick et al. 1994). However, it is determined to be a sludge layer in the Hanlon document (Hanlon 1994). The 1985 photographic montage of tank B-106 shows a thin liquid surface over a reddish brown sludge. However, the photographs were taken before the supernatant was pumped; therefore, the picture may not represent the current waste surface. An estimated inventory based on the Tank Layering Model (Agnew 1994b) is shown in Table 1. This estimate is only based on the 438 kL (116 kgal) of solids in the tank (Brevick et al.1994).

Table 1: Tank B-106 Solids Composite Inventory Estimate

Physical Properties			
Total Solid Waste	Mass = 6.51E+05 kg; Volume = 438 kL (116 kgal)		
Heat Load	1.61E-02 kW (5.50E+01 BTU/hr)		
Bulk Density	1.48 (g/cm^3)		
Void Fraction	0.59		
Water wt%	32.33		
TOC wt% C (wet)	0.00		
Chemical Constituents	**moles/L**	**µg/g**	**kg**
Na^+	9.42	1.46E+05	9.50E+04
Al^{+3}	6.16E-02	1.12E+03	7.29E+02
OH^-	0.23	2.64E+03	1.72E+03
NO_3^-	3.20	1.34E+05	8.72E+04
NO_2^{-1}	5.11E-02	1.58E+03	1.03E+03
CO_3^{2-}	0.61	2.46E+04	1.60E+04
PO_4^{3-}	1.10	7.02E+04	4.57E+04
SO_4^{2-}	0.85	5.52E+04	3.59E+04
F^{-1}	6.69E-02	8.57E+02	5.58E+02
Cl^{-1}	1.22E-02	2.91E+02	1.89E+02
Radiological Constituents	**Ci/L**	**µCi/g**	**Ci**
U	2.92E-02 (M)	4.68E+03 (µg/g)	3.05E+03 (kg)
Cs	7.83E-03	5.28	3.44E+03

5.0 STRATEGY FOR DATA QUALITY OBJECTIVE RESOLUTION

After a careful review of the historical information for tank B-106, 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-106 were in 1975. Since then, the waste has been interim stabilized and a level adjustment has been made. Tank B-106 contains a substantial amount of solids which have not been characterized since the tank was interim stabilized.

Only one sampling event for tank B-106 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 in the applicable Sampling and Analysis Plan (SAP) (*Tank 241-B-106 Push Mode Core Sampling and Analysis Plan*, Conner 1995).

Table 2: Integrated DQO Requirements

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

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