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Waste Characterization Data Manual for the Inactive Liquid Low-Level Waste Tank Systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee

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Energy Systems Environmental Restoration Program

Waste Characterization Data Manual for the Inactive Liquid Low-Level Waste Tank Systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee

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Oak Ridge, Tennessee 37831
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
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PREFACE

This report supersedes ORNL/ER-80, *Waste Characterization Data Manual for the Inactive Liquid Low-Level Waste Tank Systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee.* This report has been bound in a three-ring binder to facilitate future updates.

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	Tank No.
2.1	W-5
2.2	W-6
2.3	W-7
2.4	W-8
2.5	W-9
2.6	W-10
2.7	W-11
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2.12	T-9
2.13	TH-1
2.14	TH-2
2.15	TH-3
2.16	TH-4
2.17	WC-1
2.18	WC-15
2.19	WC-17
2.20	W-1
2.21	W-1A

	Tank No.	
2.22	W-2	
2.23	W-3	
2.24	W-4	
2.25	W-13	
2.26	W-14	
2.27	W-15	
2.28	7560	
2.29	7562	
2.30	T-30	
2.31	W-19	
2.32	W-20	
2.33	3001-B	
2.34	3003-A	
2.35	3004-B	
2.36	3013	
2.37	H209	
2.38	7503-A	
2.39	3001-S	
2.40	3002-A	
2.41	4501-P	
2.42	S-424	
2.43	T-14	
2.44	W-1I	
2.45	WC-4	
2.46	W-17	
2.47	W-18	
2.48	WC-5	
2.49	WC-6	
2.50	WC-8	
2.51	WC-11	
2.52	WC-12	
2.53	WC-13	
2.54	WC-14	
2.55	LA-104	
2.56	WC-7	Rev. 1, September 1996
2.57	2026-A	Rev. 0, April 1997
2.58	WC-19	Rev. 0, April 1997

EXECUTIVE SUMMARY

This Waste Characterization Data Manual contains the results of an analysis of the contents of liquid low-level waste (LLLW) tanks that have been removed from service in accordance with the requirements of the Oak Ridge National Laboratory (ORNL) Federal Facility Agreement (FFA), Section IX.G.1.

Pursuant to the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act, the Oak Ridge Reservation, consisting of approximately 58,000 acres owned by the United States and under the jurisdiction of the United States Department of Energy (DOE), was placed on the National Priorities List on December 21, 1989. An FFA for ORNL that was signed by the United States Environmental Protection Agency (EPA) Region IV, DOE, and the Tennessee Department of Environment and Conservation (TDEC) became effective on January 1, 1992. The objective of that agreement is to ensure that environmental impacts resulting from operations at the Oak Ridge Reservation, both present and past, are thoroughly investigated and remediated to protect the public health, welfare, and environment.

Section IX.G.1 of the FFA requires waste characterizations be conducted and provided to EPA and TDEC for all LLLW tanks that are removed from service. These waste characterizations shall include the results of sampling and analysis of the tank contents, including wastes, liquids, and sludges.

This manual was first issued as ORNL/ER-80 in June 1992. The waste characterization data were extracted from ORNL reports[1,2] that described tank sampling and analysis conducted in 1988 for 32 out-of-service tanks. This revision of the manual contains waste characterization data for tanks from the 1988 sampling campaign (Sects. 2.1 through 2.32), a sampling campaign in 1992 and 1993 (Sects. 2.33 through 2.54), and subsequent sampling of tanks as they are removed from service. Data are presented from analyses of volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyls (PCBs), pesticides, radiochemical compounds, and inorganic compounds. As additional data resulting from analyses of out-of-service tank samples become available, they will be added to this manual.

Of the 32 tanks addressed in the 1988 sampling campaign, three were empty and could not be sampled: tanks 7560 (Sect. 2.28), W-19 (Sect. 2.31), and W-20 (Sect. 2.32).

Of the 22 tanks addressed in the 1992–93 sampling campaign, four were empty and were not characterized: tanks S-424 (Sect. 2.42), 4501-P (Sect. 2.41), T-14 (Sect. 2.43), and WC-4 (Sect. 2.45). However, tabulated in the respective sections of the latter three tanks (4501-P, T-14, and WC-4) are characterization data resulting from sampling of the three tanks in August–September 1990 when the tanks were emptied. The analytical protocols for these samples are listed on the tank data sheets. One of the tanks in the 1992–93 campaign, tank 3001-S (Sect. 2.39), was not sampled because a field investigation was unable to verify the tank's existence, which had been postulated based on the existence of some design drawings of the tank. Two of the tanks, 7503-A (Sect. 2.38) and W-1I (Sect. 2.44), were not sampled because of access or worker safety concerns. Full characterization of tank 3002-A (Sect. 2.40) was postponed until the continuous inflow of nonprogrammatic waste has been stopped.

Most of the liquid samples were collected using suction from a small vacuum pump. While it was recognized that this procedure could volatilize the lighter organics in the liquid, this approach minimized radiation exposure to collection personnel. Liquid samples were collected into 250-mL glass sample jars with Teflon-lined caps. Each sample was given a unique identification number.

No standard EPA methods exist for the preparation and analysis of radioactive or mixed wastes, and very few laboratories have experience in this area. Therefore, the organic chemical characterization in this project required that much of the methodology be developed as it was needed rather than during a preliminary development phase. The laboratories performing the analyses attempted to follow as closely as possible the regulatory procedures for the analysis of hazardous wastes; aqueous liquid and sludge samples from the waste tanks were subjected to modified EPA SW-846 and Contract Laboratory Program methodology. Method modifications were documented.

Quality assurance during tank sampling activities was maintained primarily through the use of tank-specific procedures for the sampling crew to follow. These procedures provided step-by-step instructions for the collection, labeling, and transport of each sample. If any procedural changes were required, the Project Manager was notified, and approval was required from the appropriate levels of management before operations could begin. An independent surveillance by the Quality Assurance Specialist verified that sampling procedures, chain-of-custody criteria, radiation protection, and operator training were in compliance with all written procedures. Sampling activities that followed EPA procedures met analysis level III quality requirements. Analyses that required modifications of EPA procedures met analysis level V quality requirements.

The sample results are organized in this manual by individual tanks. Data reporting conventions and notations are defined in Sect. 2.

1. INTRODUCTION

1.1 BACKGROUND

Oak Ridge National Laboratory (ORNL) is a multidisciplinary research facility that began operation in 1943 as part of the Manhattan Project. The original mission of ORNL was to develop a prototype graphite reactor and to reprocess the reactor fuel for plutonium recovery. After World War II, the primary functions of ORNL were fuel reprocessing research; radioisotopes production and applications development; and development, testing, and operation of nuclear reactor concepts. More recently, ORNL has increased its role in biological, environmental, energy, and materials research. As a consequence of these multidisciplinary research activities, heterogeneous waste has been generated in varying amounts over time, including solid and liquid radioactive, hazardous, and mixed wastes.

Most of the liquid low-level waste (LLLW) system was installed more than 30 years ago. The initial system and its subsequent modifications were designed to minimize radiation exposure to LLLW system users and operators. System features include provisions for remote operations to minimize personnel exposure and unvalved, gravity-drained transfer lines to prevent waste backup into generator areas. Over the years, tank systems were abandoned as their integrity was breached or as programs were terminated. Some of the tanks were abandoned in place with liquid waste and sludge left in them. As-built drawings for most of the tank systems do not exist. The out-of-service portion of the system consists almost entirely of tanks without secondary containment. Figures 1.1 and 1.2 show the LLLW tank locations in Bethel Valley and Melton Valley, respectively.

1.2 PURPOSE

Section IX.G.1 of the Oak Ridge Reservation Federal Facility Agreement (FFA) requires the completion of waste characterizations for all out-of-service tank systems. Tank contents must be sampled and analyzed for hazardous and radioactive constituents and the data presented in the waste characterization. The purpose of this data manual is to present waste characterization data for the Category D LLLW tanks to the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC).

1.3 SCOPE

This manual was first issued as ORNL/ER-80 in June 1992. The waste characterization data and sampling methodology was extracted from ORNL reports published by Autrey et al.[1,2] that described tank sampling and analysis conducted in 1988 for 32 out-of-service tanks. The current revision of this manual contains waste characterization data for tanks from the 1988 sampling campaign (Sects. 2.1 through 2.32), a sampling campaign in 1992 and 1993 (Sects. 2.33 through 2.54), and subsequent sampling of tanks as they are removed from service. The data shown in Sects. 2.33 through 2.54 for the tanks sampled in 1992-93 were extracted from tabulations supplied by the analytical laboratories. Discussions with laboratory personnel have helped in interpreting the data.

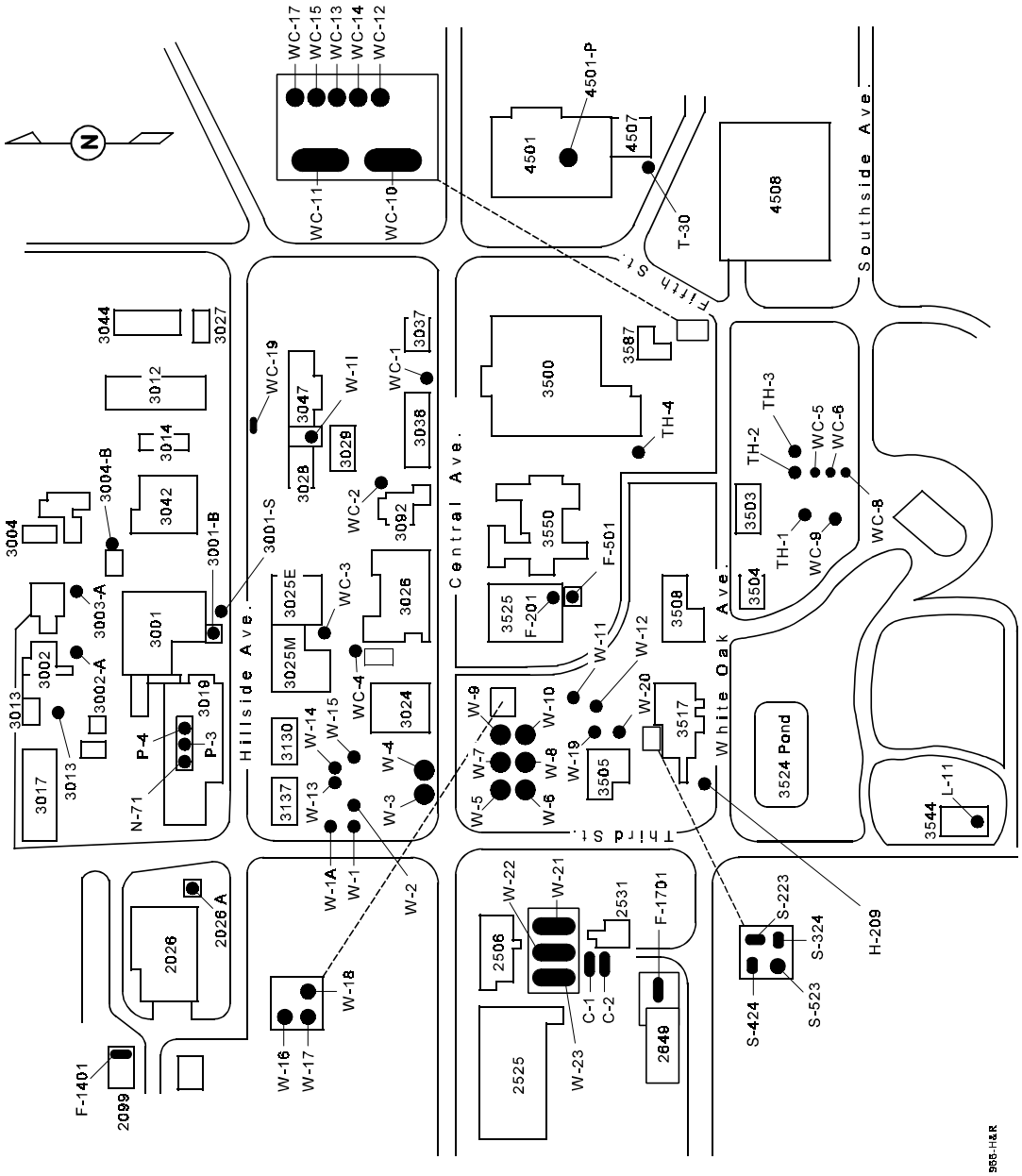

Fig. 1.1. Location of inactive LLLW tanks in the Bethel Valley main laboratory area.

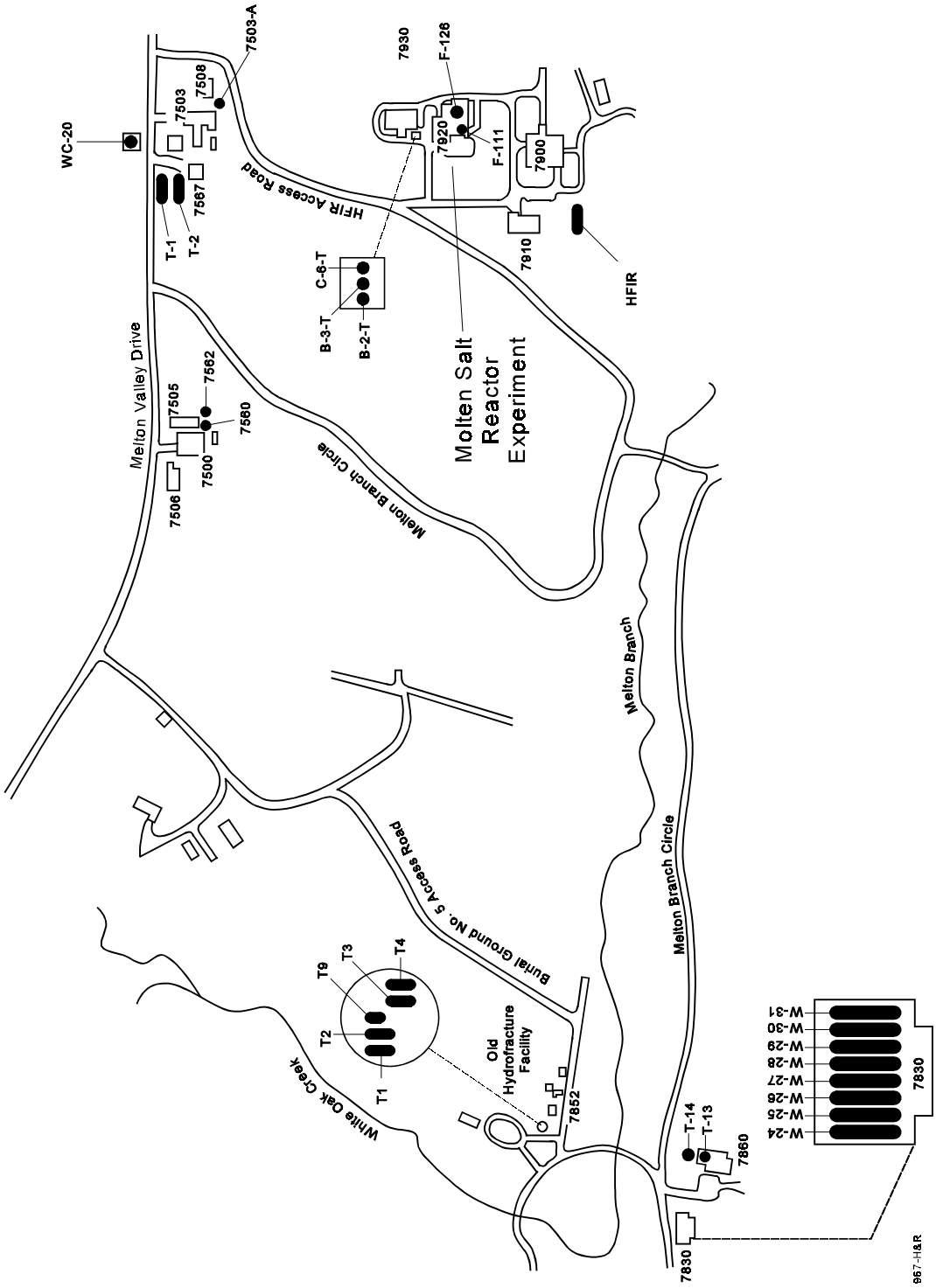

Fig. 1.2. Location of inactive LLLW tanks in the Melton Valley area.

Data are presented from analyses of volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyls (PCBs), pesticides, radiochemical compounds, and inorganic compounds. Additional data resulting from analyses of out-of-service tank samples will be incorporated into later versions as they become available. Copies of historical data and summaries of process knowledge, where it exists, will be provided on request.

Of the 32 tanks addressed in the 1988 sampling campaign, three were empty and could not be sampled: tanks 7560 (Sect. 2.28), W-19 (Sect. 2.31), and W-20 (Sect. 2.32).

Of the 22 tanks addressed in the 1992-93 sampling campaign, four were empty and were not characterized: tanks S-424 (Sect. 2.42), 4501-P (Sect. 2.41), T-14 (Sect. 2.43), and WC-4 (Sect. 2.45). However, tabulated in the respective sections of the latter three tanks (4501-P, T-14, and WC-4) are characterization data resulting from sampling of the three tanks in August–September 1990, when the tanks were emptied. The analytical protocols for these samples are listed on the tank data sheets. One of the tanks in the 1992-93 campaign, tank 3001-S (Sect. 2.39), was not sampled because a field investigation was unable to verify the tanks's existence, which had been postulated based on the existence of some design drawings of the tank. Two of the tanks, 7503-A (Sect. 2.38) and W-1I (Sect. 2.44), were not sampled because of access or worker safety concerns. Full characterization of tank 3002-A (Sect. 2.40), was postponed until the continuous inflow of nonprogrammatic waste has been stopped.

1.4 DEFINITIONS

Category D tank system. A singly-contained LLLW tank system that is removed from service and will no longer receive program-generated waste.

LLLW. Hazardous, radioactive, and mixed liquid waste having an activity greater than the trace levels permitted in process wastes but less than 5 Ci/gal of beta-gamma emitters (# 2 Ci/gal by the revised waste acceptance criteria) and less than 100 nCi/gal of alpha-emitting transuranic elements.

1.5 SAMPLING OF CONTENTS FOR CATEGORY D LLLW TANK SYSTEMS

Because of the physical design of the tanks (Fig. 1.3), sample collection could take place from only a very limited area within the tank. Sample quantities were also limited to minimize exposure of the field personnel to radiation while collecting the samples.

Most of the liquid samples were collected using suction from a small vacuum pump. Although it could volatilize the lighter organics in the liquid, this procedure minimized exposure of collection personnel to radiation. Liquid samples were collected in 250-mL glass sample jars with Teflon-lined caps. Each sample was given a unique identification number.

Vertical stratification of the liquid was expected in several tanks; therefore, if liquid depths were greater than 5 ft, samples were usually taken near the top, at the midpoint, and at the bottom of the liquid. If the liquid depth was 1–5 ft, samples were collected from the top and bottom. For very shallow liquid depths (<1 ft), either one or two samples were collected at a single depth.

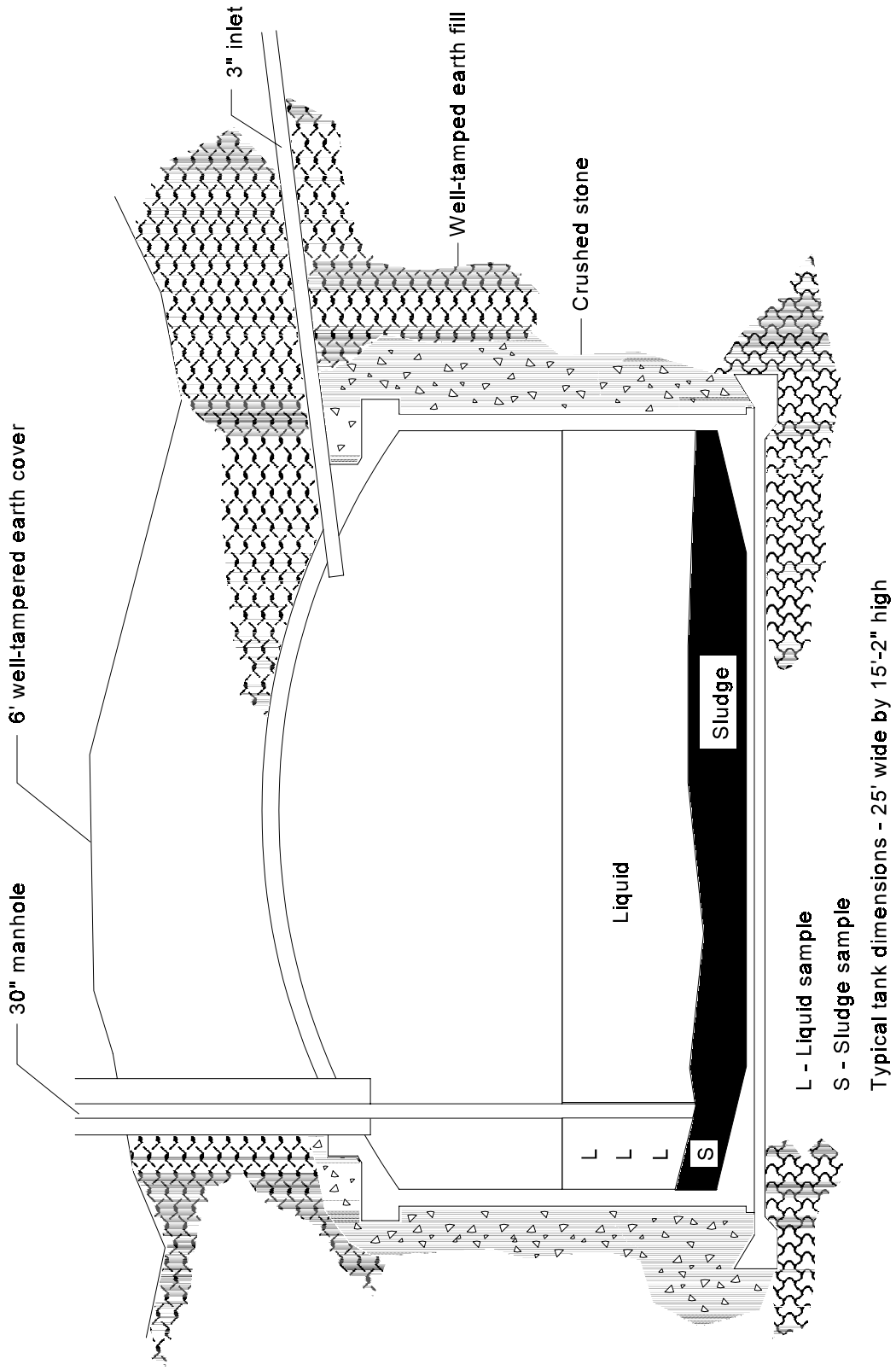

Fig. 1.3. Typical tank configuration showing sample locations.

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Sludge has been found in a number of the tanks. The liquid–sludge interface in these tanks was located using the Markland model 10 sludge gun. This tool measures the amount of light transmitted across a fixed gap in the probe to detect changes in the percentage of solids in the liquid. As the probe enters the sludge, an alarm sounds, and the operator records the depth.

Based on earlier reports, soft and hard sludges were expected to be found in the tanks. Two different sludge collectors were prepared to accommodate the varying sludge conditions. The soft sludge collector has an open-ended sample collection tube at the bottom. After the sludge enters the tube, a flat, neoprene-coated plate is rotated over the opening to close it. The hard sludge collector uses a beveled cutting edge to core samples as it is driven into the sludge. This latter collector was not used on steel tanks because of the possibility of puncturing the tank shell. All sludge was cored, and the samples were homogenized before they were analyzed.

Quality assurance (QA) during tank sampling activities was maintained primarily through the use of tank-specific procedures for the sampling crew to follow. These procedures provided step-by-step instructions for the collection, labeling, and transport of each sample. If any procedural changes were required, the Project Manager was notified, and approval was required from the appropriate levels of management before operations could begin. An independent surveillance by the QA Specialist verified that sampling procedures, chain-of-custody criteria, radiation protection, and operator training were in compliance with all written procedures. Sampling activities that followed EPA procedures met analysis-level-III quality requirements. Analyses that required modifications of EPA procedures met analysis-level-V quality requirements.

All field data, such as liquid and sludge depths, sample identification numbers, location of the sampling port on the tank, and field surveys, were recorded on data forms to ensure an accurate account of the sampling activities. Chain-of-custody forms were used to track individual samples from their collection point to the individual laboratories conducting the analyses.

1.6 ANALYTICAL METHODS

No standard EPA methods exist for the preparation and analysis of mixed wastes, and very few laboratories have experience in this area. Therefore, the organic chemical characterization in this project required that much of the methodology be developed as needed rather than during a preliminary development phase.

The approach taken for the determination of regulated organic compounds in the samples collected from the inactive tanks was to prepare extracts in (radioactive) contamination-zoned facilities and to perform the analytical measurements in nonzoned conventional analytical laboratories. The preparation methodologies followed EPA SW-846[3] or Contract Laboratory Program (CLP) methodology[4,5] as closely as possible. Method deviations required by the radioactive nature or other characteristics of the samples were documented. These deviations are explained in the ORNL report published by Autrey et al.[1] The quantitative measurements were conducted by EPA CLP methods.

The staff of the Radioactive Materials Analytical Laboratory received and logged in the samples and transferred aliquots to the Separations and Synthesis Group for organic analytical preparation. Except for the direct aqueous injection–gas chromatographic (DAI–GC) determination of major water soluble volatile organic compounds (VOCs), all the quantitative organic measurements were

performed by the Organic Analysis Group. All sample transfers were accompanied by chain-of-custody documentation and careful Health Physics screening.

The CLP analyses were specifically calibrated for the EPA CLP Target Compound List (TCL). Because EPA Region IV staff suggested analyzing for as much of the 40 CFR 261, Appendix VIII list as possible within the constraints of worker protection per the ALARA principle (radiation exposure and contamination of personnel is kept as low as reasonably achievable), the detection of such compounds as tentatively identified compounds (TICs) was also investigated.

The subsections that follow describe the analytical methods used in this project for each type of compound investigated.

1.6.1 Volatile Organic Compound Analysis

VOCs in the liquid samples were determined using modifications of SW-846 method 5030 and the CLP method for volatiles in water by purge-and-trap gas chromatography–mass spectrometry (GC-MS), which is very similar to SW-846 method 8240. The main deviation from EPA methodology during the 1988 campaign was that the purge-and-trap step was conducted in a glove box remote from the GC-MS laboratory. For the 1992-93 sampling campaign, the glove box purge-and-trap was unavailable for use. This meant that the volatile organic analysis by GC-MS could not be performed for those 1992-93 tank samples whose radioactive levels exceeded nonzoned laboratory guidelines. However, those samples that contained little radioactivity could be analyzed using purge-and-trap GC-MS in the nonzoned, conventional laboratory.

Sludge samples were not analyzed for volatile organic compounds for the group of 32 tanks in the 1988 sampling event. For the 1992-93 sampling campaign, one sludge sample was analyzed for volatile organic compounds using methanol extraction (after method 5030) followed by purge-and-trap GC-MS. The sludge volume or availability and radioactivity were the principal constraints for determining whether the 1992-93 sludges were analyzed for VOCs.

At the same time that aliquots were taken for purge-and-trap in the glove box, 1.5-mL aliquots were taken in small vials for analysis of major water soluble organic compounds. The method used was direct aqueous injection GC designed after SW-846 method 8015. This analysis was conducted to “protect” the GC-MS system used for volatile analysis by identifying those samples that were heavily contaminated with higher-boiling compounds (boiling point ∃ 100EC). These higher-boiling compounds might be collected in the adsorbent trap and subsequently would contaminate the GC column or overload the GC-MS detector. This analysis was also used to supplement the purge-and-trap analysis by providing data on highly polar, water-soluble organic compounds that are not determined effectively by the purge-and-trap method (e.g., methyl and ethyl alcohols). Such compounds were suspected because of processes used at ORNL.

1.6.2 Semivolatile Organic Compound Analysis

Semivolatile organic compounds were extracted from the liquid and sludge samples after completion of the gross alpha and beta/gamma activity measurements. The gross alpha and beta/gamma activity measurements had to be taken first to determine if the sample could be extracted in a contamination zone hood or if the extraction had to be conducted in a hot cell. Aqueous liquid samples were extracted by a modification of SW-846 method 3510. Volumes of 20 mL were extracted in the 1988 sampling campaign, and about 150-200 mL in the 1992-93 sampling campaign.

Semivolatile organic compounds from the sludge samples were also extracted, using a modification of SW-846 method 3550. Most of the extractions in the 1988 campaign were performed in a hot cell because of the high levels of radioactivity in the sludges, although a few sludges were low enough in radioactivity to allow extraction in a contamination zone hood. Since only limited amounts of sludges were collected, the extracts varied in mass from only 2–30 g. The amount of organic material extractable from the sludges often required dilution of the extracts or extraction of smaller masses (2–5 g). The reporting limits varied from about 250–2500 to 2,500–25,000 Φg/kg, depending upon the mass extracted and the dilution of the extract.

Four tanks (two each in the 1988 and 1992–93 campaign) contained organic layers. Samples from these tanks required only dilution and addition of internal standard, per SW-846 method 3580. After testing various dilution ratios with the GC screening method, it was determined that a 100-fold dilution would keep most of the major constituents detectable by GC within the calibration range of the GC-MS.

All of the extracts in the 1988 sampling campaign were screened using a Megabore capillary column GC with flame-ionization detection. This screening was conducted to identify those samples requiring dilution to "protect" the GC-MS system and to screen out those samples that contained little organic matter and would not require GC-MS.

After GC screening, the extracts were measured for total alpha and beta/gamma activity and then examined for contact and smear alpha and beta/gamma activities by the Health Physics Inspector. They were than sent to the sample-receiving laboratory for GC-MS analysis. The extracts were analyzed by the CLP GC-MS procedure, which utilizes the method of internal standards.

1.6.3 Pesticides and Polychlorinated Biphenyls Analysis

In general, samples obtained during the 1988 sampling campaign were not analyzed for pesticides or polychlorinated biphenyls (PCBs). However, two tanks analyzed during the 1988 campaign contained layers of organic liquids or oils. These layers were analyzed for PCBs in addition to volatiles and semivolatiles. The preparation method was a version of method 3580, modified with respect to the degree or extent of dilution.

In the 1992–93 sampling campaign, sludge and liquid samples were analyzed for both pesticides and PCBs. A small number of the samples contained layers of organic liquids or oils, and were therefore prepared using the modified version of method 3580. However, most of the samples were made ready for pesticide and PCB testing by drawing off an aliquot of the sample's extract prepared prior to this time for semivolatile organic compound analysis; specifically, a 10 percent portion of the semivolatile organic compound extract was purified using SW-846 method 3620.

Pesticides and PCBs were measured using SW-846 method 8080 with a capillary column.

1.6.4 Physical, Inorganic, and Radiochemical Analyses

The physical, inorganic, and radiochemical analyses were conducted at the Radioactive Materials Analytical Laboratory (Building 2026) and the Transuranium Laboratory (Building 7920), both of which serve in the Radioactive Materials Analysis Section; and the Chemical and Physical Analysis Laboratory (Building 4500S), which serves the Inorganic Chemistry Section. The sample receiving, sample distribution, sample preparation, physical measurements, metal analyses, cyanide and sulfide

analyses, total organic carbon (TOC), ^{14}C and ^{3}H analyses, and some of the other radiochemical measurements were performed by the Radioactive Materials Analytical Laboratory. The general anion (F^-, Cl^-, PO_4^{-2}, NO_3^-, and SO_4^{-2}) measurements by ion chromatography were performed initially in Building 4500S by the Chemical and Physical Analysis Laboratory group, and later in Building 2026 by the Radioactive Materials Analysis Section. The radiochemical measurements, which include the gross alpha, gross beta, gamma emitters, ^{90}Sr, and alpha emitters analyses, were initially provided by the Transuranium Laboratory, and later by the Radioactive Materials Analytical Laboratory.

Radiochemical and inorganic analysis was complicated because of the lack of standard regulatory methods for the analysis of highly radioactive wastes and mixed wastes. The laboratory attempted to mimic existing regulatory procedures (SW-846[3], U.S. EPA CLP[5], and EPA-600[6]). The complications resulted in miscellaneous deviations which involved the initial handling of the samples. It was then necessary to modify the regulatory procedures to (1) reduce radiation exposure to meet the policy of ALARA, (2) accommodate the limitations of the instrumentation and facilities available, and (3) handle the complex nature of the sample composition (e.g., high levels of salt, dissolved solids, uranium, and thorium). The main modification was the reduction of sample-size.

The EPA sample preservation procedures that involve maintenance of samples at 4EC were generally avoided for two reasons: (1) the lack of refrigeration facilities for radioactive samples and (2) the possibility of shifts in the equilibrium states of solutions with elevated levels of both pH and dissolved solids. In addition, on-site filtration upon collection and on-site acid preservation of metals in aqueous samples were not performed to reduce the radiation exposure of sampling and analytical staff.

The EPA requirement that states that all samples must initially be run undiluted was generally not met for samples with high radiation levels or high salt content. Liquid samples were often diluted fourfold with nitric acid (1 mol) prior to analysis to reduce the concentrations of salt and radionuclides to a level that enabled use of existing instrumentation.

The inactive waste tank samples were inspected by a Health Physics representative, and a field survey was performed on each sample before it was packaged and delivered to the Radioactive Materials Analytical Laboratory. On the basis of the field survey results, all liquid samples were handled in radiochemical laboratories (classified as radiation contamination zones). In the 1988 sampling campaign, most of the sludge samples required remote handling for dissolution and dilution before their removal from the hot cell and distribution to various laboratories.

Sample volumes or weights were adjusted to comply with Appendix 7 (now RP-2.16) of the ORNL Health Physics Manual. The limiting factors for laboratory operations were based mainly upon the ^{90}Sr (Class 1; very high radiotoxicity) and ^{137}Cs (Class 2; high radiotoxicity) content.

Most of the laboratory procedures were simple wet operations, permitting the application of a tenfold modifying factor to the activity levels allowed. Dose rates did not exceed 200–400 mrad/h at 1.5 in. for laboratory operations; the ^{90}Sr activity levels were maintained below 0.1–0.2 mCi, and the ^{137}Cs below 1–2 mCi. The only problem involved the determination of total and dissolved solids. This required weighing the residue from dried samples. Special care and handling were exercised with the dry samples to prevent dispersing or dusting of the material.

To meet the analytical requirements of this project, a new facility for atomic emission and atomic absorption (AA) spectroscopy was established. This facility included specially adapted instrumentation for inductively coupled plasma (ICP) atomic emission spectroscopy and an AA spectrometer for graphite furnace work and mercury analysis by the cold-vapor technique. Each of these systems was set up and modified for operation in stainless steel enclosures. The enclosures for both the ICP and the AA spectrometer were equipped with auxiliary exhaust systems to handle the bulk of radioactive aerosols generated during sample analysis. A preoperational readiness review was conducted by the Radioactive Operations Committee on each of these systems prior to their operation with radioactive samples.

The spectrochemical sample preparation (ICP and AA) could not use the acid-digestion methods recommended by EPA because if employed, the generated chloride atmosphere would degrade the stainless steel enclosure. The sample preparation chosen for the liquid samples was a simple dilution with 5% nitric acid. The sample preparation procedure for the sludges was the recommended EPA method (EPA 3050), but many sludge samples needed additional preparation to remove severe spectral/matrix interferences from high levels of uranium and thorium. The uranium and thorium were lowered to below 100 mg/L with a tri-*n*-octylphosphine oxide (TOPO) extraction[7].

It was usually not possible to meet the holding time requirements for mercury (26 d) and cyanide (14 d) because of the additional time necessary to analyze radioactive samples. This problem was discussed prior to and during the sampling campaign with both Martin Marietta Energy Systems, Inc., (Energy Systems) ER personnel, and EPA Region IV personnel and is now being addressed at the national level by the Office of Technology Development, Laboratory Management Division of DOE Headquarters.

The sample preparation for the mercury analysis of sludges was the recommended EPA method (EPA 7471). The sample digestion steps to remove the organo-mercury compounds to mercuric ions were not used because it was highly unlikely given the type of environment that the sample was in that any organo-mercury compounds existed. To determine whether an oxidizing or reducing environment was present in the samples, a test with potassium permanganate was performed where an oxidizing environment was confirmed by the retention of the permanganates purple color. Most of the samples retained the purple color; however, several of the liquid samples consumed the permaganate. The composition of the reducing species was not identified.

In addition to the above methods, the laboratory used EPA 1310, the Extraction Procedure Toxicity Test (EP-TOX). The EP-TOX method requires a minimum of 100g of sample, but the high radioactivity of many of the samples and the lack of sufficient sample available for testing resulted in a scale down of the procedure by a factor of 10. During the initial planning it was determined that EP-TOX method would not be necessary if the total metal measurement did not exceed the EP-TOX equivalent limits (which had to be defined as 20 times the EPA regulatory limits because of a 20 fold dilution).

The radiochemical sample preservation required a complete dissolution of the sample to ensure that all activity was measured. This dissolution was done by a nitric acid and hydrogen peroxide reflux.

Many of the samples obtained from the inactive waste tanks have high dissolved solids; this phenomenon translates into a high ionic strength. The effects of high ionic strength can have a significant effect on the solution chemistry and various chemical measurements. For example, a

potentiometric pH measurement is actually based upon the hydronium ion activity and not the hydronium ion concentration. The hydronium activity will differ considerably at high ionic strengths. Therefore, the pH measurements on many of the tank samples can be considered only as apparent pH values that are not directly related to hydronium ion concentration. The ionic strength will also affect the kinetics of ionic reactions and result in deviations from solubility product behavior. In general, the solution chemistry is far from ideal, and the expected behavior for many species may not be observed.

1.7 REFERENCES

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2. WASTE CHARACTERIZATION SUMMARY FOR THE ORNL CATEGORY D LLLW TANKS

This section presents the results of the chemical analyses of the Category D (inactive) LLLW tanks.

An explanation of the reporting conventions is necessary to clarify how the data are presented. The tank sample table headings refer to sample identification numbers. The "L" identifier indicates a liquid sample; the "S" identifier indicates a sludge sample. In cases where both hard and soft sludge were encountered, the sample is understood to be soft sludge unless the sample identifier is an "H." An "O" identifier on the sample number indicates an organic sample.

Some clarifications on units and other reporting conventions are as follows:

1. The units for total dissolved solids (TSD) and total solids (TS) are mg/mL rather than mg/L.

2. The units for inorganic carbon (IC), total carbon (TC), and total organic carbon (TOC) are mg/L for aqueous solutions and mg/kg for solids.

3. The units for metals and anions are mg/L for aqueous solutions and mg/kg for solids.

4. The units for CO_3^{2-}, HCO_3^{2-}, OH^-, and H^{3+} are mol/L (i.e., molarity).

5. The units for volatiles and semivolatiles are Φg/L for aqueous solutions and Φg/kg for solids.

6. An asterisk, "*", is used in the inorganic data tabulations to indicate unavailable data.

7. The acronym, NA, is used in the data tables to indicate those analytical parameters that are "not applicable" for certain samples.

8. Parenthesis, "( )", are used in the inorganic analytical data tables to indicate suspect data, and in the organic analytical data tables to indicate the number of tentatively identified compounds (TICs).

Some of the organic analytical data are listed in the tables with letters that indicate important qualifications. The qualifiers present the following information.

J. The compound was identified by the appropriate retention time and mass spectrum (if it was an organic compound determined by GC-MS), but was observed at a concentration lower than the reporting limit. The reporting limit is the lowest concentration of that compound that can be measured accurately in that sample. The quantitation is therefore an estimate.

In the discussion that follows, the notation "TIC" means that the compound has been identified solely by its mass spectrum in a machine search of spectra contained in a computer's library. The quantitation is based upon the response factor of the nearest internal standard present in the gas chromatograph. Because of the nature of the quantitation procedure, all values reported are, by definition, estimates and bear the J qualifier.

E. The concentration of the compound exceeded the calibration range of the instrument; therefore, the result must be considered an estimate.

B. The compound was detected either in the instrumental or sample preparation blank. The blanks usually contained low Φg/L levels of several species, as indicated in one of the later subsections of this section.

BE. The analyte was detected in the sample at concentrations exceeding the usual calibration range, but low levels were also detected in the blank. In almost all cases, the levels observed in the sample considerably exceeded that of the blank.

The absence of data qualifiers indicates that a compound was (1) identified on the basis of retention time and mass spectrum if it was an organic compound determined by GC-MS), (2) measured within the calibration range of the instrument, and (3) not found in the associated blank sample.

Reference is made to the TOC data where such data aid in the interpretation of the organic compound analyses. The surrogate standard and matrix spike recoveries are not discussed in detail in this report because there are no established quality control limits for analysis of these sample matrices by modified EPA methods.

2.1 TANK W-5

2.1.1 Tank Description

Tank W-5 is a 170,000-gal storage tank that was built in 1943 for the storage of LLLW. The tank is located in the South Tank Farm in Bethel Valley. The reinforced concrete (Gunite) tank is buried below grade.

2.1.2 Characterization Summary

2.1.2.1 Aqueous liquid

The results for Tank W-5 are shown in Tables 2.1.1 and 2.1.2. The major constituents detected by the volatile organic analysis (VOA) were trichloroethenes and tetrachloroethenes at 138 Φg/L and 267 Φg/L concentrations respectively. Other target analytes were observed, but at much lower levels. The semivolatile organic analysis (SVOA) did not detect any significant material in the liquids. The aqueous liquid sample foamed upon acidification during the preparation for the SVOA.

2.1.2.2 Sludge

Tributylphosphate (TBP) was found as a TIC in the sludge at 8 mg/kg. The SVOA suggested the presence of phthalates.

Table 2.1.1. Analytical data for tank W-5

Parameter	L73	S75
Physical properties and miscellaneous data		
Density (g/mL)	1.044	NA
Depth (inches)	4	NA
Suspended solids (mg/mL)	0.7	NA
TDS (mg/mL)	47.5	NA
TOC (L=mg/L, S=mg/kg)	700	4020
TS (L=mg/mL, S=mg/g)	48.2	348
RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.002	0.26
As	<4	<1
Ba	<0.2	140
Cd	<0.08	10
Cr	2.7	(580)
Hg	0.41	18
Ni	<1	52
Pb	<2	388
Se	<0.09	(0.81)
Tl	<0.09	(<0.5)
Process metals (L=mg/L, S=mg/kg)		
Si	12.9	NA
U	296	1420
Anions (L=mg/L, S=mg/kg)		
Cl^-	8.6	<84
Cn	*	0.01
F^-	56	1300
NO_3^-	21	*
PO_4^{-2}	420	<840
SO_4^{-2}	26	<840
Alkalinity		
CO_3^{-2} (mol)	0.16	*
HCO_3^-(mol)	0.26	*
pH (units)	10.6	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha (Bq/pCi)	6.0E+00 / 1.6E+02	1.3E+03 / 3.5E+04
Gross beta (Bq/pCi)	4.2E+03 / 1.1E+05	1.8E+05 / 4.95E+06
Beta/gamma emitters (L=Bq/mL, S=Bq/g		
^{137}Cs (Bq/pCi)	5.5E+03 / 1.5E+05	3.0E+04 / 8.1E+05
^{3}H (Bq/pCi)	1.9E+00 / 5.1E+01	1.1E+01 / 3.0E+02
^{60}Co (Bq/pCi)	1.6E+02 / 4.3E+03	2.6E+02 / 7.0E+03
^{90}Sr (Bq/pCi)	9.0E+00 / 2.4E+02	2.9E+04 / 7.8E+05
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{233}U (Bq /pCi)	*	4.6E+01 / 1.2E+03
^{238}Pu (Bq /pCi)	<2 / 5.4E+01	5.4E+01 / 1.5E+03
^{239}Pu (Bq /pCi)	<4 / 1.1E+02	6.2E+02 / 1.7E+04
^{244}Cm (Bq /pCi)	<0.4 / 1.1E+01	3.5E+02 / 9.5E+03
^{252}Cf (Bq /pCi)	<0.2 / 5.0E+00	<4 / 1.1E+02

Table 2.1.2. Organic analytical data hits for tank W-5

Parameter	L73	S75
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
Acetone	19 B	
Carbon tetrachloride	68 B	
Chloroform	6	
Methylene chloride	6 B	
Tetrachloroethene	267 B	
Trichloroethene	138	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)		
Bis(2-ethylhexyl)phthalate		28,000
Di-n-butylphthalate	18 J	350 J
Diethylphthalate		230 J
Fluoranthene		230 J
Phenanthrene		440 J
Pyrene		230 J

2.2 TANK W-6

2.2.1 Tank Description

Tank W-6 is a 170,000-gal Gunite tank located in the Bethel Valley South Tank Farm. The underground tank was constructed in 1943 for the storage of LLLW.

2.2.2 Characterization Summary

The results for this tank are shown in Tables 2.2.1 and 2.2.2.

2.2.2.1 Aqueous liquid

The principal volatile organics were trichloroethene and tetrachloroethenes. The SVOA of the aqueous liquids showed only benzoic acid at 300 Φg/L in L79. Sample L78 turned green upon the addition of the SVOA matrix spike, but the surrogate recoveries were acceptable.

2.2.2.2 Sludge

A few polycyclic aromatic hydrocarbons (PAHs) and phthalates were determined in the sludge.

Table 2.2.1. Analytical data for tank W-6

Parameter	L77	L78	L79	S80
Physical properties and miscellaneous data				
Density (g/mL)	0.999	1.009	1.059	NA
Depth (inches)	4	30	54	NA
Suspended solids (mg/mL)	<0.1	<0.1	0.1	NA
TDS (mg/mL)	2.5	14.8	74.0	NA
TOC (L=mg/L, S=mg/kg)	2.0	2.0	180	9110
TS (L=mg/mL, S=mg/g)	2.5	14.7	74.1	406
RCRA metals (L=mg/L, S=mg/kg)				
Ag	<0.002	<0.002	<0.002	0.006
As	<4	<4	<4	(<2)
Ba	<0.2	<0.2	<0.2	(350)
Cd	<0.08	<0.08	<0.08	<1
Cr	<0.3	2.6	32	(2400)
Hg	<0.01	<0.01	0.07	36
Ni	<1	<1	1.5	85
Pb	<2	<2	<2	1100
Se	<0.09	<0.09	<0.09	(<2)
Tl	<0.09	<0.09	<0.09	<2
Process metals (L=mg/L, S=mg/kg)				
Si	3.99	2.98	1.65	NA
U	16.2	52.3	69.8	6340
Anions (L=mg/L, S=mg/kg)				
Cl^-	1.3	4.5	12.0	<800
Cn	<0.07	0.05	0.41	*
F^-	5.1	27	49	4000
NO_3^-	73	250	710	*
PO_4^{-2}	<5	31	210	<2500
SO_4^{-2}	4.8	34	330	<2500
Alkalinity				
CO_3^{-2} (mol)	<0.01	0.02	0.18	*
HCO_3^- (mol)	0.02	0.11	0.10	*
pH (units)	8.7	10.4	11.8	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)				
Gross alpha	1.0E+00	3.0E+00	3.0E+00	8.0E+03
Gross beta	2.8E+03	6.0E+03	1.9E+04	1.0E+06
Beta/gamma emitters (L=Bq/mL, S=Bq/g)				
^{137}Cs	1.6E+03	5.6E+03	2.0E+04	8.2E+04
^{3}H	6.3E-01	1.4E+00	3.2E+00	9.2E+00
^{60}Co	1.3E+01	2.8E+01	9.0E+01	9.1E+02
^{90}Sr	3.1E+02	7.8E+01	1.9E+02	3.6E+05
Alpha emitters (L=Bq/mL, S=Bq/g)				
^{233}U	*	*	*	2.7E+02
^{238}Pu	<2	<2	<2	2.1E+02
^{239}Pu	<4	<4	<4	1.8E+03
^{244}Cm	<0.4	<0.4	<0.4	4.2E+03
^{252}Cf	<0.2	<0.2	<0.2	<8

Table 2.2.2. Organic analytical data hits for tank W-6

Parameter	L77	L78	L79	S080
DAI-GC analysis (L=Φg/L, S=Φg/kg)				
I-Propyl alcohol			3,000	
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)				
2-Butanone			75	
2-Hexanone			9	
4-Methyl-2-pentanone		9 J	91	
Acetone	67 B	44 B	111 B	
Benzene		2 J	10	
Carbon tetrachloride	4 JB			
Chloroform	5 J	9	3 J	
Methylene chloride	9 B	8 B	7 B	
Tetrachloroethene	47 B	158 B	507 BE	
Toluene	6 B	10 B	10 B	
Trichloroethene	13	24	82	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)				
Benzoic acid			290 J	
Bis(2-ethylhexyl)phthalate				31,000
Di-n-butylphthalate				210 J
Diethylphthalate				150 J
Fluoranthene				340 J
Phenanthrene				680 J
Pyrene				350 J

2.3 TANK W-7

2.3.1 Tank Description

Tank W-7 is a 170,000-gal Gunite tank located in the Bethel Valley South Tank Farm. The underground tank was constructed in 1943 for the storage of LLLW.

2.3.2 Characterization Summary

The results for this tank are shown in Tables 2.3.1 and 2.3.2.

2.3.2.1 Aqueous liquid

The major organic constituents were 14 mg/L of methanol and −1000 Φg/L of carbon tetrachloride in L82. The data for the sample identification numbers with A and B suffixes are for duplicate determinations. These data show very good agreement, considering the low concentrations and two purging steps in the analysis. Benzoic acid (2000 Φg/L) was the only TCL compound detected. Dibromonitrophenol was estimated at 700 Φg/L as a TIC.

2.3.2.2 Sludge

Fluoranthene and several phthalates were detected in the sludges. Four of the five SVOA surrogate standard recoveries (particularly for the acid surrogate standards) from the soft sludge, S84, were very low, suggesting problems with the extraction step. Surrogate standard recoveries were somewhat better for the hard sludge, H85. This difference in recovery for the surrogates between soft and hard sludges was observed in other samples.

The samples for tanks W-8 and W-9, except for the sludges, were prepared together.

Table 2.3.1. Analytical data for tank W-7

Parameter	H85	L82	S84
Physical properties and miscellaneous data			
Density (g/mL)	NA	1.130	NA
Depth (inches)	NA	3	NA
Suspended solids (mg/mL)	NA	11.3	NA
TDS (mg/mL)	NA	158.7	NA
TOC (L=mg/L, S=mg/kg)	4,010	50.0	9,030
TS (L=mg/mL, S=mg/g)	360	170	367
RCRA metals (L=mg/L, S=mg/kg)			
Ag	0.12	*	0.36
As	<6	<4	<6
Ba	(16)	<0.2	(1,300)
Cd	2.2	<0.08	2.0
Cr	(130)	145	(660)
Hg	52	(11)	141
Ni	22	<1	84
Pb	(77)	<2	(300)
Se	(<1)	<2	(<1)
Tl	<1	<2	<1
Process metals (L=mg/L, S=mg/kg)			
Si	NA	7.35	NA
U	86,000	8,530	45,000
Anions (L=mg/L, S=mg/kg)			
Cl-	*	29	<1.2%
Cn	*	<0.06	*
F^-	*	11	1,000
NO_3^-	*	440	*
PO_4^{-2}	*	29	*
SO_4^{-2}	*	55	6.7%
Alkalinity			
CO_3^{-2} (mol)	*	0.21	*
HCO_3^- (mol)	*	0.33	*
pH (units)	NA	10.7	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)			
Gross alpha	8.0E+03	2.0E+02	1.4E+04
Gross beta	1.7E+06	5.6E+05	3.1E+06
Beta/gamma emitters (L=Bq/mL, S=Bq/g)			
^{134}Cs	*	*	1.0E+02
^{137}Cs	1.0E+06	6.4E+05	1.2E+06
^{152}Eu	*	*	1.6E+03
^{154}Eu	4.5E+02	*	1.3E+03
^{3}H	8.3E+01	1.9E+01	1.2E+02
^{60}Co	2.0E+03	2.9E+02	5.0E+03
^{90}Sr	3.1E+05	6.0E+02	8.1E+05

Table 2.3.1 (continued)

Parameter	H85	L82	S84
Alpha emitters (L=Bq/mL, S=Bq/g)			
^{233}U	1.7E+03	*	5.4E+02
^{238}Pu	6.4E+02	<2	1.1E+03
^{238}Th/^{232}Th	*	8.5E+01	*
^{238}U	1.6E+03	*	*
^{239}Pu	4.8E+02	<4	2.4E+03
^{241}Am	*	*	5.7E+02
^{244}Cm	2.5E+03	<0.4	4.2E+03
^{252}Cf	<4	<0.2	<14

Table 2.3.2. Organic analytical data hits for tank W-7

Parameter	H85	L82	L82B	S84
DAI-GC analysis (L=Φg/L, S=Φg/kg)				
Methyl alcohol		14,000		
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)				
4-Methyl-2-pentanone		7	7	
Acetone		26 B	31 B	
Carbon tetrachloride		1,088 BE	1,021 BE	
Chloroform		3 J	3 J	
Methylene chloride		7 B	4 B	
Tetrachloroethene		24 B	39 B	
Toluene		14 B	9 B	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)				
Benzoic acid		1,900 J		
Bis(2-ethylhexyl)phthalate				57,000
Di-n-butylphthalate	2,200 J			300 J
Diethylphthalate	510 J			200 J
Fluoranthene				260 J

2.4 TANK W-8

2.4.1 Tank Description

Tank W-8 is a 170,000-gal Gunite tank located in the Bethel Valley South Tank Farm. The underground tank was constructed in 1943 for the storage of LLLW.

2.4.2 Characterization Summary

Tables 2.4.1 and 2.4.2 list the findings for this tank.

2.4.2.1 Aqueous liquid

The concentrations of both volatile and semivolatile organic compounds were very low.

The main SVOA TICs were dibromocyclohexane (300 Φg/L in L86 alone), dibromoni-trophenol (500 and 700 Φg/L in L86 and L87, respectively), and TBP (20 mg/L in each liquid). The results suggest bromination reactions may have occurred.

Only the sludge was found to contain significant detectable organic compounds, which were mostly PAHs. The TICs were mostly unidentified hydrocarbons and TBP (700 mg/kg).

The acidic surrogate standard compounds were very poorly recovered from the aqueous liquids, suggesting that acidic compounds, if present in the samples, may not have been extracted or detected. The two chlorinated phenolic matrix spike compounds also were poorly recovered.

Table 2.4.1. Analytical data for tank W-8

Parameter	L86	L87	S88
Physical properties and miscellaneous data			
Density (g/mL)	1.020	1.027	NA
Depth (inches)	4	16	NA
Suspended solids (mg/mL)	<0.1	<0.1	NA
TDS (mg/mL)	29.4	37.8	NA
TOC (L=mg/L, S=mg/kg)	720	1,460	11,300
TS (L=mg/mL, S=mg/g)	29.4	37.6	558
RCRA metals (L=mg/L, S=mg/kg)			
Ag	0.007	<0.002	1.3
As	<4	<4	<4
Ba	<0.2	<0.2	(38)
Cd	<0.2	<0.2	4.1
Cr	12	18	(410)
Hg	0.09	0.17	50
Ni	<1	<1	160
Pb	<2	<2	(1,800)
Se	<0.09	<0.09	(<0.7)
Tl	<0.09	<0.09	<0.7
Process metals (L=mg/L, S=mg/kg)			
Si	1.39	1.14	NA
U	817	1,760	8,560
Anions (L=mg/L, S=mg/kg)			
Cl^-	290	840	<100
Cn	0.33	0.58	*
F^-	<50	<125	<100
NO_3^-	2,700	7,300	*
PO_4^{-2}	<250	<625	<500
SO_4^{-2}	1,400	4,900	<500
Alkalinity			
CO_3^{-2} (mol)	0.01	0.02	*
HCO_3^- (mol)	0.04	0.07	*
pH (units)	9.6	9.7	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)			
Gross alpha	1.5E+02	2.0E+02	2.9E+04
Gross beta	2.4E+05	2.8E+05	6.7E+06
Beta/gamma emitters (L=Bq/mL, S=Bq/g)			
^{137}Cs	3.4E+05	4.0E+05	4.7E+04
^{152}Eu	*	*	9.0E+01
^{154}Eu	*	*	1.4E+02
^{3}H	8.0E+00	8.8E+00	0.0E+00
^{60}Co	3.0E+02	5.9E+02	4.0E+02
^{90}Sr	6.6E+02	4.6E+02	2.8E+06

Table 2.4.1 (continued)

Parameter	L86	L87	S88
Alpha emitters (L=Bq/mL, S=Bq/g)			
^{233}U	<2	<2	1.6E+03
^{238}Pu	<2	<2	2.9E+03
^{239}Pu	<2	<2	3.2E+03
^{241}Am	*	*	2.0E+02
^{244}Cm	<2	<2	1.5E+04
^{252}Cf	<2	<2	<4

Table 2.4.2. Organic analytical data hits for tank W-8

Parameter	L86	L87	S88
DAI-GC analysis (L=Φg/L, S=Φg/kg)			
Acetone	1,000	3,000	
Methyl alcohol		1,000	
Methyl ethyl ketone		1,000	
N-Butyl alcohol		2,000	
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)			
2-Hexanone	41		
4-Methyl-2-pentanone	15		
Acetone	64 B	45 B	
Benzene	3 J	6	
Methylene chloride	12 B	7 B	
Toluene	3 BJ	4 BJ	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)			
2-Methylnaphthalene			1,300 J
Di-n-butylphthalate		17 J	630 J
Diethylphthalate			430 J
Fluoranthene			740 J
Naphthalene		28 J	2,600 J
Phenanthrene			1,300 J
Pyrene			850 J

2.5 TANK W-9

2.5.1 Tank Description

Tank W-9 is a 170,000-gal Gunite tank located in the Bethel Valley South Tank Farm. The underground tank was constructed in 1943 for the storage of LLLW.

2.5.2 Characterization Summary

The results for this tank are given in Tables 2.5.1 and 2.5.2.

2.5.2.1 Aqueous liquid

The results for this tank were similar to those for W-8. The VOA and SVOA did not reveal any significant levels of TCL constituents, except for the low levels of PAHs and phthalates in the sludge. The SVOA TIC, TBP, was estimated at 10 mg/L in L90. The recoveries of the surrogate standard compounds in L90 were all zero, suggesting either that an error had been made in surrogate standard spiking or that the matrix seriously interfered with the extraction.

Except for the sludges, the samples for tanks W-1, W-2, and W-4 were prepared together.

Table 2.5.1. Analytical data for tank W-9

Parameter	L90	L92
Physical properties and miscellaneous data		
Density (g/mL)	1.017	NA
Depth (inches)	5	NA
Suspended solids (mg/mL)	<0.1	NA
TDS (mg/mL)	21.2	NA
TOC (L=mg/L, S=mg/kg)	290	13,900
TS (L=mg/mL, S=mg/g)	21.2	944
RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.002	0.77
As	<4	<5
Ba	<0.2	(200)
Cd	<0.2	4.9
Cr	7.3	160
Hg	0.06	40
Ni	<1	110
Pb	<2	620
Se	<0.09	<0.7
Tl	<0.09	<0.7
Process metals (L=mg/L, S=mg/kg)		
Si	2.53	NA
U	2,390	25,800
Anions (L=mg/L, S=mg/kg)		
Cl^-	340	<100
Cn	0.14	*
F^-	<50	<100
NO_3^-	1,650	*
PO_4^{-2}	2,600	<500
SO_4^{-2}	900	<500
Alkalinity		
CO_3^{-2} (mol)	0.03	*
HCO_3^- (mol)	0.09	*
OH^- (mol)	*	*
pH (units)	10.2	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha (Bq /pCi)	6.0E+01 / 1.6E+03	1.1E+05 / 3.0E+06
Gross beta (Bq /pCi)	7.1E+04 / 2.0E+06	5.0E+06 / 1.35E+08
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{134}Cs (Bq/pCi)	8.5E+01 / 2.30E+03	2.0E+01 / 5.41E+02
^{137}Cs (Bq/pCi)	6.3E+04 / 1.70E+06	2.2E+04 / 5.95E+05
^{152}Eu (Bq/pCi)	*	2.3E+02 / 6.22E+03
^{154}Eu (Bq/pCi)	*	4.4E+02 / 1.19E+04
^{155}Eu (Bq/pCi)	*	5.2E+01 / 1.41E+03
^{3}H (Bq/pCi)	1.0E+01 / 2.70E+02	0.0E+00
^{60}Co (Bq/pCi)	1.1E+02 / 2.97E+03	7.8E+02 / 2.11E+04

Table 2.5.1 (continued)

Parameter	L90	L92
^{90}Sr (Bq/pCi)	3.7E+02 / 1.00E+04	2.2E+06 / 5.95E+07
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{233}U (Bq /pCi)	<3 / <8.11E+01	3.1E+03 / 8.38E+04
^{238}Pu (Bq /pCi)	<3 / <8.11E+01	2.2E+04 / 5.95E+05
^{239}Pu (Bq /pCi)	<3 / <8.11E+01	9.2E+03 / 2.49E+05
^{241}Am (Bq /pCi)		7.2E+03 / 1.95E+05
^{244}Cm (Bq /pCi)	<3 / <8.11E+01	5.4E+04 / 1.46E+06
^{252}Cf (Bq /pCi)	<3 / <8.11E+01	*

Table 2.5.2. Organic analytical data hits for tank W-9

Parameter	L90	L92
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
4-Methyl-2-pentanone	11	
Acetone	70 B	
Benzene	2 J	
Chlorobenzene	5	
Chloroform	44	
Methylene chloride	13 B	
Tetrachloroethene	4 J	
Toluene	9 B	
Trichloroethene	5	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)		
Bis(2-ethylhexyl)phthalate		160,000
Di-n-butylphthalate	20 J	760 J
Diethylphthalate		450 J
Fluoranthene		1,100 J
Naphthalene		370 J
Phenanthrene		1,300 J
Pyrene		850 J

2.6 TANK W-10

2.6.1 Tank Description

Tank W-10 is a 170,000-gal Gunite tank located in the Bethel Valley South Tank Farm. The underground tank was constructed in 1943 for the storage in LLLW.

2.6.2 Characterization Summary

The results for this tank are given in Tables 2.6.1 and 2.6.2.

2.6.2.1 Aqueous liquid

All the aqueous samples for tank W-10 were processed as a group. DAI-GC indicated the presence of 30 to 40 mg/L of methanol. The acetone determined by DAI-GC was qualitatively confirmed by VOA, but the latter indicated much lower levels. The presence of 2-butanone was not verified by VOA. Except for the methanol, there were only very low levels of volatile organic compounds in the aqueous liquids, and in L93, none were detected at all. This is consistent with TOC in L93 (8.7 mg/L) being much lower than in L94 and L95 (86.4 and 54.6 mg/L, respectively).

The only TCL semivolatile organic compound detected in the liquids was benzoic acid, in L94 and L95 (400 and 2900 Φg/L, respectively). The naphthalene detected in L95 was very low (20 Φg/L). TBP was indicated as a TIC only in L94, at 2 mg/L.

2.6.2.2 Sludge

Like the sludges from the other tanks, the sludges from tank W-10 contained PAHs and phthalates, with H120 having higher concentrations of PAHs than S96, which is consistent with their TOC levels (14,600 and 8180 mg/kg, respectively). The SVOA TIC, ethylphenyl-ethanone, was estimated at 200 and 2300 Φg/L in L94 and L95, respectively, and 9 and 40 mg/kg in S96 and H120, respectively. TBP was detected as a TIC in the sludges at 60 and 300 mg/kg in S96 and H120, respectively. The hard sludges appear to contain generally higher concentrations of organic compounds than do the soft sludges.

The acidic matrix spike recoveries for L93 were very poor; however, the acidic surrogate standard recoveries were good. The reason for this discrepancy is not clear. Two of the acidic compound and two of the neutral compound surrogate standard recoveries were low for S96 but were better for the hard sludge, H120. The hard sludges exhibited better surrogate standard and matrix spike recoveries than did the soft sludges. The reasons for these findings are not clear but may be related to the more aqueous character of the soft sludges.

Table 2.6.1. Analytical data for tank W-10

Parameter	H120	L93	L94	L95	S96
Physical properties and miscellaneous data					
Density (g/mL)	NA	1.004	1.009	1.027	NA
Depth (inches)	NA	4	28	49	NA
Suspended solids (mg/mL)	NA	<0.1	<0.1	<0.1	NA
TDS (mg/mL)	NA	5.7	13.7	37.1	NA
TOC (L=mg/L, S=mg/kg)	14,600	8.7	86.4	54.6	8,180
TS (L=mg/mL, S=mg/g)	845	5.5	13.6	36.7	449
RCRA metals (L=mg/L, S=mg/kg)					
Ag	0.89	<0.002	<0.002	<0.002	0.79
As	<7	<4	<4	<4	5.7
Ba	(24)	<0.2	<0.2	<0.2	(94)
Cd	6.1	<0.2	<0.2	<0.2	4.7
Cr	(97)	0.55	4.4	19	(140)
Hg	11	<0.01	0.05	0.37	48
Ni	31	<1	<1	<1	83
Pb	190	2.2	<2	<2	480
Se	(<1)	<0.09	<0.09	<0.09	(<0.9)
Tl	<1	<0.09	<0.09	<0.09	(<0.9)
Process metals (L=mg/L, S=mg/kg)					
Si	NA	1.71	1.9	2.34	NA
U	82,300	34.7	64.5	460	10,800
Anions (L=mg/L, S=mg/kg)					
Cl^-	<60	170	410	990	<120
CN	*	<0.04	<0.04	0.54	*
F^-	<60	74	190	430	<120
NO_3^-	*	2,900	4,440	8,500	*
PO_4^{-3}	<300	<200	<200	<200	<600
SO_4^{-2}	<300	280	690	2,100	<600
Alkalinity					
CO_3^{-2} (mol)	*	*	0.02	0.09	*
HCO_3^- (mol)	*	0.02	<0.01	0.02	*
pH (units)	NA	9.2	10.5	10.9	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)					
Gross alpha (Bq / pCi)	4.1E+04 / 1.11E+05	5.0E+00 / 1.35E+02	1.0E+01 / 2.70E+02	2.8E+01 / 7.57E+02	8.4E+04 / 2.27E+06
Gross beta (Bq / pCi)	1.2E+07 / 3.24E+08	3.1E+04 / 8.38E+05	7.8E+04 / 2.11E+06	1.9E+05 / 5.14E+06	5.3E+06 / 1.43E+08
Beta/gamma emitters (L=Bq/mL, S=Bq/g)					
^{134}Cs (Bq / pCi)	1.4E+03 / 3.78E+04	*	*	*	*
^{137}Cs (Bq / pCi)	1.1E+07 / 2.97E+08	3.1E+04 / 3.38E+05	8.3E+04 / 2.24E+06	2.4E+05 / 6.49E+06	8.6E+05 / 2.32E+07
^{152}Eu (Bq / pCi)	*	*	*	*	4.6E+03 / 1.24E+05
^{154}Eu (Bq / pCi)	*	*	*	*	8.0E+03 / 2.16E+05
^{3}H (Bq / pCi)	9.0E-01 / 2.43E+01	3.2E+01 / 8.65E+02	6.8E+01 / 1.84E+03	1.4E+02 / 3.78E+03	1.4E+02 / 3.78E+03
^{60}Co (Bq / pCi)	1.4E+03 / 3.78E+04	2.8E+01 / 7.57E+02	3.4E+01 / 9.19E+02	1.4E+02 / 3.78E+03	1.3E+04 / 3.51E+05
^{90}Sr (Bq / pCi)	1.2E+06 / 3.24E+07	1.2E+03 / 3.24E+04	7.6E+02 / 2.05E+04	2.1E+02 / 5.68E+03	8.6E+06 / 2.32E+08

Table 2.6.1 (continued)

Parameter	H120	L93	L94	L95	S96
Alpha emitters (L=Bq/mL, S=Bq/g)					
^{134}Cs (Bq / pCi)	2.1E+03 / 5.68E+04	<2 / 5.41E+01	<2 / 5.41E+01	7.0E+00 / 1.89E+02	<50 / <1.35E+03
^{137}Cs (Bq / pCi)	6.7E+03 / 1.81E+05	<2 / 5.41E+01	<2 / 5.41E+01	2.0E+00 / 5.41E+01	2.9E+04 / 7.84E+05
^{152}Eu (Bq / pCi)	1.3E+03 / 3.51E+04	<2 / 5.41E+01	<2 / 5.41E+01	3.0E+00 / 8.11E+01	*
^{154}Eu (Bq / pCi)	1.1E+04 / 3.78E+05	<2 / 5.41E+01	<2 / 5.41E+01	2.0E+00 / 5.41E+01	8.2E+02 / 2.22E+05
^{3}H (Bq / pCi)	*	*	*	*	4.5E+03 / 1.22E+05
^{60}Co (Bq / pCi)	1.4E+04 / 3.78E+05	<3 / 8.11E+01	<3 / 8.11E+01	<3 / 8.11E+01	4.7E+04 / 1.27E+06
^{90}Sr (Bq / pCi)	<25 / <6.76E+02	<2 / 5.41E+01	<2 / 5.41E+01	<2 / 5.41E+01	<50 / <1.35E+03

Table 2.6.2. Organic analytical data hits for tank W-10

Parameter	H120	L93	L94	L94B	L95	S96
DAI-GC analysis (L=Φg/L, S=Φg/kg)						
Acetone					3,000	
Ethyl alcohol					1,000	
Methyl alcohol		27,000	37,000		41,000	
Methyl ethyl ketone					1,000	
N-Butyl alcohol					1,000	
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)						
1,2-Dichloroethene (total)			11		31	
4-Methyl-2-pentanone					23 B	
Acetone					97 B	
Benzene			6 B	38 BM	22 B	
Chlorobenzene					5 B	
Chloroform					16	
Methylene chloride			13 B	19 B	12 B	
Tetrachloroethene			21		48	
Toluene			12		26 B	
Trichloroethene			27		81	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)						
Benzo(a)anthracene						660 J
Benzo(a)pyrene	1,900 J					
Benzo(b)fluoranthene	2,200 J					
Benzo(g,h,i)perylene	870 J					
Benzoic acid			400 J		2,900	
Bis(2-ethylhexyl)phthalate						130,000
Chrysene						760 J
Di-n-butylphthalate	770 J					2,600 J
Fluoranthene	8,000 J					1,800 J
Naphthalene	270 J				20 J	
Phenanthrene	5,100 J					1,700 J
Pyrene	8,100 J					1,400 J

2.7 TANK W-11

2.7.1 Tank Description

Tank W-11 is a 1500-gal Gunite tank located in the Bethel Valley South Tank Farm. The underground tank was constructed in 1943 to serve as a waste collection and monitoring tank for research laboratories in Building 3550.

2.7.2 Characterization Summary

The results for this tank are shown in Tables 2.7.1 and 2.7.2.

2.7.2.1 Aqueous liquid

The volatile organic compounds in tank W-11 samples were very low. Except for sludge samples, no SVOA extracts were submitted for GC-MS analysis because the GC screening did not detect sufficient concentrations of organic compounds for GC. The screening data are consistent with the TOC levels for these samples, which are the lowest TOC levels taken from any of the tanks in this study (2.0, <0.1, and <0.1 mg/L for L3, L114, and L115, respectively). Samples L3 and L115 were sequentially collected and are useful as duplicates, within the usual errors of sampling. The VOA results are in reasonable agreement, considering the very low concentrations (2–30 Φg/L).

2.7.2.2 Sludge

The sludge contained several PAHs at concentrations as high as hundreds of mg/kg, as shown in Table 2.7.2. The presence of these species was quite unexpected, since PAH-bearing wastes, such as tars, were not known to be disposed of in the tank. The PAHs were not detected in the liquid samples, as expected from their low aqueous solubilities (low Φg/L for the five-ring PAH), and they selectively partitioned into the sludge. This trend was observed for other sludge samples. Phthalates were also present.

Table 2.7.1. Analytical data for tank W-11

Parameter	H5	L114	L115	L3
		Physical properties and miscellaneous data		
Density (g/mL)	2,080	1.000	0.998	0.999
Depth (inches)	NA	24	4	4
Suspended solids (mg/mL)	NA	0.2	0.2	0.2
TDS (mg/mL)	NA	0.1	0.1	0.1
TOC (L=mg/L, S=mg/kg)	*	<0.1	<0.1	<0.1
TS (L=mg/mL, S=mg/g)	1,200	0.3	0.3	0.3
		RCRA metals (L=mg/L, S=mg/kg)		
Ag	2.4	<0.002	(<0.002)	(<0.002)
As	(1.8)	<0.8	<0.8	<0.8
Ba	64	0.05	<0.04	<0.04
Cd	(1.2)	<0.02	<0.02	<0.02
Cr	670	<0.1	<0.1	<0.1
Hg	17	<0.01	<0.01	<0.04
Ni	10	<0.2	<0.2	<0.2
Pb	(14,000)	<1	<1	<1
Se	<0.3	<0.09	<0.09	<0.09
Tl	<0.3	(<0.09)	(<0.09)	(<0.09)
		Process metals (L=mg/L, S=mg/kg)		
Si	NA	7.29	7.03	6.91
U	*	8.82	8.88	12.1
		Anions (L=mg/L, S=mg/kg)		
Cl^-	*	<1	<1	<1
Cn	*	<0.04	<0.04	<0.04
F^-	*	<1	<1	<1
NO_3^-	*	<5	<5	<5
PO_4^{-2}	*	<5	<5	<5
SO_4^{-2}	*	<5	<5	<5
		Alkalinity		
pH (units)	NA	7.7	7.8	8.0
		Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha (Bq / pCi)	*	<1 / <2.70E+01	<1 / <2.70E+01	<1 / <2.70E+01
Gross beta (Bq / pCi)	*	<20 / <5.41E+02	<20 / <5.41E+02	<20 / <5.41E+02
		Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs (Bq / pCi)	*	<20 / <5.41E+02	<20 / <5.41E+02	<20 / 5.41E+02
^{14}C (Bq / pCi)	*	1.0E-01 / 2.70	1.0E-02 / 2.70E-01	2.0E-01 / 5.41
^{3}H (Bq / pCi)	*	5.0E-01 / 1.35E+01	5.0E-01 / 1.35E+01	6.0E-01 / 1.62E+01
^{60}Co (Bq / pCi)	*	<20 / <5.41E+02	<20 / <5.41E+02	<20 / <5.41E+02
^{90}Sr (Bq / pCi)	*	2.1E+01 / 5.68E+02	4.2E+01 / 1.14E+03	2.0E+01 / 5.41E+02

Table 2.7.2. Organic analytical data hits for tank W-11

Parameter	H5	L3	L114	L115
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)				
Acetone		27 B	21 B	15 B
Chlorobenzene		5 J	3 J	2 J
Methylene chloride		7 B	8 B	13 B
Toluene		23 B	24 B	13 B
Trichloroethene		4 J		
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)				
Benzo(a)anthracene	44,000			
Benzo(a)pyrene	64,000			
Benzo(b)fluoranthene	160,000 E			
Benzo(g,h,i)perylene	22,000			
Bis(2-ethylhexyl)phtha	38,000			
Chrysene	130,000			
Di-n-butylphthalate	17,400			
Fluoranthene	240,000 E			
Indeno(1,2,3-cd)pyrene	42,000			
Phenanthrene	24,000			
Pyrene	90,000			

2.8 TANK T-1

2.8.1 Tank Description

Tank T-1 is a 15,000-gal carbon steel tank located in Melton Valley at the Old Hydro-fracture Facility (OHF). The underground tank was installed at the site in 1963 to store LLLW for mixing into grout for waste injection by hydrofracture.

2.8.2 Characterization Summary

The results for this tank are shown in Tables 2.8.1 and 2.8.2.

2.8.2.1 Aqueous liquid

Very little organic matter was detected in the samples from this tank. VOA apparently revealed high levels of methylene chloride in both the sample and the blank. These high levels can be attributed to contamination of the solid sorbent traps during storage. When the quantitation procedure was modified to permit analysis of traps within 48 h of receipt, the level of methylene chloride in the blank was reduced to acceptable levels. In the SVOA extraction, the methylene chloride and aqueous layers were difficult to separate for samples L35 and L36. Sample L36 required centrifugation to achieve separation. However, surrogate standard and matrix spike recoveries were good. There were no SVOA TCL hits in the aqueous liquids.

SVOA TICs included diphenyloxazole (300–400 Φg/L), hexadecanoic acid (300 Φg/L in one sample), and TBP (30–40 mg/L). TBP was often the major organic compound detected.

2.8.2.2 Sludge

Of the SVOA TCL compounds in the sludge, only phthalates were detected. SVOA TICs in the sludge included TBP at 2 mg/kg.

Table 2.8.1. Analytical data for tank T-1

Parameter	L35	L36	S37
Physical properties and miscellaneous data			
Density (g/mL)	1.005	1.007	NA
Depth (inches)	4	48	NA
Suspended solids (mg/mL)	0.8	<0.1	NA
TDS (mg/mL)	6.4	6.9	NA
TOC (L=mg/L, S=mg/kg)	836.0	790.0	18,600
TS (L=mg/mL, S=mg/g)	7.2	6.9	921
RCRA metals (L=mg/L, S=mg/kg)			
Ag	0.005	0.005	2.1
As	<0.8	<0.8	<2
Ba	<0.04	0.05	88
Cd	<0.02	<0.02	12.9
Cr	0.29	0.18	(130)
Hg	0.06	0.07	74
Ni	<0.2	<0.2	190
Pb	<1	<1	(860)
Se	<0.2	<0.2	(<2)
Tl	<0.2	<0.2	1.7
Process metals (L=mg/L, S=mg/kg)			
Si	9.34	6.81	NA
U	172	175	2800
Anions (L=mg/L, S=mg/kg)			
Cl^-	7.8	8.0	*
Cn	*	0.22	*
F^-	1.0	1.0	*
NO_3^-	16	17	*
PO_4^{-2}	<5	<5	*
SO_4^{-2}	7.5	8.1	*
Alkalinity			
CO_3^{-2} (mol)	0.01	0.01	*
HCO_3^- (mol)	0.04	0.04	*
pH (units)	9.7	9.7	NA

Table 2.8.1 (continued)

Parameter	L35	L36	S37
Radiochemical screening (L=Bq/mL, S=Bq/g)			
Gross alpha	1.9E+02	2.1E+02	6.5E+05
Gross beta	8.1E+04	7.8E+04	5.9E+07
Beta/gamma emitters (L=Bq/mL, S=Bq/g)			
^{137}Cs	7.4E+04	7.5E+0	3.9E+05
^{14}C	*	*	4.8E+01
^{152}Eu	*	*	1.4E+05
^{154}Eu	*	*	1.2E+05
^{155}Eu	*	*	2.3E+04
^{3}H	7.1E+01	7.1E+01	2.6E+01
^{60}Co	<50	<50	2.6E+05
^{90}Sr	3.3E+03	3.4E+03	3.2E+07
Alpha emitters (L=Bq/mL, S=Bq/g)			
^{233}U	1.8E+02	2.0E+02	*
^{238}Pu	*	*	3.4E+04
^{239}Pu	*	*	6.5E+03

Table 2.8.2. Organic analytical data hits for tank T-1

Parameter	L35	L36	S37
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)			
Acetone	51 B	27 B	
Benzene	130	5 J	
Carbon disulfide	91		
Carbon tetrachloride	2 J		
Chloroform	12 B	6 B	
Methylene chloride	1300 BE	970 BE	
Toluene	71 B	12 B	
Trichloroethene	4 J		
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)			
Bis(2-ethylhexyl)phthalate	400 J	190 J	
Di-n-butylphthalate	75 J	76 J	3500 J

2.9 TANK T-2

2.9.1 Tank Description

Tank T-2 is a 15,000-gal carbon steel tank located in Melton Valley at the OHF. The underground tank was installed at the site in 1963 to store LLLW for mixing into grout for waste injection by hydrofracture.

2.9.2 Characterization Summary

The results for this tank are shown in Tables 2.9.1 and 2.9.2.

2.9.2.1 Aqueous liquid

Very little volatile organic matter was detected in the aqueous liquids. Methylene chloride was a probable contaminant, as it was for tank T-1. However, SVOA showed the presence of 2-nitrophenol, 2,4-dichlorophenol, and 2,4,5-trichlorophenol in the liquids. These compounds could represent chemical reactions occurring in the tanks.

SVOA TICs in the three liquids included TBP at 20 mg/L and tetramethylbutyl-phenoxyethoxyethanol at 800-1000 Φg/L. Some foaming was observed in samples L39 and L112 upon acidification.

Samples L38 and L112, which were collected sequentially, are duplicates within the limits of field sampling. The agreement between the results for the two samples is quite good, especially considering the low levels determined.

2.9.2.2 Sludge

The sludge contained the usual phthalates and also naphthalene. The latter could be a component of liquid scintillator solutions. TBP was also detected in the sludge, but the amount could not be estimated because the mass spectrum of the chromatographic peak indicated coeluting interferences.

Table 2.9.1. Analytical data for tank T-2

Parameter	L112	L38	L39	S40
Physical properties and miscellaneous data				
Density (g/mL)	1.008	1.013	1.013	NA
Depth (inches)	4	4	48	NA
Suspended solids (mg/mL)	0.6	1.1	0.9	NA
TDS (mg/mL)	1,100	11.4	10.7	NA
TOC (L=mg/L, S=mg/kg)	12.1	1,120	1,310	28,000
TS (L=mg/mL, S=mg/g)		12.5	11.6	324
RCRA metals (L=mg/L, S=mg/kg)				
Ag	<0.002	<0.002	0.002	2.9
As	<0.8	<0.8	<0.8	<1
Ba	0.06	<0.04	<0.04	33
Cd	<0.02	<0.02	<0.02	6.6
Cr	<0.1	0.44	<0.1	(180)
Hg	0.1	0.1	0.15	70
Ni	<0.2	<0.2	<0.2	72
Pb	<1	<1	<1	(350)
Se	<0.09	<0.09	<0.09	(<1)
Tl	<0.09	<0.09	<0.09	<1
Process metals (L=mg/L, S=mg/kg)				
Si	6.81	5.07	6.97	NA
U	161	166	158	1,000
Anions (L=mg/L, S=mg/kg)				
Cl^-	12	12	12	4.9%
Cn	0.12	0.14	0.10	*
F^-	1.0	1.0	1.0	<0.8%
NO_3^-	8.0	8.4	8.2	*
PO_4^{-2}	<5	<5	<5	*
SO_4^{-2}	21	22	22	14%
Alkalinity				
CO_3^{-2} (mol)	0.04	0.04	0.04	*
HCO_3^- (mol)	0.09	0.08	0.09	*
pH (units)	9.9	9.9	9.9	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)				
Gross alpha (Bq / pCi)	2.1E+02 / 5.68E+03	2.0E+02 / 5.68E+03	2.0E+02 / 5.68E+03	2.5E+05 / 6.76E+06
Gross beta (Bq / pCi)	1.4E+05 / 3.79E+06	1.4E+05 / 3.79E+06	1.4E+05 / 3.79E+06	2.0E+07 / 5.41E+08
Beta/gamma emitters (L=Bq/mL, S=Bq/g)				
^{137}Cs (Bq / pCi)	1.4E+05 / 3.79E+06	1.4E+05 / 3.79E+06	1.4E+05 / 3.79E+06	2.5E+05 / 6.76E+06
^{14}C (Bq / pCi)	3.6E+02 / 9.73E+03	4.8E+02 / 1.30E+04	2.3E+02 / 6.22E+03	1.7E+01 / 4.59E+02
^{152}Eu (Bq / pCi)	*	*	*	3.8E+04 / 1.03E+06
^{154}Eu (Bq / pCi)	*	*	*	2.6E+04 / 7.03E+05
^{155}Eu (Bq / pCi)	*	*	*	3.8E+03 / 1.03E+05
^{3}H (Bq / pCi)	2.1E+02 / 5.68E+03	2.1E+02 / 5.68E+03	2.1E+02 / 5.68E+03	9.5E+01 / 2.57E+03
^{60}Co (Bq / pCi)	<75 / <2.03E+03	<75 / <2.03E+03	<75 / <2.03E+03	6.4E+04 / 1.73E+06
^{90}Sr (Bq / pCi)	2.8E+03 / 7.57E+04	2.5E+03 / 6.76E+04	2.7E+03 / 7.30E+04	1.2E+07 / 3.24E+08

Table 2.9.1. (continued)

Parameter	L112	L38	L39	S40
		Alpha emitters (L=Bq/mL, S=Bq/g)		
^{233}U (Bq / pCi)	1.8E+02 / 4.86E+03	1.9E+02 / 5.14E+03	1.8E+02 / 4.86E+03	8.3E+03 / 2.24E+05
^{238}Pu (Bq / pCi)	*		*	3.1E+03 / 8.38E+04
^{239}Pu (Bq / pCi)	*		*	5.1E+03 / 1.38E+05
^{244}Cm (Bq / pCi)	*		*	<200 / <5.41E+03
^{252}Cf (Bq / pCi)	*		*	1.8E+05 / 4.86E+06

Table 2.9.2. Organic analytical data hits for tank T-2

Parameter	L38	L39	L112	S40
		Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
Acetone	20 B	22 B	17 B	
Benzene	3 J			
Chloroform	340 BE	370 BE	310 BE	
Methylene chloride	1000 BE	820 BE	860 BE	
Toluene	12 B	7 B	8 B	
		Semivolatile compound analysis (L=Φg/L, S=Φg/kg)		
2,4,5-Trichlorophenol	99 J	110 J	120 J	
2,4-Dichlorophenol	100 J	140 J		
2-Nitrophenol	170 J	200 J	180 J	
Bis(2-ethylhexyl)phthalate	200 J	300 J	280 J	24,000
Di-n-butylphthalate			24 J	4600 J
Diethylphthalate				2800 J
Naphthalene				2300 J

2.10 TANK T-3

2.10.1 Tank Description

Tank T-3 is a 25,000-gal carbon steel tank located in Melton Valley at the OHF. The underground tank was installed at the site in 1963 to store LLLW for mixing into grout for waste injection by hydrofracture.

2.10.2 Characterization Summary

2.10.2.1 Aqueous liquid

The results from Tank T-3 are shown in Tables 2.10.1 and 2.10.2. Very little organic matter was detected in the samples from this tank. The major organic compounds were determined by DAI-GC, and consisted of acetone (4 mg/L), methanol (28 mg/L), and n-butyl alcohol (80 mg/L). As noted in Sect. 2, these identifications cannot be considered absolute because the method does not include MS confirmation. However, where the constituent was also identified by VOA, there is more confidence in the DAI-GC result. Of the CLP TCL constituents, only acetone was detected at 180 Φg/L by the purge-and-trap GC-MS VOA. The value for the VOA being lower than the value for DAI-GC is probably because of low purging efficiency at high concentration levels.

Volatile TICs were insignificant. Only benzyl alcohol was estimated at 100 Φg/L in the aqueous liquid SVOA. Among the TICs were dibromonitrophenol at 2000 Φg/L and TBP at 2000 Φg/L. Both of these TICs were found in other samples as well. The presence of a nitrated phenol suggests nitration reactions in the tank. The brominated product was unexpected, but TBP has been used in large amounts at ORNL, and its presence was expected.

The SVOA phenol and 2-fluorophenol surrogate standards were not recovered. This may reflect the highly alkaline nature of the samples (the pH of T-3/L-042 was 12.7).

2.10.2.2 Sludge

Two phthalates, diethyl- and di-n-butylphthalate, were detected at 2 and 3 mg/kg, respectively. It is not clear why neither dibromonitrophenol nor TBP was detected in the sludge SVOA TICs, unless the analysis was not sufficiently sensitive.

Table 2.10.1. Analytical data for tank T-3

Parameter	L42	S43
Physical properties and miscellaneous data		
Density (g/mL)	1.035	1.930
Depth (inches)	5	NA
Suspended solids (mg/mL)	1.5	NA
TDS (mg/mL)	51.9	NA
TOC (L=mg/L, S=mg/kg)	12,600	9,140
TS (L=mg/mL, S=mg/g)	53.4	364
RCRA metals (L=mg/L, <0.01S=mg/kg)		
Ag	<0.01	0.15
As	0.4	<3
Ba	<0.02	76
Cd	<0.01	8.5
Cr	14	(69)
Hg	5.7	40
Ni	<0.1	57
Pb	<0.5	(300)
Se	<0.5	(0.74)
Tl	<0.5	<0.6
Process metals (L=mg/L, S=mg/kg)		
Si	77.1	NA
U	0.2	3060
Anions (L=mg/L, S=mg/kg)		
Cl^-	7.0	29%
Cn	1.10	0.20
F^-	1.8	<12.7%
NO_3^-	53	*
PO_4^{-2}	160	<62.5%
SO_4^{-2}	15	<62.5%
Alkalinity		
CO_3^{-2} (mol)	0.08	*
OH^- (mol)	0.03	*
pH (units)	12.7	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	2.0E+00	2.0E+05
Gross beta	2.8E+05	2.5E+07
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs	2.7E+05	1.3E+06
^{14}C	*	7.6E+02
^{152}Eu	*	5.1E+04
^{154}Eu	*	5.3E+04
^{3}H	1.7E+02	7.7E+01
^{60}Co	3.6E+02	1.6E+05
^{90}Sr	3.0E+02	8.1E+06

Table 2.10.1 (continued)

Parameter	L42	S43
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{233}U	2.0E+00	8.3E+03
^{238}Pu	*	1.4E+04
^{239}Pu	*	5.3E+03
^{244}Cm	*	1.8E+05
^{252}Cf	*	<200

Table 2.10.2. Organic analytical data hits for tank T-3

Parameter	L42	S43
DAI-GC analysis (L=Φg/L, S=Φg/kg)		
Acetone	4,000	
Methyl alcohol	28,000	
N-Butyl alcohol	80,000	
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
Acetone	180 B	
Chloroform	3 JB	
Methylene chloride	3 JB	
Toluene	9 B	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)		
Benzyl alcohol	120 J	
Di-n-butylphthalate		3,100 J
Diethylphthalate		2,000 J

2.11 TANK T-4

2.11.1 Tank Description

Tank T-4 is a 25,000-gal carbon steel tank located in Melton Valley at the OHF. The underground tank was installed at the site in 1963 to store LLLW for mixing into grout for waste injection by hydrofracture.

2.11.2 Characterization Summary

2.11.2.1 Aqueous liquid

The results from tank T-4 are shown in Tables 2.11.1 and 2.11.2. The three aqueous liquid samples for tank T-4 yielded very similar results, as shown in Table 2.11.2. DAI-GC showed concentrations exceeding 1000 Φg/L each of acetone, ethyl alcohol, isopropyl alcohol, methanol, and n-butyl alcohol. VOA confirmed the presence of acetone and also indicated chloroform. Other TCL volatile organics were present at very low levels.

Volatile TICs were low in concentration; the major one was heptanone (80 Φg/L, found in L44). No semivolatile TCL organic compounds were detected in the liquids. Major SVOA TICs were methylhexanone (800 Φg/L in L45) and TBP (3000 Φg/L in L111).

2.11.2.2 Sludge

The sludge contained only the ubiquitous phthalates.

Two of the neutral and two of the acid surrogate standard recoveries were low for the sludge. Low recoveries of acidic surrogate standards from the alkaline sludges were often encountered, suggesting a need for pH adjustment currently unspecified in EPA method 3550. Studies are under way to improve the surrogate standard recoveries in such sample matrices.

The samples for tanks T-1, T-2, and T-9 were each prepared as a group.

Table 2.11.1. Analytical Data for Tank T-4

Parameter	L44	L45	S46	L111
Physical properties and miscellaneous data				
Density (g/mL)	1.020	1.016	1.235	1.016
Depth (inches)	4	34	NA	0
Suspended solids(mg/mL)	2.7	<0.1	NA	0.3
TDS (mg/mL)	23.6	23.7	NA	23.6
TOC (L=mg/L, S=mg/kg)	460	473	4620	460
TS (L=mg/mL, S=mg/g)	26.3	23.4	253	23.9
RCRA metals (L=mg/L, S=mg/kg)				
Ag	0.017	0.02	(1.7)	0.018
As	<0.8	<0.8	<4	<0.4
Ba	<0.04	<0.04	<50	<0.02
Cd	<0.02	<0.02	10	<0.01
Cr	9.4	14	(102)	13
Hg	1.1	2.7	585	7.9
Ni	<0.2	<0.2	160	<0.1
Pb	<1	<1	(510)	<0.5
Se	<0.09	<0.09	(1.5)	<0.23
Tl	<0.09	<0.09	0.73	<0.23
Process metals (L=mg/L, S=mg/kg)				
Si	1.96	1.45	NA	1.96
U	25.7	27.8	1850	23.3
Anions (L=mg/L, S=mg/kg)				
Cl^-	3.1	3.4	<0.83%	3.4
Cn	0.54	0.59	*	*
F^-	1.1	1.3	<0.83%	1.1
NO_3^-	26	25	*	26
PO_4^{-2}	51	50	<42%	50
SO_4^{-2}	6.3	5.9	<42%	6.3
Alkalinity				
CO_3^{-2} (mol)	0.05	0.05	*	0.05
OH^- (mol)	0.01	0.01	*	0.01
pH (units)	11.7	11.7	NA	11.7
Radiochemical screening (L=Bq/mL, S=Bq/g)				
Gross alpha	3.6E+01	4.9E+01	3.7E+05	3.8E+01
Gross beta	2.8E+05	3.1E+05	3.6E+07	3.1E+05
Beta/gamma emitters (L=Bq/mL, S=Bq/g)				
^{137}Cs	3.0E+05	3.0E+05	4.5E+05	3.0E+05
^{14}C	*	*	5.1E+02	*
^{152}Eu	*	*	5.2E+04	*
^{154}Eu	*	*	4.4E+04	*
^{155}Eu	*	*	7.0E+03	*
^{3}H	1.1E+02	1.1E+02	2.8E+01	1.1E+02
^{60}Co	6.4E+01	5.2E+01	6.0E+04	5.2E+01

Table 2.11.1 (continued)

Parameter	L44	L45	S46	L111
^{90}Sr	1.2E+03	1.4E+03	2.2E+07	1.4E+03
Alpha emitters (L=Bq/mL, S=Bq/g)				
^{233}U	2.2E+01	2.9E+01	7.1E+03	2.3E+01
^{238}Pu	*	*	2.2E+04	*
^{238}Th/^{232}Th	*	*	5.8E+02	*
^{238}U	*	*	*	*
^{239}Pu	*	*	4.6E+03	*
^{241}Am	*	*	8.2E+03	*
^{244}Cm	*	*	2.1E+05	*

Table 2.11.2. Organic analytical data hits for tank T-4

Parameter	L44	L45	S46	L111
DAI-GC analysis (L=Φg/L, S=Φg/kg)				
Acetone	7,000	8,000		7,000
Ethyl alcohol	37,000	37,000		37,000
I-Propyl alcohol	3,000	3,000		3,000
Methyl alcohol	46,000	27,000		42,000
N-Butyl	3,000	6,000		3,000
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)				
2-Hexanone		20		
4-Methyl-2-pentanone	11	10		
Acetone	400 BE	220 BE		72 B
Benzene	7	10		7
Bromodichloromethane	7 B			
Chlorobenzene		4 J		
Chloroform	170 B	160 B		120 B
Ethylbenzene	20	20		5
Methylene chloride	12 B	14 B		12 B
Toluene	78 B	99 B		60 B
Trichloroethene		3 J		
Xylene (total)		170		36
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)				
Di-n-butylphthalate			3,400 J	
Diethylphthalate			2,400 J	

2.12 TANK T-9

2.12.1 Tank Description

Tank T-9 is a 25,000-gal carbon steel tank located in the Melton Valley at the OHF. The underground tank was installed at the site in 1963 to store LLLW for mixing into grout for waste injection by hydrofracture.

2.12.2 Characterization Summary

2.12.2.1 Aqueous liquid

The results for Tank T-9 are shown in Tables 2.12.1 and 2.12.2. Tank T-9 did not contain appreciable concentrations of either volatile or semivolatile organic compounds, except for 17 mg/L of methanol determined by DAI-GC. Sample L47 contained 400 Φg/L of benzoic acid and 200 Φg/L of benzyl alcohol. TBP at 30 mg/L was the main TIC.

2.12.2.2 Sludge

Only phthalates were determined as TCL constituents in the sludge; TBP was determined as a TIC at 2 mg/kg.

Samples from tanks TH-2, TH-3, and W-11 were each processed together.

Table 2.12.1. Analytical data for tank T-9

Parameter	L47	L48
Physical properties and miscellaneous data		
Density (g/mL)	10.34	NA
Depth (inches)	6.5	NA
Suspended solids (mg/mL)	0.7	NA
TDS (mg/mL)	41.5	NA
TOC (L=mg/L, S=mg/kg)	850	7620
TS (L=mg/mL, S=mg/g)	42.2	343
RCRA metals (L=mg/L, S=mg/kg)		
Ag	0.01	0.21
As	<0.8	<2
Ba	0.12	115
Cd	<0.02	7.8
Cr	0.4	(<10)
Hg	3.4	39
Ni	<0.2	390
Pb	<1	(540)
Se	<0.09	(<2)
Tl	<0.09	<2
Process metals (L=mg/L, S=mg/kg)		
Si	9.76	NA
U	852	2930
Anions (L=mg/L, S=mg/kg)		
Cl^-	290	3%
F^-	1.0	<0.7%
NO_3^-	110	*
PO_4^{-2}	<5	*
SO_4^{-2}	37	6.8%
Alkalinity		
CO_3^{-2} (mol)	<0.01	*
HCO_3^- (mol)	0.03	*
pH (units)	9.1	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha (Bq / pCi)	7.0E+02 / 1.89E+04	1.5E+05 / 4.05E+06
Gross beta (Bq / pCi)	3.4E+05 / 9.19E+06	1.6E+07 / 4.32E+08
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs (Bq / pCi)	2.9E+05 / 7.84E+06	4.0E+05 / 1.08E+07
^{14}C (Bq / pCi)	*	2.2E+03 / 5.95E+04
^{152}Eu (Bq / pCi)	*	3.5E+04 / 9.46E+05
^{154}Eu (Bq / pCi)	*	8.9E+03 / 2.41E+05
^{3}H (Bq / pCi)	1.6E+02 / 4.32E+03	3.4E+01 / 9.19E+02
^{60}Co (Bq / pCi)	6.0E-03 / 1.62E-1	4.3E+04 / 1.16E+06
^{90}Sr (Bq / pCi)	3.6E+04 / 9.73E+05	1.4E+07 / 3.78E+08

Table 2.12.1 (continued)

Parameter	L47	L48
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{233}U	6.6E+02	4.4E+03
^{238}Pu	*	1.0E+04
^{239}Pu	*	4.3E+03
^{244}Cm	*	9.7E+04
^{252}Cf	*	<2

Table 2.12.2. Organic analytical data hits for tank T-9

Parameter	L47	S48
DAI-GC analysis (L=Φg/L, S=Φg/kg)		
Methyl alcohol	17,000	
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
1,1-Dichloroethene	2 J	
Acetone	23 B	
Benzene	11	
Carbon disulfide	4 J	
Chlorobenzene	6	
Chloroform	13 B	
Methylene chloride	600 BE	
Toluene	19 B	
Trichloroethene	5 J	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)		
Benzoic acid	340 J	
Benzyl alcohol	160 J	
Di-n-butylphthalate		3,700 J
Diethylphthalate		3,000 J

2.13 TANK TH-1

2.13.1 Tank Description

Tank TH-1 is a 2500-gal stainless steel tank located in the Bethel Valley central laboratory area south of Building 3503. The underground tank was installed in 1948 and received waste from the thorium pilot plant project in Building 3503.

2.13.2 Characterization Summary

2.13.2.1 Aqueous liquid

The results for Tank TH-1 are shown in Tables 2.13.1 and 2.13.2. The samples from this tank were not significantly different from the blank. The TOC was among the lowest determined. None of the SVOA extracts was submitted for GC-MS because the GC screening did not reveal any constituents different from the blank. A precipitate was formed when sodium hydroxide was added to sample L50, and it was difficult to increase the pH above 10 even when concentrated sodium hydroxide solution was employed.

Table 2.13.1. Analytical data for tank TH-1

Parameter	L49	L50
Physical properties and miscellaneous data		
Density (g/mL)	1.034	1.034
Depth (inches)	4	10
Suspended solids (mg/mL)	<0.1	<0.1
TDS (mg/mL)	44.4	43.6
TOC (L=mg/L, S=mg/kg)	26.0	22.0
TS (L=mg/mL, S=mg/g)	41.3	35.5
RCRA metals (L=mg/L, S=mg/kg)		
Ag	0.003	0.005
As	<4	<4
Ba	<0.2	0.23
Cd	<0.2	<0.2
Cr	1.2	1.4
Hg	16	16
Ni	1.5	1.7
Pb	<2	2.2
Se	<0.09	<0.09
Tl	<0.09	<0.09
Process metals (L=mg/L, S=mg/kg)		
Si	35.3	38.3
U	0.5	0.4
Anions (L=mg/L, S=mg/kg)		
Cl^-	<1	<1
Cn	<0.04	<0.10
F^-	<1	<1
NO_3^-	1,400	1,300
PO_4^{-2}	<250	<250
SO_4^{-2}	<250	<250
Alkalinity		
H+ (mol)	0.41	0.40
pH (units)	1.8	1.8
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	3.9E+02	4.2E+02
Gross beta	3.2E+04	3.9E+04
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs	9.0E+03	9.1E+03
^{14}C	5.0E-01	5.0E-01
^{3}H	5.0E+00	4.9E+00
^{60}Co	<20	<20
^{90}Sr	1.0E+04	1.0E+04
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{233}U	7.5E+01	8.8E+01
^{238}Pu	<6	<5
$^{238}Th/^{232}Th$	4.0E+01	5.1E+01
^{239}Pu	<3	<3
^{244}Cm	<2	<2
^{252}Cf	<5	<4

Table 2.13.2. Organic analytical data hits for tank TH-1

Parameter	L49	L50
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
Acetone	18 B	15 B
Methylene chloride	6 B	6 B
Toluene	44 B	45 B

2.14 TANK TH-2

2.14.1 Tank Description

Tank TH-2 is a 2400-gal stainless steel tank located in the Bethel Valley central laboratory area south of Building 3503. The underground tank was installed in 1952 and received waste from the thorium pilot plant project in Building 3503.

2.14.2 Characterization Summary

The results for this tank are shown in Tables 2.14.1 and 2.14.2.

2.14.2.1 Aqueous liquid

Two aqueous liquid samples, L131 and L132, were taken from tank TH-2. No sludge or organic layers were found. No TCL constituents were measured above the reporting limits (5–10 Φ/L) except for toluene (6 Φg/L in both samples). The toluene was also found in the blank (5 Φg/L); thus, it cannot be attributed to the tank contents. The main TICs were iodomethane and trichloroflouromethane, but they also were found in the blank; thus, they cannot be positively ascribed to the tank contents. Only in L132 were the TICs more concentrated (230 and 190 Φg/L respectively) than in the blank (44 and 29 Φg/L respectively). The very low results for the VOAs are consistent with the very low TOC content of 13.6 mg/L for L131 and 7.8 mg/L for L132.

Surrogate standard and matrix spike recoveries were generally good. One sample apparently had been double spiked with the surrogate standard. After correction for this mistake, the recoveries were very good. The matrix spike was omitted from the matrix spike duplicate sample, but the recoveries of the first matrix spike were very good. The blank was clean.

No compounds were detected in the major VOA compounds analysis. Matrix spike recoveries were very good, and the blank was clean.

No TCL constituents measured above the reporting limits (250–1300 Φg/L) in either sample in the SVOA, although 52 Φg/L of 2-chlorophenol was estimated in sample L132. Neither sample had TICs. The surrogate standard and matrix spike recoveries all were very good, and the blank was clean.

Table 2.14.1. Analytical data for tank TH-2

Parameter	L131	L132
Physical properties and miscellaneous data		
Density (g/mL)	0.9989	1.0002
IC (mg/L)	<0.1	0.2
TC (mg/L)	13.6	8.0
TDS (mg/mL)	4.9	5.0
TOC (L=mg/L, S=mg/kg)	13.6	7.8
TS (L=mg/mL, S=mg/g)	5.1	5.3
RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.2	<0.2
As	<2	<2
Ba	<0.1	<0.1
Cd	0.083	<0.08
Cr	0.80	0.68
Hg	2.8	2.7
Ni	0.58	0.43
Pb	1.9	2.1
Se	<1	<1
Tl	<0.5	<0.5
Process metals (L=mg/L, S=mg/kg)		
B	<0.7	<0.7
Si	<1	<1
Th	1.68	1.71
U	<8	<8
Anions (L=mg/L, S=mg/kg)		
Br^-	1510	1510
Cl^-	18	18
Cy^-	0.28	0.22
F^-	17	17
NO_3^-	<10	<10
PO_4^{-2}	<10	<10
S_2	<0.1	<0.1
SO_4^{-2}	26	26
Alkalinity		
H+ (mol)	0.056	0.056
pH (units)	244 (212)	2.46
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha (Bq / pCi)	87.6 (58) / 2.37E+03	84.5 (52) / 2.28E+03
Gross beta (Bq / pCi)	9280 (8690) / 2.51E+05	9450 (8730) / 2.55E+05
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs (Bq / pCi)	2710 (2730) / 7.32E+04	2740 (2640) / 741E.04
^{14}C (Bq / pCi)	2350 / 6.35E+04	<1 / <2.70E+01
^{3}H (Bq / pCi)	2.34 / 6.32E+01	2.39 / 6.46E+01
^{60}Co (Bq / pCi)	4 (3.6) / 108E+02	<3 (2.2) / <8.11E+01
^{90}Sr (Bq / pCi)	2820 (2780) / 7.62E+04	2920 (2720) / 7.89E+04

Table 2.14.1 (continued)

Parameter	L131	L132
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{232}U (Bq / pCi)	ND	5 / 1.35E+02
^{233}U (Bq / pCi)	15 / 4.05E+02	17 / 4.59E+02
^{238}Pu (Bq / pCi)	ND	ND
^{239}Pu/^{240}Pu (Bq / pCi)	ND	ND
^{241}Am (Bq / pCi)	ND	ND
^{244}Cm (Bq / pCi)	ND	

Table 2.14.2. Organic analytical data hits for tank TH-2

Parameter	L131 (Φg/L)	L132 (Φg/L)
Volatile organic compound analysis		
Toluene	6	6
Volatile organic compound analysis TICs (µg/L)		
Iodomethane	40	230
Trichlorofluoromethane	25	0.90
Semivolatile compound analysis		
2-Chlorophenol		52

2.15 TANK TH-3

2.15.1 Tank Description

Tank TH-3 is a 3300-gal stainless steel tank located in the Bethel Valley central laboratory area south of Building 3503. The underground tank was installed in 1952 and received waste from the thorium pilot plant project in Building 3503.

2.15.2 Characterization Summary

The results for this tank are shown in Tables 2.15.1 and 2.15.2.

2.15.2.1 Aqueous liquid

These samples were very similar to those drawn from tank TH-1. The lack of significant levels of organic compounds is reflected by the low TOC values, viz., 6.1, 5.1, and 0.8 mg/L for L52, L53, and L113, respectively. A precipitate formed during the basic pH adjustment of L53, and achieving pH > 10 for the base/neutral extraction was difficult.

The absence of detectable compounds in L113, a blank submitted blind as a regular sample, is a good check of the entire handling, preparation, and analytical procedures for contamination. The toluene VOA matrix spike was not recovered, but the perdeuterated toluene surrogate standard was recovered well.

Table 2.15.1. Analytical data for tank TH-3

Parameter	L52	L53	L113
Physical properties and miscellaneous data			
Density (g/mL)	1.015	1.015	1000
Depth (inches)	2.5	5	NA
Suspended solids (mg/mL)	<0.1	<0.1	0.1
TDS (mg/mL)	18.0	18.6	<0.1
TOC (mg/L)	6.1	5.1	0.8
TS (mg/mL)	15.1	15.6	0.1
RCRA metals (L=mg/L, S=mg/kg)			
Ag	<0.002	<0.01	<0.002
As	<2.1	<2.1	<02
Ba	0.89	0.86	<0.1
Cd	<0.08	<0.08	<0.08
Cr	202	2.2	<0.1
Hg	11	9	<0.01
Ni	2.6	2.5	<0.2
Pb	1.9	2.2	<1.4
Se	<0.09	<0.5	<0.09
Tl	<0.09	<0.5	<0.09
Process metals (L=mg/L, S=mg/kg)			
Si	15.7	18.2	3.23
U	<0.1	<0.1	<0.1
Anions (L=mg/L, S=mg/kg)			
Cl^-	<1	<1	<1
Cn	<0.04	<0.04	<0.05
F^-	<1	<1	<1
NO_3^-	510	500	<5
PO_4^{-2}	<50	<50	<5
SO_4^{-2}	<50	<50	<5
Alkalinity			
H+ (mol)	0.17	0.18	*
pH (units)	1.8	1.8	6.6
Radiochemical screening (L=Bq/mL, S=Bq/g)			
Gross alpha	1.5E+02	1.4E+02	<1
Gross beta	3.2E+04	3.0E+04	<20
Beta/gamma emitters (L=Bq/mL, S=Bq/g)			
^{137}Cs	7.7E+03	8.4E+03	<27
^{14}C	*	*	2.0E-01
^{3}H	2.6E+00	9.4E+00	1.7E-01
^{60}Co	<20	<20	<20
^{90}Sr	8.8E+03	8.7E+03	7.2E-01
Alpha emitters (L=Bq/mL, S=Bq/g)			
^{233}U	2.6E+01	7.1E+01	<1
^{238}Pu	<2	<1	<1
$^{238}Th/^{232}Th$	1.7E+01	1.5E+01	<1
^{239}Pu	<1	<1	<1
^{244}Cm	<1	<1	<1
^{252}Cf	<2	<2	*

Table 2.15.2. Organic analytical data hits for tank TH-3

Parameter	L52	L53	L113
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)			
Acetone	16 B	14 B	45 B
Chlorobenzene			2 J
Methylene chloride	8 B	6 B	4 JB
Toluene	7 B	65 B	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)			
Bis(2-ethylhexyl)phthalate		79 J	

2.16 TANK TH-4

2.16.1 Tank Description

Tank TH-4 is a 14,000-gal Gunite tank located in the Bethel Valley central laboratory area south of Building 3503. The underground tank was installed in 1952 and received waste from the thorium and uranium pilot plant development projects in Building 3550.

2.16.2 Characterization Summary

Results for this tank are shown in Tables 2.16.1 and 2.16.2.

2.16.2.1 Aqueous liquid

The aqueous samples from tank TH-4 were processed together. There was an insufficient amount of sample L117 for the SVOA extractions, so this sample received only the DAI-GC and VOA characterization.

The DAI-GC analysis indicated that the aqueous liquids contained methanol, acetone, 2-butanone, and 4-methyl-2-pentanone at high concentrations. VOA confirmed the presence of acetone, 4-methyl-2-butanone, and benzene; did not confirm the presence of 4-methyl-2-pentanone; and did not detect methanol. The lower quantitative results for acetone and 4-methyl-2-pentanone are probably because of the reduced purging efficiency of these species when present at milligram-per-liter levels.

Among the volatile TICs was di-isopropylether at 20 Φg/L, 1000 Φg/L, 1000 Φg/L, and 50 Φg/L for L55, L56, L57, and L117, respectively.

Except for three two-ring and three-ring PAHs in L56, no semivolatile TCL organics were detected in the aqueous liquid samples. The major TIC was TBP, at 20 and 30 mg/L in L56 and L57, respectively.

2.16.2.2 Sludges

PAHs were found at milligram-per-kilogram concentrations in the sludges. TBP also was found as a TIC at 2 mg/kg in both sludges.

The sludges were hard to dry, even with an approximately fourfold-mass excess of sodium sulfate. However, the surrogate standard recoveries were good, except for nitrobenzene, which was usually recovered poorly, possibly because of evaporative loses during solvent concentration by nitrogen blowdown.

Except for the sludges, the samples for tanks W-5, W-6, and W-7 were each processed as a group.

Table 2.16.1. Analytical data for tank TH-4

Parameter	L55	L56	L57	S58	S59	L116	L117
Physical properties and miscellaneous data							
Density (g/mL)	1.003	1.056	1.083	NA	NA	1.000	1.007
Depth (inches)	4	39	72	NA	NA	0	6
Suspended solids (mg/mL)	0.1	<0.1	0.3	NA	NA	<0.1	0.1
TDS (mg/mL)	1.4	70.6	103.8	NA	NA	<0.1	0.5
TOC (L=mg/L, S=mg/kg)	19.4	352	2,170	6,940	7,530	14.06	31.6
TS (L=mg/mL, S=mg/g)	1.5	70.6	104.1	256	405	<0.1	0.6
RCRA metals (L=mg/L, S=mg/kg)							
Ag	<0.002	<0.002	<0.005	0.068	0.15	<0.002	*
As	<2	<4	<10	(4.6)	(2.1)	<2	<5
Ba	<0.02	<0.2	<0.6	5.6	(12)	<0.02	<0.3
Cd	<0.06	<0.2	<0.5	<0.3	0.37	<0.06	<0.2
Cr	<0.1	1.6	5.6	(72)	(290)	<0.1	<0.4
Hg	<0.01	0.25	0.04	3.6	4.9	<0.01	<0.05
Ni	<0.1	<1	<3	16	20	<0.1	<0.5
Pb	<2	<2	<5	38	99	<2	<4
Se	<0.1	<0.1	<0.2	(<0.4)	(<0.2)	<0.1	<3
Tl	<0.09	<0.09	<0.2	<0.4	<0.2	<0.09	<4
Process metals (L=mg/L, S=mg/kg)							
Si	0.95	3.3	2.66	NA	NA	0.57	1.52
U	15.3	7,230	16,700	4,530	2,590	0.84	24
Anions (L=mg/L, S=mg/kg)							
Cl^-	8.2	140	160	<0.4%	370	1.7	6.9
CN^-	<0.07	*	*	*	0.16	<0.05	91
F^-	2.0	86	80	<0.4%	960	1.3	5.7
NO_3^-	1,300	25,000	31,000	*	*	49	1.0
PO_4^{-2}	<50	<2,500	<2,500	*	*	6.6	550
SO_4^{-2}	140	83,000	14,000	4.8%	0.47%	17	<50
Alkalinity							
CO_3^{-2} (mol)	<0.01	<0.01	0.02	*	*	<0.01	*
H+ (mol)	*	*	*	*	*	*	<0.02
HCO_3^- (mol)	*	*	*	*	*	*	<0.01
OH^- (mol)	<0.01	<0.02	0.02	*	*	<0.02	*
pH (units)	6.9	7.1	7.8	NA	NA	7.1	6.9
Radiochemical screening (L=Bq/mL, S=Bq/g)							
Gross alpha (Bq / pCi)	<20 / 5.41E+02	1.1E+02 / 2.97E+03	1.6E+02 / 4.32E+03	1.7E+03 / 4.59E+04	2.9E+03 / 7.84E+04	<20 / <5.41E+02	<20 / <5.41E+02
Gross beta (Bq /pCi)	<10 / <2.70E+02	3.7E+02 / 1.00E+04	7.0E+02 / 1.89E+04	7.0E+03 / 1.89E+05	9.9E+03 / 2.68E+05	<20 / <5.41E+02	<20 / <5.41E+02
Beta/gamma emitters (L=Bq/mL, S=Bq/g)							
^{137}Cs (Bq /pCi)	7.4E+00 / 2.00E+02	1.8E+02 / 4.86E+03	2.4E+02 / 6.49E+03	3.9E+02 / 1.05E+04	4.2E+02 / 1.14E+04	5.4E-01 / 1.46E+01	3.6E+00 / 9.73E+01
^{14}C (Bq /pCi)	5.0E-03 / 1.35E-1	*	*	*	*	*	*
^{3}H (Bq /pCi)	3.0E-02 / 8.11E-1	5.0E-02 / 1.35	*	1.3E+01 / 3.51E+02	2.2E+01 / 5.95E+02	3.0E-03 / 8.11E-02	*
^{60}Co (Bq /pCi)	<20 / <5.41E+02	2.2E-01 / 5.95	3.7E-01 / 1.00E+01	3.0E+00 / 8.11E+01	4.5E+00 / 1.22E+02	<20 / <5.41E+02	<20 / <5.41E+02
^{90}Sr (Bq /pCi)	1.4E-01 / 3.78	2.5E+01 / 6.76E+02	2.0E+01 / 5.41E+02	1.9E+03 / 5.14E+04	2.2E+03 / 5.95E+04	3.0E-02 / 8.11E-01	4.6E-01 / 1.24E+01

Table 2.16.1 (continued)

Parameter	L55	L56	L57	S58	S59	L116	L117
			Alpha emitters (L=Bq/mL, S=Bq/g)				
^{233}U (Bq /pCi)	<0.2 / <5.41	<0.3 / <8.11	<0.4 / 1.08E+01	<25 / <6.76E+02	1.2E+03 / 3.24E+04	<0.2 / <5.41	<0.2 / <5.41
^{238}Pu (Bq /pCi)	<0.2 / <5.41	<0.3 / <8.11	<0.4 / 1.08E+01	<180 / 4.86E+03	<2 / <5.41	<0.2 / <5.41	<0.2 / <5.41
^{238}Th/^{232}Th (Bq /pCi)	*	*	*	1.9E+02 / 5.14E+03	4.4E+02	1.3E-01 / 3.51	1.3E-01 / 3.51
^{239}Pu (Bq /pCi)	<0.2 / <5.41	<0.3 / <8.11	<0.4 / 1.08E+01	4.2E+01 / 1.14E+03	1.3E+02 / 3.51E+03	<0.2 / <5.41	<0.2 / <5.41
^{244}Cm (Bq /pCi)	<0.2 / <5.41	<0.3 / <8.11	<0.4 / 1.08E+01	<55 / 1.49E+03	<124 / 3.35E+03	<0.2 / <5.41	<0.2 / <5.41
^{252}Cf (Bq /pCi)	<0.2 / <5.41	<0.3 / <8.11	<0.4 / 1.08E+01	<239 / 6.46E+03	<310 / 8.38E+03	<0.2 / <5.41	<0.2 / <5.41

Table 2.16.2. Organic analytical data hits for tank TH-4

Parameter	L55	L56	L57	L57B	S58	S59	L116	L117
DAI-GC analysis (L=Φg/L, S=Φg/kg)								
Acetone		22,000						
Methyl I-butyl ketone		15,000						
Methyl alcohol	13,000	27,000	12,000					20,000
Methyl ethyl ketone		2,000						
N-Butyl alcohol		20,000						
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)								
2-Butanone		85					298 B	9 B
4-Methyl-2-pentanone		2,682 BE	397 BE	179 B			150 B	16 B
Acetone	22 B	630 BE	71 B	54 B				
Benzene	3	149	115	118			10	21
Carbon tetrachloride		11						
Chlorobenzene							8	4
Chloroform	5	11	7	5				210 B
Methylene chloride	8 B	8 B	7 B	6 B			6 B	79 B
Toluene	4 B	18 B	21 B	23 B			13 B	
Trichloroethene							5	
Xylene (total)			10	22				
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)								
Acenaphthene		42 J			4,600 J	6,700		
Anthracene					2,600			
Benzo(a)anthracene					6,300	5,800		
Benzo(a)pyrene					4,300 J			
Benzo(b)fluoranthene					5,600	8,100		
Benzo(g,h,i)perylene					3,400 J			
Bis(2-ethylhexyl)phthalate					20,000	26,000		
Chrysene					6,800	6,200		
Di-n-butylphthalate					17,000	13,000		
Dibenzofuran						4,100 J		
Fluoranthene					23,000	20,000		
Fluorene					2,800 J	3,700 J		
Indeno(1,2,3-cd)pyrene					3,600 J			
Naphthalene		110 J			8,400	17,000		
Phenanthrene		56 J			26,000	30,000		
Pyrene					18,000	21,000		

2.17 TANK WC-1

2.17.1 Tank Description

Tank WC-1 is a 2150-gal stainless steel tank located in the Isotopes Circle area of the Bethel Valley main laboratory area. The underground tank was installed in 1950 to collect LLLW from isotope production and development.

2.17.2 Characterization Summary

The results from this tank are shown in Tables 2.17.1 and 2.17.2.

2.17.2.1 Aqueous liquid

Two aqueous liquids samples, L124 and L134, were collected from this tank.

Two TCL constituents, methylene chloride and carbon disulfide, were detected in L134 at levels below the reporting limits. Methylene chloride was also detected in the blank at a comparable level. The carbon disulfide was very low (estimated at 3 Φg/L). Two unknown TICs were detected at a total of 44 Φg/L in L134. These results are consistent with the low TOC found in these samples (35 mg/L for L124 and 38 mg/L for L134).

The recoveries of both the surrogate standards and the matrix spike were very low (<14%) for these samples. The most likely cause is leakage in the new purge-and-trap apparatus used in the glove box. These samples will be rechecked after the apparatus is leak-checked and its performance is verified with the control samples.

No volatile organic compounds were detected in these samples. Matrix spikes were good, and the blanks were clean. These results support VOA findings.

No TCL constituents were found in either sample. Thirteen TICs totaled 13,000 Φg/L in sample L134. Surrogate standard recoveries were good (but tribromophenol was above quality control limits for water), and matrix spike recoveries were good except for phenol, 2-chlorophenol, 1,4-dichlorobenzene, and 1,2,4-trichlorobenzene in the matrix spike duplicate. The blank was clean.

Table 2.17.1. Analytical data for tank WC-1

Parameter	L124	L134	L134S
	Physical properties and miscellaneous data		
Density (g/mL)	0.9750	0.9760	NA
IC (L=mg/L, S=mg/kg)	32	23	560
TC (L=mg/L, S=mg/kg)	67	61	9930
TDS (mg/mL)	<1	<1	NA
TOC (L=mg/L, S=mg/kg)	35	38	9370
TS (L=mg/mL, S=mg/g)	<1	<1	NA
	RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.04	0.33	<40
As	1.3	2.0	<300
Ba	<0.02	93	927
Cd	<0.02	0.10	4.0
Cr	<0.02	2.9	112
Hg	<2	<2	193
Ni	<0.1	<0.1	10
Pb	<0.2	61	771
Se	2.4	<0.02	<20
Tl	<0.1	<0.1	<90
	Process metals (L=mg/L, S=mg/kg)		
B	<0.04	<0.04	<40
Si	10	90	NA
Th	<0.3	<0.3	<200
U	<2	<2	<100
	Anions (L=mg/L, S=mg/kg)		
Br^-	<10	<10	<495
Cl^-	113	114	220
Cy^-	<0.05	<0.05	0.33
F^-	0.60	0.70	75
NO_3^-	<10	<10	3,680
PO_4^{-2}	<10	<10	<99
S_2	<0.1	1.4	0.99
SO_4^{-2}	196	204	449
	Alkalinity		
pH (units)	8.25 (6.50)	7.46 (6.39)	NA
	Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	5 (<50)	286 (1,560)	8.07E+04 (8.62E+04)
Gross beta	64,200 (68,600)	73,000 (110,000)	1.09E+06 (1.36E+05)
	Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs (Bq / pCi)	59,200 (58,000) / 1.6E+06	61,700 (56,500) / 1.67E+06	2.69E+05 (7.27E+06) / 2.73E+05
^{14}C (Bq / pCi)	276 / 7.46E+03	375 / 1.01E+04	1.88E+04 / 5.08E+05
^{152}Eu (Bq / pCi)	<30 / <8.11E+02	<30 / <8.11E+02	<2.68E+02 (<1.86E+03) / <7.24E+03
^{154}Eu (Bq / pCi)	<30 / <8.11E+02	<30 / <8.11E+02	4.12E+03 (4.66E+03) / 1.11E+05
^{155}Eu (Bq / pCi)	<150 / <4.05E+03	<150 / <4.05E+03	3.16E+03 (4.12E+03) / 8.54E+04
^{241}Am (Bq / pCi)	<300 / <8.11E+03	131 (<300) / 3.54E+03	1.57E+04 (1.73E+04) / 4.24E+05
^{3}H (Bq / pCi)	1,600 / 4.32E+04	1,590 / 4.30E+04	4.30E+02 / 1.16E+04
^{60}Co (Bq / pCi)	767 (852) / 2.07E+04	432 (594) / 1.17E+04	1.30+05 (1.29E+05) / 3.51E+06
^{90}Sr (Bq / pCi)	1,290 (1,270) / 3.49E+04	1,420 (3,310) / 3.84	3.03E+05 (4.03E+05) / 8.19E+06

Table 2.17.1 (continued)

Parameter	L124	L134	L134S
		Alpha emitters (L=Bq/mL, S=Bq/g)	
^{232}U (Bq / pCi)	ND	ND	ND
^{233}U (Bq / pCi)	ND	ND	ND
^{238}Pu (Bq / pCi)	ND	1,110 / 3.00E+04	4.06E+04 / 1.10E+06
^{239}Pu/^{240}Pu (Bq / pCi)	ND	ND	ND
^{241}Am (Bq / pCi)	ND	200 / 5.41E+03	3.48E+04 / 9.41E+05
^{244}Cm (Bq / pCi)	ND	251 / 6.78E+03	1.08E+04 / 2.92E+05

Table 2.17.2. Organic analytical data hits for tank WC-1

Parameter	L124	L134
	Volatile organic compound analysis (L=Φg/L, S=Φg/kg)	
Carbon disulfide		3
Chloroform		1
Methylene chloride	240	160
	Volatile organic compound analysis TICs (No. of TICs) (Φg/L)	
Unknown TICs[a]		44 (2)
	Semivolatile compound analysis (L=Φg/L, S=Φg/kg)	
Butylbenzylphthalate		190 J[b]
	Semivolatile organic compound analysis TICs (No. of TICs) (Φg/L)	
Unknown TICs[a]		13,110 (13)

[a] Result is the sum of the tentatively identified compounds (TICs). The number of TICs is shown in parentheses.
[b] Inadvertently omitted from the original analysis report, ORNL/ER-19.

2.18 TANK WC-15

2.18.1 Tank Description

Tank WC-15 is a 1000-gal stainless steel tank located in the Building 4500 area of the Bethel Valley main laboratory area. The underground tank was installed in 1951 to collect LLLW from the Building 4500 research laboratories.

2.18.2 Characterization Summary

The results for this tank are shown in Tables 2.18.1 and 2.18.2.

2.18.2.1 Aqueous liquid

The samples from this tank consisted of three aqueous liquids (L126, L127, L128) and a thin oil layer (O130) that appeared much like 90-weight oil. These samples had very low levels of radioactivity. Because of the low radioactivity of these samples, the aqueous liquids were not prepared offline by remote purge-and-trap in a glove box, but rather they were prepared by direct purge-and-trap GC-MS. TCL constituents measured included traces of methylene chloride and 1,1,1-trichloroethane (also found in the blank) and traces of 1,2-dichloroethene (14–15 Φg/L). Carbon disulfide in L128 (estimated at 1 Φg/L) was essentially insignificant. All three samples contained the TIC ethyl ether (−15–17 Φg/L), and L128 also exhibited two unknown TICs totaling 9 Φg/L. These very low concentrations of volatile organic compounds are consistent with the low TOC determinations of 21 mg/L, 19 mg/L, and 24 mg/L for L126, L127, and L128, respectively. Surrogate standard recoveries were all within quality control limits, but the holding time for groundwater samples exceeded the time allowed by 7 d.

The oil sample did not contain TCL compounds or TICs detectable by the VOA; this indicates that it is a relatively heavy oil devoid of volatile organic matter. It apparently does not have an appreciable solubility in the aqueous layer.

No major volatile organic compounds were detected in the aqueous samples. Major VOA is not appropriate for the oil layer, and that sample was not analyzed. Matrix spike recoveries were good, and the blank was clean.

SVOA did not reveal any TCL constituents or TICs for the aqueous samples. The oil layer did have one TCL, di-n-butylphthalate, at 1900 Φg/L. The essentially hydrocarbon nature of the oil is suggested by the 15 unknown hydrocarbon TICs totaling −189,000 Φg/kg, the 3 unknown TICs totaling −39,000 Φg/kg, and the 2 TICs apparently consisting of brominated benzene derivatives (possibly bromodiethyl benzenes), all of which added up to −14,000 Φg/kg. The sum of the TCL constituents and the TICs is −243,800 Φg/kg (−0.02 wt %). The bulk of the GC-MS profile was a large unresolved hump (typical of heavy oil).

The surrogate standard and matrix spike recoveries were all good except for the slightly low 2-fluorobiphenyl in L-127 and the lack of recovery of 4-nitrophenol in both the matrix spike and matrix spike duplicate. The blank was clean.

Table 2.18.1. Analytical data for tank WC-15

Parameter	L126	L127	L128	O130
Physical properties and miscellaneous data				
Density (g/mL)	0.950	0.9610	0.9620	0.9570
IC (mg/L)	98	99	102	100
TC (mg/L)	119	118	126	435
TDS (mg/mL)	<1	<1	<1	<1
TOC (mg/L)	21	19	24	335
TS (mg/mL)	<1	<1	<1	<1
RCRA metals (L=mg/L, S=mg/kg)				
Ag	<1	0.22	0.16	<1.0
As	<8	<8	<8	<8
Ba	0.10	0.03	0.08	0.05
Cd	<0.5	<0.5	<0.5	<0.5
Cr	<0.5	<0.5	0.3	<0.5
Hg	<2	<2	<2	<2
Ni	0.11	<2	0.11	0.16
Pb	<5	<5	<5	<5
Se	0.58	0.05	0.3	<0.5
Tl	<2	<2	<2	<2
Process metals (L=mg/L, S=mg/kg)				
B	<1	<1	<1	<1
Si	5.2	<2	<2	<2
Th	<7	<7	<7	<7
U	1.4	3.7	<50	2.4
Anions (L=mg/L, S=mg/kg)				
Br^-	<10	<10	<10	<10
Cl^-	89	87	89	85
Cy^-	<0.005	<0.05	<0.05	<0.05
F^-	1.2	1.2	1.2	1.2
NO_3^-	<10	<10	<10	<10
PO_4^{-2}	<10	<10	<10	<10
S_2	<0.01	<0.01	0.2	1.3
SO_4^{-2}	50	50	38	41
Alkalinity				
pH (units)	8.8 (8.52)	8.7 (8.50)	707 (8.53)	6.5 (8.39)
Radiochemical screening (L=Bq/mL, S=Bq/g)				
Gross alpha	0.89 (<1)	0.13 (<1)	0.43 (<1)	0.56 (<1)
Gross beta	11.7 (<10)	10.3 (<10)	14.6 (<10)	15.4 (<10)
Beta/gamma emitters (L=Bq/mL, S=Bq/g)				
^{137}Cs	3.0 (<5)	3.1 (<5)	4.0 (<5)	3.5 (<5)
^{14}C	<1	<1	33	95
^{3}H	18.4	18.6	18.9	18.5
^{60}Co	<0.2	<0.2	<0.2	<0.3
^{90}Sr	1.40 (<10)	1.71 (<10)	1.93 (<10)	3.36(<10)

Table 2.18.2. Organic analytical data hits for tank WC-15

Parameter	L126	L127	L128	O130
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)				
1,1,1-Tricholoroethane	16			
1,2-Dichloroethene (total)	15[a]	15	14	
Carbon disulfide			1	
Chloroform	18			
Methylene chloride				
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)				
Di-n-butylphthalate				1900 J

[a]Did not appear in the RAP data base.

Negative ion, chemical ionization GC-MS was used to examine the oil sample (O-130) for PCBs and polybrominated biphenyls. Neither were detected. However, chlorinated aromatic compounds were detected, and these would explain the response observed in the PCB analysis. Identification of these chlorinated compounds is continuing.

2.19 TANK WC-17

2.19.1 Tank Description

Tank WC-17 is a 1000-gal stainless steel tank located in the Building 4500 area of the Bethel Valley main laboratory area. The underground tank was installed in 1951 to collect LLLW from the Building 4500 research laboratories.

2.19.2 Characterization Summary

The results for this tank are shown in Tables 2.19.1 and 2.19.2.

2.19.2.1 Aqueous liquid

This complex sample set, prepared as a group, consisted of three samples having an organic layer floating on an aqueous liquid, as well as two additional aqueous liquids. The activity of these samples was low enough that both the aqueous and organic layers could be subjected to purge-and-trap GC-MS in the GC-MS laboratory. Small volumes were diluted in water at the time of purge and trap because of the expected high concentrations of volatile organic compounds. There was insufficient sludge S106 for SVOA.

The main compounds identified in the VOA were acetone, benzene, methylene chloride, and xylene. However, considering the high blank levels, only xylene appears to be present in the sample at 50–80 Φg/L. The reason for the high blank level is not known. The lack of detectable organic compounds in the DAI-GC supports the contention that most of the VOA results were blank-related.

In the SVOA, only phthalates were detected at levels similar to those in the blank.

Considering the elevated levels of compounds detected in the VOA blank, only styrene (at 5000–8000 Φg/L) can be confidently identified in the organic layer. Trichloroethylene and vinyl acetate also were found, but in only one of the samples. SVOA detected only phthalates, which appear to be related to the blank. TICs were mostly unknown hydrocarbons, except for 1,1-biphenyl-2-o1 (200 mg/kg in all three organic layers). A low level of PCBs was determined in the organic layers. This appeared to be a mixture of Aroclors 1254 and 1260, with a total concentration of 29–33 mg/kg.

The samples from tanks W-13, W-14, W-15, and W-1A were each processed together.

Table 2.19.1. Analytical data for tank WC-17

Parameter	L103	L104	L105	O101	O102	S106
Physical properties and miscellaneous data						
Density (g/mL)	0.989	1.005	1.004	0.996	0.999	NA
Depth (inches)	6	14	26	0	1	NA
Suspended solids (mg/mL)	0.3	0.1	<0.1	0.3	0.3	NA
TDS (mg/mL)	309	153	0.4	0.3	0.4	NA
TOC (L=mg/L, S=mg/kg)	0.7	0.5	127	191	143	*
TS (L=mg/mL, S=mg/g)			0.3	0.6	0.7	122
RCRA metals (L=mg/L, S=mg/kg)						
Ag	(<0.001)	<0.001	<0.001	<0.001	<0.001	4.5
As	<2	<2	<2	<2	<2	(0.76)
Ba	0.17	0.18	0.14	0.19	0.15	1400
Cd	<0.09	<0.09	<0.09	<0.09	<0.09	79
Cr	<0.1	<0.1	<0.1	<0.1	<0.1	(2000)
Hg	49	0.04	0.005	0.78	0.08	380
Ni	<0.6	<0.6	<0.6	<0.6	<0.6	270
Pb	<1	<1	<1	<1	<1	390
Se	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
Tl	<0.05	<0.05	<0.05	<0.05	<0.05	(<0.5)
Process metals (L=mg/L, S=mg/kg)						
Si	4.51	4.66	7.64	4.7	4.67	NA
U	0.03	0.01	0.01	0.02	0.01	60.4
Anions (L=mg/L, S=mg/kg)						
Cl^-	39	30	31	35	32	<50
CN^-	<0.06	0.06	<0.06	<0.06	0.06	*
F^-	1.0	1.0	<1	<1	<1	<50
NO_3^-	<5	15	16	8.2	13	*
PO_4^{-2}	<5	<5	<5	<5	<5	<300
SO_4^{-2}	89	82	91	99	98	<300
Alkalinity						
HCO_3^- (mol)	<0.01	<0.01	<0.01	<0.01	<0.01	*
pH (units)	7.6	7.6	7.9	7.6	7.6	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)						
Gross alpha (Bq / pCi)	<10 / <2.70E+02	<10 / 2.70E+02	<10 / 2.70E+02	<10 / <2.70E+02	<10 / 2.70E+2	2.7E+03 / 7.30E+04
Gross beta (Bq / pCi)	<20 / <5.41E+02	<20 / 5.41E+02	<20 / 5.41E+02	<20 / 5.41E+02	<20 / 5.41E+02	3.5E+03 /9.46E+04
Beta/gamma emitters (L=Bq/mL, S=Bq/g)						
^{137}Cs (Bq / pCi)	1.3E+00 / 3.51E+01	4.8E-01 / 1.30E+01	9.7E-01 / 2.62E+01	1.2E+00 / 3.24E+01	1.3E-01 / 3.51	1.5E+01 / 1.50E +01
^{154}Eu (Bq / pCi)	*	*	*	*	*	3.3E+00 / 8.92E+01
^{155}EU (Bq / pCi)	*	*	*	*	*	5.6E-01 / 1.51E+01
^{3}H (Bq / pCi)	8.2E-01 / 2.22E+01	1.6E-01 / 4.32	2.7E-01 / 7.30	9.4E-01 / 2.54E+01	4.0E-01 / 1.08E+01	9.1E+01 / 2.46E+03
^{60}Co (Bq / pCi)		*	*	*	*	8.2E-01 / 2.22E+01
^{90}Sr (Bq / pCi)	<1 / 2.70E+01	<1 / 2.70E+01	<1 / 2.70E+01	<1 / 2.70E+01	<1 / 2.70E+01	2.9E+02 / 7.84E+03
Alpha emitters (L=Bq/mL, S=Bq/g)						
^{238}Pu (Bq / pCi)	*	*	*	*	*	4.3E+02 / 1.16E+04
^{238}Th/^{232}Th (Bq / pCi)	*	*	1.6E-02 / 4.32E-1	*	*	*
^{239}Pu (Bq / pCi)	*	*	*	*	*	6.2E+01 / 1.68
^{241}Am (Bq / pCi)	*	*	*	*	*	2.6E+02 / 7.03E+03
^{244}Cm (Bq / pCi)	*	*	*	*	*	1.6E+03 / 1.60E+03
^{252}Cf (Bq/pCi)	*	*	*	*	*	<3 / <8.11E+01

Table 2.19.2. Organic analytical data hits for tank WC-17

Parameter	L103AQ	L103ORG		L104AQ	L105AQ	O102AQ	0102ORG	0101AQ0101ORG
Volatile organic compound analysis (L or O=Φg/L, S=Φg/kg)								
Acetone	170 B	6,400 B	150 B	130 B	140 B	7,400 B	150 B	6,700 B (6,700 B)
Benzene	10 JB	420 JB	10 JB	10 JB	400 JB	7 JB	450 JB	450 JB (410 JB)
Methylene chloride	38 JB	5,300 B	44 JB	40 JB	37 JB	6,600 B	6,500 B	6,500 B (4,000 B)
Styrene		7,500					7,100	7,100 (8,200)
Trichloroethene								920 J
Vinyl acetate								1,200 J
Xylene (total)	50 J	2,500 B	59	50 J	76	2,700 B	465	2,200 JB (2,300 JB)
Semivolatile compound analysis (AQ=Φg/L, ORG=Φg/kg)[a]								
Bis(2-ethylhexyl) phthalate	38 J							
Di-n-butylphthalate	56 JB	68,000 JB				44,000 JB		74,000 JB (57,000 JB)
Di-n-octylphthalate	93 JB		33 JB		24 JB		40 JB	
PCB analysis (AQ=Φg/L, ORG=Φg/kg)[a]								
PCB (Aroclor-1254)		20,000				20,000		18,000 (16,000)
PCB (Aroclor-1260)		13,000				13,000		10,000 (11,000)

[a]Instead of the units being *Φg/L* or *Φg/kg* depending on the sample ID prefix “L” or “S” respectively), the units depend on the sample ID suffix.

2.20 TANK W-1

2.20.1 Tank Description

Tank W-1 is a 4800-gal Gunite tank located in the Bethel Valley North Tank Farm. The underground tank was constructed in 1943 and received LLLW from the Building 3019 Radiochemical Processing Facility.

2.20.2 Characterization Summary

The results from this tank are shown in Tables 2.20.1 and 2.20.2.

2.20.2.1 Aqueous liquid

No significant concentrations of TCL compounds were detected in the samples from this tank. This is consistent with the very low TOC, 6.4 and 10.1 mg/L for L7 and L8, respectively. Two aliquots from L7 underwent VOA. The VOA surrogate standard recoveries were very poor for the A aliquot (10–19%) but were good for the B aliquot. The latter should be considered the more accurate analysis.

Table 2.20.1. Analytical data for tank W-1

Parameter	L7	L8
Physical properties and miscellaneous data		
Density (g/mL)	1.002	1.002
Depth (inches)	4	9
Suspended solids (mg/mL)	<0.1	<0.1
TDS (mg/mL)	0.2	0.2
TOC (mg/L)	6.4	10.1
TS (mg/mL)	0.2	0.2
RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.002	<0.002
As	<2	<2
Ba	0.13	0.11
Cd	<0.04	<0.04
Cr	<0.1	<0.1
Hg	<0.01	<0.01
Ni	<0.6	<0.6
Pb	<1	<1
Se	<0.09	<0.09
Tl	(<0.09)	(<0.09)
Process metals (L=mg/L, S=mg/kg)		
Si	8.38	8.69
U	<0.1	<0.1
Anions (L=mg/L, S=mg/kg)		
Cl^-	13	13
Cn	<0.06	<0.05
F^-	6.1	6.2
NO_3^-	32	32
PO_4^{-2}	<5	<5
SO_4^{-2}	47	47
Alkalinity		
CO_3^{-2} (mol)	<0.01	<0.01
HCO_3^- (mol)	<0.01	<0.01
pH (units)	7.9	8.0
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	<3	<3
Gross beta	8.7E+02	8.7E+02
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs	1.8E+01	1.8E+01
^{3}H	3.9E+00	2.5E+00
^{60}Co	<10	<10

Table 2.20.2. Organic analytical data hits for tank W-1

Parameter	L7	L7B	8
		Volatile organic compound analysis (L=Φg/L, S=Φg/kg)	
Methylene chloride		10 B	11 B
Toluene		5 B	11 B
		Semivolatile compound analysis (L=Φg/L, S=Φg/kg)	
Di-n-butylphthalate	9 J		8 J

2.21 TANK W-1A

2.21.1 Tank Description

Tank W-1A is a 4000-gal stainless steel tank located in the Bethel Valley North Tank Farm. The underground tank was installed in 1951 and received waste from the Radiochemical Processing Facility (Building 3019) and the HRLAL (Buildings 3026 and 3019-B).

2.21.2 Characterization Summary

The results for this tank are shown in Tables 2.21.1 and 2.21.2.

2.21.2.1 Aqueous liquid

The results for this tank were very similar to the results for WC-15, WC-17, and W-1. DAI-GC determined 7 mg/L of methanol, and only very low levels of volatiles were detected by VOA. SVOA determined only a phthalate. TICs included C_4-benzenes (probably diethylbenzenes used in radiochemical extractions) at 5 mg/L and ethylphenylethanone at 3 mg/L.

The samples for tanks T-30 and 7562 were each processed together.

Table 2.21.1. Analytical data for tank W-1A

Parameter	L1
Physical properties and miscellaneous data	
Density (g/mL)	1.002
Depth (inches)	2
Suspended solids (mg/mL)	0.3
TDS (mg/mL)	0.4
TS (L=mg/mL, S=mg/g)	0.7
RCRA metals (L=mg/L, S=mg/kg)	
Ag	0.008
As	<4
Ba	<0.2
Cd	7.3
Cr	0.33
Hg	0.96
Ni	<1
Pb	<2
Se	<0.09
Tl	<0.09
Process metals (L=mg/L, S=mg/kg)	
Si	4.47
U	477
Anions (L=mg/L, S=mg/kg)	
Cl^-	33
Cn	<0.06
F^-	1.0
NO_3^-	<5
PO_4^{-2}	<5
SO_4^{-2}	58.0
Alkalinity	
HCO_3^- (mol)	<0.01
pH (units)	8.8
Radiochemical screening (Bq/mL)	
Gross alpha	1.1E+03
Gross beta	1.3E+03
Beta/gamma emitters (Bq/mL)	
^{134}Cs	4.6E+00
^{137}Cs	1.4E+02
^{3}H	2.6E+00
^{60}Co	4.4E+00
^{90}Sr	3.2E+02
Alpha emitters (Bq/mL)	
^{232}U	2.7E+02
^{233}U	7.3E+02
^{238}Pu	1.9E+01
^{238}U	5.0E+00
^{239}Pu	6.7E+01
^{241}Am	5.4E+01
^{244}Cm	9.0E+00
^{252}Cf	<2

Table 2.21.2. Organic analytical data hits for tank W-1A

Parameter	L1
DAI-GC analysis (L=Φg/L, S=Φg/kg)	
Methyl alcohol	7000
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)	
Acetone	17 B
Benzene	3 JB
Chlorobenzene	3 J
Ethylbenzene	4 J
Methylene chloride	4 JB
Toluene	63 B
Trichloroethene	20 B
Xylene (total)	13
Semivolatile compound analysis (Φg/L)	
Diethylphthalate	24 J

2.22 TANK W-2

2.22.1 Tank Description

Tank W-2 is a 4800-gal Gunite tank located in the Bethel Valley North Tank Farm. The underground tank was constructed in 1943 and received LLLW from the Building 3019 Radiochemical Processing Facility.

2.22.2 Characterization Summary

The results for this tank are shown in Tables 2.22.1 and 2.22.2.

2.22.2.1 Aqueous liquid

Neither sample contained significant levels of TCL constituents. This is consistent with the low TOCs of 18.9 mg/L for L11 and 22.6 mg/L for L118. These samples were collected in series and are useful as field duplicates, within normal sampling errors.

The acidic surrogate standard compounds were very poorly recovered from the aqueous liquids, suggesting that acidic compounds, if present in the samples, may not have been extracted or detected. The two chlorinated phenolic matrix spike compounds were also poorly recovered.

Table 2.22.1. Analytical data for tank W-2

Parameter	L11	L118
Physical properties and miscellaneous data		
Density (g/mL)	1.002	1.003
Depth (inches)	4	4
Suspended solids (mg/mL)	<0.1	0.2
TDS (mg/mL)	0.4	0.3
TOC (mg/L)	18.9	22.6
TS (mg/mL)	0.3	0.5
RCRA metals (mg/L)		
Ag	<0.002	<0.002
As	<2	<2
Ba	0.19	0.14
Cd	<0.04	<0.04
Cr	<0.1	<0.1
Hg	<0.01	<0.01
Ni	<0.5	<0.6
Pb	1.1	<1
Se	<0.09	<0.09
Tl	(<0.09)	(<0.09)
Process metals (mg/L)		
Si	4.94	4.5
U	0.18	0.17
Anions (mg/L)		
Cl^-	7.2	7.6
Cn	<0.05	<0.05
F^-	9.2	9.9
NO_3^-	<5	<5
PO_4^{-2}	<5	<5
SO_4^{-2}	15	15
Alkalinity		
CO_3^{-2} (mol)	<0.01	<0.01
$HC)_3^-$ (mol)	<0.01	<0.01
pH (units)	8.5	8.5
Radiochemical screening (Bq/mL)		
Gross alpha	<3	<3
Gross beta	7.1E+02	7.4E+02
Beta/gamma emitters (Bq/mL)		
^{137}Cs	2.2E+01	2.0E+01
^{3}H	1.5E+00	1.7E+00
^{60}Co	<10	<10

Table 2.22.2. Organic analytical data hits for tank W-2

Parameter	L11	L118
	Volatile organic compound analysis (Φg/L)	
Methylene chloride	10 B	9 B
Toluene		15 B
	Semivolatile compound analysis (Φg/L)	
Di-n-butylphthalate	10 J	

2.23 TANK W-3

2.23.1 Tank Description

Tank W-3 is a 42,500-gal Gunite tank located in the Bethel Valley North Tank Farm. The underground tank was constructed in 1943 and received LLLW from the Building 3019 Radiochemical Processing Facility.

2.23.2 Characterization Summary

The results for this tank are shown in Tables 2.23.1 and 2.23.2.

2.23.2.1 Aqueous liquid

The analytical results for these samples, which were prepared as a group, are listed in Table 2.23. The major organic compound was methanol. DAI-GC also determined mg/L levels of acetone and 2-butanone that were not confirmed by VOA. Very low concentrations of other volatiles were detected by VOA. SVOA determined very low levels of phthalates that were not significantly different from those in the blank. PAHs were also detected in L18, which had a TOC approximately double that of the other two liquids. TBP was estimated at 30 mg/L as a TIC in L16, L17, and L18.

2.23.2.2 Sludge

As in other samples, somewhat higher levels of PAHs and phthalates were measured in the sludge. The latter were not significantly different in concentration from the blank. TBP was estimated at 4 mg/kg as a TIC.

Table 2.23.1. Analytical data for tank W-3

Parameter	L16	L17	L18	S19
Physical properties and miscellaneous data				
Density (g/mL)	1.004	1.006	1.009	NA
Depth (inches)	4	60	106	NA
Suspended solids (mg/mL)	<0.1	<0.1	<0.1	NA
TDS (mg/mL)	2.9	4.6	8.6	NA
TOC (L=mg/L, S=mg/kg)	772	1130	1500	3410
TS (L=mg/mL, S=mg/g)	2.7	4.4	8.4	300
RCRA metals (L=mg/L, S=mg/kg)				
Ag	0.002	0.002	0.002	0.05
As	<4	<4	<4	(<2)
Ba	<0.2	<0.2	<0.2	(6.4)
Cd	<0.2	<0.2	<0.2	0.52
Cr	3.3	6.8	20	1300
Hg	<0.01	0.01	0.02	0.83
Ni	<1	<1	<1	<7
Pb	<2	<2	<2	52
Se	<0.09	0.09	<0.09	(<0.3)
Tl	<0.09	<0.09	<0.09	<0.3
Process metals (L=mg/L, S=mg/kg)				
Si	6.5	5.3	7.2	NA
U	88	163	285	61300
Anions (L=mg/L, S=mg/kg)				
Cl^-	7.8	7.9	10.0	<100
Cn	<0.08	<0.07	0.10	*
F^-	<10	<10	<10	<100
NO_3^-	<50	<50	<50	*
PO_4^{-2}	490	600	800	<500
SO_4^{-2}	280	430	620	<500
Alkalinity				
CO_3^{-2} (mol)	<0.01	0.02	0.05	*
HCO_3^- (mol)	0.03	*	*	*
pH (units)	9.0	10.1	11.1	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)				
Gross alpha	6.0E+00	1.2E+01	1.7E+01	8.4E+03
Gross beta	4.9E+02	6.7E+02	1.2E+03	1.5E+06
Beta/gamma emitters (L=Bq/mL, S=Bq/g)				
^{137}Cs	5.8E+02	8.4E+02	1.3E+03	4.7E+04
^{154}Eu	*	*	*	7.6E+01
^{3}H	6.9E-01	9.4E-01	1.1E+00	2.2E+00
^{60}Co	<10	1.0E-01	2.6E-01	2.4E=01
^{90}Sr	4.0E+01	6.4E=01	9.0E+01	1.5E+05
Alpha emitters (L=Bq/mL, S=Bq/g)				
^{233}U	<5	<5	<5	1.1E+03
^{238}Pu	<5	<5	<5	1.7E+02
^{238}U	*	*	*	4.3E+02
^{239}Pu	<5	<5	<5	3.9E+03
^{241}Am	*	*	*	2.6E+02

Parameter	L16	L17	L18	S19
^{244}Cm	<5	<5	<5	<10
^{252}Cf	<5	<5	<5	<10

Table 2.23.2. Organic analytical data hits for tank W-3

Parameter	L16	L17	L18	S20
DAI-GC analysis (L=Φg/L, S=Φg/kg)				
Acetone			7,000	
Methyl alcohol	38,000	40,000	20,000	
Methyl ethyl ketone			5,000	
N-Butyl alcohol			7,000	
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)				
4-Methyl-2-pentanone			18	
Acetone	2 JB	26 B	5 JB	
Benzene			4 J	
Chlorobenzene			8	
Chloroform		1 J		
Methylene chloride	4 JB	4 JB	3 JB	
Tetrachloroethene	6 B	8 B		
Toluene	5 JB	14 B	37 B	
Trichloroethene	11 B	14 B	11 B	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)				
2-Nitrophenol			53 J	
Bis(2-ethylhexyl)phthalate				23 JB
Chrysene				4 J
Di-n-butylphthalate	60 J	48 J	230 J	47 JB
Di-n-octylphthalate	49 J	80 J		
Fluoranthene			56 J	
Phenanthrene			33 J	12 J
Pyrene			60 J	

2.24 TANK W-4

2.24.1 Tank Description

Tank W-4 is a 42,500-gal Gunite tank located in the Bethel Valley North Tank Farm. The underground tank was constructed in 1943 and received LLLW from the Building 3019 Radiochemical Processing Facility.

2.24.2 Characterization Summary

The results from this tank are shown in Tables 2.24.1 and 2.24.2.

2.24.2.1 Aqueous liquid

Some of the samples from this tank contained elevated levels of organic compounds. Sample L23 contained 4-methyl-2-pentanone (7 mg/L by DAI-GC, 1.1 mg/L by VOA). The VOA was not effective for determining mg/L concentrations of volatile organics, and the DAI-GC result probably is more accurate. Sample L23 also contained 200 Φg/L of naphthalene. These data are consistent with the elevated TOC in L23 (558.5 mg/L) compared to the other liquids (49.5 and 59.9 mg/L for L22 and L119, respectively).

2.24.2.2 Sludge

The two sludges contained PAHs and phthalates at levels of hundreds of milligrams per kilogram. Their SVOA extracts had to be filtered twice because of crystal precipitation. The surrogate standard recoveries of nitrobenzene, 2-fluorophenol, and fleorobiphenyl were low for the soft sludge, but better for the hard sludge. The SVOA extraction for S24 was repeated, using a pH adjustment to obtain base/neutral and acid fractions. Two organic layers separated when the extracts were concentrated to 1 mL. Also, a lump of dark tar was found in the S24 sample and could be a source of the PAHs that were detected previously.

Table 2.24.1. Analytical data for tank W-4

Parameter	H26	L119	L22	L23	S24
		Physical properties and miscellaneous data			
Density (g/mL)	NA	1.014	1.013	1.027	NA
Depth (inches)	NA	30	4	54	NA
Suspended solids (mg/mL)	NA	0.2	0.2	0.5	NA
TDS (mg/mL)	NA	10.1	6.1	27.4	NA
TOC (L=mg/L, S=mg/kg)	9020	59.9	49.5	558.5	9190
TS (L=mg/mL, S=mg/g)	349	10.3	6.3	27.9	307
		RCRA metals (L=mg/L, S=mg/kg)			
Ag	0.06	<0.002	0.003	<0.02	0.08
As	<2	<4	<4	<4	<4
Ba	(5.8)	<0.2	<0.2	<0.2	(11)
Cd	201	0.09	<0.08	0.09	22
Cr	(200)	5	2.8	13.5	(720)
Hg	0.82	<0.01	<0.01	<0.01	2.4
Ni	14	<1	<1	<1	15
Pb	62	<2	<2	<2	(150)
Se	(0.49)	<0.09	<0.09	<0.09	(<0.7)
Tl	<0.4	<0.09	<0.09	<0.09	<0.7
		Process metals (L=mg/L, S=mg/kg)			
Si	NA	2.07	2.55	1.75	NA
U	29.6%	1780	910	3680	33.0%
		Anions (L=mg/L, S=mg/kg)			
Cl^-	<10	<20	<20	<20	<10
Cn	*	<0.04	<0.04	<0.07	*
F^-	<10	<20	<20	<20	<10
NO_3^-	*	1600	1700	2200	*
PO_4^{-2}	<50	<100	<100	250	<50
SO_4^{-2}	<50	930	570	2600	<50
		Alkalinity			
CO_3^{-2} (mol)	*	0.01	<0.01	0.08	*
HCO_3^- (mol)	*	0.04	0.02	0.19	*
pH (units)	NA	10.0	9.1	10.9	NA
		Radiochemical screening (L=Bq/mL, S=Bq/g)			
Gross alpha	6.6E+03	<3	<3	<3	5.9E+03
Gross beta	8.7E+04	2.6E+03	1.6E+03	2.2E+03	3.1E+05
		Beta/gamma emitters (L=Bq/mL, S=Bq/g)			
^{137}Cs	1.3E+04	1.4E+03	8.9E+02	2.1E+03	3.1E+04
^{3}H	3.3E+00	2.0E+03	1.2E+00	2.1E+00	0.0E+00
^{60}Co	*	<10	<10	<13	1.2E+01
^{90}Sr	2.1E+04	*	*	2.9E+02	8.9E+04
		Alpha emitters (L=Bq/mL, S=Bq/g)			
^{233}U	2.7E+03	*	*	*	2.0E+03
^{238}Pu	<7	*	*	*	<6
^{238}U	3.0E+03	*	*	*	2.3E+03
^{239}Pu	2.1E+02	*	*	*	4.4E+02
^{244}Cm	<6	*	*	*	<7

Parameter	H26	L119	L22	L23	S24
^{252}Cf	<7	*	*	*	<6

Table 2.24.2. Organic analytical data hits for tank W-4

Parameter	H26	L22	L23	L119	S24
DAI-GC analysis (L=Φg/L, S=Φg/kg)					
Methyl 1-butyl ketone					
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)					
4-Methyl-2-pentanone			1102	3 J	
Acetone			55		
Benzene			3 J	2 JB	
Methylene chloride		10 B	10 B	10 B	
Toluene		13 B	14 B	46 B	
Trichloroethene			49	14	
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)					
Bis(2-ethylhexyl)phthalate	5700				11,000
Chrysene					69 J
Di-n-butylphthalate	1400	11 J			2,100
Di-n-octylphthalate					51 J
Diethylphthalate					33 J
Fluoranthene	49 J				220 J
Naphthalene			160 J	35 J	
Phenanthrene	110 J				170 J
Pyrene	130 J				170 J

2.25 TANK W-13

2.25.1 Tank Description

Tank W-13 is a 2000-gal stainless steel tank located in the Bethel Valley North Tank Farm. The underground tank was installed in 1945 and received waste from the Radiochemical Processing Facility (Building 3019) and from recovery of fission products.

2.25.2 Characterization Summary

The results from this tank are shown in Tables 2.25.1 and 2.25.2.

2.25.2.1 Aqueous liquid

Very little organic matter was determined in these samples. The main compound measured by DAI-GC was methanol. Toluene was the main TCL species found by the VOA. The VOA surrogate standard recoveries were low for L28, which probably is the reason that the VOA for L27 yielded more hits. The SVOA did not detect any TCL constituents, and the TICs were not significant, except for TBP (90 Φg/L in L27). The SVOA extracts for both samples were not different from the blank, and L28 was not submitted for GC-MS. The TOCs for these samples were low, 41.4 and 39 mg/L for L27 and L28, respectively.

Table 2.25.1. Analytical data for tank W-13

Parameter	L27	L28
Physical properties and miscellaneous data		
Density (g/mL)	1.033	1.033
Depth (inches)	4	18
Suspended solids (mg/mL)	0.6	<0.1
TDS (mg/mL)	34.2	33.9
TOC (L=mg/L, S=mg/kg)	41.4	39.0
TS (L=mg/mL, S=mg/g)	34.8	33.6
RCRA metals (L=mg/L, S=mg/kg)		
Ag	0.003	0.004
As	<4	<4
Ba	0.69	0.7
Cd	0.22	0.3
Cr	2.5	2.7
Hg	31	35
Ni	8.4	8.7
Pb	8.8	8.9
Se	<0.09	<0.09
Tl	<0.09	<0.09
Process metals (L=mg/L, S=mg/kg)		
Si	14.9	14.5
U	18.8	17.4
Anions (L=mg/L, S=mg/kg)		
Cl^-	<3	<3
Cn	<0.05	<0.05
F^-	<3	<3
NO_3^-	43	43
PO_4^{-2}	<13	<13
SO_4^{-2}	<13	<13
Alkalinity		
H^* (mol)	0.26	0.27
pH (units)	3.0	3.0
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	7.4E+02	7.6E+02
Gross beta	1.4E+06	1.3E+06
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs	6.1E+05	5.8E+05
^{154}Eu	1.6E+03	1.5E+03
^{3}H	2.8E+03	2.8E+03
^{60}Co	1.5E+02	1.9E+02
^{90}Sr	5.5E+05	5.9E+05
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{238}Pu	5.5E+02	5.5E+02
$^{238}Th/^{232}Th$	1.2E+02	1.3E+02
^{239}Pu	5.8E+01	6.9E+01
^{244}Cm	<4	<4
^{252}Cf	<4	<4

Table 2.25.2. Organic analytical data hits for tank W-13

Parameter	L27	L28
DAI-GC analysis (L=Φg/L, S=Φg/kg)		
Methyl alcohol	11,000	5,000
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
Acetone	15 B	
Benzene	3 JB	
Chlorobenzene	4 J	
Methylene chloride	24 B	14 B
Styrene	3 J	
Toluene	100 B	

2.26 TANK W-14

2.26.1 Tank Description

Tank W-14 is a 2000-gal stainless steel tank located in the Bethel Valley North Tank Farm. The underground tank was installed in 1945 and received waste from the Radiochemical Processing Facility (Building 3019) and from recovery of fission products.

2.26.2 Characterization Summary

The results for this tank are shown in Tables 2.26.1 and 2.26.2.

2.26.2.1 Aqueous liquid

The results were essentially the same as for W-13 (i.e., methanol was the major compound detected by DAI-GC, very little was measured by VOA, and only a phthalate was found by SVOA). As from W-13, the SVOA extract of only one sample (L30) from W-14 was submitted for GC-MS. TBP was estimated at 200 Φg/L in L30. The TOCs were higher for this tank (121 and 132 mg/L, respectively).

Table 2.26.1. Analytical data for tank W-14

Parameter	L30	L31
Physical properties and miscellaneous data		
Density (g/mL)	1.049	1.052
Depth (inches)	4	14
Suspended solids (mg/mL)	<0.1	1.4
TDS (mg/mL)	29.8	27.7
TOC (L=mg/L, S=mg/kg)	121	132
TS (L=mg/mL, S=mg/g)	27.5	29.1
RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.002	0.008
As	<4	<4
Ba	0.45	0.63
Cd	<0.2	<0.2
Cr	60	64
Hg	0.08	0.18
Ni	50	52
Pb	7.5	7.5
Se	<0.09	<0.09
Tl	<0.09	<0.09
Process metals (L=mg/L, S=mg/kg)		
Si	16.5	16.2
U	0.56	0.56
Anions (L=mg/L, S=mg/kg)		
Cl^-	<3	<3
CN	<0.05	<0.05
F^-	<3	<3
NO_3^-	70	70
PO_4^{-2}	<13	<13
SO_4^{-2}	<13	<13
Alkalinity		
H^+ (mol)	0.19	0.21
pH (units)	0.6	0.5
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha (Bq / pCi)	8.3E+03 / 2.24E+05	8.4E+03 / 2.27E+05
Gross beta (Bq / pCi)	9.7E+05 / 2.62E+07	1.0E+06 / 2.70E+07
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs (Bq / pCi)	4.1E+05 / 1.11E+07	4.1E+05 / 1.11E+07
^{3}H (Bq / pCi)	2.4E+00 / 6.49E+01	3.0E+00 / 8.11E+01
^{60}Co (Bq / pCi)	1.1E+03 / 2.97E+04	1.1E+03 / 2.97E+04
^{90}Sr (Bq / pCi)	4.5E+05 / 1.22E+7	4.3E+05 / 1.16E+07
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{238}Pu (Bq / pCi)	<150 / <4.05E+03	<150 / <4.05E+03
^{238}Th/^{232}Th (Bq / pCi)	8.0E+03 / 2.16E+05	8.2E+02 / 2.22E+04
^{239}Pu (Bq / pCi)	<20 / <5.41E+02	<50 / <1.35E+03
^{244}Cm (Bq / pCi)	<100 / <2.70E+03	<150 / <4.05E+03
^{252}Cf (Bq / pCi)	<50 / <1.35E+03	<50 / <1.35E+03

Table 2.26.2. Organic analytical data hits for tank W-14

Parameter	L30	L31
DAI-GC analysis (L=Φg/L, S=Φg/kg)		
Ethyl Alcohol	3,000	2,000
I-Propyl alcohol	2,000	
Methyl alcohol	17,000	15,000
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
Acetone	20 B	25 B
Benzene	3 JB	4 JB
Chlorobenzene		6
Methylene chloride	22 B	23 B
Tetrachloroethene		5
Toluene	14 B	21 B
Trichloroethene		6 B
Xylene (total)		4 J
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)		
Di-n-butylphthalate	12 B	

2.27 TANK W-15

2.27.1 Tank Description

Tank W-15 is a 2000-gal stainless steel tank located in the Bethel Valley North Tank Farm. The underground tank was installed in 1945 and received waste from the Radiochemical Processing Facility (Building 3019) and from recovery of fission products.

2.27.2 Characterization Summary

The results for this tank are shown in Tables 2.27.1 and 2.27.2.

2.27.2.1 Aqueous liquid

The results were very similar to those for tanks W-13 and W-14. The DAI-GC indicated 7 mg/L of methanol for both samples, and VOA detected very little material. No TCL compounds were detected by SVOA. TBP was estimated at 400 Φg/L in both L32 and L33. This is consistent with the low TOCs, 53.7 mg/L for L32 and 42.7 mg/L for L33. The deuterated perylene internal standard was missing from the L32 SVOA extract. The reason is not clear. A matrix effect is possible because the other internal standards were found in the extract, and all were added together before the GC screening. It may be significant that the pH for both of these samples was 0.2, which was the lowest of all the inactive tank samples. However, all the internal standards were found in the L33 sample, and the inorganic characterization did not suggest any unusual properties.

Table 2.27.1. Analytical data for tank W-15

Parameter	L32	L33
Physical properties and miscellaneous data		
Density (g/mL)	1.080	1.081
Depth (inches)	4	21
Suspended solids (mg/mL)	2.0	<0.1
TDS (mg/mL)	38.1	41.1
TOC (mg/L)	53.7	42.7
TS (mg/mL)	40.1	38.4
RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.002	0.002
As	<4	<4
Ba	3.2	3.4
Cd	<0.2	<0.2
Cr	53	55
Hg	0.40	0.39
Ni	48	48
Pb	7.5	7.5
Se	<0.09	<0.09
Tl	<0.09	<0.09
Process metals (L=mg/L, S=mg/kg)		
Si	22.3	21.9
U	387	383
Anions (L=mg/L, S=mg/kg)		
Cl^-	<4	<4
Cn	<0.06	<0.07
F^-	<4	<4
NO_3^-	120	120
PO_4^{-2}	<20	<20
SO_4^{-2}	<20	<20
Alkalinity		
H^+ (mol)	0.70	0.73
pH (units)	0.2	0.2
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	2.6E+03	2.3E+03
Gross beta	3.6E+06	3.6E+06
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs	1.6E+06	1.5E+06
^{3}H	3.0E+01	3.2E+01
^{60}Co	1.4E+03	1.2E+03
^{90}Sr	1.7E+06	1.5E+06
Alpha emitters (L=Bq/mL, S=Bq/g)		
^{233}U	1.1E+02	1.4E+02
^{238}Pu	2.5E+02	2.4E+02
$^{238}Th/^{232}Th$	1.5E+03	1.3E+03
^{239}Pu	6.3E+02	5.8E+02
^{244}Cm	<25	<15
^{252}Cf	<10	<10

Table 2.27.2. Organic analytical data hits for tank W-15

Parameter	L32	L33
DAI-GC analysis (L=Φg/L, S=Φg/kg)		
Methyl alcohol	7,000	7,000
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
Acetone	24 B	26 B
Benzene	4 JB	3 JB
Chlorobenzene	5	2 J
Methylene chloride	21 B	24 B
Styrene	2 J	
Toluene	29 B	26 B
Trichloroethene	4 JB	1 JB
Xylene (total)	5 J	4 J

2.28 TANK 7560

2.28.1 Tank Description

Tank 7560 is a 1000-gal stainless steel tank located in the Melton Valley area east of the Homogenous Reactor Experiment (HRE) facility (Building 7500). The underground tank was installed in 1957 and served as a waste tank for Building 7500.

2.28.2 Characterization Summary

This tank is empty and no samples have been taken.

2.29 TANK 7562

2.29.1 Tank Description

Tank 7562 is a 12,000-gal stainless steel tank located in the Melton Valley area southeast of the HRE facility (Building 7500). The underground tank was installed in 1957 and served as a waste tank for Building 7500.

2.29.2 Characterization Summary

The results from this tank are shown in Tables 2.29.1 and 2.29.2.

2.29.2.1 Aqueous liquid

Very little organic matter was detected in this sample: methanol was detected at 14 mg/L by DAI-GC, VOA results were very low, and there were no SVOA TCL hits. The TOC was 29.6 mg/L. There was insufficient sludge in S98 for SVOA.

Table 2.29.1. Analytical data for tank 7562

Parameter	L97	S98
Physical properties and miscellaneous data		
Density (g/mL)	1.001	NA
Depth (inches)	4	NA
Suspended solids (mg/mL)	0.1	NA
TDS (mg/mL)	0.2	NA
TOC (L=mg/L, S=mg/kg)	29.6	*
TS (L=mg/mL, S=mg/g)	0.3	75.9
RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.001	0.0020
As	<2	(<2)
Ba	<0.1	140
Cd	<0.09	18
Cr	<0.1	(2300)
Hg	<0.01	1.8
Ni	<0.6	320
Pb	<1	900
Se	<0.05	<0.006
Tl	<0.05	(<0.006)
Process metals (L=mg/L, S=mg/kg)		
Si	2.36	NA
U	6.77	1990
Anions (L=mg/L, S=mg/kg)		
Cl^-	13	<90
Cn	<0.05	*
F^-	<10	<90
NO_3^-	160	*
PO_4^{-2}	<50	<450
SO_4^{-2}	120	<450
Alkalinity		
HCO_3^- (mol)	<0.01	*
pH (units)	7.4	NA
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	<1	<1
Gross beta	1.2E+03	8.8E+05
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{137}Cs	1.7E+00	3.8E+03
^{3}H	1.6E+00	*
^{90}Sr	1.7E+03	2.2E+05

Table 2.29.2. Organic analytical data hits for tank 7562

Parameter	L97
DAI-GC analysis (L=Φg/L, S=Φg/kg)	
Methyl alcohol	14,000
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)	
Acetone	15 B
Benzene	3 J
Methylene chloride	18 B
Tetrachloroethene	4 J
Toluene	10

2.30 TANK T-30

2.30.1 Tank Description

Tank T-30 is an 825-gal stainless steel tank located south of Building 4507 in the ORNL Bethel Valley main plant area. The tank was installed in 1961 in an in-ground vault and was used to store radioactive materials for the Curium Recovery Facility (Building 4507).

2.30.2 Characterization Summary

The results from this tank are shown in Tables 2.30.1 and 2.30.2.

2.30.2.1 Aqueous liquid

DAI-GC determined 11 mg/L of methanol, and very little volatile organics material was found by VOA. SVOA identified only a phthalate. These findings are consistent with the low TOC, 13.7 mg/L.

Table 2.30.1. Analytical data for tank T-30

Parameter	L121
Physical properties and miscellaneous data	
Density (g/mL)	1.001
Depth (inches)	2
Suspended solids (mg/mL)	<0.1
TDS (mg/mL)	<0.1
TOC (mg/L)	13.7
TS (mg/mL)	<0.1
RCRA metals (L=mg/L, S=mg/kg)	
Ag	0.002
As	<2
Ba	<0.1
Cd	<0.09
Cr	<0.1
Hg	0.01
Ni	<0.6
Pb	<1
Se	<0.05
Tl	<0.05
Process metals (L=mg/L, S=mg/kg)	
Si	0.62
U	<1.0
Anions (L=mg/L, S=mg/kg)	
Cl^-	<1
Cn	<0.06
F^-	<1
NO_3^-	<5
PO_4^{-2}	<5
SO_4^{-2}	<5
Alkalinity	
HCO_3^- (mol)	<0.01
pH (units)	8.7
Radiochemical screening (L=Bq/mL, S=Bq/g)	
Gross alpha	9.4E+01
Gross beta	2.7E+02
Beta/gamma emitters (L=Bq/mL, S=Bq/g)	
^{137}Cs	4.0E+00
^{3}H	1.6E+00
^{90}Sr	1.5E+01
Alpha emitters (L=Bq/mL, S=Bq/g)	
^{233}U	<2
^{238}Pu	<2
^{238}U	4.0E+00
^{239}Pu	3.5E+00
^{241}Am	<10
^{244}Cm	3.1E+01
^{252}Cf	<2

Table 2.30.2. Organic analytical data hits for tank T-30

Parameter	L121
DAI-GC analysis (L=Φg/L, S=Φg/kg)	
Methyl alcohol	11,000
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)	
Acetone	21 B
Benzene	3 J
Methylene chloride	24 B
Tetrachloroethene	9
Toluene	10
Trichloroethene	4 J
Semivolatile compound analysis (L=Φg/L, S=Φg/kg)	
Bis(2-ethylhexyl)phthalate	37 J

2.31 TANK W-19

2.31.1 Tank Description

Tank W-19 is a 2250-gal stainless steel tank located in the ORNL Bethel Valley South Tank Farm area. The underground tank was installed in 1955 and collected waste produced from the recovery and reprocessing of uranium and other nuclear material from the Metal Recovery Facility in Building 3505.

2.31.2 Characterization Summary

This tank is empty and has not been sampled.

2.32 TANK W-20

2.32.1 Tank Description

Tank W-20 is a 2250-gal stainless steel tank located in the ORNL Bethel Valley South Tank Farm area. The underground tank was installed in 1955 and collected waste produced from the recovery and reprocessing of uranium and other nuclear material from the Metal Recovery Facility in Building 3505.

2.32.2 Characterization Summary

This tank is empty and has not been sampled.

2.33 TANK 3001-B

Tank 3001-B was removed in October 1995. The following information is retained in this document for record only.

2.33.1 Tank Description

Tank 3001-B is a 75-gal stainless steel tank located south of Building 3001 under the concrete stairway landing. The tank was installed in 1943 and is believed to have been a holding tank for radioactive laboratory drains in Building 3001.

2.33.2 Characterization Summary

Sampling of the tank was performed on July 17, 1992, through a 2-in.-diameter access. Monitored radiation levels at the ground surface and at the tank access were less than 0.1 mR/h. No vapor monitoring was performed during sampling because the tank is equipped with an offgas system. The distance measured from the top of the tank access to the bottom of the tank was 7 ft 8 in. The liquid depth in the tank was 3/4 in., and therefore only one clear-liquid sample (L186) was pulled from the tank. No sludge was encountered.

The liquid sample was submitted to the ORNL laboratories for measurement of various physical properties, inorganic analyses, and organic analyses. The sample volume was adequate for the requested analyses. The analytical results are shown in Tables 2.33.1 and 2.33.2.

The results of the physical measurements for the liquid sample were generally unremarkable. The density of 1.072 g/mL was well within the range of 0.9982–1.1303 g/mL observed for aqueous samples from other tanks. Low total solids (1.232 mg/mL), of which approximately 2/3 were dissolved and 1/3 suspended, were observed in the sample. No organic carbon was evident; however, the total carbon measured was 46.7 mg/L.

RCRA metals were detected at concentrations ranging from less than 0.002–0.216 mg/L. The two proposed RCRA metals, Ni and Tl, were detected at 0.0105 and 1.76 mg/L, respectively. Uranium was detected at 30 mg/L, a concentration that is relatively low compared to the range of uranium concentrations in other tanks, but a concentration that may still be high enough to interfere (i.e., cause false positives) in the detection of other elements. Thorium was not detected (<2 mg/L). With the exception of Na (191 mg/L), K (108 mg/L), and Ca (6.57 mg/L), the other process metals were present in the sample at concentrations less than 2 mg/L.

Cyanide and sulfide analyses were not performed for tank 3001-B because the holding times were exceeded. A semiqualitative analytical method (EM strips) was attempted for cyanide; however, the results were negative. The highest anion concentration detected was for sulfate at 287 mg/L. A high level of sulfate, such as was found in L186, may interfere with accurate detection of other elements; for example, a high sulfate level may cause selenium, which was detected in L186 at a concentration of 0.002 mg/L, to be detected at a lower concentration than actually exists (a possible false negative). The concentrations of other anions (maximum of 12.2 mg/L) were generally low compared to other tanks tested. Carbonates were not detected in the 8.2-pH liquid sample.

Table 2.33.1. Analytical data for tank 3001-B

Parameter	L186(a)
Physical properties and miscellaneous data	
Density (g/mL)	1.072
TDS (mg/mL)	0.816
TS (L=mg/mL, S=mg/g)	1.232
TOC (L=mg/L, S=mg/kg)	<1
TC (L=mg/L, S=mg/kg)	46.7
RCRA metals (L=mg/L, S=mg/kg)	
Ag	<0.002
As	<0.002
Ba	0.0179
Cd	0.01
Cr	0.0149
Hg	0.0044
Ni	0.0105
Pb	0.216
Se	0.002
Tl	1.76
Process metals (L=mg/L, S=mg/kg)	
Al	0.375
B	1.76
Be	0.0029
Ca	6.57
Co	0.0112
Cu	0.022
Fe	1.03
K	108
Mg	0.923
Mn	0.0149
Na	191
Sb	0.0735
Th	<2
U	30
V	0.0211
Zn	0.077
Anions (L=mg/L, S=mg/kg)	
Cl^-	3.4
F^-	0.8
NO_3^-	12.2
PO_4^{-3}	<0.5
SO_4^{-2}	287
Alkalinity	
CO_3^{-2} (moles/L)	<0.02
HCO_3^- (moles/L)	<0.02
pH (units)	8.2
Radiochemical screening	
Gross alpha (L=Bq/mL, S=Bq/g)	3.02E+00
Gross beta (L=Bq/mL, S=Bq/g)	2.92E+02
Gross fissile--^{239}Pu equiv (L=mg/L, S=mg/kg)	2.79E-01
Gross fissile--^{235}U equiv (L=mg/L, S=mg/kg)	1.9E-01

Table 2.33.1. (continued)

Parameter	L186(a)
Beta/gamma emitters (L=Bq/mL, S=Bq/g)	
^{3}H	4.9E-01
^{14}C	<2.0E+0
^{60}Co	1.47E+00
^{90}Sr	8.33E+01
^{137}Cs	2.89E+02
^{152}Eu	<1.76E+00
^{154}Eu	<2.2E-01
^{155}Eu	<8.8E-01

a) Tank 3001-B was sampled on July 17, 1992. The sample was collected within 3/4-inches of the bottom of the tank.

Table 2.33.2. Organic analytical data hits for tank 3001-B

Parameter	L186
Semivolatile organic compound analysis (L=Φg/L, S=Φg/kg)	
Bis(2-ethylhexyl)phthalate	620 B
Di-n-butylphthalate	220 B
Semivolatile organic compound analysis TICs (L=Φg/L, S=Φg/kg)	
Unknown TICs (a)	42,350 J (4)

(a) Result is the sum of the concentrations of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

The gamma scan indicated that the highest activity radionuclide in the sample is ^{137}Cs (289 Bq/mL). Other radionuclides detected at levels above their detection limit were ^{90}Sr at 83.3 Bq/mL, ^{60}Co at 1.47 Bq/mL, and ^{3}H at 0.49 Bq/mL. Alpha spectrometry was not performed on the sample because the gross alpha measurement of 3.02 Bq/mL did not warrant it. The gross fissile measurements, performed for purposes of criticality and accountability, were 0.279 Bq/mL, in terms of ^{239}Pu equivalency, and 0.19 Bq/mL, in terms of ^{235}U equivalency.

No VOCs were detected at concentrations above the reporting limits of 5–10 Φg/L. The absence of VOCs is partially confirmed by the DAI-GC analysis that was performed even though the reporting limits are much higher; the result for allyl or n-propyl alcohol was less than 2 ppm (< 2,000 Φg/L), and the results for the eight other reported analytes were less than 1 ppm (< 1,000 Φg/L). In addition, no pesticides or PCBs were detected at concentrations above the reporting limits of 0.33–6.7 Φg/L.

With regard to semivolatile organic compounds (SVOCs), two phthalates, bis(2-ethylhexyl) -phthalate and di-n-butylphthalate, were detected at 620 B and 220 B Φg/L, respectively. It is likely, however, that the two phthalates are laboratory artifacts because the laboratory blank analysis revealed the same two phthalates at corresponding concentrations of 690 J and 200 J Φg/L, respectively. Four “unknown” SVOA TICs were detected in the aqueous liquid at concentrations ranging from 750 J to 38,000 J Φg/L, the sum of the 4 concentrations equaling 42,350 J Φg/L. No TICs were found in the laboratory blank. The TIC concentrations in the aqueous liquid are rough estimates; i.e., the GC-MS results are not compared to those of a specific standard.

2.34 TANK 3003-A

2.34.1 Tank Description

Tank 3003-A is a 16,000-gal concrete tank located south of Building 3003 in the Bethel Valley main laboratory area. The tank was constructed in 1943 and collected drainage from three cells and a stack in Building 3003.

2.34.2 Characterization Summary

Tank sampling was performed on June 2, 1992, through a 3-ft-diameter access. Monitored radiation levels at the ground surface and at the tank access were less than 0.1 mR/h. Vapor monitoring was performed during sampling because of environmental, safety, and health (ES&H) considerations. The distance measured from the top of the tank access to the tank bottom was 21 ft. Liquid was found at depths ranging from 14 ft 9 in. to 20 ft 3 in., and sludge was found at depths ranging from 20 ft 3 in. to the tank bottom at 21 ft. Two liquid samples (L174 and L175) were pulled from the tank: one from slightly below the liquid surface and one at the liquid vertical midpoint. One sludge sample (S176) was pulled from the tank.

The liquid samples were submitted to the ORNL laboratories for measurement of various physical properties, inorganic analyses (i.e., metals, anions, alkalinity), and organic analyses (i.e., VOCs, SVOCs, pesticides/PCBs). The sludge sample, due to its slurry consistency, was filtered before the filtrate and sludge residue were submitted separately to the laboratories. The filtrate was analyzed for metals and radionuclides only, but the sludge residue was analyzed for metals, radionuclides, organic compounds, and a few physical properties. The analytes S^{-2} and CN^- were not measured in the residue because the residue was micro-digested with HNO_3 during the analytical procedure, and any S^{-2} or CN^- would have volatilized out of the sample prior to measurement. Analytical results for tank 3003-A are shown in Tables 2.34.1 and 2.34.2.

2.34.2.1 Aqueous liquid (L174 and L175)

The density measured for liquid samples L174 and L175 is 0.9608 and 0.9575 g/mL, respectively. These densities are suspect. ORNL laboratory personnel indicated that the undissolved solids in the sample were “fluffy” in appearance.

The RCRA metals As, Ba, and Cd, as well as Ni, a proposed RCRA metal, were detected at concentrations below 0.013 mg/L. Uranium was not detected above the relatively high detection limit of 50 mg/L. Thorium was detected in L174 at 0.07 mg/L and in L175 at 0.09 mg/L. The concentrations of other process metals, as might be expected from the low total solids content of the samples, were also relatively low: the concentrations ranged from highs of 22.1 mg/L for Ca and 3.09 mg/L for K, to lows of 0.003 for Cu and V.

Cyanide and sulfide analyses were not performed for tank 3003-A because the holding times were exceeded. A semiqualitative analytical method (EM strips) was attempted for CN^-; however, the results were negative. The concentrations of other anions were low (<0.02–5.9 mg/L), and the measured pH was 8.

Table 2.34.1. Analytical data for tank 3003-A

Parameter	L174 (a,b)	L175 (a,c)	S176 Filtrate (a,d)	S176 (a,d)
Physical properties and miscellaneous data				
Density (g/mL)	0.9608	0.9575	*	Dry: 0.3037 Wet: 1.0288
TDS (mg/mL)	0.196	0.292	*	*
TS (L=mg/mL, S=mg/g)	0.3	0.388	*	*
TOC (L=mg/L, S=mg/kg)	<1	<1	*	*
TC (L=mg/L, S=mg/kg)	15	14.6	*	39,600
RCRA metals (L=mg/L, S=mg/kg)				
Ag	<0.002	<0.002	<0.02	<0.002
As	0.00231	<0.002	<0.002	*
Ba	0.0123	0.013	0.25	92.5
Cd	0.0055	0.00671	0.00737	4
Cr	<0.005	<0.005	0.00803	140
Hg	<0.0002	<0.0002	<0.0002	*
Ni	0.00979	0.0122	0.0183	26.5
Pb	<0.094	<0.094	0.172	156
Se	<0.002	<0.002	<0.002	*
Process metals (L=mg/L, S=mg/kg)				
Al	0.0597	0.0712	0.111	1,850
B	0.0656	0.0383	0.25	1.32
Be	<0.0003	<0.0003	<0.0003	0.0372
Ca	21.7	22.1	16.9	12,300
Co	<0.007	<0.007	<0.007	4.05
Cu	0.00418	0.00374	0.00407	67.9
Fe	<0.021	0.0352	0.106	28,200
K	3	3.09	<0.035	445
Mg	1.35	1.42	12.2	1,900
Mn	0.00213	0.027	0.0616	509
Na	0.579	2.94	34.1	143
Sb	0.0663	0.0867	0.0804	<0.045
Th	0.07	0.09	*	*
U	<50	<50	*	*
V	0.00418	0.00341	0.00506	3.21
Zn	0.0359	0.0347	0.0796	2,010
Anions (L=mg/L, S=mg/kg)				
Cl^-	0.4	0.4	*	*
F^-	<0.2	<0.2	*	*
NO_3^-	1	0.93	*	*
PO_4^{-3}	<0.5	<0.5	*	*
SO_4^{-2}	5.9	4.7	*	*
Alkalinity				
CO_3^{-2} (moles/L)	<0.02	<0.02	*	*
HCO_3^- (moles/L)	<0.02	<0.02	*	*
pH (units)	8.0	8.0	*	*

Table 2.34.1 (continued)

Parameter	L174 (a,b)	L175 (a,c)	S176 Filtrate (a,d)	S176 (a,d)
Radiochemical screening				
Gross alpha (L=Bq/mL, S=Bq/g)	<1.0E-01	<1.0E-02	3.03E-02	2.85E+01
Gross beta (L=Bq/mL, S=Bq/g)	<2.0E-01	2.0E-01	1.03E+00	1.03E+03
Gross fissile--^{239}Pu equiv (L=mg/L, S=mg/kg)	<1.0E-04	2.1E-04	*	8.23
Gross fissile--^{235}U equiv (L=mg/L, S=mg/kg)	1.5E-04	1.5E-04	*	5.61
Beta/gamma emitters (L=Bq/mL, S=Bq/g)				
^{60}Co	<8.0E-02	<1.2E-01	<7.92E-02	<2.07E+01
^{137}Cs	2.5E-01	2.6E-01	3.01E-01	1.22E+03
^{152}Eu	<1.6E-01	<1.8E-01	<1.59E-01	<3.82E+01
^{154}Eu	<1.0E-01	<2.0E-01	<1.44E-01	<3.09E+01
^{155}Eu	<1.2E-01	<1.2E-01	<4.06E-01	<4.28E+02

(a) Tank 3003-A was sampled on June 2, 1992.
(b) The liquid sample was collected slightly below the liquid surface located 6 ft 3 inches above the bottom of the tank.
(c) The liquid sample was collected from the midpoint of the liquid layer, located approximately 3 ft 6 inches above the bottom of the tank.
(d) The sludge sample was collected from the sludge layer that covered the bottom of the tank to a height of 9 inches.

Table 2.34.2. Organic analytical data hits for tank 3003-A

Parameter	L174	L175	S176 Filtrate	S176
Semivolatile organic compound analysis (L=Φg/L, S=Φg/kg)				
2-Methylnaphthalene				5,000
3-Nitroaniline				130 J
Acenaphthene				880 J
Benzo(b)fluoranthene				1,200 J
Chrysene				1,100 J
Dibenzofuran				930 J
Diethylphthalate				1,100 B
Di-n-butylphthalate				1,800 B
Di-n-octylphthalate				1,700 B
Fluoranthene				1,800 J
Hexachlorobenzene				210 J
Naphthalene				1,800 J
Phenanthrene				1,000 J
Semivolatile organic compounds analysis TICs (L=Φg/L, S=Φg/kg)				
alkyl benzene (a)				3,000 J (2)
alkyl naphthalene (a)				16,900 J (6)
biphenyl TICs (a)				1,200 J (1)
unknown hydrocarbons (a)				17,500 J (8)
unknown TICs (a)				12,400 J (5)

(a) Result is the sum of the concentrations of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

The radionuclide investigation indicated the presence of ^{137}Cs (0.25–0.26 Bq/mL). The activity level for cesium is small and it was the only radionuclide present in activities greater than the detection limits. Alpha spectrometry was not performed because the gross alpha measurement (<0.01 Bq/mL) was too low for pulse height analysis. In addition, the ^{90}Sr measurement was canceled because the gross beta value (0.2 Bq/mL) was too low. The gross fissile measurement had maximum values of 0.00021 mg/L in terms of ^{239}Pu equivalency, and 0.00015 mg/L ^{235}U equivalency.

No VOCs were detected at concentrations above the reporting limits of 5–10 Φg/L for either of the liquid samples. In addition, no VOC TICs were detected. No SVOCs were detected at concentrations above the reporting limits of 52–270 Φg/L, and no SVOC TICs were encountered. No pesticides or PCBs were detected at concentrations above the reporting limits of 0.26–5.4 Φg/L for either of the liquid samples.

2.34.2.2 Sludge (S176) filtrate

As mentioned previously, the filtrate was analyzed for metals and radionuclides. RCRA metal concentrations ranged from 0.00737–0.25 mg/L. The highest concentrations of the process metals were 34.1 mg/L for Na, 16.9 mg/L for Cd, and 12.2 mg/L for Mg. The other process metals were all less than 0.25 mg/L. The only radionuclide detected was ^{137}Cs at 0.301 Bq/mL.

When the analytical results were compared with those for L174 and L175, vertical concentration gradients were found for some of the RCRA metals (Ba, Cd, Cr, Ni, and Pb), for some of the process metals (Al, Fe, Mg, Mn, and Na), for the radionuclide ^{137}Cs, and for the gross alpha and gross beta parameters.

2.34.2.3 Sludge (S176)

Elevated levels of some RCRA and process metals were found in the sludge. The RCRA metals with the greatest concentrations were Pb (156 mg/kg) and Cr (140 mg/kg). High levels of Pb and Cr were also observed in many of the other inactive waste tanks.

The process metals with the greatest concentrations were Fe at 28,200 mg/kg, Ca at 12,300 mg/kg, Zn at 2010 mg/kg, and Mg at 1900 mg/kg. The concentration range of the other process metals was 509 to <0.045 mg/kg. Uranium and thorium analyses were not performed. Gamma spectroscopy indicated only the presence of ^{137}Cs at 1,220 Bq/g. Alpha spectroscopy was not performed. Neutron activation techniques provide gross fissile estimates of 8.23 and 5.61 mg/kg in terms of ^{239}Pu and ^{235}U equivalents, respectively.

No VOCs were detected at concentrations above the reporting limits of 25 or 50 Φg/kg for the sludge sample (S176). In addition, no pesticides or PCBs were detected at concentrations above the reporting limits of 40–800 Φg/kg. The reporting limits for the pesticide/PCB analysis were relatively high because S176 required a 5-fold dilution for the analysis. In addition, pesticide organic compounds could not be determined in the laboratory blank because of contamination.

Thirteen SVOCs were detected in the sludge sample. The compound 2-methylnaphthalene had the highest concentration at 5000 Φg/kg. The other compounds, which consisted of PAHs, phthalates, substituted and chlorinated benzenes, and dibenzofuran, were detected at concentrations ranging from 130 J to 1800 J Φg/kg. However, it is likely that the phthalates in S176 are common laboratory artifacts because the laboratory sand blank was found to contain four phthalate

compounds with concentrations in the range 340 J to 3100 Φg/kg. Individual phthalate concentrations in the sand blank were within a factor of 5 of the corresponding concentrations in S176.

Twenty-two SVOC TICs were also detected for the sludge sample (two alkyl benzene derivatives with a summed concentration of 3000 J Φg/kg, six alkyl naphthalene derivatives with a summed concentration of 16,900 J Φg/kg, one biphenyl TIC at 1200 J Φg/kg, eight unknown hydrocarbons with a summed concentration of 17,500 J Φg/kg, and five other unknown TICs with a summed concentration of 12,400 J Φg/kg. The laboratory blank was also found to contain some SVOC TICs: 1 unknown hydrocarbon at 430 J Φg/kg and 11 other unknown TICs with a summed concentration of 16,420 J Φg/kg. However, the unknown hydrocarbon and other unknown TICs in the laboratory blank were different from those in S176; i.e., the TIC peaks in the blank did not coincide with those found in the sample, and did not contribute to the latter.

2.35 TANK 3004-B

Tank 3004-B was removed in August 1995. The following information is retained in this document for record only.

2.35.1 Tank Description

Tank 3004-B is a 30-gal stainless steel tank located east of Building 3008 in the Bethel Valley main laboratory area. The tank was installed in an in-ground vault in 1956 and was used as a waste holding tank for the Low Intensity Test Reactor.

2.35.2 Characterization Summary

Sampling of the tank was performed on May 27, 1992, through a 0.8-ft-diameter access. The monitored radiation level at the ground surface was less than 0.1 mR/h, and at the tank access was 0.8 mR/h. The distance measured from the top of the tank flange (access) to the bottom of the tank was 35 in. Clear liquid was found in the tank with the liquid level up to the top of the tank flange; no sludge was encountered. Liquid samples L183, L184, and L185 were pulled from the tank at a point near the liquid surface, at the liquid midpoint, and at the bottom of the tank, respectively.

The liquid samples were submitted to the ORNL laboratories for a limited set of analyses: ICP metals, AA metals (i.e., Hg, As, and Se), pH, some radionuclides (gross alpha, gross beta, and gamma scan), and organic compounds (i.e., VOCs, SVOCs, and pesticides/PCBs). The analytical results for tank 3004-B are shown in Table 2.35.1.

The RCRA metal investigation indicated the presence of Ba in all three liquid samples. Sample L184 additionally contained Hg, and L185 additionally contained Ag, As, and Cr. Concentrations of these analytes reached a maximum at 0.0237 mg/L. Nickel, a proposed RCRA metal, was also present in measurable quantities in all three samples at a maximum concentration of 0.00847 mg/L. The process metals with the greatest concentrations were Ca at 40.5 mg/L, Mg at 4.64 mg/L, K at 3.59 mg/L, and Na at 1.41 mg/L. Uranium and thorium analyses were not performed.

Radiochemical screening of the 8.3- to 8.5-pH liquid samples indicated gross beta results at a maximum of 0.3 Bq/mL; no gross alpha activity was measured above the detection limit of 0.1 Bq/mL. The gamma scan indicated the presence of ^{137}Cs in all three samples in the activity range of 0.159–0.558 Bq/mL.

No VOCs were detected at concentrations above the reporting limits of 25–50 Φg/L for any of the three liquid samples, nor were any VOC TICs reported for any of the samples. The absence of VOCs is partly substantiated by the DAI-GC analysis that was performed (although the detection limit for the DAI-GC is significantly higher than that for GC-MS): the results for the nine reported analytes for all three samples were less than 1 ppm (<1,000 Φg/L).

No SVOCs were detected at concentrations above the reporting limits of 52–260 Φg/L, and no SVOC TICs were encountered. In addition, no pesticides or PCBs were detected at concentrations above the reporting limits of 0.26–5.3 Φg/L for any of the samples.

Table 2.35.1. Analytical data for tank 3004-B

Parameter	L183 (a,b)	L184 (a,c)	L185 (a,d)
	RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.02	<0.002	0.00517
As	<0.002	<0.002	0.00264
Ba	0.0237	0.0229	0.0233
Cd	<0.004	<0.004	<0.004
Cr	<0.005	<0.005	0.00627
Hg	<0.0002	0.00055	<0.0002
Ni	0.00847	0.00671	0.00814
Pb	<0.0940	<0.094	<0.094
Se	<0.002	<0.002	<0.002
Tl	<0.147	<0.147	<0.147
	Process metals (L=mg/L, S=mg/kg)		
Al	<0.016	<0.016	0.0384
B	0.0107	0.00825	0.0248
Be	<0.0003	<0.0003	<0.0003
Ca	40.7	40.5	40.5
Co	0.00935	0.00935	0.0099
Cu	<0.002	0.00418	0.00462
Fe	<0.021	<0.021	0.0287
K	3.60	3.59	3.59
Mg	4.66	4.63	4.64
Mn	<0.0004	<0.0004	<0.0004
Na	1.61	1.36	1.41
Sb	0.125	0.106	0.133
V	<0.002	<0.002	0.00462
Zn	0.016	0.0131	0.0171
	Alkalinity		
pH (units)	8.5	8.5	8.3
	Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	<1.0E-01	<1.0E-01	<1.0E-01
Gross beta	<2.0E-01	1.0E-01	3.0E-01
	Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{60}Co	<7.35E-02	<9.87E-02	<8.7E-02
^{137}Cs	2.07E-01	1.59E-01	5.58E-01
^{152}Eu	<1.68E-01	<2.05E-01	<2.06E-01
^{154}Eu	<2.22E-01	<2.22E-01	<2.80E-01
^{155}Eu	<1.16E-01	<1.34E-01	<1.28E-01

(a) Sampling of tank 3004-B occurred on May 27, 1992.
(b) The liquid sample was collected at a point near the liquid surface located approximately 35 inches from the bottom of the tank.
(c) The liquid sample was collected near the liquid midpoint located approximately 17–18 inches from the bottom of the tank.
(d) The liquid sample was collected at a point near the bottom of the tank.

2.36 TANK 3013

Tank 3013 was isolated from its piping system and filled with grout in August 1995. The following information is retained in this document for record only.

2.36.1 Tank Description

Tank 3013 is a 400-gal stainless steel tank located south of Building 3013 in the Bethel Valley main laboratory area. The tank was installed in 1949 and served an environmental processing laboratory in Building 3013 that dealt with environmental samples that had very low-level contamination.

2.36.2 Characterization Summary

Sampling of the tank was performed through a 0.8-ft-diameter access. Monitored radiation levels at the ground surface and at the tank access were less than 0.1 mR/h. Vapor monitoring was performed during sampling because of ES&H considerations. The distance measured from the top of the tank flange (access) to the tank bottom was 11 ft 10 in. The liquid level in the tank was 4 ft 11 in. below the top of the tank access. On May 19, 1992, three liquid samples (L171, L172, and L173) were pulled from the tank at points near the surface, midpoint, and bottom of the liquid, respectively. The first two samples were clear, but the third sample was “tan” in color. No sludge was detected. On June 26, 1992, three additional samples (L192, L193, and L194) were pulled from the tank at the same depths sampled in the first event.

The first set of three liquid samples (L171, L172, and L173) was submitted to the ORNL laboratories for a limited set of analyses: ICP metals, AA metals (i.e., Hg, Se, and Tl), pH, some radionuclides (gross alpha, gross beta, and gamma scan), and organic compounds (i.e., VOCs, SVOCs, pesticides/PCBs). The analytical results for these tank samples are shown in Tables 2.36.1 and 2.36.2. The second set of three samples (L192, L193, and L194) was submitted for mercury and VOC analyses due to missed holding times for the first sample set. The analytical results for these tank samples are shown in Tables 2.36.3 and 2.36.4.

The RCRA metals investigation of the liquid samples revealed the presence of As, Ba, Cr, Hg, and Pb; the highest concentration detected was for Pb in sample L173 at 5.89 mg/L. Nickel, a proposed RCRA metal, was detected at concentrations below 0.1 mg/L. The process metals with the greatest concentrations were Ca at 49.9 mg/L; Fe, Mg, and Na in the 12- to 14-mg/L range; and Al and Zn in the 1- to 6-mg/L range. Uranium and thorium analyses were not performed.

Radiochemical screening and gamma spectroscopy of the near-neutral liquid (pH of 6.9–7.4) did not detect any measurable activity.

Using the GC-MS method, no VOCs were detected at concentrations above the reporting limits of 25–50 Φg/L for the liquid samples (L171, L172, and L173). However, for samples L192, L193, L194, the GC-MS reporting limits were less than those for the other samples; this enabled the detection of chloroform at a concentration of 10.7 Φg/L in L193 and 12.8 Φg/L in L194. The lower-sensitivity DAI-GC analyses for water-soluble organics was also conducted for both sets of samples. No VOCs were detected for sample L171, L172, and L173 (i.e., concentrations were all less than the DAI-GC reporting limit of 1000 Φg/L). However, for samples L192, L193, and L194, the DAI-GC analyses

Table 2.36.1. Analytical data for tank 3013

Parameter	L171 (a,b)	L172 (a,c)	L173 (a,d)
	RCRA metals (L=mg/L, S=mg/kg)		
Ag	<0.002	<0.002	<0.002
As	<0.002	<0.002	0.00455
Ba	0.179	0.184	0.201
Cd	<0.004	<0.004	<0.004
Cr	0.0626	<0.005	0.119
Hg	<0.0002	<0.0002	<0.0002
Ni	0.028	0.021	0.0973
Pb	0.752	0.329	5.89
Se	<0.002	<0.002	<0.002
Tl	<0.147	<0.147	<0.147
	Process metals (L=mg/L, S=mg/kg)		
Al	1.22	0.468	5.74
B	0.874	0.875	0.764
Be	<0.0003	<0.0003	<0.0003
Ca	57.3	56.2	49.9
Co	0.0145	<0.007	<0.007
Cu	0.0194	0.00988	0.162
Fe	1.41	0.438	13.4
K	5.15	5.02	5.2
Mg	13.7	13.7	12.9
Mn	0.00329	<0.0004	0.0287
Na	14.2	13.8	12.6
Sb	0.111	0.142	0.207
V	<0.002	<0.002	0.00565
Zn	0.315	0.468	1.96
	Alkalinity		
pH (units)	6.9	7.4	7.4
	Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	<1.0E-01	<1.0E-01	<1.0E-01
Gross beta	<2.0E-01	<2.0E-01	<2.0E-01
	Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{60}Co	<1.0E+01	<1.0E+01	<1.0E+01
^{137}Cs	<1.0E+01	<1.0E+01	<1.0E+01
^{152}Eu	<1.0E+01	<1.0E+01	<1.0E+01
^{154}Eu	<1.0E+01	<1.0E+01	<1.0E+01
^{155}Eu	<1.0E+01	<1.0E+01	<1.0E+01

(a) Tank 3013 was sampled on May 19, 1992.
(b) The liquid sample was collected at a point near the liquid surface located 6 ft 11 inches above the bottom of the tank.
(c) The liquid sample was collected near the liquid midpoint approximately 3 ft 6 inches above the bottom of the tank.
(d) The liquid sample was collected from a point near the bottom of the tank.

Table 2.36.2. Organic analytical data hits for tank 3013

Parameter	L171	L172	L173
Semivolatile organic compound analysis (L=Φg/L, S=Φg/kg)			
Bis(2-chloroisopropyl)ether		7 J	

Table 2.36.3. Analytical data for tank 3013

Parameter	L192 (a,b)	L193 (a,c)	L194 (a,d)
RCRA metals (L=mg/L, S=mg/kg)			
Hg	0.00066	<0.0002	<0.0002

(a) Tank 3013 was sampled on June 26, 1992.
(b) The liquid sample was collected at a point near the liquid surface located 6 ft 11 inches above the bottom of the tank.
(c) The liquid sample was collected near the liquid midpoint approximately 3 ft 6 inches above the bottom of the tank.
(d) The liquid sample was collected from a point near the bottom of the tank.

Table 2.36.4. Organic analytical data hits for tank 3013

Parameter	L192	L193	L194
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)			
Chloroform		10.7	12.8
Water soluble organic compound analysis (L=Φg/L, S=Φg/kg)			
Methyl Alcohol	29,000	27,000	30,000

detected methyl alcohol in all three at concentrations of 27,000–30,000 Φg/L. No explanation for this apparent discrepancy between the two sets of DAI-GC results has yet been suggested.

The only SVOC detected was bis(2-chloroisopropyl)ether in sample L172 at 7 J Φg/L. Reporting limits for the SVOCs ranged from 68–355 Φg/L. No SVOC TICs were detected in any of the samples. In addition, no pesticides or PCBs were detected at concentrations above the reporting limits of 0.34–7.1 Φg/L for the liquid samples.

2.37 TANK H-209

2.37.1 Tank Description

Tank H-209 is a 2500-gal (best estimate) stainless steel tank located west of Building 3517 in the Bethel Valley main laboratory area. The tank was installed in 1961 and held condensate and floor drainage from Building 3517.

2.37.2 Characterization Summary

Sampling of the tank was performed through a 2-ft-diameter access. Monitored radiation levels at the ground surface and at the tank access were less than 0.1 mR/h. Vapor monitoring was performed during sampling because of ES&H considerations. The distance measured from the top of the tank access to the bottom of the tank was 6 ft 5 in. The liquid level in the tank was 5 ft 6 in. beneath the tank access; no sludge was encountered. On September 17, 1992, two clear liquid samples (L177 and L178) were pulled from the tank: one from just below the liquid surface and one from near the tank bottom. Due to missed holding times on the VOC analyses at the laboratory, the tank was resampled at the same depths on March 9, 1993. Of the two liquid samples from the second sampling event (L195 and L196), the first sample extracted from just below the surface was clear; however, the second sample taken near the tank bottom was rust-colored.

The liquid samples were submitted to the ORNL laboratories for a limited set of analyses: ICP metals, other metals (i.e., Hg, As, Pb, Se, and Ti), pH, some radionuclides (gross alpha, gross beta, and gamma scan), and organic compounds (i.e., VOCs, SVOCs, pesticides/PCBs). The analytical results for tank H-209, samples L177 and L178, are shown in Tables 2.37.1 and 2.37.2. The VOC analytical results for samples L195 and L196 are shown in Table 2.37.3.

Three RCRA metals (Cr, Pb, and Se) were detected in the liquid samples at concentrations ranging from 0.0012–0.0316 mg/L. All the concentrations were well below the RCRA limits. Nickel, a proposed RCRA metal, was found at concentrations of 0.02 and 0.028 mg/L. Eight process metals (Al, Ca, Fe, K, Mg, Mn, Na, and Zn) were also detected; those metals with the largest concentrations are Na at 20.4 mg/L, K at 18.2 mg/L, and Ca at 9.40 mg/L. Uranium and thorium analyses were not performed.

Radiochemical screening indicates relatively low activity: the maximum gross alpha and beta activities were 0.018 and 0.985 Bq/mL, respectively. Gamma spectroscopy detected ^{137}Cs at an activity level of 0.69 (L177) and 0.81 Bq/mL (L178).

Chloromethane was detected in L196 at a concentration of 51 Φg/L, a value that is only slightly higher than the 50 Φg/L reporting limit. Acetone was the only VOC detected in both L195 and L196; the acetone concentrations are 190 Φg/L and 820 Φg/L, respectively. However, acetone was also found in the trip blank at 58 Φg/L. Though the acetone concentration in the trip blank is only a factor of 3 less than that in L195, it is a factor of 14 less than that in L196, which suggests that the acetone contamination is not a laboratory artifact.

No SVOCs were detected at concentrations above the reporting limits of 26–150 Φg/L for the two liquid samples. However, one unknown SVOC TIC was detected for L177 at a concentration of 240 J Φg/L, and three SVOC TICs were detected for L178: one unknown at 210 J Φg/L, and two

Table 2.37.1. Analytical data for tank H-209

Parameter	L177 (a,b)	L178 (a,c)
	RCRA metals (L=mg/L, S=mg/kg)	
Ag	<0.004	<0.004
As	<0.002	<0.002
Ba	<0.0003	<0.0003
Cd	<0.004	<0.004
Cr	<0.004	0.006
Hg	<0.0002	<0.0002
Ni	0.02	0.028
Pb	0.0012	0.0316
Se	0.005	0.002
	Process metals (L=mg/L, S=mg/kg)	
Al	0.04	<0.013
Be	<0.0002	<0.0002
Ca	9.12	9.40
Co	<0.005	<0.005
Cu	<0.003	<0.003
Fe	0.07	1.58
K	17.9	18.2
Mg	1.72	1.73
Mn	0.001	0.0309
Na	20.4	20.4
Sb	<0.055	<0.055
Ti	<0.22	<0.219
V	<0.003	<0.003
Zn	0.02	0.01
	Alkalinity	
pH (units)	7.4	8.1
	Radiochemical screening (L=Bq/mL, S=Bq/g)	
Gross alpha	1.8E-02	<1.0E-02
Gross beta	9.85E-01	9.8E-01
	Beta/gamma emitters (L=Bq/mL, S=Bq/g)	
^{60}Co	<1.4E-01	<1.0E-01
^{137}Cs	6.9E-01	8.1E-01
^{152}Eu	<2.2E-01	<2.3E-01
^{154}Eu	<2.8E-01	<2.1E-01
^{155}Eu	<1.6E-01	<1.4E-01

(a) Tank H-209 was sampled initially on September 17, 1992 (samples L177 and L178). It was resampled on March 9, 1993, (samples L195 and L196) due to missed holding times on the VOC analyses.
(b) The liquid sample was collected near the liquid surface located 11 inches above the bottom of the tank.
(c) The liquid sample was collected near the bottom of the tank.

Table 2.37.2. Organic analytical data hits for tank H-209

Parameter	L177	L178
Semivolatile organic compound analysis TICs (L=Φg/L, S=Φg/kg)		
Unknown TICs (a)	240 J (1)	210 J (1)
benzenesulfonamide (a)		99 J (2)

(a) Result is the sum of the concentrations of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

Table 2.37.3. Organic analytical data hits for tank H-209

Parameter	L195	L196
Volatile organic compound analysis (L=Φg/L, S=Φg/kg)		
Acetone	190	820
Chloromethane		51

benzenesulfonamide derivatives at 54 J and 45 J Φg/L. Analysis of the trip blank also revealed one unknown SVOC TIC at a concentration of 6 J Φg/L. No pesticides or PCBs were detected at concentrations above the reporting limits of 0.27–5.9 Φg/L for the samples.

2.38 TANK 7503-A

2.38.1 Tank Description

Tank 7503-A is an 11,000-gal stainless steel tank located in an in-ground vault northwest of Building 7503 in the Melton Valley area. The tank was installed in 1962 and was a waste holding tank for the Molten Salt Reactor Experiment.

The tank is accessed by removing some of the concrete blocks that form the in-ground vault. A bridge crane is available for concrete block removal; however, an ORNL-wide ban on hoisting and rigging was recently imposed by DOE and Energy Systems due to health and safety (H&S) considerations. Because the ban prevents access for the sampling team, tank characterization has not yet been performed. When the H&S considerations have been addressed to the satisfaction of DOE and Energy Systems and the hoisting and rigging ban is lifted, then tank sampling and characterization will be performed and an addendum to this latest data manual revision will be issued.

2.39 TANK 3001-S

2.39.1 Tank Description

Tank 3001-S is indicated on drawings to be a 2000-gal stainless steel tank that was planned to be installed adjacent to the south side of Building 3001 in the Bethel Valley main laboratory area. The originally proposed use for the tank is not known. Field investigations did not locate the tank, and it is probable that the tank was never installed.

2.40 TANK 3002-A

2.40.1 Tank Description

Tank 3002-A is a 2200-gal stainless steel tank located in a below-grade vault south of Building 3002. The tank was installed in 1943 to collect condensate from the 3002 filter house which served the Old Graphite Reactor. The reactor was shut-down in 1963. However, ventilation is still maintained in the facility.

A design package for the permanent isolation of tank 3002-A has been prepared. The isolation of the tank is projected to be completed in FY 1997. The design includes rerouting the ventilation system drains to the process waste system.

2.40.2 Characterization Summary

A sample of the liquid in tank 3002-A was collected from the bottom of the tank using a vacuum-pump sampling system. The sample was a clear, colorless liquid and contained no sediment or particulates. There was no indication of any organic layers that are immiscible with the aqueous phase in the tank. Video camera inspection indicated the presence of a thin layer of solid residue caked on the tank bottom, which had the appearance of brown paint with cracks in it.

The results for the liquid sample are shown in Table 2.40.1. Sample analysis indicated that the levels of contaminants were low. Very few metal analytes were detected, and their concentrations were low. The gross alpha and gross beta activities were 0.13 and 4.7 Bq/mL, respectively. The dose rate (field survey) for −1 L of sample was near background (<0.1 mrem/h).

Table 2.40.1. Analytical data for tank 3002-A

Parameter	3002A-L1 (*a*)
RCRA metals (L = mg/L)	
Ag	<0.025
As	<0.006
Ba	0.018
Cd	<0.025
Cr	<0.006
Hg	<0.001
Ni	<0.025
Pb	<2.0
Se	<0.006
Tl	<0.25
Process metals (L = mg/L) (b)	
Ca	24.1
Fe	0.012
K	37.2
Mg	3.05
Mn	0.004
Na	13.1
Th	<0.062
U	0.28
Anions (L = mg/L)	
Bromide	<0.05
Chloride	4.93
Fluoride	0.12
Nitrate	6.38
Phosphate	<0.20
Sulfate	38.2
Alkalinity	
pH (units)	8.1
Radiochemical screening (L = Bq/mL)	
Gross alpha	1.3E-1
Gross beta	4.7E+0
Beta/gamma emitters (L = Bq/mL)	
^{60}Co	<8.0E–2
^{134}Cs	<7.0E–2
^{137}Cs	5.7E–1
^{152}Eu	<3.2E–1
^{154}Eu	<1.9E–1
^{155}Eu	<1.4E–1
^{90}Sr	1.7E+0

(*a*) Sample collected June 21, 1996, from the bottom of the tank.
(*b*) With the exception of Th, only metals whose presence was indicated by the analysis are listed.

2.41 TANK 4501-P

Tank 4501-P was isolated from its piping and filled with grout in August 1996. The following information is retained in this document for information only.

2.41.1 Tank Description

Tank 4501-P is a 100 gallon stainless steel tank located in building 4501. The tank was used to store waste from the plutonium recovery loop experiment and other waste from experiments in building 4501. Tank 4501-P was removed form service before 1990.

2.41.2 Characterization Summary

Tank 4501-P was emptied in September 1990 as part of a program to reduce the environmental risk from inactive tanks at ORNL. When the tank was emptied, approximately 3.7 gallons of rinse water was added, and the tank's bubbler system was operated for 10 minutes to mix the rinse water and the remaining tank heel. The rinse solution was then drained and samples were collected for analysis. Analysis procedures included EPA 200.7, for RCRA metals, EPA 245.1 for mercury, EPA 600 160.2 for total dissolved solids and total solids, EPA 600 905.0 for strontium 90, MM 9002301 and 9002302 for gross alpha and gross beta, MM 11011 for density, and SW-846-9040 for pH. Anions were analyzed using the Dionex procedure. The VOA conducted by off-line purge and trap GC-MS showed 155 Φg/L B of acetone. The acetone in the blank was 10 Φg/L. Only diethylphtualate was detected in the SVOA at 250 Φg/L B, versus 91 Φg/L in the blank. However, holding times were not observed in these analyses.

The radiation level of the solution was 100–300 counts per minute. The operations personnel who collected the sample estimated the volume of liquid remaining in the tank after it was emptied (the tank heel) at 1.5 gallons.

The tank does not leak nor does it receive any input.

Table 2.41.1 Analytical data for tank 4501-P
Data were collected in September 1990

Parameter	4501-P-L170
Physical properties and miscellaneous data	
Density (g/mL)	0.9986
IC (L=mg/L, S=mg/kg)	1.7
TC (L=mg/L, S=mg/kg)	60
TDS (L=mg/L)	9.9
TOC (L=mg/L, S=mg/kg)	58.3
TS (L=mg/mL, S=mg/g)	15.6
Process metals (L=mg/L, S=mg/kg)	
Ca	*
Na	*
Th	*
U	*
Zn	*
Anions (L=mg/L, S=mg/kg)	
Cl^-	1160
CN^-	<40
F^-	960
NO_3^-	42400
Alkalinity	
pH (units)	3.48
OH^- (*M*)	*
CO_3^{2-} (*M*)	*
HCO_3^- (*M*)	*
Radiochemical screening (L=Bq/mL, S=Bq/g)	
Gross alpha	9.8E+01 ± 5.11
Gross beta	2.4E+01 ± 12.5
Beta/gamma emitters (L=Bq/ml)	
^{137}Cs	0.01
^{155}Eu	0.64
^{90}Sr	0.49
Alpha emitters (L=Bq/ml)	
^{241}Am	49.0
^{235}U	0.4

* Not analyzed for,

2.42 TANK S-424

2.42.1 Tank Description

Tank S-424 is a 500-gal, glass-lined, stainless steel tank located in a shielded concrete vault adjacent to Building 3517. The tank was used to collect highly corrosive chloride-bearing supernate from a precipitation operation. The tank was removed from service in the mid-1960s.

2.42.2 Characterization Summary

Tank S-424 is empty and was not sampled. The tank does not leak or collect nonprogrammatic waste. It was emptied and rinsed several times, upon removal from service.

The tank's steam jet was operated in July 1992, to verify that the tank was still empty. No liquid was found, and it was concluded that the tank is still empty. No further investigation is planned for this tank until the remedial investigation.

2.43 TANK T-14

2.43.1 Tank Description

Tank T-14 is a 48,500-gal concrete tank located near the new Hydrofracture Facility. The tank was installed in 1979 as an overflow emergency waste tank for the new Hydrofracture Facility. The removal-from-service date is unknown.

2.43.2 Characterization Summary

Tank T-14 was sampled when it was emptied in August 1990. The analysis results are shown in Table 2.43.1.

2.43.2.1 Aqueous Liquid

Analysis procedures used in for this tank included EPA 200.7 for RCRA metals, EPA 245.1 for mercury, EPA 600 160.2 for total dissolved solids and total solids, EPA 600 905.0 for strontium 90, MM 9002301 and 9002302 for gross alpha and gross beta, MM 11011 for density, and SW-846-9040 for pH. Anions were analyzed using the Dionex procedure.

Table 2.43.1. Analytical data for tank T-14

Parameter	T-14-S1 (a)
Physical properties and miscellaneous data	
Density (g/mL)	1.0954
IC (L=mg/L, S=mg/kg)	
TC (L=mg/L, S=mg/kg)	
TDS (L=mg/mL)	0.1227
TOC (L=mg/L, S=mg/kg)	6.93 E+3
TS (L=mg/mL, S=mg/g)	0.1694
Process metals (L=mg/L, S=mg/kg)	
Ca	
Mg	423
Na	8.7 E+4
Th	
U	0.02
Zn	
K	2.1 E+3
Anions (L=mg/L, S=mg/kg)	
Br)	
Cl)	
CN)	
F)	
NO_3)	1.35 E+4
PO_4^{-3}	< 5
SO_4^{-2}	
Radiochemical screening (L=Bq/mL, S=Bq/g)	
Gross alpha	1.9
Gross beta	6.2 E+3
Beta/gamma emitters (L=Bq/mL, S=Bq/g)	
^{60}Co	<10
^{137}Cs	85.3 ± 4.6
^{152}Eu	
^{154}Eu	
^{3}H	1.99 ± 0.49
^{90}Sr	3.14 E+3

[a]Sample taken May 11, 1991.

2.44 TANK W-1I

2.44.1 Tank Description

Tank W-1I is a 500-gal stainless steel tank located approximately 20 feet east of Building 3028. The tank was installed in 1950 as an intermediate hold-up tank for radioactive waste from hot cells in Building 3028 (Fig. 2.44-1). An east wing was added to the building to house the alpha powder handling operations. The floor slab of the east wing was constructed over the tank, which is now situated under the east wing air lock. The tank sits on a concrete pad that is designed to collect leakage and channel it to an adjacent detection well. The leak monitoring well was constructed from 6 inch vitrified clay pipe that extended to just above grade. Access to the well is still available, but no instrumentation is provided in the well. Two valve and/or pump pits associated with the tank are still accessible; but no manway or other access to the tank remains. Neither the level sensing instruments nor the waste transfer equipment are operable. All inlet lines, to the tank from the hot cell areas have been isolated. The facility was reduced to twice a year operation by 1980 and operations were completely discontinued by 1987. The tank was removed from service by 1987.

At peak operation, approximately 2 kg of powder, such as $^{241}AmO_2$, was received annually from other DOE sites. The material was loaded into the water-shielded cells in Building 3028. Most of the shipments were in 25 gram quantities of americium-241, so a campaign of loading stainless steel powder cans containing this quantity was conducted twice a year. The powder was weighed, loaded into an inner container, and a press-fit plug was inserted. The inner container was then placed in a stainless steel capsule. The capsule was then welded closed. After cleaning and vacuum testing, the capsule was loaded into an approved container for shipment. Gram quantities of $^{243}AmO_2$, $^{244}CmO_2$, $^{238}PuO_2$, and $^{237}NpO_2$ were handled by the same procedure.

2.44.2 Characterization Summary

Neither the tank level sensing instruments nor the waste transfer equipment are operable. Process information and operations logs indicate that liquids were emptied from the tank in 1987. During its operating life, the tank serviced only Building 3028. Inlets to the tank consist of drains from 4 hot cells and 1 floor drain. The sources have been capped and no liquids are thought to be in the tank. Operation of the tank's hot offgas system combined with no liquid introduction to the tank since 1987 increases the likelihood that no liquid remains in the tank. The tank is, however, suspected to contain sludge that has a high level of alpha radiation. In addition, because the tank is located in a personnel airlock, attempts to collect samples would result in a high potential for area contamination and personnel exposure. The probability is high that the tank contains no liquids, and the secured condition of the inlet lines assures that no additional liquids will enter it. Inspection of the monitoring well in March 1993 indicated <10 Bq/L gross alpha, 5.5 E-3 Bq/L gross beta, and no gamma emitters. This is strong evidence that the tank does not leak.

No programmatic or nonprogrammatic waste is entering the tank. The tank is thought to contain only sludge. If any liquids are present, leaks from the tank can be detected in the adjacent monitoring well. No further sampling is planned until the remedial investigation is conducted.

2.45 TANK WC-4

2.45.1 Tank Description

Tank WC-4 is a 1700-gal stainless steel tank located west of Building 3026. The tank was installed in 1944 to collect wastes generated from the Roll Up Process, which involved dissolving uranium targets and extracting isotopes. The tank received waste until the late 1950s, when it was removed from the active system. At the time the tank was removed from service, it contained approximately 1400 gallons of waste. The tank was emptied in May 1990; a heel of less than 200 gallons remained in the tank.

2.45.2 Characterization Summary

Tank WC-4 was sampled when it was emptied in August 1990. The analysis results are shown in tables 2.45.1 and 2.45.2.

2.45.2.1 Aqueous Liquid

Analysis procedures included EPA 200.7 for RCRA metals, EPA 245.1 for mercury, EPA 600 160.2 for total dissolved solids and total solids, EPA 600 905.0 for strontium 90, MM 9002301 and 9002302 for gross alpha and gross beta, MM 11011 for density, and SW-846-9040 for pH. Anions were analyzed using the Dionex procedure.

No semivolatile organic compounds were detected with reporting limits of 20–200 mg/kg. A modification of the water soluble organics procedure was run and no hits were observed with a sensitivity of −5,000 Φg/L. Methyl alcohol was not determined in this latter analysis.

Table 2.45.1. Analytical data for tank WC-4

Parameter	WC-4-L1 (a)
Physical properties and miscellaneous data	
Density (g/mL)	
IC (L=mg/L, S=mg/kg)	1460
TC (L=mg/L, S=mg/kg)	1600
TDS (L=mg/mL)	26.1
TOC (L=mg/L, S=mg/kg)	141
TS (L=mg/mL, S=mg/g)	26.0
RCRA metals (L=mg/L, S=mg/kg)	
Ag	10.0
As	23.
Ba	<0.02
Cd	<0.5
Cr	16.
Hg	<0.002
Ni	<1.7
Pb	5.5
Se	6.1
Tl	0.71
Process metals (L=mg/L, S=mg/kg)	
Ca	-
Mg	-
Na	-
Th	42
U	1.76 E+3
Zn	-
Tc	4.2 E+2
Anions (L=mg/L, S=mg/kg)	
Br^-	-
Cl^-	154
CN^-	1.7
F^-	17
NO_3^-	2.80 E+3
PO_4^{-3}	-
SO_4^{-2}	2.67 E+2
Alkalinity	
pH (units)	11.1
OH^- (*M*)	-
CO_3^{-2} (*M*)	-
HCO_3^- (*M*)	-
Radiochemical screening (L=Bq/mL, S=Bq/g)	
Gross alpha	1.05E+2
Gross beta	1.42E+5
Beta/gamma emitters (L=Bq/mL, S=Bq/g)	
^{60}Co	<8.7E-01
^{137}Cs	6.16E+03
^{152}Eu	<13
^{154}Eu	<1.6

^{155}Eu	<1.2
^{3}H	1.75
^{90}Sr	14.1

(a) Tank sampled August 27, 1990.

Table 2.45.2. Organic analytical data hits and TICs for tank WC–4.

Parameter	WC-4-L1
None	

2.46 TANK W-17

2.46.1 Tank Description

Tank W-17 is a 1000-gal stainless steel tank located in the South Tank Farm. The tank was installed in 1951 and served as a waste tank for isotope production in Building 3026C.

2.46.2 Characterization Summary

The analysis results for this tank are shown in Tables 2.46.1 and 2.46.2.

The tank collects nonprogrammatic waste, and it is pumped out periodically to the LLLW System. As a result, the analyses in this Sect. represent a snapshot of the tank contents. Sample analysis indicated very low levels of contaminants. The only volatile organic compound detected was acetone at a concentration of 39 Φg/l, but acetone was also detected in the blank (17 Φg/L). No SVOAs were detected with reporting limits of 50–250 Φg/L, nor were pesticides or PCBs detected with reporting limits of 0.25–5 Φg/L. The sample was basic and contained dilute sodium hydroxide.

Table 2.46.1. Analytical data for tank W-17

Parameter	W-17-L1 (a,b)	W-17-L2 (a,c)
Physical properties and miscellaneous data		
Density (g/mL)	1.002	*
IC (L=mg/L, S=mg/kg)	22.	*
TC (L=mg/L, S=mg/kg)	255.	*
TDS (L=mg/mL)	3.9	*
TOC (L=mg/L, S=mg/kg)	233.	*
TS (L=mg/mL, S=mg/g)	3.9	*
RCRA metals (L=mg/L, S=mg/kg)		
Ag	(<0.006)	(<0.006)
As	0.006	0.003
Ba	<0.001	<0.001
Cd	<0.006	<0.006
Cr	<0.006	0.008
Hg	<0.005	<0.005
Ni	<0.015	<0.015
Pb	0.40	0.38
Se	<0.002	<0.002
Tl	<0.002	0.003
Process metals (L=mg/L, S=mg/kg)		
Ca	3.1	4.0
Na	1430.	1460
Th	<0.17 (d)	<0.17 (d)
U	3.3	3.1
Zn	10.5	10.7
Anions (L=mg/L, S=mg/kg)		
Br^-	12-30 (e)	*
Cl^-	30.	*
CN^-	<0.01	*
F^-	<0.1	*
NO_3^-	<0.1	*
PO_4^{-3}	<0.1	*
SO_4^{-2}	<0.1	*
Alkalinity		
pH (units)	12.4	12.4
OH^- (*M*)	0.06	*
CO_3^{2-} (*M*)	<0.02	*
HCO_3^- (*M*)	-	*
Radiochemical Screening (L=Bq/mL, S=Bq/g)		
Gross alpha	<1.0	1.0
Gross beta	2.4E+01	2.4E+01

Table 2.46.1 (continued)

Parameter	W-17-L1 (a,b)	W-17-L2 (a,c)
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{60}Co	<1.6E-01	<1.4E-01
^{137}Cs	1.60E+01	1.59E+01
^{152}Eu	<5.4E-01	<5.4E-01
^{154}Eu	<2.2E-01	<4.3E-01
^{155}Eu	<3.2E-01	<3.2E-01
^{3}H	1.79E+01	*
^{90}Sr	4.1E+00	*
^{65}Zn	(f)	(f)

(a) Tank sampled October 12, 1992.
(b) Sample collected from the midpoint of the liquid layer, – $4^{1}/_{2}$ in. above the bottom of the tank.
(c) Sample collected from the bottom of the tank.
(d) Visual scan.
(e) Some peak broadening due to older column; lower value excludes tail, higher value includes tail.
(f) Possibly some ^{65}Zn (–2 Bg/mL) was observed, but this is suspect given the half-life and the known history of the tank.

Table 2.46.2. Organic analytical data hits and TICs for tank W–17.

Parameter	W-17-L1
Volatile organic compound analysis (Φg/L)	
Acetone	39 B
Semivolatile organic compound analysis TICs (No. of TICs) (Φg/L)	
Unknown TICs (a)	1938 J (3)

(a) Result is the sum of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

2.47 TANK W-18

2.47.1 Tank Description

Tank W-18 is a 1000-gal stainless steel tank located in the South Tank Farm. The tank was installed in 1951 and served as a waste tank for isotope production in Building 3026C.

2.47.2 Characterization Summary

The results for this tank are shown in Tables 2.47.1 and 2.47.2.

2.47.2.1 Aqueous liquid

The tank collects nonprogrammatic waste, and it is pumped out periodically to the LLLW System. As a result, the analyses in this Sect. represent a snapshot of the tank contents. Sample analysis indicated very low levels of contaminants. The only volatile organic compound detected was acetone at a concentration of 37Φg/l, but acetone was also detected in the blank (17 Φg/L). There were no SVOA hits at reporting limits of 50–250 Φg/L, but traces of two pesticides and PCBs were detected below the reporting limits. The sample was basic and contained dilute sodium hydroxide. The sample also contained some bromide (1200 mg/l).

Table 2.47.1 Analytical data for tank W-18

Parameter	W-18-L1 (a,b)
Physical properties and miscellaneous data	
Density (g/mL)	1.001
IC (L=mg/L, S=mg/kg)	57.
TC (L=mg/L, S=mg/kg)	68.
TDS (L=mg/mL)	2.1
TOC (L=mg/L, S=mg/kg)	11.
TS (L=mg/mL, S=mg/g)	*
RCRA metals (L=mg/L, S=mg/kg)	
Ag	(0.008)
As	<0.002
Ba	<0.001
Cd	<0.006
Cr	<0.006
Hg	<0.005
Ni	<0.015
Pb	<0.27
Se	<0.002
Tl	0.002
Process metals (L=mg/L, S=mg/kg)	
Ca	3.1
Mg	2.1
Na	550.
Th	<0.17 (c)
U	0.04
Zn	1.4
Anions (L=mg/L, S=mg/kg)	
Br^-	1200.
Cl^-	20.
CN^-	<0.01
F^-	<0.1
NO_3^-	<0.1
PO_4^{-3}	<0.1
SO_4^{-2}	<0.1
Alkalinity	
pH (units)	10.2
OH^- (*M*)	<0.01
CO_3^{-2} (*M*)	<0.01
HCO_3^- (*M*)	-
Radiochemical screening (L=Bq/mL, S=Bq/g)	
Gross alpha	<1.0E+00
Gross beta	1.4E+01
Beta/gamma emitters (L=Bq/mL, S=Bq/g)	
^{60}Co	<1.0E-02
^{137}Cs	1.26E+01
^{152}Eu	<5.0E-01
^{154}Eu	<2.2E-01
^{155}Eu	<2.9E-01
^{3}H	9.29E+01
^{90}Sr	1.7E+00

(a) Tank sampled October 12, 1992.
(b) Tank contained – 1-in.-deep layer of liquid. Sample was collected from the bottom of the tank and was filtered before analysis.
(c) Visual scan.

Table 2.47.2. Organic analytical data hits and TICs for tank W–18.

Parameter	W-18-L1
Volatile organic compound analysis (Φg/L)	
Acetone	37 B
Pesticides/PCBs analysis (Φg/L)	
Endosulfan II	0.046 J
∀– Chlordane	0.12 J
Aroclor 1254	4 J
Aroclor 1260	1.9 J
Semivolatile organic compound analysis TICs (No. of TICs) (Φg/L)	
Unknown TICs (a)	918 J (3)

(a) Result is the sum of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

2.48 TANK WC-5

Tank WC-5 was isolated and filled with grout in January 1997. The following information is retained in this document for information only.

2.48.1 Tank Description

Tank WC-5 is a 1000-gal stainless steel tank located south of Building 3503. The tank was installed in 1952 and received waste from development projects in Buildings 3508, 3503, 3541, and 3592.

2.48.2 Characterization Summary

The analysis results for this tank are shown in Tables 2.48.1 and 2.48.2.

2.48.2.1 Aqueous liquid

This tank collects nonprogrammatic waste, and it is pumped out periodically to the LLLW System. As a result, the analyses in this Sect. represent a snapshot of the tank contents.

No volatile organic compounds were detected. The sample was basic and contained dilute sodium hydroxide (NaOH). No volatile organic compounds were detected with reporting limits of 50–250 Φg/L. Only traces of a phthalate were found in the SVOA with reporting limits of 16–80 Φg/L. No pesticides or PCBs were detected with reporting limits of 0.08–1.6 Φg/L.

Table 2.48.1. Analytical data for tank WC-5

Parameter	WC-5-L1 (a,b)	WC-5-L2 (a,c)
Physical properties and miscellaneous data		
Density (g/mL)	1.012	1.011
IC (L=mg/L, S=mg/kg)	106.	*
TC (L=mg/L, S=mg/kg)	123.	*
TDS (L=mg/mL)	8.1	*
TOC (L=mg/L, S=mg/kg)	17.	*
TS (L=mg/mL, S=mg/g	7.9	*
RCRA metals (L=mg/L, S=mg/kg)		
Ag	(<0.006)	(<0.006)
As	0.006	*
Ba	0.017	0.016
Cd	<0.006	<0.006
Cr	0.29	0.31
Hg	0.22	0.22
Ni	<0.015	<0.015
Pb	0.25	0.16
Se	0.002	*
Tl	<0.002	*
Process metals (L=mg/L, S=mg/kg)		
Ca	8.0	5.2
K	5.8	6.0
Na	3300.	3300
Th	<0.17	<0.17
U	<0.35	0.46
Anions (L=mg/L, S=mg/kg)		
Br^-	<0.05	*
Cl^-	70.	*
CN^-	<0.01	*
F^-	<10. (d)	*
NO_3^-	9.2	*
PO_4^{-3}	<0.1	*
SO_4^{-2}	18.	*
Alkalinity		
pH (units)	13.1	13.0
OH^- (*M*)	0.15	*
CO_3^{-2} (*M*)	<0.02	*
HCO_3^- (*M*)	-	*
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	1.1E+00	<1.0E+00
Gross beta	1.0E+00	<1.0E+00

Table 2.48.1 (continued)

Parameter	WC-5-L1 (a,b)	WC-5-L2 (a,c)
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{60}Co	<1.0E-01	<8.3E-02
^{137}Cs	3.5E-01	2.4E-01
^{152}Eu	<2.8E-01	<2.3E-01
^{154}Eu	<1.9E-01	<2.5E-01
^{155}Eu	<2.0E-01	<1.7E-01
^{3}H	<4.0E-02	*
^{90}Sr	<1.0E+00	*

(a) Tank sampled October 26, 1992.
(b) Sample collected from the midpoint of the liquid layer, – 10 in. above the bottom of the tank.
(c) Sample collected from the bottom of the tank. Sample was filtered before analysis.
(d) Interference with the fluoride analysis. This interference may be due to small aliphatic acids that elute from the AS4A column at about the same time as fluoride.

Table 2.48.2. Organic analytical data hits and TICs for tank WC–5

Parameter	WC-5-L1
Semivolatile organic compound analysis (Φg/L)	
Butylbenzyl Phthalate	2 J
Semivolatile organic compound analysis TICs (No. of TICs) (Φg/L)	
Unknown TICs (a)	711 J (3)

(a) Result is the sum of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

2.49 TANK WC-6

Tank WC-6 was isolated and filled with grout in January 1997. The following information is retained in this document for information only.

2.49.1 Tank Description

Tank WC-6 is a 500-gal stainless steel tank located south of Building 3503. The tank was installed in 1952 to receive waste from development projects in Buildings 3508, 3541, and 3592.

2.49.2 Characterization Summary

The analysis results for this tank are shown in Tables 2.49.1 and 2.49.2.

2.49.2.1 Aqueous liquid

This tank collects nonprogrammatic waste, and it is pumped out periodically to the LLLW System. As a result, the analyses in this Sect. represent a snapshot of the tank contents.

Sample analysis indicated low levels of contaminants. No volatile organic compounds were detected with reporting limits of 25–50 Φg/L, and only a trace of a phthalate was detected in the SVOA with reporting limits of 16–80 Φg/L. No pesticides or PCBs were detected with reporting limits of 0.08–1.6 Φg/L. The sample was basic and contained dilute NaOH.

Table 2.49.1. Analytical data for tank WC-6

Parameter	WC-6-L1 (a,b)	WC-6-L2 (a,c)
Physical properties and miscellaneous data		
Density (g/mL)	1.010	1.011
IC (L=mg/L, S=mg/kg)	105.	*
TC (L=mg/L, S=mg/kg)	125.	*
TDS (L=mg/mL)	6.2	*
TOC (L=mg/L, S=mg/kg)	20.	*
TS (L=mg/mL, S=mg/g)	5.9	*
RCRA metals (L=mg/L, S=mg/kg)		
Ag	(<0.006)	(<0.006)
As	<0.002	*
Ba	0.012	0.002
Cd	<0.006	<0.006
Cr	0.018	0.035
Hg	<0.001	0.002
Ni	<0.015	<0.015
Pb	0.007	0.008
Se	<0.002	*
Tl	<0.002	*
Process metals (L=mg/L, S=mg/kg)		
Ca	20.	10.
K	9.4	8.2
Na	2500.	4100.
Th	<0.17	<0.17
U	<0.35	0.55
Anions (L=mg/L, S=mg/kg)		
Br^-	<0.05	*
Cl^-	50.	*
CN^-	<0.01	*
F^-	< 10. (d)	*
NO_3^-	16.	*
PO_4^{-3}	<0.1	*
SO_4^{-2}	13.	*
Alkalinity		
pH (units)	13.1	13.1
OH^- (*M*)	0.11	*
CO_3^{-2} (*M*)	<0.02	*
HCO_3^- (*M*)	-	*
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	<1.0E+00	<1.0E+00
Gross beta	1.1E+00	1.0E+00

Table 2.49.1 (continued)

Parameter	WC-6-L1 (a,b)	WC-6-L2 (a,c)
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{60}Co	<1.0E-01	<1.4E-01
^{137}Cs	3.6E-01	1.2E-01
^{152}Eu	<2.3E-01	<2.0E-01
^{154}Eu	<2.9E-01	<4.0E-01
^{155}Eu	<1.9E-01	<1.8E-01
^{3}H	<4.0E-02	*
^{90}Sr	<1.0E+00	*

(a) Tank sampled October 26, 1992.
(b) Sample collected from the midpoint of the liquid layer, $-4^{1}/_{2}$ in. above the bottom of the tank.
(c) Sample collected from the bottom of the tank. Sample was filtered before analysis.
(d) Interference with the fluoride analysis. This interference may be due to small aliphatic acids that elute from the AS4A column at about the same time as fluoride.

Table 2.49.2. Organic analytical data hits and TICs for tank WC–6

Parameter	WC-5-L1
Semivolatile organic compound analysis (Φg/L)	
Butylbenzyl Phthalate	2 J
Semivolatile organic compound analysis TICs (No. of TICs) (Φg/L)	
Unknown TICs (a)	184 J (3)
Hydrocarbons (a)	13 J (1)

(a) Result is the sum of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

2.50 TANK WC-8

Tank WC-8 was isolated and filled with grout in January 1997. The following information is retained in this document for information only.

2.50.1 Tank Description

Tank WC-8 is a 1000-gal stainless steel tank located south of Building 3503. The tank was installed in 1952 and received waste from development projects in Buildings 3508, 3503, 3541, and 3592.

2.50.2 Characterization Summary

The results for this tank are shown in Tables 2.50.1 and 2.50.2.

2.50.2.1 Aqueous liquid

This tank collects nonprogrammatic waste, and it is pumped out periodically to the LLLW System. As a result, the analyses in this Sect. represents a snapshot of the tank contents.

Sample analysis indicated low levels of contaminants. No volatile organic compounds were detected with reporting limits of 50–100 Φg/L. No semivolatile hits were found with reporting limits of 17–85 Φg/L. No pesticides or PCBs were detected with reporting limits of 0.085–1.7 Φg/L. The sample was basic and contained dilute sodium hydroxide.

Table 2.50.1. Analytical data for tank WC-8

Parameter	WC-8-L1 (a,b)	WC-8-L2 (a,c)
Physical properties and miscellaneous data		
Density (g/mL)	1.013	1.013
IC (L=mg/L, S=mg/kg)	64.	*
TC (L=mg/L, S=mg/kg)	79.	*
TDS (L=mg/mL)	12.	*
TOC (L=mg/L, S=mg/kg)	15.	*
TS (L=mg/mL, S=mg/g)	12.	*
RCRA metals (L=mg/L, S=mg/kg)		
Ag	(<0.006)	(<0.006)
As	<0.002	*
Ba	0.005	0.006
Cd	<0.006	<0.006
Cr	0.022	0.021
Hg	0.002	0.002
Ni	0.015	0.015
Pb	0.23	0.22
Se	<0.002	*
Tl	0.002	*
Process metals (L=mg/L, S=mg/kg)		
Ca	11.6	11.5
K	7.6	7.6
Na	5500.	5500.
Th	<0.17	0.17
U	<1.4	3.2
Anions (L=mg/L, S=mg/kg)		
Br^-	<1.1	*
Cl^-	110.	*
CN^-	0.01	*
F^-	<10. (d)	*
NO_3^-	27.	*
PO_4^{-3}	<0.1	*
SO_4^{-2}	15.	*
Alkalinity		
pH (units)	13.4	13.2
OH^- (*M*)	0.26	0.26
CO_3^{-2} (*M*)	<0.02	<0.02
HCO_3^- (*M*)	-	-
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	<1.0E+00	<1.0E+00
Gross beta	6.3E+00	6.8E+00

Table 2.50.1 (continued)

Parameter	WC-8-L1 (a,b)	WC-8-L2 (a,c)
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{60}Co	<1.5E-01	<7.3E-02
^{137}Cs	2.5E+00	2.8E+00
^{152}Eu	<3.4E-01	<1.5E-01
^{154}Eu	<3.1E-01	<2.7E-01
^{155}Eu	<2.0E-01	<1.5E-01
^{3}H	2.6E-01	*
^{90}Sr	1.9E+00	*

(a) Tank sampled October 26, 1992.
(b) Sample collected from the midpoint of the liquid layer, – $3^{1}/_{2}$ in. above the bottom of the tank.
(c) Sample collected from the bottom of the tank.
(d) Interference with the fluoride analysis. This interference may be due to small aliphatic acids that elute from the column at about the same time as fluoride.

Table 2.50.2. Organic analytical data hits and TICs for tank WC–8

Parameter	WC-8-L1
Semivolatile organic compound analysis TICs (No. of TICs) (Φg/L)	
Unknown TICs (a)	713 J (3)
Hydrocarbons (a)	11 J (1)

(a) Result is the sum of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

2.51 TANK WC-11

2.51.1 Tank Description

Tank WC-11 is a 4000-gal stainless steel tank located south of Building 3587. The tank was installed in 1951 to collect waste from the 4500 complex, 4505, and 4507.

2.51.2 Characterization Summary

The results for this tank are shown in Tables 2.51.1 and 2.51.2.

2.51.2.1 Aqueous liquid

This tank collects nonprogrammatic waste, and it is pumped out periodically to the LLLW System. As a result, the analyses in this Sect. represent a snapshot of the tank contents.

The sample was basic and contained dilute NaOH. No volatile organic compounds were detected in the water soluble organics analysis (reporting limits of 1,000 Φg/L). Traces of two phthalates and several TICs were found in the SVOA (reporting limits of 25–125 Φg/L). No pesticides or PCBs were detected at reporting limits of 0.125–2.5 Φg/L. The aqueous liquid was radioactive with ^{137}Cs as the principal contributor.

2.51.2.2 Organic layer

The tank contains a layer of oil approximately 0.5 in. thick floating over the aqueous phase. Purge-and-trap GC-MS of a methyl alcohol dilution of the oil (reporting limits of 50–100 mg/L) revealed no volatile compounds beyond traces of methylene chloride and hexane, which were also present in a solvent blank. SVOA of a methylene chloride dilution (reporting limits of 55–275 mg/L) did not have any hits, but the pesticide/PCB analysis of a hexane dilution (reporting limits of 53–1050 Φg/L) indicated Aroclor 1254 at 1700 Φg/L. Some pesticides also were detected, but these are believed to be compounds of the Aroclor mixture which co-elute with pesticides on the GC. Further work would be required to confirm these pesticides. A GC profile of the organic layer suggested that it is vacuum pump oil or an oil with a boiling range similar to vacuum pump oil.

Table 2.51.1. Analytical data for tank WC-11

Parameter	WC-11-L1 (a,b)	WC-11-L2 (a,c)
Physical properties and miscellaneous data		
Density (g/mL)	1.006	1.005
IC (L=mg/L, S=mg/kg)	98.	*
TC (L=mg/L, S=mg/kg)	182.	*
TDS (L=mg/mL)	1.7	*
TOC (L=mg/L, S=mg/kg)	84.	*
TS (L=mg/mL, S=mg/g)	*	*
RCRA metals (L=mg/L, S=mg/kg)		
Ag	(<0.006)	(<0.006)
As	<0.002	*
Ba	0.024	0.061
Cd	<0.006	0.016
Cr	0.055	0.13
Hg	0.005	0.018
Ni	0.13	0.31
Pb	0.23	0.36
Se	0.002	*
Tl	0.003	*
Process metals (L=mg/L, S=mg/kg)		
Ca	4.7	5.0
K	16.	20.
Mg	0.20	1.8
Na	500.	850.
Th	<0.17	<0.17
U	<0.35	0.91
Anions (L=mg/L, S=mg/kg)		
Br^-	<0.05	*
Cl^-	15.	*
CN^-	0.012	*
F^-	<0.05	*
NO_3^-	52.	*
PO_4^{-3}	<0.08	*
SO_4^{-2}	20.	*
Alkalinity		
pH (units)	11.4	11.2
OH^- (*M*)	<0.01	0.02
CO_3^{-2} (*M*)	<0.01	<0.02
HCO_3^- (*M*)	-	-
Radiochemical screening (L=Bq/mL, S=Bq/g)		
Gross alpha	<1.0E+00	*
Gross beta	5.0E+04	*

Table 2.51.1 (continued)

Parameter	WC-11-L1 (a,b)	WC-11-L2 (a,c)
Beta/gamma emitters (L=Bq/mL, S=Bq/g)		
^{60}Co	1.10E+02	1.50E+02
^{137}Cs	4.77E+04	5.80E+04
^{152}Eu	<1.6E+02	<2.6E+02
^{154}Eu	<1.4E+01	<1.9E+01
^{155}Eu	<8.4E+01	<2.0E+02
^{3}H	3.1E+01	*
^{90}Sr	9.3E+00	*

(a) Tank sampled November 3, 1992.
(b) Sample collected from the midpoint of the liquid layer, – 5 in. above the bottom of the tank. Sample was filtered before the radiochemical analysis.
(c) Sample collected from the bottom of the tank. Sample was filtered before analysis.

Table 2.51.2. Organic analytical data hits and TICs for tank WC–11

Parameter	WC-11-L1	WC-11-0
Semivolatile organic compound analysis (Φg/L)		
Diethyl Phthalate	7 J	
Di–n–Octyl Phthalate	17 J	
Pesticides/PCBs analysis (Φg/L)		
Aroclor 1254		1700 (a)
Semivolatile organic compound analysis TICs (No. of TICs) (Φg/L)		
Unknown TICs (b)		1158 J (8)
Hydrocarbons (b)		114 J (7)

a) Some pesticides also were detected, but those are believed to be co-eluting components from the Aroclor mixture, and not pesticides. Further work is required before the presence of pesticides can be confirmed.
(b) Result is the sum of the tentatively identified compounds (TICs). The number of TICs is shown in parenthesis.

2.52 TANK WC-12

2.52.1 Tank Description

Tank WC-12 is a 1000-gal stainless steel tank located in the WC-10 tank farm, which lies south of Building 3587. The tank was installed in 1951 and received waste from Building 4505.

2.52.2 Characterization Summary

The results for this tank are shown in Tables 2.52.1 and 2.52.2.

2.52.2.1 Aqueous liquid

This tank receives nonprogrammatic inflow, which is pumped periodically to the active LLLW system. As a result, the analyses in this section represent a snapshot of the tank contents.

Sample WC12-L1 from the midpoint of the liquid layer was radioactive—with ^{137}Cs as the principal contributor. The waste was basic and contained dilute NaOH. The concentrations of inorganic analytes (except sodium) were low. Very little organic matter was found in sample WC12-L1. No water-soluble volatile organic compounds were detected (reporting limits of 1000 Φg/L), and no constituents on the target compound lists (TCLs) were found in the semivolatile organic compound analysis (reporting limits of 25–125 Φg/L) or the pesticide/PCB analysis (reporting limits of 0.50–10 Φg/L). Several semivolatile organic tentatively identified compounds (TICs) were observed (total – 1017J Φg/L).

2.52.2.2 Sludge

Tank WC-12 contained a shallow layer (−0.5 in. deep) of a thin sludge containing highly radioactive solids. Because this layer was too shallow to sample with the soft-sludge sampler, it was sampled as liquid samples using the vacuum-pump sampling system to suction material from the bottom of the tank. This method provides qualitative information about the bottom layer and solids. Because of the limited quantity of sample material available and the highly radioactive nature of the solids, the analysis of the sample was limited per the ALARA principle. An aliquot of sample WC12-L3-A (including the solids) was treated by microwave-assisted digestion in HNO_3 and filtered, and the resulting solution was analyzed for metals and radioactive materials. Sample WC12-L3-B was filtered, and the filtrate was analyzed for metals and radioactive materials.

The constituents in the sludge that were soluble after microwave digestion included relatively high levels of europium isotopes, ^{60}Co, ^{137}Cs, and some curium and plutonium (sample WC12-L3-A including solids). The principal metal analytes present in addition to Na were Ca, Fe, Mg, and Mn. Low concentrations of Pb, Hg, Th, and U were also detected. The difference between the results for sample WC12-L3-A including the solids and the filtered sample WC12-L3-B provides a qualitative indication of the constituents in the solids. The residue from the microwave digestion of WC12-L3-A was not analyzed because of the highly radioactive nature of the solids.

Sample WC12-L3-C was filtered, and the filtrate was analyzed for organic compounds. No pesticides or PCBs were detected (at reporting limits of 3.4–69 Φg/L), and the only semivolatile

Table 2.52.1. Analytical data for tank WC-12

Parameter	WC12-L1 (*a*)	WC12-L3-B Filtered (*b*)	WC12-L3-A Including solids (*b*), (*c*)
Physical properties and miscellaneous data			
Density (g/mL)	1.008	1.006	*
IC (L = mg/L)	1110	*	*
TC (L = mg/L)	1050	*	*
TDS (L = mg/L)	6.4	4.9	*
TOC (L = mg/L)	<10	*	*
TS (L = mg/mL)	6.4	*	*
RCRA metals (L = mg/L)			
Ag	(<0.006)	(<0.009)	(0.07)
As	<0.002	<0.006	<0.006
Ba	0.019	0.094	8.92
Cd	0.067	0.058	0.55
Cr	0.25	0.29	5.62
Hg	0.002	0.064	4.32
Ni	0.36	0.74	12.8
Pb	1.92	0.75	26.1
Se	0.003	<0.006	<0.006
Tl	<0.002	<0.4	<0.4
Process metals (L = mg/L)			
Al	5.8	3.2	69
Ca	2.8	8.0	430
Fe	0.1	2.3	220
K	42	58	62
Mg	0.6	2.2	110
Mn	0.9	2.6	210
Na	2700	2200	2200
Th	<0.17	0.41	21.6
U	2.6	6.1	8.7
Anions (L = mg/L)			
Bromide	<0.05	*	*
Chloride	35	*	*
Cyanide	0.016	*	*
Fluoride	<0.05	*	*
Nitrate	45	*	*
Phosphate	<0.08	*	*
Sulfate	9.3	*	*
Alkalinity			
pH (units)	10.1	9.8	*
OH^- (*M*)	0.04	*	*
CO_3^{-2} (*M*)	<0.02	*	*
HCO_3^- (*M*)	<0.02	*	*
Radiochemical screening (L = Bq/mL)			
Gross alpha	<1.0E+0	<2.6E+1	1.8E+3
Gross beta	5.6E+4	3.7E+4	7.3E+5

Table 2.52.1 (continued)

Parameter	WC12-L1 (*a*)	WC12-L3-B Filtered (*b*)	WC12-L3-A Including solids (*b*), (*c*)
Beta/gamma emitters (L = Bq/mL)			
^{60}Co	2.63E+2	9.25E+2	4.56E+4
^{137}Cs	5.03E+4	2.76E+4	3.59E+4
^{152}Eu	<1.7E+2	4.50E+3	3.80E+5
^{154}Eu	<1.7E+1	3.42E+3	3.02E+5
^{155}Eu	<8.7E+1	8.38E+2	7.04E+5
^{3}H	2.8E+1	*	*
^{90}Sr	1.1E+1	*	1.43+3
Alpha emitters (L = Bq/mL)			
^{244}Cm	(*d*)	(*d*)	1.6E+3
^{238}Pu			1.5E+2
^{239}Pu/^{240}Pu			2.4E+1
^{233}U/^{239}Th/^{237}Np			2.3E+0

(*a*) Sample collected November 4, 1992, from the midpoint of the liquid layer, – 4 in. above the tank bottom. The sample was filtered before the radiochemical analysis.
(b) Sample collected March 17, 1993, from the bottom of the tank.
(c) Data are for the liquid plus the solids, which dissolved during microwave- assisted digestion in –2.6 *M* HNO_3 acid. The residue was not analyzed.
(*d*) Gross alpha too low for alpha spectrometry measurements.

Table 2.52.2. Organic analytical data hits for tank WC-12

Parameter (*a*)	WC12-L1	WC12-L3-C Filtered
Volatile organic compound analysis (L = Φg/L)		
	(*b*)	(*b*)
Water-soluble organic compound analysis (L = Φg/L)		
		(*c*)
Semivolatile organic compound analysis (L = Φg/L)		
Diethylphthalate		89 B
Di-n-butylphthalate		390
Bis(2-ethylhexyl)phthalate		25 J
Di-n-octylphthalate		12 J
Pecticides/PCBs analysis (L = Φg/L)		
Semivolatile organic compound analysis TICs (L = Φg/L) (d)		
Unknown	943 J (10)	7540 J (18)
Unknown hydrocarbons	74 J (5)	
Tributylphosphate		630 J
Propanol derivative		64 J
2,6-Dibromo-4-nitrophenol		54 J (*e*)
Dibutylphthalate		66 J

(*a*) Only compounds whose possible presence was indicated by the analysis are listed.
(*b*) Analysis was not run because the sample was too radioactive for nonzoned laboratory.
(*c*) Analysis was not run because of instrument breakdown.
(*d*) The result is the sum of the tentatively identified compounds (TICs). The number of TICs are shown in parenthesis.
(*e*) Compound could result from nitration of surrogate standard.

organic compounds on the target compound list were four phthalates at low concentrations. The semivolatile organic TICs included tributylphosphate (630J Φg/L), an isomer of dibutylphthalate (66J Φg/L), a propanol derivative (64J Φg/L), and 18 unknown compounds (total 7540J Φg/L). Of interest was the identification of 2,6-dibromo-4-nitrophenol (54J Φg/L), which is a nitration product of the 2,4,6-tribromophenol surrogate standard added to the sample as part of the quality control check.

2.53 TANK WC-13

2.53.1 Tank Description

Tank WC-13 is a 1000-gal stainless steel tank located in the WC-10 tank farm, which lies south of Building 3587. The tank was installed in 1951 and received waste from Buildings 4501, 4508, 4500N, and 4500S.

2.53.2 Characterization Summary

The results for this tank are shown in Tables 2.53.1 and 2.53.2.

2.53.2.1 Aqueous liquid

This tank receives nonprogrammatic inflow, which is pumped periodically to the active LLLW system. As a result, the analyses in this section represent a snapshot of the tank contents.

The aqueous sample WC13-L1 collected November 1992 from the midpoint of the liquid layer was radioactive—with ^{137}Cs as the principal contributor. The waste was basic (with sodium the principal metal analyte), and it contained some phosphate, sulfate, chloride, and nitrate. There were also low concentrations of other metal analytes including uranium and mercury. Sample WC13S-L was the supernatant liquid from over the sludge samples collected in March 1993. The results for WC13S-L were similar to those for WC13-L1.

The water-soluble volatile organics analysis of WC13-L1 showed the presence of 9600 Φg/L of methyl alcohol, 8900 Φg/L of n-butyl alcohol, and 230J Φg/L of an unknown compound. No semivolatile organic compounds on the target compound list (TCL) were detected at reporting limits of 250–1300 Φg/L, and no pesticides or PCBs were found at reporting limits of 2.5–50 Φg/L. Tributylphosphate (470J Φg/L) and three unknowns (total −2480J Φg/L) were observed in the semivolatile organic tentatively identified compounds (TICs).

2.53.2.2 Sludge

The tank WC-13 sludge contained relatively high levels of europium isotopes, ^{60}Co, ^{137}Cs, and ^{90}Sr, and some alpha emitters and metals listed as hazardous under RCRA. The principal metals in the sludge were sodium, uranium, thorium, calcium, and iron. The volume of sludge in the tank is probably in the range of 70–175 gal. (There are uncertainties in estimating sludge inventory because of the complex tank geometry and limited access for measurements.)

The only semivolatile organic TCL compound found was di-n-butylphthalate (31,000B Φg/kg). The semivolatile organic TICs included tributylphosphate (47,000J Φg/kg) and six unknowns (total −377,000J Φg/kg). The pesticide/PCB analysis showed 1630 Φg/kg of Aroclor-1254. Some pesticide peaks also were detected, but these are believed to be the result of co-eluting components from the Aroclor mixture, and not pesticides. This sample was found to contain approximately 6 wt % oil, which appeared to be vacuum-pump oil. Because of the large amount of organic material, in the semivolatile organic compound analysis (SVOA) the extracts required dilution before analysis by gas chromatography—mass spectrometry (GC-MS). This procedure raised the reporting limits for the SVOA to 92,000–460,000 Φg/kg. Water-soluble volatile organics were determined in an interstitial

Table 2.53.1. Analytical data for tank WC-13

Parameter	WC13-L1 Liquid (*a*)	WC13S-L Liquid (*b*)	WC13-S Sludge (*c*), (*d*)
Physical properties and miscellaneous data			
Density (g/mL)	1.020	*	1.062
IC (L = mg/L, S = mg/kg)	168	*	1,700
TC (L = mg/L, S = mg/kg)	342	*	42,000
TDS (L = mg/mL, S = mg/g)	18.1	*	23
TOC (L = mg/L, S = mg/kg)	174	*	41,400
TS (L = mg/mL, S = mg/g	18.4	*	106
RCRA metals (L = mg/L, S = mg/kg)			
Ag	(<0.006)	(0.016)	(18)
As	0.054	*	<0.006
Ba	0.001	0.038	18.8
Cd	<0.006	<0.006	1.3
Cr	2.7	3.6	280
Hg	2.7	0.33	390
Ni	3.6	2.4	240
Pb	<0.26	<0.28	34.7
Se	0.015	*	<0.006
Tl	0.008	*	<0.22
Process metals (L = mg/L, S = mg/kg)			
Al	12	16	360
Ca	1.9	0.8	3,800
Cu	2.8	3.0	84
Fe	0.7	0.5	3,400
K	48	32	50
Mg	<0.04	<0.03	1,100
Mn	<0.01	<0.01	110
Na	8,200	9,600	11,700
Si	*	*	270
Th	0.44	0.36	1,600
U	14.4	10.0	6,700
V	1.6	1.0	7.8
Zn	0.5	9.4	83
Anions (L = mg/L)			
Bromide	<0.05	*	*
Chloride	170	*	*
Cyanide	0.25	*	0.17
Fluoride	(*e*)	*	*
Nitrate	84	*	*
Phosphate	2,200	*	*
Sulfate	580	*	*
Alkalinity			
pH (units)	13.2	13.2	(*f*)
OH^- (*M*)	0.29	*	NA
CO_3^{-2} (*M*)	<0.02	*	NA
HCO_3^- (*M*)	(*g*)	*	NA

Table 2.53.1 (continued)

Parameter	WC13-L1 Liquid (*a*)	WC13S-L Liquid (*b*)	WC13-S Sludge (*c*), (*d*)
	Radiochemical screening (L = Bq/mL, S = Bq/g)		
Gross alpha	<1.0E+0	<1.0E+0	5.8E+2
Gross beta	5.0E+3	4.9E+3	6.2E+4
	Beta/gamma emitters (L = Bq/mL, S = Bq/g)		
^{14}C	*	*	9.7E+1
^{60}Co	1.33E+1	8.57E+1	1.52E+3
^{137}Cs	5.54E+3	4.58E+3	4.58E+3
^{152}Eu	<9.1E+0	<1.8E+1	3.97E+4
^{154}Eu	<1.2E+0	<3.5E+0	2.04E+4
^{155}Eu	<4.7E+0	<1.1E+1	5.17E+3
^{3}H	4.2E+0	*	*
^{90}Sr	<2.0E+0	*	2.86E+2
	Alpha emitters (L = Bq/mL, S = Bq/g)		
^{244}Cm	(*h*)	(*h*)	1.1E+2
^{238}Pu			4.9E+1
$^{239}Pu/^{240}Pu$			4.7E+1
$^{233}U/^{229}Th/^{237}Np$			3.0E+2
^{235}U			1.1E+1
^{238}U			4.9E+1

(*a*) Sample collected November 12, 1992, from the midpoint of the liquid layer, ~ 5 in. above the sludge layer.
(*b*) Aqueous supernate over the sludge; a vertical "column" of tank liquid collected March 2, 1993. Sample was filtered before analysis.
(*c*) Sludge sample data are reported on a weight basis.
(*d*) Sample WC13-S was a composite of the sludge phases in samples WC13-S1 and WC13-S2, collected March 2, 1993. The samples were combined and sonicated before taking aliquots.
(*e*) Interference with the fluoride analysis from small aliphatic acids.
(*f*) The pH of the sludge interstitial liquid was >14 by qualitative analysis with pH stick.
(*g*) Bicarbonate not stable at this pH.
(*h*) Gross alpha too low for alpha spectrometry measurements.

Table 2.53.2. Organic analytical data hits for tank WC-13

Parameter (*a*)	WC13-L1 Aqueous layer	WC13-O Organic layer	WC13-S Sludge (*b*)
Volatile organic compound analysis (L = Φg/L, S = Φg/kg)			
	(*c*)	(*d*)	(*c*)
Water-soluble organic compound analysis (L = Φg/L)			
Methyl alcohol	9,600	NA (*e*)	5,000 (*f*)
n-Butyl alcohol	8,900	NA (*e*)	5,200 (*f*)
Semivolatile organic compound analysis (L = Φg/L, S = Φg/kg)			
Di-n-butylphthalate		17,000,000 J	31,000 B
Pesticides/PCBs analysis (L = Φg/L, S = Φg/kg)			
Aroclor-1254		5, 060 (*g*)	1,630 (*g*)
Semivolatile organic compound analysis TICs (L = Φg/L, S = Φg/kg) (h)			
Unknown	2,480 J (3)		377,000 J (6)
Tributylphosphate	470 J		47, 000 J
Oil analysis (wt %)			
Vacuum pump oil range	NA	*	–6

(*a*) Only compounds whose possible presence was indicated by the analysis are listed.
(*b*) Sludge sample data are reported on a weight basis.
(*c*) Analysis was not run because the sample was too radioactive for nonzoned laboratory.
(*d*) Traces of methylene chloride and hexane were detected. Their presence in the blank suggests cross-contamination among the diluted oil samples during transport.
(*e*) Analysis is not appropriate for organic samples.
(*f*) Analysis performed on the interstitial liquid of the sludge. Units are Φg/L of interstitial liquid.
(*g*) Some pesticide peaks also were detected, but these are believed to be the result of co-eluting components from the Aroclor mixture, and not pesticides.
(*h*) The result is the sum of the tentatively identified compounds (TICs). The number of TICs are shown in parenthesis.

liquid sample from the sludge. Methyl and n-butyl alcohols were found at 5000 and 5200 Φg/L, respectively.

2.53.2.3 Organic layer

Tank WC-13 contained a layer of oil, about 0.5-in. deep, floating on the aqueous layer. The volatile organics analysis of a methyl alcohol dilution of the oil did not reveal any volatile compounds beyond traces of methylene chloride and hexane, which also were present in the solvent blank. The reporting limits for the volatile organics analysis were 50–100 mg/L. In the SVOA (reporting limits of 55–280 mg/L), the only TCL constituent detected was di-n-butyl-phthalate at 17,000J mg/L. The pesticide/PCB analysis showed 5060 Φg/L of Aroclor-1254 (reporting limits were 105–2100 Φg/L). Some pesticide peaks also were detected, but these are believed to be the result of co-eluting components from the Aroclor mixture, and not pesticides. A GC profile of the organic layer suggested that it is vacuum-pump oil or an oil with a distillation range similar to vacuum-pump oil.

2.54 TANK WC-14

2.54.1 Tank Description

Tank WC-14 is a 1000-gal stainless steel tank located in the WC-10 tank farm, which lies south of Building 3587. The tank was installed in 1951 and received waste from Buildings 4501 and 4507.

2.54.2 Characterization Summary

The results for this tank are shown in Tables 2.54.1–2.54.3.

2.54.2.1 Aqueous liquid

This tank receives a small amount of nonprogrammatic inflow, and the analyses in this section represent a snapshot of the tank contents.

Sample WC14-L1 (November 1992) was radioactive—with ^{137}Cs as the principal contributor. The principal inorganic constituents were sodium, nitrate, chloride, and sulfate. The results for sample WC14-L2, which was collected in December 1994, were in general similar to, or lower than, those for WC14-L1.

The water-soluble volatile organics analysis of sample WC14-L1 (November 1992) showed 14,700 Φg/L of methyl alcohol and 330 Φg/L of an unknown. During the semivolatile organic compound analysis (reporting limits of 250–1300 Φg/L), the only analyte detected on the target compound list (TCL) was benzoic acid at a concentration below the reporting limit. Several semivolatile organic tentatively identified compounds (TICs) were observed, including tributylphosphate (9700J Φg/L), diethylbenzene (280J Φg/L), two unknown hydrocarbons (total –1770J Φg/L), and ten unknowns (total –2870J ΦgL).

Sample WC14-L1 (November 1992) contained 278 Φg/L of Aroclor-1248. The analysis of the second sampling of this tank (Table 2.54.3), conducted almost 1 year later, showed only a trace (5–7 Φg/L) of Aroclor-1248. A third sampling and analysis of WC-14 aqueous liquid (conducted in December 1994) yielded similar results of 10.9 and 13.2 Φg/L of Aroclor-1248 for duplicate samples. The first set (taken in November 1992) of liquid samples from tank WC-14 were collected about 2.5 in. above the sludge phase. These samples were slightly cloudy and may have contained a trace of the sludge phase, which could have elevated the apparent PCB concentration.

2.54.2.2 Sludge

The sludge samples from tank WC-14 contained relatively high levels of alpha emitters, europium isotopes, ^{137}Cs, ^{60}Co, and ^{90}Sr; PCBs at greater than 50 ppm; and some metals listed as hazardous under RCRA. The sludge is a transuranic (TRU) waste containing –1000 nCi/g (–38,000 Bq/g; wet basis) of transuranics with half-lives greater than 20 years. The principal metals were uranium, thorium, iron, and sodium. The volume of sludge in the tank is probably in the range of 70–130 gal. (There are uncertainties in estimating the sludge inventory because of the complex tank geometry and limited access for measurements.)

Table 2.54.1. Analytical data for tank WC-14

Parameter	WC14-L1 Liquid (*a*)	WC14-L2 Liquid (*b*)	WC14-S Sludge (*c*), (*d*)
Physical properties and miscellaneous data			
Density (g/mL)	1.013	*	1.094
IC (L = mg/L, S = mg/kg)	12	*	4,500
TC (L = mg/L, S = mg/kg)	499	*	15,300
TDS (L = mg/mL, S = mg/g)	14.0	*	20
TOC (L = mg/L, S = mg/kg)	487	*	10,800
TS (L = mg/mL, S = mg/g	14.4	*	147
RCRA metals (L = mg/L, S = mg/kg)			
Ag	(0.032)	(0.199)	<0.009
As	<0.002	*	<0.006
Ba	0.006	0.094	64
Cd	0.15	<0.075	140
Cr	0.44	0.775	360
Hg	0.032	*	8.5
Ni	7.8	1.00	1,330
Pb	<0.26	<4.2	580
Se	<0.002	*	<0.006
Tl	<0.002	<1.5	(*e*)
Process metals (L = mg/L, S = mg/kg)			
Al	1.4	<0.25	650
Ca	52	11.6	2,600
Co	0.2	0.23	58
Cu	1.7	1.25	68
Fe	0.3	<0.04	6,200
K	32	63.3	180
Mg	42	2.89	780
Mn	1.1	0.17	74
Na	4,300	3,190	13,000
Th	1.5	39.2	12,000
U	48	1,370	50,000
Zn	1.0	0.25	140
Anions (L = mg/L, S = mg/kg)			
Bromide	8.9	6.0	*
Chloride	2,000	460	*
Cyanide	0.06	*	0.26
Fluoride	35.(*f*)	40	*
Nitrate	5,300	1,020	*
Phosphate	<0.08	40	*
Sulfate	1,800	324	*
Alkalinity			
pH (units)	7.4	10.0	−13-14 (*g*)
OH^- (*M*)	NA	*	NA
CO_3^{-2} (*M*)	NA	*	NA
HCO_3^- (*M*)	NA	*	NA

Table 2.54.1 (continued)

Parameter	WC14-L1 Liquid (*a*)	WC14-L2 Liquid (*b*)	WC14-S Sludge (*c*), (*d*)
Radiochemical screening (L = Bq/mL, S = Bq/g)			
Gross alpha	1.52E+1	9.0E+1	3.6E+4
Gross beta	5.5E+4	3.3E+4	5.2E+5
Beta/gamma emitters (L = Bq/mL, S = Bq/g)			
^{14}C	*	*	<3.0E+1
^{60}Co	3.10E+1	3.4E+1	1.27E+4
^{134}Cs	1.13E+3	2.9E+2	2.72E+3
^{137}Cs	5.48E+4	2.7E+4	1.58E+5
^{152}Eu	<1.3E+2	<1.3E+2	2.64E+5
^{154}Eu	<1.3E+1	<1.9E+1	8.48E+4
^{155}Eu	<6.8E+1	<7.5E+1	2.11E+4
^{3}H	3.1E+1	*	*
^{90}Sr	6.64E+2	9.2E+1	2.24E+4
Alpha emitters (L = Bq/mL, S = Bq/g)			
^{241}Am	3.8E+0		1.4E+4
^{244}Cm	2.9E+0		1.3E+3
^{237}Np	4.5E+0		
^{238}Pu			2.3E+3
$^{239}Pu/^{240}Pu$	2.3E+0		2.2E+4
^{228}Th	3.4E-1		
$^{233}U/^{234}U$	9.3E-1		
$^{233}U/^{229}Th/^{237}Np$			2.6E+2
^{238}U	4.3E-1		3.8E+2

(*a*) Sample collected November 12, 1992, from the midpoint of the liquid layer, −2.5 in. above the sludge layer.
(*b*) Sample collected December 1, 1994, from the midpoint of the liquid layer, −19 in. above the sludge layer.
(*c*) Sludge sample data are reported on a weight basis.
(*d*) Sample WC14-S was a composite of the sludge phases in samples WC14-S1 and WC14-S2 collected March 24, 1993. The samples were combined and sonicated before taking aliquots.
(*e*) Analysis not run due to spectral interference from uranium.
(*f*) Interference with the fluoride analysis due to small aliphatic acids.
(*g*) pH of the sludge interstitial liquid by qualitative analysis with pH stick.

Table 2.54.2. Organic analytical data hits for tank WC-14

Parameter (*a*)	WC14-L1 Liquid (*b*)	WC14-S Sludge (*c*), (*d*)
Volatile organic compound analysis (L = Φg/L, S = Φg/kg)		
	(*e*)	(*f*)
Water-soluble organic compound analysis (L = mg/L)		
Methyl alcohol	14,700	(*g*)
Semivolatile organic compound analysis (L = Φg/L)		
Benzoic acid	100 J	
Bis(2-ethylhexyl)phthalate		14,000 J
Naphthalene		3,500 J
Pesticides/PCBs analysis (L = Φg/L, S = Φg/kg)		
Aroclor-1248	278 (*h*), (*i*)	119,000 (*I*)
Heptachlor		7, 370
Semivolatile organic compound analysis TICs (L = Φg/L, S = Φg/kg) (j)		
Unknown	2, 870 J (10)	734,000 J (7)
Unknown hydrocarbons	1,770 J (2)	674,200 J (7)
C_4-benzene		95,200 J (2)
Diethylbenzene	280 J	
Tributylphosphate	9,700 J	270,000 J
Trichlorobiphenyl		25,500 J (2)
Tetrachlorobiphenyl		15,600 J (2)
Pentachlorobiphenyl		8,000 J

(*a*) Only compounds whose possible presence was indicated by the analysis are listed.
(*b*) Sample collected November 12, 1992.
(*c*) Sludge sample data are reported on a weight basis.
(*d*) Sample collected March 24, 1993.
(*e*) Analysis was not run because the sample was too radioactive for nonzoned laboratory.
(*f*) Analysis was not run because of insufficient sample quantity and high radioactivity.
(g) Analysis was not run because insufficient sample to collect interstitial liquid.
(*h*) Some pesticide peaks also were detected, but these are believed to be the result of co-eluting components from the Aroclor mixture, and not pesticides.
(*i*) The tank was resampled for PCB analysis. See Table 2.54.3 for the PCB results of the second and third set of samples.
(*j*) The result is the sum of the tentatively identified compounds (TICs). The number of TICs are shown in parenthesis.

Table 2.54.3. PCB results for the second and third sets of samples from tank WC-14

Phrase	Sample	Aroclor-1248
Liquid	WC14-L1 (*a*)	4.7 Φg/L
	WC14-Surface (*a*)	6.9 Φg/L
	WC14-L2-B (*b*)	13.2 Φg/L
	WC14-L2-C (*b*)	10.9 Φg/L
Sludge	WC-14S-1 (*a*)	105,000 Φg/kg
	WC-14S-1-MS (*a*)	126,000 Φg/kg (*c*)
	WC-14S-1-MSD (*a*)	163,000 Φg/kg (*c*)
	WC-14S-2 (*a*)	241,000 Φg/kg

(*a*) Second set of samples collected in August 1993.
(*b*) Third set of samples collected in December 1994.
(*c*) "Native" Aroclor-1248 in the aliquot after correction for that added by the matrix spike.

Results for the organic chemical characterization of the composite sludge sample WC14-S (March 1993 sampling) are given in Table 2.54.2. The two TCL semivolatile compounds found were bis(2-ethylhexyl)phthalate (14,000J Φg/kg) and naphthalene (3,500J Φg/kg). The semivolatile organic TICs included tributylphosphate (270,000J Φg/kg), two C_4-benzenes (–total of 95,200J Φg/kg), seven unknown hydrocarbons (total –674,200J Φg/kg) and seven unknown compounds (total –734,000J Φg/kg).

The pesticide/PCB analysis of WC14-S (March 1993) found 119,000 Φg/kg of Aroclor-1248. The matrix spike sample (which was not spiked with PCBs, but only with certain pesticides) was found to contain 128,000 Φg/kg of Aroclor-1248. The average of the two analyses was 124,000 Φg/kg. Heptachlor also was reported at 7370 Φg/kg in the sample, but none was found in the matrix spike sample (<414 Φg/kg), so this is not considered to be a confident hit. The sludge was resampled only for PCB analysis in August 1993 (Table 2.54.3). Samples WC-14S-1 and WC-14S-2 were found to contain Aroclor-1248 at concentrations of 105,000 and 241,000 Φg/kg, respectively. Results for the matrix spike and matrix spike duplicate of the WC-14S-1 sample, after correcting for the spike, were 126,000 and 163,000 Φg/kg, respectively. The matrix spike recoveries could not be accurately measured because the Aroclor-1248 was spiked at 20,000 Φg/kg, which was "overshadowed" by the native PCB and aliquot-to-aliquot inhomogeneity. The second set of sludge samples were stirred only with a spatula (according to recommended SW-846 practice) before aliquots were taken. The composite sludge sample WC14-S, which was mixed by sonication, produced more homogeneous aliquots.

2.55 TANK LA-104

2.55.1 Tank Description

Tank LA-104 is a 296-gal, stainless steel tank located in a below-grade, reinforced concrete vault under Building 3047. The tank was installed in 1960 as a surge tank to prevent liquid carryover to the vacuum pump in the Building 3047 vacuum system. The vacuum system was not intended to transfer LLLW; however, contamination of the LA-104 vacuum system occurred, possibly due to off-normal operations.

Hot cell operation and use of the vacuum system and Tank LA-104 were discontinued in 1985. Tank LA-104 was officially removed from service in November 1994.

2.55.2 Characterization Summary

A radiological survey of the tank exterior indicated dose rates of 200 mrem/h on the side of the tank and 900 mrem/h on the center of the tank bottom. The survey identified a localized dose rate of 1.5 rem/h under the tank bottom at a point directly below the tank inlet. Interviews with operations personnel familiar with the operation of the tank and the vacuum system strongly suggest that no liquid material is in the tank. Cognizant personnel think that the radiation field generated by the tank contents results from residues that were inadvertently entrained in the vacuum stream before 1985. Process knowledge of the hot cells served by this tank suggests that the following isotopes may be present within the residue that remains in the tank: ^{60}Co, ^{152}Eu, ^{241}Pu, ^{154}Eu, ^{244}Cm, ^{241}Am, ^{14}C, ^{239}Pu, ^{233}U, and ^{235}U. Miscellaneous contaminant residues that may also be present in the tank include nitric acid, oxalic acid, sodium hydroxide, lead, and oils. Because the vacuum system was operated at a pressure of approximately 27 in. Hg vacuum and because the vacuum system has not been operated since 1985, any volatile and semivolatile organics within the tank would probably be below detectable limits.

Sampling the tank would require cutting a line entering the top of the tank. Because of limited access to the top of the tank and the risk to personnel collecting the sample, no samples have been taken. The tank will be isolated by cutting and capping the inlet lines before the tank is remediated; samples will be taken at that time thus minimizing personnel exposure.

The tank does not leak and, because of the physical configuration of the system, is highly unlikely to accumulate additional liquids.

2.56 TANK WC-7

Tank WC-7 was isolated from its piping and filled with grout in May 1996. The following information is retained in this document for information only.

2.56.1 Tank Description

Tank WC-7 is a 1100-gal stainless steel tank located west of Building 3504. The tank was installed in 1951 and received wastes from geosciences projects in Building 3504.

2.56.2 Characterization Summary

In November 1995, tank WC-7 was emptied and rinsed three times with water. The tank was physically isolated from the source drains, and inflow to the tank was stopped. Therefore, no waste characterization is necessary. However, to support future tank remediation efforts, the residue in the tank was characterized. A vacuum-pump sampling system was used to collect a sample of the residual liquid heel from the bottom of the tank. This sample was a clear, colorless liquid and contained no sediment or particulates. No indication existed of any organic layers that were immiscible with the aqueous phase in the tank. Video camera inspection of the tank showed the presence of some debris (e.g., a few small rocks, a pipe fitting) and a small amount of a solid residue, which had the appearance of mud or clay, caked on the tank bottom.

Analysis results for the liquid sample are shown in Table 2.56.1. Sample analysis indicated that the levels of contaminants are low. The liquid was basic (pH of 9.6). Sodium was the principal metal analyte. Very few other metal analytes were detected. The gross alpha and gross beta activities were <0.3 and 18 Bq/mL, respectively. The predominant radiological contaminant was ^{137}Cs (12 Bq/mL).

Table 2.56.1. Analytical data for tank WC-7 residual liquid

Parameter	WC7-L1 (*a*)
RCRA metals (mg/L)	
Ag	<0.064
As	0.025
Ba	0.130
Cd	<0.110
Cr	<0.016
Hg	<0.005
Ni	<0.113
Pb	0.038
Se	<0.025
Tl	<0.025
Process metals (mg/L) (b)	
Ca	22.8
K	3.6
Mg	5.5
Na	79.4
Th	<0.24
U	<0.46
Alkalinity	
pH (units)	9.6
Radiochemical screening (Bq/mL)	
Gross alpha	<0.03
Gross beta	18
Beta/gamma emitters (Bq/mL)	
^{60}Co	<0.2
^{137}Cs	12
^{152}Eu	<0.6
^{154}Eu	<0.3
^{155}Eu	<0.4

(*a*) Tank sampled November 16, 1995. Sample collected from the bottom of the tank.
(*b*) With the exception of U and Th, only metals whose presence was indicated by the analysis are listed.

2.57 TANK 2026-A

2.57.1 Tank Description

Tank 2026-A is a 700-gal vertical tank located inside an in-ground concrete vault southeast of Building 2026. It is constructed of Hastelloy C and has a stainless steel top head and piping. The tank was installed in 1962 and received radioactive and chemical wastes from processes involving radioactive sample analysis in Building 2026. Tank 2026-A was removed from service March 31, 1996.

2.57.2 Characterization Summary

The results for this tank are shown in Table 2.57.1.

2.57.2.1 Aqueous liquid

Sample 2026A-L1 from the midpoint of the liquid layer contained some ^{137}Cs and ^{90}Sr. The gross alpha and gross beta activities were −1 and 270 Bq/mL, respectively. The concentrations of inorganic analytes were relatively low. There was no indication of any organic layers that were immiscible with the aqueous phase in the tank.

2.57.2.2 Sludge

Tank 2026-A contained a shallow layer of a watery sludge, which was −1 in. deep at the sampling access. Because this layer was too shallow to sample with the soft-sludge sampler, it was sampled as liquid samples using the vacuum-pump sampling system to suction material from the bottom of the tank. The samples contained both the sludge phase and overlying tank liquid. At the analytical laboratory the samples were allowed to stand to allow the sludge solids to settle, and the phases were then separated. The sludge phases from three samples were combined to form the composite sample 2026A-S. The volume of sludge in the tank is probably in the range of 30–40 gal. (There are uncertainities in estimating the sludge inventory because of the complex tank geometry and limited access for measurements.)

The sludge sample 2026A-S contained relatively high levels of alpha emitters, ^{137}Cs, and ^{90}Sr; some europium isotopes; PCBs at greater than 50 ppm; and mercury and other metals listed as hazardous under RCRA. The sludge was a transuranic (TRU) waste containing −280 nCi/g (−10,300 Bq/g; wet basis) of transuranics with half-lives greater than 20 years. The principal metals in the sludge were manganese, mercury, iron, and zinc.

Table 2.57.1. Analytical data for tank 2026-A

Parameter	2026A-L1 Liquid (*a*), (*b*)	2026A-S Sludge (*a*), (*c*)
Physical properties and miscellaneous data		
Density (g/mL)	*	1.19
IC (L = mg/L, S = mg/kg)	23	450
TC (L = mg/L, S = mg/kg)	44	13,000
TDS (L = mg/mL, S = mg/g)	0.440	*
TOC (L = mg/L, S = mg/kg)	21	12,000
TS (L = mg/mL, S = mg/g)	*	134
RCRA metals (L = mg/L, S = mg/kg)		
Ag	<0.033	23.1
As	<0.025	3.2
Ba	0.047	171
Cd	<0.033	3.0
Cr	0.012	355
Hg	<0.035	14,700
Ni	0.420	104
Pb	<0.025	298
Se	<0.025	1.3
Tl	<0.025	<0.7
Process metals (L = mg/L, S = mg/kg) (d)		
Al	<0.06	286
Ca	59	258
Cu	0.04	20
Fe	<0.01	10,500
K	44	193
Mg	7.0	56
Mn	30	52,800
Na	11	20
Th	<0.08	28
U	0.05	26
Zn	6.9	6,900
Anions (water wash for sludge) (L = mg/L, S = mg/kg)		
Bromide	49	66
Chloride	22	21
Chromate	<1.0	<16
Fluoride	1.0	10
Nitrate	94	104
Nitrite	0.8	8.3
Phosphate	<1.0	<16
Sulfate	20	31
Alkalinity (water wash for sludge)		
pH (units)	6.9	6.4
Radiochemical screening (L = Bq/mL, S = Bq/g)		
Gross alpha	6.7E–1	1.9E+4
Gross beta	2.7E+2	9.1E+4
Total Pu alpha	3.8E–1	7.7E+3

Table 2.57.1 (continued)

Parameter	2026A-L1 Liquid (*a*), (*b*)	2026A-S Sludge (*a*), (*c*)
Beta/gamma emitters (L = Bq/mL, S = Bq/g)		
^{241}Am	<4.6E+0	3.1E+3
^{60}Co	<6.9E–1	2.3E+1
^{134}Cs	<1.1E+0	5.5E+1
^{137}Cs	1.7E+2	1.6E+4
^{152}Eu	<1.1E+0	1.1E+2
^{154}Eu	<2.2E+0	6.5E+2
^{155}Eu	<1.7E+0	3.5E+2
^{90}Sr	3.9E+1	7.8E+3
^{110M}Ag	<1.9E+0	1.1E+3
Alpha emitters (L = Bq/mL, S = Bq/g)		
Gross alpha (*e*)		
^{244}Cm		8.3E+3
^{238}Pu/^{241}Am		5.0E+3
^{239}Pu/^{240}Pu		5.2E+3
^{233}U/^{234}U		4.4E+2
Plutonium isotopes (*f*)		
^{238}Pu	1.4E–1	2.5E+3
^{239}Pu/^{240}Pu	2.4E–1	5.3E+3
PCB analysis (L = mg/L, S = mg/kg)		
Aroclor-1254		22 (*g*)
Aroclor-1260		76

(*a*) Tank sampled January 31, 1997.
(*b*) Sample collected from the midpoint of the liquid layer, –2.5 in. above the sludge layer.
(*c*) Sludge sample data are reported on a weight basis.
(*d*) Metals present at concentrations ∃1 mg/L are listed for the liquid sample 2026A-L1 and ∃10 mg/kg for the sludge sample 2026A-S.
(*e*) Alpha emitters identified in gross alpha spectrum.
(*f*) Plutonium isotopes determined after radiochemical separation.
(*g*) Aroclor-1254 is estimated value due to varient peak patterns on the confirmatory column (one peak not identified).

2.58 TANK WC-19

2.58.1 Tank Description

Tank WC-19 is a 2000-gal stainless steel tank located north of Building 3047 near Hillside Drive. The tank was installed in 1955, and received waste from buildings in the 3001 (Old Graphite Reactor) and 3042 (Oak Ridge Research Reactor) areas. The waste was primarily from the regeneration and back-washing of the demineralizers for the reactors and storage canal, and condensate from ventilation systems. Tank WC-19 was removed from active service September 30, 1996.

A design package for the permanent isolation of tank WC-19 has been prepared. The isolation of the tank is projected to be completed in FY 1997. The design includes rerouting ventilation system drains to the process waste system.

2.58.2 Characterization Summary

The results for this tank are shown in Table 2.58.1.

2.58.2.1 Aqueous liquid

Sample analysis indicated that the levels of contaminants in the liquid phase were relatively low. The gross alpha and gross beta activities were <0.1 and 13 Bq/mL, respectively for sample WC19-L1 which was collected from the midpoint of the liquid layer. The activities for the "WC19-L3 filtered" sample from the tank bottom were a little higher (3.2 and 50 Bq/mL, respectively). There was no indication of any organic layers that were immiscible with the aqueous phase in the tank.

2.58.2.2 Sludge

Tank WC-19 contained a shallow layer (−0.5 in. deep) of a thin sludge. Because this layer was too shallow to sample with the soft-sludge sampler, it was sampled as a liquid sample using the vacuum-pump sampling system to suction material from the tank bottom. The solids appeared to be a mixture of ion-exchange resins and chemically precipitated sludge (visual examination). Because of the limited quantity of sample material available it was not practical to separate the sludge phase from the supernatant liquid. One aliquot including the solids was treated by microwave-assisted digestion in nitric acid, and the resulting solution was analyzed. There was a small amount of residue (not analyzed) from the digestion. A second aliquot was filtered, and the filtrate was analyzed.

The sample "WC19-L3 including solids" contained ^{137}Cs and ^{90}Sr as well as some alpha emitters, ^{60}Co, and metals listed hazardous under RCRA. The principal metal analytes were Na, Ca, and Fe. The levels of contaminants in the filtered aliquot were low indicating that most of the contaminants were in the sludge solids.

Table 2.58.1 Analytical data for tank WC-19

Parameter	WC19-L1 (*a*)	WC19-L3 Filtered (*b*)	WC19-L3 Including solids (*b*), (*c*)
	Physical properties and miscellaneous data		
Density (g/mL)	*	*	1.023
TDS (L = mg/mL)	0.41	*	*
	RCRA metals (L = mg/L)		
Ag	<0.040	<0.040	0.13
As	<0.030	<0.030	0.13
Ba	0.016	0.012	14.7
Cd	<0.040	0.076	22.2
Cr	<0.010	0.042	23.3
Hg	<0.006	0.022	1.24
Ni	<0.040	<0.040	6.4
Pb	<0.010	0.19	51
Se	<0.030	<0.030	<0.04
Tl	<0.010	<0.010	<1.3
	Process metals (L = mg/L) (d)		
Al	<0.07	2.5	124
Ca	8.2	1.9	3,390
Fe	<0.01	2.7	1,040
K	4.2	4.5	205
Mg	2.5	3.5	581
Na	153	248	4,710
Th	<0.10	0.14	4.8
U	1.32	1.40	102
Zn	<0.06	0.43	66
	Anions (L = mg/L)		
Bromide	<0.25	*	*
Chloride	25	*	*
Fluoride	0.75	*	*
Nitrate	33	*	*
Nitrite	<0.25	*	*
Phosphate	<0.50	*	*
Sulfate	49	*	*
	Alkalinity		
pH (units)	7.4		9 (*e*)
	Radiochemical screening (L = Bq/mL)		
Gross alpha	<8.0E–2	3.2E+0	1.4E+2
Gross beta	1.3E+1	5.0E+1	6.7E+3
	Beta/gamma emitters (L = Bq/mL)		
^{241}Am	<2.3E+0	<4.1E+0	1.6E+1
^{60}Co	<6.6E–1	3.6E+0	3.5E+2
^{134}Cs	<7.7E–1	<8.6E–1	<4.2E+0
^{137}Cs	4.5E+0	1.4E+1	7.9E+2
^{152}Eu	<5.2E+0	<3.3E+0	3.4E+1
^{154}Eu	<2.3E+0	<2.7E+0	1.5E+1
^{155}Eu	<1.2E+0	<1.7E+0	<9.3E+0
^{90}Sr	2.9E+0	6.4E+0	1.9E+3

Table 2.58.1 (continued)

Parameter	WC19-L1 (*a*)	WC19-L3 Filtered (*b*)	WC19-L3 Including solids (*b*), (*c*)
		Alpha emitters (L = Bq/mL)	
$^{238}Pu/^{241}Am$	(*f*)	8.0E–1	1.7E+1
$^{239}Pu/^{240}Pu$		2.4E+0	1.2E+2
$^{233}U/^{234}U$			4.6E+0

(*a*) Sample collected November 7, 1996, from the midpoint of the liquid layer, −7.5 in. above the tank bottom.
(*b*) Sample collected November 7, 1996, from the bottom of the tank.
(*c*) Data are for the liquid plus the solids which dissolved during microwave assisted digestion in −3.2 *M* HNO_3. There was a small amount of residue (not analyzed).
(*d*) Metals present at concentrations ∃1 mg/L are listed for WC19-L1 and WC19-L3 filtered, and concentrations ∃10 mg/L for WC19-L3 including solids.
(*e*) pH of the sludge liquid by qualitative analysis with pH stick.
(*f*) Gross alpha too low for alpha spectrometry measurements.

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