DOE/OR/03-1195&D2

Design Demonstrations for Category B Tank Systems Piping at Oak Ridge National Laboratory, Oak Ridge, Tennessee



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Environmental Restoration and Waste Management Programs

Design Demonstrations for Category B Tank Systems Piping at Oak Ridge National Laboratory, Oak Ridge, Tennessee

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Prepared by
Foster Wheeler Environmental Corporation
and
Parsons Engineering Science, Inc.
Oak Ridge, Tennessee
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Oak Ridge, Tennessee 37831-6285
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
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MASTER

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ACRONYMS

AEC	Atomic Energy Commission
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AMCA	Air Moving and Conditioning Association
ASME	American Society of Mechanical Engineers
CMP	helically corrugated metal pipe
DOE	Department of Energy
ERDA	Energy Research and Development Administration
FFA	Federal Facility Agreement
ICPL	Interconnecting Pipe Line
LLLW	liquid low-level waste
MVCT	Melton Valley Collection and Transfer
MVCTS	Melton Valley Collection and Transfer System
NFPA	National Fire Protection Association
NHF	New Hydrofracture Facility
ORNL	Oak Ridge National Laboratory
psig	pounds per square inch, gauge
PWD	Process Waste Drain
PWTP	Process Waste Treatment Plant
REDC	Radiochemical Engineering Development Center
R/h	rem per hour
RHD	Radioactive Hot Drain
RHD-HOG	Radioactive Hot Drain-Hot Offgas
RHDR	Radioactive Hot Drain Recoverable
RPP	Radioactive Processing Plant
SS	stainless steel
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UCC-ND	Union Carbide Corporation Nuclear Division

EXECUTIVE SUMMARY

Demonstration of the design of the piping systems described in this report is stipulated by the Federal Facility Agreement (FFA) between the U.S. Environmental Protection Agency (EPA)-Region IV, the Tennessee Department of Environment and Conservation (TDEC), and the U.S. Department of Energy (DOE). This report provides a design demonstration of the secondary containment and ancillary equipment of 30 piping systems designated in the FFA as Category B (i.e., existing tank systems with secondary containment). Based on the findings of the Design Demonstrations for the Remaining 19 Category B Tank Systems, (DOE/OR/03-1150 & D2), three tank systems originally designated as Category B have been redesignated as Category C (i.e., existing tank systems without secondary containment). The design demonstrations were developed using information obtained from design drawings (as-built when available), construction specifications, and interviews with facility operators. Each design demonstration addresses system conformance to the requirements of the FFA (Appendix F, Section C). Deficiencies or restrictions regarding the ability to demonstrate that each of the containment systems conforms to FFA requirements are noted in the discussion of each piping system and presented in Table 2.0-1.

1.0 INTRODUCTION

This document presents design demonstrations conducted of liquid low-level waste (LLLW) storage tank systems located at the Oak Ridge National Laboratory (ORNL). ORNL is part of the United States Department of Energy's (DOE's) Oak Ridge Reservation located southwest of the city of Oak Ridge, Tennessee. The laboratory has conducted research in energy-related fields since 1943. The facilities used to conduct the research include nuclear reactors, chemical pilot plants, research laboratories, radioisotope production laboratories, and support facilities. These facilities have produced a variety of radioactive and/or hazardous wastes that have been stored and transported through an extensive network of piping and tankage.

Demonstration of the design of these tank systems has been stipulated by the Federal Facility Agreement (FFA) between the United States Environmental Protection Agency (EPA)-Region IV, the Tennessee Department of Environment and Conservation (TDEC), and the DOE. The FFA establishes four categories of tank systems:

Category A—New or Replacement Tank Systems with Secondary Containment,
Category B—Existing Tank Systems with Secondary Containment,
Category C—Existing Tank Systems Without Secondary Containment, and
Category D—Existing Tank Systems That are Removed from Service.

This document provides a design demonstration of the secondary containment and ancillary equipment of 30 piping systems designated in the FFA as Category B. Three tank systems originally designated as Category B have been redesignated as Category C. The design demonstration for each system is presented in Section 2. These design demonstrations were developed using information obtained from the design drawings (as-built when available), construction specifications, and interviews with facility operators. The assessments assume that each piping system was constructed in accordance with the design drawings and construction specifications for that system unless specified otherwise. Each design demonstration addresses system conformance to the requirements of the FFA (Appendix F, Section C).

2.0 SUMMARY ASSESSMENT

Individual design demonstrations of the secondary containment of 30 piping systems designated as FFA Category B systems are included in Sections 2.1 through 2.30. Three tank systems originally designated as Category B have been redesignated. If additional information is identified for a specific system, the section containing the assessment of that containment system may be revised and reissued.

The objective of each assessment is to demonstrate that the design of the secondary containment system meets the requirements of Appendix F, Section C of the FFA. Three piping systems (WC-20, F-201 and F-501) have deficiencies which do not fully meet the secondary containment requirements and have been redesignated as Category C. Deficiencies or restrictions regarding the ability to demonstrate that the remaining 27 containment systems conform to FFA requirements have been noted in the discussion of each requirement.

A matrix identifying the deficiencies associated with each piping system and the name of the project which will provide the requisite corrective action is presented in Table 2.0-1.

TABLE 2.0-1
CONTAINMENT SYSTEM DEFICIENCIES

TANK SYSTEM (SECTION)	DEFICIENCY / CONTAINMENT AREA	A SINGLY CONTAINED PIPING	B SECONDARY CONTAINMENT PROTECTIVE LINER OR COATING NOT PROVIDED	C SECONDARY CONTAINMENT MATERIAL NOT COMPATIBLE WITH WASTE	D PIPING PENETRATION SLEEVES NOT COMPATIBLE WITH WASTE	E LEAK DETECTION SYSTEM NOT PROVIDED	F MEANS OF LIQUID REMOVAL NOT PROVIDED	G DRAIN SYSTEM MAY TRANSFER LLLW TO AN INAPPROPRIATE SYSTEM	H INADEQUATE CATHODIC PROTECTION	PROJECT NAME FOR CORRECTIVE ACTION *FOR PROJECT COMPLETION DATE, SEE (CURRENT) IMPLEMENTATION PLAN FOR LLLW TANK SYSTEMS.*
B-2-T (2.1)	UNDERGROUND PIPING	X							X	A: Melton Valley LLLW-CAT Sys. Upgrade H: Melton Valley LLLW-CAT Sys. Upgrade
	EMBEDDED PIPING	X								A: Melton Valley LLLW-CAT Sys. Upgrade
	PITOT TUBE PIT		X			X	X			B: Melton Valley LLLW-CAT Sys. Upgrade E: Melton Valley LLLW-CAT Sys. Upgrade F: Melton Valley LLLW-CAT Sys. Upgrade
	NORTH VALVE PIT		X							B: Melton Valley LLLW-CAT Sys. Upgrade
	CELL F CORRIDOR			X				X		C: Melton Valley LLLW-CAT Sys. Upgrade G: Melton Valley LLLW-CAT Sys. Upgrade
	OPERATING AREA NO. 119			X		X		X		C: Melton Valley LLLW-CAT Sys. Upgrade E: Melton Valley LLLW-CAT Sys. Upgrade G: Melton Valley LLLW-CAT Sys. Upgrade
	CELL G PUMP ROOM			X				X		C: Melton Valley LLLW-CAT Sys. Upgrade G: Melton Valley LLLW-CAT Sys. Upgrade
	ROOM 214 DECONTAMINATION PAN					X		X		E: Melton Valley LLLW-CAT Sys. Upgrade G: Melton Valley LLLW-CAT Sys. Upgrade
	MOCK-UP AREA NO. 305			X		X		X		C: Melton Valley LLLW-CAT Sys. Upgrade E: Melton Valley LLLW-CAT Sys. Upgrade G: Melton Valley LLLW-CAT Sys. Upgrade
	OPERATING CELLS B & D					X				E: Melton Valley LLLW-CAT Sys. Upgrade
B-3-T (2.2)	EMBEDDED PIPING	X								A: Piping is out of service and capped. Valves are tagged out.
	UNDERGROUND CMP			X		X	X		X	C, E, F, H: Piping is out of service and capped. Valves are tagged out.

X = Deficiency Stated in Document

TABLE 2.0-1
CONTAINMENT SYSTEM DEFICIENCIES

TANK SYSTEM (SECTION)	DEFICIENCY / CONTAINMENT AREA	A SINGLY CONTAINED PIPING	B SECONDARY CONTAINMENT PROTECTIVE LINER OR COATING NOT PROVIDED	C SECONDARY CONTAINMENT MATERIAL NOT COMPATIBLE WITH WASTE	D PIPING PENETRATION SLEEVES NOT COMPATIBLE WITH WASTE	E LEAK DETECTION SYSTEM NOT PROVIDED	F MEANS OF LIQUID REMOVAL NOT PROVIDED	G DRAIN SYSTEM MAY TRANSFER LLLW TO AN INAPPROPRIATE SYSTEM	H INADEQUATE CATHODIC PROTECTION	PROJECT NAME FOR CORRECTIVE ACTION *FOR PROJECT COMPLETION DATE, SEE (CURRENT) IMPLEMENTATION PLAN FOR LLLW TANK SYSTEMS.*
C-6-T (2.3)	UNDERGROUND PIPING	X							X	A: Melton Valley LLLW-CAT Sys. Upgrade H: Melton Valley LLLW-CAT Sys. Upgrade
	EMBEDDED PIPING (2 SEPARATE LINES FROM TANK C-6-T TO BLDG. 7930)	X								A: MELTON VALLEY LLLW-CAT Sys. Upgrade A: Piping is out of service and capped. Vales are taggged out.
	UNDERGROUND CMP			X		X	X		X	C, E, F, H: Piping is out of service and capped. Valves are tagged out.
	OPERATING CELL D					X				E: Melton Valley LLLW-CAT Sys. Upgrade
	CELL G PUMP ROOM			X				X		C: Melton Valley LLLW-CAT Sys. Upgrade G: Melton Valley LLLW-CAT Sys. Upgrade
	MOCK-UP AREA NO. 305			X		X		X		C: Melton Valley LLLW-CAT Sys. Upgrade E: Melton Valley LLLW-CAT Sys. Upgrade G: Melton Valley LLLW-CAT Sys. Upgrade
C-1 (2.4)	EMBEDDED PIPING	X								A: See Note 1 on Page 2.0-5
C-2 (2.5)	EMBEDDED PIPING	X								A: See Note 1 on Page 2.0-5
F-126 (2.7)	UNDERGROUND PIPING	X							X	A: Melton Valley LLLW-CAT Sys. Upgrade H: Melton Valley LLLW-CAT Sys. Upgrade
	MVCT BOX NO. 1					X	X			E: Melton Valley LLLW-CAT Sys. Upgrade F: Melton Valley LLLW-CAT Sys. Upgrade
L-11 (2.10)	UNDERGROUND & EMBEDDED PIPING	X							X	A: ORNL Process Waste Treatment Facility H: ORNL Process Waste Treatment Facility
	TANK VAULT L-11 WALL PENETRATIONS				X					D: ORNL Process Waste Treatment Facility
P-3 (2.12)	UNDERGROUND PIPING	X							X	A: GPP-FFA Compliance Work, Bldg. 3019A H: GPP-FFA Compliance Work, Bldg. 3019A
T-13 (2.14)	EMBEDDED PIPING	X								A: See Note 1 on Page 2.0-5

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TABLE 2.0-1
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W-21 (2.16)	TANK VAULT W-21 WALL PENETRATIONS (EMBEDDED PIPING)	X								A: See Note 1 on Page 2.0-5.
W-22 (2.17)	CONCRETE WALL PENETRATIONS (EMBEDDED PIPING)	X								A: See Note 1 on Page 2.0-5.
W-23 (2.18)	CONCRETE WALL PENETRATIONS (EMBEDDED PIPING)	X								A: See Note 1 on Page 2.0-5.
	DOUBLE WALL UNDERGROUND PIPING								X	H: Upgrade Cathodic Protection Systems. Phase 1 scheduled for completion in Fiscal Year 1995.
	EVAPORATOR ANNEX VALVE PIT NO. 1					X	X			E: East Evaporator Valve Pit Upgrade-GPP F: East Evaporator Valve Pit Upgrade-GPP
W-24 (2.19) THROUGH W-31 (2.26)	TANK VAULT WALL PENETRATIONS (EMBEDDED PIPING)	X								A: See Note 1 on Page 2.0-5.
TRANSFER LINES (2.27)	EMBEDDED PIPING	X								A: See Note 1 on Page 2.0-5
	DOUBLE WALL UNDERGROUND PIPING								X	H: Upgrade Cathodic Protection Systems. Phase 1 scheduled for completion in Fiscal Year 1995.
	VALVE BOX AT TANK W-6						X			F: W-6 Valve Box Upgrade-GPP
	SOUTH PARKING LOT VALVE BOX		X			X	X			B: Incinerator Drive Valve Box Upgrade-GPP E: Incinerator Drive Valve Box Upgrade-GPP F: Incinerator Drive Valve Box Upgrade-GPP
	ICPL VALVE BOX NO. 1						X			F: Incinerator Drive Valve Box Upgrade-GPP

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TABLE 2.0-1
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S-223 (2.28)	UNDERGROUND PIPING	X							X	A: Piping is scheduled to be taken out of service. H: Upgrade Cathodic Protection Systems. Phase 2 scheduled for completion in Fiscal Year 1996.
	DOUBLE WALL UNDERGROUND PIPING								X	H: Upgrade Cathodic Protection Systems. Phase 2 scheduled for completion in Fiscal Year 1996.
	TANK VAULT & CELL WALL PENETRATIONS (EMBEDDED PIPING)	X								A: See Note 1 below
S-324 (2.29)	EMBEDDED PIPING	X								A: See Note 1 below
S-523 (2.30)	EMBEDDED PIPING	X								A: See Note 1 below

Note 1: On the basis of the ***Risk Evaluation of Embedded, Single-Walled Liquid Low-Level Waste Piping at Oak Ridge National Laboratory***, it has been determined the risk to human health and the environment from the embedded pipes in their current configuration is less than the risk from replacing the existing pipes with double wall pipes. Therefore, DOE recommends making no changes to the current embedded piping configuration.

X = Deficiency Stated in Document

2.1 Tank System B-2-T Piping

2.1.1 Tank System Summary

Tank System B-2-T is located near the Radiochemical Engineering Development Center (REDC) (Building 7930) at the Melton Valley High Flux Isotope Reactor Complex (Figures 2.1-1 and 2.1-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from Tank Vault B-2-T (Waste Tank Pit that also contains Tanks B-3-T and C-6-T) through the Radioactive Hot Drain (RHD) Line Pit and outside underground to the Melton Valley Collection and Transfer System (MVCTS) main transfer line. Additional system piping is routed from Tank Vault B-2-T outside underground beneath Building 7930 and extends into areas within Building 7930.

Tank System B-2-T piping is used to transfer liquid low-level waste (LLLW) from the Building 7930 Radioactive Hot Drain-Hot Offgas (RHD-HOG) System to Tank B-2-T and from Tank B-2-T to the MVCTS and is classified as a Federal Facility Agreement Category B tank system.

2.1.2 Standards for Pipe Assessment of Tank Systems

2.1.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System B-2-T piping extends from Tank Vault B-2-T, near the southwest corner of Building 7930, to within Building 7930 and to a main transfer line connected to the MVCTS. The piping system is under the control of the REDC and is operated by the Chemical Technology Division.

Tank System B-2-T piping is constructed of 3/4″, 1″, 1-1/2″, 2″, 4″, and 6″, 304L SS with a maximum design temperature and pressure of 130°F and 150 psig. Tank System B-2-T piping has the capacity to contain a maximum volume of 408 gal.

Design Standards

The applicable codes and standards used for Tank System B-2-T piping and the associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;
AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

American Concrete Institute;

American Concrete Pipe Association;

American Conference of Governmental Industrial Hygienists;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), IV, VII, VIII, and IX;

American Society for Testing and Materials A93, A244, A307, C39, C78, C138, C143, and D1752;

American Standards Association Safety Code for Building Construction;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrument Society of America;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.1.2.2 Generic Description of Piping Contents

Tank System B-2-T piping is designed to transfer LLLW from the Building 7930 RHD-HOG System to Tank B-2-T and from Tank B-2-T to a main transfer line connected to the MVCTS. The primary source of LLLW is Cell G in Building 7930. These wastes may include a variety of dilute acids, bases, and organics. The tank system may contain radioactive materials from the REDC.

The analytical data (Figure 2.1-3) of waste stream contaminants from the generators are representative of waste transferred through Tank System B-2-T piping.

2.1.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault B-2-T, the RHD Line Pit, and Building 7930 is not in direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The piping that is routed outside underground is singly contained, and the external surfaces are exposed to the soil and water. Protective coatings or cathodic protection measures are not present in the section of outside underground piping from Tank Vault B-2-T to Building 7930.

The cathodic protection for the piping leading from the RHD Line Pit to the connection at the MVCTS main transfer line is included in the Facility Manager's Cathodic Protection System No. 5. The galvanic anode cathodic protection system consists of magnesium anodes, test stations, and connecting wire as shown on the cathodic protection drawing C-20013-EA-003D. The system was installed in May 1972.

The system is not considered adequate because electrical isolating devices were not called out for the pipe termination points. Harco Technologies determined that insulating gaskets were not present during its 1990 surveys. In addition, the cathodic protection field testing performed in 1991 indicated that 60% of the pipe was not receiving adequate corrosion control. The lack of electrical isolation of the outside underground pipe from the interior piping and depleted anode beds are contributing factors in the resultant lack of corrosion control. In 1991, Harco completed the engineering design to upgrade the existing system to protect the piping.

2.1.2.4 Documented Age of Tank System

Tank System B-2-T piping was originally installed in 1965. The section of piping between the RHD Line Pit and the MVCTS main transfer line was installed in 1972.

2.1.3 Standards for Containment/Release Detection

Tank System B-2-T piping incorporates approximately 1240′ of outside underground and embedded piping that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.1.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System B-2-T piping is single-wall, schedule 40S, type 304L SS pipe. The piping is routed outside underground from Tank Vault B-2-T to the MVCTS main transfer line and to areas within Building 7930. Areas of secondary containment are discussed below.

Tank Vault B-2-T

The assessment of the secondary containment system for Tank Vault B-2-T is presented in the Design Demonstrations for Tank B-2-T. That assessment concludes that Tank Vault B-2-T is coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

RHD Line Pit

The RHD Line Pit floor is coated with a 30-mil-thick system of Amercoat 66 epoxy. The concrete walls of the RHD Line Pit are coated with a 5-mil-thick system of Amercoat 99 vinyl emulsion. According to the manufacturer's specifications, the Amercoat 66 and Amercoat 99 coatings are compatible with the waste and designed to prevent migration of waste into the concrete.

Areas Within Building 7930

Pitot Tube Pit

The Pitot Tube Pit floor and walls are not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

North Valve Pit

The North Valve Pit floor and walls are not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Cell F Corridor

The floor of the Cell F Corridor is coated with a 20-mil-thick system of Amercoat 74. According to the manufacturer's specifications, the Amercoat 74 system is compatible with the waste and designed to prevent migration of waste into the concrete. The concrete walls of the Cell F Corridor are coated with a 6-mil-thick system of Amercoat 88. According to the manufacturer's specifications, the Amercoat 88 system is not compatible with the waste and is not designed to prevent migration of waste into the concrete. According to the manufacturer, this coating system does not provide the appropriate resistance to chemicals and radiation.

Operating Area No. 119

The concrete floor in Operating Area No. 119 is covered with vinyl asbestos tiles and is not provided with a protective liner or coating that is compatible with the waste and designed to prevent migration of waste into the concrete. The trench, drain, and covers are coated with a 20-mil-thick system of Amercoat 74. According to the manufacturer's specifications, the Amercoat 74 system is compatible with the waste and designed to prevent migration of waste into the concrete. The walls of Operating Area No. 119 are coated with a 6-mil-thick system of Amercoat 88. According to the manufacturer's

specifications, the Amercoat 88 system is not compatible with the waste and is not designed to prevent migration of waste into the concrete.

Cell G Pump Room

The concrete floor, trench, drain, and covers are coated with a 20-mil-thick system of Amercoat 74. According to the manufacturer's specifications, the Amercoat 74 system is compatible with the waste and designed to prevent migration of waste into the concrete. The concrete and masonry walls are coated with a 6-mil-thick system of Amercoat 88. According to the manufacturer's specifications, the Amercoat 88 system is not compatible with the waste and is not designed to prevent migration of waste into the concrete.

Room 214 Decontamination Pan

The Decontamination Pan in Maintenance Operating Area No. 214 is lined with 1/4", 304L SS plate, which is the same material as that used for the piping. The SS decontamination pan lining is compatible with the waste and designed to prevent migration of waste into the concrete.

Mock-Up Area No. 305

The concrete floor and the exposed ferrous metal embedded in the floor are coated with a 20-mil-thick system of Amercoat 74. According to the manufacturer's specifications, the Amercoat 74 system is compatible with the waste and designed to prevent migration of waste into the concrete. The concrete and masonry walls are coated with a 6-mil-thick system of Amercoat 88. According to the manufacturer's specifications, the Amercoat 88 system is not compatible with the waste and is not designed to prevent migration of waste into the concrete.

Operating Cells B, C, D, and G

Operating Cells B, C, D, and G are lined with 304L SS plate. The floor and trench linings are 1/4" thick; the wall lining is 3/16" thick; and the trench sumps are constructed of capped, 4" diameter, schedule 10S, type 304L SS pipe. All components are constructed of the same material as that used for the piping. Therefore, the SS cell lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Operating Cell E

The floor and trench in Cell E are lined with 1/4" thick, 304L SS plate. The sump is constructed of capped, 4" diameter, schedule 10S, type 304L SS pipe. The walls in Cell E are lined with 3/16" thick, 304L SS that extends 1'0" up from the floor lining. The remainder of the walls are coated with a 12-mil-thick system of Amercoat 66. The SS lining material, which is the same material as that used for the piping, is compatible with the waste and designed to prevent migration of waste into the concrete. According to the manufacturer's specifications, the Amercoat 66 coating is also compatible with the waste and designed to prevent migration of waste into the concrete.

Operating Cell F

The concrete floor is coated with a 30-mil-thick system of Amercoat 66, and the walls are coated with a 5-mil-thick system of Amercoat 99. According to the manufacturer's specifications, the Amercoat 66 and Amercoat 99 systems are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the interior surfaces of Tank Vault B-2-T, RHD Line Pit, and Operating Cell F; the floors in Cell F Corridor, the Cell G Pump Room, and Mock-Up Area No. 305; and the trench in Operating Area No. 119 are coated with systems that are compatible with the waste and designed to prevent migration of waste into the concrete. In addition, the Room 214 Decontamination Pan and Operating Cells B, C, D, E, and G are lined with 304L SS, which is also compatible with the waste and designed to prevent migration of waste into the concrete.

Areas of secondary containment that are not coated or lined with materials that are compatible with the waste and are not designed to prevent migration of waste into the concrete include the Pitot Tube Pit; the North Valve Pit; the walls of Cell F Corridor, the Cell G Pump Room, and Mock-Up Area No. 305; and the walls and floor of Operating Area No. 119.

2.1.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault B-2-T

The assessment of the secondary containment system for Tank Vault B-2-T is presented in the Design Demonstrations for Tank B-2-T. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

RHD Line Pit

The RHD Line Pit foundation is a 7′6″ × 9′0″ × 1′0″ thick, reinforced concrete base slab that rests on compacted backfill.

Areas Within Building 7930

Pitot Tube Pit

The Pitot Tube Pit foundation is a 6′8″ × 7′8″ × 1′0″ thick, reinforced concrete base slab that rests on stabilized aggregate.

North Valve Pit

The North Valve Pit foundation is a 13′2″ × 17′2″ × 1′4″ thick, reinforced concrete base slab designed to rest on undisturbed soil. In the event of overexcavation, the base slab is designed to rest on concrete backfill.

Cell F Corridor

The Cell F Corridor foundation is a 1′0″ thick, "L"-shaped, reinforced concrete slab that rests on compacted backfill.

Operating Area No. 119

The Operating Area No. 119 foundation is a 6″ thick, reinforced concrete slab that rests on stabilized aggregate.

Cell G Pump Room

The Cell G Pump Room foundation is a 6″ thick, "L"-shaped, reinforced concrete slab that rests on undisturbed soil.

Room 214 Decontamination Pan

The Room 214 Decontamination Pan foundation is an approximately 9′0″ × 10′0″ × 4″ thick, reinforced concrete slab that rests on a structural concrete slab within Building 7930.

Mock-Up Area No. 305

The Mock-Up Area No. 305 foundation is a combination of 4′9″ thick, reinforced concrete plugs and a 5′0″ thick, reinforced concrete slab that rests on the outer and inner walls of Cells C, D, E, and G.

Operating Cells B, C, D, and G

The foundation of Operating Cell B is an 8″ thick, reinforced concrete slab that rests on the walls of Operating Cell F and Cell F Corridor in addition to stabilized aggregate. The foundations of Operating Cells C and D are 8″ thick, reinforced concrete slabs supported by 18″ × 30″ thick, reinforced concrete beams. The foundation of Operating Cell G is an 8″ thick, reinforced concrete slab that rests on stabilized aggregate backfill.

Operating Cell E

The Operating Cell E foundation is an 8″ thick, reinforced concrete slab that rests on stabilized aggregate backfill.

Operating Cell F

The Operating Cell F foundation is an 8″ thick, reinforced concrete slab that rests on stabilized aggregate backfill.

The assessment concludes that Tank Vault B-2-T; the RHD Line Pit; the Pitot Tube Pit; the North Valve Pit; the Cell F Corridor; Operating Area No. 119; the Cell G Pump Room; the Room 214 Decontamination Pan; Mock-Up Area No. 305; and Operating Cells B, C, D, E, F, and G are properly designed to support the secondary containment systems.

2.1.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault B-2-T

The assessment of the secondary containment system for Tank Vault B-2-T is presented in the Design Demonstrations for Tank B-2-T. That assessment concludes that the vault is provided with a leak detection system.

RHD Line Pit

The RHD Line Pit is a coated area. Any leakage within the line pit flows by gravity to a sump in Tank Vault B-2-T. Accumulation in the sump will be detected by a level indicator that will activate an alarm in the operating area of Building 7930.

Areas Within Building 7930

Pitot Tube Pit

The Pitot Tube Pit is not provided with a leak detection system.

North Valve Pit

Any leakage within the valve pit flows by gravity to a 12″ × 12″ × 6″ sump located within the valve pit. Accumulation will be detected by a level indicator that will activate an alarm in the operating area of Building 7930.

Cell F Corridor

Any leakage within the corridor flows by gravity to a 4″ diameter, schedule 10S, type 304L SS, capped pipe sump that is 1′0″ deep and is located in the corridor floor. Accumulation in the sump will be detected by a level indicator that will activate an alarm in the operating area of Building 7930.

Operating Area No. 119

Operating Area No. 119 is not provided with a leak detection system.

Cell G Pump Room

Any leakage within the Cell G Pump Room flows by gravity to a trench and continues to a 6″ diameter, schedule 10S, type 304L SS, capped pipe sump that is 2′0″ deep and is located in the bottom of the collection trench. Accumulation in the sump will be detected by a level indicator that will activate an alarm in the operating area of Building 7930.

Room 214 Decontamination Pan

The Room 214 Decontamination Pan is an SS-lined area. Any leakage within the pan flows by gravity to a 6″ diameter by 6″ deep, 304L SS floor drain that transfers fluids to the Process Waste Drain (PWD) System. The Room 214 Decontamination Pan is not provided with a leak detection system.

Mock-Up Area No. 305

Any leakage within the area flows by gravity to a 3″ diameter, PWD floor drain. Mock-Up Area No. 305 is not provided with a leak detection system.

Operating Cells B, C, D, and G

Cells B, C, D, and G are SS-lined areas. Any leakage within the cells will flow by gravity to a low point within each cell. Cells B and D are not provided with leak detection systems. Cells C and G are provided with level indicators that will detect accumulation and activate alarms located in the operating area of Building 7930.

Operating Cell E

Cell E is a lined and coated area. Any leakage in the cell will flow by gravity to a sump. Accumulation in the sump will be detected by a level indicator that will activate an alarm located in the operating area of Building 7930.

Operating Cell F

Cell F is a coated area. Any leakage in the area will flow by gravity to a sump. Accumulation in the sump will be detected by a level indicator that will activate an alarm located in the operating area of Building 7930.

The assessment concludes that Tank Vault B-2-T; the RHD Line Pit; the North Valve Pit; the Cell F Corridor; the Cell G Pump Room; and Cells C, E, F, and G are provided with leak detection.

However, the Pitot Tube Pit, Operating Area No. 119, the Room 214 Decontamination Pan, Mock-Up Area No. 305, and Cells B and D are not provided with leak detection systems.

2.1.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault B-2-T

The assessment of the secondary containment system for Tank Vault B-2-T is presented in the Design Demonstrations for Tank B-2-T. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

RHD Line Pit

The RHD Line Pit floor is sloped to a 2″ diameter, 304L SS drain that transfers liquids to the sump in Tank Vault B-2-T. The sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Areas Within Building 7930

Pitot Tube Pit

The Pitot Tube Pit is not designed or provided with a means to drain or otherwise remove liquids resulting from leaks, spills, or precipitation.

North Valve Pit

The North Valve Pit floor is sloped to a 12″ × 12″ × 6″ concrete sump. The sump provides a low point within the valve pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Cell F Corridor

The corridor floor is sloped to a 4″ diameter sump. The sump provides a low point within the corridor to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

An additional sump is located in the corridor at a high point in the finished floor, and collects rainwater from stairwell #6 and the freight elevator pit through pipes passing below floor elevation. In the event of a leak in the piping system during the transfer of liquids, it would flow to the low point corridor sump, trigger an alarm, and by operating procedure requirements the transfer is discontinued not allowing an overflow to the rainwater sump.

Operating Area No. 119

The Operating Area No. 119 floor is sloped to a trench. The trench provides a low point within the area to divert liquids to a drain point. In addition, a safety shower drain is mounted flush in the floor. The liquids gravity flow from the trench and drain into the PWD system.

Cell G Pump Room

The Cell G Pump Room floor is sloped to a trench and several 3″ diameter floor drains. The trench and drains divert liquids to a 6″ diameter, schedule 10S, type 304L SS, capped pipe sump. The sump provides a low point within the pump room to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

An additional sump is located in the pump room at a high point in the finished floor, and collects rainwater from stairwell #7 through pipes passing below floor elevation. In the event of a leak in the piping system during the transfer of liquids, it would flow to the low point pump room sump, trigger an alarm, and by operating procedure requirements the transfer is discontinued not allowing an overflow to the rainwater sump.

Room 214 Decontamination Pan

The Room 214 Decontamination Pan floor is sloped to PWD drains mounted flush in the floor. The drains provide a low point within the decontamination pan to divert liquids to a drain point. The liquids flow from the drains into the PWD system.

Mock-Up Area No. 305

The Mock-Up Area No. 305 floor is sloped to PWD drains mounted flush in the floor. The drains provide a low point within the Mock-Up Area to divert liquids to a drain point. The liquids flow from the drains into the PWD system.

Operating Cells B, C, D, and G

The floors in Cells B, C, and D are sloped to trapped floor drains centrally located in the cells. The floor in Cell G is sloped to a 6″ diameter sump. The drains and sump provide low points within the cells to drain liquids. A pumping system is provided for the sump to remove the liquid accumulation, and the floor drains gravity feed to Tank C-6-T.

Operating Cell E

The floor in Cell E is sloped to a 4″ diameter sump. The sump provides a low point within the cell to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Operating Cell F

The floor in Cell F is sloped to a 4″ diameter sump. The sump provides a low point within the cell to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containments for Tank Vault B-2-T; the RHD Line Pit; the North Valve Pit; the Cell F Corridor; Operating Area No. 119; the Cell G Pump Room; the Room 214 Decontamination Pan; Mock-Up Area No. 305; and Operating Cells B, C, D, E, F, and G are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. The Pitot Tube Pit, however, is not designed or provided with a means to drain or otherwise remove liquids resulting from leaks, spills, or precipitation.

2.1.4 Supplemental Information

2.1.4.1 Ancillary Equipment

Tank B-2-T is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault B-2-T, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.1.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontamination, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System B-2-T.

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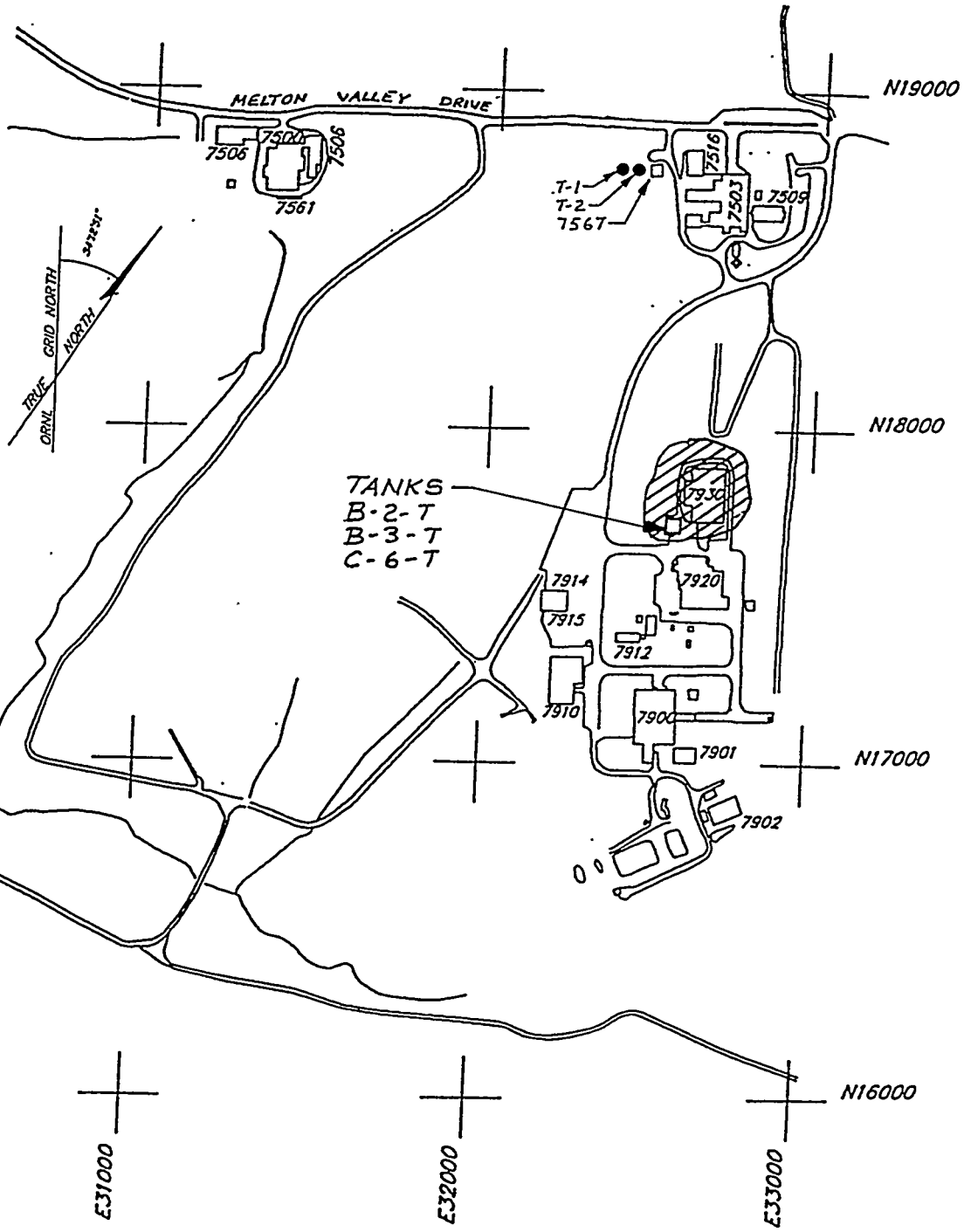
Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

R. M. Parson Co. 1977. *Natural Disturbance Analysis of Buildings 7930 and 3019.* Document No. X-OE-23.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

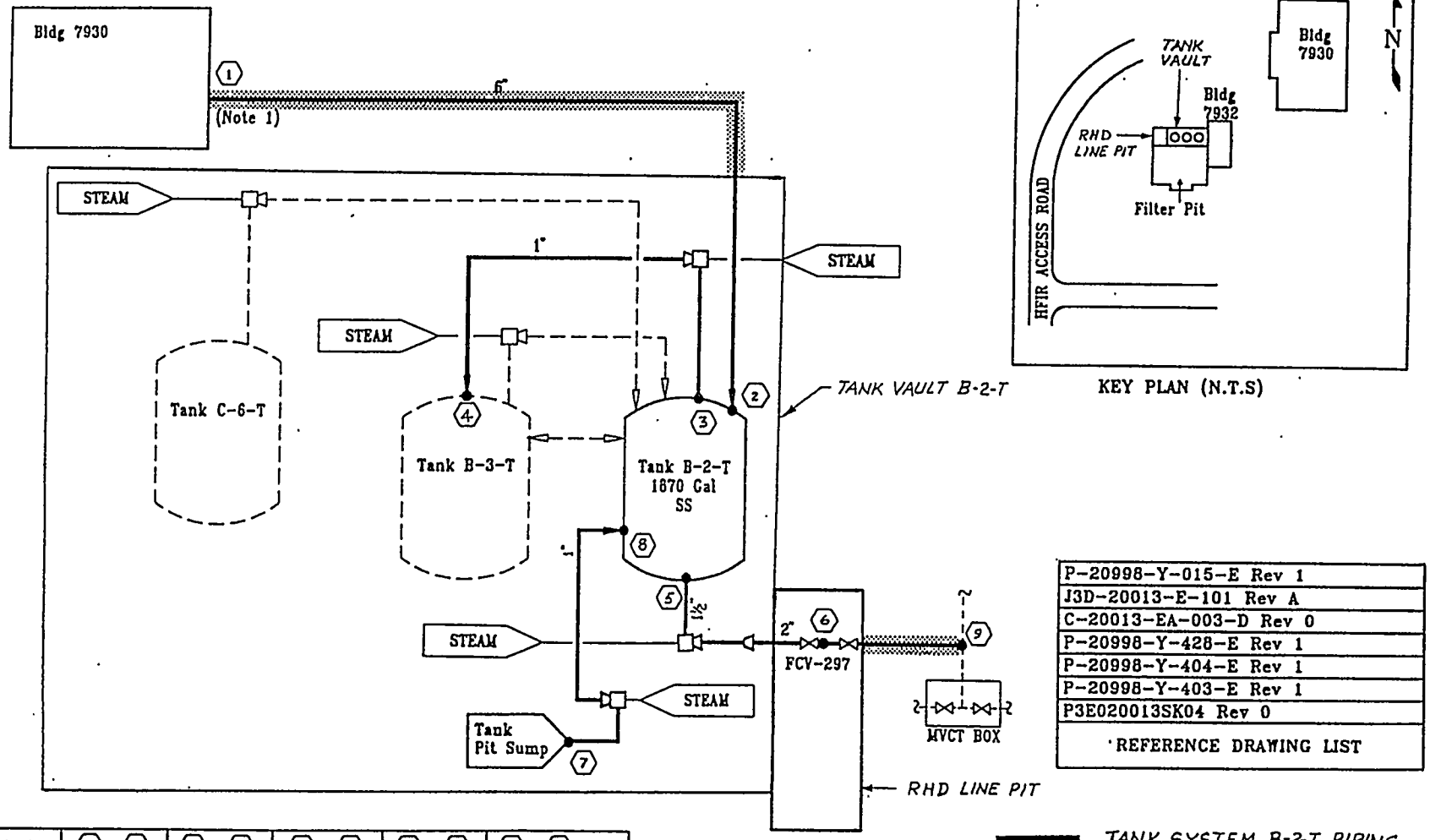
Specifications for the Construction of Thorium-Uranium Fuel Cycle Development Facility Building 7930. Invitation No. 401-65-4A.

Figure 2.1-1
Location of Tank System B-2-T Piping



EBASCO/MAIN

Figure 2.1-2 Tank System B-2-T Piping Diagram



REFERENCE DRAWING LIST
P-20998-Y-015-E Rev 1
J3D-20013-E-101 Rev A
C-20013-EA-003-D Rev 0
P-20998-Y-428-E Rev 1
P-20998-Y-404-E Rev 1
P-20998-Y-403-E Rev 1
P3E020013SK04 Rev 0

LINE SEGMENT	1-2	3-4	5-6	7-8	6-9
SIZE IN-DIA	6	1	1-1/2	1	2
SCHEDULE	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS
LENGTH (FT)	113	20	23	42	126
VOLUME (GAL)	167	1	2	2	22

NOTES:
(1) Node (1) does not include piping inside Bldg 7930.

TANK SYSTEM B-2-T PIPING
UNDERGROUND PIPE (SINGLE WALL)
COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.1-3
Analytical Data for Liquid (Tank System B-2-T)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	Cf–252	(b) Quantities	0.5 mg/year
	Other Cf		Trace

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

acidified butyrates	824.9 g/year
nitric acid (dilute)	Trace
palladium tetrammine di–hydrate	Trace
hydrazine decomposition products	Trace

Ref. LLLW Survey 1990

2.2 Tank System B-3-T Piping

2.2.1 Tank System Summary

Tank System B-3-T is located near the Radiochemical Engineering Development Center (REDC) (Building 7930) at the Melton Valley High Flux Isotope Reactor Complex (Figures 2.2-1 and 2.2-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from Tank Vault B-3-T (Waste Tank Pit that also contains Tanks B-2-T and C-6-T) to the Radioactive Hot Drain (RHD) Line Pit and from Tank Vault B-3-T outside underground to beneath Building 7930 and further into Building 7930.

Tank System B-3-T piping is used as process piping for the Radioactive Hot Drain Recoverable (RHDR) System and is classified as a Federal Facility Agreement Category B tank system.

2.2.2 Standards for Pipe Assessment of Tank Systems

2.2.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System B-3-T piping extends from Tank Vault B-3-T, near the southwest corner of Building 7930, to within Building 7930 and from Tank Vault B-3-T to the RHD Line Pit. The piping system is under the control of the REDC and is operated by the Chemical Technology Division.

Tank System B-3-T piping is constructed of 1″, 1-1/2″, and 3″, 304L SS with a maximum design pressure and temperature of 150 psig and 400°F. Tank System B-3-T piping has a maximum volume of 10 gal.

A section of the 1″ SS piping is routed through an 18-gauge, galvanized, helically corrugated metal pipe (CMP); and the combination is designed to be installed outside underground between Tank Vault B-3-T and Building 7930. The CMP isolates the 1″ SS piping from direct contact with the soil or water, and in so doing, the CMP indirectly acts as a secondary containment structure.

Design Standards

The applicable codes and standards used for Tank System B-3-T piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;
AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

American Concrete Institute;

American Concrete Pipe Association;

American Conference of Governmental Industrial Hygienists;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), IV, VII, VIII, and IX;

American Society for Testing and Materials A93, A244, A307, C39, C78, C138, C143, and D1752;

American Standards Association Safety Code for Building Construction;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrument Society of America;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.2.2.2 Generic Description of Piping Contents

Tank System B-3-T piping was designed to transfer liquid low-level waste (LLLW) to Cell G. The pipe leading into Cell G is out of service and is capped off, and Tank System B-3-T piping currently serves Tank B-3-T, an LLLW overflow tank for the Building 7930 RHD-HOG System. These

wastes may include a variety of dilute acids, bases, and organics. The system may contain radioactive materials from the REDC.

The analytical data (Figure 2.2-3) of waste stream contaminants from the generators are representative of waste transferred through Tank System B-3-T piping. However, at the present time no transfers are made to Tank B-3-T.

2.2.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault B-3-T, the RHD Line Pit, and Building 7930 is not in direct contact with the soil or water. In addition, SS piping located within a section of 18-gauge, galvanized CMP installed outside underground between Tank Vault B-3-T and Building 7930 is also not in direct contact with the soil or water. Cathodic protection measures for SS piping in these areas are not required for external corrosion protection. However, the CMP is in direct contact with the soil and water and is not provided with protective coatings or cathodic protection.

2.2.2.4 Documented Age of Tank System

Tank System B-3-T piping was installed in 1965.

2.2.3 Standards for Containment/Release Detection

Tank System B-3-T piping incorporates approximately 18′ of embedded piping within Building 7930 that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.2.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System B-3-T piping is single-wall, schedule 40S, type 304L SS pipe that is routed outside underground from Tank Vault B-3-T to areas within Building 7930 and from Tank Vault B-3-T to the RHD Line Pit. Areas of secondary containment are discussed below.

Tank Vault B-3-T

The assessment of the secondary containment for Tank Vault B-3-T is presented in the Design Demonstrations for Tank B-3-T. That assessment concludes that Tank Vault B-3-T is coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Outside Underground CMP

Approximately 250′ of galvanized CMP shrouds a 1″ diameter, schedule 40S, type 304L SS pipe in Tank System B-3-T. The 1″ SS line is centrally supported within the CMP. The galvanized CMP is not constructed of material that is compatible with the waste.

RHDR Valve Pocket

The Radioactive Hot Drain Recoverable (RHDR) Valve Pocket located in Building 7930 is coated with a 5-mil-thick system of Amercoat 99 vinyl emulsion on the floor and walls. According to manufacturer's specifications, the Amercoat 99 coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Operating Cell G

Operating Cell G is lined with 304L SS plate. The floor and trench linings are 1/4" thick; the wall lining is 3/16" thick; and the trench sumps are constructed of capped, 4" diameter, schedule 10S, type 304L SS pipe. The SS lining material is the same material as that used for the piping. Therefore, the SS cell lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

RHD Line Pit

The RHD Line Pit floor is coated with a 30-mil-thick system of Amercoat 66 epoxy. The concrete walls of the RHD Line Pit are coated with a 5-mil-thick system of Amercoat 99 vinyl emulsion. According to manufacturer's specifications, the Amercoat 66 and Amercoat 99 coatings are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault, valve pocket, operating cell, and line pit are lined or coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. The CMP, however, is not compatible with the waste.

2.2.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault B-3-T

The assessment of the secondary containment system for Tank Vault B-3-T is presented in the Design Demonstrations for Tank B-3-T. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

RHDR Valve Pocket

The RHDR Valve Pocket foundation consists of an 8″ thick, reinforced concrete slab that rests on stabilized aggregate.

Operating Cell G

The Operating Cell G foundation is an 8″ thick, reinforced concrete slab that rests on stabilized aggregate.

RHD Line Pit

The RHD Line Pit foundation is a 7′6″ × 9′0″ × 1′0″ thick, reinforced concrete base slab that rests on compacted backfill.

The assessment concludes that the tank vault, valve pocket, operating cell, and line pit are properly designed to support the secondary containment systems.

2.2.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault B-3-T

The assessment of the secondary containment system for Tank Vault B-3-T is presented in the Design Demonstrations for Tank B-3-T. That assessment concludes that the vault is provided with a leak detection system.

Outside Underground CMP

A leak detection system for the CMP could not be identified in the design drawings or construction specifications.

RHDR Valve Pocket

The valve pocket floor is sloped to an SS cove scupper. Any leakage within the area will flow by gravity to the scupper and continue through a 1″, 304L SS pipe to the Cell G Pump Room sump. Liquid accumulation in the sump will be detected by a level sensor that will activate an alarm in the operating area of Building 7930.

Operating Cell G

The cell is SS-lined and sloped to a 6″ diameter, 304L SS sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 7930.

RHD Line Pit

The line pit floor is a coated area. Any leakage within the area flows by gravity through a 2″ diameter, SS pipe to a sump in Tank Vault B-3-T. Accumulation of liquid in the sump will be detected by a level sensor that will activate an alarm in the operating area of Building 7930.

The assessment concludes that the tank vault, valve pocket, operating cell, and line pit are provided with leak detection. The CMP is not provided with a leak detection system.

2.2.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault B-3-T

The assessment of the secondary containment system for Tank Vault B-3-T is presented in the Design Demonstrations for Tank B-3-T. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Outside Underground CMP

The CMP is sloped towards Tank Vault B-3-T; however, the CMP is not provided with a means to drain or otherwise remove liquids that may accumulate in the CMP.

RHDR Valve Pocket

The valve pocket floor slopes to an SS cove scupper that slopes to an SS drain. The drain piping leads into a 6″ diameter, 304L SS, capped pipe sump. A pumping system is provided to remove liquids that accumulate in the sump.

Operating Cell G

The operating cell floor is sloped to a centrally located collection trench that slopes to a 6″ diameter, 304L SS, capped pipe sump. The sump provides a low point within the cell to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

RHD Line Pit

The line pit floor slopes to an SS drain that leads to a sump located in Tank Vault B-3-T. The sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containment structures for the tank vault, valve pocket, operating cell, and line pit are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. The outside underground CMP is sloped, but it is not provided with a means to drain and remove liquids.

2.2.4 Supplemental Information

2.2.4.1 Ancillary Equipment

Tank B-3-T is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault B-3-T, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.2.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System B-3-T.

2.2.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate-Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. May 14, 1993. *Design Demonstrations—Category B Tank Systems*, Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing A-20998-Y-128-E-1, Architectural, Cell Area, Sections, Revision 1.

Energy Systems Drawing A-20998-Y-143-E-3, Architectural, Cell Sleeves and Service Tube Details, Revision 3.

Energy Systems Drawing A-20998-Y-147-E-1, Architectural, Misc. Cell Details, Sheet 3, Revision 1.

Energy Systems Drawing A-20998-Y-115-E, Architectural, Misc. Interior Details, Dated 1/15/65 (No Revision No.).

Energy Systems Drawing A-20998-Y-124-E-2, Architectural, Plan, Cell Area at Basement, Revision 2.

Energy Systems Drawing H-20998-Y-325-E-1, Cell Exhaust and H.O.G. Filter Pit, H.O.G. Fans Plan and Details, Revision 1.

Energy Systems Drawing C-20998-Y-015-E-1, Civil Utility Details, Sheet 1, Revision 1.

Energy Systems Drawing H-20998-Y-302-E-A, Flow Diagram HVAC, Revision A.

Energy Systems Drawing P-20998-Y-404-E, Flow Diagram RHD, RHDR and PWD Systems, Sheet 2, Revision 1.

Energy Systems Drawing P-20998-Y-403-E-1, Flow Diagram RHD-HOG, RHDR and PWD Systems, Sheet 1, Revision 1.

Energy Systems Drawing S-20998-Y-224-E, Radioactive Waste and Filter Pits, Sheet 2, Dated 1/15/64 (No Revision No.).

Energy Systems Drawing S-20998-Y-212-E-1, Wall Sections and Details, Revision 1.

Energy Systems Drawing P-20998-Y-405-E-3, Waste Piping, Below First Floor Part Plan V4, 34 North, Revision 3.

Energy Systems Drawing P-20998-Y-413-E, Waste Piping Details, Sheet 1, Dated 1/15/65 (No Revision No.).

Energy Systems Drawing P-20998-Y-428-E-1, Waste Pit Piping Details, Sheet 1, Revision 1.

Energy Systems Drawing P-20998-Y-430-E-1, Waste Pit Piping Details, Sheet 3, Revision 1.

King, Notz, and Bigelow. 1987. *Safety Analysis: TURF: Building 7930.* ORNL/TM-9505. Oak Ridge National Laboratory.

LLLW Generator Survey 1990 for Building 7930.

Oak Ridge National Laboratory. *Specification for the Construction of Thorium-Uranium Fuel Cycle Development Facility Building 7930.* Invitation No. 401-65-4A.

Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

R. M. Parson Co. 1979. *Natural Disturbance Analysis of Buildings 7930 and 3019.* Document No. X-OE-23.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.2-1
Location of Tank System B-3-T Piping

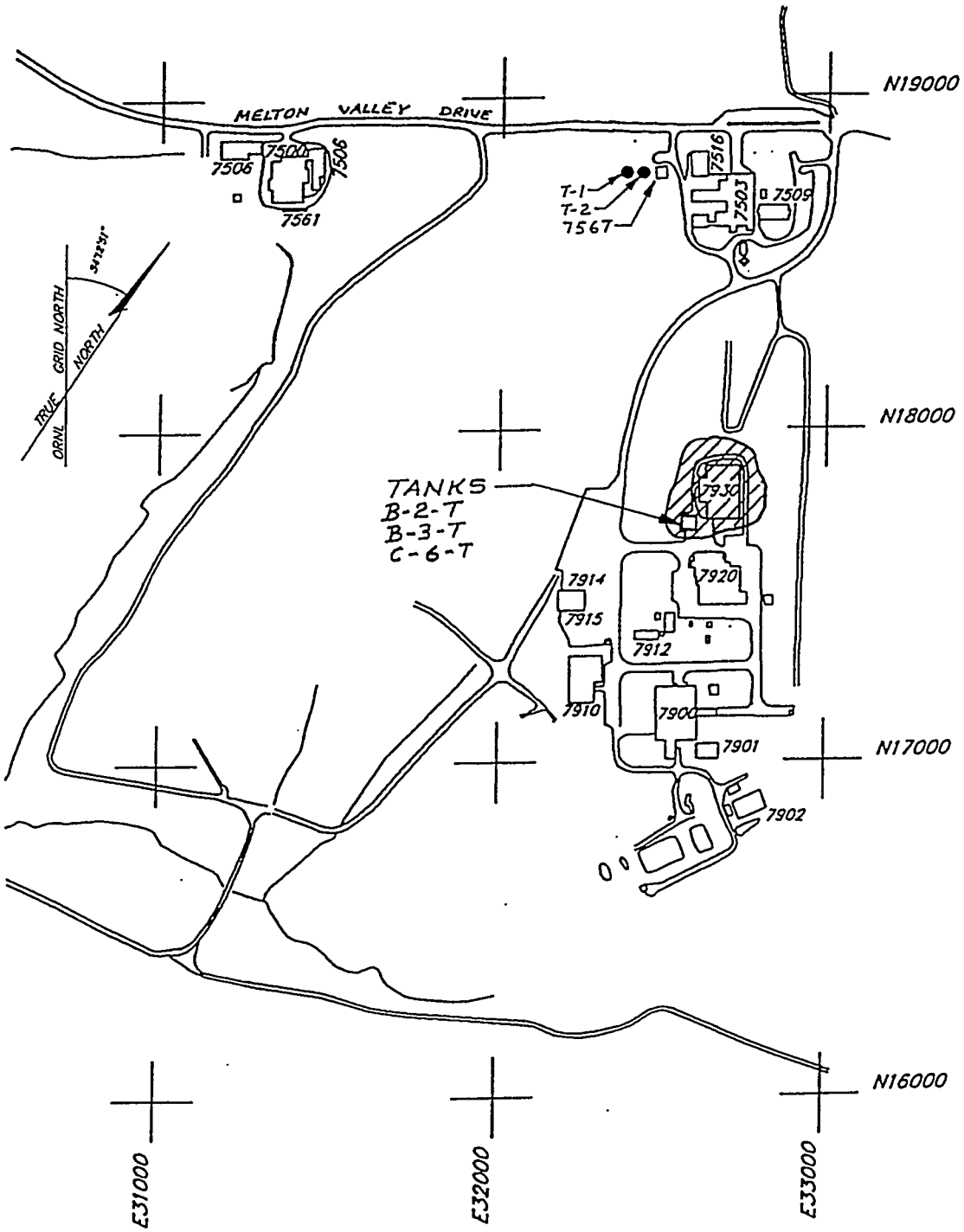
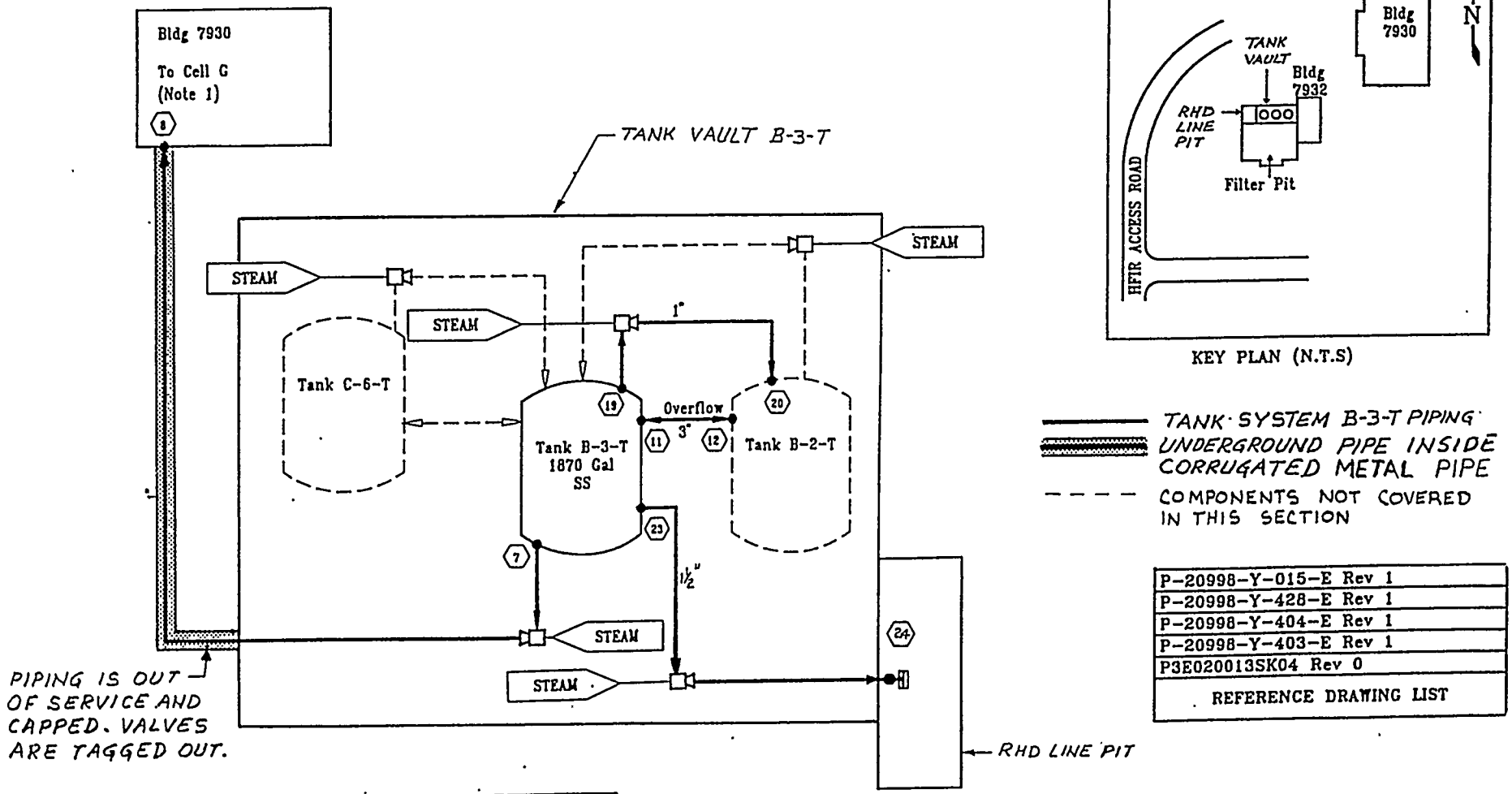
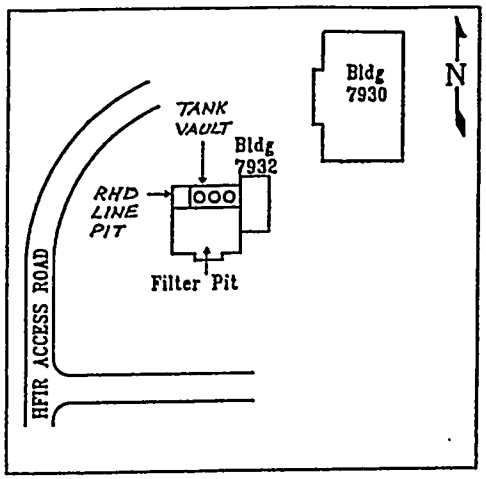


Figure 2.2-2 Tank System B-3-T Piping Diagram





KEY PLAN (N.T.S)

TANK SYSTEM B-3-T PIPING
UNDERGROUND PIPE INSIDE CORRUGATED METAL PIPE
COMPONENTS NOT COVERED IN THIS SECTION

REFERENCE DRAWING LIST
P-20998-Y-015-E Rev 1
P-20998-Y-428-E Rev 1
P-20998-Y-404-E Rev 1
P-20998-Y-403-E Rev 1
P3E020013SK04 Rev 0

LINE SEGMENT	(7) - (8)	(11) - (12)	(19) - (20)	(23) - (24)
SIZE IN-DIA	1	3	1	1 1/2
SCHEDULE	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS
LENGTH (FT)	128	1	19	22
VOLUME (GAL)	6	1	1	2

NOTES :

(1) Node (8) is blanked off in Cell G.

Figure 2.2-3
Analytical Data for Liquid (Tank System B-3-T)

WASTE STREAM CONTAMINANTS:

(a)	Isotopes:	Cf–252	(b) Quantities 0.5 mg/year
		Other Cf	Trace

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

acidified butyrates	824.9 g/year
nitric acid (dilute)	Trace
palladium tetrammine di–hydrate	Trace
hydrazine decomposition products	Trace

Ref. LLLW Survey 1990

2.3 Tank System C-6-T Piping

2.3.1 Tank System Summary

Tank System C-6-T is located near the Radiochemical Engineering Development Center (REDC) (Building 7930) in the Melton Valley High Flux Isotope Reactor Complex (Figures 2.3-1 and 2.3-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS); is routed from Tank Vault C-6-T (Waste Tank Pit that also contains Tanks B-2-T and B-3-T) outside underground to beneath Building 7930; and terminates in areas within Building 7930.

Tank System C-6-T piping is used to transfer liquid low-level waste (LLLW) from the Building 7930 Radioactive Hot Drain Recoverable (RHDR) System to Tank C-6-T and is classified as a Federal Facility Agreement Category B tank system.

2.3.2 Standards for Pipe Assessment of Tank Systems

2.3.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System C-6-T piping extends from Tank Vault C-6-T, near the southwest corner of Building 7930 to within Building 7930. The piping system is under the control of the REDC and is operated by the Chemical Technology Division.

Tank System C-6-T piping is constructed of 1/2″, 1″, 1-1/2″, 2″, and 3″, 304L SS with a maximum design temperature and pressure of 338°F and 150 psig. Tank System C-6-T piping has a maximum volume of 154 gal.

A section of the 1″ SS piping is routed through an 18-gauge, galvanized, helically corrugated metal pipe (CMP); and the combination is designed to be installed outside underground between Tank Vault C-6-T and Building 7930. The CMP isolates the 1″ SS piping from direct contact with the soil or water, and in so doing, the CMP indirectly acts as a secondary containment structure.

Design Standards

The applicable codes and standards used for Tank System C-6-T piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

American Concrete Institute;

American Concrete Pipe Association;

American Conference of Governmental Industrial Hygienists;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), IV, VII, VIII, and IX;

American Society for Testing and Materials A93, A244, A307, C39, C78, C138, C143, and D1752;

American Standards Association Safety Code for Building Construction;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrument Society of America;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.3.2.2 Generic Description of Piping Contents

Tank System C-6-T piping is designed to transfer LLLW to and from the Building 7930 RHDR System and Tank C-6-T. The pipe that transfers LLLW to Cell G is out of service and is capped off. The primary source of LLLW is Cell G in Building 7930. These wastes may include a variety

of dilute acids, bases, and organics. The tank system may contain radioactive materials from the REDC.

The analytical data (Figure 2.3-3) of waste stream contaminants from the generators are representative of waste transferred through Tank System C-6-T. However, at the present time no transfers are made to Tank C-6-T.

2.3.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault C-6-T and Building 7930 is not in direct contact with the soil or water. In addition, SS piping located within a section of 18-gauge, galvanized, CMP installed outside underground between Tank Vault C-6-T and Building 7930 is also not in direct contact with the soil or water. Cathodic protection for SS piping in these areas is not required for external corrosion protection. However, the CMP and a section of SS piping routed outside underground between Tank Vault C-6-T and Building 7930 are in direct contact with the soil and water, and these pipes are not provided with protective coatings or cathodic protection.

2.3.2.4 Documented Age of Tank System

Tank System C-6-T was installed in 1965.

2.3.3 Standards for Containment/Release Detection

Tank System C-6-T piping incorporates approximately 510′ of piping that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment. The omitted areas include the 3″ diameter outside underground SS piping and the embedded piping within Building 7930.

2.3.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System C-6-T piping is single-wall, schedule 40S, type 304L SS pipe. The piping is routed outside underground from Tank Vault C-6-T to areas within Building 7930. Areas of secondary containment are discussed below.

Tank Vault C-6-T

The assessment of the secondary containment system for Tank Vault C-6-T is presented in the Design Demonstrations for Tank C-6-T. That assessment concludes that Tank Vault C-6-T is coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Outside Underground CMP

Approximately 250′ of galvanized CMP shrouds a 1″ diameter, schedule 40S, type 304L SS pipe in Tank System C-6-T. The 1″ SS line is centrally supported within the CMP. The galvanized CMP is not constructed of material that is compatible with the waste.

Areas Within Building 7930

Operating Cells C, D, E, and G

Operating Cells C, D, and G are lined with 304L SS plate. The floor and trench linings are 1/4″ thick; the wall linings are 3/16″ thick; and the trench sumps are constructed of capped, 4″ diameter, schedule 10S, type 304L SS pipe. The SS cell lining material is the same material as that used for the piping. Therefore, the SS cell lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

The floor and trench in Operating Cell E are lined with 1/4″ thick, 304L SS plate. The sump is constructed of capped, 4″ diameter, schedule 10S, type 304L SS pipe. The walls in Cell E are lined with 3/16″ thick, 304L SS that extends 1′0″ from the floor lining. The remainder of the walls are coated with a 12-mil-thick system of Amercoat 66. The SS lining material is the same material as that used for the piping. Therefore, it is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the Amercoat 66 coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Waste Ejector Pocket and RHDR Valve Pocket

The Waste Ejector Pocket and the RHDR Valve Pocket located in Building 7930 are both coated with a 5-mil-thick system of Amercoat 99 on the floors and walls. According to the manufacturer's specifications, the Amercoat 99 coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Cell G Pump Room

The concrete floor, trench, drain, and covers are coated with a 20-mil-thick system of Amercoat 74. According to the manufacturer's specifications, the Amercoat 74 system is compatible with the waste and designed to prevent migration of waste into the concrete. The concrete and masonry walls are coated with a 6-mil-thick system of Amercoat 88. According to the manufacturer's specifications, the Amercoat 88 system is not compatible with the waste and is not designed to prevent migration of waste into the concrete. According to the manufacturer, this coating system does not provide the appropriate resistance to chemicals and radiation.

Mock-Up Area No. 305

The concrete floor and the exposed ferrous metal embedded in the floor are coated with a 20-mil-thick system of Amercoat 74. According to the manufacturer's specifications, the Amercoat 74 system is compatible with the waste and designed to prevent migration of waste into the concrete. The concrete and masonry walls are coated with a 6-mil-thick system of Amercoat 88. According to the manufacturer's specifications, the Amercoat 88 system is not compatible with the waste and is not designed to prevent migration of waste into the concrete.

The assessment concludes that Tank Vault C-6-T; Operating Cells C, D, E, and G; the Waste Ejector Pocket; the RHDR Valve Pocket; and the floors of Cell G Pump Room and Mock-Up Area No. 305 are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. However, the walls of Cell G Pump Room and Mock-Up Area No. 305 are not constructed of or lined with materials that are compatible with the waste and that will prevent migration of waste into the concrete. The galvanized CMP is not constructed of material that is compatible with the waste.

2.3.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault C-6-T

The assessment of the secondary containment system for Tank Vault C-6-T is presented in the Design Demonstrations for Tank C-6-T. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Areas Within Building 7930

Operating Cells C, D, E, and G

The foundations of Operating Cells C and D are 8″ thick, reinforced concrete slabs supported by 18″ × 30″ thick, reinforced concrete beams that span reinforced concrete footers that are placed on undisturbed shale. The floors of Operating Cells E and G are 8″ thick, reinforced concrete slabs that rest on stabilized aggregate backfill.

Waste Ejector Pocket and RHDR Valve Pocket

The Waste Ejector Pocket and RHDR Valve Pocket foundations consist of 8″ thick, reinforced concrete slabs that rest on stabilized aggregate backfill.

Cell G Pump Room

The Cell G Pump Room foundation is a 6″ thick, "L"-shaped, reinforced concrete slab that rests on undisturbed soil.

Mock-Up Area No. 305

The foundation of Mock-Up Area No. 305 is a combination of 4'9" thick, reinforced concrete plugs and a 5'0" thick, reinforced concrete slab that rests on the outer and inner walls of Cells C, D, E, and G.

The assessment concludes that Tank Vault C-6-T; Operating Cells C, D, E, and G; the Waste Ejector Pocket; the RHDR Valve Pocket; the Cell G Pump Room; and Mock-Up Area No. 305 foundations are properly designed to support the secondary containment systems.

2.3.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault C-6-T

The assessment of the secondary containment system for Tank Vault C-6-T is presented in the Design Demonstrations for Tank C-6-T. That assessment concludes that the vault is provided with a leak detection system.

Outside Underground CMP

A leak detection system for the outside underground CMP could not be identified in the design drawings or construction specifications.

Areas Within Building 7930

Operating Cells C, D, E, and G

The floors of Operating Cells C, D, E, and G are sloped to collection trenches located within each cell. The collection trenches in Cells C and D slope to trapped floor drains, and the collection trenches in Cells E and G slope to sumps. The sumps in Cells E and G and the drain in Cell C are provided with level sensors that will detect accumulation and activate alarms located in the operating area of Building 7930. Cell D is not provided with a leak detection system.

Waste Ejector Pocket and RHDR Valve Pocket

The Waste Ejector Pocket and RHDR Valve Pocket floors are sloped to SS cove scuppers that divert liquids through 1", 304L SS pipes to the Cell G Pump Room sump. Liquid accumulation in the sump will be detected by a level sensor that will activate an alarm in the operating area of Building 7930.

Cell G Pump Room

The Cell G Pump Room floor is sloped to a collection trench that slopes to a sump located in the bottom of the trench. Liquid accumulation in the sump will be detected by a level sensor that will activate an alarm in the operating area of Building 7930.

Mock-Up Area No. 305

The Mock-Up Area No. 305 floor is provided with 3″ diameter, Process Waste Drain (PWD) floor drains; however, Mock-Up Area No. 305 is not provided with a leak detection system.

The assessment concludes that Tank Vault C-6-T; Operating Cells C, E, and G; the Waste Ejector Pocket; the RHDR Valve Pocket; and the Cell G Pump Room are provided with leak detection. However, the outside underground CMP, Operating Cell D, and Mock-Up Area No. 305 are not provided with leak detection systems.

2.3.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault C-6-T

The assessment of the secondary containment system for Tank Vault C-6-T is presented in the Design Demonstrations for Tank C-6-T. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Outside Underground CMP

The CMP is sloped towards Tank Vault C-6-T; however, the CMP is not provided with a means to drain or otherwise remove liquids.

Areas Within Building 7930

Operating Cells C, D, E, and G

The floors in Operating Cells C and D are sloped to centrally located floor trenches that slope to trapped drains. The floors in Cells E and G are sloped to centrally located floor trenches that slope to sumps incorporated in the bottom of the trenches. The sumps and drains provide low points within the cells to drain liquids. Pumping systems are provided to remove the accumulation from the sumps, and the floor drains gravity feed to Tank C-6-T.

Waste Ejector Pocket and RHDR Valve Pocket

The Waste Ejector Pocket and RHDR Valve Pocket floors are sloped to centrally located, SS cove scuppers. The scuppers transfer liquids out of the pockets through 1″ diameter, 304L SS pipes by gravity flow to the Cell G Pump Room sump.

Cell G Pump Room

The Cell G Pump Room floor is sloped to a trench and several 3″ diameter floor drains. The trench and drains divert liquids to a 6″ diameter, schedule 10S, type 304L SS, capped pipe sump. The sump provides a low point within the pump room to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

An additional sump is located in the pump room at a high point in the finished floor, and collects rainwater from stairwell #7 through pipes passing below floor elevation. In the event of a leak in the piping system during the transfer of liquids, it would flow to the low point pump room sump, trigger an alarm, and by operating procedure requirements the transfer is discontinued not allowing an overflow to the rainwater sump.

Mock-Up Area No. 305

The Mock-Up Area No. 305 floor is sloped to PWD drains mounted flush in the floor. The drains provide a low point within the Mock-Up Area to divert liquids to a drain point. The liquids flow from the drains into the PWD system.

The assessment concludes that the secondary containments for Tank Vault C-6-T; Operating Cells C, D, E, and G; the Waste Ejector Pocket; the RHDR Valve Pocket; the Cell G Pump Room; and Mock-Up Area No. 305 are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. The outside underground CMP is sloped, but it is not provided with a means to drain and remove liquids.

2.3.4 Supplemental Information

2.3.4.1 Ancillary Equipment

Tank C-6-T is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault C-6-T, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.3.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontamination, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System C-6-T.

2.3.5 References

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Energy Systems Drawing A-20998-Y-136-E-2, Architectural, Penetrations Interior Cell "E", Sheet 1, Revision 2.

Energy Systems Drawing A-20998-Y-137-E-2, Architectural, Penetrations Interior Cell "E", Sheet 2, Revision 2.

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Energy Systems Drawing P-20998-Y-407-E-2, Waste Piping, First Floor, Part Plan—North, Revision 2.

Energy Systems Drawing P-20998-Y-408-E-2, Waste Piping, First Floor, Part Plan—South, Revision 2.

Energy Systems Drawing P-20998-Y-409-E-1, Waste Piping, Second Floor, Part Plan—North, Revision 1.

Energy Systems Drawing P-20998-Y-410-E-2, Waste Piping, Second Floor, Part Plan—South, Revision 2.

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Energy Systems Drawing P-20998-Y-412-E, Waste Piping, Third Floor and Roof, Part Plan—South, Dated 1/15/65 (No Revision No.).

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Specifications for the Construction of Thorium-Uranium Fuel Cycle Development Facility Building 7930.

Figure 2.3-1
Location of Tank System C-6-T Piping

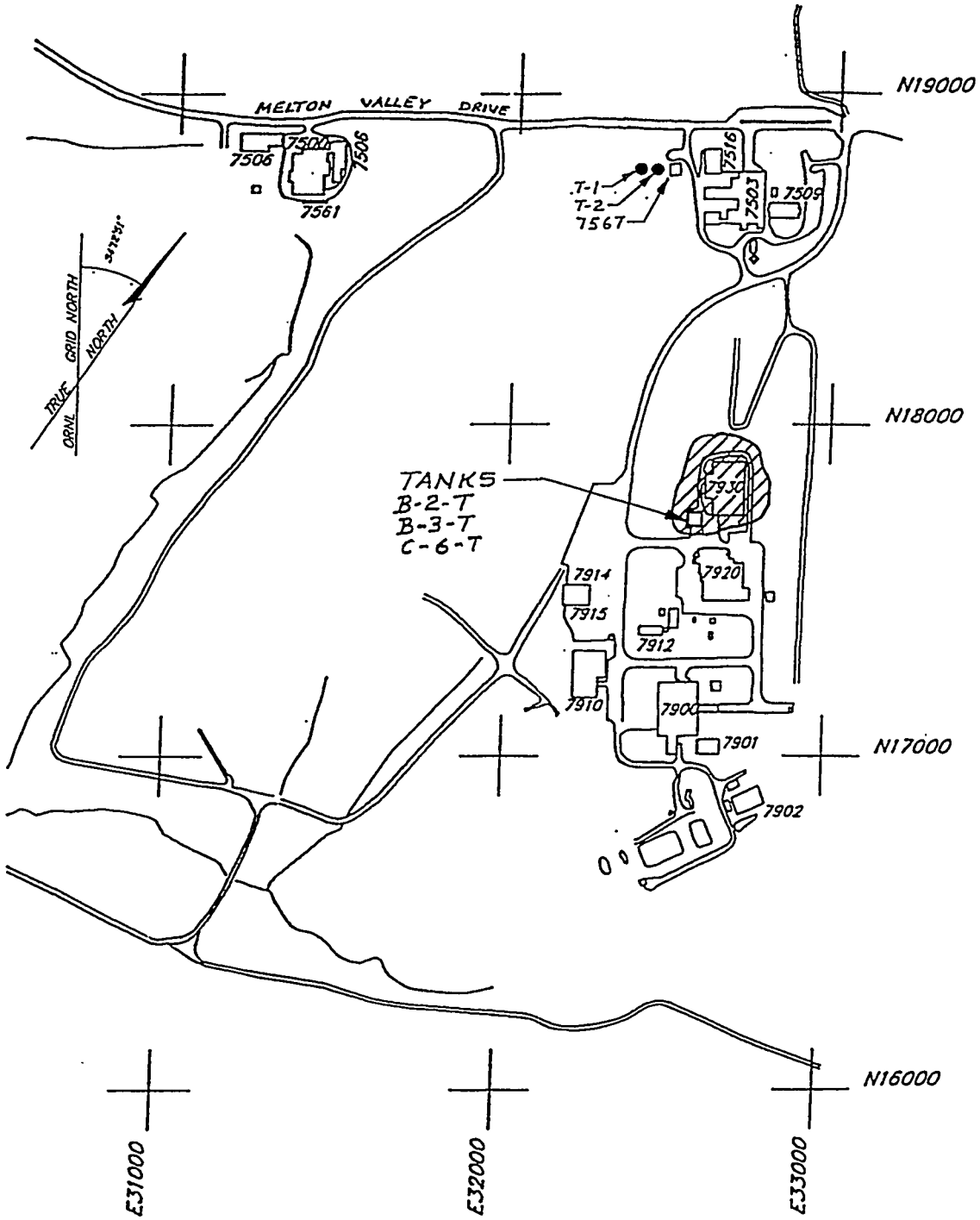
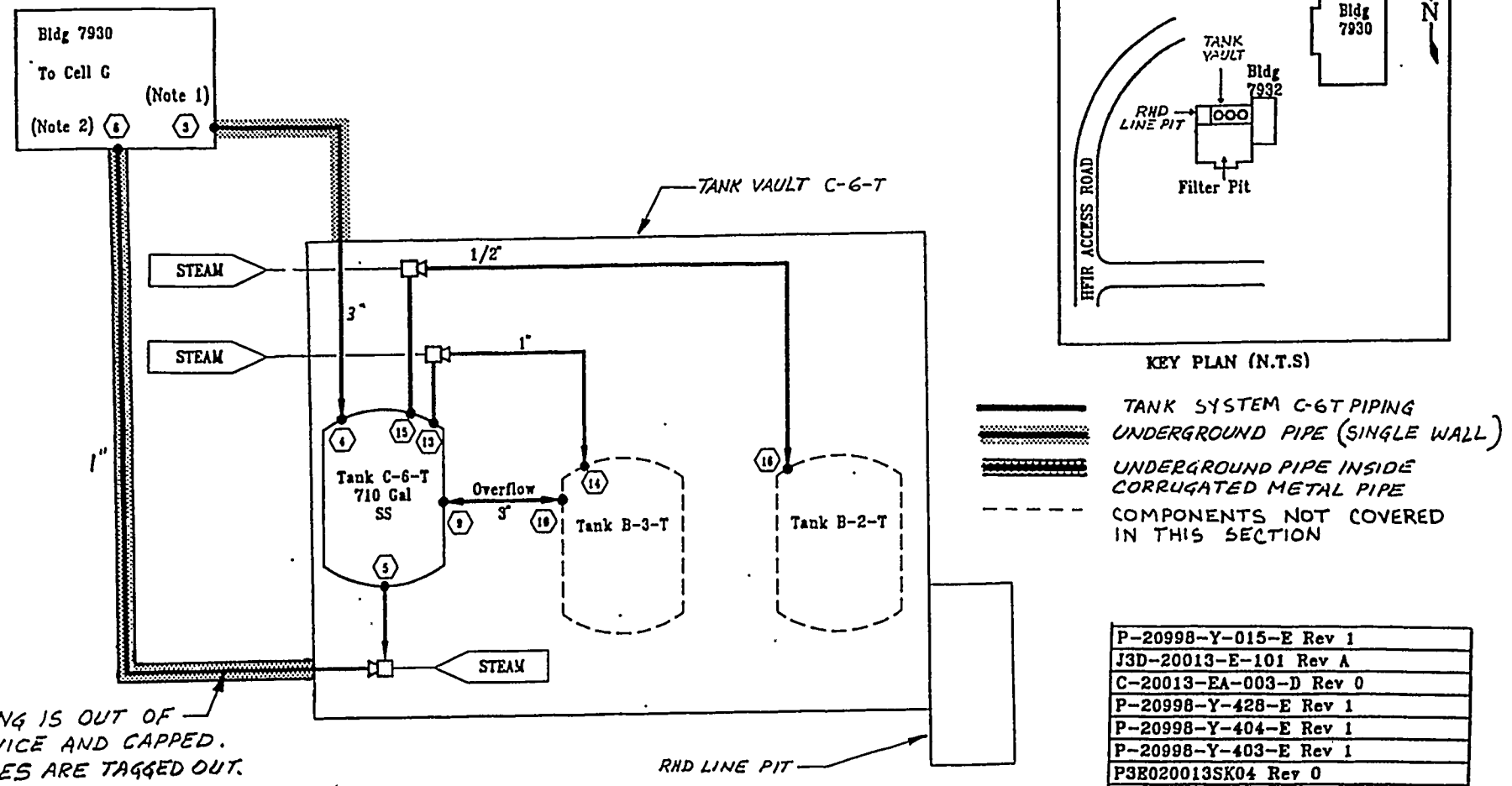


Figure 2.3-2 Tank System C-6-T Piping Diagram



LINE SEGMENT	3 - 4	5 - 6	9 - 10	13 - 14	15 - 16
SIZE IN-DIA	3	1	3	1	1/2
SCHEDULE	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS
LENGTH (FT)	133	135	1	20	29
VOLUME (GAL)	51	6	1	1	1

NOTES :

(1) Nodes 3 , 6 do not include piping inside Bldg 7930.
(2) Node 6 is blanked off in Cell G.

REFERENCE DRAWING LIST
P-20998-Y-015-E Rev 1
J3D-20013-E-101 Rev A
C-20013-EA-003-D Rev 0
P-20998-Y-428-E Rev 1
P-20998-Y-404-E Rev 1
P-20998-Y-403-E Rev 1
P3E020013SK04 Rev 0

Figure 2.3-3
Analytical Data for Liquid (Tank System C-6-T)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	Cf–252	(b) Quantities	0.5 mg/year
	Other Cf		Trace

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

acidified butyrates	824.9 g/year
nitric acid (dilute)	Trace
palladium tetrammine di–hydrate	Trace
hydrazine decomposition products	Trace

Ref. LLLW Survey 1990

2.4 Tank System C-1 Piping

2.4.1 Tank System Summary

Tank System C-1 is located near the liquid low-level waste (LLLW) Evaporator (Building 2531) at the main Bethel Valley Complex (Figure 2.4-1). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from Tank Vault C-1 to Valve Pit 2VP-3 (Figure 2.4-2). Tank System C-1 piping is used to transfer concentrate from the LLLW Evaporator to the Melton Valley Storage Tanks and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.4.2 Standards for Pipe Assessment of Tank Systems

2.4.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System C-1 piping is located near Building 2531 and is routed from Tank Vault C-1 to Valve Pit 2VP-3. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System C-1 piping is constructed of 1-1/2", 304L SS with a maximum design pressure and temperature of 150 psig and 400°F. Tank System C-1 piping has a maximum volume of 9 gal.

Design Standards

The applicable codes and standards used for Tank System C-1 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

American Concrete Institute 318, Building Code Requirements for Reinforced Concrete;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240) and VIII;

American Society for Testing and Materials C94, C175, A15, A185, A240, A262, A214, A182, A269, A276, A312, A371, A376, A403, E94, E142, E165, A7, A325, A245, A141, A53, A167, A403, A312, B68, A234, A120, C200, A181, and A213;

American Standards Association Standard B31.1, Code for Pressure Piping.

Atomic Energy Commission Safety Code;

Federal Specifications 55A666, 55A701, HHF191, HHC581, R381, HHF201, HHC591, TTC655, and LLLF321;

Institute of Electrical and Electronic Engineers Standards;

Underwriters Laboratories Inc.; and

Unfired Pressure Vessels (1962 edition).

2.4.2.2 Generic Description of Piping Contents

Tank System C-1 was designed to collect high-level waste generated at the Oak Ridge National Laboratory (ORNL). However, because no significant quantities of high-level waste were ever generated, this system was repiped to serve as a LLLW concentrate transfer system. LLLW is generated from a variety of facilities at ORNL including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to LLLW Evaporator Feed Tank W-22. Any waste found to be acidic is adjusted to basic with sodium hydroxide in the generator collection tanks or in the evaporator feed tank, which precipitates most of the transuranic waste components and heavy metals. The waste is then processed through the evaporator; and the concentrate is transferred to Tanks C-1, C-2, W-21, and W-23 before it is sent to the Melton Valley Storage Tanks.

Tank System C-1 piping transfers LLLW to and from Tank C-1. Because of the lack of a convenient access point, Tank C-1 has not been sampled. However, Tank W-23, which is also used to store LLLW concentrate, has been sampled. Because both Tank W-23 and Tank C-1 are used to collect LLLW concentrate from the evaporator, it is logical to assume that the characteristics of the waste stored in Tank W-23 should be similar to those of the waste transferred through Tank System C-1.

The liquid waste supernate sampled in Tank W-23 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions and should be similar to the waste concentrate expected to be found in Tank C-1 (Figure 2.4-3). Based on radiation levels found in Tank W-23 and the historical use of Tank C-1 as an evaporation feed tank, Tank System C-1 piping may contain radioactive materials (Figure 2.4-4).

2.4.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault C-1 and Valve Pit 2VP-3 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.4.2.4 Documented Age of Tank System

Tank System C-1 piping was installed in 1964.

2.4.3 Standards for Containment/Release Detection

2.4.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System C-1 piping is single-wall, schedule 40S, type 304L SS pipe that is routed from Tank Vault C-1 to Valve Pit 2VP-3. Each area is discussed below. The piping penetrations from Tank Vault C-1 to Valve Pit 2VP-3 are singly contained, 1-1/2", schedule 40S, type 304L SS pipes that are embedded in the concrete wall to a length of 3'2".

Tank Vault C-1

The assessment of the secondary containment system for Tank Vault C-1 is presented in the Design Demonstrations for Tank C-1. That assessment concludes that Tank Vault C-1 is coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Pit 2VP-3

The bottom of Valve Pit 2VP-3 is lined with 16-gauge (1/16"), 304L SS, with sidewalls that project 4'0" up the valve pit. The valve pit walls above the SS liner are provided with a system of Carboline 193 epoxy. The SS valve pit lining material is the same material as that used for the piping. Therefore, the lining is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve pit's epoxy coating is also compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault and valve pit are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.4.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault C-1

The assessment of the secondary containment system for Tank Vault C-1 is presented in the Design Demonstrations for Tank C-1. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Valve Pit 2VP-3

The valve pit foundation is an 18′2″ × 27′4″ × 1′2″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the tank vault and valve pit foundations are properly designed to support the secondary containment systems.

2.4.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault C-1

The assessment of the secondary containment system for Tank Vault C-1 is presented in the Design Demonstrations for Tank C-1. That assessment concludes that the vault is provided with a leak detection system.

Valve Pit 2VP-3

The Valve Pit 2VP-3 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

The assessment concludes that the tank vault and valve pit are provided with leak detection.

2.4.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault C-1

The assessment of the secondary containment system for Tank Vault C-1 is presented in the Design Demonstrations for Tank C-1. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Valve Pit 2VP-3

The Valve Pit 2VP-3 floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containments for the tank vault and valve pit are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.4.4 Supplemental Information

2.4.4.1 Ancillary Equipment

Tank C-1 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault C-1, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.4.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System C-1.

2.4.5 References

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Energy Systems Drawing E-S-52714, Wall Penetrations, Sheet 1, Revision 6.

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Figure 2.4-1 Location of Tank System C-1 Piping

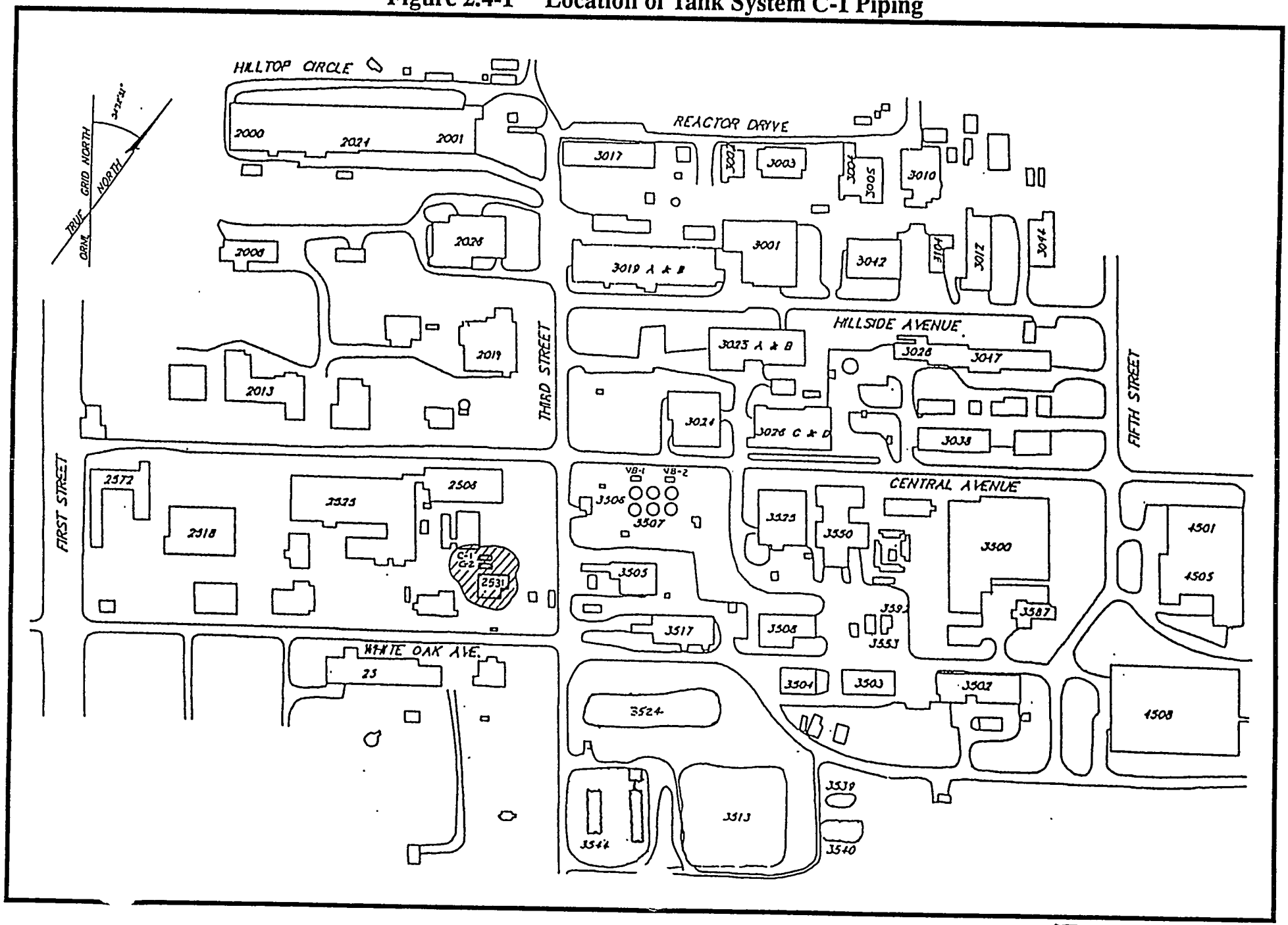
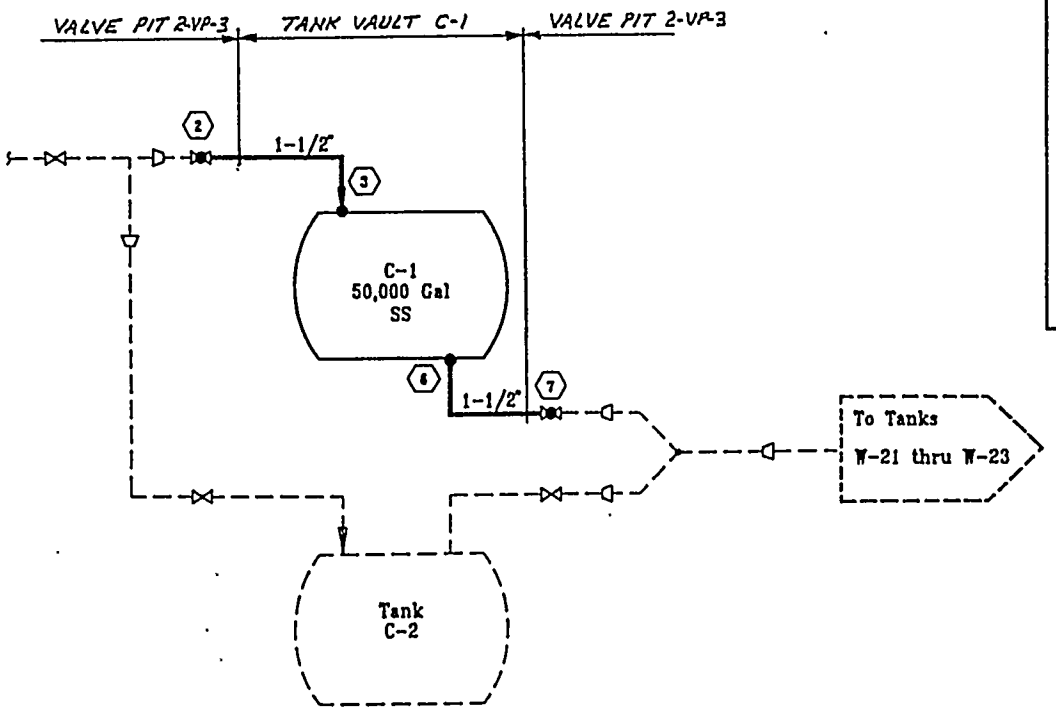
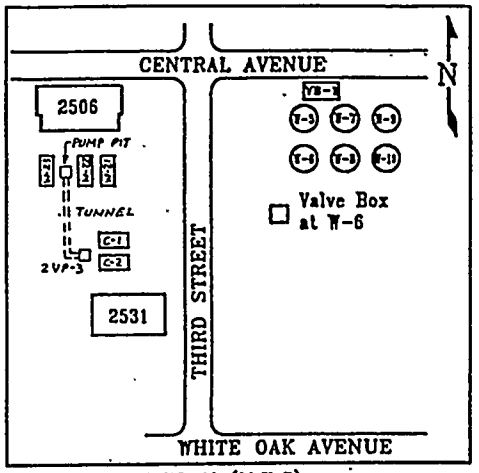


Figure 2.4-2 Tank System C-1 Piping Diagram





KEY PLAN (N.T.S)

REFERENCE DRAWING LIST
P3E-20237-C021 Rev 0
D-52591 Rev 3
D-52589 Rev 4
P3E-20237-C020 Rev 0
P3E020013SK03 Rev 0

LINE SEGMENT	(2)-(3)	(6)-(7)
SIZE IN-DIA	1-1/2	1-1/2
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	48	34
VOLUME (GAL)	5	4

——— TANK SYSTEM C-1 PIPING

– – – – COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.4-3
Analytical Data for Liquid and Sludge Samples (Tank System C-1)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN. 1990 * WZ3-L1 REPRESENTATIVE SAMPLE
Physical properties and miscellaneous data		
TDS	(mg/mL)	331
TS	(mg/mL)	383
Density	(g/mL)	1.2423
IC	(mg/L)	8340
TC	(mg/L)	9500
TOC	(mg/L)	1160
RCRA metals		
Ag	(mg/L)	<0.44
As	(mg/L)	<3.0
Ba	(mg/L)	<0.19
Cd	(mg/L)	1.7
Cr	(mg/L)	0.42
Hg	(mg/L)	0.07
Ni	(mg/L)	3.0
Pb	(mg/L)	2.7
Se	(mg/L)	<2.3
Tl	(mg/L)	<0.94
Process metals		
Al	(mg/L)	1.8
B	(mg/L)	10
Ca	(mg/L)	18
Co	(mg/L)	-
Fe	(mg/L)	0.70
K	(mg/L)	78000
Mg	(mg/L)	3.4
Na	(mg/L)	82000
Si	(mg/L)	<1
Sr	(mg/L)	0.40
Th	(mg/L)	15.8
U	(mg/L)	17
Anions		
Chloride	(M)	0.10
Fluoride	(M)	<0.053
Nitrate	(M)	3.23
Phosphate	(M)	<0.053
Sulfate	(M)	0.081
Alkalinity		
pH		12.8
H^+	(M)	-
OH	(M)	0.15
CO_3^{2}	(M)	0.70
HCO_3	(M)	
Beta/gamma emitters		
Gross alpha	(Bq/mL)	8.20e+01
Gross beta	(Bq/mL)	4.62e+05
^{14}C	(Bq/mL)	6.35e+01
^{144}Ce	(Bq/mL)	<1.6e+03
^{60}Co	(Bq/mL)	6.21e+02
^{134}Cs	(Bq/mL)	4.63e+03
^{137}Cs	(Bq/mL)	4.36e+05
^{152}Eu	(Bq/mL)	<2.1e+02
^{154}Eu	(Bq/mL)	<1.6e+02
^{155}Eu	(Bq/mL)	<8.5e+02
^{3}H	(Bq/mL)	1.19e+02
^{93}Nb	(Bq/mL)	<1.0e+02
^{106}Ru	(Bq/mL)	3.78e+03
^{90}Sr	(Bq/mL)	4.12e+02
^{93}Zr	(Bq/mL)	<1.0e+02
Alpha emitters		
^{233}U	(Bq/mL)	4.00e+00
^{235}U	(Bq/mL)	6.00e+00
$^{239}Pu/^{240}Pu$	(Bq/mL)	6.00e+00
$^{238}Pu/^{241}Am$	(Bq/mL)	3.90e+01
^{243}Cm	(Bq/mL)	4.00e+00

* NO DATA FOR TANK C-1, TANK W23 SHOWN AS A REP. SAMPLE

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN, 1990 * WZ3-S REPRESENTATIVE SAMPLE
Physical properties and miscellaneous data		
TS	(mg/kg)	544
Density	(g/mL)	1.34
IC	(mg/kg)	18100
TC	(mg/kg)	22200
TOC	(mg/kg)	4120
RCRA metals		
Ag	(mg/kg)	(28)
As	(mg/kg)	(<50)
Ba	(mg/kg)	63
Cd	(mg/kg)	32
Cr	(mg/kg)	190
Hg	(mg/kg)	19
Ni	(mg/kg)	110
Pb	(mg/kg)	(450)
Se	(mg/kg)	<39
Tl	(mg/kg)	<16
Process metals		
Al	(mg/kg)	2500
B	(mg/kg)	<10
Ca	(mg/kg)	55000
Co	(mg/kg)	
Fe	(mg/kg)	1900
K	(mg/kg)	18000
Mg	(mg/kg)	16000
Na	(mg/kg)	82000
Sr	(mg/kg)	290
Th	(mg/kg)	12000
U	(mg/kg)	17000
Beta/gamma emitters		
Gross alpha	(Bq/g)	2.23e+05
Gross beta	(Bq/g)	6.67e+06
^{14}C	(Bq/g)	3.65e+02
^{144}Ce	(Bq/g)	<2.7e+04
^{60}Co	(Bq/g)	2.52e+05
^{134}Cs	(Bq/g)	<6.5e+03
^{137}Cs	(Bq/g)	4.95e+05
^{152}Eu	(Bq/g)	7.22e+05
^{154}Eu	(Bq/g)	5.14e+05
^{155}Eu	(Bq/g)	1.21e+05
^{93}Nb	(Bq/g)	<7.0e+03
^{106}Ru	(Bq/g)	<6.2e+04
^{90}Sr	(Bq/g)	2.28e+06
^{93}Zr	(Bq/g)	<4.5e+04
Alpha emitters		
^{233}U	(Bq/g)	
^{235}U	(Bq/g)	1.18e+04
^{238}U	(Bq/g)	<2.8e+04
$^{239}Pu/^{240}Pu$	(Bq/g)	1.18e+04
$^{238}Pu/^{241}Am$	(Bq/g)	3.21e+04
^{243}Cm	(Bq/g)	<2.6e+04
^{244}Cm	(Bq/g)	1.67e+05

LEGEND:
TSD - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC - TOTAL ORGANIC CARBON

Figure 2.4-4 Radiochemical Analyses In the Evaporator Service Tanks (Tank System C-1)

Radiochemical analyses of beta emitters in the Evaporator Service Tanks[a]

Tank	Sample date	Sample location	Gross beta		Gross gamma (c/min-mL)	Sr-90	Cs-137	Co-60	Eu-152	Eu-154	Eu-155	Zr-95	Nb-95
			TRU[b]	RHAL[c]									
W-21	Nov. 85	Solids[d]	84,900	68,300	1.49E+07	16,400	6,760	1,060	11,600	5,840	2,400	2,660	200
W-22	Nov. 85	Solids[d]	56,500	53,700	1.18E+07	10,200	5,050	740	10,900	5,350	2,060	2,920	330
* W-23	Nov. 85	Liquid[e]	66,800	49,800	1.25E+07	9,400	2,040	760	13,000	[f]	2,250		200
REPRESENTATIVE SAMPLE	Nov. 85	Solids[d]	237,000	205,000	1.35E+07	73,700	6,510	880	12,100	8,220	2,550	3,400	

[a] All data from the TRU laboratory except RHAL gross beta and Sr-90.
[b] TRU data: Request No. 45764, received 1/30/86, completed 2/6/86.
[c] RHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.
[d] nCi/g for solid samples.
[e] nCi/mL for liquid samples.
[f] A blank space means no data available.

Radiochemical analyses of alpha emitters in the Evaporator Service Tanks[a]

Tank	Sample date	Sample location	Gross alpha		Cm-244	Am-241	Pu-239 & Pu-240	Pu-238	U-233
			TRU[b]	RHAL[c]					
W-21	Nov. 85	Solids[d]	5110	1980	810	70	380	830	50
W-22	Nov. 85	Solids[d]	3510	2260	1100	100	190	280	58
W-23	Nov. 85	Liquid[e]	870	710	280	50	50	90	38
	Nov. 85	Solids[d]	6970	3190	2190	<30	580	500	130

[a] All data from the TRU laboratory except RHAL gross alpha.
[b] TRU data: Request No. 45764, received 1/30/86, completed 2/6/86.
[c] RHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.
[d] nCi/g for solid samples.
[e] nCi/mL for liquid samples.

* = NO DATA FOR TANK C-1, TANK W23 SHOWN AS REPRESENTATIVE SAMPLE

2.5 Tank System C-2 Piping

2.5.1 Tank System Summary

Tank System C-2 is located near the liquid low-level waste (LLLW) Evaporator (Building 2531) at the main Bethel Valley Complex (Figure 2.5-1). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from Tank Vault C-2 through Valve Pit 2VP-3 and Pipe Tunnel 2 to the Control House Pump Pit (Figure 2.5-2). Tank System C-2 piping is used to transfer concentrate from the LLLW Evaporator to the Melton Valley Storage Tanks and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.5.2 Standards for Pipe Assessment of Tank Systems

2.5.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System C-2 piping is located near Building 2531 and is routed from Tank Vault C-2 through Valve Pit 2VP-3 and Pipe Tunnel 2 to the Control House Pump Pit. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System C-2 piping is constructed of 1-1/2″, 2″, and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 400°F. Tank System C-2 piping has a maximum volume of 34 gal.

Design Standards

The applicable codes and standards used for Tank System C-2 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

American Concrete Institute 318, Building Code Requirements for Reinforced Concrete;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240) and VIII;

American Society for Testing and Materials C94, C175, A15, A185, A240, A262, A214, A182, A269, A276, A312, A371, A376, A403, E94, E142, E165, A7, A325, A245, A141, A53, A167, A403, A312, B68, A234, A120, C200, A181, and A213;

American Standards Association Standard B31.1, Code for Pressure Piping.

Atomic Energy Commission Safety Code;

Federal Specifications 55A666, 55A701, HHF191, HHC581, R381, HHF201, HHC591, TTC655, and LLLF321;

Institute of Electrical and Electronic Engineers Standards;

Underwriters Laboratories Inc.; and

Unfired Pressure Vessels (1962 edition).

2.5.2.2 Generic Description of Piping Contents

Tank System C-2 piping was designed to transfer high-level waste generated at the Oak Ridge National Laboratory (ORNL). However, because no significant quantities of high-level waste were ever generated, this system was repiped to serve as a LLLW concentrate transfer system. LLLW is generated from a variety of facilities at ORNL including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to LLLW Evaporator Feed Tank W-22. Any waste found to be acidic is adjusted to basic with sodium hydroxide in the generator collection tanks or in the evaporator feed tank, which precipitates most of the transuranic waste components and heavy metals. The waste is then processed through the evaporator; and the concentrate is transferred to Tanks C-1, C-2, W-21, and W-23 before it is sent to the Melton Valley Storage Tanks.

Tank System C-2 piping transfers LLLW to and from Tank C-2. Because of the lack of a convenient access point, Tank C-2 has not been sampled. However, Tank W-23, which is also used to store LLLW concentrate, has been sampled. Because both Tank W-23 and Tank C-2 are used to collect LLLW concentrate from the evaporator, it is logical to assume that the characteristics of the waste stored in Tank W-23 should be similar to those of the waste transferred through Tank System C-2.

The liquid waste supernate sampled in Tank W-23 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions and should be similar to the waste concentrate expected to be found in Tank C-2 (Figure 2.5-3). Based on radiation levels found in Tank W-23 and the historical use of Tank C-2 as an evaporator feed tank, Tank System C-2 piping may contain radioactive materials (Figure 2.5-4).

2.5.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault C-2, Valve Pit 2VP-3, Pipe Tunnel 2, and the Control House Pump Pit has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.5.2.4 Documented Age of Tank System

Tank System C-2 piping was installed in 1964.

2.5.3 Standards for Containment/Release Detection

2.5.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System C-2 piping is single-wall, schedule 40S, type 304L SS that is routed from Tank Vault C-2 through Valve Pit 2VP-3 and Pipe Tunnel 2 to the Control House Pump Pit. Each area is discussed below. The piping penetrations from Tank Vault C-2 to Valve Pit 2VP-3 are singly contained, 1-1/2″, schedule 40S, type 304L SS pipes that are embedded in the concrete wall to a length of 3′2″. The pipe penetration from Pipe Tunnel 2 to the pump pit is a singly contained, 2″, schedule 40S, type 304L SS pipe that is embedded in the concrete wall to a length of 2′0″.

Tank Vault C-2

The assessment of the secondary containment system for Tank Vault C-2 is presented in the Design Demonstrations for Tank C-2. That assessment concludes that Tank Vault C-2 is coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Pit 2VP-3

The bottom of Valve Pit 2VP-3 is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project 4′0″ up the valve pit. The valve pit walls above the SS liner are provided with a system of Carboline 193 epoxy. The SS valve pit lining material is the same material as that used for the piping. Therefore, the lining is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve pit's epoxy coating is also compatible with the waste and designed to prevent migration of waste into the concrete.

Pipe Tunnel 2

The bottom of Pipe Tunnel 2 is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project up to the pipe tunnel roof. The SS pipe tunnel lining material is the same material as that used for the piping. Therefore, the lining is compatible with the waste and designed to prevent migration of waste into the concrete.

Control House Pump Pit

The bottom of the pump pit is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project 3′0″ up the pump pit. The pump pit walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS pump pit lining material is the same material as that used for the piping. Therefore, the lining is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the pump pit's epoxy coating is also compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault, valve pit, pipe tunnel, and pump pit are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.5.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault C-2

The assessment of the secondary containment system for Tank Vault C-2 is presented in the Design Demonstrations for Tank C-2. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Valve Pit 2VP-3

The valve pit foundation is an 18′2″ × 27′4″ × 1′2″ thick, reinforced concrete base slab that rests on limestone.

Pipe Tunnel 2

The pipe tunnel foundation is a 9′6″ × 63′8″ × 1′0″ thick, reinforced concrete base slab that rests on limestone.

Control House Pump Pit

The pump pit foundation is a 21′0″ × 40′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the tank vault, valve pit, pipe tunnel, and pump pit foundations are properly designed to support the secondary containment systems.

2.5.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault C-2

The assessment of the secondary containment system for Tank Vault C-2 is presented in the Design Demonstrations for Tank C-2. That assessment concludes that the vault is provided with a leak detection system.

Valve Pit 2VP-3

The Valve Pit 2VP-3 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Pipe Tunnel 2

The Pipe Tunnel 2 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump. Any liquid that flows to the Pipe Tunnel 2 sump will continue to flow to the Control House Pump Pit sump through a 4″, schedule 40S, type 304L SS, sump drain pipe. The pump pit sump is lined with 16-gauge (1/16″), 304L SS; and accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Control House Pump Pit

The pump pit floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

The assessment concludes that the tank vault, valve pit, pipe tunnel, and pump pit are provided with leak detection.

2.5.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault C-2

The assessment of the secondary containment system for Tank Vault C-2 is presented in the Design Demonstrations for Tank C-2. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Valve Pit 2VP-3

The Valve Pit 2VP-3 floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Pipe Tunnel 2

The pipe tunnel floor is sloped to a 304L SS-lined sump. Any liquid that flows to the pipe tunnel sump will continue to flow to the pump pit sump through a sump drain pipe. The pump pit sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Control House Pump Pit

The pump pit floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pump pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containments for the tank vault, valve pit, pipe tunnel, and pump pit are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.5.4 Supplemental Information

2.5.4.1 Ancillary Equipment

Tank C-2 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault C-2, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.5.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System C-2.

2.5.5 References

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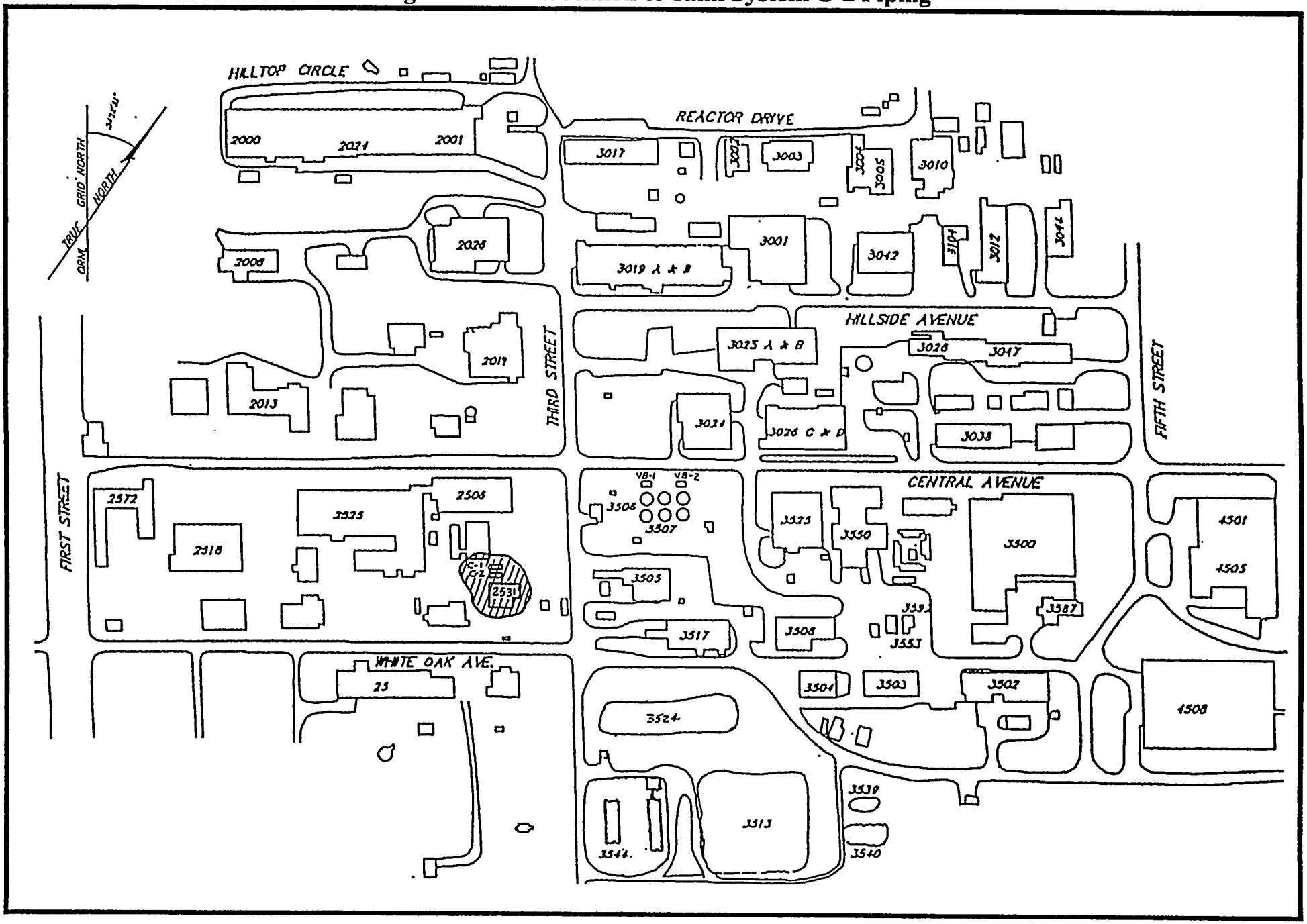
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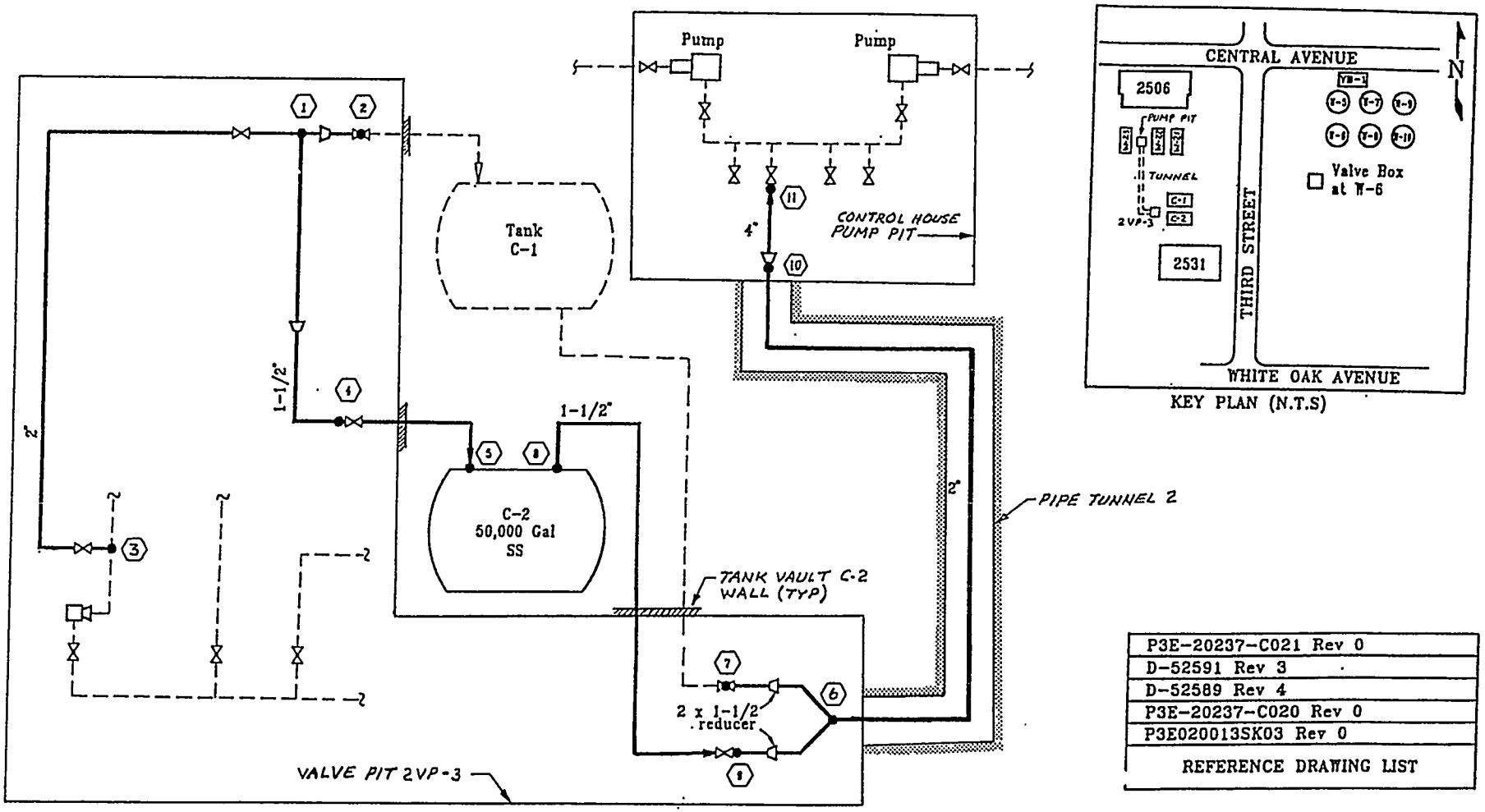
Technical Specifications for the Construction of Improvements to Radioactive Liquid Waste System, Phase I, Building 2531.

Figure 2.5-1 Location of Tank System C-2 Piping



EBASCO/MAIN

Figure 2.5-2 Tank System C-2 Piping Diagram



P3E-20237-C021 Rev 0
D-52591 Rev 3
D-52589 Rev 4
P3E-20237-C020 Rev 0
P3E020013SK03 Rev 0
REFERENCE DRAWING LIST

LINE SEGMENT	③ - ①	① - ②	① - ④	④ - ⑤	⑦ - ⑥	⑧ - ⑨	⑥ - ⑩	⑩ - ⑪
SIZE IN-DIA	2	2	2	1-1/2	2	1-1/2	2	4
SCHEDULE	40S	40S	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS	SS	SS
LENGTH (FT)	5	<1	<1	49	<1	34	115	<1
VOLUME (GAL)	1	<1	<1	5	<1	4	20	<1

TANK SYSTEM C-2 PIPING

PIPE IN UNDERGROUND TUNNEL

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.5-3
Analytical Data for Liquid and Sludge Samples (Tank System C-2)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN. 1990 * W23-L1 REPRESENTATIVE SAMPLE
Physical properties and miscellaneous data		
TDS	(mg/mL)	331
TS	(mg/mL)	383
Density	(g/mL)	1.2423
IC	(mg/L)	8340
TC	(mg/L)	9500
TOC	(mg/L)	1160
RCRA metals		
Ag	(mg/L)	<0.44
As	(mg/L)	<3.0
Ba	(mg/L)	<0.19
Cd	(mg/L)	1.7
Cr	(mg/L)	0.42
Hg	(mg/L)	0.07
Ni	(mg/L)	3.0
Pb	(mg/L)	2.7
Se	(mg/L)	<2.3
Tl	(mg/L)	<0.94
Process metals		
Al	(mg/L)	1.8
B	(mg/L)	10
Ca	(mg/L)	18
Co	(mg/L)	
Fe	(mg/L)	0.70
K	(mg/L)	78000
Mg	(mg/L)	3.4
Na	(mg/L)	82000
Si	(mg/L)	<1
Sr	(mg/L)	0.40
Th	(mg/L)	15.8
U	(mg/L)	17
Anions		
Chloride	(M)	0.10
Fluoride	(M)	<0.053
Nitrate	(M)	3.23
Phosphate	(M)	<0.053
Sulfate	(M)	0.081
Alkalinity		
pH		12.8
H^+	(M)	
OH	(M)	0.15
CO_3^{2}	(M)	0.70
HCO_3	(M)	
Beta/gamma emitters		
Gross alpha	(Bq/mL)	8.20e+01
Gross beta	(Bq/mL)	4.62e+05
^{14}C	(Bq/mL)	6.35e+01
^{144}Ce	(Bq/mL)	<1.6e+03
^{60}Co	(Bq/mL)	6.21e+02
^{134}Cs	(Bq/mL)	4.63e+03
^{137}Cs	(Bq/mL)	4.36e+05
^{152}Eu	(Bq/mL)	<2.1e+02
^{154}Eu	(Bq/mL)	<1.6e+02
^{155}Eu	(Bq/mL)	<8.5e+02
^{3}H	(Bq/mL)	1.19e+02
^{93}Nb	(Bq/mL)	<1.0e+02
^{106}Ru	(Bq/mL)	3.78e+03
^{90}Sr	(Bq/mL)	4.12e+02
^{93}Zr	(Bq/mL)	<1.0e+02
Alpha emitters		
^{233}U	(Bq/mL)	4.00e+00
^{235}U	(Bq/mL)	6.00e+00
$^{239}Pu/^{240}Pu$	(Bq/mL)	6.00e+00
$^{238}Pu/^{241}Am$	(Bq/mL)	3.90e+01
^{243}Cm	(Bq/mL)	4.00e+00

* NO DATA FOR TANK C-2, TANK W23 SHOWN AS A REP. SAMPLE

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN, 1990 * W23-S REPRESENTATIVE SAMPLE
Physical properties and miscellaneous data		
TS	(mg/g)	544
Density	(g/mL)	1.34
IC	(mg/kg)	18100
TC	(mg/kg)	22200
TOC	(mg/kg)	4120
RCRA metals		
Ag	(mg/kg)	(28)
As	(mg/kg)	(<50)
Ba	(mg/kg)	63
Cd	(mg/kg)	32
Cr	(mg/kg)	190
Hg	(mg/kg)	19
Ni	(mg/kg)	110
Pb	(mg/kg)	(450)
Se	(mg/kg)	<39
Tl	(mg/kg)	<16
Process metals		
Al	(mg/kg)	2500
B	(mg/kg)	<10
Ca	(mg/kg)	55000
Co	(mg/kg)	
Fe	(mg/kg)	1900
K	(mg/kg)	18000
Mg	(mg/kg)	16000
Na	(mg/kg)	82000
Sr	(mg/kg)	290
Th	(mg/kg)	12000
U	(mg/kg)	17000
Beta/gamma emitters		
Gross alpha	(Bq/g)	2.23e+05
Gross beta	(Bq/g)	6.67e+06
^{14}C	(Bq/g)	3.65e+02
^{144}Ce	(Bq/g)	<2.7e+04
^{60}Co	(Bq/g)	2.52e+05
^{134}Cs	(Bq/g)	<6.5e+03
^{137}Cs	(Bq/g)	4.95e+05
^{152}Eu	(Bq/g)	7.22e+05
^{154}Eu	(Bq/g)	5.14e+05
^{155}Eu	(Bq/g)	1.21e+05
^{93}Nb	(Bq/g)	<7.0e+03
^{106}Ru	(Bq/g)	<6.2e+04
^{90}Sr	(Bq/g)	2.23e+06
^{93}Zr	(Bq/g)	<4.5e+04
Alpha emitters		
^{233}U	(Bq/g)	
^{235}U	(Bq/g)	1.18e+04
^{233}U	(Bq/g)	<2.8e+04
$^{239}Pu/^{240}Pu$	(Bq/g)	1.18e+04
$^{238}Pu/^{241}Am$	(Bq/g)	3.21e+04
^{243}Cm	(Bq/g)	<2.6e+04
^{244}Cm	(Bq/g)	1.67e+05

LEGEND:
TSD - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC - TOTAL ORGANIC CARBON

Figure 2.5-4 Radiochemical Analyses In the Evaporator Service Tanks (Tank System C-2)

Radiochemical analyses of beta emitters in the Evaporator Service Tanks[a]

Tank	Sample date	Sample location	Gross beta TRU[b]	Gross beta RHAL[c]	Gross gamma (c/min-mL)	Sr-90	Cs-137	Co-60	Eu-152	Eu-154	Eu-155	Zr-95	Nb-95
W-21	Nov. 85	Solids[d]	84,900	68,300	1.49E+07	16,400	6,760	1,060	11,600	5,840	2,400	2,660	200
W-22	Nov. 85	Solids[d]	56,500	53,700	1.18E+07	10,200	5,050	740	10,900	5,350	2,060	2,920	330
* W-23	Nov. 85	Liquid[e]	66,800	49,800	1.25E+07	9,400	2,040	760	13,000	[f]	2,250		200
REPRESENTATIVE SAMPLE	Nov. 85	Solids[d]	237,000	205,000	1.35E+07	73,700	6,510	880	12,100	8,220	2,550	3,400	

[a]All data from the TRU laboratory except RHAL gross beta and Sr-90.
[b]TRU data: Request No. 45764, received 1/30/86, completed 2/6/86.
[c]RHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.
[d]nCi/g for solid samples.
[e]nCi/mL for liquid samples.
[f]A blank space means no data available.

Radiochemical analyses of alpha emitters in the Evaporator Service Tanks[a]

Tank	Sample date	Sample location	Gross alpha TRU[b]	Gross alpha RHAL[c]	Cm-244	Am-241	Pu-239 & Pu-240	Pu-238	U-233
W-21	Nov. 85	Solids[d]	5110	1900	810	70	380	830	50
W-22	Nov. 85	Solids[d]	3510	2260	1100	100	190	280	58
W-23	Nov. 85	Liquid[e]	870	710	280	50	50	90	38
	Nov. 85	Solids[d]	6970	3190	2190	<30	580	500	130

[a]All data from the TRU laboratory except RHAL gross alpha.
[b]TRU data: Request No. 45764, received 1/30/86, completed 2/6/86.
[c]RHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.
[d]nCi/g for solid samples.
[e]nCi/mL for liquid samples.

*= NO DATA FOR TANK C-2, TANK W 23 SHOWN AS A REPRESENTATIVE SAMPLE.

2.6 Tank System F-111 Piping

2.6.1 Tank System Summary

Tank System F-111 is located in Building 7920 of the Radiochemical Engineering Development Center (REDC) (Figures 2.6-1 and 2.6-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and 3/8″ zircaloy tubing (wall thickness 0.049″). The piping is routed from Tank Vault F-111 through the Cell 7 Tank Pit to Cubicle 7 in Building 7920. Tank System F-111 piping is used to transfer liquid low-level waste (LLLW) from Cubicle 7 to Tank F-111, to Tank F-126 (via cubicle 7) and occasionally through Tank F-115 to Tank F-126 and is classified as a Federal Facility Agreement Category B tank system.

2.6.2 Standards for Pipe Assessment of Tank Systems

2.6.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System F-111 piping is routed from Tank Vault F-111 through the Cell 7 Tank Pit to Cubicle 7 in Building 7920. The piping system is under the control of the Radiochemical Engineering Development Center (REDC) and is operated by the Chemical Technology Division. Tank System F-111 piping is constructed of 1/2″, 304L SS and 3/8″ zircaloy tubing (wall thickness 0.049″). The piping system has a maximum volume of less than 2 gal.

Design Standards

The applicable codes and standards used for Tank System F-111 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Conference of Governmental Industrial Hygienists;

American Concrete Institute 318-56, 604-56, and 613-54;

American Concrete Pipe Association;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), IV, V, VIII, and IX;

American Society for Testing and Materials C39, C144, D1190, D1751, A93, A245, and A307;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrumentation Society of America.

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration;

State of Tennessee Department of Transportation Specifications; and

Underwriters Laboratories Inc.;

2.6.2.2 Generic Description of Piping Contents

Tank System F-111 piping is designed to serve as an LLLW process collection system for Building 7920. Its primary source of LLLW is water used in equipment flushing procedures and high Ph dejacketing waste solutions transferred from Tank T-70. These wastes may include a variety of dilute acids, bases, and organics. The tank may contain radioactive materials from Building 7920.

The analytical data (Figure 2.6-3) of waste stream contaminants from the generators are representative of the waste transferred through Tank System F-111.

2.6.2.3 Pipe Corrosion Protection Measures

Tank System F-111 piping is located within Building 7920 and has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.6.2.4 Documented Age of Tank System

Tank System F-111 piping was installed in 1966.

2.6.3 Standards for Containment/Release Detection

2.6.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System F-111 piping is single-wall, schedule 40S, type 304L SS and 3/8″ zircaloy tubing that is routed from Tank Vault F-111 through the Cell 7 Tank Pit to Cubicle 7 in Building 7920. Each area is discussed below. The piping penetrations from Tank Vault F-111 to the Cell 7 Tank Pit are routed through a 4′-5″ long, SS, interpit piping plug assembly. The piping plug has sealed end plates and provides containment for any leaks within the plug. The secondary containment areas on either side of the plug have leak detection and liquid removal systems. Therefore, in the event of a leak, any liquid that would penetrate through the plug would be contained, detected, and removed.

Tank Vault F-111

The assessment of the secondary containment system for Tank Vault F-111 is presented in the Design Demonstrations for Tank F-111. That assessment concludes that Tank Vault F-111 is provided with a coating and lining system that is compatible with the waste and designed to prevent migration of waste into the concrete.

Cell 7 Tank Pit

The Cell 7 Tank Pit bottom is lined with 1/4″ Hastelloy "C" plate, and its sidewalls are lined with 1/8″ Hastelloy "C" plate. The vault walls above the Hastelloy "C" liner are provided with a system of Amercoat 74 epoxy. The Hastelloy "C" cell lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the cell's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Cubicle 7

Cubicle 7 is a complete 304L SS enclosure. The SS material is compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault, tank pit, and cubicle are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.6.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault F-111

The assessment of the secondary containment system for Tank Vault F-111 is presented in the Design Demonstrations for Tank F-111. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Cell 7 Tank Pit

The Cell 7 Tank Pit foundation is a 9′0″ × 7′0″ × 2′6″ thick, reinforced concrete base slab resting on bedrock.

Cubicle 7

The SS enclosure is welded to structural steel members that are embedded in reinforced concrete walls.

The assessment concludes that the tank vault, tank pit, and cubicle foundations are properly designed to support the secondary containment system.

2.6.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault F-111

The assessment of the secondary containment system for Tank Vault F-111 is presented in the Design Demonstrations for Tank F-111. That assessment concludes that the vault is provided with a leak detection system.

Cell 7 Tank Pit

The Cell 7 Tank Pit floor is sloped to a Hastelloy "C" lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 7920.

Cubicle 7

The Cubicle 7 floor is sloped to an SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 7920.

The assessment concludes that the tank vault, tank pit, and cubicle are provided with leak detection systems.

2.6.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault F-111

The assessment of the secondary containment system for Tank Vault F-111 is presented in the Design Demonstrations for Tank F-111. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Cell 7 Tank Pit

The Cell 7 Tank Pit floor is sloped to a Hastelloy "C" lined sump. The sump provides a low point within the tank pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Cubicle 7

Cubicle 7 is sloped to an SS-lined sump. The sump provides a low point within the cubicle to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containments for the tank vault, tank pit, and cubicle are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.6.4 Supplemental Information

2.6.4.1 Ancillary Equipment

Tank F-111 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault F-111, which provides secondary containment. The jet ejectors associated with Tank System F-111 are constructed of 304L SS, which is the same material as that used in the tank and piping system, and are located in the tank vault, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.6.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for

waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System F-111.

2.6.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate-Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Catalytic Construction Company. *Specification for the Construction of Transuranium Processing Plant Building 7920.* Invitation No. 401-63-11A. Oak Ridge National Laboratory.

Chemical Technology Division. 1978. *Quality Assurance Procedure Manual.*

Ebasco, and Main. May 14, 1993. *Design Demonstrations—Category B Tank Systems*, Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

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Energy Systems Drawing 2397-V-247, Concrete, Cell Elevation and Sections, Revision 7.

Energy Systems Drawing 2397-V-248, Concrete, Cell Sections and Details, Revision 4.

Energy Systems Drawing 2397-V-303, Equipment Arrangement, Plan and Section, Revision 2.

Energy Systems Drawing 2397-V-225, Floor Plan, Waste System Pit, Revision 3.

Energy Systems Drawing 2397-V-52, Grading and Paving Plan, Revision 3.

Energy Systems Drawing 2397-V-801, Instrument Flow Diagram, Process Waste System, Revision 1.

Energy Systems Drawing 2397-V-305, Piping, Plan, and Sections, Revision 5.

Energy Systems Drawing 2397-V-306, Piping, Plan, and Sections, Revision 3.

Energy Systems Drawing 2397-V-03, Vessel Off Gas and Cell Cubicle Vents, Revision 5.

Energy Systems Drawing 2397-V-08, Waste Disposal System, Flow Diagram, Sheet 3, Revision 4.

Energy Systems Drawing E52178, Waste Pit Process Piping Plan, Revision 9.

Energy Systems Drawing E52179, Waste Pit Process Piping Sections, Revision 6.

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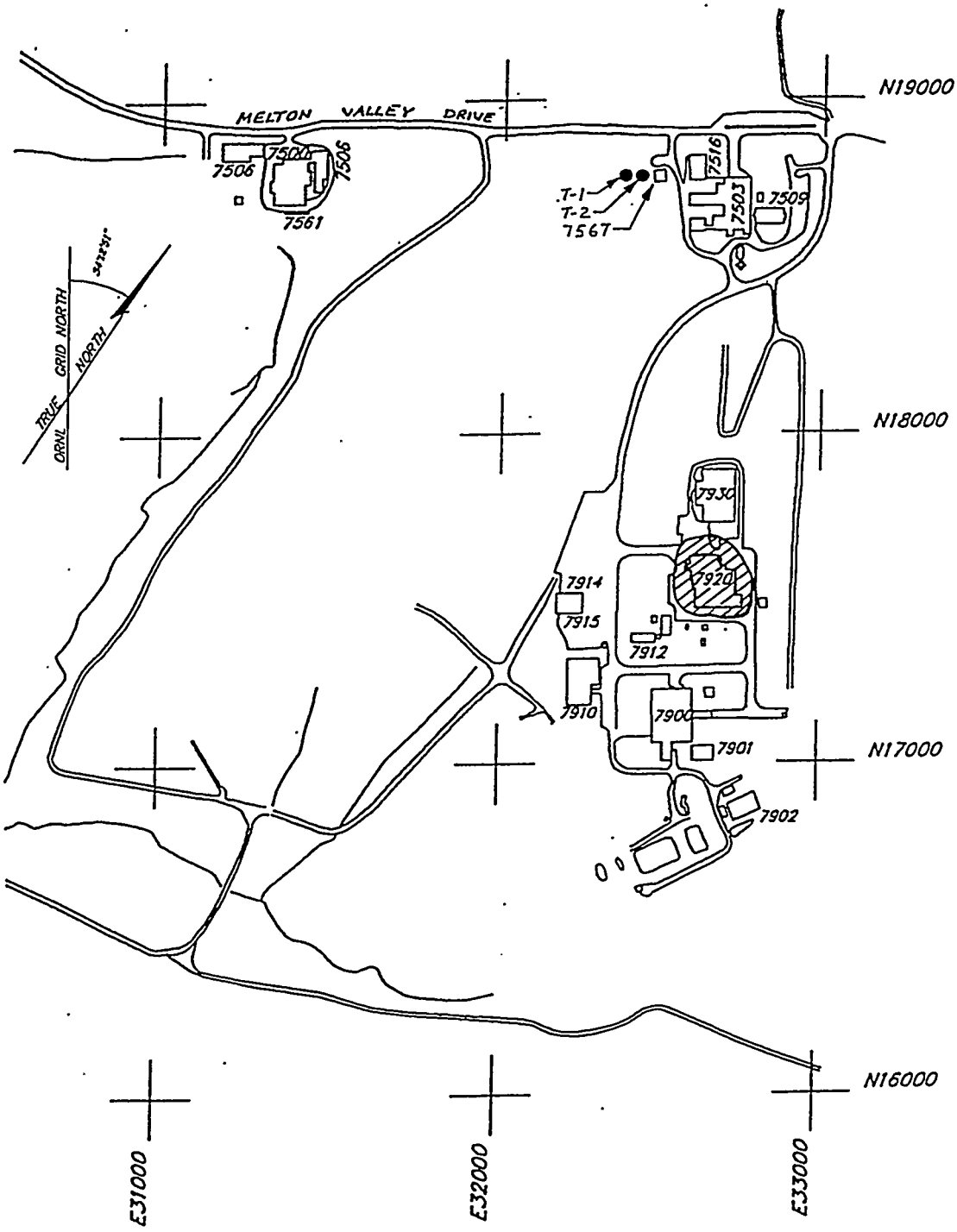
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Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

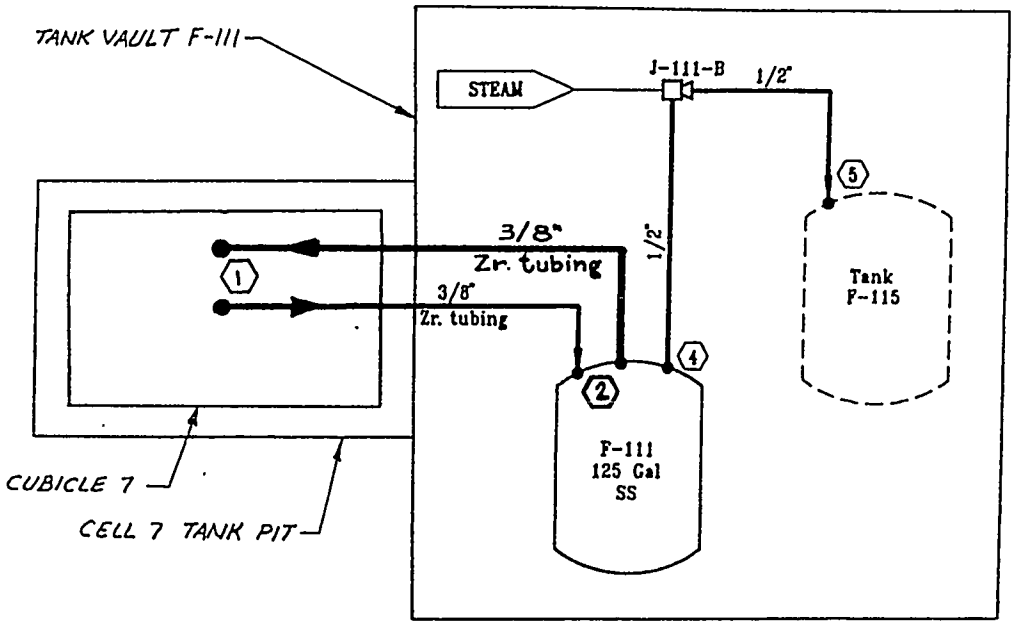
Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

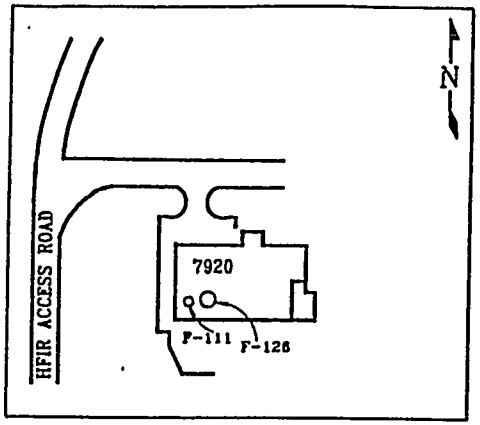
Figure 2.6-1
Location of Tank System F-111 Piping



EBASCO/MAIN

Figure 2.6-2 Tank System F-111 Piping Diagram





KEY PLAN (N.T.S)

REFERENCE DRAWING LIST
M-12175-CP-501-E Rev 6
E-57193 Rev 5
E-52071 Rev 17
E-52118 Rev 18
E-52118 Rev 8
E-52117 Rev 12
E-52116 Rev 12
E-52162 Rev 16
E-52161 Rev 16
E-58088 Rev 7
P3E020013 SK04 Rev 0
E-52182 Rev 6
E-52181 Rev 7
E-52179 Rev 6
E-52178 Rev 9

LINE SEGMENT	①-②	④-⑤
SIZE IN-DIA	3/8	1/2
SCHEDULE	.049" WALL	40S
MATERIAL	Zr.	SS
LENGTH (FT)	45	19
VOLUME (GAL)	<1	<1

TANK SYSTEM F-111 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.6-3
Analytical Data for Liquid (Tank System F-111)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	Cm-244	Quantities: Trace
	Cf-252	Trace
	Sr-90	Trace
	Tc-99	Trace
	Cs-137	Trace
	Am-241	Trace
	Am-243	Trace

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

sodium nitrate	Trace
nitric acid	Trace
sodium hydroxide	Trace
potassium iodide	Trace
ferrous chloride	Trace
ferrous sulfate	Trace
thenoyltrifluoroacetone (TTA)	Trace

Ref. LLLW Survey 1990

2.7 Tank System F-126 Piping

2.7.1 Tank System Summary

Tank System F-126 is located in Building 7920 of the Radiochemical Engineering Development Center (REDC) (Figures 2.7-1 and 2.7-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and zircaloy tubing (wall thickness 0.049″). The piping is routed from Tank Vault F-126 to numerous locations as follows: through the Cell 7 Tank Pit to Cubicle 7, to a pipe tunnel within Building 7920, outside underground through the Melton Valley Collection and Transfer (MVCT) Box No. 1, and further outside underground to the Diversion Box. Tank System F-126 piping is used to transfer liquid low-level waste (LLLW) from Building 7920 to the Diversion Box and is classified as a Federal Facility Agreement Category B tank system.

2.7.2 Standards for Pipe Assessment of Tank Systems

2.7.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System F-126 piping is located in Building 7920 and is routed from Tank Vault F-126 to numerous locations as follows: through the Cell 7 Tank Pit to Cubicle 7, to a pipe tunnel within Building 7920, outside underground through the MVCT Box No. 1, and further outside underground to the Diversion Box. The piping system is under the control of the Radiochemical Engineering Development Center (REDC) and operated by the Chemical Technology Diversion.

Tank System F-126 piping is constructed of 1/4″, 1/2″, 1″, and 2″; schedule 40S; type 304L SS piping and 3/8″, 1/2″, and 3/4″ zircaloy tubing (wall thickness 0.049″). Tank System F-126 piping has a maximum volume of 281 gal.

Design Standards

The applicable codes and standards used for Tank System F-126 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

American Society for Testing and Materials C39, C144, D1190, D1751, A93, A245, and A307;

American Conference of Governmental Industrial Hygienists;

American Concrete Pipe Association;

American Concrete Institute 318-56, 604-56, and 613-54;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), IV, V, VIII, and IX;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

ASHRAE Guide and Data Book—Applications;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrument Society of America;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.7.2.2 Generic Description of Piping Contents

Tank System F-126 is designed to serve as an LLLW process collection system for Building 7920. The primary source of LLLW is spent caustic from the scrubber, an aqueous acidic waste stream from the batch liquid-liquid extraction process in Tank F-115, and neutralized organic wastes. These wastes may include a variety of dilute acids, bases, and organics. The tank may contain radioactive materials from Building 7920.

The analytical data (Figure 2.7-3) of waste stream contaminants from the generators are representative of the waste transferred through Tank System F-126.

2.7.2.3 Pipe Corrosion Protection Measures

Piping inside Building 7920, MVCT Box No. 1, and the Diversion Box has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

Piping outside underground from Building 7920 to MVCT Box No. 1 and from MVCT Box No. 1 to the Diversion Box is singly contained piping and is provided with cathodic protection, which is included in the Facility Manager's Cathodic Protection System No. 5. The system consists of magnesium anodes, test stations, and connecting wire as shown on cathodic protection drawings C-20013-EA-001D, C-20013-EA-002D, and C-20013-EA-003D. The system was installed in May 1972.

The system is not considered adequate because electrical isolating devices were not called out for the pipe termination points. Harco Technologies determined that insulating gaskets were not present during its 1990 surveys. In addition, the cathodic protection field testing performed in 1991 indicates that 49% of the pipe was not receiving adequate corrosion control. The lack of electrical isolation of the outside underground pipe from the interior piping and depleted anode beds are contributing factors in the resultant lack of corrosion control. In 1991, Harco completed the engineering design to upgrade the existing system to protect the piping.

2.7.2.4 Documented Age of Tank System

Tank System F-126 piping was originally installed in 1966. The section of piping between Building 7920 and the Diversion Box was installed in 1972.

2.7.3 Standards for Containment/Release Detection

Tank System F-126 piping incorporates approximately 1500′ of outside underground piping that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.7.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System F-126 piping is single-wall, schedule 40S, type 304L SS and zircaloy tubing that is routed from Tank Vault F-126 to numerous locations as follows: through the Cell 7 Tank Pit to Cubicle 7, to a pipe tunnel within Building 7920, outside underground through MVCT Box No. 1, and further outside underground to the Diversion Box. Each area is discussed below. The piping penetrations from Tank Vault F-126 to the Cell 7 Tank Pit and Pipe Tunnel are routed through a 4′5″ long, SS, interpit piping plug assembly. The piping plug has sealed end plates and provides containment for any leaks within the plug. The secondary containment areas on either side of the plug have leak detection and liquid removal systems. Therefore, in the event of a leak, any liquid that would penetrate through the plug would be contained, detected, and removed.

Tank Vault F-126

The assessment of the secondary containment system for Tank Vault F-126 is presented in the Design Demonstrations for Tank F-126. That assessment concludes that Tank Vault F-126 is provided with a coating and lining system that is compatible with the waste and designed to prevent migration of waste into the concrete.

Cell 7 Tank Pit

The Cell 7 Tank Pit bottom is lined with 1/4″, Hastelloy "C" plate; and its sidewalls are lined with 1/8″, Hastelloy "C" plate. The vault walls above the Hastelloy "C" liner are provided with a system of Amercoat 74 epoxy. The Hastelloy "C" cell lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the cell's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Cubicle 7

Cubicle 7 is a complete 304L SS enclosure. The material of construction is compatible with the waste and designed to prevent migration of waste into the concrete.

Pipe Tunnel

The surfaces of the pipe tunnel are provided with a system of Amercoat 74 epoxy in combination with a Thalco 1522 woven glass coating. According to manufacturer's specifications, the pipe tunnel's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Melton Valley Collection and Transfer Box No. 1

The bottom of MVCT Box No. 1 is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project 4′3″ up the valve box. The SS lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Diversion Box

The Diversion Box is provided with an 11-gauge (1/8″), 304L SS liner that projects 3′11″ up the box walls. The SS lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault, tank pit, cubicle, pipe tunnel, collection and transfer box, and Diversion Box are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.7.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault F-126

The assessment of the secondary containment system for Tank Vault F-126 is presented in the Design Demonstrations for Tank F-126. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Cell 7 Tank Pit

The Cell 7 Tank Pit foundation is a 7′0″ × 9′0″ × 2′6″ thick, reinforced concrete base slab resting on bedrock.

Cubicle 7

The SS enclosure is welded to structural steel members that are embedded in reinforced concrete walls.

Pipe Tunnel

The Pipe Tunnel foundation is an 87′0″ × 12′2″ × 2′0″ thick, reinforced concrete base slab resting on bedrock.

Melton Valley Collection and Transfer Box No. 1

The MVCT Box No. 1 foundation is a 4′0″ × 4′0″ × 1′0″ thick, reinforced concrete base slab that rests on bedrock.

Diversion Box

The Diversion Box foundation is a 6′4″ × 6′10″ × 1′2″ thick, reinforced concrete slab.

The assessment concludes that the tank vault, tank pit, cubicle, pipe tunnel, collection and transfer box, and Diversion Box foundations are properly designed to support the secondary containment system.

2.7.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault F-126

The assessment of the secondary containment system for Tank Vault F-126 is presented in the Design Demonstrations for Tank F-126. That assessment concludes that the vault is provided with a leak detection system.

Cell 7 Tank Pit

The Cell 7 Tank Pit floor is sloped to a Hastelloy "C" lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 7920.

Cubicle 7

The Cubicle 7 floor is sloped to an SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 7920.

Pipe Tunnel

The Pipe Tunnel floor is sloped to an SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 7920.

Melton Valley Collection and Transfer Box No. 1

MVCT Box No. 1 is sloped to an SS-lined sump where accumulation of liquid is collected. The sump is not provided with a leak detection system.

Diversion Box

The LLLW transferred to the Diversion Box is contained in the SS-lined portion of the box and flows by gravity to Tanks T-1 and T-2. A leak detection system is not required.

The assessment concludes that the tank vault, tank pit, cubicle, and pipe tunnel are provided with a leak detection system. A leak detection system is not required for the Diversion Box. The collection and transfer box, however, is not provided with a leak detection system.

2.7.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault F-126

The assessment of the secondary containment system for Tank Vault F-126 is presented in the Design Demonstrations for Tank F-126. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Cell 7 Tank Pit

The Cell 7 Tank Pit floor is sloped to a Hastelloy "C" lined sump. The sump provides a low point within the tank pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Cubicle 7

Cubicle 7 is sloped to an SS-lined sump. The sump provides a low point within the cubicle to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Pipe Tunnel

The Pipe Tunnel is sloped to an SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Melton Valley Collection and Transfer Box No. 1

MVCT Box No. 1 is sloped to an SS-lined sump. The sump provides a low point within the collection and transfer box to drain liquids. A pumping system is not provided to remove liquids that accumulate in the sump.

Diversion Box

The Diversion Box is SS-lined and sloped to an SS drain. The drain provides a low point within the box to divert liquids that will flow to Tanks T-1 and T-2.

The assessment concludes that the tank vault, tank pit, cubicle, pipe tunnel, and Diversion Box are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. MVCT Box No. 1 is sloped and designed to drain liquids resulting from leaks, spills, or precipitation; however, a pumping system is not provided to remove liquids.

2.7.4 Supplemental Information

2.7.4.1 Ancillary Equipment

Tank F-126 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault F-126, which provides secondary containment. The pump associated with Tank System F-126 is constructed of 304L SS, which is the same material as that used for the tank. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.7.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System F-126.

2.7.5 References

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Energy Systems Drawing 2397-V-306, Piping, Plan, and Sections, Revision 3.

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Energy Systems Drawing E52179, Waste Pit Process Piping Sections, Revision 6.

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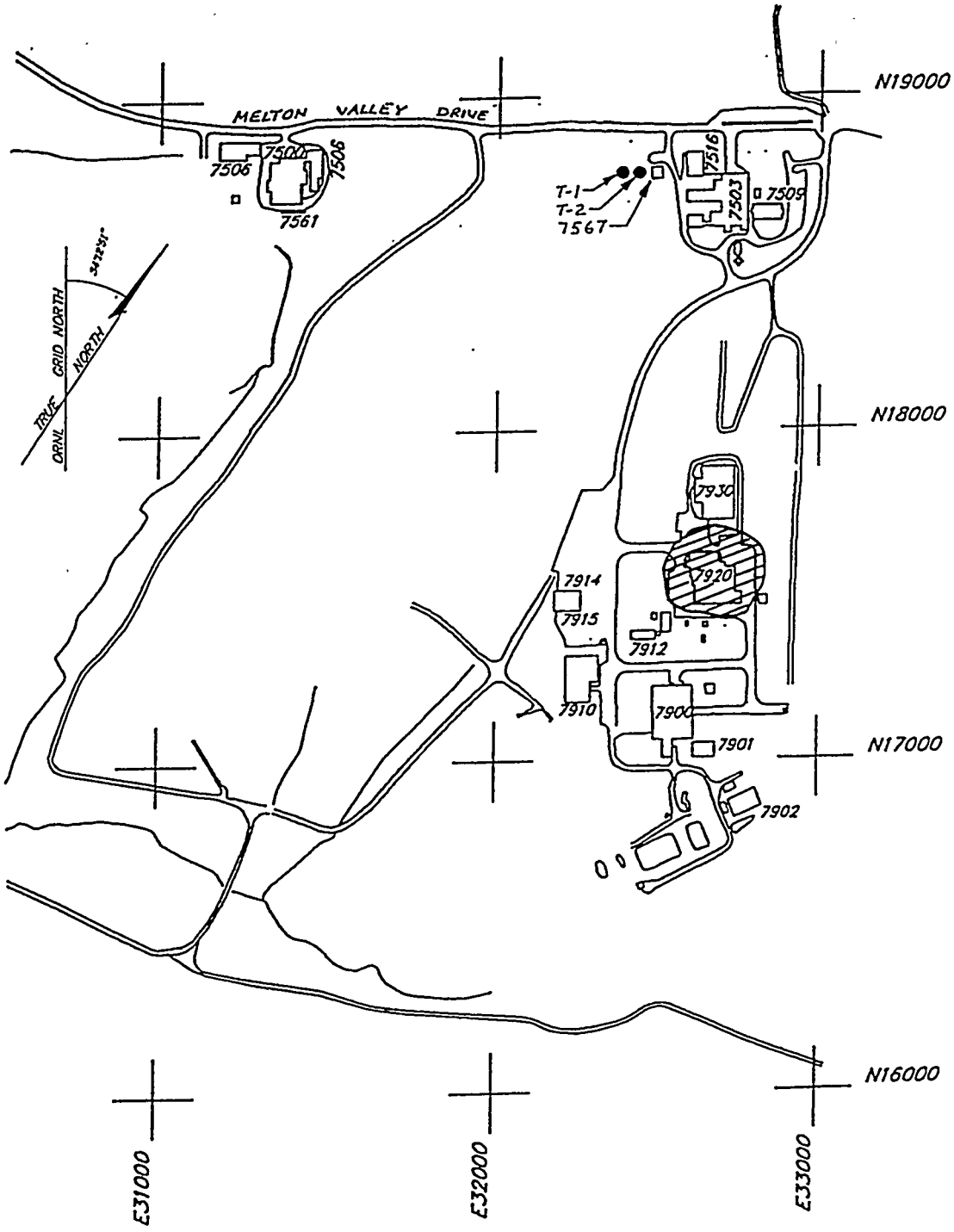
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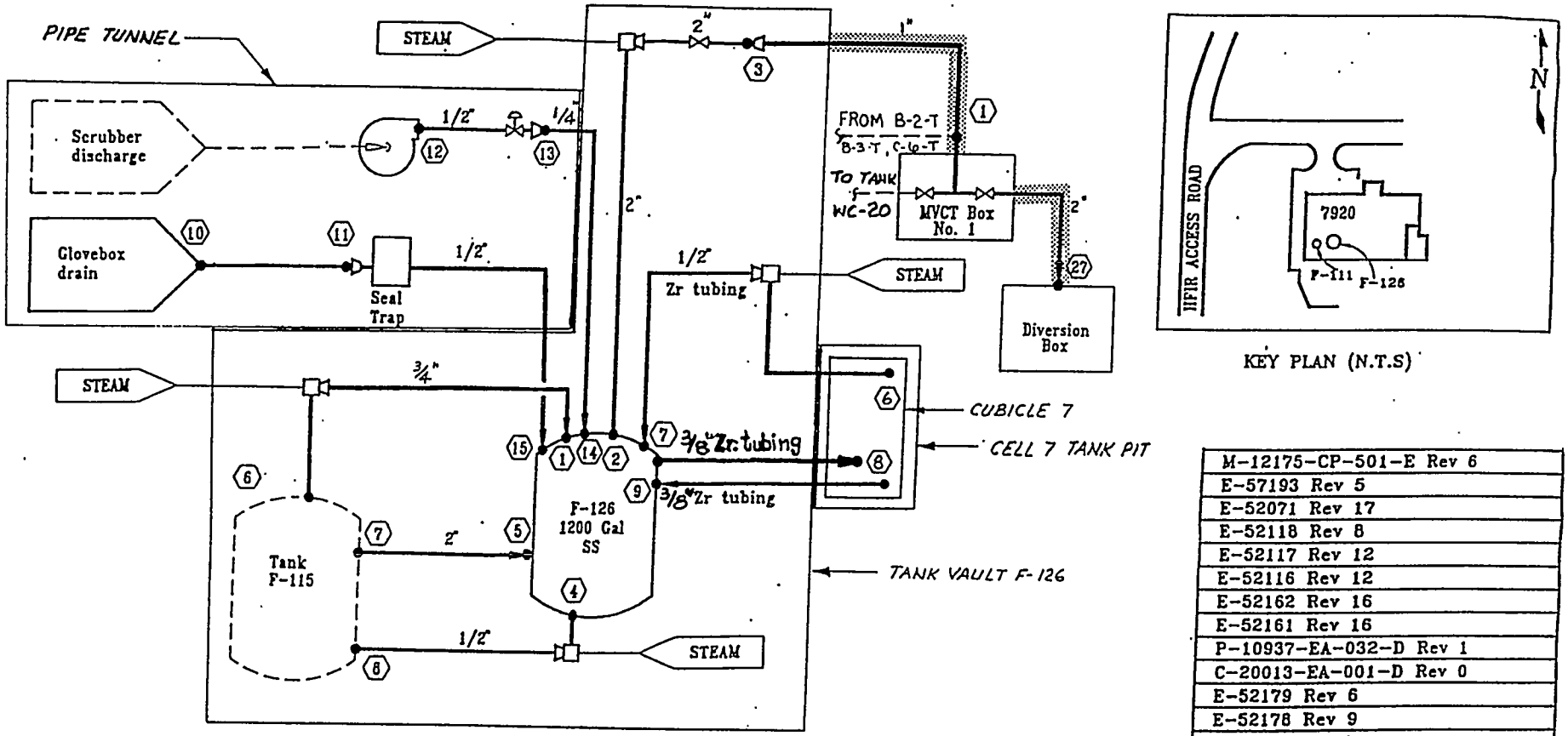
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Figure 2.7-1
Location of Tank System F-126 Piping



EBASCO/MAIN

Figure 2.7-2 Tank System F-126 Piping Diagram



KEY PLAN (N.T.S)

REFERENCE DRAWING LIST
M-12175-CP-501-E Rev 6
E-57193 Rev 5
E-52071 Rev 17
E-52118 Rev 8
E-52117 Rev 12
E-52116 Rev 12
E-52162 Rev 16
E-52161 Rev 16
P-10937-EA-032-D Rev 1
C-20013-EA-001-D Rev 0
E-52179 Rev 6
E-52178 Rev 9
E-58088 Rev 7
P3E020013SK04 Rev 0

LINE SEGMENT	6-7	8-9	10-11	11-15	7-5	4-8	6-1	12-13	13-14	2-3	3-1	1-27
SIZE IN-DIA	1/2	3/8	2	1/2	2	1/2	3/4	1/2	1/4	1	2	2
SCHEDULE	.049 WALL	.049 WALL	40S	40S	40S	40S	.049 WALL	40S	40S	40S	40S	40S
MATERIAL	Zr	Zr	SS	SS	SS	SS	Zr	SS	SS	SS	SS	SS
LENGTH (FT)	40	40	11	20	2	9	8	35	30	196	230	1273
VOLUME (GAL)	<1	<1	2	3	<1	<1	<1	1	<1	9	40	221

Figure 2.7-3
Analytical Data for Liquid (Tank System F-126)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	(b) Quantities
Cm–244,245,246,247	Trace
Cf–250,251,252	Trace
Sr–90	Trace
Tc–99	Trace
Cs–137	Trace
Am–241,242,243	Trace

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

sodium nitrate	Trace
nitric acid	Trace
sodium hydroxide	Trace
potassium iodide	Trace
ferrous chloride	Trace
ferrous sulfate	Trace
thenoyltrifluoroacetone (TTA)	Trace

Ref. LLLW Survey 1990

2.8 Tank System F-201 Piping

Based on the findings of the Design Demonstrations for the Remaining 19 Category B Tank Systems, (DOE/OR/03-1150 & D2), Tank System F-201, originally designated as Category B, has been redesignated as Category C by FFA Modification Request Change Control Number FFA-PM/93-008, June 23, 1994. However, this section of the original Design Demonstrations has been retained for reference.

2.8.1 Tank System Summary

Tank System F-201 is located near the High Radiation Level Examination Laboratory (Building 3525) at the main Bethel Valley Complex (Figures 2.8-1 and 2.8-2). The tank system piping is constructed of schedule 40S, ASME SA-240, type 304L stainless steel (SS); is routed from Tank Vault F-201 outside underground to beneath Building 3525; and terminates in areas within Building 3525. Tank System F-201 piping is used to transfer liquid low-level waste (LLLW) from the Radioactive Hot Drain (RHD) System to Tank F-201 and is classified as a Federal Facility Agreement Category B tank system.

2.8.2 Standards for Pipe Assessment of Tank Systems

2.8.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System F-201 piping is located near Building 3525 and is routed from Tank Vault F-201 to areas within Building 3525. The piping system is used and managed by the Metals and Cereamics Division.

Tank System F-201 piping consists of 1-1/2", schedule 40S, type 304L SS and 6," 8," and 10"; schedule 10S; type 304L SS with a maximum design pressure and temperature of 150 psig and 400°F for the schedule 40S piping and 15 psig and 150°F for the schedule 10S piping. Tank System F-201 piping has a maximum volume of 192 gal.

Design Standards

The applicable codes and standards used for Tank System F-201 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

American Concrete Institute 318, 315, and 604;

American Society for Testing and Materials A15, A185, C31, C33, C39, C76, C94, C192, D155, A401, A53, A74, A106, A107, A120, A181, A182, A193, A217, A234, A298, A312, A338, B75, A240, and A403;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240) and VIII; and Federal Specifications HHF191, HHF341, QQS632, SSA281, SSC164, SSC192, and UUP264.

2.8.2.2 Generic Description of Piping Contents

Tank System F-201 piping is designed to transfer LLLW from drainage fixtures within Building 3525 to Tank F-201. LLLW is produced during the decontamination and cleanup of the hot cells used in the disassembly and examination process. The tank system may contain radioactive materials from Building 3525.

The analytical data (Figure 2.8-3) of the waste stream contaminants from the generators are representative of the waste transferred through Tank System F-201 piping.

2.8.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault F-201 and Building 3525 is not in direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The piping that is routed outside underground is singly contained, and the external surfaces are exposed to the soil and water. Protective coatings or cathodic protection measures are not present in the outside underground piping.

2.8.2.4 Documented Age of Tank System

Tank System F-201 piping was installed in 1962.

2.8.3 Standards for Containment/Release Detection

Tank System F-201 piping incorporates approximately 355′ of outside underground and embedded piping that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.8.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System F-201 piping is single-wall, schedule 10S and schedule 40S, type 304L SS pipe. The piping is routed from Tank Vault F-201 outside underground to the flush-mounted floor drain and storage wells located in Charging Area No. 130 and to the Cell Exhaust Fan Room. There is no piping routed within Charging Area No. 130. Areas of secondary containment are discussed below.

Tank Vault F-201

The assessment of the secondary containment system for Tank Vault F-201 is presented in the Design Demonstrations for Tank F-201. That assessment concludes that Tank Vault F-201 is not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Cell Exhaust Fan Room

The Cell Exhaust Fan Room is not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault and the Cell Exhaust Fan Room are not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.8.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault F-201

The assessment of the secondary containment system for Tank Vault F-201 is presented in the Design Demonstrations for Tank F-201. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Cell Exhaust Fan Room

The Cell Exhaust Fan Room foundation is a 9″ thick, reinforced concrete base slab designed to rest on a 2″ thick, concrete base that rests on crushed limestone.

The assessment concludes that the tank vault and Cell Exhaust Fan Room foundations are properly designed to support the secondary containment system.

2.8.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault F-201

The assessment of the secondary containment system for Tank Vault F-201 is presented in the Design Demonstrations for Tank F-201. That assessment concludes that the vault is not provided with a leak detection system.

Cell Exhaust Fan Room

The Cell Exhaust Fan Room is not provided with a leak detection system.

The assessment concludes that the tank vault and Cell Exhaust Fan Room are not provided with a system that will detect leaks.

2.8.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault F-201

The assessment of the secondary containment system for Tank Vault F-201 is presented in the Design Demonstrations for Tank F-201. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Cell Exhaust Fan Room

The floor in the Cell Exhaust Fan Room is sloped towards 2″ diameter floor drains. The liquids are collected by the floor drains and transferred to a 2′6″ diameter by 4′6″ deep, steel sump embedded in the floor of the basement. The sump was formerly equipped with a sump pump that transferred the liquids into the Process Drain Hot system. The sump pump has since been removed and replaced with a temporary system that currently transfers accumulation into Tank F-201.

The assessment concludes that the secondary containments for the tank vault and Cell Exhaust Fan Room are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.8.4 Supplemental Information

2.8.4.1 Ancillary Equipment

Tank F-201 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault F-201, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.8.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontamination, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste*

Treatment Systems at the Oak Ridge National Laboratory (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System F-201.

2.8.5 References

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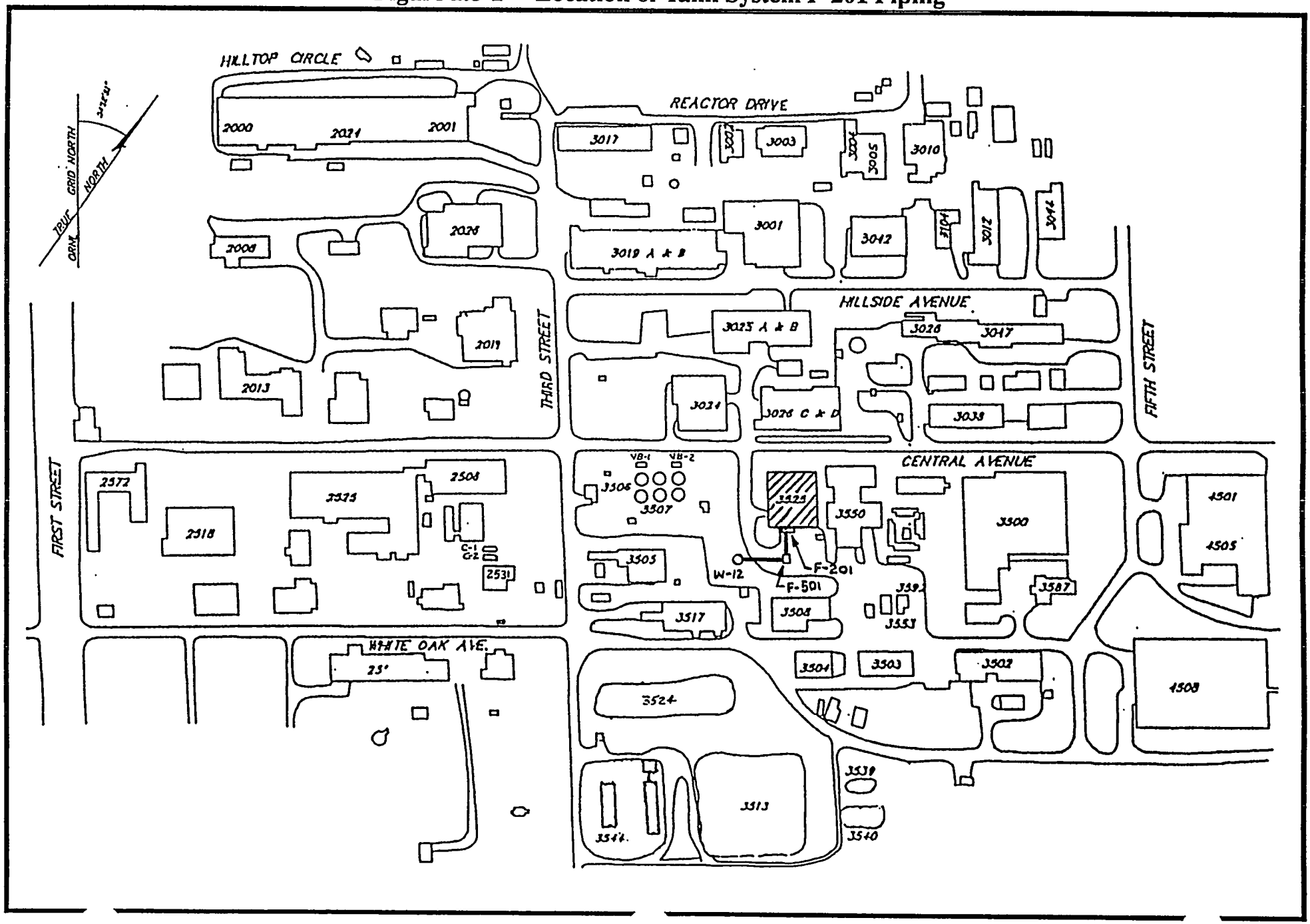
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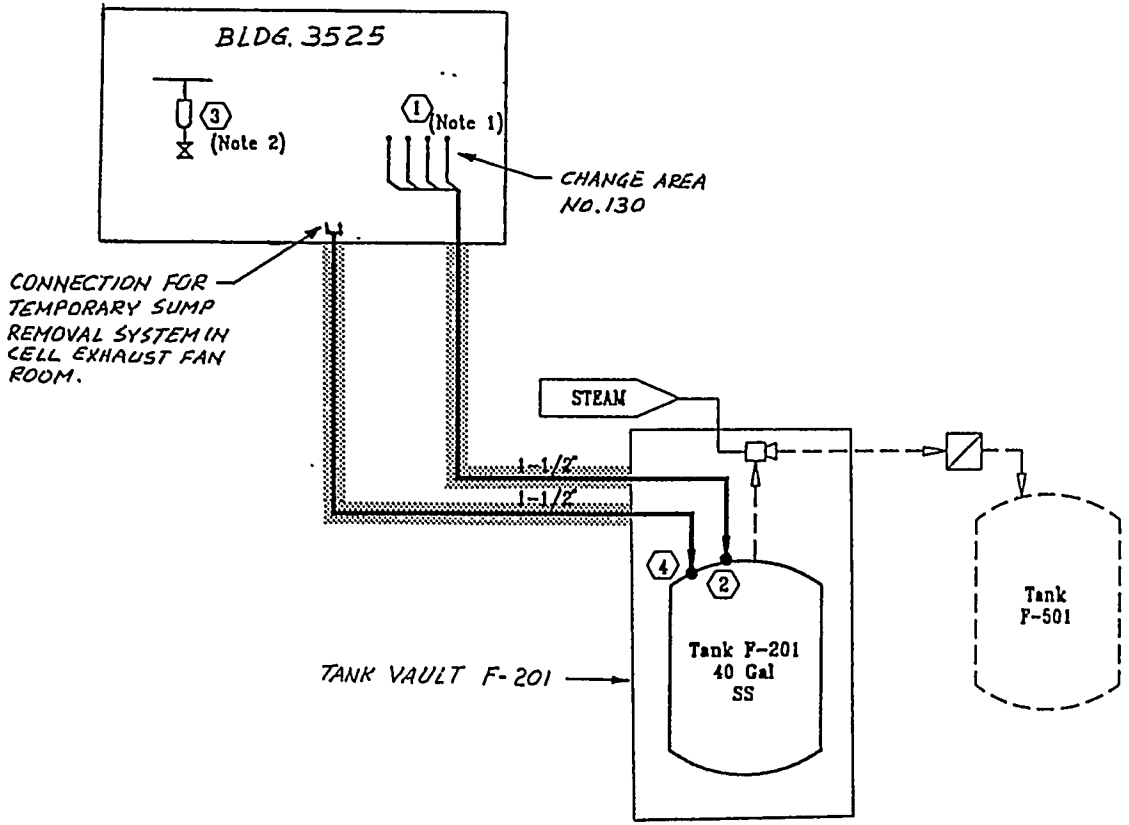
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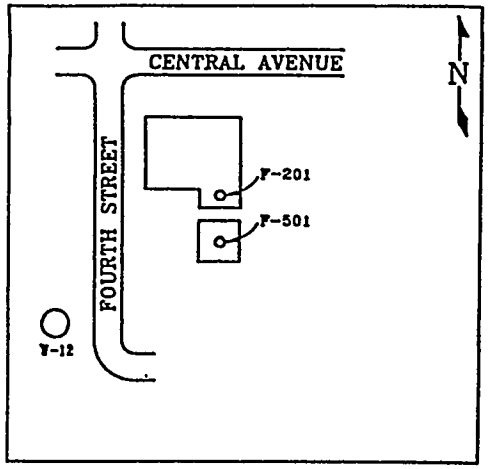
Figure 2.8-1 Location of Tank System F-201 Piping



EBASCO, MAIN

Figure 2.8-2 Tank System F-201 Piping Diagram





KEY PLAN (N.T.S)

REFERENCE DRAWING LIST
M-20566-Y-311-E
H20566-Y-218-E Rev 2
P3E020013SK03 Rev 0
P-20566-Y-403-E Rev 2

NOTES:

(1) Node (1) includes 4 embedded drain headers from the Charging Areas. Each header connects to six embedded storage wells. Six of the storage wells are constructed of a 4'2" length of 8" schedule 10S type 304L SS and a 3'0" length of 10" schedule 10S type 304L SS. The remaining eighteen storage wells are constructed of a 4'2" length of 6" schedule 10S type 304L SS and a 3'0" length of 8" schedule 10S type 304L SS. Ref. drawings P-20566-Y-403-E and M-20566-Y-311-E.

(2) Node (3) is the connection to off-gas drain pots at Bldg 3525 column lines (2) and (G); Reference drawing P-20566-Y-403-E.

LINE SEGMENT	(1)-(2)	(3)-(4)
SIZE IN-DIA	1-1/2	1-1/2
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	135	65
VOLUME (GAL)	14	7

TANK SYSTEM F-201 PIPING

UNDERGROUND PIPE

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.8-3
Analytical Data (Tank System F-201)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	(b) Quantities
U–233	Trace
U–235	Trace
U–238	Trace
Pu–239	Trace
Th–232	Trace
Kr–85	Trace
Cs–137	50.00 Ci/year

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid	5.0 gal/year
sodium hydroxide	5.0 gal/year
Mr. Clean	5.0 gal/year
sodium bisulfate	200.0 gal/year

Ref. LLLW Survey 1990

2.9 Tank System F-501 Piping

Based on the findings of the Design Demonstrations for the Remaining 19 Category B Tank Systems, (DOE/OR/03-1150 & D2), Tank System F-501, originally designated as Category B, has been redesignated as Category C by FFA Modification Request Change Control Number FFA-PM/93-008, June 23, 1994. However, this section of the original Design Demonstrations has been retained for reference.

2.9.1 Tank System Summary

Tank System F-501 is located near the High Radiation Level Examination Laboratory (Building 3525) at the main Bethel Valley Complex (Figures 2.9-1 and 2.9-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from Tank Vault F-501 outside underground to Tank Vault F-201, Tank W-12, and areas within Building 3525.

Tank System F-501 piping is used to transfer liquid low-level waste (LLLW) from the Building 3525 Radioactive Hot Drain (RHD) System and Tank F-201 to Tank F-501 and from Tank F-501 to Tank W-12 and is classified as a Federal Facility Agreement Category B tank system.

2.9.2 Standards for Pipe Assessment of Tank Systems

2.9.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System F-501 piping is located in the vicinity of Building 3525 and is routed from Tank Vault F-501 outside underground to Tank Vault F-201, Tank W-12, and areas within Building 3525. The piping system is used and managed by the Metals and Ceramics Division.

Tank System F-501 piping is constructed of 1″, 1-1/2″, 2″, 3″, and 4″; schedule 40S; type 304L SS with a maximum design pressure and temperature of 150 psig and 200°F. Tank System F-501 has a maximum volume of 154 gal.

Design Standards

The applicable codes and standards used for Tank System F-501 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

American Concrete Institute 315, 318, and 604;

American Society for Testing and Materials A15, A185, C31, C33, C39, C76, C94, C192, D155, A40.1, A53, A74, A106, A107, A120, A181, A182, A193, A217, A234, A298, A312, A338, B75, A240, and A403;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240) and VIII;

Federal Specifications HHF191, HHF341, QQS632, SSA281, SSC164, SSC192, and UUP264; and

National Fire Prevention Association.

2.9.2.2 Generic Description of Piping Contents

Tank System F-501 piping was designed to transfer LLLW from within Building 3525 to Tank Vault F-501, from Tank Vault F-201 to Tank Vault F-501, and from Tank Vault F-501 to Tank W-12. LLLW is produced during the decontamination and cleanup of the hot cells used in the disassembly and examination process. The tank system may contain radioactive materials from Building 3525.

The analytical data (Figure 2.9-3) of the waste stream contaminants from the generators are representative of the waste transferred through Tank System F-501 piping.

2.9.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault F-501, Tank Vault F-201, and Building 3525 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The piping that is routed outside underground is singly contained, and the external surfaces are exposed to the soil and water. Protective coatings or cathodic protection measures are not present in the outside underground piping.

2.9.2.4 Documented Age of Tank System

Tank System F-501 piping was installed in 1964.

2.9.3 Standards for Containment/Release Detection

Tank System F-501 incorporates approximately 665′ of outside underground and embedded piping that is singly contained. These singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.9.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System F-501 piping is single-wall, schedule 40S, type 304L SS. The piping is routed from Tank Vault F-501 outside underground to Tank Vault F-201, Tank W-12, and areas within Building 3525. Areas of secondary containment are discussed below.

Tank Vaults F-501 and F-201

The assessments of the secondary containment systems for Tank Vaults F-501 and F-201 are presented in the Design Demonstrations for Tanks F-501 and F-201. Those assessments conclude that Tank Vaults F-501 and F-201 are not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Areas Within Building 3525

H&V Equipment Room No. 209

Heating and Ventilation (H&V) Equipment Room No. 209 is not provided with a liner or a protective coating on the concrete that is designed to prevent migration of waste into the concrete.

Airlock No. 206

Airlock No. 206 is not provided with a liner or a protective coating on the concrete that is designed to prevent migration of waste into the concrete.

Charging Area No. 130

The floor in Charging Area No. 130 is lined with 3/16″ thick, 304L SS that extends 6″ up the walls. The SS lining material, which is the same material as that used for the piping, is compatible with the waste and designed to prevent migration of the waste into the concrete.

Operating Area No. 201

Operating Area No. 201 is not provided with a liner or a protective coating on the concrete that is designed to prevent migration of waste into the concrete.

The assessment concludes that Charging Area No. 130 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. However, Tank Vaults F-501 and F-201, H&V Equipment Room No. 209, Airlock No. 206, and Operating Area No. 201 are not provided with a liner or a protective coating on the concrete that will prevent migration of waste into the concrete.

2.9.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vaults F-501 and F-201

The assessments of the secondary containment systems for Tank Vaults F-501 and F-201 are presented in the Design Demonstrations for Tanks F-501 and F-201. Those assessments conclude that the vault foundations are properly designed to support the secondary containment systems.

Areas Within Building 3525

H&V Equipment Room No. 209

The secondary containment foundation for H&V Equipment Room No. 209 is constructed of reinforced concrete slabs supported on a structural steel frame. The concrete is designed with a minimum 28-day compressive strength of 3000 psi.

Airlock No. 206

The secondary containment foundation for Airlock No. 206 is constructed of reinforced concrete slabs supported on a structural steel frame. The concrete is designed with a minimum 28-day compressive strength of 3000 psi.

Charging Area No. 130

The secondary containment foundation for Charging Area No. 130 is constructed of reinforced concrete that rests on crushed stone. The concrete is designed with a minimum 28-day compressive strength of 3000 psi.

Operating Area No. 201

The secondary containment foundation for Operating Area No. 201 is constructed of reinforced concrete slabs supported on a structural steel frame. The concrete is designed with a minimum 28-day compressive strength of 3000 psi.

The assessment concludes that Tank Vaults F-501 and F-201, H&V Equipment Room No. 209, Airlock No. 206, Charging Area No. 130, and Operating Area No. 201 foundations are properly designed to support the secondary containment systems.

2.9.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vaults F-501 and F-201

The assessments of the secondary containment systems for Tank Vaults F-501 and F-201 are presented in the Design Demonstrations for Tanks F-501 and F-201. Those assessments conclude that Tank Vault F-501 is provided with a leak detection system; however, Tank Vault F-201 is not provided with a leak detection system.

Areas Within Building 3525

H&V Equipment Room No. 209

H&V Equipment Room No. 209 is not provided with a leak detection system.

Airlock No. 206

Airlock No. 206 is not provided with a leak detection system.

Charging Area No. 130

Charging Area No. 130 is not provided with a leak detection system.

Operating Area No. 201

Operating Area No. 201 is not provided with a leak detection system.

The assessment concludes that Tank Vault F-501 is provided with leak detection; however, Tank Vault F-201, H&V Equipment Room No. 209, Airlock No. 206, Charging Area No. 130, and Operating Area No. 201 are not provided with leak detection.

2.9.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vaults F-501 and F-201

The assessments of the secondary containment systems for Tank Vaults F-501 and F-201 are presented in the Design Demonstrations for Tanks F-501 and F-201. Those assessments conclude that the secondary containments are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Areas Within Building 3525

H&V Equipment Room No. 209

The floor in H&V Equipment Room No. 209 is not sloped or otherwise designed to remove liquids.

Airlock No. 206

The floor in Airlock No. 206 is sloped to a 304L SS floor drain. The drain provides a low point within the air lock to route liquids to the Process Hot Drain (PHD) System.

Charging Area No. 130

Charging Area No. 130 has two, type 304L SS drains installed flush in the SS-lined floor. The drain located near the middle, south edge of the cell directs collected fluids to the RHD System. The other drain, located near the southeast corner of the cell, is a safety shower drain that transfers waste to the PHD System.

Operating Area No. 201

Operating Area No. 201 has two drains installed flush in the concrete floor. The drains direct waste to the PHD System.

The assessment concludes that the secondary containment areas for Tank Vaults F-501 and F-201 and Airlock No. 206 are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. Charging Area No. 130 and Operating Area No. 201 have drains but are not sloped. H&V Equipment Room No. 209 is not sloped or otherwise designed to remove liquids resulting from leaks, spills, or precipitation.

2.9.4 Supplemental Information

2.9.4.1 Ancillary Equipment

Tank F-501 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault F-501, which provides secondary containment. Tank F-201 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault F-201, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.9.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontamination, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System F-501.

2.9.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate-Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. May 14, 1993. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing M20566-Y-311-E, 6″ and 8″ Floor Storage Wells, Dated 6/23/59 (No Revision No.).

Energy Systems Drawing S-20566-Y-109-E-R4, Cell, Block Plans, Revision 4.

Energy Systems Drawing S-20566-Y-110-E-R3, Cell Elevations, Sheet 1, Revision 3.

Energy Systems Drawing S-20566-Y-111-E-R1, Cell Elevations, Sheet 2, Revision 1.

Energy Systems Drawing S-20566-Y-114-E-R3, Cell Liner, Plate Details, Sheet 1, Revision 3.

Energy Systems Drawing S-20566-Y-115-E-R3, Cell Liner, Plate Details, Sheet 2, Revision 3.

Energy Systems Drawing S-20566-Y-112-E, Cell Sections and Details, Dated 4/21/60 (No Revision No.).

Energy Systems Drawing S-20566-Y-103-E-R2, Foundation, Basement Plan and Details, Revision 2.

Energy Systems Drawing P20566-Y-400-E, General Arrangement of Process Hot and RHD Drain Systems, Plan First Floor, Cell Area, Dated 9/4/59 (No Revision No.).

Energy Systems Drawing 1343-M-501, General Arrangement, RHD Tank System, Dated 4/25/61 (No Revision No.).

Energy Systems Drawing H20566-Y-224-E-R, H.V. and A.C., Cells, Ductwork Sections and Details, Revision C.

Energy Systems Drawing H20566-Y-223-E-R-3, H.V. and A.C., Upper Levels, Ductwork, Sheet 2, Revision 3.

Energy Systems Drawing P20566-Y-403-E-R, Piping Drains, Hot and Low Level Areas, First Floor, Plan and Sections, Revision 2.

Energy Systems Drawing P20566-Y-404-E-R1, Piping Drains, Hot and Low Level Areas, Second Floor, Plan and Sections, Revision 1.

Energy Systems Drawing P20566-Y-405-E-R1, Piping Drains, Hot and Low Level Areas, Upper Level, Plan and Sections, Revision 1.

Energy Systems Drawing 1343-M-502, R.H.D. Tank System, Details and Profile of RHD Transfer Pipeline, Dated 4/25/61 (No Revision No.).

Energy Systems Drawing 1343-H-501, R.H.D. Tank System Concrete Plans, Sections and Details, Revision 2.

Energy Systems Drawing 1343-L-501, R.H.D. Tank System Strainer Arrangement, Dated 4/25/61 (No Revision No.).

Energy Systems Drawing H20566-Y-218-E-R-2, Radioactive OffGas Pit and RHD Pit, Revision 2.

Energy Systems Drawing P20566-Y-401-E-R4, Yard Piping, Plan, Revision 4.

Hertel, J. P. 1964. Procedure for Mass Spec. Leak Test. Job 3-127.

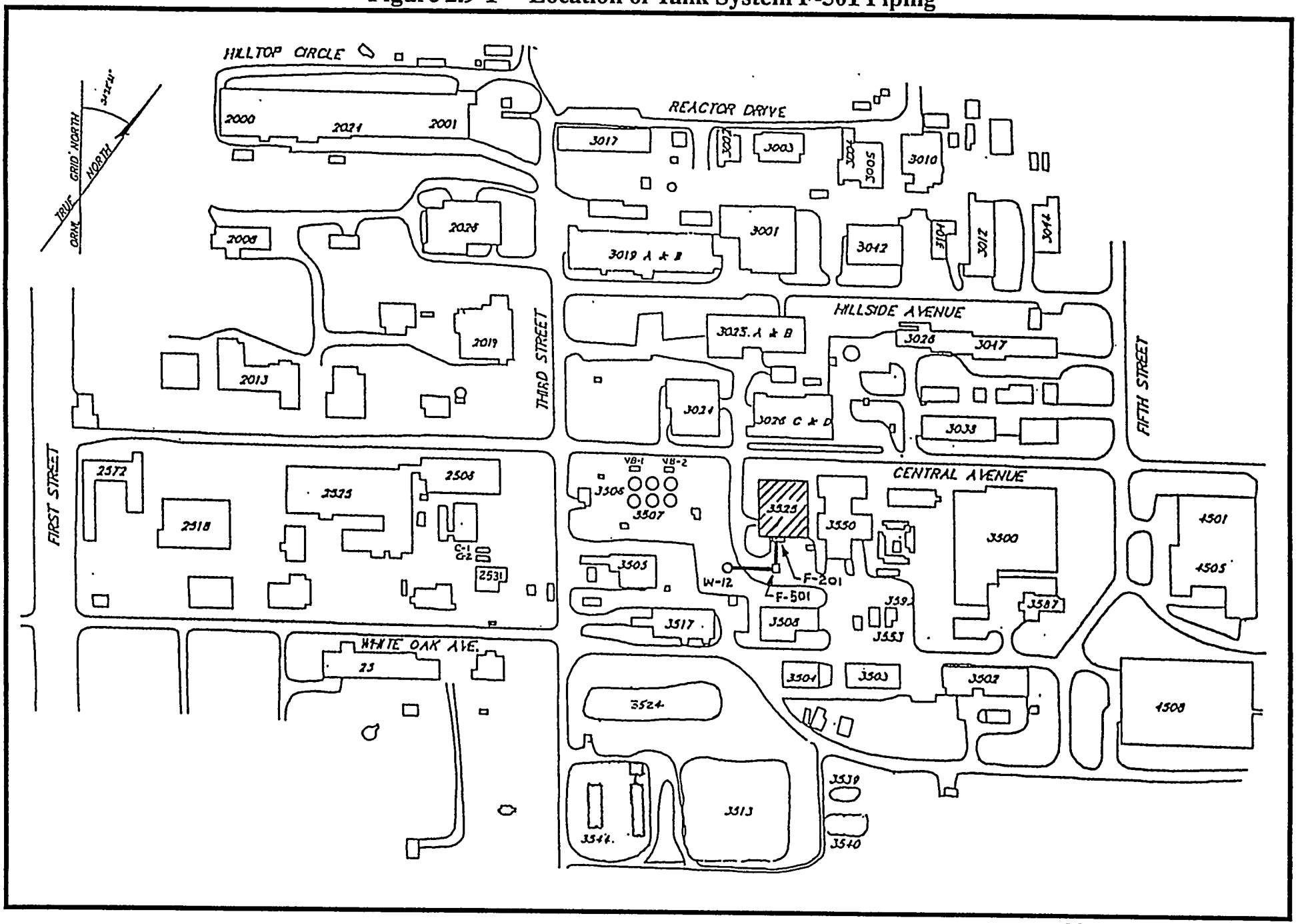
Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1919. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM/11795. Oak Ridge National Laboratory.

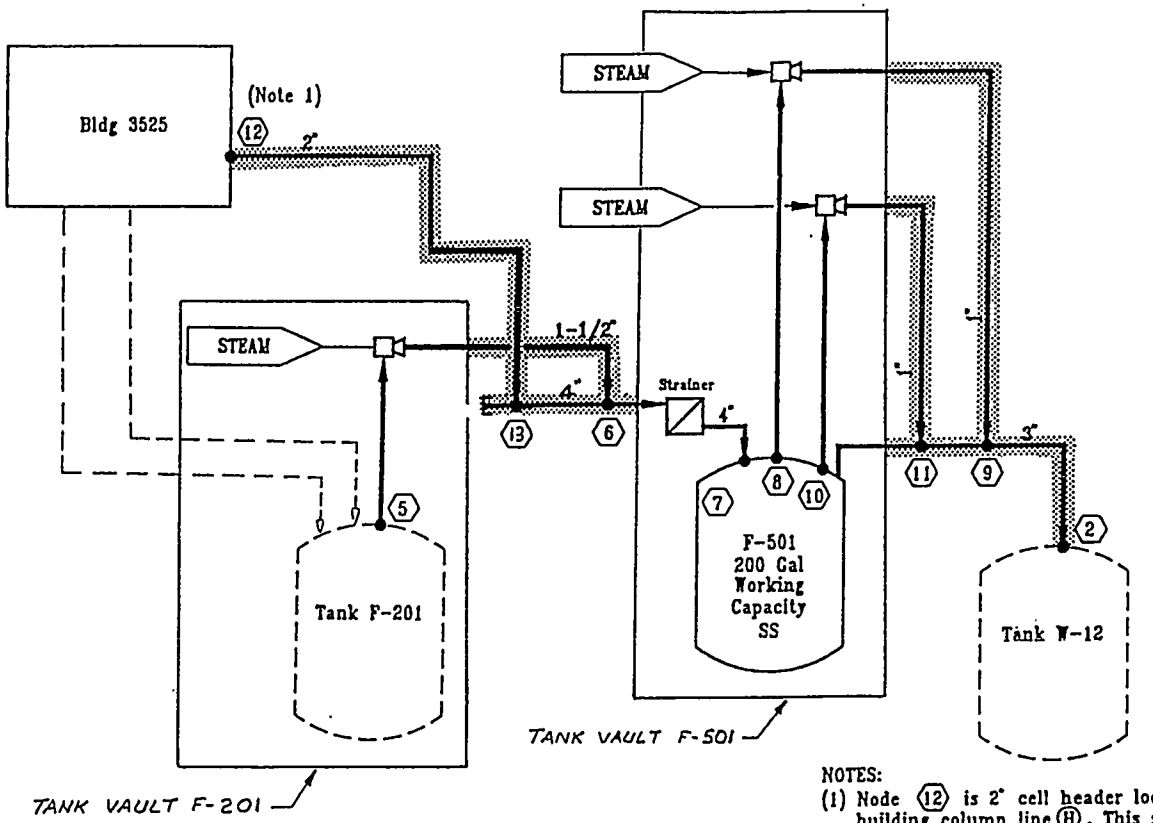
Technical Specifications for the Construction of High Radiation Level Examination Laboratory Building 3525.

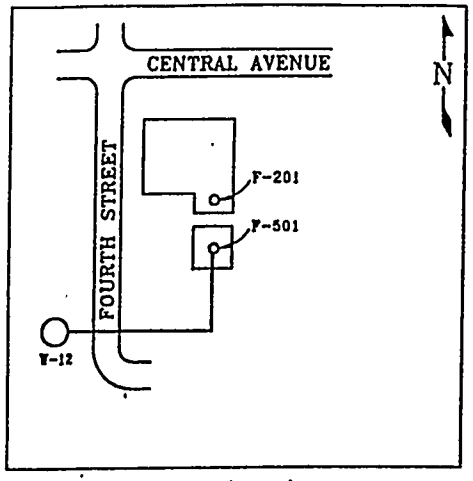
Figure 2.9-1 Location of Tank System F-501 Piping



EBASCO/MAIN

Figure 2.9-2 Tank System F-501 Piping Diagram





KEY PLAN (N.T.S)

NOTES:
(1) Node (12) is 2" cell header located near building column line (H). This segment does not include other piping within the building.

P3E020013SK03 Rev 0
1343-M-501 Rev 0
P-10937-A-012-D Rev 8
P-10937-A-007-D Rev 8
1343-M-502 Rev 0
REFERENCE DRAWING LIST

LINE SEGMENT	(5)-(6)	(6)-(7)	(8)-(9)	(10)-(11)	(12)-(13)	(9)-(2)
SIZE IN-DIA	1-1/2	4	1	1	2	3
SCHEDULE	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS
LENGTH (FT)	18	9	8	7	12	202
VOLUME (GAL)	2	6	<1	<1	2	78

TANK SYSTEM F-501 PIPING
UNDERGROUND PIPE
COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.9-3
Analytical Data for Liquid (Tank System F-501)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	(b) Quantities
U–233	Trace
U–235	Trace
U–238	Trace
Pu–239	Trace
Th–232	Trace
Kr–85	Trace
Cs–137	50.00 Ci/year

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid	5.0 gal/year
sodium hydroxide	5.0 gal/year
Mr. Clean	5.0 gal/year
sodium bisulfate	200.0 gal/year

Ref. LLLW Survey 1990

2.10 Tank System L-11 Piping

2.10.1 Tank System Summary

Tank System L-11 is located at the Process Waste Treatment Plant (PWTP) (Building 3544) in the main Bethel Valley Complex (Figures 2.10-1 and 2.10-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed outside underground from Tank Vault L-11 to Valve Box No. 1. Tank System L-11 piping is used to transfer concentrates from the liquid low-level waste (LLLW) Evaporator to Valve Box No. 1 and is classified as a Federal Facility Agreement Category B tank system.

2.10.2 Standards for Pipe Assessment of Tank Systems

2.10.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System L-11 piping is located at Building 3544 and is routed underground from Tank Vault L-11 to Valve Box No. 1. The piping system is used and managed by the Waste Management and Remedial Action Division.

Tank System L-11 piping is constructed of 3/4", 1-1/2," and 3", 304L SS with a maximum design pressure and temperature of 150 psig and 400°F. Tank System L-11 piping has a maximum volume of 122 gal.

Design Standards

The applicable codes and standards used for Tank System L-11 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American National Standards Institute B16.5, B16.9, B16.11, B16.14, B16.3, B16.1, A21.6, A21.1, A21.11, A21.4, A21.10, B16.18, A112.5.1, B16.12, B16.22, and B31.3;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240) and VIII;

American Conference of Governmental Industrial Hygienists;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Concrete Institute;

American Concrete Pipe Association;

American Standards Association Safety Code for Building Construction;

American Society for Testing and Materials C39, C78, C138, C143, and D1752;

ASHRAE Guide and Data Book—Applications;

ASHRAE Handbook—Systems;

ASHRAE Guide and Data Book—Equipment;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrument Society of America;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.10.2.2 Generic Description of Piping Contents

Tank System L-11 piping is designed to collect LLLW process waste from the L-10 PWTP Evaporator Tank in Building 3544. These wastes may include a variety of dilute acids, bases, organics, and radioactive materials.

The analytical data (Figure 2.10-3) of waste stream contaminants from the generators are representative of the waste transferred through Tank System L-11 piping.

2.10.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault L-11 and Valve Box No. 1 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

Tank System L-11 outside underground piping is singly contained, 304L SS. Approximately 500′ of the underground pipe is encased in concrete and has no cathodic protection. The remaining 500′ of underground pipe is buried in direct contact with the soil and water and is partially cathodically protected.

The cathodic protection for the outside underground LLLW piping between Tank Vault L-11 (Building 3544) and Valve Box No. 1 is included in the Facility Manager's Cathodic Protection System No. 9. The galvanic anode cathodic protection system consists of magnesium anodes, test stations, and connecting wire as shown in cathodic protection drawings E-21246-ED-023 and E-21246-ED-024. The system was installed in July 1974. The cathodic protection system as shown on the construction drawings reviewed is considered to be inadequate because electrical isolation of the buried piping system is not shown on these construction drawings.

Harco Technologies determined that insulating gaskets were not present during its 1990 surveys, and the cathodic protection current requirements through field testing in 1991 indicate that 44% of the piping is not receiving adequate corrosion control. This is due mainly to the lack of electrical isolation devices used between the interior piping and the outside underground piping, and is also because of the destroyed anode beds. In 1991, Harco completed the engineering design to upgrade the existing system to protect the piping.

2.10.2.4 Documented Age of Tank System

Tank System L-11 piping was installed in 1974.

2.10.3 Standards for Containment/Release Detection

Tank System L-11 incorporates approximately 1000′ of outside underground and embedded piping that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.10.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System L-11 piping is single-wall, schedule 40S, type 304L SS that is routed outside underground from Tank Vault L-11 to Valve Box No. 1. Each area is discussed below. The piping penetration at Tank Vault L-11 is a 1-1/2″ diameter, schedule 40S, type 304L SS pipe that passes through a carbon steel sleeve embedded in the concrete wall. The space between the pipe and sleeve is packed with oakum and bitumastic seal. The carbon steel sleeve is not compatible with the waste.

Tank Vault L-11

The assessment of the secondary containment system for Tank Vault L-11 is presented in the Design Demonstrations for Tank L-11. That assessment concludes that Tank Vault L-11 is coated and lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box No. 1

The bottom of Valve Box No. 1 is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project 2′0″ up the valve box walls. The SS valve box lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault and valve box are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.10.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault L-11

The secondary containment system for Tank Vault L-11 is presented in the Design Demonstrations for Tank L-11. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Valve Box No. 1

The valve box foundation is a 6′8″ × 19′2″ × 10″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the tank vault and valve box foundations are properly designed to support the secondary containment system.

2.10.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault L-11

The assessment of the secondary containment system for Tank Vault L-11 is presented in the Design Demonstrations for Tank L-11. That assessment concludes that the vault is provided with a leak detection system.

Valve Box No. 1

The Valve Box No. 1 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

The assessment concludes that the tank vault and valve box are provided with leak detection.

2.10.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault L-11

The assessment of the secondary containment system for Tank Vault L-11 is presented in the Design Demonstrations for Tank L-11. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Valve Box No. 1

The Valve Box No. 1 floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve box to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containment for the tank vault and valve box are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.10.4 Supplemental Information

2.10.4.1 Ancillary Equipment

Tank L-11 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault L-11, which provides secondary containment. The pumps associated with Tank System L-11 are constructed of 304L SS, which is the same material as that used in the tank and piping system, and are located in the Tank Vault L-11. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.10.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste*

Treatment Systems at the Oak Ridge National Laboratory (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System L-11.

2.10.5 References

Construction Specification for Clarifier Foundation and Containment Work Order A-2991G-G1. November 11, 1985.

Ebasco, and Main. May 14, 1993. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing A-21246-EE-018, General Structural Notes, Revision 1.

Energy Systems Drawing C-20013-EA-029-E, Waste Collection Header Connector Plan, Revision C.

Energy Systems Drawing C-20013-EA-031-E, Waste Collection Header Valve Boxes Piping Details, Revision E.

Energy Systems Drawing C-20013-EA-033-E, Waste Collection Header Valve Boxes Liner and Sleeve Details, Revision E.

Energy Systems Drawing C-21246-EA-018-D, Underground Piping Plan Detail and General Notes, Revision 1.

Energy Systems Drawing C-21246-EA-021-D, PWC Pipeline, Plan and Profile, Sheet 1, Dated 2/22/74 (No. Revision No).

Energy Systems Drawing C-21246-EA-022-D, PWC Pipeline, Plan and Profile, Sheet 2, Revision 1.

Energy Systems Drawing E-21246-ED-023-D, PWC Pipeline Cathodic Protection, Sheet 1, Revision 0.

Energy Systems Drawing E-21246-ED-024-D, PWC Pipeline Cathodic Protection, Sheet 2, Revision 0.

Energy Systems Drawing H-21246-EG-003-D, Heating and Ventilating Flow and Control Diagram, Revision 0.

Energy Systems Drawing I-21246-EI-015, Instrumentation Systems, Revision C.

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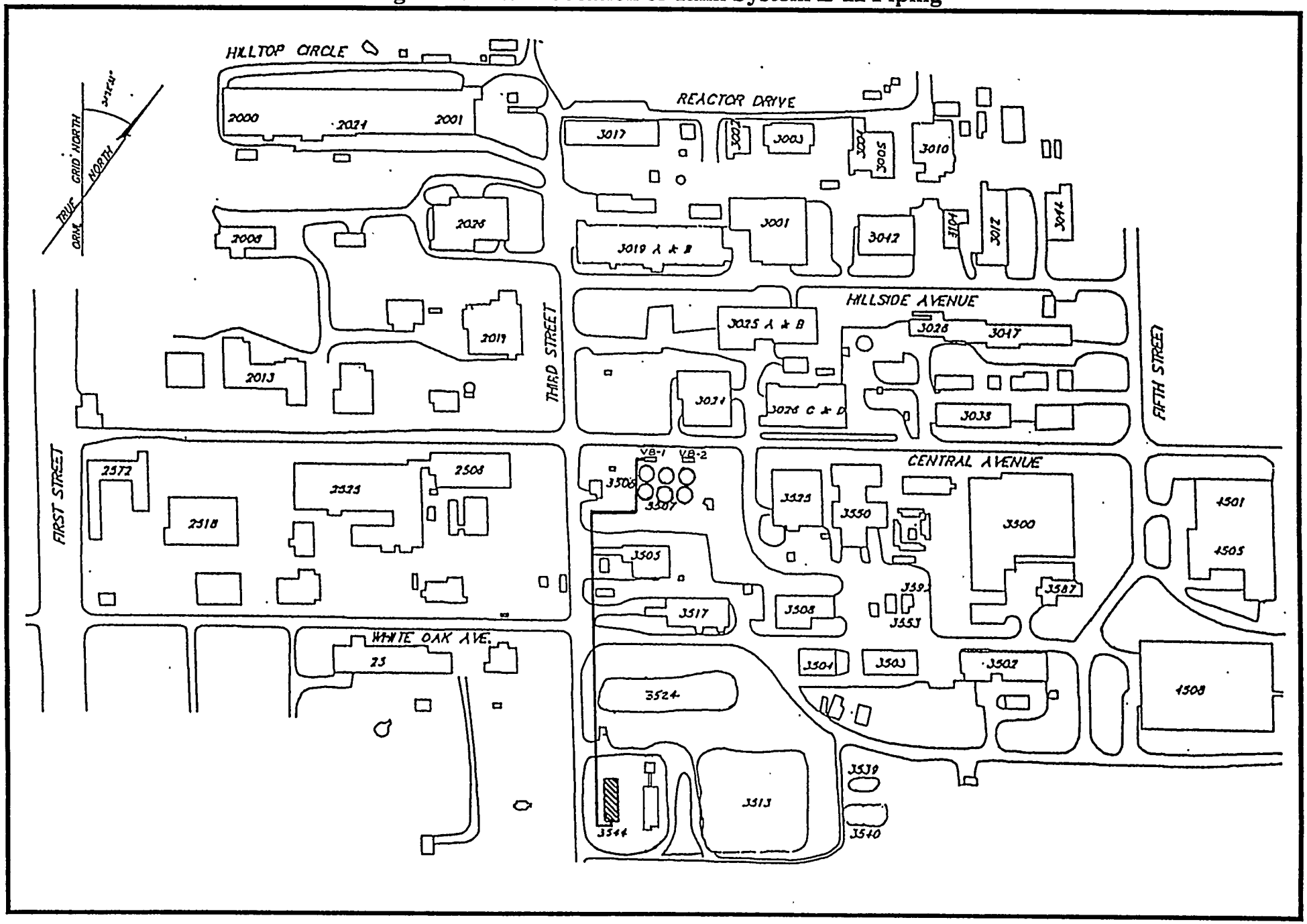
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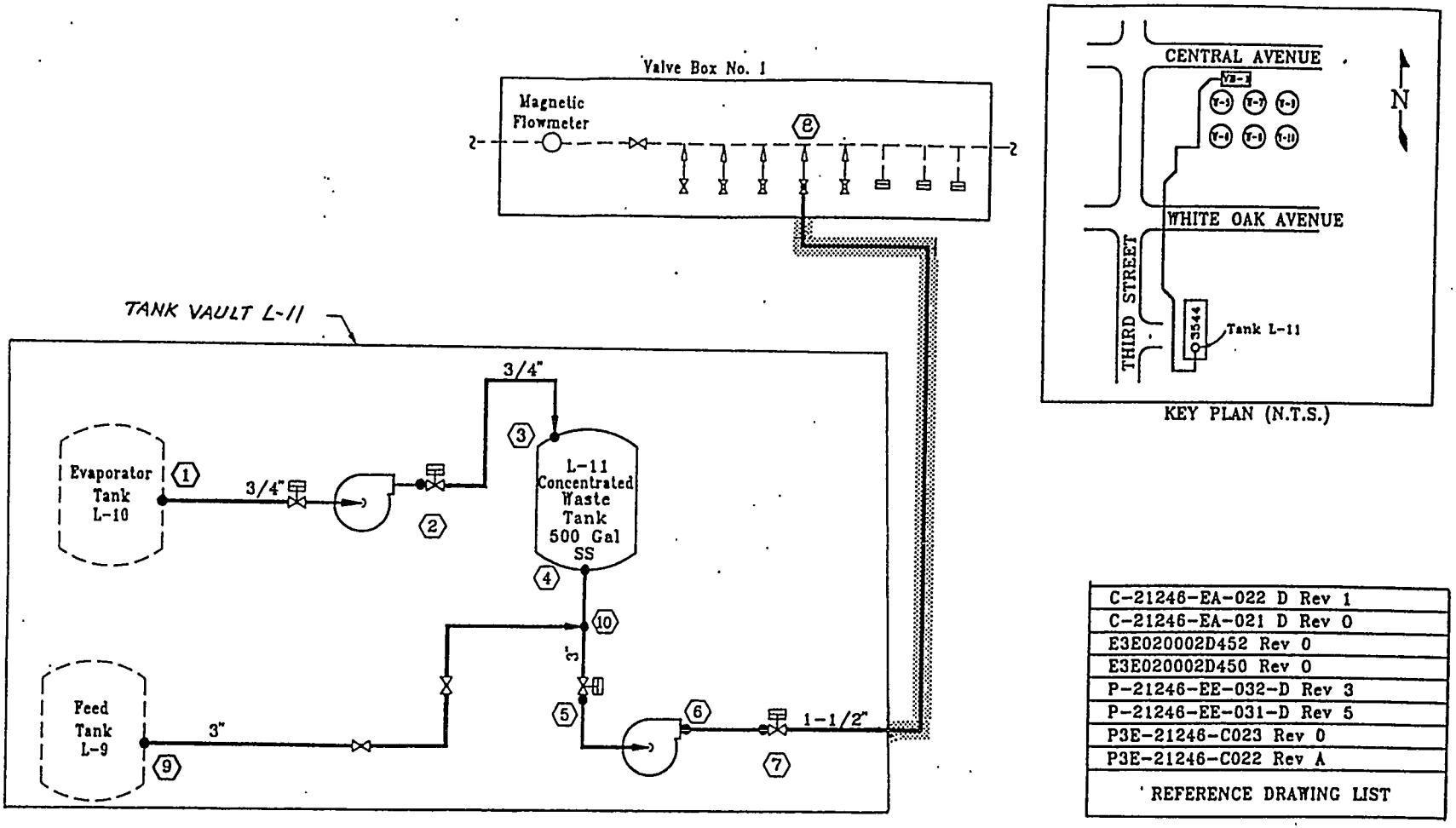
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Figure 2.10-1 Location of Tank System L-11 Piping



EBASCO/MAIN

Figure 2.10-2 Tank System L-11 Piping Diagram



REFERENCE DRAWING LIST
C-21246-EA-022 D Rev 1
C-21246-EA-021 D Rev 0
E3E020002D452 Rev 0
E3E020002D450 Rev 0
P-21246-EE-032-D Rev 3
P-21246-EE-031-D Rev 5
P3E-21246-C023 Rev 0
P3E-21246-C022 Rev A

LINE SEGMENT	1-2	2-3	4-5	5-6	6-7	7-8	9-10
SIZE IN-DIA	3/4	3/4	3	3	1 1/2	1 1/2	3
SCHEDULE	40S	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS	SS
LENGTH (FT)	6	12	4	1	3	1000	21
VOLUME (GAL)	1	<1	2	3	<1	106	8

TANK SYSTEM L-11 PIPING

UNDERGROUND PIPE (SINGLE WALL)

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.10-3
Analytical Data for Liquid (Tank System L-11)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	all	Quantities: Trace

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid (3N)	2000.0 gal/year
sodium hydroxide (50%)	440.0 gal/year

Ref. LLLW Survey 1990

2.11 Tank System N-71 Piping

2.11.1 Tank System Summary

Tank System N-71 is located at the Radiochemical Development Facility (Building 3019) at the main Bethel Valley Complex (Figures 2.11-1 and 2.11-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from the southwest area of Building 3019 to Tank Vault N-71. Tank System N-71 piping is used to transfer the liquid low-level waste (LLLW) from the Building 3019 west drain header to Tank N-71 and further to Tank P-3 and is classified as a Federal Facility Agreement Category B tank system.

2.11.2 Standards for Pipe Assessment of Tank Systems

2.11.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System N-71 piping is located in Building 3019 and is routed from the southwest area of Building 3019 to Tank Vault N-71. The piping system is used and managed by the Chemical Technology Division and is part of the Bethel Valley LLLW system.

Tank System N-71 piping is constructed of 1/2″ and 2″, 304L SS with a maximum design pressure and temperature of 150 psig and 125°F. Tank System N-71 piping has a maximum volume of 80 gal.

Design Standards

The applicable codes and standards used for Tank System N-71 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

American Concrete Institute;

American Society for Testing and Materials;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section II (SA-240);

Atomic Energy Commission (AEC) General Design Criteria;

Instrument Society of America;

National Fire Protection Association;

National Plumbing Code; and

Underwriters Laboratories Inc.

2.11.2.2 Generic Description of Piping Content

Tank System N-71 piping is designed to serve as a radioactive LLLW laboratory transfer piping system for the Building 3019 southwest drain header. LLLW includes raffinates from extraction processes; overheads from evaporation processes; and liquids left after analyses, decontamination solutions, and bench-scale experimental processes. The wastes may also include a variety of laboratory-generated acids and bases, typically nitric and caustic.

The analytical data (Figure 2.11-3) of waste stream contaminants from the generators are representative of the waste transferred through Tank System N-71 piping.

2.11.2.3 Pipe Corrosion Protection Measures

Piping inside the southwest area of Building 3019 and Tank Vault N-71 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.11.2.4 Documented Age of Tank System

Tank System N-71 piping was installed in 1954.

2.11.3 Standards for Containment/Release Detection

2.11.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System N-71 piping is single-wall, schedule 40S, type 304L SS that is routed inside Building 3019 from the southwest area to Tank Vault N-71. Areas of secondary containment are discussed below.

<u>Tank Vault N-71</u>

The assessment of the secondary containment system for Tank Vault N-71 is presented in the Design Demonstrations for Tank N-71. That assessment concludes that Tank Vault N-71 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Southwest Area of Building 3019

The southwest area of Building 3019 is constructed of reinforced concrete and provided with a coating on the concrete. The piping in the area is aboveground and visually inspected. In the event of a leak, the liquid would be manually removed.

The assessment concludes that the tank vault is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. The southwest area of Building 3019 is an aboveground visually inspected area.

2.11.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault N-71

The assessment of the secondary containment system for Tank Vault N-71 is presented in the Design Demonstrations for Tank N-71. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Southwest Area of Building 3019

The foundation base in the southwest area of Building 3019 is an 18″ thick, reinforced concrete base slab that was designed with a minimum 28-day compressive strength of 3000 psi.

The assessment concludes that the tank vault and the southwest area foundations are properly designed to support the secondary containment system.

2.11.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault N-71

The assessment of the secondary containment system for Tank Vault N-71 is presented in the Design Demonstrations for Tank N-71. That assessment concludes that the vault is provided with a leak detection system.

Southwest Area of Building 3019

Leak detection is performed by visual inspection of the piping system conducted once each operating day.

The assessment concludes that the tank vault is provided with a leak detection system. Leak detection of the piping system is performed by visual inspection once each operating day in the southwest area of Building 3019.

2.11.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault N-71

The assessment of the secondary containment system for Tank Vault N-71 is presented in the Design Demonstrations for Tank N-71. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Southwest Area of Building 3019

The floor in the southwest area of Building 3019 is sloped to low points and has permanently plugged drains. The piping in the area is aboveground and visually inspected. In the event of a leak, the liquid would be manually removed.

The assessment concludes that the tank vault is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. The southwest area floor is sloped to low points. The piping in the area is aboveground and visually inspected. In the event of a leak, the liquid would be manually removed.

2.11.4 Supplemental Information

2.11.4.1 Ancillary Equipment

Tank N-71 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault N-71, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, type 304L SS is an acceptable material for the support equipment.

2.11.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating division. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System N-71.

2.11.5 References

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Energy Systems Drawing D-14168, Cell 6 and 7 Sections and Details, Revision 1.

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Figure 2.11-1 Location of Tank System N-71 Piping

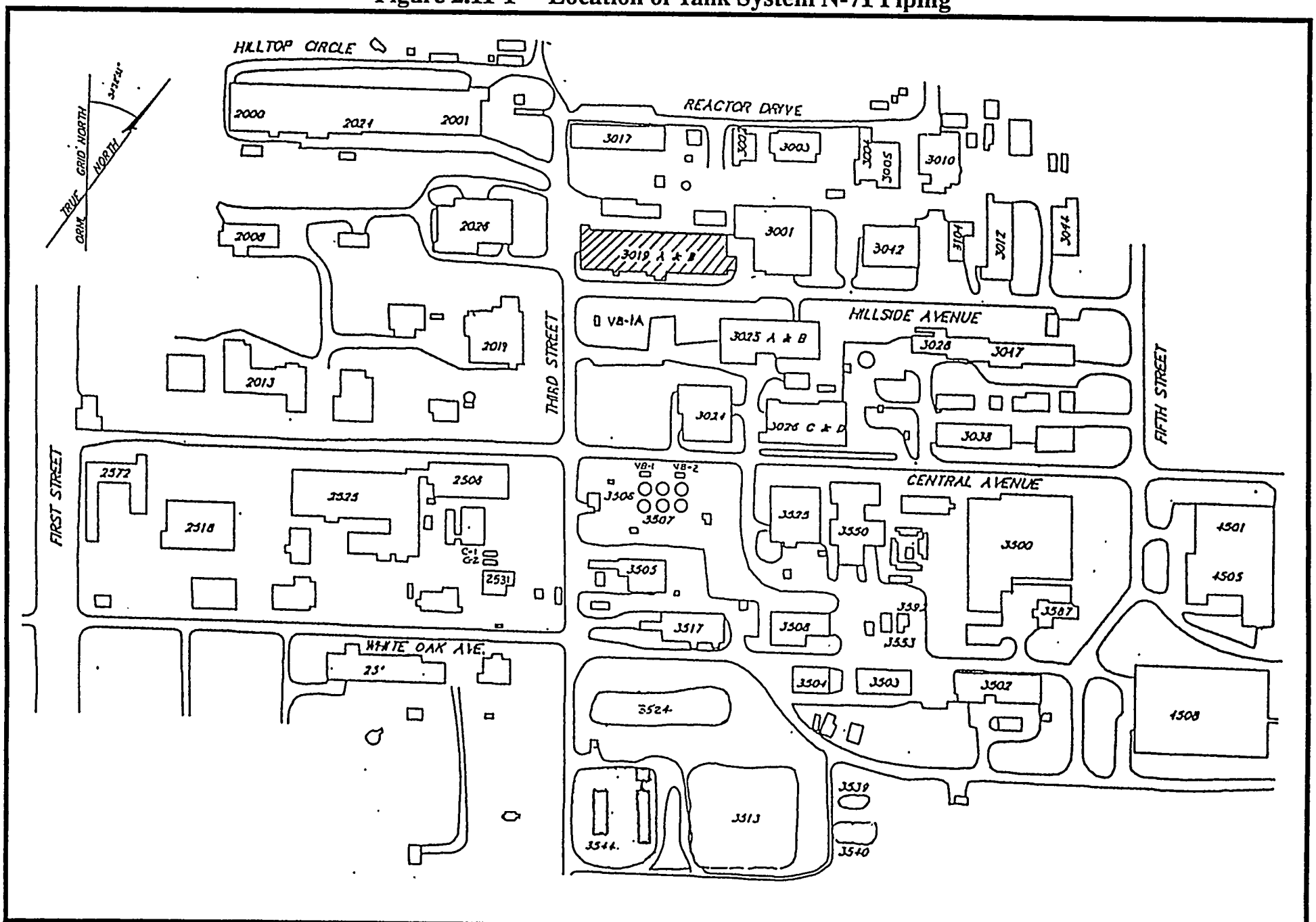
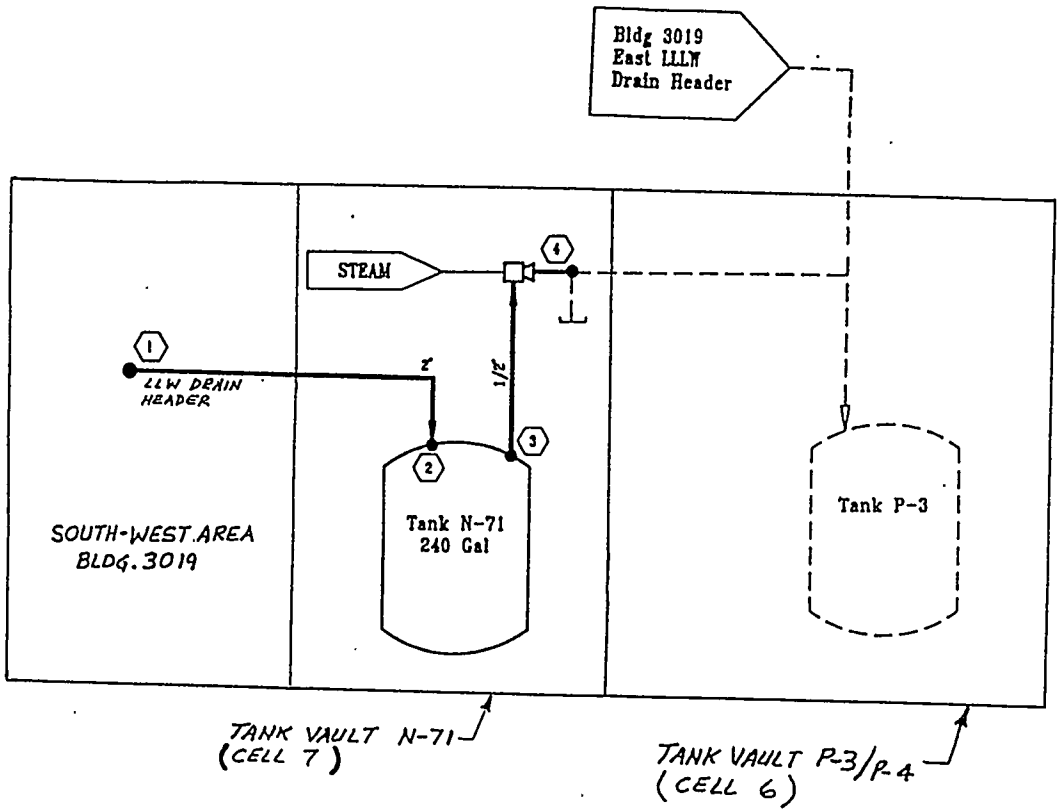
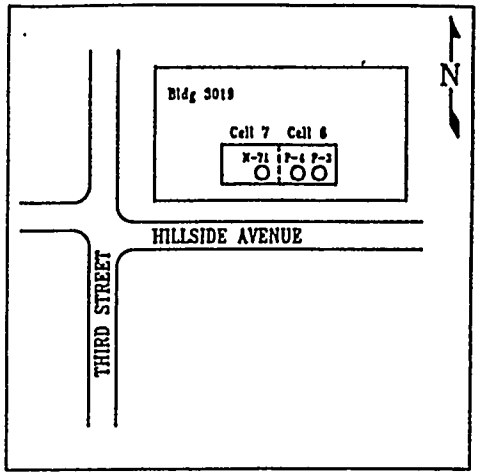


Figure 2.11-2 Tank System N-71 Piping Diagram





KEY PLAN (N.T.S)

P-20327-CP-023 Rev. 0
P-20327-CP-040 Rev. 0
P-20327-CP-042 Rev. 1
D-11203 Rev 0
D-11201 Rev 1
E-9183 Rev 1
E-23540 Rev 0
REFERENCE DRAWING LIST

LINE SEGMENT	(1)-(2)	(3)-(4)
SIZE IN-DIA	2	1/2
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	460	8
VOLUME (GAL)	80	<1

——— TANK SYSTEM N-71 PIPING

– – – – COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.11-3
Analytical Data for Liquid (Tank System N-71)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	(b) Quantities
Sr–90	Trace
Cs–137	Trace
U–235	0.4 g/year
U–238	50.0 g/year
U–233	1.0 g/year
Th–232	100.0 g/year

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid	4.7 Kg/year

Ref. LLLW Survey 1990

2.12 Tank System P-3 Piping

2.12.1 Tank System Summary

Tank System P-3 is located at the Radiochemical Development Facility (Building 3019) at the main Bethel Valley Complex (Figures 2.12-1 and 2.12-2). The tank system piping is constructed of schedule 40S, ASME SA-240, type 347 and 304L stainless steel (SS); is routed outside underground from Tank Vault P-3/P-4 to Valve Box-1A; and continues outside underground to Valve Box No. 1. The piping is also routed inside the building from Tank Vault P-3/P-4 to Tank Vault N-71 and from Tank Vault P-3/P-4 to Cells 1, 2, 3, and 5 and to the east, central, and west tunnels. The Tank System P-3 piping is used to transfer liquid low-level waste (LLLW) outside underground from Building 3019 to Valve Box No. 1 and is classified as a Federal Facility Agreement Category B tank system.

2.12.2 Standards for Pipe Assessment of Tank Systems

2.12.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System P-3 piping is located at Building 3019, is routed outside underground from Tank Vault P-3/P-4 to Valve Box-1A, and continues outside underground to Valve Box No. 1. The piping is also routed inside the building from Tank Vault P-3/P-4 to Tank Vault N-71 and from Tank Vault P-3/P-4 to Cells 1, 2, 3, and 5 and to the east, central, and west tunnels. The piping system is used and managed by the Chemical Technology Division and is part of the Bethel Valley LLLW system.

Tank System P-3 piping is constructed of 1″, 2″, and 3″, 347 and 304L SS with a maximum design pressure and temperature of 150 psig and 125°F. Tank System P-3 piping has a maximum volume of 295 gal.

Design Standards

The applicable codes and standards used for Tank System P-3 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

American Concrete Institute;

American Society for Testing and Materials;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section II (SA-240);

Atomic Energy Commission (AEC) General Design Criteria;

Instrument Society of America;

National Fire Protection Association;

National Plumbing Code; and

Underwriters Laboratories Inc.

2.12.2.2 Generic Description of Piping Contents

Tank System P-3 piping is designed to serve as part of a radioactive LLLW process transfer piping system from Tank P-3 and the east drain header in Building 3019 to Valve Box No. 1. The LLLW includes raffinates from extraction processes, overheads from evaporation processes, and liquids left after analyses and bench-scale experimental processes. The waste may also include a variety of laboratory-generated acids and bases, typically nitric and caustic.

The analytical data (Figure 2.12-3) of waste stream contaminants from the generators are representative of the waste transferred through Tank System P-3.

2.12.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault P-3/P-4; Tank Vault N-71; Cells 1, 2, 3, and 5; the east, central, and west tunnels; Valve Box-1A; and Valve Box No. 1 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The section of piping that is routed outside underground from Tank Vault P-3/P-4 to Valve Box-1A is singly contained, schedule 40S, type 347 SS, with the exterior surfaces of the pipe in direct contact with the soil and water. Protective coatings or cathodic protection measures are not present in this section of underground piping.

The section of piping that is routed outside underground from Valve Box-1A to Valve Box No. 1 is doubly contained. The core pipe is schedule 40S, type 304L SS; and the jacket is schedule 10S, type 304L SS. The exterior of the jacket is in direct contact with the soil and water and is provided with cathodic protection as described below.

The cathodic protection for the outside underground LLLW piping between Valve Box-1A and Valve Box No. 1 is included in the Facility Manager's Cathodic Protection System No. 20. A galvanic anode cathodic protection system was installed in 1984. The system is made up of magnesium anodes, test stations, and connecting wire as shown on the installation drawings E3E20013D021 and E3E20013D022. The design of the cathodic protection system called for electrical isolation devices to be installed. The cathodic protection system design, as shown on the drawings reviewed, is considered to be adequate.

The cathodic protection test report and survey performed in 1990 and 1991 indicate overall effective cathodic protection on the piping except for 10′ of pipe at the end near Valve Box-1A.

2.12.2.4 Documented Age

Tank System P-3 piping was placed in operation in 1954. The section of piping between Valve Box-1A and Valve Box No. 1 was installed in 1984.

2.12.3 Standards for Containment/Release Detection

Tank System P-3 piping incorporates approximately 290′ of outside underground piping that is singly contained and approximately 430′ of outside underground piping that is doubly contained. The singly contained area is omitted from discussion in the following sections that address secondary containment.

2.12.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System P-3 piping is single-wall, schedule 40S, type 347 and type 304L SS, with a section of piping that is double wall. The jacket of the double-wall piping is schedule 10S, type 304L SS. The piping is routed outside underground from Tank Vault P-3/P-4 to Valve Box-1A and continues outside underground to Valve Box No. 1. The piping is also routed from Tank Vault P-3/P-4 to Tank Vault N-71 and from Tank Vault P-3/P-4 to Cells 1, 2, 3, and 5 and to the east, central, and west tunnels. Each area is discussed below. The piping penetrations in the cell and tunnel walls are routed through stainless steel sleeves that are embedded in the concrete walls. The annulus of the sleeves are sealed with an unspecified material. The stainless steel sleeves are compatible with the waste. The piping penetrations from Tank Vault P-3/P-4 to outside underground and from Valve Box-1A to outside underground are routed through stainless steel sleeves embedded in the concrete walls. The annulus of the sleeves are sealed with oakum and bitumastic seal. The stainless steel sleeves are compatible with the waste.

Tank Vaults P-3/P-4 and N-71

The assessments of the secondary containment systems for Tank Vaults P-3/P-4 and N-71 are presented in the Design Demonstrations for Tanks P-3, P-4, and N-71. Those assessments conclude that the tank vaults are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

East Area Building 3019

The east area of Building 3019 consists of Cells 1, 2, 3, and 5; the East Tunnel; the Center Tunnel; and the West Tunnel. The bottom of each of the cells and tunnels are lined with 11-gauge (1/8″), 304L SS, with sidewalls that project 4″ up the walls. The SS lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box-1A

The bottom of Valve Box-1A is lined with 16-gauge (1/16″), 304L SS, which projects 2′0″ up the valve box sidewalls. The SS lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box No. 1

The bottom of Valve Box No. 1 is lined with 16-gauge (1/16″), 304L SS, which projects 2′0″ up the valve box sidewalls. The SS lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Outside Underground Piping

The jacket of the outside underground, double-wall pipe is schedule 10S, type 304L SS. The secondary containment material is compatible with the waste.

The assessment concludes that the tank vaults, the east area of Building 3019, and the valve boxes are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. The assessment concludes that the jacket of the double-wall pipe is constructed of a material that is compatible with the waste.

2.12.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vaults P-3/P-4 and N-71

The assessments of the secondary containment systems for Tank Vaults P-3/P-4 and N-71 are presented in the Design Demonstrations for Tanks P-3, P-4, and N-71. Those assessments conclude that the vault foundations are properly designed to support the secondary containment system.

East Area Building 3019

The foundation for each cell and tunnel in the east area of Building 3019 is an 18″ thick, reinforced concrete base slab designed with a minimum 28-day compressive strength of 3000 psi.

Valve Box-1A

The valve box foundation is a 7′0″ × 16′0″ with a 12″ thick, reinforced concrete base slab that rests on limestone.

Valve Box No. 1

The valve box foundation is a 6′8″ × 19′2″ × 10″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the tank vaults, the east area of Building 3019, and the valve boxes are properly designed to support the secondary containment systems.

2.12.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vaults P-3/P-4 and N-71

The assessments of the secondary containment systems for Tank Vaults P-3/P-4 and N-71 are presented in the Design Demonstrations for Tanks P-3, P-4, and N-71. Those assessments conclude that the vaults are provided with a leak detection system.

East Area Building 3019

The secondary containment of each cell and tunnel is sloped to an 11-gauge (1/8″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 3019.

Valve Box-1A

The Valve Box-1A floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Valve Box No. 1

The Valve Box No. 1 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Outside Underground Piping

The doubly contained underground piping associated with this system is provided with a nitrogen-blanketed leak detection system.

The assessment concludes that the tank vaults, the east area of Building 3019, Valve Box-1A, Valve Box No. 1, and the doubly contained underground piping are provided with leak detection systems.

2.12.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vaults P-3/P-4 and N-71

The assessments of the secondary containment systems for Tank Vaults P-3/P-4 and N-71 are presented in the Design Demonstrations for Tanks P-3, P-4, and N-71. Those assessments conclude that the secondary containments are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

East Area Building 3019

The secondary containment of each cell and tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids resulting from leaks, spills, or precipitation.

Valve Box-1A

The Valve Box-1A floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve box to drain liquids to an instrumented location. A pumping system is provided to remove liquids resulting from leaks, spills, or precipitation.

Valve Box No. 1

The Valve Box No. 1 floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve box to drain liquids to an instrumented location. A pumping system is provided to remove liquids resulting from leaks, spills, or precipitation.

Outside Underground Piping

The doubly contained outside underground piping is sloped and provided with a valved nitrogen tap connection at the low point of the line. In the event of a leak, the nitrogen line would be disconnected and the liquid would be removed through the valved connection.

The assessment concludes that the tank vaults, the east area of Building 3019, Valve Box-1A, Valve Box No. 1, and the doubly contained underground piping are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.12.4 Supplemental Information

2.12.4.1 Ancillary Equipment

Tank P-3 is constructed of 347 SS, which is the same material to that used in the piping system, and is located in Tank Vault P-3/P-4, which provides secondary containment. The support equipment

is exposed to the same liquids as other components of the tank system; therefore, 347 SS is an acceptable material for the support equipment.

2.12.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System P-3.

2.12.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate-Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

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Energy Systems Drawing D-14161, Cell 5 Plan and Details, Dated 7/2/53 (No Revision No.).

Energy Systems Drawing D-11203, Cell 6 Piping Elevations "B-B" and "C-C", Dated 4/27/54 (No Revision No.).

Energy Systems Drawing D-11201, Cell 6 Process Piping Plans, Revision 1.

Energy Systems Drawing E-2354, Cell 6 and 7 Piping Lower Plan and Section D-D, Dated 5/1/47 (No Revision No.).

Energy Systems Drawing D-14165, Cell 6 and 7 Plan and Details, Revision 2.

Energy Systems Drawing D-14167, Cell 6 and 7 Sections and Details, Revision 2.

Energy Systems Drawing D-14168, Cell 6 and 7 Sections and Details, Revision 1.

Energy Systems Drawing D-14169, Cell 6 and 7 Sections and Details, Revision 1.

Energy Systems Drawing E-11731, Cell 7 Piping Flowsheet, Sheet 2, Revision 2.

Energy Systems Drawing D-17188, Drain Piping for Cell 6 and 7, Revision 1.

Energy Systems Drawing D-23534, Equipment Layout Cell 6 and 7 Lower Plan, Revision 3.

Energy Systems Drawing D-14534, Equipment Layout Make-Up Area Plan, Revision 3.

Energy Systems Drawing D-14535, Equipment Layout Make-Up Area Section A-A, Revision 2.

Energy Systems Drawing M-12229-CP-047-D, Equipment Layout Plan, Revision 1.

Energy Systems Drawing M-12229-CP-049-D, Equipment Layout Section, Dated 4/31/71 (No Revision No.).

Energy Systems Drawing E-55205, Isometric Piping SW Corner Cell 7, Dated 10/62 (No Revision No.).

Energy Systems Drawing D-10619, North and South Elevations, Revision E.

Energy Systems Drawing P3E-20013-C-013, Piping Details Double Contained Pipe, Revision 0.

Energy Systems Drawing P3E-20013-C-014, Piping Details Double Contained Pipe, Revision 0.

Energy Systems Drawing P3E-20013-C-011, Piping Plan Double Contained Pipe, Revision 0.

Energy Systems Drawing D-10615, Plot Plan, Revision E.

Energy Systems Drawing E-5393, Process Drain System Plan, Revision 3.

Energy Systems Drawing D-10667, Site Plan and Details, Revision B.

Energy Systems Drawing D-14185, Tank Supports Plan and Details, Revision 1.

Energy Systems Drawing H-20327-EG-075-E, Ventilation Flow Diagram, Revision 0.

Energy Systems Drawing D-40310, Waste Catch Tank, Dated 1/7/54 (No Revision No.).

Energy Systems Drawing D-40311, Waste Catch Tank Details, Dated 1/11/54 (No Revision No.).

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Energy Systems Drawing E3E20013D022, Cathodic Protection Plan, Revision 0.

Harco Technologies Corporation. August 1991. *Cathodic Protection System Upgrade Design Underground ILW Lines, VLV Box 1A to VLV Box 1, System No. 20. Oak Ridge National Laboratories, United States Department of Energy, Oak Ridge, Tennessee.* Martin Marietta Energy Systems, Inc.

Harco Technologies Corporation. June 1990. *Resurvey of the Cathodic Protection Systems, Oak Ridge National Laboratories, United States Department of Energy, Oak Ridge, Tennessee.* Martin Marietta Energy Systems, Inc.

Kenner, K., Ebasco. August 27, 1993. Record of Telephone Conversation with M. Peet, Martin Marietta Energy Systems, Inc. Re: Addition of leak detection and liquid removal system to Valve Box-1A.

LLLW Generator Survey 1990 for Building 3019.

Oak Ridge National Laboratory. 1984. *Final Safety Analysis Report for the Radiochemical Processing Plant (RPP).* ORNL/CF-81/37. Oak Ridge National Laboratory.

Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

R. M. Parsons Co. 1977. *National Disturbance Analysis of Buildings 7930 and 3019.* Document No. X-OE-23.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.12-1 Location of Tank System P-3 Piping

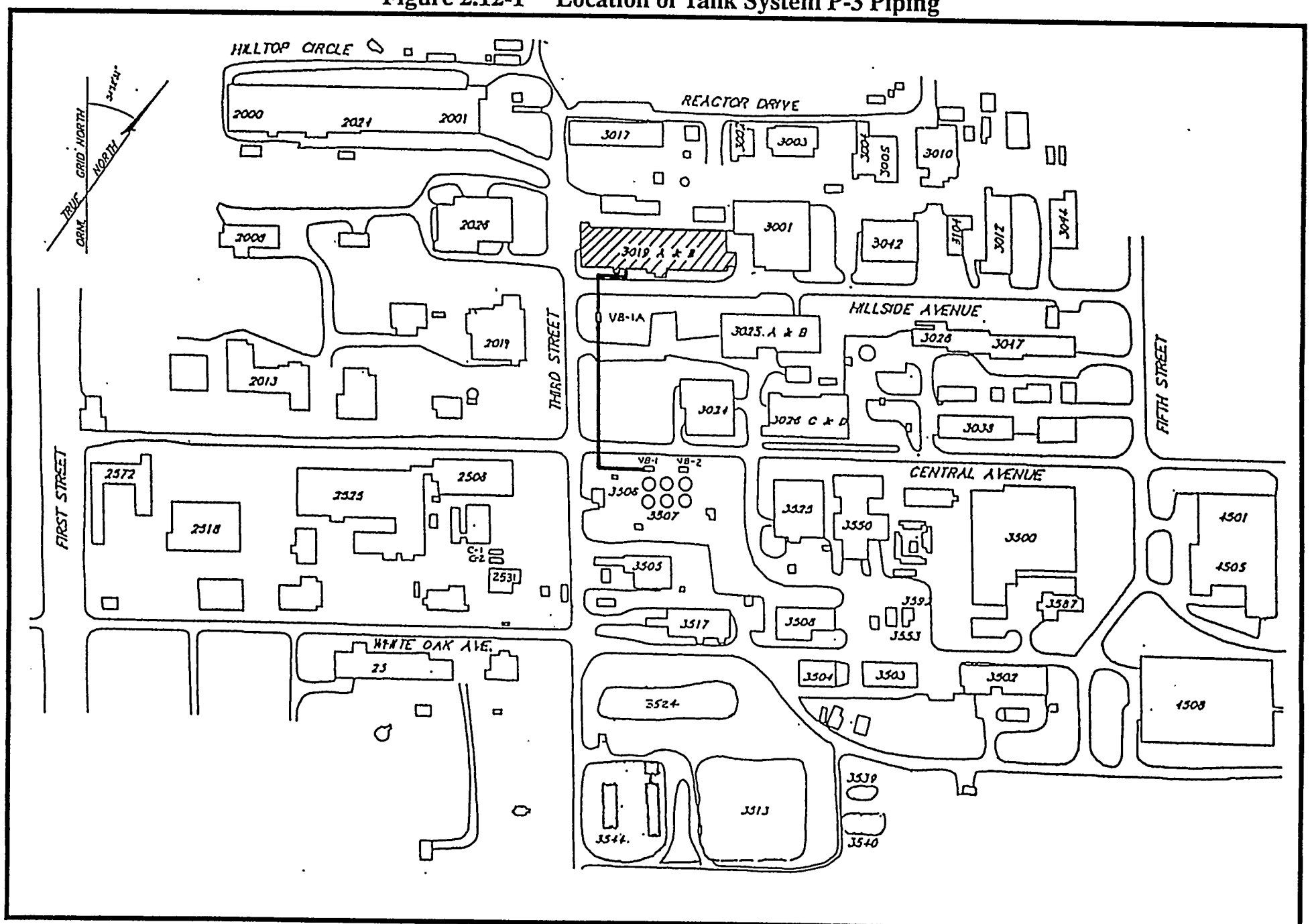
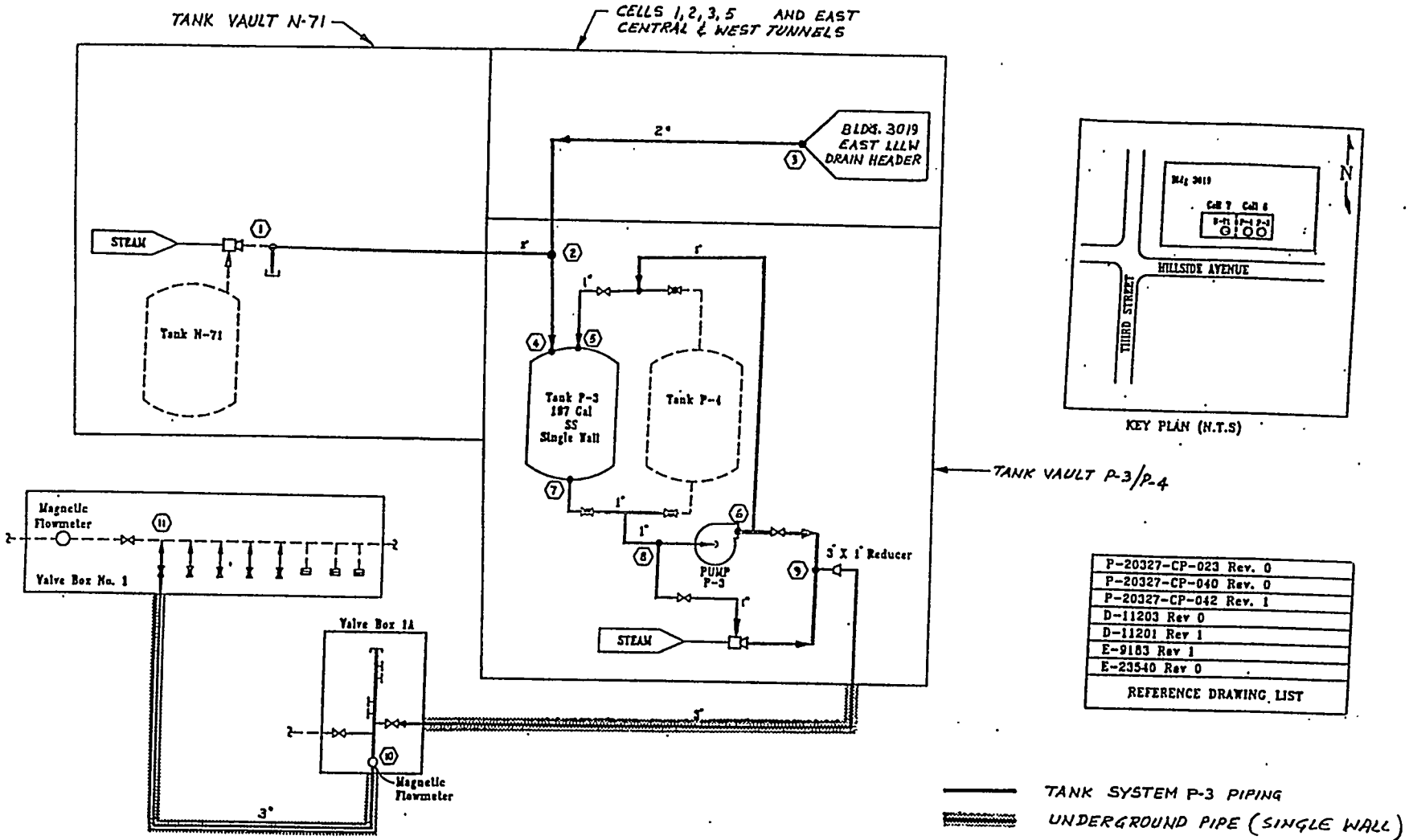


Figure 2.12-2 Tank System P-3 Piping Diagram



REFERENCE DRAWING LIST
P-20327-CP-023 Rev. 0
P-20327-CP-040 Rev. 0
P-20327-CP-042 Rev. 1
D-11203 Rev 0
D-11201 Rev 1
E-9183 Rev 1
E-23540 Rev 0

LINE SEGMENT	①-②	③-④	⑤-⑥	⑦-⑥	⑧-⑨	⑥-⑨	⑨-⑩	⑩-⑪
SIZE IN-DIA	2	2	1	1	1	1	3	3
SCHEDULE	40S	40S	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS	SS	SS
LENGTH (FT)	52	75	18	15	10	.25	290	436
VOLUME (GAL)	3	14	1	1	1	1	111	167

Figure 2.12-3
Analytical Data for Liquid (Tank System P-3)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	(b) Quantities
Sr–90	Trace
Cs–137	Trace
U–235	0.4 g/year
U–238	50.0 g/year
U–233	1.0 g/year
Th–232	100.0 g/year

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid	4.7 Kg/year

Ref. LLLW Survey 1990

2.13 Tank System P-4 Piping

2.13.1 Tank System Summary

Tank System P-4 is located at the Radiochemical Development Facility (Building 3019) at the main Bethel Valley Complex (Figures 2.13-1 and 2.13-2). The tank system piping is schedule 40S, ASME SA-240, type 347 stainless steel (SS) and is routed within Tank Vault P-3/P-4. The Tank System P-4 piping is used to transfer liquid low-level waste (LLLW) to and from Tank P-4 and is classified as a Federal Facility Agreement Category B tank system.

2.13.2 Standards for Pipe Assessment of the Tank System

2.13.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System P-4 piping is routed within Tank Vault P-3/P-4, which is located in Building 3019. The piping system is used and managed by the Chemical Technology Division and is part of the Bethel Valley LLLW system.

Tank System P-4 piping is constructed of 1″, 347 SS with a maximum design pressure and temperature of 150 psig and 125°F. Tank System P-4 piping has a maximum volume of 1 gal.

Design Standards

The applicable codes and standards used for Tank System P-4 piping and its associated secondary containment system are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

American Concrete Institute;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section II (SA-240);

American Society for Testing and Materials;

American Welding Society;

Atomic Energy Commission (AEC) General Design Criteria;

Concrete Reinforcing Steel Institute;

Instrument Society of America;

National Fire Protection Association;

National Plumbing Code; and

Underwriters Laboratories Inc.

2.13.2.2 Generic Description of Piping Content

Tank System P-4 piping is designed to serve as part of a radioactive LLLW laboratory transfer piping system for Building 3019. LLLW includes raffinates from extraction processes; overheads from evaporation processes; and liquids left after analyses, decontamination solutions, and bench-scale experimental processes. The wastes may also include a variety of laboratory-generated acids and bases, typically nitric and caustic.

The analytical data (Figure 2.13-3) of waste stream contamination from the generators are representative of waste transferred through the Tank System P-4 piping.

2.13.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault P-3/P-4 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.13.2.4 Documented Age of Tank System

Tank System P-4 piping was installed in 1954.

2.13.3 Standards for Containment/Release Detection

2.13.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System P-4 piping is single-wall, schedule 40S, type 347 SS that is routed within Tank Vault P-3/P-4. The area is discussed below.

Tank Vault P-3/P-4

The assessments of the secondary containment system for Tank Vault P-3/P-4 are presented in the Design Demonstrations for Tanks P-3 and P-4. Those assessments conclude that Tank Vault P-3/P-4 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.13.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault P-3/P-4

The assessments of the secondary containment system for Tank Vault P-3/P-4 are presented in the Design Demonstrations for Tanks P-3 and P-4. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

2.13.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault P-3/P-4

The assessments of the secondary containment system for Tank Vault P-3/P-4 are presented in the Design Demonstrations for Tanks P-3 and P-4. Those assessments conclude that the vault is provided with a leak detection system.

2.13.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault P-3/P-4

The assessments of the secondary containment system for Tank Vault P-3/P-4 are presented in the Design Demonstrations for Tanks P-3 and P-4. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.13.4 Supplemental Information

2.13.4.1 Ancillary Equipment

Tank P-4 is constructed of 347 SS, which is the same material as that used in the piping system, and is located in Tank Vault P-3/P-4, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 347 SS is an acceptable material for the support equipment.

2.13.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for

waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System P-4.

2.13.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate-Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. May 14, 1993. *Design Demonstrations—Category B Tank Systems*, Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing D-10616, Basement Plan, Revision C.

Energy Systems Drawing D-14161, Cell 5 Plan and Details, Dated 7/2/53 (No Revision No.).

Energy Systems Drawing D-11203, Cell 6 Piping Elevations "B-B" and "C-C", Dated 4/27/54 (No Revision No.).

Energy Systems Drawing D-11201, Cell 6 Process Piping Plans, Revision 1.

Energy Systems Drawing E-2354, Cell 6 and 7 Piping Lower Plan and Section D-D, Dated 5/1/47 (No Revision No.).

Energy Systems Drawing D-14165, Cell 6 and 7 Plan and Details, Revision 2.

Energy Systems Drawing D-14167, Cell 6 and 7 Sections and Details, Revision 2.

Energy Systems Drawing D-14168, Cell 6 and 7 Sections and Details, Revision 1.

Energy Systems Drawing D-14169, Cell 6 and 7 Sections and Details, Revision 1.

Energy Systems Drawing E-11731, Cell 7 Piping Flowsheet, Sheet 2, Revision 2.

Energy Systems Drawing D-17188, Drain Piping for Cell 6 and 7, Revision 1.

Energy Systems Drawing D-23534, Equipment Layout Cell 6 and 7 Lower Plan, Revision 3.

Energy Systems Drawing D-14534, Equipment Layout Make-Up Area Plan, Revision 3.

Energy Systems Drawing D-14535, Equipment Layout Make-Up Area Section A-A, Revision 2.

Energy Systems Drawing M-12229-CP-047-D, Equipment Layout Plan, Revision 1.

Energy Systems Drawing M-12229-CP-049-D, Equipment Layout Section, Dated 4/31/71 (No Revision No.).

Energy Systems Drawing E-55205, Isometric Piping SW Corner Cell 7, Dated 10/62 (No Revision No.).

Energy Systems Drawing D-10619, North and South Elevations, Revision E.

Energy Systems Drawing D-10615, Plot Plan, Revision E.

Energy Systems Drawing E-5393, Process Drain System Plan, Revision 3.

Energy Systems Drawing D-10667, Site Plan and Details, Revision B.

Energy Systems Drawing D-14185, Tank Supports Plan and Details, Revision 1.

Energy Systems Drawing H-20327-EG-075-E, Ventilation Flow Diagram, Revision 0.

Energy Systems Drawing D-40310, Waste Catch Tank, Dated 1/7/54 (No Revision No.).

Energy Systems Drawing D-40311, Waste Catch Tank Details, Dated 1/11/54 (No Revision No.).

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Oak Ridge National Laboratory. 1984. *Final Safety Analysis Report for the Radiochemical Processing Plant (RPP).* ORNL/CF-81/37. Oak Ridge National Laboratory.

Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

R. M. Parsons Co. 1977. *National Disturbance Analysis of Buildings 7930 and 3019.* Document No. X-OE-23.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.13-1 Location of Tank System P-4 Piping

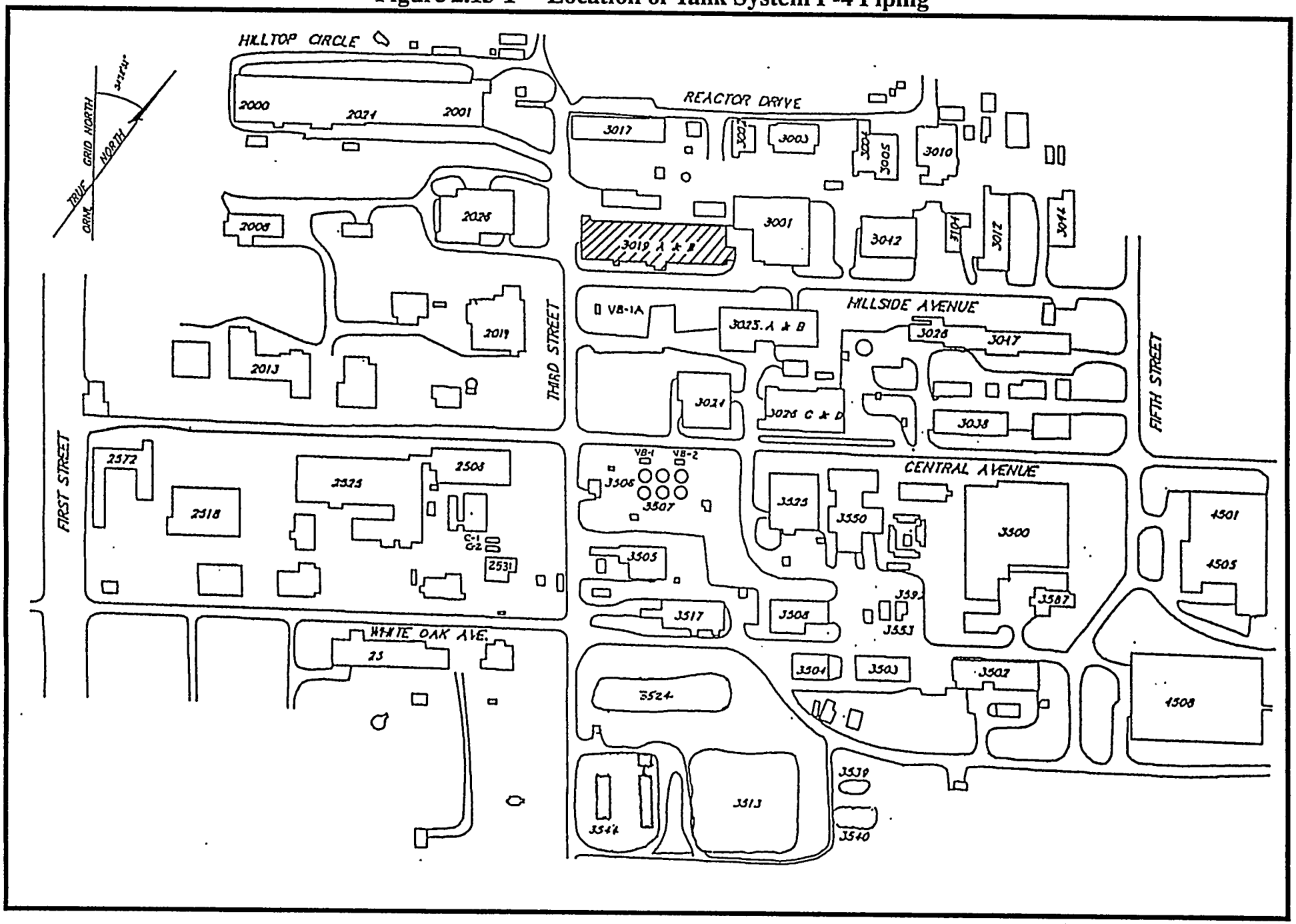
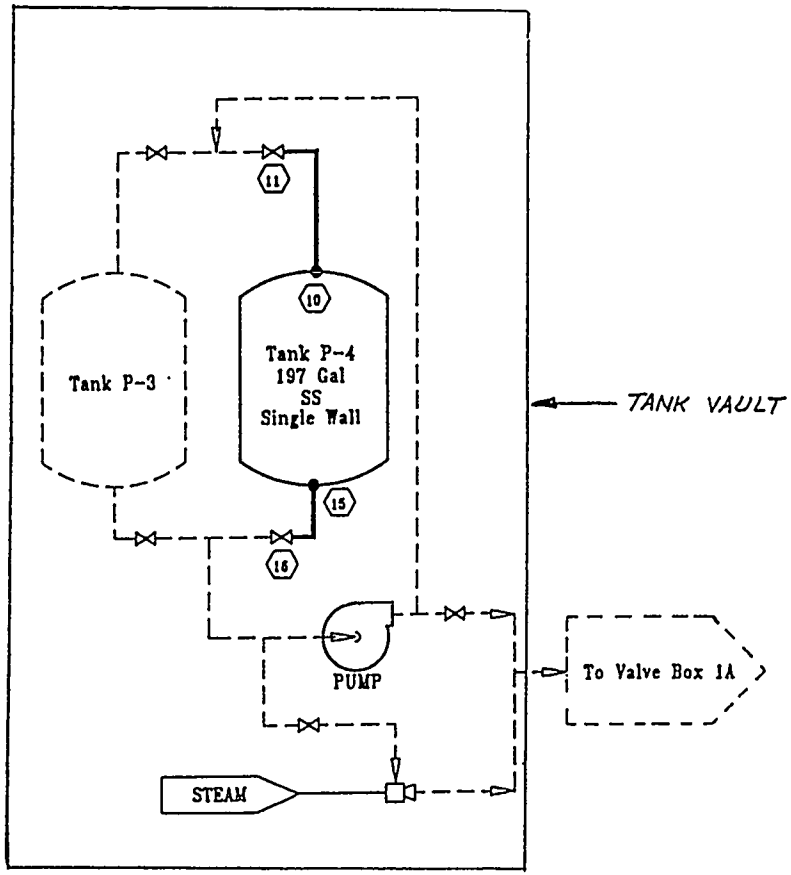
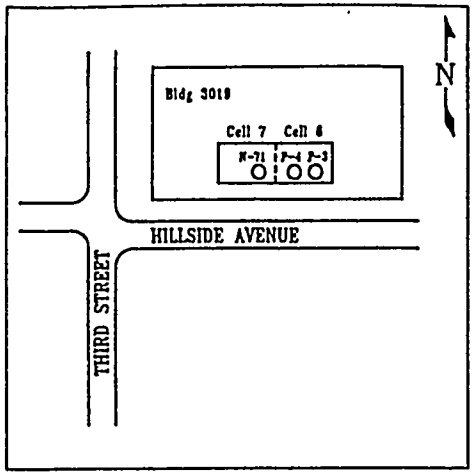


Figure 2.13-2 Tank System P-4 Piping Diagram





KEY PLAN (N.T.S)

REFERENCE DRAWING LIST
P-20327-CP-023 Rev. 0
P-20237-CP-040 Rev. 0
P-20327-CP-042 Rev. 1
D-11203 Rev 0
D-11201 Rev 1
E-9183 Rev 1
E-23540 Rev 0

LINE SEGMENT	10 - 11	15 - 16
SIZE IN-DIA	1	1
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	4	4
VOLUME (GAL)	<1	<1

TANK SYSTEM P-4 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.13-3
Analytical Data for Liquid (Tank System P-4)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	(b) Quantities
Sr–90	Trace
Cs–137	Trace
U–235	0.4 g/year
U–238	50.0 g/year
U–233	1.0 g/year
Th–232	100.0 g/year

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid	4.7 Kg/year

Ref. LLLW Survey 1990

2.14 Tank System T-13 Piping

2.14.1 Tank System Summary

Tank System T-13 is located in the New Hydrofracture Facility (NHF) at Building 7860 in the main Melton Valley Complex (Figures 2.14-1 and 2.14-2). The tank system piping is schedule 40, polyvinyl chloride (PVC) pipe and schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from Tank Vault T-13 to the Metering Pit and Mixing Cell of the NHF. An additional, singly contained, embedded pipe is routed from Tank Vault T-13 to several floor drains within Building 7860. Tank System T-13 piping is used to transfer liquid low-level waste (LLLW) concentrate from the Hydrofracture Facility Process Tanks and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.14.2 Standards for Pipe Assessment of Tank Systems

2.14.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System T-13 piping is located at Building 7860 and is routed from Tank Vault T-13 to the Metering Pit and Mixing Cell of the NHF. An additional, singly contained, embedded pipe is routed from Tank Vault T-13 to several floor drains within Building 7860. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System T-13 piping is constructed of 3″, schedule 40, PVC pipe and 2″, 3″, 4″, and 6″; schedule 40S; type 304L SS pipe with a maximum design pressure and temperature of 150 psig and 125°F. Tank System T-13 piping has a maximum volume of 151 gal.

Design Standards

The applicable codes and standards used for Tank System T-13 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

American Conference of Governmental Industrial Hygienists;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American National Standards Institute;

American Society for Testing and Materials A48, C91, C139, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240) and VIII;

American Standards Association Standard B31.1-1955, Code for Pressure Piping;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrument Society of America;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Nuclear Safety Information Center 65—Design, Construction, and Testing of High Efficiency Air Filtration Systems for Nuclear Applications;

Occupational Safety and Health Administration;

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) High Velocity Duct Construction Standards and Low Velocity Standards;

SMACNA Ducted Electric Heat Guide for Air Handling Systems; and

Unfired Pressure Vessels (1962 edition).

2.14.2.2 Generic Description of Piping Contents

Tank System T-13 piping is designed to serve as a waste piping system for the NHF and was previously used as a feed tank for LLLW to be used in the solidification process. The tank system is not presently used for programmatic waste; however, the tank system piping transfers groundwater.

2.14.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault T-13, the Metering Pit, and the Mixing Cell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.14.2.4 Documented Age of Tank System

Tank System T-13 piping was installed in 1979.

2.14.3 Standards for Containment/Release Detection

Tank System T-13 piping incorporates approximately 60′ of embedded piping that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.14.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System T-13 piping is single-wall, schedule 40 PVC and schedule 40S, type 304L SS that is routed from Tank Vault T-13 to the Metering Pit and Mixing Cell of the NHF. An additional, singly contained, embedded pipe is routed from Tank Vault T-13 to several floor drains within Building 7860. The areas of secondary containment are discussed below.

Tank Vault T-13

The assessment of the secondary containment system for Tank Vault T-13 is presented in the Design Demonstrations for Tank T-13. That assessment concludes that Tank Vault T-13 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Metering Pit

The bottom of the Metering Pit is lined with 11-gauge (1/8″), 304L SS, with sidewalls that project 2′3″ up the Metering Pit. The Metering Pit walls above the SS liner are provided with a three-coat system of Amercoat 99 epoxy. The SS lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the Metering Pit's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Mixing Cell

The bottom of the Mixing Cell is lined with 11-gauge (1/8″), 304L SS, with sidewalls that project 2′3″ up the Mixing Cell. The Mixing Cell walls above the SS liner are provided with a three-coat system of Amercoat 99 epoxy. The SS lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the Mixing Cell's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault, Metering Pit, and Mixing Cell are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.14.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault T-13

The assessment of the secondary containment system for Tank Vault T-13 is presented in the Design Demonstrations for Tank T-13. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Metering Pit

The Metering Pit foundation is a 20′0″ × 12′0″ × 1′4″ thick, reinforced concrete base slab that rests on 4″ of crushed stone on top of limestone.

Mixing Cell

The Mixing Cell foundation is a 23′0″ × 18′0″ × 1′4″ thick, reinforced concrete base slab that rests on 4″ of crushed stone on top of limestone.

The assessment concludes that the tank vault, Metering Pit, and Mixing Cell foundations are properly designed to support the secondary containment systems.

2.14.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault T-13

The assessment of the secondary containment system for Tank Vault T-13 is presented in the Design Demonstrations for Tank T-13. That assessment concludes that the vault is provided with a leak detection system.

Metering Pit

The Metering Pit floor is sloped to a 6″, schedule 40S 304L SS floor drain pipe that is gravity fed into the Tank Vault T-13 sump. The tank vault sump is provided with a leak detection system.

Mixing Cell

The Mixing Cell floor is sloped to a 6″, schedule 40S, type 304L SS floor drain pipe that is gravity fed directly into Tank T-13. The assessment of the secondary containment system for Tank T-13 concludes that Tank T-13 is provided with a tank level monitor.

The assessment concludes that the tank vault, Metering Pit, and Mixing Cell are provided with leak detection.

2.14.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault T-13

The assessment of the secondary containment system for Tank Vault T-13 is presented in the Design Demonstrations for Tank T-13. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Metering Pit

The Metering Pit floor is sloped to a 6″, schedule 40S, type 304L SS floor drain pipe that is gravity fed into the Tank Vault T-13 sump. The sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Mixing Cell

The Mixing Cell floor is sloped to a 6″, schedule 40S, type 304L SS floor drain pipe that is gravity fed directly into Tank T-13. The tank provides a low point to drain liquids to an instrumented location.

The assessment concludes that the secondary containments for the tank vault, Metering Pit, and Mixing Cell are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.14.4 Supplemental Information

2.14.4.1 Ancillary Equipment

Tank T-13 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault T-13, which provides secondary containment. The pumps associated with the Tank System T-13 piping are constructed of 304L SS, which is the same material as that used in Tank T-13 and the piping system, and are located in Tank Vault T-13, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.14.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System T-13.

2.14.5 References

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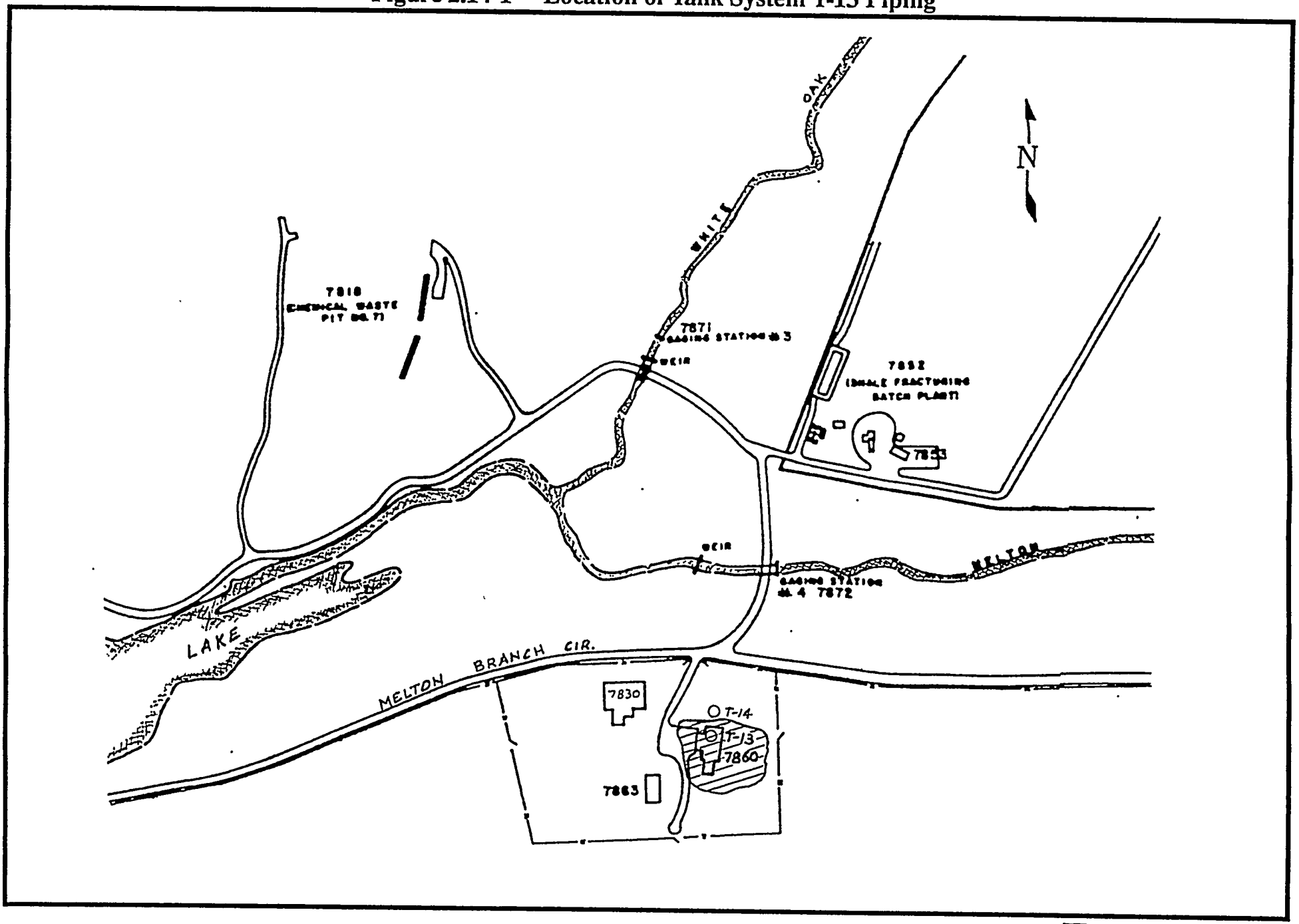
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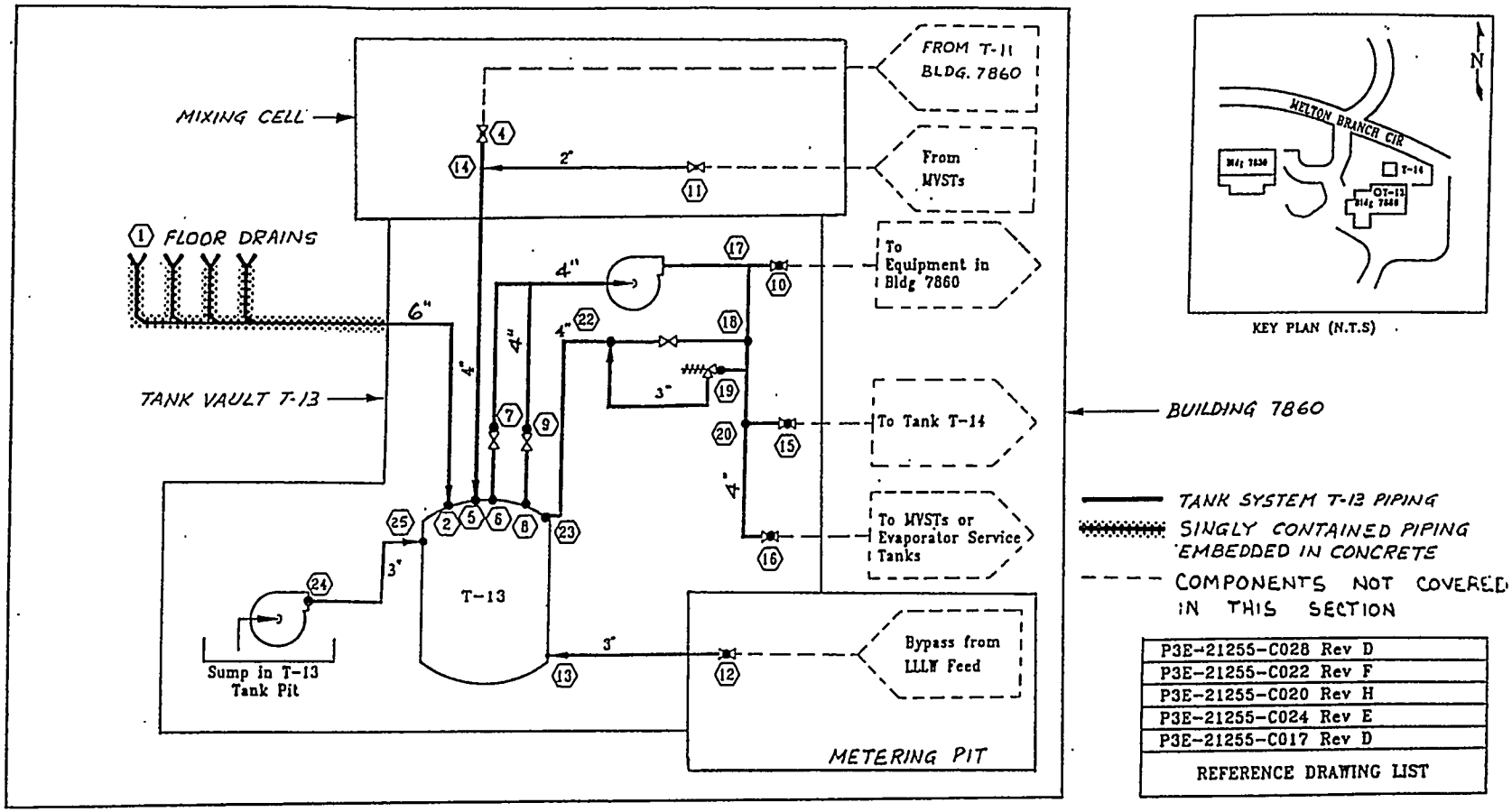
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Figure 2.14-1 Location of Tank System T-13 Piping



EBASCO/MAIN

Figure 2.14-2 Tank System T-13 Piping Diagram



REFERENCE DRAWING LIST
P3E-21255-C028 Rev D
P3E-21255-C022 Rev F
P3E-21255-C020 Rev H
P3E-21255-C024 Rev E
P3E-21255-C017 Rev D

LINE SEGMENT	1-2	4-5	6-7	8-9	7-10	11-14	12-13	17-16	19-22	18-22	22-23	24-25
SIZE IN-DIA	6	4	4	4	4	2	3	4	3	4	4	3
SCHEDULE	40S	40S	40S	40S	40S	40S	40S	40S	40S	40S	40S	40
MATERIAL	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	PVC
LENGTH (FT)	64	21	4	4	12	10	18	4	2	1	7	27
VOLUME (GAL)	96	14	2	2	8	2	7	3	1	1	5	10

2.15 Tank System WC-20 Piping

Based on the findings of the Design Demonstrations for the Remaining 19 Category B Tank System, (DOE/OR/03-1150 & D2), Tank System WC-20, originally designated as Category B, has been redesignated as Category C by FFA Modification Request Change Control Number FFA-PM/93-008, June 23, 1994. However, this section of the original Design Demonstrations has been retained for reference.

2.15.1 Tank System Summary

Tank System WC-20 is located near the Melton Valley Storage Tank Facility (Building 7569) (Figures 2.15-1 and 2.15-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS). The piping is routed underground from Melton Valley Collection and Transfer (MVCT) Box No. 1 to Tank Vault WC-20 and continues underground from Tank Vault WC-20 to the Building 7567 Pump House. From the pump house, the piping is routed underground to the South Parking Lot Valve Box (also known as the Incinerator Drive Valve Box) at Bethel Valley (Figure 2.15-3). Tank System WC-20 piping is used to transfer liquid low-level waste (LLLW) to and from Tank WC-20 and is classified as a Federal Facility Agreement Category B tank system.

2.15.2 Standards for Pipe Assessment of Tank Systems

2.15.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System WC-20 piping is located near Building 7569 and is routed underground from MVCT Box No. 1 to Tank Vault WC-20. The piping continues underground from Tank Vault WC-20 to the Building 7567 Pump House. From the pump house, the piping is routed underground to the South Parking Lot Valve Box. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System WC-20 piping is constructed of 2″ and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 300°F. Tank System WC-20 piping has the capacity to contain a maximum volume of 704 gal.

Design Standards

The applicable codes and standards used for Tank System WC-20 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Conference of Governmental Industrial Hygienists;

American National Standards Institute;

American Society for Testing and Materials A48, A262-70, C91, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrument Society of America;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Nuclear Safety Information Center 65—Design, Construction, and Testing of High Efficiency Air Filtration Systems for Nuclear Applications;

Occupational Safety and Health Administration;

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) High Velocity Duct Construction Standards and Low Velocity Standards;

SMACNA Ducted Electric Heat Guide for Air Handling Systems;

UCC-ND Engineering Standards;

UCC-ND General Design Criteria, Y-EF-53;

UCC-ND Technical Specifications;

Underwriters Laboratories Inc.; and

Union Carbide Corporation Nuclear Division (UCC-ND) Standards, Sections 303, 401, 411, 702, and 924.04.

2.15.2.2 Generic Description of Piping Contents

Tank System WC-20 is designed to transfer LLLW generated at Buildings 7920 and 7930 to Tank WC-20. LLLW is produced from radiochemical operations designed to recover isotopes produced from irradiated High Flux Isotope Reactor targets and other sources. These wastes may include a variety of dilute acids, bases, and organics. The tank may contain radioactive materials from the Radiochemical Engineering Development Center, which is the main contributor of transuranic radionuclides in the LLLW system. The analytical data (Figure 2.15-4) of waste stream contaminants from the generators are representative of waste transferred through Tank System WC-20 piping.

2.15.2.3 Pipe Corrosion Protection Measures

Piping inside MVCT Box No. 1, Tank Vault WC-20, the Building 7567 Pump House, and the South Parking Lot Valve Box has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The outside underground piping for Tank System WC-20 is made up of two cathodically protected systems of piping.

The first system is between the Building 7567 Pump House and the South Parking Lot Valve Box. The piping is included in the Facility Manager's Cathodic Protection System No. 6B. The galvanic anode cathodic protection system consists of magnesium anodes, test stations, and connection wire as shown on cathodic protection drawings C-20013-EA-007 and C-20013-EA-013 through C-20013-EA-018. The system was installed in May 1972.

The system as shown on the construction drawings reviewed is not considered to be adequate because there are no indications of electrical isolation devices being required at the ends of the buried piping on any of the construction drawings that were reviewed. Harco Technologies determined that insulating gaskets were not present during its 1990 surveys, and the cathodic protection field testing performed in 1991 indicate that 39% of the piping is not receiving adequate corrosion control. This

is due primarily to the piping being electrically shorted and in part to depleted anode beds. In 1991, Harco completed the engineering design to upgrade the existing system.

The second system is between the Building 7567 Pump House and MVCT Box No. 1. The piping is included in the Facility Manager's Cathodic Protection System No. 17. The system consists of magnesium anodes, test stations, and connecting wire as shown on drawing E-20854-ED-003. The system was installed in June 1976. Insulating flanges were called for on the drawings reviewed. The design of the cathodic protection system as shown on the construction drawings is considered to be adequate.

The cathodic protection test report and survey performed in 1990 and 1991 indicate that the entire line is effectively protected except in the immediate vicinity of Tank WC-20. This may be due to a shorted connection or the concrete footing contacting the pipe.

2.15.2.4 Documented Age of Tank System

Part of Tank System WC-20 piping was originally installed in 1972. The remaining part of the piping was installed in 1976.

2.15.3 Standards for Containment/Release Detection

Tank System WC-20 piping incorporates approximately 3801′ of outside underground piping that is singly contained and approximately 205′ of outside underground piping that is doubly contained. The singly contained area is omitted from discussion in the following sections that address secondary containment.

2.15.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System WC-20 piping is single-wall, schedule 40S, type 304L SS with a section of piping that is double wall. The jacket of the double-wall piping is schedule 10S, type 304L SS. The piping is routed underground from MVCT Box No. 1 to Tank Vault WC-20. The piping continues underground from Tank Vault WC-20 to the Building 7567 Pump House. From the pump house, the piping is routed underground to the South Parking Lot Valve Box. Each area is discussed below.

Outside Underground Piping

The piping routed underground from MVCT Box No. 1 to Tank Vault WC-20 is doubly contained. The jacket of the outside underground, double-wall pipe is 304L SS. The secondary containment material is compatible with the waste.

MVCT Box No. 1

The bottom of MVCT Box No. 1 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used for the piping, with sidewalls that project 4′3″ up the valve box. The valve box walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS valve box lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve box's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault WC-20

The assessment of the secondary containment system for Tank Vault WC-20 is presented in the Design Demonstrations for Tank WC-20. That assessment concludes that Tank Vault WC-20 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Building 7567 Pump House

The bottom and sidewalls of the pump house, up 5′0″ from the bottom are lined with 11-gauge (1/8″), 304L SS, which is the same material as that used for the piping. The SS lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

South Parking Lot Valve Box

The South Parking Lot Valve Box is not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the MVCT Box No. 1, Tank Vault WC-20, and Building 7567 Pump House are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. The assessment concludes that the jacket of the underground piping is compatible with the waste. The South Parking Lot Valve Box, however, is not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.15.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

MVCT Box No. 1

The MVCT Box No. 1 foundation is a 4′0″ × 4′0″ × 1′0″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault WC-20

The assessment of the secondary containment system for Tank Vault WC-20 is presented in the Design Demonstrations for Tank WC-20. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Building 7567 Pump House

The Building 7567 Pump House foundation is a 9′3″ × 8′4″ × 1′0″ thick, reinforced concrete base slab that rests on limestone.

South Parking Lot Valve Box

The valve box foundation is a 5′0″ × 5′0″ × 1′0″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the valve boxes, tank vault, and pump house foundations are properly designed to support the secondary containment systems.

2.15.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Outside Underground Piping

The doubly contained underground piping associated with this system is provided with a nitrogen-blanketed leak detection system.

MVCT Box No. 1

A leak detection system for MVCT Box No. 1 could not be identified in the design drawings or construction specifications.

Tank Vault WC-20

The assessment of the secondary containment system for Tank Vault WC-20 is presented in the Design Demonstrations for Tank WC-20. That assessment concludes that the vault is provided with a leak detection system.

Building 7567 Pump House

The Building 7567 Pump House floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump. Accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

South Parking Lot Valve Box

A leak detection system for the South Parking Lot Valve Box could not be identified from the design drawings or construction specifications.

The assessment concludes that the underground piping, tank vault, and pump house, are provided with leak detection, but that MVCT Box No. 1 and the South Parking Lot Valve Box do not have leak detection systems.

2.15.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Outside Underground Piping

The doubly contained outside underground piping is sloped and provided with 1/2″ drain test connections to remove liquids resulting from leaks.

MVCT Box No. 1

The MVCT Box No. 1 floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve box to drain liquids. A pumping system is not provided to remove liquids that accumulate in the sump.

Tank Vault WC-20

The assessment of the secondary containment system for Tank Vault WC-20 is presented in the Design Demonstrations for Tank WC-20. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Building 7567 Pump House

The pump house floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pump house to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

South Parking Lot Valve Box

The valve box floor is sloped to a sump. The sump provides a low point within the valve box to drain liquids. A pumping system is not provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containments for the underground piping, tank vault, and pump house are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. MVCT Box No. 1 and the South Parking Lot Valve Box are sloped and designed to drain liquids. Pumping systems are not provided to remove liquids that accumulate in the sumps.

2.15.4 Supplemental Information

2.15.4.1 Ancillary Equipment

Tank WC-20 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault WC-20, which provides secondary containment. The pumps associated with Tank System WC-20 are constructed of 304L SS, which is the same material as that used in the tank and piping system, and are located in the pump house, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.15.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System WC-20.

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Figure 2.15-1
Location of Tank System WC-20 Piping, Sheet 1

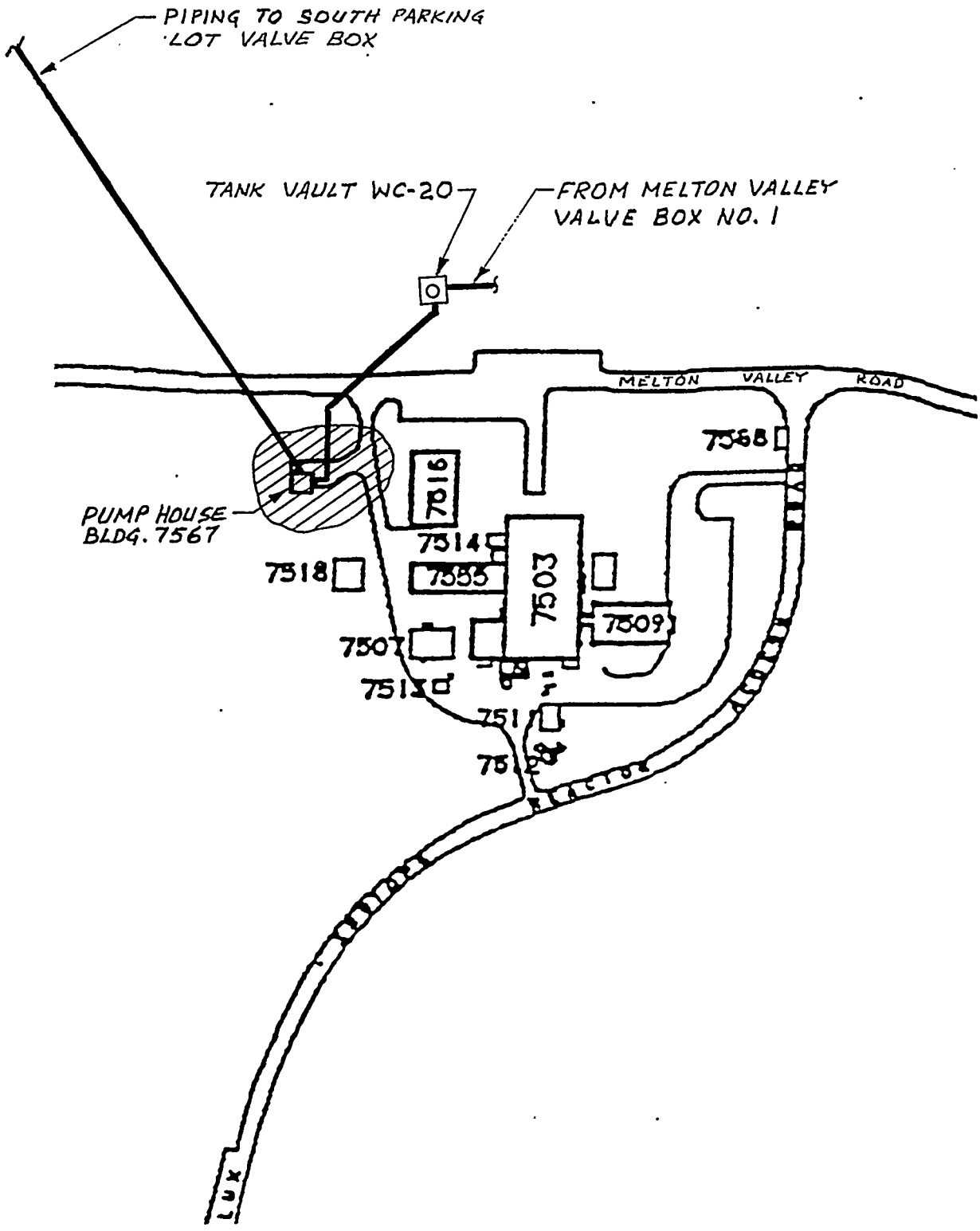


Figure 2.15-2
Location of Tank System WC-20 Piping, Sheet 2

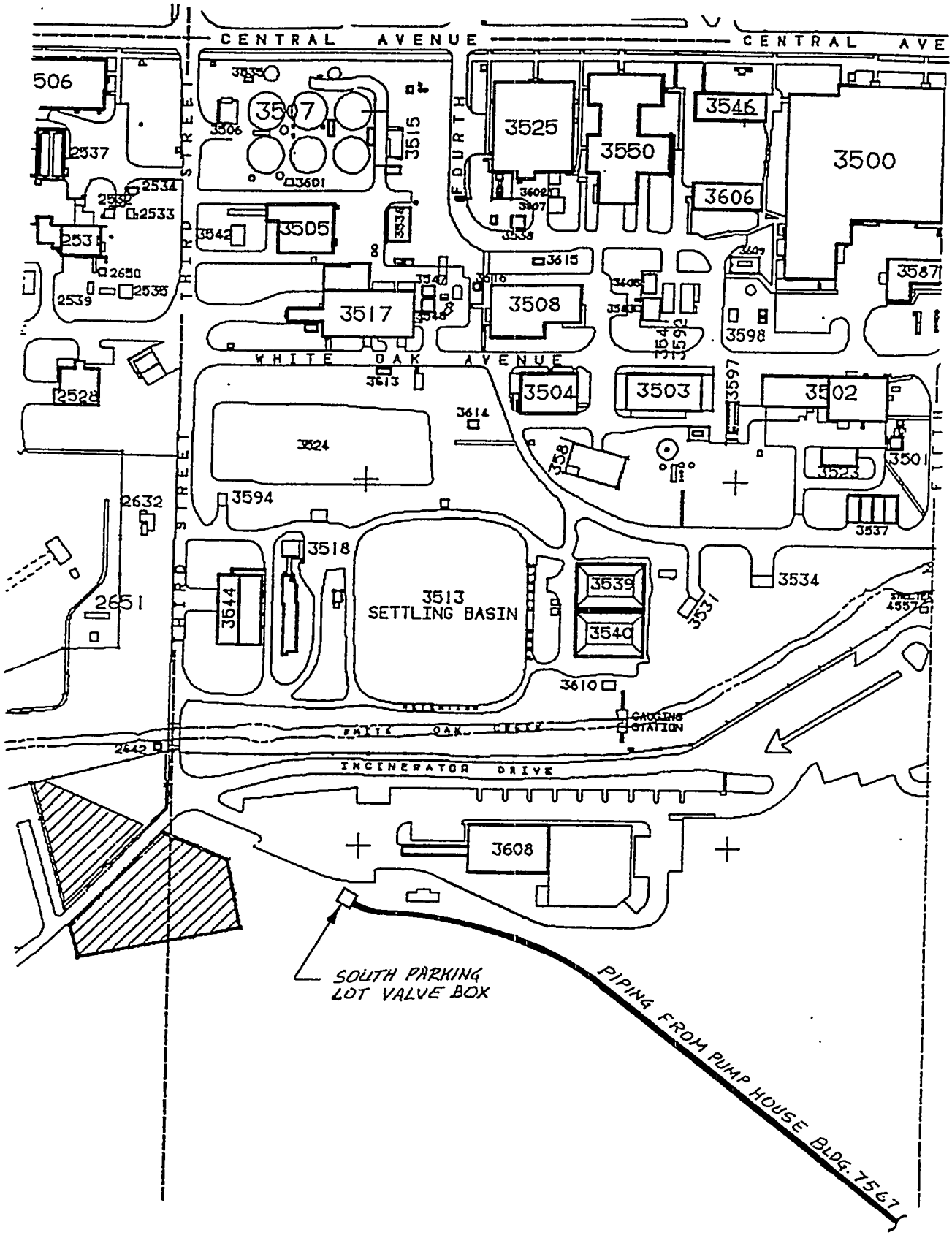
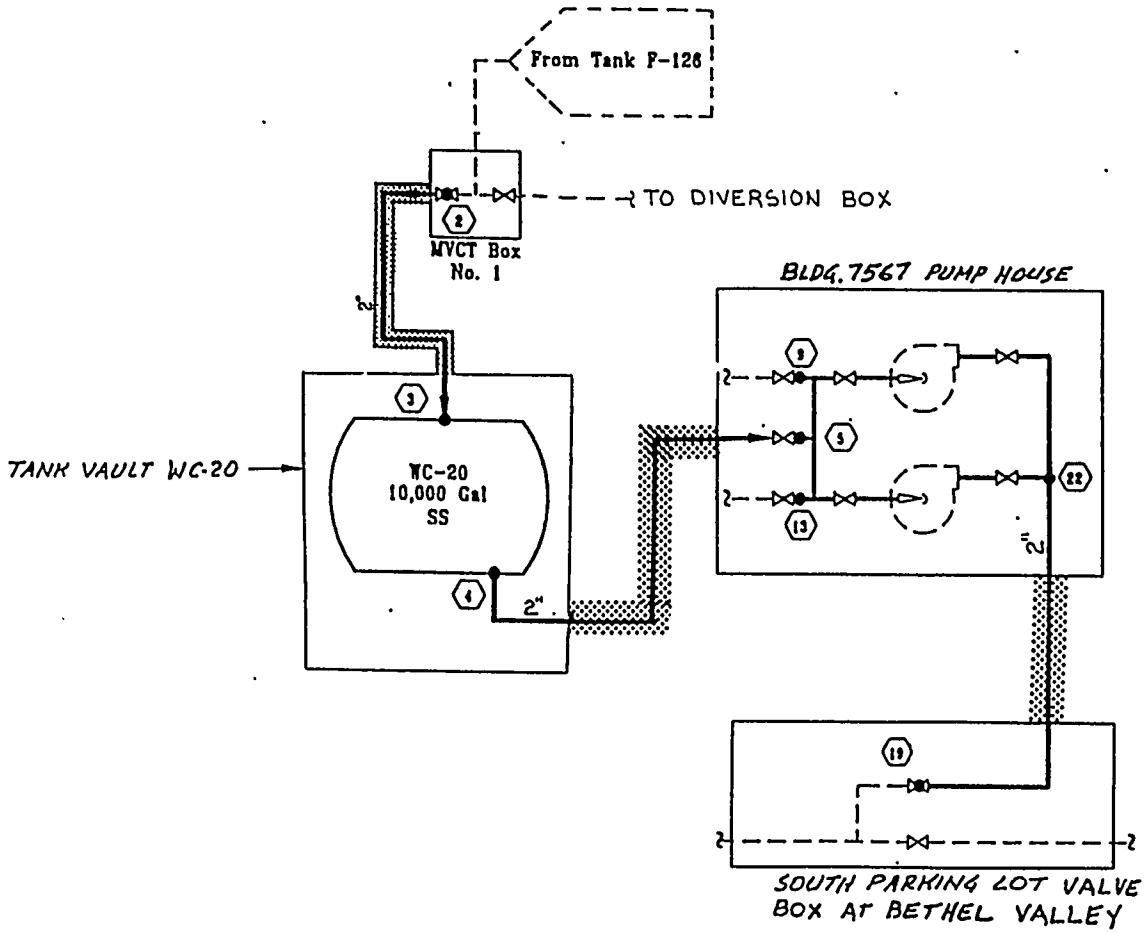
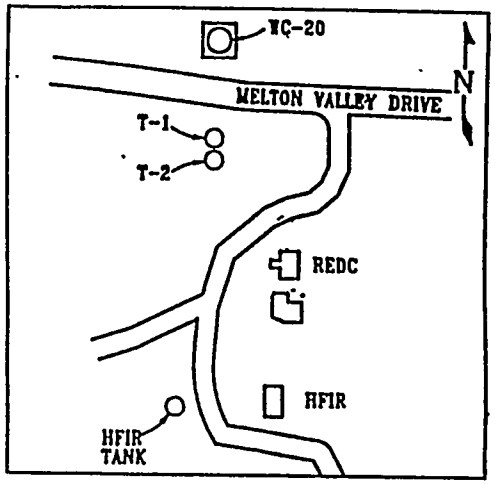


Figure 2.15-3 Tank Syst. WC-20 Piping Diagram





KEY PLAN (N.T.S)

REFERENCE DRAWING LIST
H&R-Section 2.1-Sheet 10 Rev 1
H&R-Section 2.1-Sheet 14 Rev 1
H&R-Section 2.1-Sheet 14A Rev 1
C-20013-EA-013D thru-018D Rev0
C-20013-EA-007D Rev 0
E3E20002D450 Rev 0
E3E20002D452 Rev 0
E3E20002D455 Rev 0
C-20854-YA-003-E Rev H
P-20854-YC-002-E Rev C
P3E020013SK04 Rev 0

LINE SEGMENT	② - ③	④ - ⑤	⑨ - ㉒	⑬ - ㉒	㉒ - ⑲
SIZE IN-DIA	2	2	2	4	2
SCHEDULE	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS
LENGTH (FT)	205	280	16	19	3521
VOLUME (GAL)	36	49	3	3	613

TANK SYSTEM WC-20 PIPING

DOUBLY CONTAINED UNDERGROUND PIPING

SINGLY CONTAINED UNDERGROUND PIPING

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.15-4
Analytical Data for Liquid (Tank System WC-20)

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	(b) Quantities
Cm–244,245,246,247	Trace
Cf–250,251,252	Trace
Sr–90	Trace
Tc–99	Trace
Cs–137	Trace
Am–241,242,243	Trace

(b) Others (i.e. acids, bases, organics, cleaners, etc.)

sodium nitrate	Trace
nitric acid	Trace
sodium hydroxide	Trace
potassium iodide	Trace
ferrous chloride	Trace
ferrous sulfate	Trace
thenoyltrifluoroacetone (TTA)	Trace

Ref. LLLW Survey 1990

2.16 Tank System W-21 Piping

2.16.1 Tank System Summary

Tank System W-21 is located near the Evaporator Building 2531 and near the center of the main Bethel Valley Complex (Figures 2.16-1 and 2.16-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from Tank Vault W-21/W-22 to the Control House Pump Pit and Valve Box No. 3. Tank System W-21 piping is used to transfer concentrate for the Evaporator and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.16.2 Standards for Pipe Assessment of Tank Systems

2.16.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-21 piping is located near the Evaporator Building 2531 and is routed from Tank Vault W-21/W-22 to the Control House Pump Pit and Valve Box No. 3. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-21 piping is constructed of 2″ and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 300°F. Tank System W-21 piping has the capacity to contain a maximum volume of 91 gal.

Design Standards

The applicable codes and standards used for Tank System W-21 piping and its associated secondary containment system are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Conference of Governmental Industrial Hygienists;

American National Standards Institute;

American Society for Testing and Materials A48, A262-70, C91, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Nuclear Safety Information Center 65—Design, Construction, and Testing of High Efficiency Air Filtration Systems for Nuclear Applications;

Occupational Safety and Health Administration;

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) High Velocity Duct Construction Standards and Low Velocity Standards;

SMACNA Ducted Electric Heat Guide for Air Handling Systems;

UCC-ND Engineering Standards;

UCC-ND General Design Criteria, Y-EF-53;

UCC-ND Technical Specifications;

Underwriters Laboratories Inc.; and

Union Carbide Corporation Nuclear Division (UCC-ND) Standards, Sections 303, 401, 411, 702, and 914.04.

2.16.2.2 Generic Description of Piping Contents

Tank System W-21 piping is designed to serve Tank W-21, which is designed as an evaporator feed tank. Because of a general lack of storage capacity in the Melton Valley Tank Farm Complex, Tank W-21 has also been used as a Process Waste Treatment Plant concentrate storage tank and as a liquid low-level waste (LLLW) concentrate storage tank. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL), including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the Evaporator Feed Tank W-22 (and formerly Tank W-21). Any waste found to be acidic is adjusted to basic with sodium hydroxide in the generator collection tanks or in the evaporator feed tank. This Ph adjustment causes most of the transuranic waste components and heavy metals to precipitate out of solution.

The liquid waste supernate is single phase and ranges in color from pale to deep yellow with sodium/potassium nitrate salt solutions. The principal metals found in the sludges are sodium, potassium, calcium, magnesium, uranium, and thorium. The sludge contains radioactive materials that produce radiation levels of 1.0–1.5 rem per hour (R/h) (Figure 2.16-3).

The analytical data (Figure 2.16-4) of waste samples are representative of the waste received by Tank W-21; however, the composition of the waste in the Tank W-21 system may vary depending upon the experiments conducted by the waste generators.

2.16.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault W-21/W-22, the Control House Pump Pit, and Valve Box No. 3 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.16.2.4 Documented Age of Tank System

Tank System W-21 piping was installed in 1980.

2.16.3 Standards for Containment/Release Detection

2.16.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-21 piping is single-wall, schedule 40S, type 304L SS that is routed between Tank Vault W-21/W-22, the Control House Pump Pit, and Valve Box No. 3. Each area is discussed below. The piping penetrations from Tank Vault W-21/W-22 to the Control House Pump Pit and

Valve Box No. 3 are singly contained, schedule 40S, type 304L SS pipes that are embedded in the concrete wall at varying lengths.

Tank Vault W-21/W-22

The assessments of the secondary containment system for Tank Vault W-21/W-22 are presented in the Design Demonstrations for Tanks W-21 and W-22. Those assessments conclude that Tank Vault W-21/W-22 is coated and lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Control House Pump Pit

The bottom of the pump pit is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used for the piping, with sidewalls that project 3′0″ up the pump pit. The pump pit walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS pump pit lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the pump pit's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box No. 3

The bottom of Valve Box No. 3 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used for the piping, with sidewalls that project 4′3″ up the valve box. The valve box walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS valve box lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve box's epoxy coating is also compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vault, pump pit, and valve box are coated and lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.16.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault W-21/W-22

The assessments of the secondary containment system for Tank Vault W-21/W-22 are presented in the Design Demonstrations for Tanks W-21 and W-22. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

Control House Pump Pit

The pump pit foundation is a 21′0″ × 40′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

Valve Box No. 3

The valve box foundation is an 8′6″ × 11′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the tank vault, pump pit, and valve box foundations are properly designed to provide support to the secondary containment systems.

2.16.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault W-21/W-22

The assessments of the secondary containment system for Tank Vault W-21/W-22 are presented in the Design Demonstrations for Tanks W-21 and W-22. Those assessments conclude that the vault is provided with a leak detection system.

Control House Pump Pit

The pump pit floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Valve Box No. 3

The Valve Box No. 3 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid is transferred via a gravity fed drain line to a 304L SS-lined sump in Tank Vault-W-21/W-22. Accumulation of liquid in the tank vault sump will be detected by a level sensor that will activate alarms in the Evaporator Control Room and Waste Operations Control Center (Building 3130).

The assessment concludes that the tank vault, pump pit, and valve box are provided with leak detection.

2.16.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault W-21/W-22

The assessments of the secondary containment system for Tank Vault W-21/W-22 are presented in the Design Demonstrations for Tanks W-21 and W-22. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Control House Pump Pit

The pump pit floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pump pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Box No. 3

The valve box floor is sloped to a 304L SS-lined sump. Liquid that flows to the valve box sump will continue to flow to the Tank Vault W-21/W-22 sump through a sump drain pipe. The tank vault sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containments for the tank vault, pump pit, and valve box are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.16.4 Supplemental Information

2.16.4.1 Ancillary Equipment

Tank W-21 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-21/W-22, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.16.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste

generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-21.

2.16.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate-Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. July 20, 1992. *Design Demonstrations—Category B Tank Systems*, Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing I-202-YE-105-E, Evaporator Service Tanks Instrument Flow Diagram, Title I Issue, Revision 3.

Energy Systems Drawing P-20237-YE-079-E, Evaporator Service Tanks Piping Flow Diagram, Process, Revision 3.

Energy Systems Drawing P-20237-YC-029-E, Evaporator Service Tanks Piping Sections and Details, Tanks W-21, W-22, and W-23, Revision 3.

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Energy Systems Drawing P-20237-YC-028-E, Evaporator Services Tanks Plan Piping Tanks W-21, W-22, and W-23, Revision 3.

Energy Systems Drawing S-20237-YB-019-E, Evaporator Service Tanks Section and Details of Concrete Vault, Revision 2.

Energy Systems Drawing P-20237-YC-031-E, Evaporator Service Tanks Tank Piping Sections and Details, Sheet 2, Tanks W-21, W-22 and W-23, Revision 2.

Energy Systems Drawing P-20237-YC-032-E, Evaporator Service Tanks Tank Piping Section and Details, Sheet 3, Revision 2.

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Samborn, Steketee, Otis and Evans, Inc. July 1975. *Intermediate-Level Waste Management Facilities Design Calculations (Sheets 1 to 69) Tanks W-21 Through W-31.* Prepared by Samborn, Steketee, Otis and Evans, Inc., Toledo, Ohio, for Oak Ridge National Laboratory.

Samborn, Steketee, Otis and Evans, Inc. July 1975. *Intermediate-Level Waste Management Facilities Title I Report (Books 1 and 2). Holifield National Laboratory, Oak Ridge, Tennessee.* Prepared by Samborn, Steketee, Otis and Evans, Inc., Toledo, Ohio, for Oak Ridge National Laboratory.

Samborn, Steketee, Otis and Evans, Inc. December 1975. *Special Design Calculations Tank Freezing Analysis, Solvent-Flammability Hazard, Nitrogen Purge, Thermal Pipe Stresses in Vault, Seismic Analysis Tornado Loading Analysis.* Prepared by Samborn, Steketee, Otis and Evans, Inc., Toledo, Ohio, for Oak Ridge National Laboratory.

Sears, M. B., et al. 1990. *Sampling an Analysis of Radioactive Liquid Wastes and Sludges in the Melton Valley and Evaporator Facility Storage Tanks at ORNL.* ORNL/TM-11652. Oak Ridge National Laboratory.

Specifications for Construction of Intermediate-Level Waste Facilities for the Energy Research and Development Administration. Invitation No. EY-77-B-05-5350.

Technical Specifications for the Construction of Improvements to Radioactive Liquid Waste System, Phase I, Building 2531.

Figure 2.16-1
Location of Tank System W-21 Piping

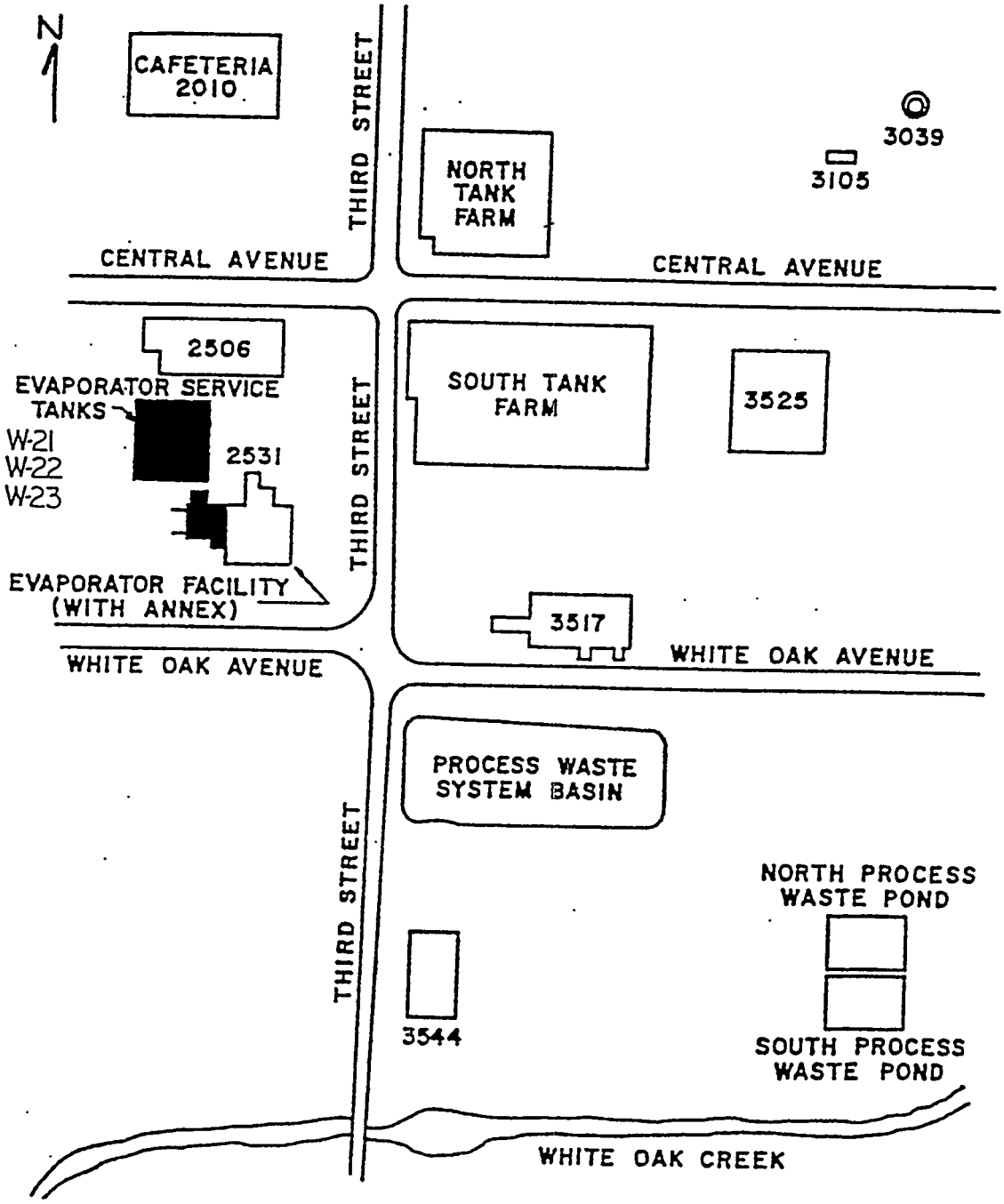
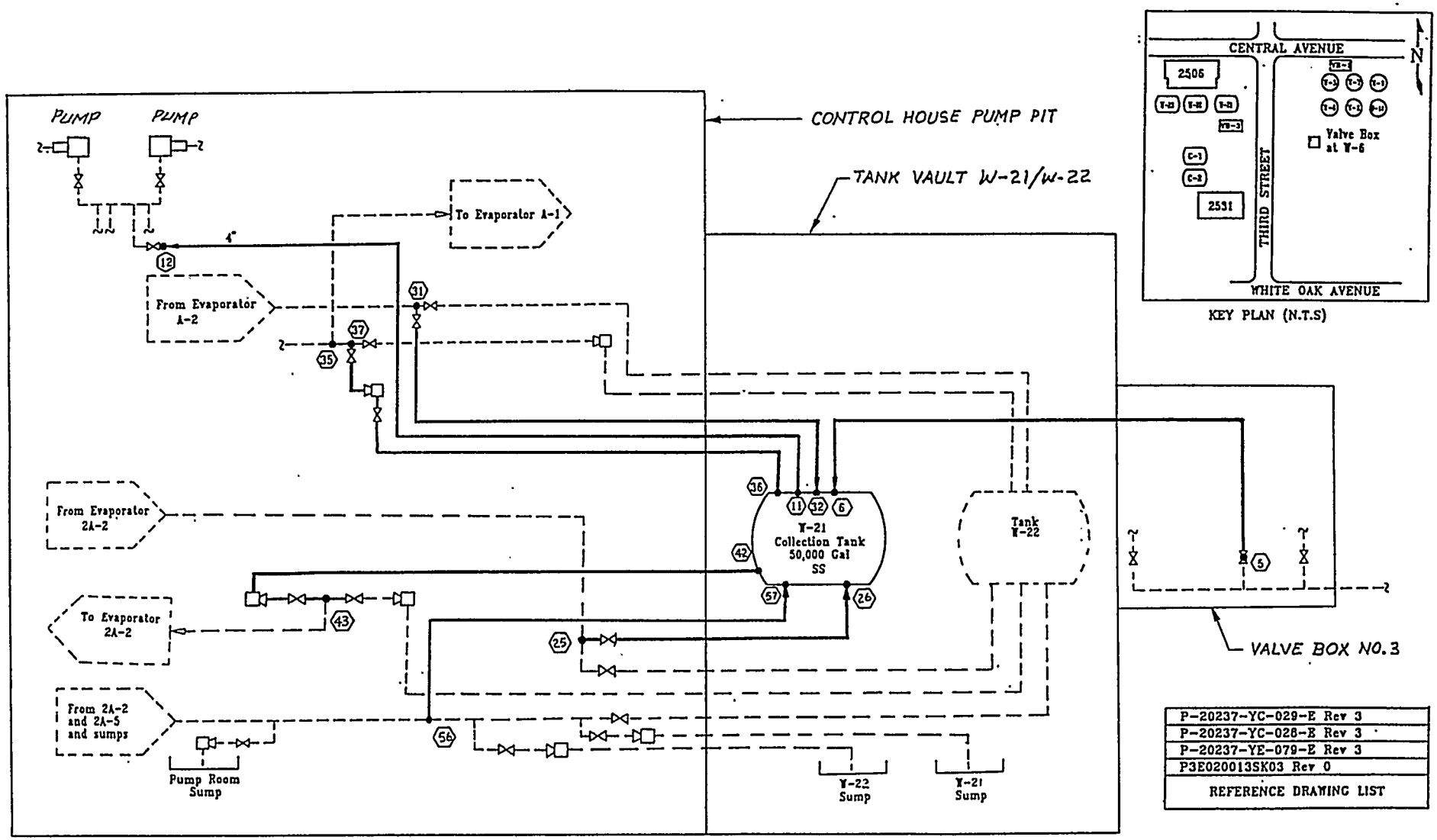


Figure 2.16-2 Tank System W-21 Piping Diagram



P-20237-YC-029-E Rev 3
P-20237-YC-028-E Rev 3
P-20237-YE-079-E Rev 3
P3E020013SK03 Rev 0
REFERENCE DRAWING LIST

LINE SEGMENT	(5)-(6)	(11)-(12)	(36)-(37)	(31)-(32)	(25)-(26)	(42)-(43)	(56)-(57)
SIZE IN-DIA	4	4	2	2	2	2	2
SCHEDULE	40S	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS	SS
LENGTH (FT)	22	41	47	49	51	47	88
VOLUME (GAL)	15	27	8	9	9	8	15

TANK SYSTEM W-21 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.16-3 General Characteristics of Waste Samples

Liquid samples:			Sludge samples		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-21	0.300	No	2/soft sludge	1.0-1.5	Sonicated sludge: consistency of prepared mustard; medium yellow with dark flecks
W-23	0.120	No	3/soft sludge	1.0-2.5	Top sample (W23-S1): smooth, brownish-yellow paste; 2.5 R/h Sonicated sludge: consistency of prepared mustard; medium brown with dark flecks

Figure 2.16-4
Analytical Data for Liquid and Sludge Samples

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN., 1990 TANK W21-L2
Physical properties and miscellaneous data		
TDS (1)	(mg/mL)	393
TS (2)	(mg/mL)	421
Density	(g/mL)	1.2391
IC (3)	(mg/L)	<1.0
TC (4)	(mg/L)	571
TOC(5)	(mg/L)	571
RCRA metals		
Ag	(mg/L)	1.2
As	(mg/L)	3.8
Ba	(mg/L)	25
Cd	(mg/L)	2.0
Cr	(mg/L)	27
Hg	(mg/L)	0.92
Ni	(mg/L)	15
Pb	(mg/L)	.7.1
Se	(mg/L)	<2.3
Tl	(mg/L)	<0.94
Process metals		
Al	(mg/L)	<1.2
B	(mg/L)	1.0
Ca	(mg/L)	23000
Co	(mg/L)	-
Fe	(mg/L)	240
K	(mg/L)	20000
Mg	(mg/L)	5600
Na	(mg/L)	61000
Si	(mg/L)	<1
Sr	(mg/L)	160
Th	(mg/L)	95.1
U	(mg/L)	750
Anions		
Chloride	(M)	0.059
Fluoride	(M)	<0.053
Nitrate	(M)	5.0
Phosphate	(M)	<0.053
Sulfate	(M)	<0.052
Alkalinity		
pH		* 0.56
H^+	(M)	0.085
OH^-	(M)	-
CO_3^{2-}	(M)	-
HCO_3^-	(M)	-
Beta/gamma emitters		
Gross alpha	(Bq/mL)	2.14e+03
Gross beta	(Bq/mL)	4.99e+05
^{14}C	(Bq/mL)	<1.0e+00
^{144}Ce	(Bq/mL)	<1.5e+03
^{60}Co	(Bq/mL)	8.50e+03
^{134}Cs	(Bq/mL)	5.12e+03
^{137}Cs	(Bq/mL)	3.19e+05
^{152}Eu	(Bq/mL)	3.31e+04
^{154}Eu	(Bq/mL)	1.66e+04
^{155}Eu	(Bq/mL)	5.22e+03
^{3}H	(Bq/mL)	3.50e+02
^{93}Nb	(Bq/mL)	<1.5e+02
^{106}Ru	(Bq/mL)	1.95e+03
^{90}Sr	(Bq/mL)	7.46e+04
^{93}Zr	(Bq/mL)	<7.1e+03
Alpha emitters		
^{233}U	(Bq/mL)	6.80e+01
^{235}U	(Bq/mL)	3.96e+02
$^{238}Pu/^{239}Pu$	(Bq/mL)	6.20e+01
$^{241}Pu/^{241}Am$	(Bq/mL)	2.61e+02
^{244}Cm	(Bq/mL)	1.15e+03

* JUNE 1990
6.9 pH

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN., 1990 TANK W21-S
Physical properties and miscellaneous data		
TS (2)	(mg/g)	511
Density	(g/mL)	1.40
IC (3)	(mg/g)	12000
TC(4)	(mg/g)	18500
TOC(5)	(mg/g)	6480
RCRA metals		
Ag	(mg/g)	(50)
As	(mg/g)	(42)
Ba	(mg/g)	78
Cd	(mg/g)	27
Cr	(mg/g)	160
Hg	(mg/g)	56
Ni	(mg/g)	75
Pb	(mg/g)	290
Se	(mg/g)	<25
Tl	(mg/g)	<10
Process metals		
Al	(mg/g)	1000
B	(mg/g)	<6.6
Ca	(mg/g)	45000
Co	(mg/g)	-
Fe	(mg/g)	2300
K	(mg/g)	8500
Mg	(mg/g)	9600
Na	(mg/g)	48000
Sr	(mg/g)	200
Th	(mg/g)	13700
U	(mg/g)	31000
Beta/gamma emitters		
Gross alpha	(Bq/g)	1.29e+05
Gross beta	(Bq/g)	3.36e+06
^{14}C	(Bq/g)	1.80e+02
^{144}Ce	(Bq/g)	<2.8e+04
^{60}Co	(Bq/g)	8.07e+04
^{134}Cs	(Bq/g)	6.99e+03
^{137}Cs	(Bq/g)	2.49e+05
^{152}Eu	(Bq/g)	1.30e+06
^{154}Eu	(Bq/g)	4.77e+05
^{155}Eu	(Bq/g)	1.33e+05
^{93}Nb	(Bq/g)	<4.7e+03
^{106}Ru	(Bq/g)	<4.4e+04
^{90}Sr	(Bq/g)	7.52e+05
^{93}Zr	(Bq/g)	<3.9e+04
Alpha emitters		
^{233}U	(Bq/g)	-
^{235}U	(Bq/g)	8.13e+03
^{238}U	(Bq/g)	<2.8e+04
$^{238}Pu/^{239}Pu$	(Bq/g)	2.45e+04
$^{241}Pu/^{241}Am$	(Bq/g)	5.13e+04
^{243}Cm	(Bq/g)	<2.5e+04
^{244}Cm	(Bq/g)	4.46e+04

LEGEND: PHYSICAL PROPERTIES
(1) TSD – TOTAL DISSOLVED SOLIDS
(2) TS – TOTAL SOLIDS
(3) I.C – INORGANIC CARBON
(4) TC – TOTAL CARBON
(5) TOC – TOTAL ORGANIC CARBON

2.17 Tank System W-22 Piping

2.17.1 Tank System Summary

Tank System W-22 is located near the Evaporator Building 2531 and near the center of the main Bethel Valley Complex (Figures 2.17-1 and 2.17-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS). Piping is routed from Tank Vault W-21/W-22 through the Control House Pump Pit, into Pipe Tunnel 2 where it is routed into Valve Pit 2VP-3, and outside underground where it continues into the Valve Pit East of Building 2531. Additional piping is routed from the Control House Pump Pit into Tank Vault W-23. Piping is also routed from Tank Vault W-21/W-22 through Valve Box No. 3, outside underground, through Valve Box No. 1, then outside underground to Valve Box No. 2. Tank System W-22 piping is used as a liquid low-level waste (LLLW) transfer system for Tank W-22 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.17.2 Standards for Pipe Assessment of Tank Systems

2.17.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-22 piping is located north of Evaporator Building 2531 and is routed from Tank Vault W-21/W-22 to several areas as follows: from Tank Vault W-21/W-22 through the Control House Pump Pit, into Pipe Tunnel 2 where it is routed into Valve Pit 2VP-3, and outside underground where it continues into the Valve Pit East of Building 2531. Additional piping is routed from the Control House Pump Pit into Tank Vault W-23. Piping is also routed from Tank Vault W-21/W-22 through Valve Box No. 3, outside underground, through Valve Box No. 1, then outside underground to Valve Box No. 2. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-22 piping is constructed of 2″, 4″, and 6″, 304L SS with a maximum design pressure and temperature of 150 psig and 300°F. Tank System W-22 piping has the capacity to contain a maximum volume of 891 gal.

Design Standards

The applicable codes and standards used for Tank System W-22 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Conference of Governmental Industrial Hygienists;

American National Standards Institute;

American Society for Testing and Materials A48, A262-70, C91, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

Instrument Society of America;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Nuclear Safety Information Center 65—Design, Construction, and Testing of High Efficiency Air Filtration Systems for Nuclear Applications;

Occupational Safety and Health Administration;

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) High Velocity Duct Construction Standards and Low Velocity Standards;

SMACNA Ducted Electric Heat Guide for Air Handling Systems;

UCC-ND Engineering Standards;

UCC-ND General Design Criteria, Y-EF-53;

UCC-ND Technical Specifications;

Underwriters Laboratories Inc.; and

Union Carbide Corporation Nuclear Division (UCC-ND) Standards, Sections 303, 401, 411, 702, and 914.04.

2.17.2.2 Generic Description of Piping Contents

Tank System W-22 piping is designed as an LLLW transfer system for Tank W-22, an LLLW collection tank for the main Oak Ridge National Laboratory (ORNL) complex in Bethel Valley and Melton Valley. The waste solution generators are "hot" sinks and drains in research and development laboratories, radiochemical pilot plants, and nuclear reactors located at ORNL. The waste solutions discharged from the source buildings are transferred to and monitored in collection tanks that are distributed throughout the ORNL complex. LLLW from the collection tanks is transferred to the Evaporator Feed Tank W-22 via the Tank System W-22 piping for processing at the low-level waste evaporator. Tank W-23 collects the concentrated waste after processing.

The liquid waste supernate is single phase and ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions. The principal metals found in the tank are sodium, potassium, calcium, magnesium, uranium, and thorium, with a low level of aluminum and iron. The sludge contains radioactive materials that produce radiation levels of approximately 1.0–2.0 rem per hour (R/h).

The analytical data (Figures 2.17-3 and 2.17-4) of waste solution samples from the generators are representative of waste received by Tank W-22; however, the composition of the waste transferred in the Tank W-22 system may vary depending upon the experiments conducted by the waste generators.

2.17.2.3 Pipe Corrosion Protection Measures

The piping inside Tank Vault W-21/W-22, Tank Vault W-23, the Control House Pump Pit, Pipe Tunnel 2, Valve Pit 2VP-3, Valve Box No. 3, the Valve Pit East of Building 2531, and Valve Boxes Nos. 1 and 2 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The outside underground piping for Tank System W-22 is provided with two cathodic protection systems to minimize external corrosion.

The first system is provided for piping that extends from Valve Box No. 3 near Tank W-21 to Valve Box No. 2. The piping is included in the Facility Manager's Cathodic Protection System No. 15.

The system consists of magnesium anodes, test stations, and connecting wire as shown on cathodic protection drawings E-20013-ED-006-E and E-20013-ED-007-E. The cathodic protection system was installed in June 1976. The system shown on the drawings mentioned above is considered adequate. The cathodic protection test report and survey performed in 1990 and 1991 indicate that the piping is receiving adequate corrosion control.

The second system is provided for piping that extends between Pipe Tunnel 2 and the Valve Pit East of Building 2531. The piping is included in the Facility Manager's Cathodic Protection System No. 16. The system consists of an impressed current type cathodic protection system as shown on the cathodic protection drawing E-20237-ED-008-E. The system was installed in June 1976. The design of the cathodic protection system does not indicate test stations on the construction drawing; however, the cathodic protection test reports and surveys performed in 1990 and 1991 indicate that the majority of the piping discussed is effectively protected against corrosion.

2.17.2.4 Documented Age of Tank System

Tank System W-22 piping was installed in 1976.

2.17.3 Standards for Containment/Release Detection

Tank System W-22 piping incorporates approximately 60′ of embedded wall piping penetrations that are singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.17.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-22 piping is single-wall, schedule 40S, type 304L SS, except for the outside underground piping that is routed from Valve Box No. 3 to Valve Box No. 1, from Valve Box No. 1 to Valve Box No. 2, and from Pipe Tunnel 2 to the Valve Pit East of Building 2531, which is double-wall piping with a schedule 10S, type 304L SS jacket. The piping is routed from Tank Vault W-21/W-22 through the Control House Pump Pit, into Pipe Tunnel 2 where it is routed into Valve Pit 2VP-3, and outside underground where it continues into the Valve Pit East of Building 2531. Additional piping is routed from the Control House Pump Pit into Tank Vault W-23. Piping is also routed from Tank Vault W-21/W-22 through Valve Box No. 3, outside underground, through Valve Box No. 1, then outside underground to Valve Box No. 2. Each area is discussed below.

Tank Vaults W-21/W-22 and W-23

The assessments of the secondary containment systems for Tank Vaults W-21/W-22 and W-23 are presented in the Design Demonstrations for Tanks W-21, W-22, and W-23. Those assessments conclude that the tank vaults are coated and lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Control House Pump Pit

The bottom of the pump pit is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 3′0″ up the pump pit walls. The pump pit walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS pump pit lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the pump pit's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Pipe Tunnel 2

The bottom of Pipe Tunnel 2 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project up to the pipe tunnel roof. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Pit 2VP-3

The bottom of Valve Pit 2VP-3 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 4′0″ up the valve pit walls. The valve pit walls above the SS liner are provided with a system of Carboline 193 epoxy. The SS valve pit lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve pit's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Outside Underground Piping

The jacket of the outside underground, double-wall pipe is schedule 10S, type 304L SS. The pipe jacket material is compatible with the waste.

Valve Box No. 3

The bottom of Valve Box No. 3 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 4′3″ up the valve box walls. The valve box walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS valve box lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve box's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Pit East of Building 2531

The floor and walls of the valve pit are provided with a system of Amercoat 99. According to manufacturer's specifications, the valve pit's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box No. 1

The bottom of the valve box is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project approximately 2′0″ up the valve box walls. The SS valve box lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box No. 2

The bottom of the valve box is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project approximately 2′0″ up the valve box walls. The SS valve box lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vaults, pump pit, pipe tunnel, valve pits, and valve boxes are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. The assessment concludes that the underground piping jacket is compatible with the waste.

2.17.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vaults W-21/W-22 and W-23

The assessments of the secondary containment systems for Tank Vaults W-21/W-22 and W-23 are presented in the Design Demonstrations for Tanks W-21, W-22, and W-23. Those assessments conclude that the vault foundations are properly designed to support the secondary containment systems.

Control House Pump Pit

The pump pit foundation is a 21′0″ × 40′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

Pipe Tunnel 2

The pipe tunnel foundation is a 9′6″ × 63′8″ × 1′0″ thick, reinforced concrete base slab that rests on limestone.

Valve Pit 2VP-3

The valve pit foundation is an 18′2″ × 27′4″ × 1′2″ thick, reinforced concrete base slab that rests on limestone.

Valve Box No. 3

The valve box foundation is an 8′6″ × 11′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

Valve Pit East of Building 2531

The valve pit foundation is a 13′0″ × 14′0″ × 8″ thick, reinforced concrete base slab that rests on limestone.

Valve Box No. 1

The valve box foundation is a 6′8″ × 19′2″ × 10″ thick, reinforced concrete base slab that rests on limestone.

Valve Box No. 2

The valve box foundation is a 6′8″ × 14′4″ × 10″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the tank vaults, pump pit, pipe tunnel, valve pits, and valve boxes have foundations that are properly designed to support the secondary containment systems.

2.17.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vaults W-21/W-22 and W-23

The assessments of the secondary containment systems for Tank Vaults W-21/W-22 and W-23 are presented in the Design Demonstrations for Tanks W-21, W-22, and W-23. Those assessments conclude that the tank vaults are provided with leak detection systems.

Control House Pump Pit

The pump pit floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Pipe Tunnel 2

The Pipe Tunnel 2 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump. Liquid that flows to the Pipe Tunnel 2 sump will continue to flow to the Control House Pump Pit sump through a 4″, schedule 40S, type 304L SS sump drain pipe. The pump pit sump is lined with 16-gauge (1/16″),

304L SS; and accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Valve Pit 2VP-3

The Valve Pit 2VP-3 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Outside Underground Piping

All underground piping associated with this system is provided with a nitrogen-blanketed leak detection system.

Valve Box No. 3

Valve Box No. 3 has a 16-gauge (1/16″), 304L SS-lined sump. Liquid that flows to the valve box sump will continue to flow through a drain line to a 304L SS-lined sump in Tank Vault W-21/W-22. Accumulation of liquid in the Tank Vault W-21/W-22 sump will be detected by a level sensor that will activate alarms in the Evaporator Control Room and the Waste Operations Control Center (Building 3130).

Valve Pit East of Building 2531

The valve pit is sloped to a coated sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Valve Box No. 1

The valve box floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Valve Box No. 2

The valve box floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

The assessment concludes that the tank vaults, pump pit, pipe tunnel, valve pits, underground piping, and valve boxes are provided with leak detection.

2.17.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vaults W-21/W-22 and W-23

The assessments of the secondary containment systems for Tank Vaults W-21/W-22 and W-23 are presented in the Design Demonstrations for Tanks W-21, W-22, and W-23. Those assessments conclude that the secondary containment systems are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Control House Pump Pit

The pump pit floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pump pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Pipe Tunnel 2

The pipe tunnel floor is sloped to a 304L SS-lined sump. Liquid that flows to the pipe tunnel sump will continue to flow to the pump pit sump through a sump drain pipe. The pump pit sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Pit 2VP-3

The valve pit floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Outside Underground Piping

All outside underground piping is sloped and provided with 1/2″ drain test connections to remove liquids resulting from leaks.

Valve Box No. 3

The valve box floor is sloped to a 304L SS-lined sump. Liquid that flows to the valve box sump will continue to flow to the Tank Vault W-21/W-22 sump through a sump drain pipe. The tank vault sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Pit East of Building 2531

The valve pit floor is sloped to a coated sump. The sump provides a low point within the valve pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Box No. 1

The valve box floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve box to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Box No. 2

The valve box floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve box to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the tank vaults, pump pit, pipe tunnel, valve pits, underground piping, and valve boxes are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.17.4 Supplemental Information

2.17.4.1 Ancillary Equipment

Tank W-22 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-21/W-22, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.17.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-22.

2.17.5 References

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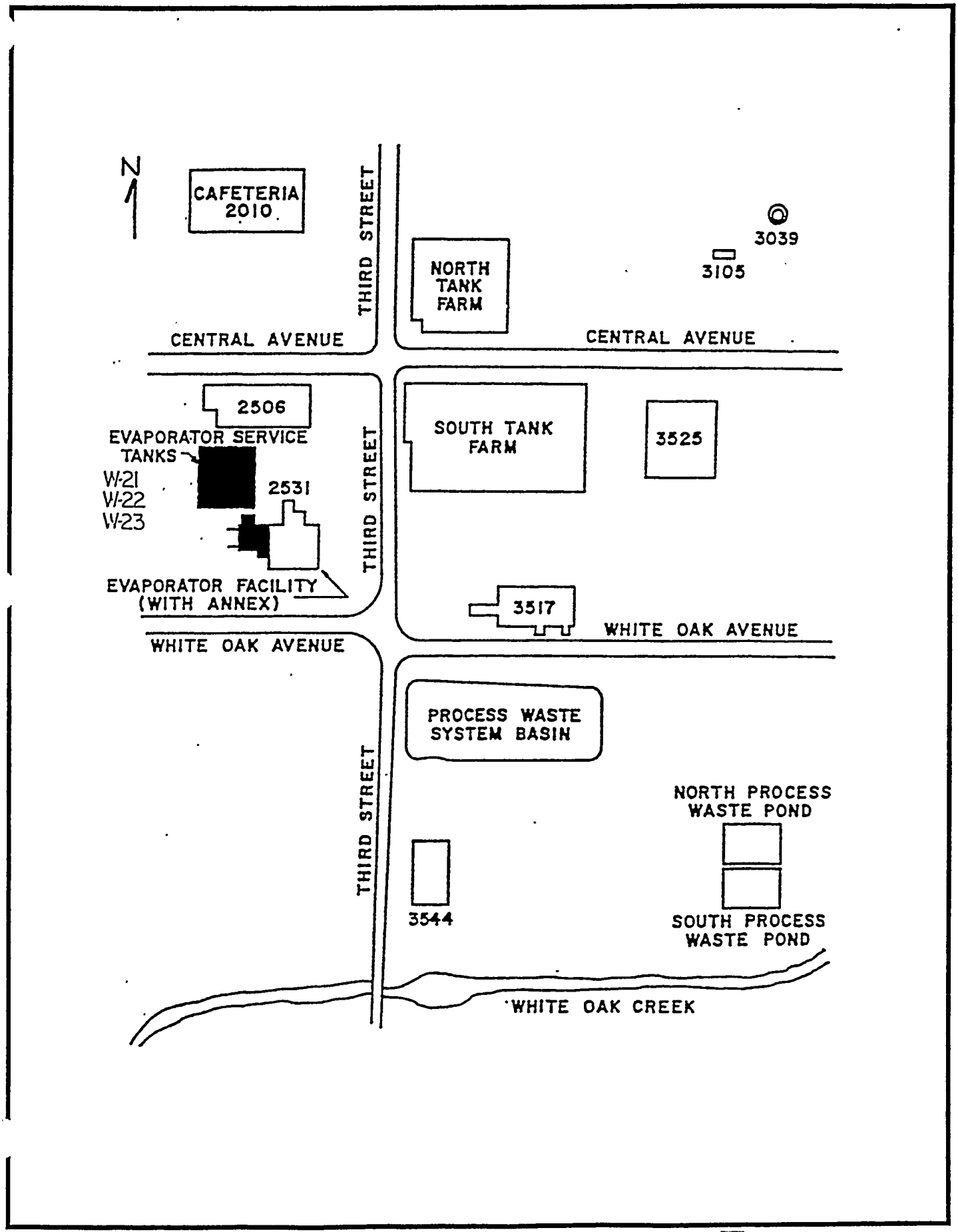
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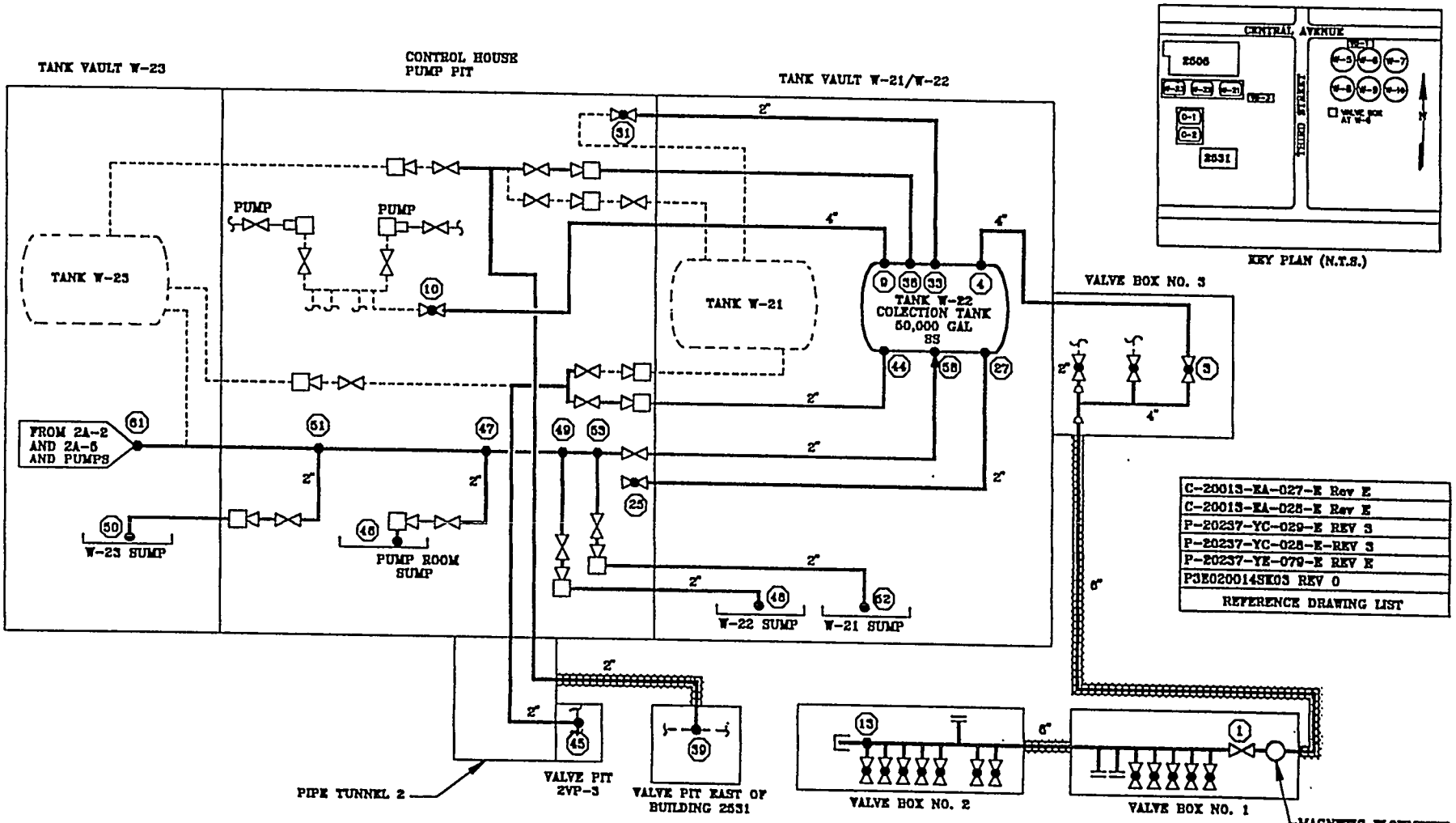
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Figure 2.17-1
Location of Tank System W-22 Piping



EBASCO/MAIN

Figure 2.17-2 Tank System W-22 Piping Diagram



LINE SEGMENT	(1) - (3)	(3) - (4)	(26) - (27)	(44) - (45)	(58) - (61)	(31) - (33)	(9) - (10)	(46) - (47)	(48) - (49)	(50) - (51)	(52) - (53)	(13) - (1)
SIZE IN-DIA	6	4	2	2	2	2	4	2	2	2	2	6
SCHEDULE	40S	40S	40S	40S	40S	40S	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS
LENGTH (FT)	402	39	35	112	144	33	27	20	58	39	61	103
WOLUME (GAL)	603	26	6	20	25	6	18	4	10	7	11	155

TANK SYSTEM W-22 PIPING

UNDERGROUND PIPE DOUBLY CONTAINED

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.17-3 Radiochemical Analyses In the Evaporator Service Tanks

Radiochemical analyses of beta emitters in the Evaporator Service Tanks[a]

Tank	Sample date	Sample location	Gross beta		Gross gamma (c/min-mL)	Sr-90	Cs-137	Co-60	Eu-152	Eu-154	Eu-155	Zr-95	Nb-95
			TRU[b]	RMAL[c]									
W-21	Nov. 85	Solids[d]	84,900	68,300	1.49E+07	16,400	6,760	1,060	11,600	5,840	2,400	2,660	200
W-22	Nov. 85	Solids[d]	56,500	53,700	1.18E+07	10,200	5,050	740	10,900	5,350	2,060	2,920	330
W-23	Nov. 85	Liquid[e]	66,800	49,800	1.25E+07	9,400	2,040	760	13,000	[f]	2,250		200
	Nov. 85	Solids[d]	237,000	205,000	1.35E+07	73,700	6,510	880	12,100	8,220	2,550	3,400	

[a]All data from the TRU laboratory except RMAL gross beta and Sr-90.
[b]TRU data: Request No. 45764, received 1/30/86, completed 2/6/86.
[c]RMAL data: Request No. 34529, received 11/12/85, completed 11/22/85.
[d]nCi/g for solid samples.
[e]nCi/mL for liquid samples.
[f]A blank space means no data available.

Radiochemical analyses of alpha emitters in the Evaporator Service Tanks[a]

Tank	Sample date	Sample location	Gross alpha		Cm-244	Am-241	Pu-239 & Pu-240	Pu-238	U-233
			TRU[b]	RMAL[c]					
W-21	Nov. 85	Solids[d]	5110	1980	810	70	380	830	50
W-22	Nov. 85	Solids[d]	3510	2260	1100	100	190	280	58
W-23	Nov. 85	Liquid[e]	870	710	280	50	50	90	38
	Nov. 85	Solids[d]	6970	3190	2190	<30	580	500	130

[a]All data from the TRU laboratory except RMAL gross alpha.
[b]TRU data: Request No. 45764, received 1/30/86, completed 2/6/86.
[c]RMAL data: Request No. 34529, received 11/12/85, completed 11/22/85.
[d]nCi/g for solid samples.
[e]nCi/mL for liquid samples.

Figure 2.17-4
Analytical Data for Liquid and Sludge Samples

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN. 1990 * W23-L1 REPRESENTATIVE SAMPLE
Physical properties and miscellaneous data		
TDS	(mg/mL)	331
TS	(mg/mL)	383
Density	(g/mL)	1.2423
IC	(mg/L)	8340
TC	(mg/L)	9500
TOC	(mg/L)	1160
RCRA metals		
Ag	(mg/L)	<0.44
As	(mg/L)	<3.0
Ba	(mg/L)	<0.19
Cd	(mg/L)	1.7
Cr	(mg/L)	0.42
Hg	(mg/L)	0.07
Ni	(mg/L)	3.0
Pb	(mg/L)	2.7
Se	(mg/L)	<2.3
Tl	(mg/L)	<0.94
Process metals		
Al	(mg/L)	1.8
B	(mg/L)	10
Ca	(mg/L)	18
Co	(mg/L)	
Fe	(mg/L)	0.70
K	(mg/L)	78000
Mg	(mg/L)	3.4
Na	(mg/L)	82000
Si	(mg/L)	<1
Sr	(mg/L)	0.40
Th	(mg/L)	15.8
U	(mg/L)	17
Anions		
Chloride	(M)	0.10
Fluoride	(M)	<0.053
Nitrate	(M)	3.23
Phosphate	(M)	<0.053
Sulfate	(M)	0.081
Alkalinity		
pH		12.8
H^+	(M)	-
OH^-	(M)	0.15
CO_3^{2-}	(M)	0.70
HCO_3^-	(M)	
Beta/gamma emitters		
Gross alpha	(Bq/mL)	8.20e+01
Gross beta	(Bq/mL)	4.62e+05
^{14}C	(Bq/mL)	6.35e+01
^{144}Ce	(Bq/mL)	<1.6e+03
^{60}Co	(Bq/mL)	6.21e+02
^{134}Cs	(Bq/mL)	4.63e+03
^{137}Cs	(Bq/mL)	4.36e+05
^{152}Eu	(Bq/mL)	<2.1e+02
^{154}Eu	(Bq/mL)	<1.6e+02
^{155}Eu	(Bq/mL)	<8.5e+02
^{3}H	(Bq/mL)	1.19e+02
^{93}Nb	(Bq/mL)	<1.0e+02
^{106}Ru	(Bq/mL)	3.78e+03
^{90}Sr	(Bq/mL)	4.12e+02
^{93}Zr	(Bq/mL)	<1.0e+02
Alpha emitters		
^{234}U	(Bq/mL)	4.00e+00
^{233}U	(Bq/mL)	6.00e+00
$^{238}Pu/^{240}Pu$	(Bq/mL)	6.00e+00
$^{239}Pu/^{241}Am$	(Bq/mL)	3.90e+01
^{244}Cm	(Bq/mL)	4.00e+00

* NO DATA FOR TANK W22, TANK W23 SHOWN AS A REP. SAMPLE

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN, 1990 * W23-S REPRESENTATIVE SAMPLE
Physical properties and miscellaneous data		
TS	(mg/g)	544
Density	(g/mL)	1.34
IC	(mg/kg)	18100
TC	(mg/kg)	22200
TOC	(mg/kg)	4120
RCRA metals		
Ag	(mg/kg)	(25)
As	(mg/kg)	(<50)
Ba	(mg/kg)	63
Cd	(mg/kg)	32
Cr	(mg/kg)	190
Hg	(mg/kg)	19
Ni	(mg/kg)	110
Pb	(mg/kg)	(450)
Se	(mg/kg)	<39
Tl	(mg/kg)	<16
Process metals		
Al	(mg/kg)	2500
B	(mg/kg)	<10
Ca	(mg/kg)	55000
Co	(mg/kg)	
Fe	(mg/kg)	1900
K	(mg/kg)	15000
Mg	(mg/kg)	16000
Na	(mg/kg)	82000
Sr	(mg/kg)	290
Th	(mg/kg)	12000
U	(mg/kg)	17000
Beta/gamma emitters		
Gross alpha	(Bq/g)	2.23e+05
Gross beta	(Bq/g)	6.67e+06
^{14}C	(Bq/g)	3.65e+02
^{144}Ce	(Bq/g)	<2.7e+04
^{60}Co	(Bq/g)	2.52e+05
^{134}Cs	(Bq/g)	<6.5e+03
^{137}Cs	(Bq/g)	4.95e+05
^{152}Eu	(Bq/g)	7.22e+05
^{154}Eu	(Bq/g)	5.14e+05
^{155}Eu	(Bq/g)	1.21e+05
^{93}Nb	(Bq/g)	<7.0e+03
^{106}Ru	(Bq/g)	<6.2e+04
^{90}Sr	(Bq/g)	2.25e+06
^{93}Zr	(Bq/g)	<4.5e+04
Alpha emitters		
^{234}U	(Bq/g)	
^{233}U	(Bq/g)	1.18e+04
^{235}U	(Bq/g)	<2.8e+04
$^{238}Pu/^{240}Pu$	(Bq/g)	1.18e+04
$^{239}Pu/^{241}Am$	(Bq/g)	3.21e+04
^{243}Cm	(Bq/g)	<2.6e+04
^{244}Cm	(Bq/g)	1.67e+05

LEGEND:
TSD - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC - TOTAL ORGANIC CARBON

2.18 Tank System W-23 Piping

2.18.1 Tank System Summary

Tank System W-23 is located near the Evaporator Building 2531 and near the center of the main Bethel Valley Complex (Figures 2.18-1 and 2.18-2). The tank system piping is constructed of schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from Tank Vault W-23 to the Control House Pump Pit. The piping is routed to several locations from the Control House Pump Pit as follows: to Tank Vault W-21/W-22 and further to Valve Box No. 3, and to Pipe Tunnel 2 and further to Valve Pit 2VP-3 and Evaporator Annex Cell No. 4. An additional line is routed outside underground from Pipe Tunnel 2 to Evaporator Annex Valve Pit No. 1. Tank System W-23 piping is used to transfer concentrate for the Evaporator and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.18.2 Standards for Pipe Assessment of Tank Systems

2.18.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-23 piping is located near Building 2531 and is routed from Tank Vault W-23 to the Control House Pump Pit. The piping is routed to several locations from the Control House Pump Pit as follows: to Tank Vault W-21/W-22 and further to Valve Box No. 3, and to Pipe Tunnel 2 and further to Valve Pit 2VP-3 and Evaporator Annex Cell No. 4. An additional line is routed outside underground from Pipe Tunnel 2 to Evaporator Annex Valve Pit No. 1. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-23 piping is constructed of 1-1/2," 2," and 4", 304L SS with a maximum design pressure and temperature of 150 psig and 300°F. Tank System W-23 piping has the capacity to contain a maximum volume of 129 gal.

Design Standards

The applicable codes and standards used for Tank System W-23 piping and its associated secondary containments systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Conference of Governmental Industrial Hygienists;

American National Standards Institute.

American Society for Testing and Materials A48, A262-70, C91, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electric Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Nuclear Safety Information Center 65—Design, Construction, and Testing of High Efficiency Air Filtration Systems for Nuclear Applications;

Occupational Safety and Health Administration;

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) High Velocity Duct Construction Standards and Low Velocity Standards;

SMACNA Ducted Electric Heat Guide for Air Handling Systems;

UCC-ND Engineering Standards;

UCC-ND General Design Criteria, Y-EF-53;

UCC-ND Technical Specifications;

Underwriters Laboratories Inc.; and

Union Carbide Corporation Nuclear Division (UCC-ND) Standards, Sections 303, 401, 411, 702, and 914.04.

2.18.2.2 Generic Description of Piping Contents

Tank System W-23 piping was designed for and is currently being used with Tank W-23, a concentrate storage tank for the Low-Level Waste Evaporator in the Bethel Valley complex. Liquid low-level waste (LLLW) is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the Evaporator Feed Tank, W-22. The waste is concentrated by being processed in the Evaporator by a batch operation until a predetermined specific gravity is reached. After processing, the evaporator bottoms are pumped directly into Tank W-23 for storage with the ability to transfer from Tank W-23 to additional Concentrate Storage Tanks C-1, C-2, and W-24 through W-31.

The liquid waste supernate is single phase and ranges in color from pale to deep yellow with a high Ph (11–13) sodium/potassium nitrate salt solutions. The principal metals found in the tank sludge are sodium, potassium, calcium, magnesium, uranium, and thorium with a low level of aluminum and iron. The tank contains radioactive materials that produce radiation levels of 1.0–2.5 rem per hour (R/h) (Figure 2.18-3).

The analytical data (Figure 2.18-4) of waste solution samples from the generators are representative of waste received by Tank W-23; however, the composition of the waste transferred to and stored in Tank W-23 may vary depending upon the experiments conducted by the waste generators.

2.18.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault W-23, Tank Vault W-21/W-22, the Control House Pump Pit, Pipe Tunnel 2, Valve Pit 2VP-3, Evaporator Annex Valve Pit No. 1, Evaporator Annex Cell No. 4, and Valve Box No. 3 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The cathodically protected outside underground piping associated with Tank System W-23 piping extends from the Building 2531 Evaporator Annex Valve Pit No. 1 to Pipe Tunnel 2. The piping is included in the Facility Manager's Cathodic Protection System No. 16. The system, as installed in June 1976, consists of an impressed current type cathodic protection system as shown on drawing E-20237-ED-008. The design of the system is not considered adequate because test stations are not shown on the installation drawings.

The cathodic protection test report and survey performed in 1990 and 1991 indicate that test stations were not installed during construction of the system and that some of the piping segments may not be bonded together as shown on the installation drawings. Piping that is discontinuous will be inadequately protected. In 1991, Harco completed an engineering design to install test stations on this piping and the adjacent piping and ducts. Energy Systems' upgrade is shown in Table 2.0-1.

2.18.2.4 Documented Age of Tank System

Tank System W-23 piping was installed in 1976.

2.18.3 Standards for Containment/Release Detection

2.18.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-23 piping is single-wall, schedule 40S, type 304L SS. The section of piping that is routed outside underground from Pipe Tunnel 2 to Evaporator Annex Valve Pit No. 1 is double wall with a schedule 10S, type 304L SS jacket. The piping is routed from Tank Vault W-23 to the Control House Pump Pit. The piping is routed to several locations from the Control House Pump Pit as follows: to Tank Vault W-21/W-22 and further to Valve Box No. 3, and to Pipe Tunnel 2 and further to Valve Pit 2VP-3 and Evaporator Annex Cell No. 4. An additional line is routed outside underground from Pipe Tunnel 2 to Evaporator Annex Valve Pit No. 1. Each area is discussed below. The piping penetrations from Tank Vaults W-23 and W-21/W-22 to the Control House Pump Pit, from Tank Vault W-21/W-22 to Valve Box No. 3, from the Control House Pump Pit to Pipe Tunnel 2, and from Valve Pit 2VP-3 to the Evaporator Annex Cell No. 4 are singly contained, schedule 40S, type 304L SS pipes embedded in the concrete walls to lengths of 2′0″ and 3′0″.

Tank Vaults W-23 and W-21/W-22

The assessments of the secondary containment systems for Tank Vaults W-23 and W-21/W-22 are presented in the Design Demonstrations for Tanks W-23, W-21, and W-22. Those assessments conclude that Tank Vaults W-23 and W-21/W-22 are coated and lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Control House Pump Pit

The bottom of the pump pit is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 3′0″ up the pump pit. The pump pit walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS pump pit lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the pump pit's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box No. 3

The bottom of Valve Box No. 3 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 4′3″ up the valve box. The valve box walls above the SS liner are provided with a system of 30-mil-thick Amercoat 66 epoxy. The SS valve box lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve box's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Pipe Tunnel 2

The bottom of Pipe Tunnel 2 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project up to the pipe tunnel roof. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Pit 2VP-3

The bottom of Valve Pit 2VP-3 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 4′0″ up the valve pit. The valve pit walls above the SS liner are provided with a system of Carboline 193 epoxy. The SS valve pit lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve pit's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Evaporator Annex Cell No. 4

The bottom of the cell is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 4′0″ up the cell wall. The walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS cell lining material is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the cell's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Outside Underground Piping

The jacket of the outside underground, double-wall pipe is 304L SS. The selection of secondary containment material is compatible with the waste.

Evaporator Annex Valve Pit No. 1

The bottom of the valve pit is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 6′6″ up the entire valve pit wall. The SS valve pit lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the tank vaults, pump pit, valve box, pipe tunnel, valve pits, and cell are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. The assessment concludes that the underground piping jacket is compatible with the waste.

2.18.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vaults W-23 and W-21/W-22

The assessments of the secondary containment systems for Tank Vaults W-23 and W-21/W-22 are presented in the Design Demonstrations for Tanks W-23, W-21, and W-22. Those assessments conclude that the vault foundations are properly designed to support the secondary containment system.

Control House Pump Pit

The pump pit foundation is a 21′0″ × 40′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

Valve Box No. 3

The valve box foundation is an 8′6″ × 11′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

Pipe Tunnel 2

The pipe tunnel foundation is a 9′6″ × 63′8″ × 1′0″ thick, reinforced concrete base slab that rests on limestone.

Valve Pit 2VP-3

The valve pit foundation is an 18′2″ × 27′4″ × 1′2″ thick, reinforced concrete base slab that rests on limestone.

Evaporator Annex Cell No. 4

The cell foundation is a 20′0″ × 24′11″ × 3′0″ thick, reinforced concrete base slab that rests on limestone.

Evaporator Annex Valve Pit No. 1

The valve pit foundation is a 7′0″ × 8′5″ × 10″ thick, reinforced concrete base slab that rests on limestone and concrete footings.

The assessment concludes that the tank vaults, pump pit, valve box, pipe tunnel, valve pits, and cell foundations are properly designed to support the secondary containment systems.

2.18.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vaults W-23 and W-21/W-22

The assessments of the secondary containment systems for Tank Vaults W-23 and W-21/W-22 are presented in the Design Demonstrations for Tanks W-23, W-21, and W-22. Those assessments conclude that Tank Vaults W-23 and W-21/W-22 are provided with leak detection systems.

Control House Pump Pit

The pump pit floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Valve Box No. 3

Valve Box No. 3 has a 16-gauge (1/16″), 304L SS-lined collection sump where accumulation of liquid is transferred via a gravity-fed drain line to a 304L SS-lined sump in Tank Vault W-21/W-22. Accumulation of liquid in the tank vault sump will be detected by a level sensor that will activate alarms in the Evaporator Control Room and Waste Operations Control Center (Building 3130).

Pipe Tunnel 2

The Pipe Tunnel 2 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump. Liquid that flows to the Pipe Tunnel 2 sump will continue to flow to the Control House Pump Pit sump through a 4″, schedule 40S, type 304L SS sump drain pipe. The pump pit sump is lined with 16-gauge (1/16″), 304L SS; and accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Valve Pit 2VP-3

The Valve Pit 2VP-3 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Evaporator Annex Cell No. 4

The Evaporator Annex Cell No. 4 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Outside Underground Piping

All underground piping associated with this system is provided with a nitrogen-blanketed leak detection system.

Evaporator Annex Valve Pit No. 1

A leak detection system for Evaporator Annex Valve Pit No. 1 could not be identified from the design drawings or construction specifications.

The assessment concludes that the tank vaults, pump pit, valve box, pipe tunnel, Valve Pit 2VP-3, cell, and underground piping are provided with leak detection. The Evaporator Annex Valve Pit No. 1 is not provided with a leak detection system.

2.18.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vaults W-23 and W-21/W-22

The assessments of the secondary containment systems for Tank Vaults W-23 and W-21/W-22 are presented in the Design Demonstrations for Tanks W-23, W-21, and W-22. Those assessments conclude that the secondary containments are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Control House Pump Pit

The pump pit floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pump pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Box No. 3

The valve box floor is sloped to a 304L SS-lined sump. Liquid that flows to the valve box sump will continue to flow to the Tank Vault W-21/W-22 sump through a sump drain pipe. The tank vault sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Pipe Tunnel 2

The pipe tunnel floor is sloped to a 304L SS-lined sump. Liquid that flows to the pipe tunnel sump will continue to flow to the pump pit sump through a sump drain pipe. The pump pit sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Pit 2VP-3

The Valve Pit 2VP-3 floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Evaporator Annex Cell No. 4

The Evaporator Annex Cell is sloped to a 304L SS-lined sump. The sump provides a low point within the cell to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Outside Underground Piping

All outside underground piping is provided with 1/2″ drain test connections to remove liquids resulting from leaks.

Evaporator Annex Valve Pit No. 1

The Evaporator Annex Valve Pit is sloped to a 304L SS-lined sump. The sump provides a low point within the valve pit to drain liquids. Evaporator Annex Valve Pit No. 1 is not provided with a means to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containments for the tank vaults, pump pit, valve box, pipe tunnel, Valve Pit 2VP-3, cell, and underground piping are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. Evaporator Annex Valve Pit No. 1 is not provided with a means to remove accumulation of liquids.

2.18.4 Supplemental Information

2.18.4.1 Ancillary Equipment

Tank W-23 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-23, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.18.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National*

Laboratory (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-23.

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Figure 2.18-1
Location of Tank System W-23 Piping

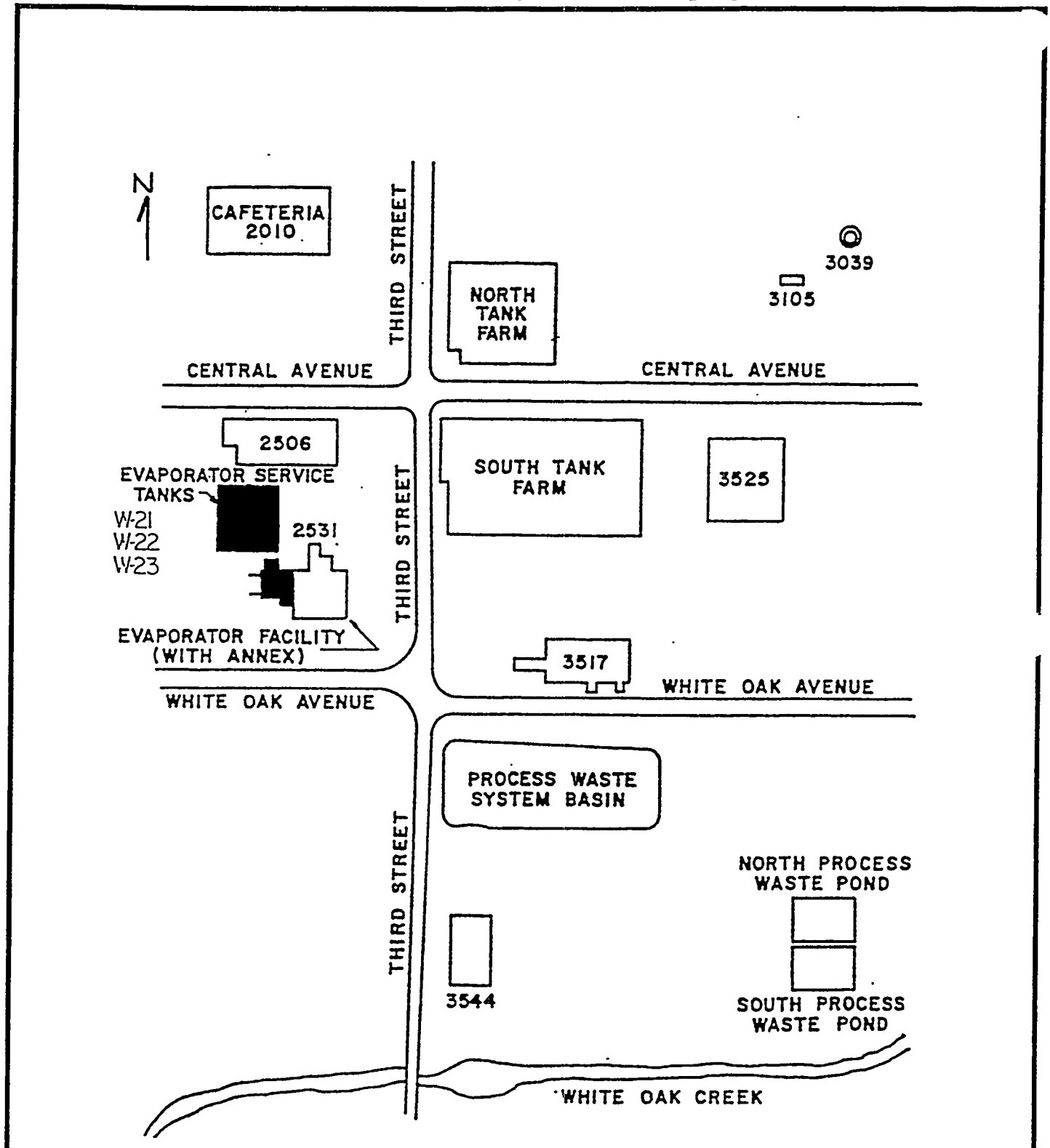
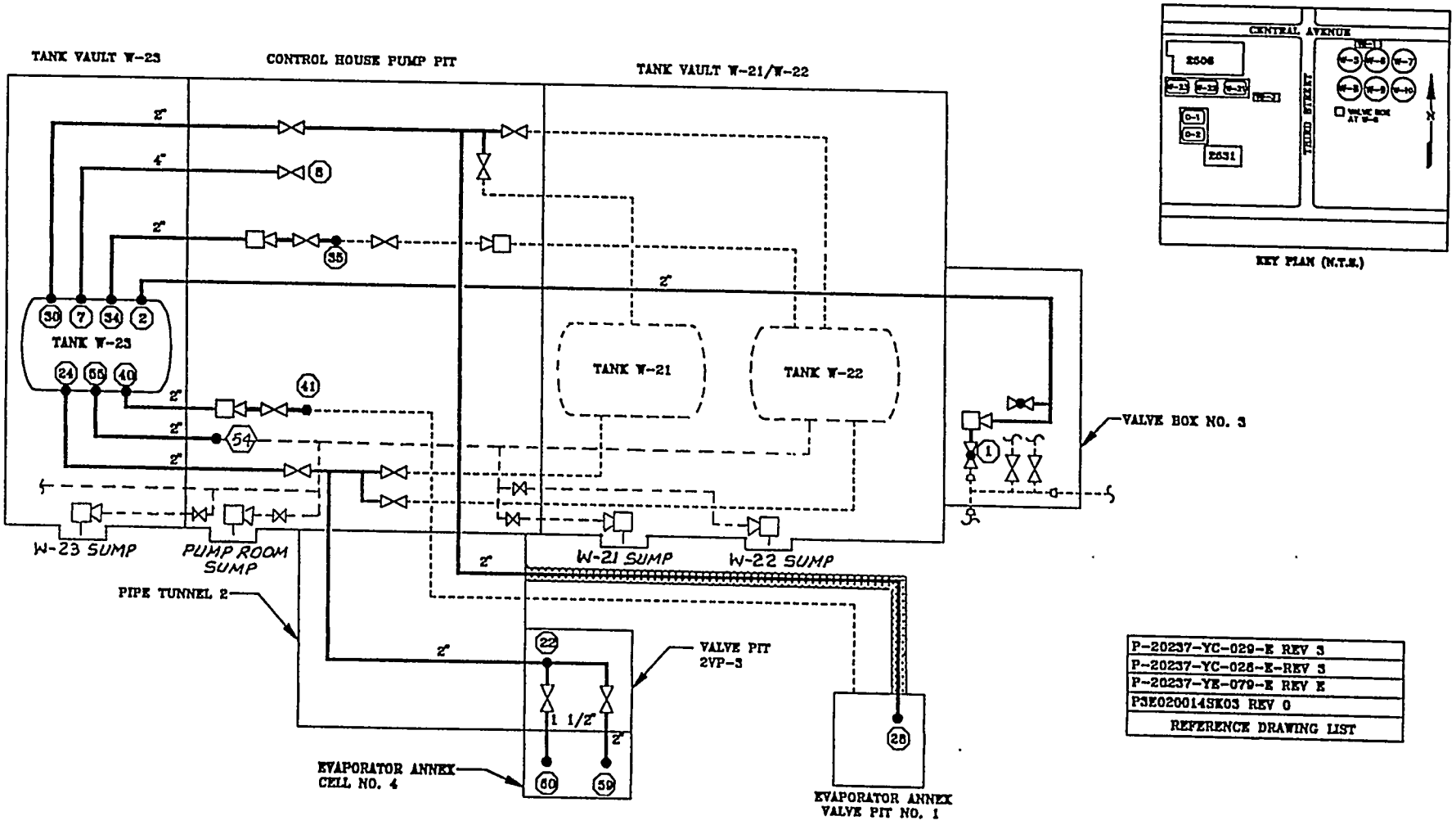


Figure 2.18-2 Tank System W-23 Piping Diagram



REFERENCE DRAWING LIST
P-20237-YC-029-E REV 3
P-20237-YC-028-E-REV 3
P-20237-YE-079-E REV E
P3E020014SK03 REV 0

LINE SEGMENT	(1) - (2)	(7) - (8)	(22) - (24)	(28) - (30)	(34) - (35)	(40) - (41)	(54) - (55)	(59) - (22)	(60) - (22)
SIZE IN-DIA	2	4	2	2	2	2	2	1 1/2	2
SCHEDULE	40S	40S	40S	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS	SS	SS	SS
LENGTH (FT)	141	16	112	225	26	50	64	26	27
WOLUME (GAL)	25	12	20	39	5	9	11	3	5

TANK SYSTEM W-23 PIPING

UNDERGROUND PIPE (DOUBLE WALL)

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.18-3 General Characteristics of Waste Samples

Liquid samples:			Sludge samples		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-21	0.300	No	2/soft sludge	1.0-1.5	Sonicated sludge: consistency of prepared mustard; medium yellow with dark flecks
W-23	0.120	No	3/soft sludge	1.0-2.5	Top sample (W23-S1): smooth, brownish-yellow paste; 2.5 R/h Sonicated sludge: consistency of prepared mustard; medium brown with dark flecks

Figure 2.18-4
Analytical Data for Liquid and Sludge Samples

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic	JAN. 1990	W23-L1
Physical properties and miscellaneous data		
TDS	(mg/mL)	381
TS	(mg/mL)	383
Density	(g/mL)	1.2423
IC	(mg/L)	8340
TC	(mg/L)	9500
TOC	(mg/L)	1160
RCRA metals		
Ag	(mg/L)	<0.44
As	(mg/L)	<3.0
Ba	(mg/L)	<0.19
Cd	(mg/L)	1.7
Cr	(mg/L)	0.42
Hg	(mg/L)	0.07
Ni	(mg/L)	3.0
Pb	(mg/L)	2.7
Se	(mg/L)	<2.3
Tl	(mg/L)	<0.94
Process metals		
Al	(mg/L)	1.8
B	(mg/L)	10
Ca	(mg/L)	18
Co	(mg/L)	-
Fe	(mg/L)	0.70
K	(mg/L)	76000
Mg	(mg/L)	3.4
Na	(mg/L)	82000
Si	(mg/L)	<1
Sr	(mg/L)	0.40
Th	(mg/L)	15.8
U	(mg/L)	17
Anions		
Chloride	(M)	0.10
Fluoride	(M)	<0.053
Nitrate	(M)	3.23
Phosphate	(M)	<0.053
Sulfate	(M)	0.081
Alkalinity		
pH		12.8
H^+	(M)	-
OH^-	(M)	0.15
CO_3^{2-}	(M)	0.70
HCO_3^-	(M)	
Beta/gamma emitters		
Gross alpha	(Bq/mL)	8.20e+01
Gross beta	(Bq/mL)	4.62e+05
^{14}C	(Bq/mL)	6.35e+01
^{144}Ce	(Bq/mL)	<1.6e+03
^{60}Co	(Bq/mL)	6.21e+02
^{134}Cs	(Bq/mL)	4.63e+03
^{137}Cs	(Bq/mL)	4.36e+05
^{152}Eu	(Bq/mL)	<2.1e+02
^{154}Eu	(Bq/mL)	<1.6e+02
^{155}Eu	(Bq/mL)	<8.5e+02
^{3}H	(Bq/mL)	1.19e+02
^{93}Nb	(Bq/mL)	<1.0e+02
^{106}Ru	(Bq/mL)	3.78e+03
^{90}Sr	(Bq/mL)	4.12e+02
^{93}Zr	(Bq/mL)	<1.0e+02
Alpha emitters		
^{235}U	(Bq/mL)	4.00e+00
^{233}U	(Bq/mL)	6.00e+00
$^{239}Pu/^{240}Pu$	(Bq/mL)	6.00e+00
$^{238}Pu/^{241}Am$	(Bq/mL)	3.90e+01
^{243}Cm	(Bq/mL)	4.00e+00

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic	JAN, 1990	W23-S
Physical properties and miscellaneous data		
TS	(g/g)	544
Density	(g/mL)	1.34
IC	(mg/kg)	18100
TC	(mg/kg)	22200
TOC	(mg/kg)	4120
RCRA metals		
Ag	(mg/kg)	(25)
As	(mg/kg)	(<50)
Ba	(mg/kg)	63
Cd	(mg/kg)	32
Cr	(mg/kg)	190
Hg	(mg/kg)	19
Ni	(mg/kg)	110
Pb	(mg/kg)	(450)
Se	(mg/kg)	<39
Tl	(mg/kg)	<16
Process metals		
Al	(mg/kg)	2500
B	(mg/kg)	<10
Ca	(mg/kg)	55000
Cs	(mg/kg)	
Fe	(mg/kg)	1900
K	(mg/kg)	15000
Mg	(mg/kg)	16000
Na	(mg/kg)	82000
Sr	(mg/kg)	290
Th	(mg/kg)	12000
U	(mg/kg)	17000
Beta/gamma emitters		
Gross alpha	(Bq/g)	2.23e+05
Gross beta	(Bq/g)	6.67e+06
^{14}C	(Bq/g)	3.65e+02
^{144}Ce	(Bq/g)	<2.7e+04
^{60}Co	(Bq/g)	2.52e+05
^{134}Cs	(Bq/g)	<6.5e+03
^{137}Cs	(Bq/g)	4.95e+05
^{152}Eu	(Bq/g)	7.22e+05
^{154}Eu	(Bq/g)	5.14e+05
^{155}Eu	(Bq/g)	1.21e+05
^{93}Nb	(Bq/g)	<7.0e+03
^{106}Ru	(Bq/g)	<6.2e+04
^{90}Sr	(Bq/g)	2.28e+06
^{93}Zr	(Bq/g)	<4.5e+04
Alpha emitters		
^{235}U	(Bq/g)	
^{233}U	(Bq/g)	1.18e+04
^{233}U	(Bq/g)	<2.6e+04
$^{239}Pu/^{240}Pu$	(Bq/g)	1.18e+04
$^{238}Pu/^{241}Am$	(Bq/g)	3.21e+04
^{243}Cm	(Bq/g)	<2.6e+04
^{243}Cm	(Bq/g)	1.67e+05

LEGEND:
TSD - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC - TOTAL ORGANIC CARBON

2.19 Tank System W-24 Piping

2.19.1 Tank System Summary

Tank System W-24 is located at the Melton Valley Storage Tank Facility (Building 7830) (Figures 2.19-1 and 2.19-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from a pipe tunnel to Tank Vault W-24 through W-27. Tank System W-24 piping is used to transfer concentrate from the Evaporator to Tanks W-24 through W-31 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.19.2 Standards for Pipe Assessment of Tank Systems

2.19.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-24 piping is located at Building 7830 and is routed from a pipe tunnel to Tank Vault W-24 through W-27. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-24 piping is constructed of 6″, and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 150°F for the 6″ line and 300 psig and 150°F for the 4″ line. Tank System W-24 piping has a maximum volume of 111 gal.

Design Standards

The applicable codes and standards used for Tank System W-24 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American National Standards Institute;

American Society for Testing and Materials A48, A262-70, C91, C139, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX;

ASHRAE Guide and Data Book—Application;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Building Code Requirements for Reinforced Concrete;

Factory Mutual Engineering Corporation;

National Electrical Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Nuclear Safety Information Center 65—Design, Construction and Testing of High Efficiency Air Filtration Systems for Nuclear Application;

Occupational Safety and Health Administration;

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) High Velocity Duct Construction Standards and Low Velocity Standards;

SMACNA Ducted Electric Heat Guide for Air Handling Systems; and

Union Carbide Corporation Nuclear Division (UCC-ND) Standards, Sections 303, 401, 411, 702, and 914.04.

2.19.2.2 Generic Description of Piping Contents

Tank System W-24 piping was designed to serve as part of an interim storage tank system for the hydrofracture facility. The waste concentrates stored in Tank W-24 were being disposed of as a cement-waste mixture (grout) by injection into shale formations located 800′ to 1100′ below the ground surface using hydrofracture. However, hydrofracture was terminated in 1984, and Tank W-24 has become a waste concentrates storage tank for the liquid low-level waste (LLLW) system. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including

reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the LLLW Evaporator for concentration, with transfer of evaporator bottoms to Tanks W-24 through W-31 for storage.

Tank System W-24 piping transfers LLLW to and from Tank W-24. The analytical data (Figure 2.19-3) of the waste samples are representative of the waste received by Tank W-24. The liquid waste supernate sampled in Tank W-24 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions. The principal metals found in the tank sludge were sodium, potassium, calcium, magnesium, uranium, and thorium. The sludge contains radioactive materials that produce a radiation level of 1.2 rem per hour (R/h) (Figure 2.19-4).

2.19.2.3 Pipe Corrosion Protection Measures

Piping inside the pipe tunnel and Tank Vault W-24 through W-27 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.19.2.4 Documented Age of Tank System

Tank System W-24 piping was installed in 1980.

2.19.3 Standards for Containment/Release Detection

2.19.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-24 piping is single-wall, schedule 40S, type 304L SS and is routed from a pipe tunnel to Tank Vault W-24 through W-27. Each area is discussed below. The piping penetrations from the pipe tunnel to Tank Vault W-24 through W-27 are singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes embedded in the concrete wall to a length of 3′0″.

Pipe Tunnel

The bottom of the pipe tunnel is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 3′0″ up the pipe tunnel. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that Tank Vault W-24 through W-27 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe tunnel and tank vault are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.19.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Pipe Tunnel

The pipe tunnel foundation is a 20′3″ × 133′6″ × 1′6″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe tunnel and tank vault foundations are properly designed to support the secondary containment systems.

2.19.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Pipe Tunnel

The pipe tunnel floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a pneumatic level indicator that will activate alarms in the Evaporator Service Tanks Control Room and Waste Operations Control Center (Building 3130).

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault is provided with a leak detection system.

The assessment concludes that the pipe tunnel and tank vault are provided with leak detection.

2.19.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Pipe Tunnel

The pipe tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe tunnel and the tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.19.4 Supplemental Information

2.19.4.1 Ancillary Equipment

Tank W-24 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-24 through W-27, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.19.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-24.

2.19.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. July 20, 1992. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing P3E-21247-C012, Melton Valley Waste Storage Tanks, Piping Modifications Pump Room and Pipe Gallery Modifications, Revision A.

Energy Systems Drawing P3E-21247-C013, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P3E-21247-C014, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P-21247-YE-026-E, Waste Storage Tanks, Piping Flow Diagram-Process, Sheet 1, Revision G.

Energy Systems Drawing P-21247-YC-002-E, Waste Storage Tanks, Piping Plan, Revision B.

Energy Systems Drawing S-21247-YB-002-E, Waste Storage Tanks, Plan and Detail for Control House and Pump Room, Revision D.

Energy Systems Drawing S-21247-YB-001-E, Waste Storage Tanks, Plan Concrete Vault, Revision C.

Energy Systems Drawing P-21247-YC-003-E, Waste Storage Tanks, Pump Room Piping Plan, Revision G.

Energy Systems Drawing S-21247-YB-003-E, Waste Storage Tanks, Sections and Details of Concrete Vault, Revision D.

Energy Systems Drawing P-21247-YC-004-E, Waste Storage Tanks, Tank Piping Section, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-012-E, Waste Storage Tanks, Tank Piping Section, Sheet 2, Revision B.

Energy Systems Drawing P-21247-YC-001-E, Waste Storage Tanks, Tanks, Pump Room and Tunnel Piping Plan, Revision E.

Energy Systems Drawing P-21247-YC-011-E, Waste Storage Tanks, Tanks, Pump Room Piping Section, Sheet 2, Revision D.

Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

Risk Evaluation of Embedded, Single-Walled Liquid Low-Level Waste Piping at Oak Ridge National Laboratory.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* Oak Ridge National Laboratory. ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.19-1
Location of Tank System W-24 Piping

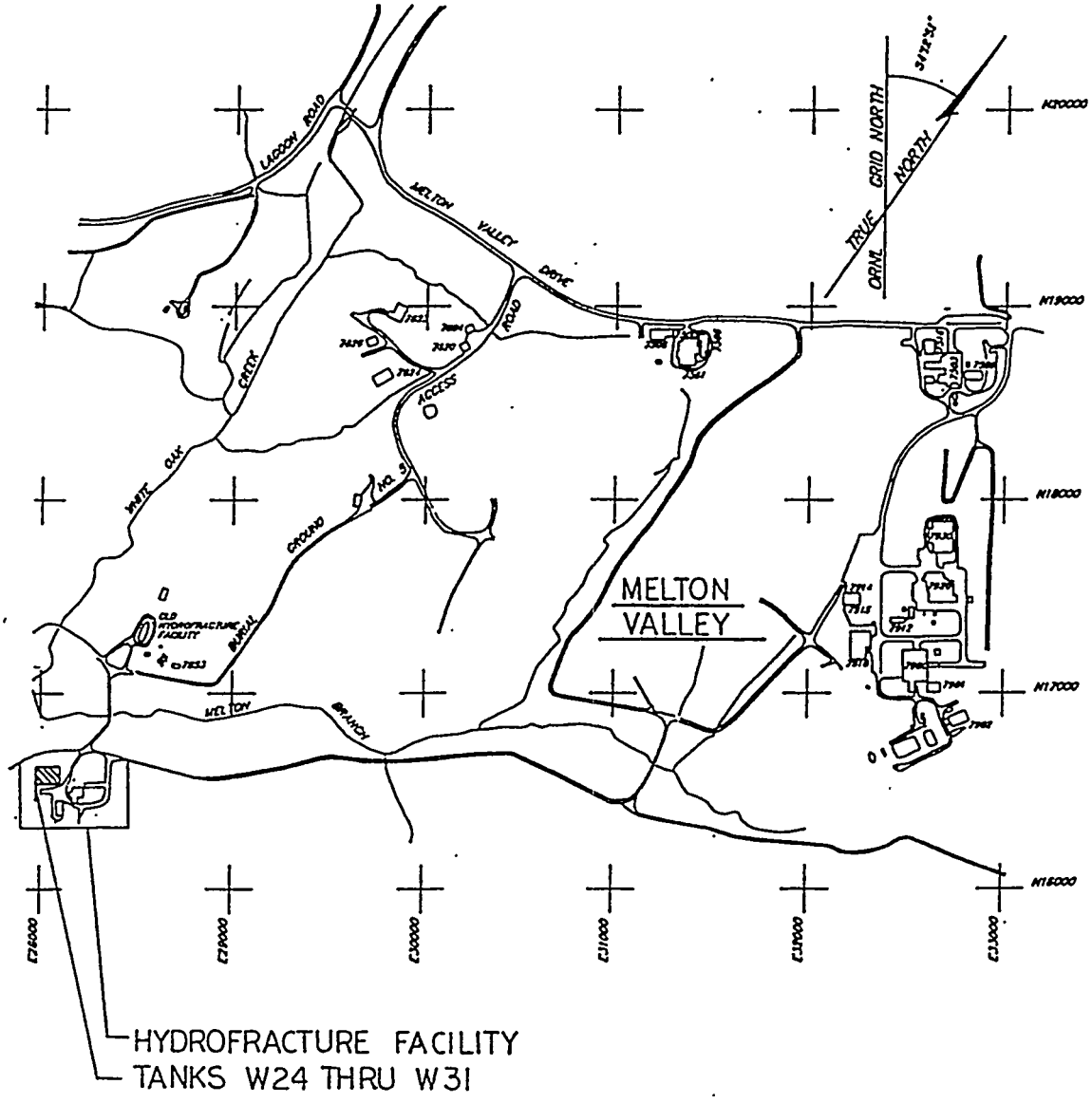
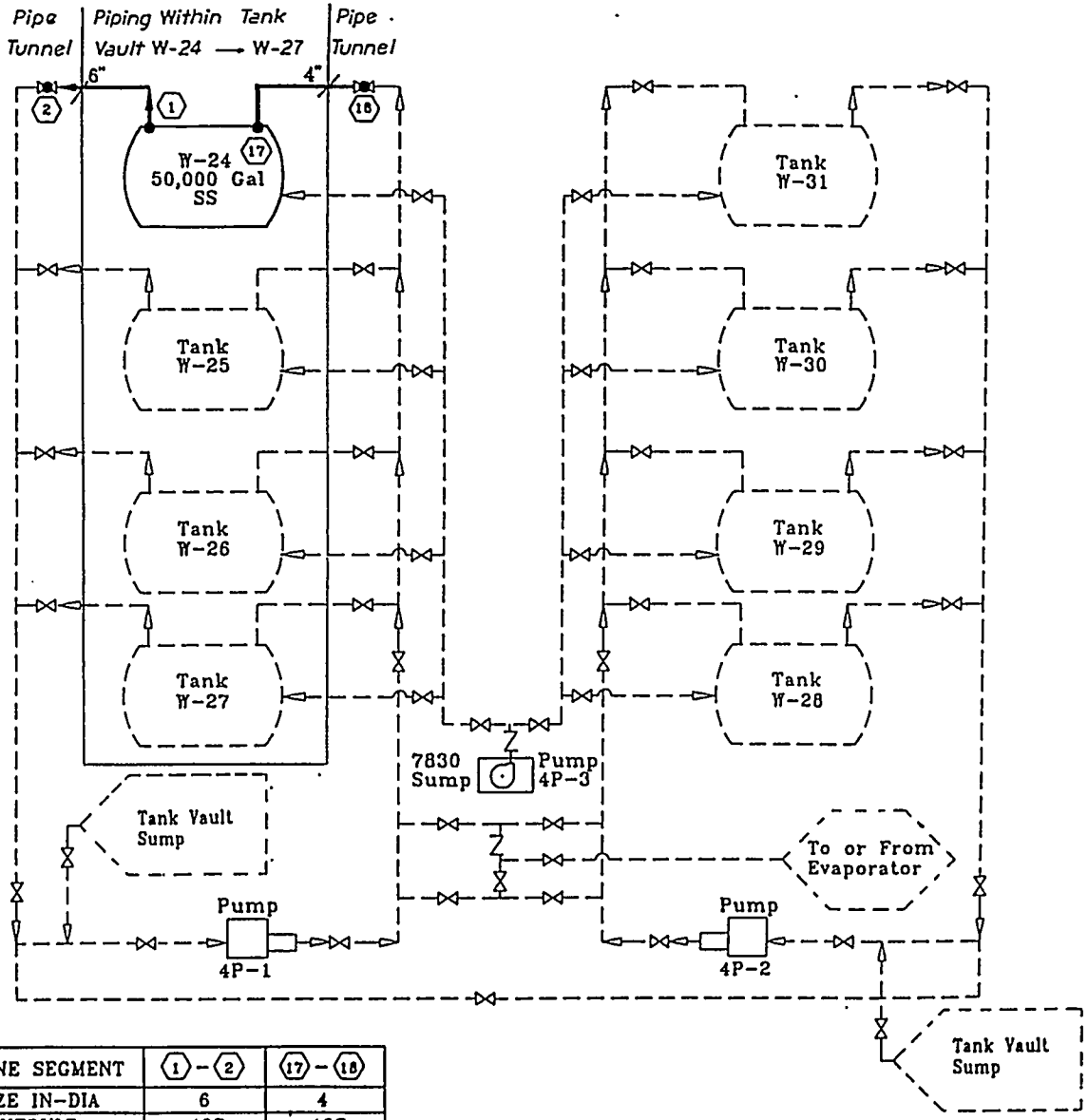
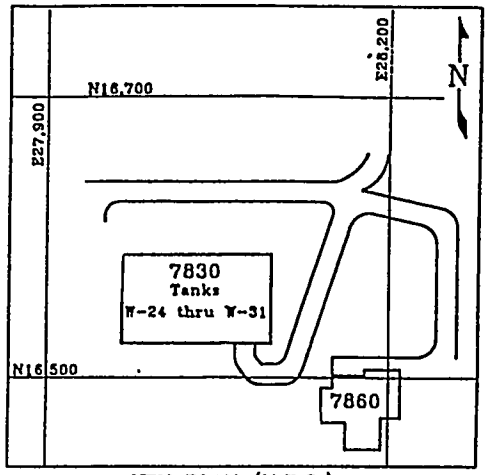


Figure 2.19-2 Tank System W-24 Piping Diagram





KEY PLAN (N.T.S.)

LINE SEGMENT	(1) - (2)	(17) - (18)
SIZE IN-DIA	6	4
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	37	85
VOLUME (GAL)	55	56

REFERENCE DRAWING LIST
P-21247-YC-011-E Rev D
P-21247-YC-005-E Rev B
P-21247-YC-003-E Rev G
P-21247-YC-002-E Rev B
P-21247-YC-001-E Rev E
P-21247-YE-027-E Rev C
P-21247-YE-026-E Rev G

TANK SYSTEM W-24 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.19-3
Analytical Data for Liquid and Sludge Samples (Tank System W-24)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN. 1990	TANK W24-L2
Physical properties and miscellaneous data			
TDS	(mg/mL)		377
TS	(mg/mL)		383
Density	(g/mL)		1.2348
IC	(mg/L)		1910
TC	(mg/L)		2400
TOC	(mg/L)		489
RCRA metals			
Ag	(mg/L)		<0.69
As	(mg/L)		<3.7
Ba	(mg/L)		0.29
Cd	(mg/L)		0.22
Cr	(mg/L)		3.1
Hg	(mg/L)		0.046
Ni	(mg/L)		<0.38
Pb	(mg/L)		6.7
Se	(mg/L)		<4.7
Tl	(mg/L)		<1.4
Process metals			
Al	(mg/L)		46
B	(mg/L)		0.95
Ca	(mg/L)		7.2
Co	(mg/L)		<0.57
Fe	(mg/L)		<2.6
K	(mg/L)		11000
Mg	(mg/L)		<1.3
Na	(mg/L)		100000
Si	(mg/L)		245
Sr	(mg/L)		<0.74
Th	(mg/L)		<2.2
U	(mg/L)		9.4
Anions			
Chloride	(M)		0.073
Fluoride	(M)		<0.026
Nitrate	(M)		4.19
Phosphate	(M)		<0.053
Sulfate	(M)		<0.052
Alkalinity			
pH			11.1
H^+	(M)		-
OH^-	(M)		0.29
CO_3^{2-}	(M)		0.15
HCO_3^-	(M)		<0.01
Beta/gamma emitters			
Gross alpha	(Bq/mL)		5.00e+00
Gross beta	(Bq/mL)		2.30e+05
^{14}C	(Bq/mL)		7.87e+02
^{144}Ce	(Bq/mL)		<7.4e+02
^{60}Co	(Bq/mL)		3.29e+02
^{134}Cs	(Bq/mL)		1.34e+03
^{137}Cs	(Bq/mL)		2.21e+05
^{152}Eu	(Bq/mL)		<3.2e+02
^{154}Eu	(Bq/mL)		<6.0e+01
^{155}Eu	(Bq/mL)		<4.0e+02
^{3}H	(Bq/mL)		3.08e+02
^{95}Nb	(Bq/mL)		<2.8e+02
^{106}Ru	(Bq/mL)		<1.1e+03
^{90}Sr	(Bq/mL)		9.13e+02
^{95}Zr	(Bq/mL)		<5.0e+02

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN. 1990	TANK W24-S
Physical properties and miscellaneous data			
TS	(mg/g)		487
Density	(g/mL)		1.26
IC	(mg/kg)		6630
TC	(mg/kg)		9570
TOC	(mg/kg)		2940
RCRA metals			
Ag	(mg/kg)		(<7.7)
As	(mg/kg)		<42
Ba	(mg/kg)		44
Cd	(mg/kg)		6.1
Cr	(mg/kg)		36
Hg	(mg/kg)		26
Ni	(mg/kg)		22
Pb	(mg/kg)		150
Se	(mg/kg)		<52
Tl	(mg/kg)		<16
Process metals			
Al	(mg/kg)		1600
B	(mg/kg)		3.1
Ca	(mg/kg)		29000
Cs	(mg/kg)		<1.3
Fe	(mg/kg)		600
K	(mg/kg)		7600
Mg	(mg/kg)		5600
Na	(mg/kg)		69000
Sr	(mg/kg)		110
Th	(mg/kg)		1480
U	(mg/kg)		3700
Beta/gamma emitters			
Gross alpha	(Bq/g)		2.34e+04
Gross beta	(Bq/g)		2.62e+06
^{14}C	(Bq/g)		8.43e+02
^{144}Ce	(Bq/g)		<3.9e+03
^{60}Co	(Bq/g)		3.39e+04
^{134}Cs	(Bq/g)		<6.2e+02
^{137}Cs	(Bq/g)		1.96e+05
^{152}Eu	(Bq/g)		6.20e+04
^{154}Eu	(Bq/g)		3.60e+04
^{155}Eu	(Bq/g)		1.03e+04
^{95}Nb	(Bq/g)		<5.6e+02
^{106}Ru	(Bq/g)		<5.7e+03
^{90}Sr	(Bq/g)		1.05e+06
^{95}Zr	(Bq/g)		<2.8e+03
Alpha emitters			
^{233}U	(Bq/g)		
^{235}U	(Bq/g)		5.15e+02
^{238}U	(Bq/g)		<3.7e+03
$^{239}Pu/^{240}Pu$	(Bq/g)		1.54e+03
$^{238}Pu/^{241}Am$	(Bq/g)		3.74e+03
^{243}Cm	(Bq/g)		<3.6e+03
^{244}Cm	(Bq/g)		1.63e+04

LEGEND: PHYSICAL PROPERTIES
TDS - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC TOTAL ORGANIC CARBON

Figure 2.19-4 General Characteristics of Waste Samples (Tank System W-24)

	Liquid samples:		Sludge samples		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-24	0.180	No	2/soft sludge	1.2	Could probably pump with a peristaltic pump, except for the thin layer of "mud" on bottom
					Sonicated sludge: light yellow tan; very fine particles with a few coarser particles
W-25	0.260	No	3/soft sludge	1.3	Thicker sludge than in tank W-24
					Could probably pump with a peristaltic pump, except for the thin layer of "mud" on bottom
					Sonicated sludge: light tan; very fine particles with a few coarser particles

2.20 Tank System W-25 Piping

2.20.1 Tank System Summary

Tank System W-25 is located at the Melton Valley Storage Tank Facility (Building 7830) (Figures 2.20-1 and 2.20-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from a pipe tunnel to Tank Vault W-24 through W-27. Tank System W-25 piping is used to transfer concentrate from the Evaporator to Tanks W-24 through W-31 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.20.2 Standards for Pipe Assessment of Tank Systems

2.20.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-25 piping is located at Building 7830 and is routed from a pipe tunnel to Tank Vault W-24 through W-27. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-25 piping is constructed of 6″, and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 150°F for the 6″ line and 300 psig and 150°F for the 4″ line. Tank System W-25 piping has the capacity to contain a maximum volume of 150 gal.

Design Standards

The applicable codes and standards used for Tank System W-25 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Society for Testing and Materials A48, A262-70, C91, C139, C144, and D1751.;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX;

ASHRAE Guide and Data Book—Application;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electrical Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.20.2.2 Generic Description of Piping Contents

Tank System W-25 piping was designed to serve as part of an interim storage tank system for the hydrofracture facility. The waste concentrates stored in Tank W-25 were being disposed of as a cement-waste mixture (grout) by injection into shale formations located 800′ to 1100′ below the ground surface using hydrofracture. However, hydrofracture was terminated in 1984, and Tank W-25 has become a waste concentrates storage tank for the liquid low-level waste (LLLW) system. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the LLLW Evaporator for concentration, with transfer of evaporator bottoms to Tanks W-24 through W-31 for storage.

Tank System W-25 piping transfers LLLW to and from Tank W-25. The analytical data (Figure 2.20-3) of the waste samples are representative of the waste received by Tank W-25. The liquid waste supernate sampled in Tank W-25 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions. The principal metals found in the tank sludge were sodium, potassium, calcium, magnesium, uranium, and thorium. The sludge contains radioactive materials that produce a radiation level of 1.3 rem per hour (R/h) (Figure 2.20-4).

2.20.2.3 Pipe Corrosion Protection Measures

Piping inside the pipe tunnel and Tank Vault W-24 through W-27 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.20.2.4 Documented Age of Tank System

Tank System W-25 piping was installed in 1980.

2.20.3 Standards for Containment/Release Detection

2.20.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-25 piping is single-wall, schedule 40S, type 304L SS that is routed from a pipe tunnel to Tank Vault W-24 through W-27. Each area is discussed below. The piping penetrations from the pipe tunnel to Tank Vault W-24 through W-27 are singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes embedded in the concrete wall to a length of 3′0″.

Pipe Tunnel

The bottom of the pipe tunnel is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 3′0″ up the pipe tunnel. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that Tank Vault W-24 through W-27 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe tunnel and tank vault are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.20.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Pipe Tunnel

The pipe tunnel foundation is a 20′3″ × 133′6″ × 1′6″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe tunnel and tank vault foundations are properly designed to support the secondary containment systems.

2.20.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Pipe Tunnel

The pipe tunnel floor is sloped to a 16-gauge (1/16"), 304L SS-lined sump where accumulation of liquid will be detected by a pneumatic level indicator that will activate alarms in the Evaporator Service Tanks Control Room and Waste Operations Control Center (Building 3130).

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault is provided with a leak detection system.

The assessment concludes that the pipe tunnel and tank vault are provided with leak detection.

2.20.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Pipe Tunnel

The pipe tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe tunnel and the tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.20.4 Supplemental Information

2.20.4.1 Ancillary Equipment

Tank W-25 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-24 through W-27, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.20.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-25.

2.20.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. July 20, 1992. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing P3E-21247-C012, Melton Valley Waste Storage Tanks, Piping Modifications Pump Room and Pipe Gallery Modifications, Revision A.

Energy Systems Drawing P3E-21247-C013, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P3E-21247-C014, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P-21247-YE-026-E, Waste Storage Tanks, Piping Flow Diagram, Process, Sheet 1, Revision G.

Energy Systems Drawing P-21247-YE-027-E, Waste Storage Tanks, Piping Flow Diagram, Process, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-002-E, Waste Storage Tanks, Piping Plan, Revision B.

Energy Systems Drawing S-21247-YB-002-E, Waste Storage Tanks, Plan and Detail for Control House and Pump Room, Revision D.

Energy Systems Drawing S-21247-YB-001-E, Waste Storage Tanks, Plan Concrete Vault, Revision C.

Energy Systems Drawing P-21247-YC-003-E, Waste Storage Tanks, Pump Room Piping Plan, Revision G.

Energy Systems Drawing S-21247-YB-003-E, Waste Storage Tanks, Sections and Details of Concrete Vault, Revision D.

Energy Systems Drawing P-21247-YC-004-E, Waste Storage Tanks, Tank Piping Section, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-012-E, Waste Storage Tanks, Tank Piping Section, Sheet 2, Revision B.

Energy Systems Drawing P-21247-YC-001-E, Waste Storage Tanks, Tanks, Pump Room and Tunnel Piping Plan, Revision E.

Energy Systems Drawing P-21247-YC-011-E, Waste Storage Tanks, Tanks, Pump Room Piping Section, Sheet 2, Revision D.

Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

Risk Evaluation of Embedded, Single-Walled Liquid Low-Level Waste Piping at Oak Ridge National Laboratory.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.20-1
Location of Tank System W-25 Piping

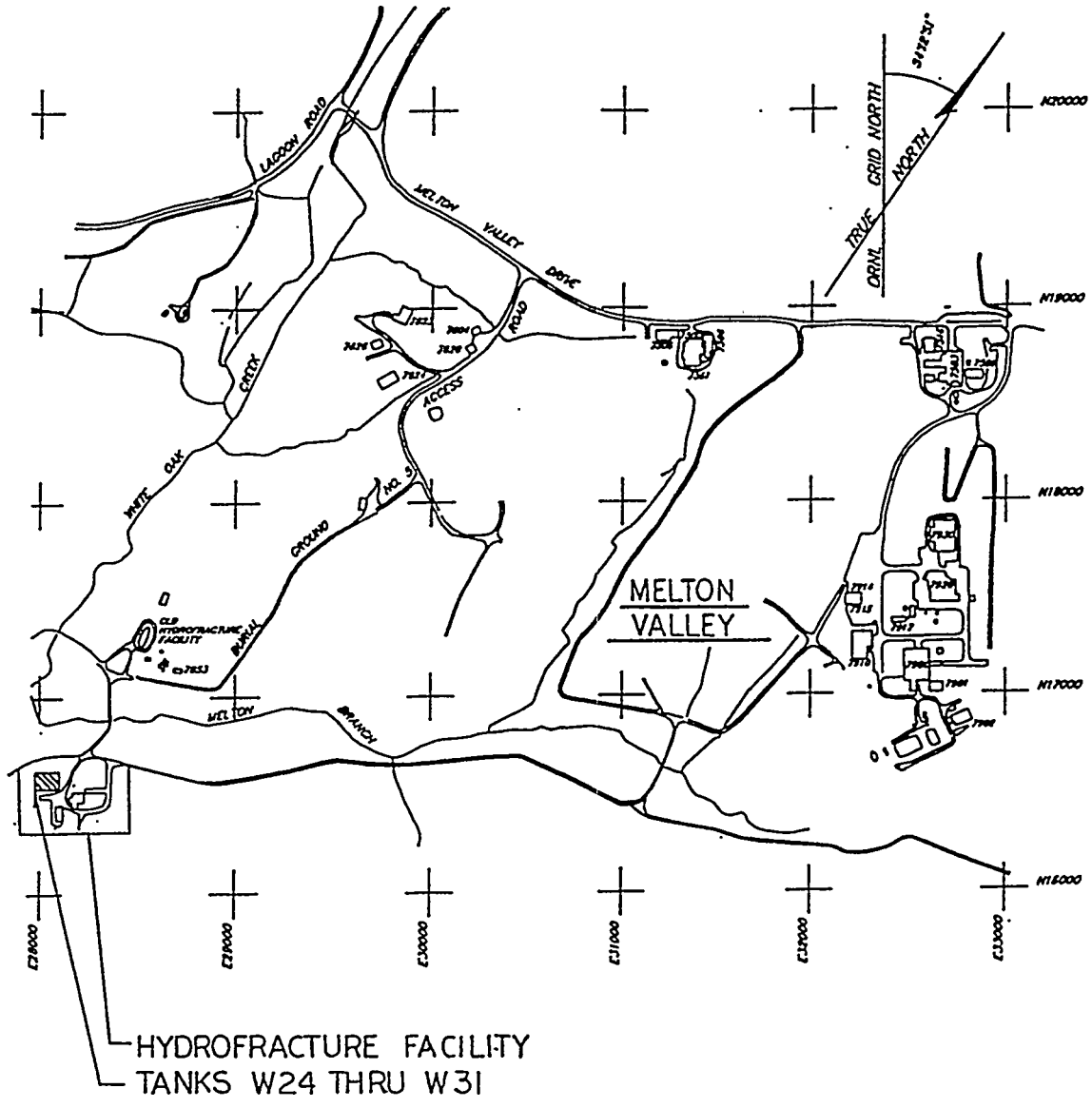
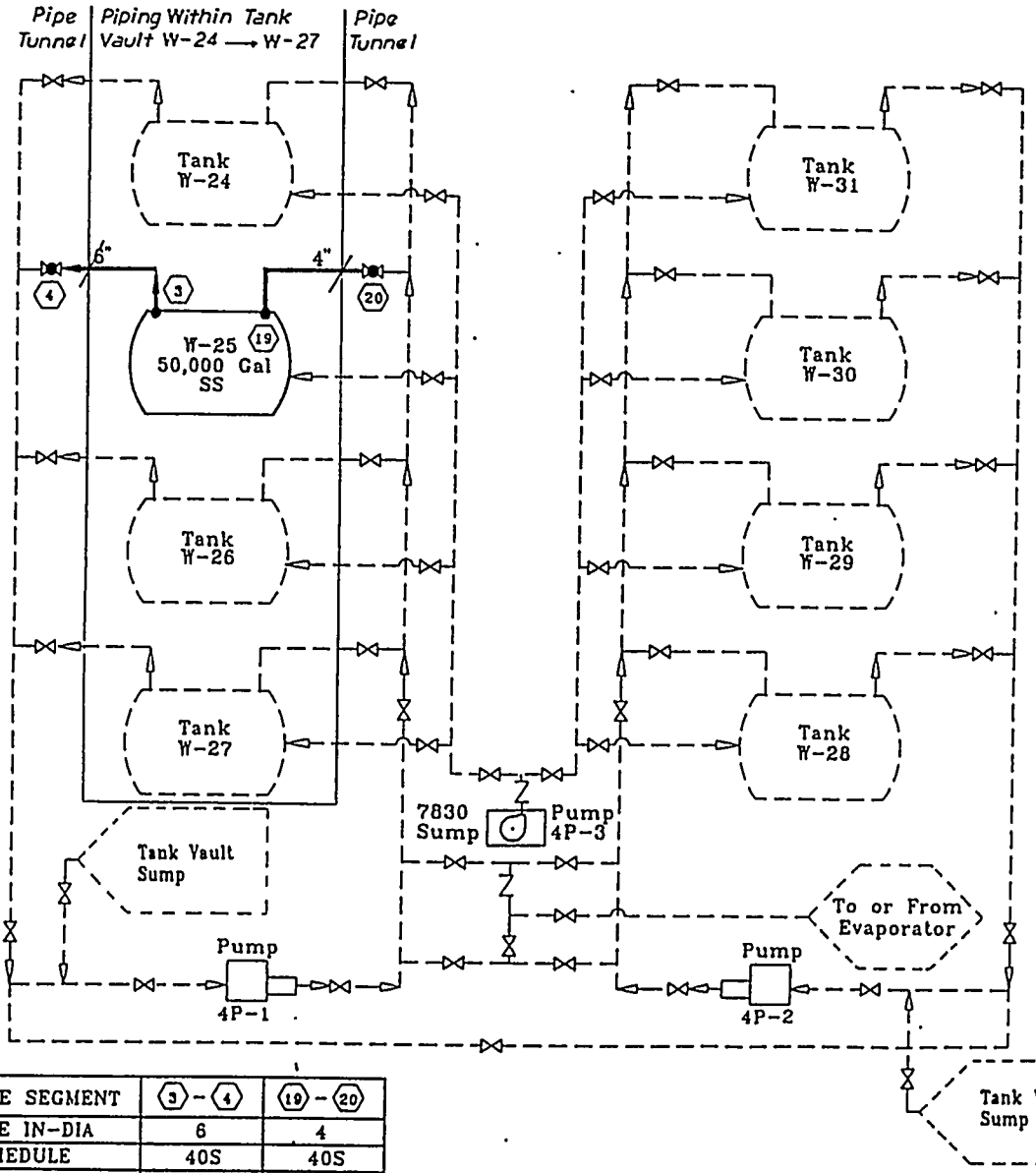
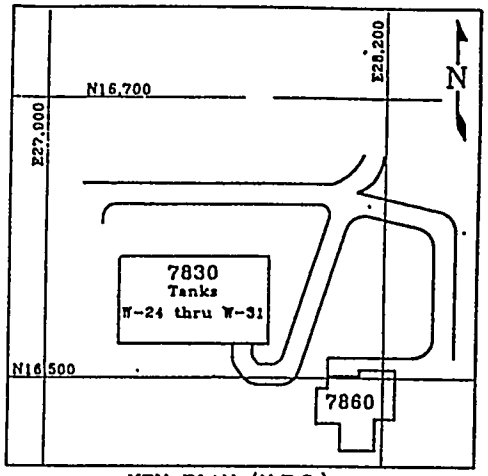


Figure 2.20-2 Tank System W-25 Piping Diagram





KEY PLAN (N.T.S.)

LINE SEGMENT	③ - ④	⑲ - ⑳
SIZE IN-DIA	6	4
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	86	32
VOLUME (GAL)	129	21

REFERENCE DRAWING LIST
P-21247-YC-011-E Rev D
P-21247-YC-005-E Rev B
P-21247-YC-003-E Rev G
P-21247-YC-002-E Rev B
P-21247-YC-001-E Rev E
P-21247-YE-027-E Rev C
P-21247-YE-026-E Rev G

TANK SYSTEM W-25 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.20-3
Analytical Data for Liquid and Sludge Samples (Tank System W-25)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN 1990	TANK W25-L2
Physical properties and miscellaneous data			
TDS	(mg/mL)		348
TS	(mg/mL)		334
Density	(g/mL)		1.2018
IC	(mg/L)		15.8
TC	(mg/L)		478
TOC	(mg/L)		462
RCRA metals			
Ag	(mg/L)		<0.69
As	(mg/L)		<3.7
Ba	(mg/L)		3.2
Cd	(mg/L)		<0.12
Cr	(mg/L)		1.9
Hg	(mg/L)		0.054
Ni	(mg/L)		0.45
Pb	(mg/L)		<2.1
Se	(mg/L)		<4.7
Tl	(mg/L)		<1.4
Process metals			
Al	(mg/L)		<4.2
B	(mg/L)		0.60
Ca	(mg/L)		250
Co	(mg/L)		<0.57
Fe	(mg/L)		<2.6
K	(mg/L)		17000
Mg	(mg/L)		<1.3
Na	(mg/L)		78000
Si	(mg/L)		<1
Sr	(mg/L)		23
Th	(mg/L)		<2.2
U	(mg/L)		<0.10
Anions			
Chloride	(M)		0.071
Fluoride	(M)		<0.026
Nitrate	(M)		4.19
Phosphate	(M)		<0.053
Sulfate	(M)		<0.052
Alkalinity			
pH			12.5
H^+	(M)		-
OH^-	(M)		0.06
CO_3^{2-}	(M)		<0.01
HCO_3^-	(M)		<0.01
Beta/gamma emitters			
Gross alpha	(Bq/mL)		2.00e+00
Gross beta	(Bq/mL)		3.92e+05
^{14}C	(Bq/mL)		3.29e+02
^{141}Ce	(Bq/mL)		<1.3e+03
^{60}Co	(Bq/mL)		1.55e+03
^{134}Cs	(Bq/mL)		3.77e+03
^{137}Cs	(Bq/mL)		3.27e+05
^{152}Eu	(Bq/mL)		<1.6e+02
^{154}Eu	(Bq/mL)		<1.2e+02
^{155}Eu	(Bq/mL)		<6.9e+02
^{3}H	(Bq/mL)		3.45e+02
^{95}Nb	(Bq/mL)		<6.3e+01
^{106}Ru	(Bq/mL)		<1.9e+03
^{90}Sr	(Bq/mL)		1.95e+04
^{95}Zr	(Bq/mL)		<1.2e+02

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN. 1990	TANK W25-S
Physical properties and miscellaneous data			
TS	(mg/g)		531
Density	(g/mL)		1.32
IC	(mg/kg)		3920
TC	(mg/kg)		6250
TOC	(mg/kg)		2330
RCRA metals			
Ag	(mg/kg)		(<7.6)
As	(mg/kg)		<41
Ba	(mg/kg)		59
Cd	(mg/kg)		11
Cr	(mg/kg)		59
Hg	(mg/kg)		37
Ni	(mg/kg)		34
Pb	(mg/kg)		220
Se	(mg/kg)		<51
Tl	(mg/kg)		<16
Process metals			
Al	(mg/kg)		2800
B	(mg/kg)		<1.5
Ca	(mg/kg)		38000
Cs	(mg/kg)		<1.3
Fe	(mg/kg)		940
K	(mg/kg)		9200
Mg	(mg/kg)		5900
Na	(mg/kg)		66000
Sr	(mg/kg)		150
Th	(mg/kg)		3860
U	(mg/kg)		4800
Beta/gamma emitters			
Gross alpha	(Bq/g)		4.65e+04
Gross beta	(Bq/g)		4.00e+06
^{14}C	(Bq/g)		1.71e+02
^{144}Ce	(Bq/g)		<4.2e+03
^{60}Co	(Bq/g)		4.03e+04
^{134}Cs	(Bq/g)		7.07e+02
^{137}Cs	(Bq/g)		2.21e+05
^{152}Eu	(Bq/g)		8.14e+04
^{154}Eu	(Bq/g)		5.06e+04
^{155}Eu	(Bq/g)		1.63e+04
^{95}Nb	(Bq/g)		<5.9e+02
^{106}Ru	(Bq/g)		<5.9e+03
^{90}Sr	(Bq/g)		1.65e+06
^{95}Zr	(Bq/g)		<4.6e+03
Alpha emitters			
^{233}U	(Bq/g)		
^{235}U	(Bq/g)		8.37e+02
^{238}U	(Bq/g)		<4.2e+03
$^{239}Pu/^{240}Pu$	(Bq/g)		2.93e+03
$^{241}Pu/^{241}Am$	(Bq/g)		7.35e+03
^{243}Cm	(Bq/g)		<3.9e+03
^{244}Cm	(Bq/g)		3.32e+04

LEGEND: PHYSICAL PROPERTIES
TDS – TOTAL DISSOLVED SOLIDS
TS – TOTAL SOLIDS
IC – INORGANIC CARBON
TC – TOTAL CARBON
TOC TOTAL ORGANIC CARBON

Figure 2.20-4 General Characteristics of Waste Samples (Tank System W-25)

Liquid samples:			Sludge samples		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-24	0.180	No	2/soft sludge	1.2	Could probably pump with a peristaltic pump, except for the thin layer of "mud" on bottom
					Sonicated sludge: light yellow tan; very fine particles with a few coarser particles
W-25	0.260	No	3/soft sludge	1.3	Thicker sludge than in tank W-24
					Could probably pump with a peristaltic pump, except for the thin layer of "mud" on bottom
					Sonicated sludge: light tan; very fine particles with a few coarser particles

2.21 Tank System W-26 Piping

2.21.1 Tank System Summary

Tank System W-26 is located at the Melton Valley Storage Tank Facility (Building 7830) (Figures 2.21-1 and 2.21-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from a pipe tunnel to Tank Vault W-24 through W-27. Tank System W-26 piping is used to transfer concentrate from the Evaporator to Tanks W-24 through W-31 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.21.2 Standards for Pipe Assessment of Tank Systems

2.21.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-26 piping is located at Building 7830 and is routed from a pipe tunnel to Tank Vault W-24 through W-27. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-26 piping is constructed of 6″ and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 150°F for the 6″ line and 300 psig and 150°F for the 4″ line. Tank System W-26 piping has the capacity to contain a maximum volume of 111 gal.

Design Standards

The applicable codes and standards used for Tank System W-26 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Society for Testing and Materials A48, A262-70, C91, C139, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX;

ASHRAE Guide and Data Book—Application;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electrical Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.21.2.2 Generic Description of Piping Contents

Tank System W-26 piping was designed to serve as part of an interim storage tank system for the hydrofracture facility. The waste concentrates stored in Tank W-26 were being disposed of as a cement-waste mixture (grout) by injection into shale formations located 800 to 1100′ below the ground surface using hydrofracture. However, hydrofracture was terminated in 1984, and Tank W-26 has become a waste concentrates storage tank for the liquid low-level waste (LLLW) system. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the LLLW Evaporator for concentration, with transfer of evaporator bottoms to Tanks W-24 through W-31 for storage.

Tank System W-26 piping transfers LLLW to and from Tank W-26. The analytical data (Figure 2.21-3) of waste samples are representative of the waste received by Tank W-26. The liquid waste supernate sampled in Tank W-26 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions. The principal metals found in the tank sludge were sodium, potassium, calcium, magnesium, uranium, and thorium. The sludge contains radioactive materials that produce a radiation level of 0.8–2.0 rem per hour (R/h) (Figure 2.21-4).

2.21.2.3 Pipe Corrosion Protection Measures

Piping inside the pipe tunnel and Tank Vault W-24 through W-27 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.21.2.4 Documented Age of Tank System

Tank System W-26 piping was installed in 1980.

2.21.3 Standards for Containment/Release Detection

2.21.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-26 piping is single-wall, schedule 40S, type 304L SS that is routed from a pipe tunnel to Tank Vault W-24 through W-27. Each area is discussed below. The piping penetrations from the pipe tunnel to Tank Vault W-24 through W-27 are singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes embedded in the concrete wall to a length of 3′0″.

Pipe Tunnel

The bottom of the pipe tunnel is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 3′0″ up the pipe tunnel. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that Tank Vault W-24 through W-27 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe tunnel and tank vault are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.21.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Pipe Tunnel

The pipe tunnel foundation is a 20′3″ × 133′6″ × 1′6″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe tunnel and tank vault foundations are properly designed to support the secondary containment systems.

2.21.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Pipe Tunnel

The pipe tunnel floor is sloped to a 16-gauge (1/16"), 304L SS-lined sump where accumulation of liquid will be detected by a pneumatic level indicator that will activate alarms in the Evaporator Service Tanks Control Room and Waste Operations Control Centers (Building 3130).

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault is provided with a leak detection system.

The assessment concludes that the pipe tunnel and tank vault are provided with leak detection.

2.21.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Pipe Tunnel

The pipe tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe tunnel and the tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.21.4 Supplemental Information

2.21.4.1 Ancillary Equipment

Tank W-26 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-24 through W-27, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.21.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-26.

2.21.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. July 20, 1992. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

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Energy Systems Drawing P3E-21247-C014, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P-21247-YE-026-E, Waste Storage Tanks, Piping Flow Diagram-Process, Sheet 1, Revision G.

Energy Systems Drawing P-21247-YE-027-E, Waste Storage Tanks, Piping Flow Diagram-Process, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-002-E, Waste Storage Tanks, Piping Plan, Revision B.

Energy Systems Drawing S-21247-YB-002-E, Waste Storage Tanks, Plan and Detail for Control House and Pump Room, Revision D.

Energy Systems Drawing S-21247-YB-001-E, Waste Storage Tanks, Plan Concrete Vault, Revision C.

Energy Systems Drawing P-21247-YC-003-E, Waste Storage Tanks, Pump Room Piping Plan, Revision G.

Energy Systems Drawing S-21247-YB-003-E, Waste Storage Tanks, Sections and Details of Concrete Vault, Revision D.

Energy Systems Drawing P-21247-YC-004-E, Waste Storage Tanks, Tank Piping Section, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-012-E, Waste Storage Tanks, Tank Piping Section, Sheet 2, Revision B.

Energy Systems Drawing P-21247-YC-001-E, Waste Storage Tanks, Tanks, Pump Room and Tunnel Piping Plan, Revision E.

Energy Systems Drawing P-21247-YC-011-E, Waste Storage Tanks, Tanks, Pump Room Piping Section, Sheet 2, Revision D.

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Figure 2.21-1
Location of Tank System W-26 Piping

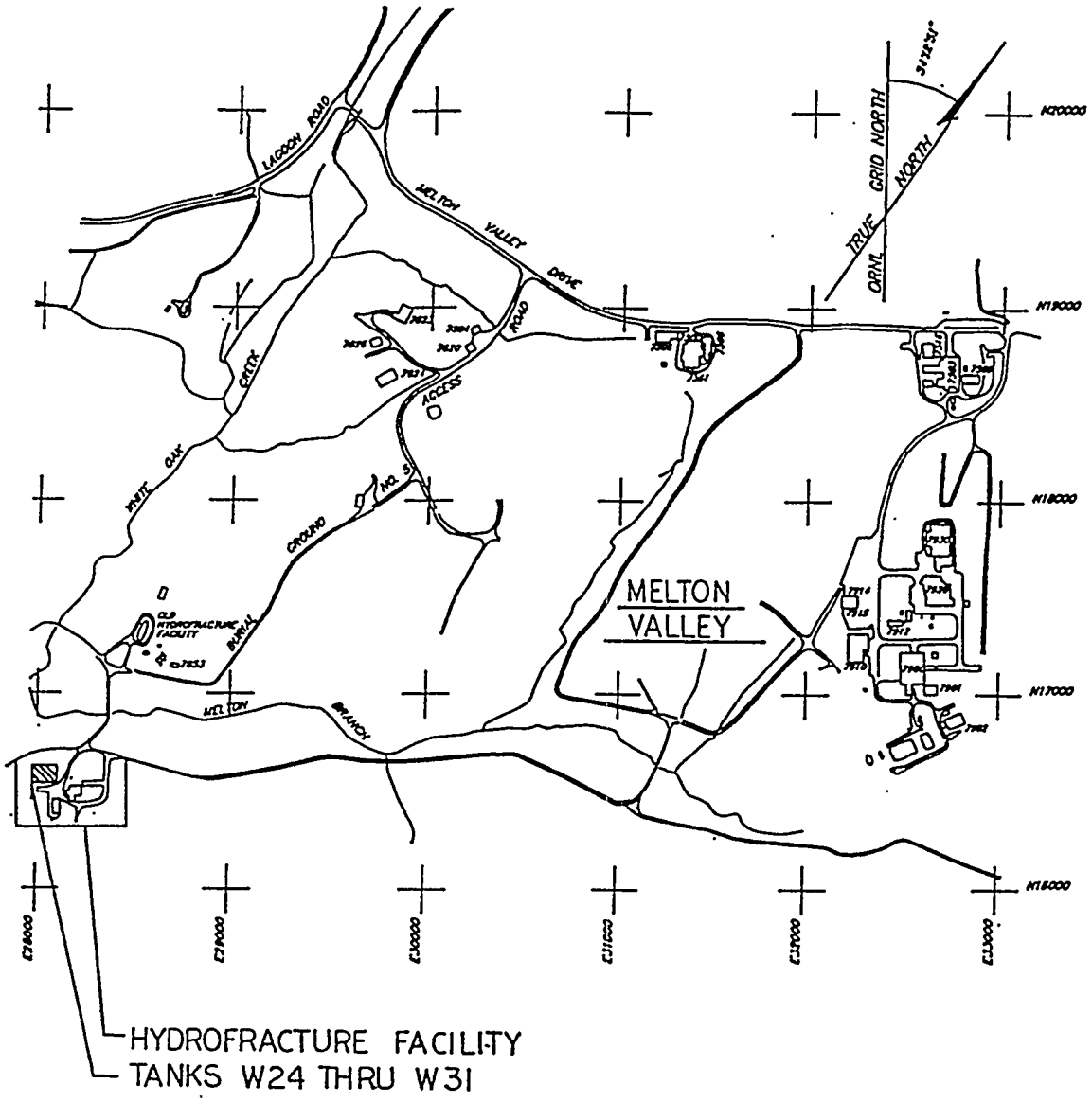
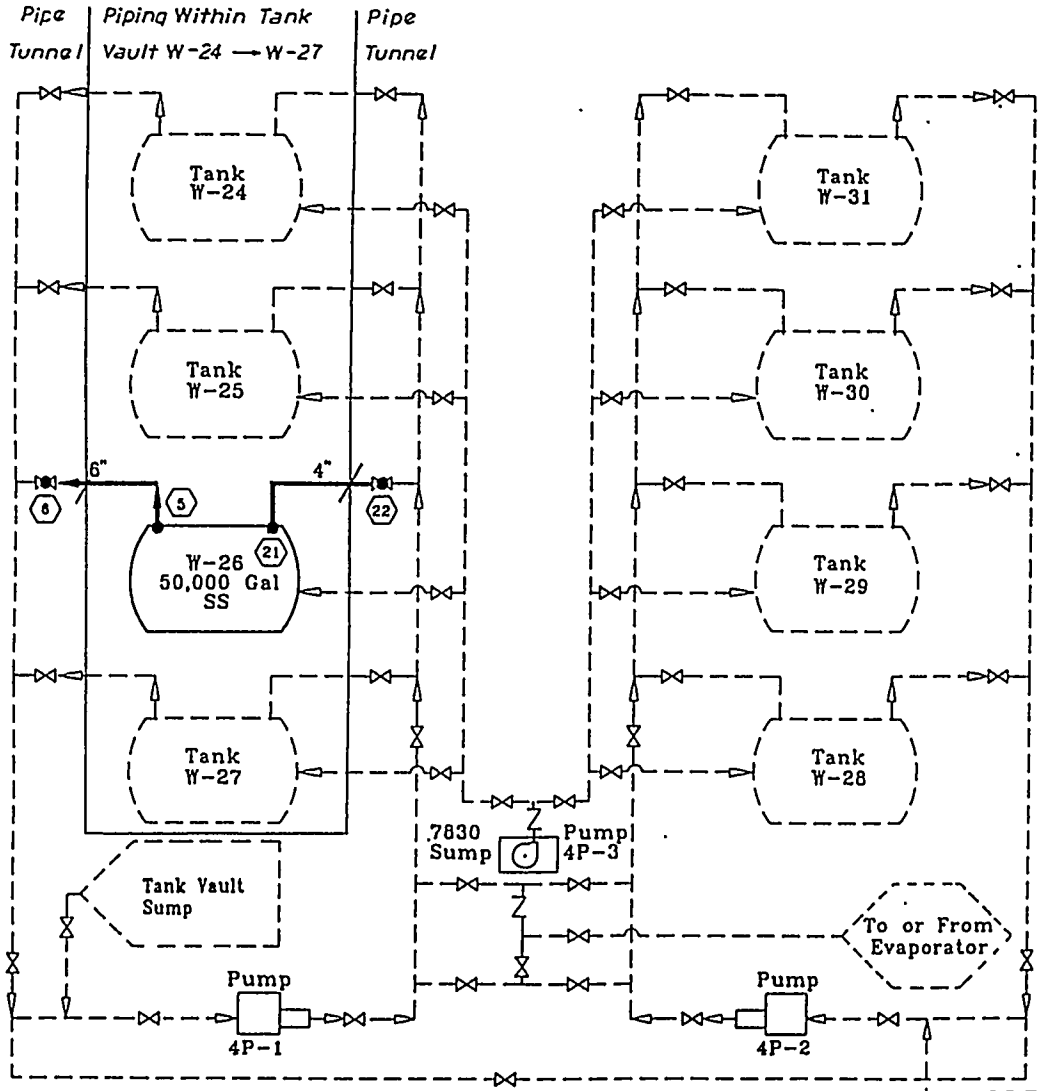
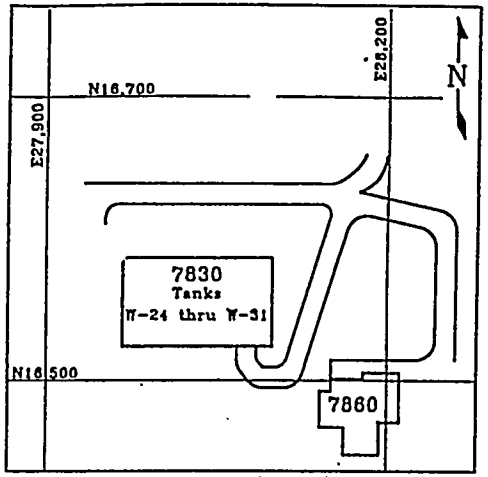


Figure 2.21-2 Tank System W-26 Piping Diagram





KEY PLAN (N.T.S.)

LINE SEGMENT	(5) - (6)	(21) - (22)
SIZE IN-DIA	6	4
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	37	85
VOLUME (GAL)	55	56

REFERENCE DRAWING LIST
P-21247-YC-011-E Rev D
P-21247-YC-005-E Rev B
P-21247-YC-003-E Rev G
P-21247-YC-002-E Rev B
P-21247-YC-001-E Rev E
P-21247-YE-027-E Rev C
P-21247-YE-026-E Rev G

TANK SYSTEM W-26 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.21-3
Analytical Data for Liquid and Sludge Samples (Tank System W-26)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN, 1990	TANK W26-L2
Physical properties and miscellaneous data			
TDS	(mg/mL)		369
TS	(mg/mL)		366
Density	(g/mL)		1.2177
IC	(mg/L)		2580
TC	(mg/L)		3860
TOC	(mg/L)		1280
RCRA metals			
Ag	(mg/L)		1.2
As	(mg/L)		<3.7
Ba	(mg/L)		0.20
Cd	(mg/L)		4.5
Cr	(mg/L)		1.8
Hg	(mg/L)		<0.08
Ni	(mg/L)		8.2
Pb	(mg/L)		3.2
Se	(mg/L)		<4.7
Tl	(mg/L)		<1.4
Process metals			
Al	(mg/L)		4.8
B	(mg/L)		3.9
Ca	(mg/L)		20
Co	(mg/L)		<0.57
Fe	(mg/L)		<2.6
K	(mg/L)		51000
Mg	(mg/L)		3.5
Na	(mg/L)		68000
Si	(mg/L)		11.9
Sr	(mg/L)		<0.74
Th	(mg/L)		10
U	(mg/L)		1130
Anions			
Chloride	(M)		0.099
Fluoride	(M)		<0.026
Nitrate	(M)		3.29
Phosphate	(M)		<0.053
Sulfate	(M)		<0.052
Alkalinity			
pH			11.2
H^+	(M)		<0.01
OH^-	(M)		0.20
CO_3^{2-}	(M)		0.02
HCO_3^-	(M)		
Beta/gamma emitters			
Gross alpha	(Bq/mL)		1.03e+03
Gross beta	(Bq/mL)		2.20e+06
^{14}C	(Bq/mL)		1.23e+02
^{144}Ce	(Bq/mL)		<2.3e+03
^{60}Co	(Bq/mL)		1.22e+04
^{134}Cs	(Bq/mL)		1.31e+04
^{137}Cs	(Bq/mL)		2.07e+06
^{152}Eu	(Bq/mL)		<2.1e+02
^{154}Eu	(Bq/mL)		<2.4e+02
^{155}Eu	(Bq/mL)		<1.2e+03
^{3}H	(Bq/mL)		6.18e+02
^{95}Nb	(Bq/mL)		<1.4e+02
^{106}Ru	(Bq/mL)		<2.8e+03
^{90}Sr	(Bq/mL)		4.90e+02
^{95}Zr	(Bq/mL)		<2.7e+02
Alpha emitters			
^{233}U	(Bq/mL)		3.60e+01
^{235}U	(Bq/mL)		9.20e+02
^{238}U	(Bq/mL)		1.00e+01
$^{239}Pu/^{240}Pu$	(Bq/mL)		1.00e+01
$^{238}Pu/^{241}Am$	(Bq/mL)		<1.5e+01

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN. 1990	TANK W26-S
Physical properties and miscellaneous data			
TS	(mg/g)		449
Density	(g/mL)		1.54
IC	(mg/kg)		12000
TC	(mg/kg)		18200
TOC	(mg/kg)		6220
RCRA metals			
Ag	(mg/kg)		(30)
As	(mg/kg)		65
Ba	(mg/kg)		87
Cd	(mg/kg)		42
Cr	(mg/kg)		170
Hg	(mg/kg)		94
Ni	(mg/kg)		92
Pb	(mg/kg)		470
Se	(mg/kg)		<55
Tl	(mg/kg)		<17
Process metals			
Al	(mg/kg)		7500
B	(mg/kg)		<7.3
Ca	(mg/kg)		36000
Co	(mg/kg)		
Fe	(mg/kg)		2300
K	(mg/kg)		15000
Mg	(mg/kg)		11000
Na	(mg/kg)		51000
Sr	(mg/kg)		120
Th	(mg/kg)		9360
U	(mg/kg)		24100
Beta/gamma emitters			
Gross alpha	(Bq/g)		9.13e+04
Gross beta	(Bq/g)		5.70e+06
^{14}C	(Bq/g)		2.13e+02
^{144}Ce	(Bq/g)		<1.2e+04
^{60}Co	(Bq/g)		1.03e+05
^{134}Cs	(Bq/g)		2.97e+03
^{137}Cs	(Bq/g)		6.84e+05
^{152}Eu	(Bq/g)		4.92e+05
^{154}Eu	(Bq/g)		3.19e+05
^{155}Eu	(Bq/g)		7.51e+04
^{95}Nb	(Bq/g)		<2.6e+03
^{106}Ru	(Bq/g)		<2.5e+04
^{90}Sr	(Bq/g)		2.03e+06
^{95}Zr	(Bq/g)		<1.3e+05
Alpha emitters			
^{233}U	(Bq/g)		
^{235}U	(Bq/g)		6.66e+03
^{238}U	(Bq/g)		<1.2e+04
$^{239}Pu/^{240}Pu$	(Bq/g)		5.11e-03
$^{238}Pu/^{241}Am$	(Bq/g)		1.45e+04
^{242}Cm	(Bq/g)		<1.3e+04
^{244}Cm	(Bq/g)		6.14e+04

LEGEND: PHYSICAL PROPERTIES
TDS - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC TOTAL ORGANIC CARBON

Figure 2.21-4 General Characteristics of Waste Samples (Tank System W-26)

Liquid samples:			Sludge samples		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-25	0.260	No	3/soft sludge	1.3	Thicker sludge than in tank W-24 Could probably pump with a peristaltic pump, except for the thin layer of "mud" on bottom Sonicated sludge: light tan; very fine particles with a few coarser particles
W-26	1.200	No	3/soft sludge	0.8-2.0	Top sample (W26-S1): highest radiation level Bottom sample (W26-S3): highest viscosity of the tank samples studied by Cheh and Shor[6] Sonicated sludge: dense and plastic with the consistency of peanut butter; gritty particles

2.22 Tank System W-27 Piping

2.22.1 Tank System Summary

Tank System W-27 is located at the Melton Valley Storage Tank Facility (Building 7830) (Figures 2.22-1 and 2.22-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from a pipe tunnel to Tank Vault W-24 through W-27. Tank System W-27 piping is used to transfer concentrate from the Evaporator to Tanks W-24 through W-31 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.22.2 Standards for Pipe Assessment of Tank Systems

2.22.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-27 piping is located at Building 7830 and is routed from a pipe tunnel to Tank Vault W-24 through W-27. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-27 piping is constructed of 6″ and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 150°F for the 6″ line and 300 psig and 150°F for the 4″ line. Tank System W-27 piping has the capacity to contain a maximum volume of 150 gal.

Design Standards

The applicable codes and standards used for Tank System W-27 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Society for Testing and Materials A48, A262-70, C91, C139, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX.

ASHRAE Guide and Data Book—Application;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electrical Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.22.2.2 Generic Description of Piping Contents

Tank System W-27 piping was designed to serve as part of an interim storage tank system for the hydrofracture facility. The waste concentrates stored in Tank W-27 were being disposed of as a cement-waste mixture (grout) by injection into shale formations located 800′ to 1100′ below the ground surface using hydrofracture. However, hydrofracture was terminated in 1984, and Tank W-27 has become a waste concentrates storage tank for the liquid low-level waste (LLLW) system. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the LLLW Evaporator for concentration, with transfer of evaporator bottoms to Tanks W-24 through W-31 for storage.

Tank System W-27 piping transfers LLLW to and from Tank W-27. The analytical data (Figure 2.22-3) of the waste samples are representative of the waste received by Tank W-27. The liquid waste supernate sampled in Tank W-27 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions. The principal metals found in the tank sludge were sodium, potassium, calcium, magnesium, uranium, and thorium. The sludge contains radioactive materials that produce a radiation level of 0.2–0.3 rem per hour (R/h) (see Figure 2.22-4).

2.22.2.3 Pipe Corrosion Protection Measures

Piping inside the pipe tunnel and Tank Vault W-24 through W-27 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.22.2.4 Documented Age of Tank System

Tank System W-27 piping was installed in 1980.

2.22.3 Standards for Containment/Release Detection

2.22.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-27 piping is single-wall, schedule 40S, type 304L SS that is routed from a pipe tunnel to Tank Vault W-24 through W-27. Each area is discussed below. The piping penetrations from the pipe tunnel to Tank Vault W-24 through W-27 are singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes embedded in the concrete wall to a length of 3′0″.

Pipe Tunnel

The bottom of the pipe tunnel is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 3′0″ up the pipe tunnel. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that Tank Vault W-24 through W-27 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe tunnel and tank vault are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.22.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Pipe Tunnel

The pipe tunnel foundation is a 20′3″ × 133′6″ × 1′6″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe tunnel and tank vault foundations are properly designed to support the secondary containment systems.

2.22.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Pipe Tunnel

The pipe tunnel floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a pneumatic level indicator that will activate alarms in the Evaporator Service Tanks Control Room and Waste Operations Control Center (Building 3130).

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault is provided with a leak detection system.

The assessment concludes that the pipe tunnel and tank vault are provided with leak detection.

2.22.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Pipe Tunnel

The pipe tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe tunnel and the tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.22.4 Supplemental Information

2.22.4.1 Ancillary Equipment

Tank W-27 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-24 through W-27, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.22.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-27.

2.22.5 References

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Ebasco, and Main. July 20, 1992. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing P3E-21247-C012, Melton Valley Waste Storage Tanks, Piping Modifications Pump Room and Pipe Gallery Modifications, Revision A.

Energy Systems Drawing P3E-21247-C013, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P3E-21247-C014, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P-21247-YE-026-E, Waste Storage Tanks, Piping Flow Diagram, Process, Sheet 1, Revision G.

Energy Systems Drawing P-21247-YE-027-E, Waste Storage Tanks, Piping Flow Diagram, Process, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-002-E, Waste Storage Tanks, Piping Plan, Revision B.

Energy Systems Drawing S-21247-YB-002-E, Waste Storage Tanks, Plan and Detail for Control House and Pump Room, Revision D.

Energy Systems Drawing S-21247-YB-001-E, Waste Storage Tanks, Plan Concrete Vault, Revision C.

Energy Systems Drawing P-21247-YC-003-E, Waste Storage Tanks, Pump Room Piping Plan, Revision G.

Energy Systems Drawing S-21247-YB-003-E, Waste Storage Tanks, Sections and Details of Concrete Vault, Revision D.

Energy Systems Drawing P-21247-YC-004-E, Waste Storage Tanks, Tank Piping Section, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-012-E, Waste Storage Tanks, Tank Piping Section, Sheet 2, Revision B.

Energy Systems Drawing P-21247-YC-001-E, Waste Storage Tanks, Tanks, Pump Room and Tunnel Piping Plan, Revision E.

Energy Systems Drawing P-21247-YC-011-E, Waste Storage Tanks, Tanks, Pump Room Piping Section, Sheet 2, Revision D.

Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

Risk Evaluation of Embedded, Single-Walled Liquid Low-Level Waste Piping at Oak Ridge National Laboratory.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.22-1
Location of Tank System W-27 Piping

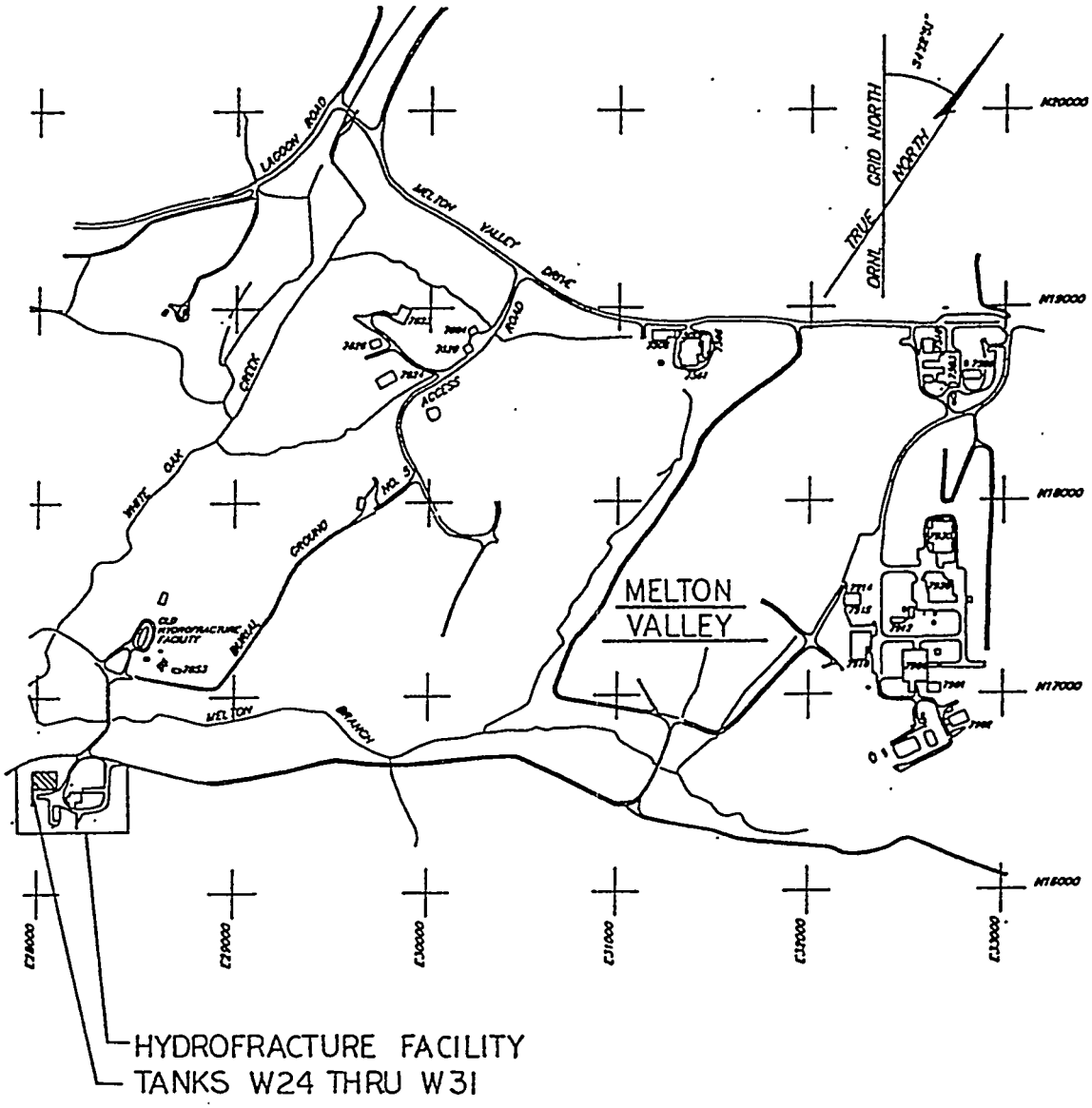
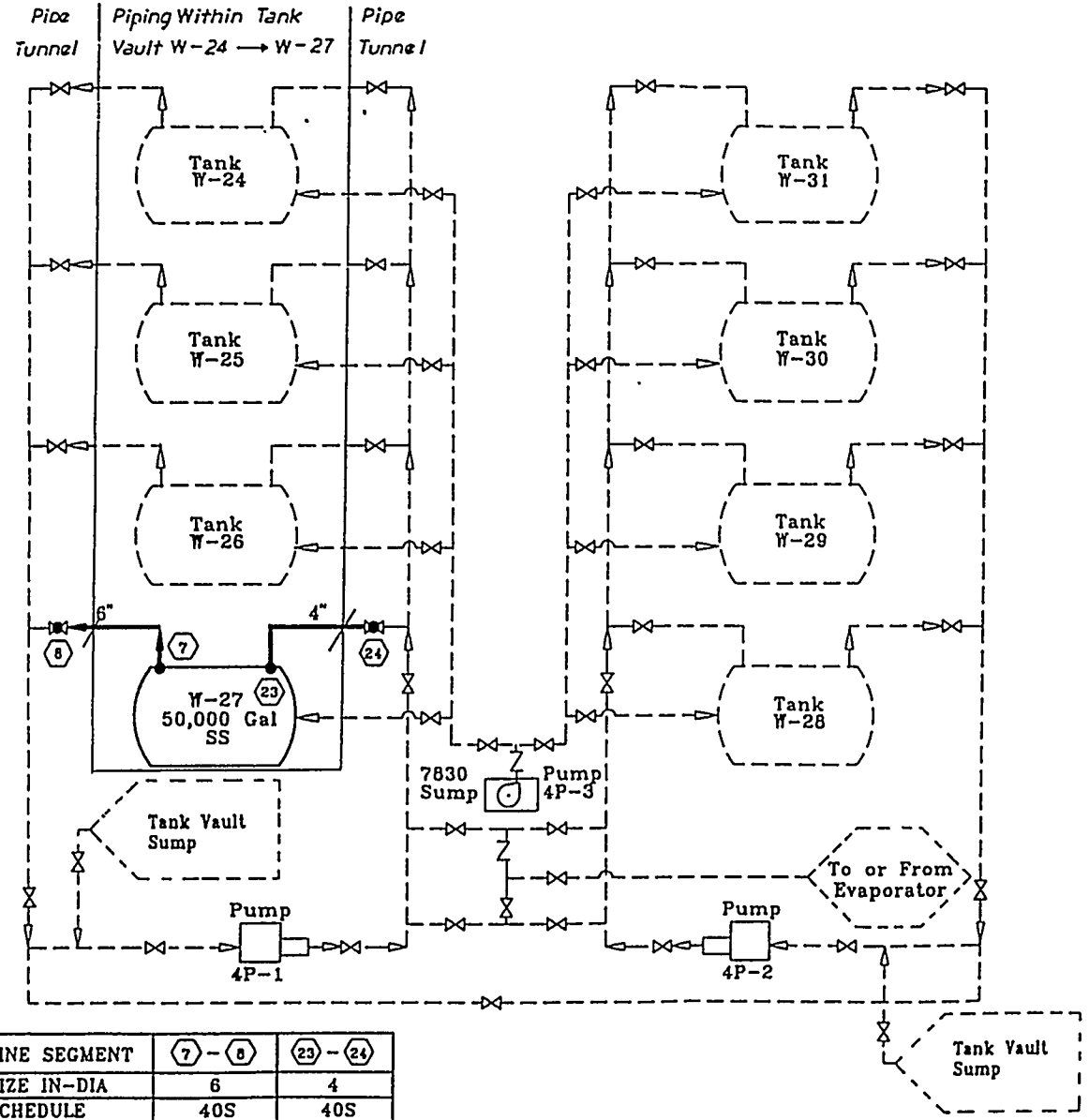
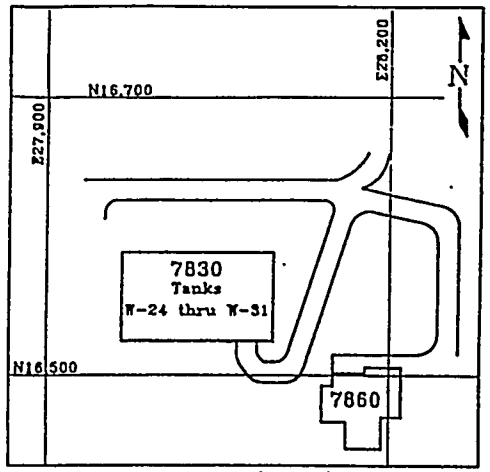


Figure 2.22-2 Tank System W-27 Piping Diagram





KEY PLAN (N.T.S.)

LINE SEGMENT	(7) - (8)	(23) - (24)
SIZE IN-DIA	6	4
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	86	32
VOLUME (GAL)	129	21

REFERENCE DRAWING LIST
P-21247-YC-011-E Rev D
P-21247-YC-005-E Rev B
P-21247-YC-003-E Rev G
P-21247-YC-002-E Rev B
P-21247-YC-001-E Rev E
P-21247-YE-027-E Rev C
P-21247-YE-026-E Rev G

TANK SYSTEM W-27 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.22-3
Analytical Data for Liquid and Sludge Samples (Tank System W-27)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN. 1990	TANK W27-L2
Physical properties and miscellaneous data			
TDS	(mg/mL)		
TS	(mg/mL)		358
Density	(g/mL)		355
IC	(mg/L)		1.2118.
TC	(mg/L)		4.7
TOC	(mg/L)		364
RCRA metals			359
Ag	(mg/L)		
As	(mg/L)		<0.69
Ba	(mg/L)		<3.7
Cd	(mg/L)		4.1
Cr	(mg/L)		0.12
Hg	(mg/L)		2.8
Ni	(mg/L)		<0.048
Pb	(mg/L)		<0.38
Se	(mg/L)		<2.1
Tl	(mg/L)		<4.7
Process metals			<1.4
Al	(mg/L)		
B	(mg/L)		<4.2
Ca	(mg/L)		0.67
Co	(mg/L)		2600
Fe	(mg/L)		<0.57
K	(mg/L)		<2.6
Mg	(mg/L)		8500
Na	(mg/L)		<1.3
Si	(mg/L)		90000
Sr	(mg/L)		<1.0
Th	(mg/L)		18
U	(mg/L)		<2.2
Anions			<0.1
Chloride	(M)		
Fluoride	(M)		0.071
Nitrate	(M)		<0.026
Phosphate	(M)		4.52
Sulfate	(M)		<0.053
Alkalinity			<0.052
pH			
H^+	(M)		11.8
OH^-	(M)		0.01
CO_3^{2-}	(M)		<0.01
HCO_3^-	(M)		<0.01
Beta/gamma emitters			
Gross alpha	(Bq/mL)		<1.0e+00
Gross beta	(Bq/mL)		3.30e+05
^{14}C	(Bq/mL)		1.81e+02
^{144}Ce	(Bq/mL)		<7.5e+02
^{60}Co	(Bq/mL)		3.09e+02
^{134}Cs	(Bq/mL)		1.61e+03
^{137}Cs	(Bq/mL)		2.16e+05
^{152}Eu	(Bq/mL)		<1.1e+02
^{154}Eu	(Bq/mL)		<6.6e+01
^{155}Eu	(Bq/mL)		<4.0e+02
^{3}H	(Bq/mL)		2.09e+02
^{93}Nb	(Bq/mL)		<3.0e+01
^{106}Ru	(Bq/mL)		<1.1e+03
^{90}Sr	(Bq/mL)		5.57e+04
^{93}Zr	(Bq/mL)		<5.2e+01

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN. 1990	TANK W27-H1-S	W27-H1-H
Physical properties and miscellaneous data				
TS	(mg/g)		386	471
Density	(g/mL)		1.26	1.33
IC	(mg/kg)		5250	12700
TC	(mg/kg)		7690	16500
TOC	(mg/kg)		2440	3830
RCRA metals				
Ag	(mg/kg)		(<7.2)	(<13.)
As	(mg/kg)		<39	<69
Ba	(mg/kg)		49	72
Cd	(mg/kg)		13	17
Cr	(mg/kg)		65	90
Hg	(mg/kg)		11	18
Ni	(mg/kg)		27	40
Pb	(mg/kg)		120	200
Se	(mg/kg)		<49	<86
Tl	(mg/kg)		20	<27
Process metals				
Al	(mg/kg)		4300	6800
B	(mg/kg)		<6.4	<11
Ca	(mg/kg)		38000	54000
Cs	(mg/kg)			
Fe	(mg/kg)		1400	2500
K	(mg/kg)		6100	6700
Mg	(mg/kg)		4800	5900
Na	(mg/kg)		71000	66000
Sr	(mg/kg)		120	150
Th	(mg/kg)		1890	3040
U	(mg/kg)		2710	1960
Beta/gamma emitters				
Gross alpha	(Bq/g)		2.25e+04	3.10e+04
Gross beta	(Bq/g)		1.44e+06	2.02e+06
^{14}C	(Bq/g)		1.89e+02	4.86e+02
^{144}Ce	(Bq/g)		<5.6e+03	<7.7e+03
^{60}Co	(Bq/g)		1.61e+04	2.50e+04
^{134}Cs	(Bq/g)		<1.2e+03	<1.8e+03
^{137}Cs	(Bq/g)		3.75e+05	5.71e+05
^{152}Eu	(Bq/g)		1.99e+04	2.42e+04
^{154}Eu	(Bq/g)		1.26e+04	1.51e+04
^{155}Eu	(Bq/g)		<3.4e+03	3.26e+03
^{93}Nb	(Bq/g)		<7.3e+02	<1.4e+03
^{106}Ru	(Bq/g)		<1.1e+04	<1.6e+04
^{90}Sr	(Bq/g)		4.55e+05	5.51e+05
^{93}Zr	(Bq/g)		<1.7e+03	<2.6e+03
Alpha emitters				
^{233}U	(Bq/g)			
^{235}U	(Bq/g)		5.18e+02	6.20e+02
^{238}U	(Bq/g)		<5.8e+03	<8.3e+03
$^{239}Pu/^{240}Pu$	(Bq/g)		1.04e+03	1.86e+03
$^{238}Pu/^{241}Am$	(Bq/g)		4.41e+03	6.73e+03
^{243}Cm	(Bq/g)		<6.5e+03	<1.0e+04
^{244}Cm	(Bq/g)		1.60e+04	2.15e+04

LEGEND: PHYSICAL PROPERTIES
TDS - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC TOTAL ORGANIC CARBON

Figure 2.22-4 General Characteristics of Waste Samples (Tank System W-27)

Liquid samples:			Sludge samples.		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-27	0.160-0.200	No	2/soft sludge	0.2	Sample W27-S2: appearance of small pieces of concrete in a softer sludge
			1/auger bit (soft and hard sludge)	0.3	Soft sludge in auger-bit sampler: (a) Unsonicated: appearance of small pieces of concrete in a softer sludge (b) Sonicated sludge (W27-H1-S): gray and gritty; consistency of cooked oatmeal Hard sludge: (a) Felt like hitting concrete during sampling; on first attempt to collect sample W27-S2, bent closure plate of soft sludge sampler when hit hard layer (b) Consistency like a hard mud; no free liquid; appearance of concrete pieces mixed with mud or clay; too stiff to sonicate General: soft sludge over hard layer; had to cut hard layer with auger-bit sampler; estimated 1 ft thick; below hard layer, about 2-ft thick layer of soft sludge; hard sludge plugged sampler; no sample of underlying soft layer

2.23 Tank System W-28 Piping

2.23.1 Tank System Summary

Tank System W-28 is located at the Melton Valley Storage Tank Facility (Building 7830) (Figures 2.23-1 and 2.23-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from a pipe tunnel to Tank Vault W-28 through W-31. Tank System W-28 piping is used to transfer concentrate from the Evaporator to Tanks W-24 through W-31 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.23.2 Standards for Pipe Assessment of Tank Systems

2.23.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-28 piping is located at Building 7830 and is routed from a pipe tunnel to Tank Vault W-28 through W-31. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-28 piping is constructed of 6″ and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 150°F for the 6″ line and 300 psig and 150°F for the 4″ line. Tank System W-28 piping has the capacity to contain a maximum volume of 76 gal.

Design Standards

The applicable codes and standards used for Tank System W-28 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Society for Testing and Materials A48, A262-70, C91, C139, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX.

ASHRAE Guide and Data Book—Application;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electrical Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.23.2.2 Generic Description of Piping Contents

Tank System W-28 piping was designed to serve as part of an interim storage tank system for the hydrofracture facility. The waste concentrates stored in Tank W-28 were being disposed of as a cement-waste mixture (grout) by injection into shale formations located 800′ to 1100′ below the ground surface using hydrofracture. However, hydrofracture was terminated in 1984, and Tank W-28 has become a waste concentrates storage tank for the liquid low-level waste (LLLW) system. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the LLLW Evaporator for concentration, with transfer of evaporator bottoms to Tanks W-24 through W-31 for storage.

Tank System W-28 piping transfers LLLW to and from Tank W-28. The analytical data (Figure 2.23-3) of waste samples are representative of the waste received by Tank W-28. The liquid waste supernate sampled in Tank W-28 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions. The principal metals found in the tank sludge were sodium, potassium, calcium, magnesium, uranium, and thorium. The sludge contains radioactive materials that produce a radiation level of 1.2 rem per hour (R/h) (Figure 2.23-4).

2.23.2.3 Pipe Corrosion Protection Measures

Piping inside the pipe tunnel and Tank Vault W-28 through W-31 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.23.2.4 Documented Age of Tank System

Tank System W-28 piping was installed in 1980.

2.23.3 Standards for Containment/Release Detection

2.23.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-28 piping is single-wall, schedule 40S, type 304L SS that is routed from a pipe tunnel to Tank Vault W-28 through W-31. Each area is discussed below. The piping penetrations from the pipe tunnel to Tank Vault W-28 through W-31 are singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes embedded in the concrete wall to a length of 3′0″.

Pipe Tunnel

The bottom of the pipe tunnel is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 3′0″ up the pipe tunnel. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that Tank Vault W-28 through W-31 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe tunnel and tank vault are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.23.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Pipe Tunnel

The pipe tunnel foundation is a 20′3″ × 133′6″ × 1′6″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe tunnel and tank vault foundations are properly designed to support the secondary containment systems.

2.23.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Pipe Tunnel

The pipe tunnel floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a pneumatic level indicator that will activate alarms in the Evaporator Service Tanks Control Room and Waste Operations Control Center (Building 3130).

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault is provided with a leak detection system.

The assessment concludes that the pipe tunnel and tank vault are provided with leak detection.

2.23.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Pipe Tunnel

The pipe tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe tunnel and the tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.23.4 Supplemental Information

2.23.4.1 Ancillary Equipment

Tank W-28 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-28 through W-31, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.23.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-28.

2.23.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. July 20, 1992. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing P3E-21247-C012, Melton Valley Waste Storage Tanks, Piping Modifications Pump Room and Pipe Gallery Modifications, Revision A.

Energy Systems Drawing P3E-21247-C013, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P3E-21247-C014, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P-21247-YE-026-E, Waste Storage Tanks, Piping Flow Diagram, Process, Sheet 1, Revision G.

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Energy Systems Drawing P-21247-YC-002-E, Waste Storage Tanks, Piping Plan, Revision B.

Energy Systems Drawing S-21247-YB-002-E, Waste Storage Tanks, Plan and Detail for Control House and Pump Room, Revision D.

Energy Systems Drawing S-21247-YB-001-E, Waste Storage Tanks, Plan Concrete Vault, Revision C.

Energy Systems Drawing P-21247-YC-003-E, Waste Storage Tanks, Pump Room Piping Plan, Revision G.

Energy Systems Drawing S-21247-YB-003-E, Waste Storage Tanks, Sections and Details of Concrete Vault, Revision D.

Energy Systems Drawing P-21247-YC-004-E, Waste Storage Tanks, Tank Piping Section, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-012-E, Waste Storage Tanks, Tank Piping Section, Sheet 2, Revision B.

Energy Systems Drawing P-21247-YC-001-E, Waste Storage Tanks, Tanks, Pump Room and Tunnel Piping Plan, Revision E.

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Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

Risk Evaluation of Embedded, Single-Walled Liquid Low-Level Waste Piping at Oak Ridge National Laboratory.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.23-1
Location of Tank System W-28 Piping

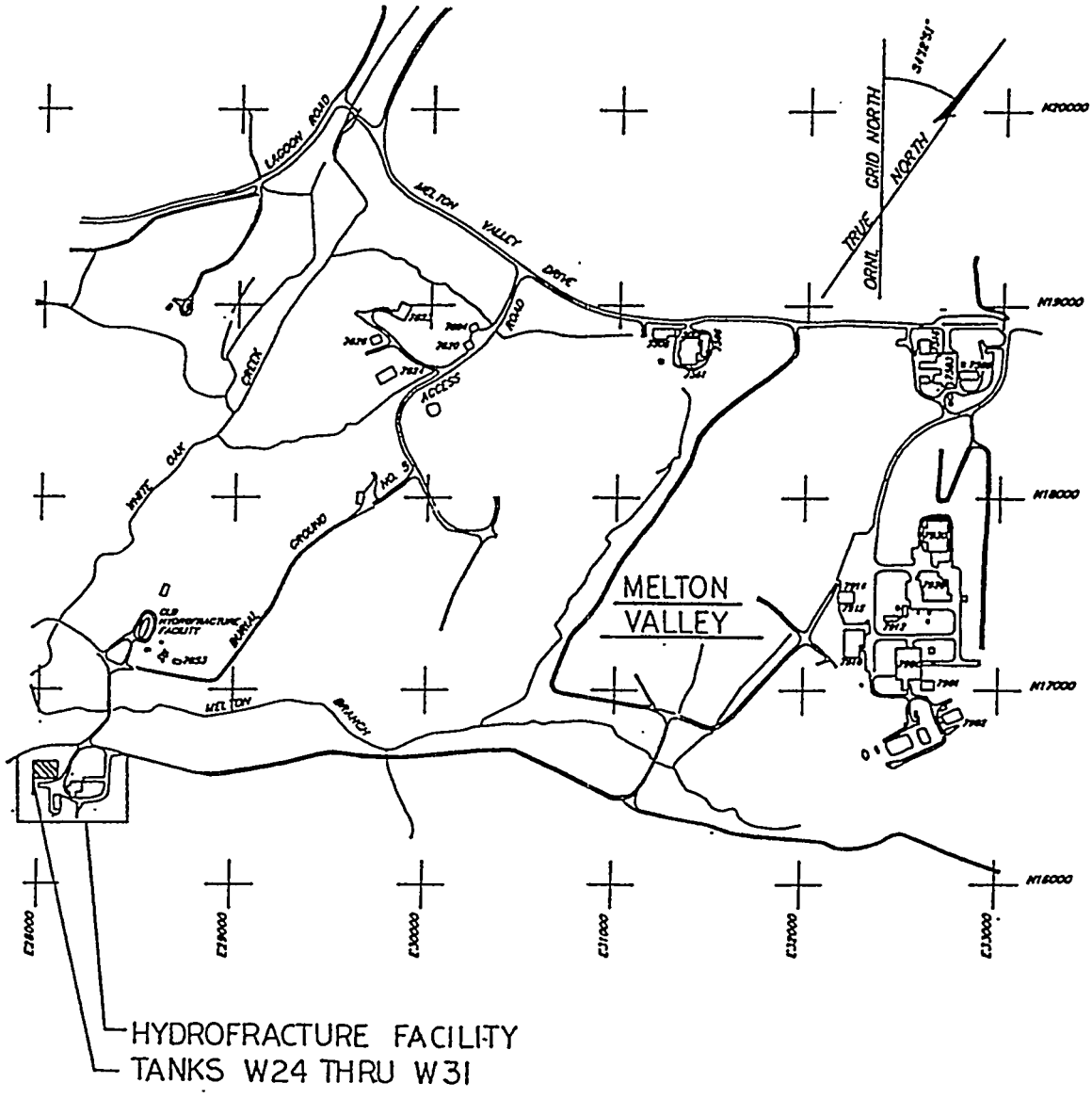
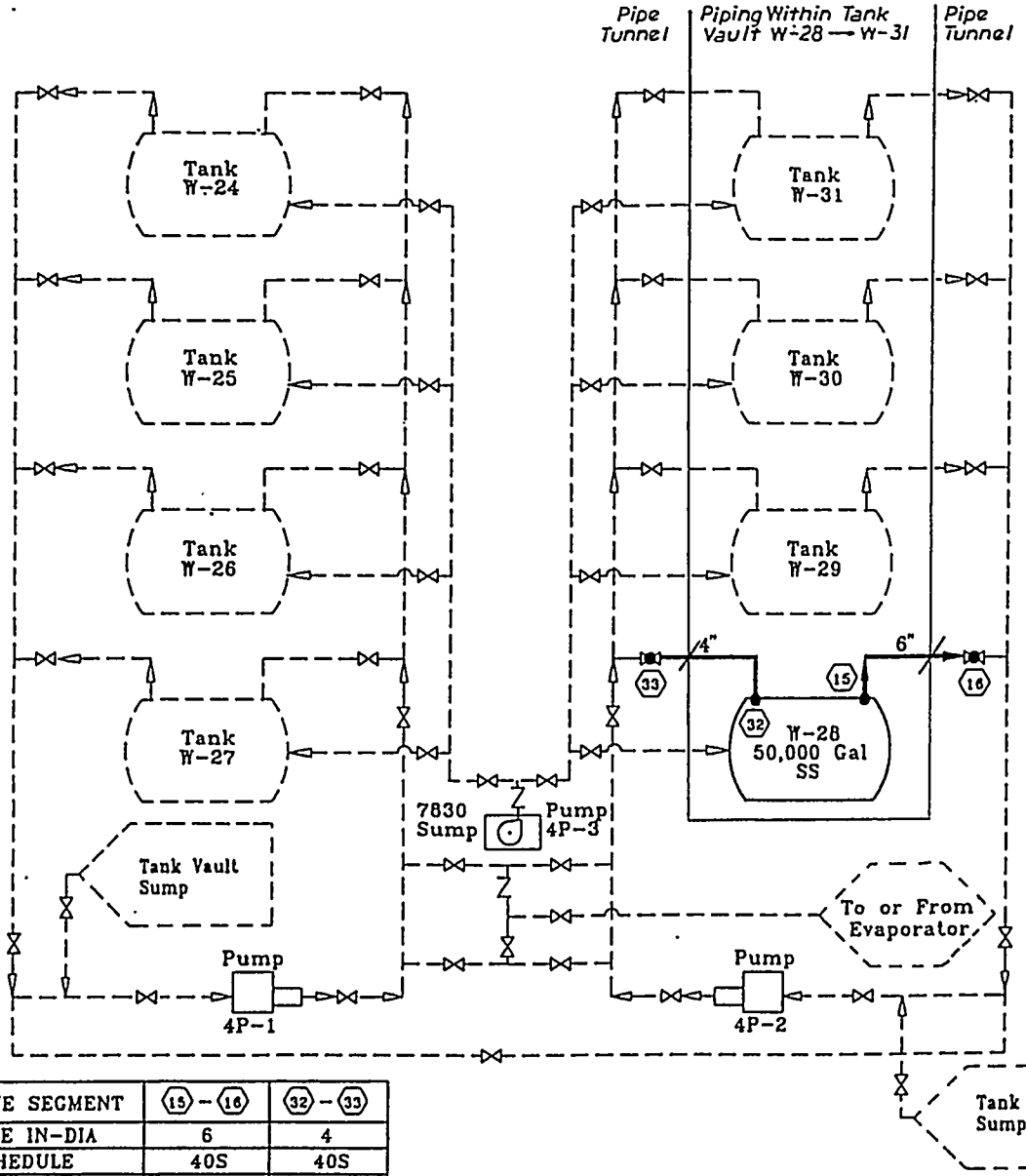
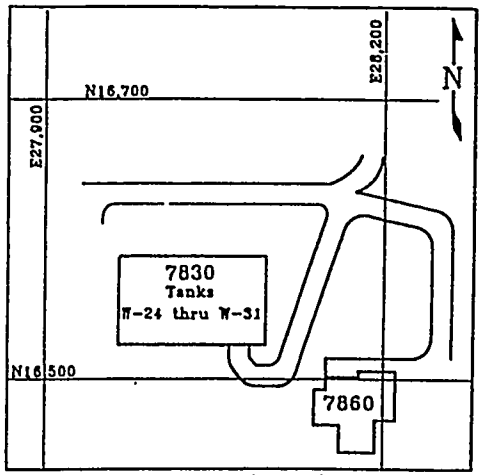


Figure 2.23-2 Tank System W-28 Piping Diagram





KEY PLAN (N.T.S.)

LINE SEGMENT	(15) - (16)	(32) - (33)
SIZE IN-DIA	6	4
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	37	32
VOLUME (GAL)	55	21

REFERENCE DRAWING LIST
P-21247-YC-011-E Rev D
P-21247-YC-005-E Rev B
P-21247-YC-003-E Rev G
P-21247-YC-002-E Rev B
P-21247-YC-001-E Rev E
P-21247-YE-027-E Rev C
P-21247-YE-026-E Rev G

TANK SYSTEM W-28 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.23-3
Analytical Data for Liquid and Sludge Samples (Tank System W-28)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic		JAN. 1990	TANK W28-L2
Physical properties and miscellaneous data			
TDS	(mg/mL)		485
TS	(mg/mL)		478
Density	(g/mL)		1.2852
IC	(mg/L)		7.0
TC	(mg/L)		581
TOC	(mg/L)		574
RCRA metals			
Ag	(mg/L)		<0.69
As	(mg/L)		<3.7
Ba	(mg/L)		5.8
Cd	(mg/L)		0.51
Cr	(mg/L)		0.38
Hg	(mg/L)		0.14
Ni	(mg/L)		1.4
Pb	(mg/L)		<2.1
Se	(mg/L)		<4.7
Tl	(mg/L)		<1.4
Process metals			
Al	(mg/L)		5.2
B	(mg/L)		0.35
Ca	(mg/L)		7800
Co	(mg/L)		<0.57
Fe	(mg/L)		<2.6
K	(mg/L)		26000
Mg	(mg/L)		1600
Na	(mg/L)		96000
Si	(mg/L)		<1.0
Sr	(mg/L)		65
Th	(mg/L)		<2.2
U	(mg/L)		<0.1
Anions			
Chloride	(M)		0.14
Fluoride	(M)		<0.026
Nitrate	(M)		5.97
Phosphate	(M)		<0.053
Sulfate	(M)		<0.052
Alkalinity			
pH			9.1
H^+	(M)		<0.01
OH^-	(M)		<0.01
CO_3^{2-}	(M)		<0.01
HCO_3^-	(M)		
Beta/gamma emitters			
Gross alpha	(Bq/mL)		4.40e+01
Gross beta	(Bq/mL)		9.80e+05
^{14}C	(Bq/mL)		1.67e+02
^{144}Ce	(Bq/mL)		<1.8e+03
^{60}Co	(Bq/mL)		8.72e+03
^{134}Cs	(Bq/mL)		1.06e+04
^{137}Cs	(Bq/mL)		5.66e+05
^{152}Eu	(Bq/mL)		1.67e+03
^{154}Eu	(Bq/mL)		7.37e+02
^{155}Eu	(Bq/mL)		<9.3e+02
^{3}H	(Bq/mL)		1.19e+02
^{93}Nb	(Bq/mL)		<1.2e+02
^{106}Ru	(Bq/mL)		3.02e+03
^{90}Sr	(Bq/mL)		1.75e+05
^{93}Zr	(Bq/mL)		<2.2e+02

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic		JAN. 1990	TANK W28-S
Physical properties and miscellaneous data			
TS	(mg/g)		533
Density	(g/mL)		1.49
IC	(mg/kg)		3620
TC	(mg/kg)		6120
TOC	(mg/kg)		2500
RCRA metals			
Ag	(mg/kg)		(17.)
As	(mg/kg)		27
Ba	(mg/kg)		39
Cd	(mg/kg)		26
Cr	(mg/kg)		55
Hg	(mg/kg)		12
Ni	(mg/kg)		62
Pb	(mg/kg)		190
Se	(mg/kg)		<29
Tl	(mg/kg)		<9
Process metals			
Al	(mg/kg)		830
B	(mg/kg)		4.9
Ca	(mg/kg)		57000
Cs	(mg/kg)		<0.8
Fe	(mg/kg)		630
K	(mg/kg)		11000
Mg	(mg/kg)		15000
Na	(mg/kg)		66000
Sr	(mg/kg)		130
Th	(mg/kg)		1370
U	(mg/kg)		17000
Beta/gamma emitters			
Gross alpha	(Bq/g)		5.39e+04
Gross beta	(Bq/g)		2.40e+06
^{14}C	(Bq/g)		7.60e+01
^{144}Ce	(Bq/g)		<1.7e+04
^{60}Co	(Bq/g)		7.91e+04
^{134}Cs	(Bq/g)		<4.6e+03
^{137}Cs	(Bq/g)		1.94e+05
^{152}Eu	(Bq/g)		7.18e+05
^{154}Eu	(Bq/g)		3.20e+05
^{155}Eu	(Bq/g)		9.70e+04
^{93}Nb	(Bq/g)		<2.9e+03
^{106}Ru	(Bq/g)		<2.8e+04
^{90}Sr	(Bq/g)		5.57e+05
^{93}Zr	(Bq/g)		<2.4e+04
Alpha emitters			
^{233}U	(Bq/g)		1.46e+03
^{235}U	(Bq/g)		3.56e+03
^{238}U	(Bq/g)		<1.7e+04
$^{238}Pu/^{240}Pu$	(Bq/g)		1.51e+03
$^{241}Pu/^{241}Am$	(Bq/g)		5.28e+03
^{243}Cm	(Bq/g)		<1.4e+04
^{244}Cm	(Bq/g)		3.83e+04

LEGEND: PHYSICAL PROPERTIES
TDS – TOTAL DISSOLVED SOLIDS
TS – TOTAL SOLIDS
IC – INORGANIC CARBON
TC – TOTAL CARBON
TOC TOTAL ORGANIC CARBON

Figure 2.23-4 General Characteristics of Waste Samples (Tank System W-28)

	Liquid samples:			Sludge samples	
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-28	0.480	No	1/soft sludge to the bottom; took second sample for more material	1.2	Fluid (weight of handle carried sampler to the bottom of the tank) Sludge (W28-S1): deep yellow; seems homogeneous Sonicated sludge: very finely divided with a few dark flakes
W-29	0.110	NA	NA	NA	
W-30	0.110	NA	NA	NA	

2.24 Tank System W-29 Piping

2.24.1 Tank System Summary

Tank System W-29 is located at the Melton Valley Storage Tank Facility (Building 7830) (Figures 2.24-1 and 2.24-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from a pipe tunnel to Tank Vault W-28 through W-31. Tank System W-29 piping is used to transfer concentrate from the Evaporator to Tanks W-24 through W-31 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.24.2 Standards for Pipe Assessment of Tank Systems

2.24.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-29 piping is located at Building 7830 and is routed from a pipe tunnel to Tank Vault W-28 through W-31. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-29 piping is constructed of 6″ and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 150°F for the 6″ line and 300 psig and 150°F for the 4″ line. Tank System W-29 piping has the capacity to contain a maximum volume of 158 gal.

Design Standards

The applicable codes and standards used for Tank System W-29 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Society for Testing and Materials A48, A262-70, C91, C139, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX.

ASHRAE Guide and Data Book—Application;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electrical Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.24.2.2 Generic Description of Piping Contents

Tank System W-29 piping was designed to serve as part of an interim storage tank system for the hydrofracture facility. The waste concentrates stored in Tank W-29 were being disposed of as a cement-waste mixture (grout) by injection into shale formations located 800′ to 1100′ below the ground surface using hydrofracture. However, hydrofracture was terminated in 1984, and Tank W-29 has become a waste concentrates storage tank for the liquid low-level waste (LLLW) system. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the LLLW Evaporator for concentration, with transfer of evaporator bottoms to Tanks W-24 through W-31 for storage.

Tank System W-29 piping transfers LLLW to and from Tank W-29. The analytical data (Figure 2.24-3) of waste samples are representative of the waste received by Tank W-29. The liquid waste supernate sampled in Tank W-29 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions. The sludge in Tank W-29 has not been sampled; however, the contents of Tank W-29 should be very similar to the contents of Tank W-28. The principal metals found in the Tank W-28 sludge were sodium, potassium, calcium, magnesium,

uranium, and thorium. The sludge contains radioactive materials that produce a radiation level of 1.2 rem per hour (R/h) (Figure 2.24-4).

2.24.2.3 Pipe Corrosion Protection Measures

Piping inside the pipe tunnel and Tank Vault W-28 through W-31 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.24.2.4 Documented Age of Tank System

Tank System W-29 piping was installed in 1980.

2.24.3 Standards for Containment/Release Detection

2.24.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-29 piping is single-wall, schedule 40S, type 304L SS that is routed from a pipe tunnel to Tank Vault W-28 through W-31. Each area is discussed below. The piping penetrations from the pipe tunnel to Tank Vault W-28 through W-31 are singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes embedded in the concrete wall to a length of 3′0″.

Pipe Tunnel

The bottom of the pipe tunnel is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used in the piping, with sidewalls that project 3′0″ up the pipe tunnel. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that Tank Vault W-28 through W-31 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe tunnel and tank vault are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.24.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Pipe Tunnel

The pipe tunnel foundation is a 20′3″ × 133′6″ × 1′6″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe tunnel and tank vault foundations are properly designed to support the secondary containment systems.

2.24.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Pipe Tunnel

The pipe tunnel floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a pneumatic level indicator that will activate alarms in the Evaporator Service Tanks Control Room and Waste Operations Control Center (Building 3130).

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault is provided with a leak detection system.

The assessment concludes that the pipe tunnel and tank vault are provided with leak detection.

2.24.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Pipe Tunnel

The pipe tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe tunnel and the tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.24.4 Supplemental Information

2.24.4.1 Ancillary Equipment

Tank W-29 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-28 through W-31, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.24.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-29.

2.24.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. July 20, 1992. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing P3E-21247-C012, Melton Valley Waste Storage Tanks, Piping Modifications Pump Room and Pipe Gallery Modifications, Revision A.

Energy Systems Drawing P3E-21247-C013, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

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Energy Systems Drawing P-21247-YE-027-E, Waste Storage Tanks, Piping Flow Diagram, Process, Sheet 1, Revision C.

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Energy Systems Drawing S-21247-YB-001-E, Waste Storage Tanks, Plan Concrete Vault, Revision C.

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Energy Systems Drawing S-21247-YB-003-E, Waste Storage Tanks, Sections and Details of Concrete Vault, Revision D.

Energy Systems Drawing P-21247-YC-004-E, Waste Storage Tanks, Tank Piping Section, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-012-E, Waste Storage Tanks, Tank Piping Section, Sheet 2, Revision B.

Energy Systems Drawing P-21247-YC-001-E, Waste Storage Tanks, Tanks, Pump Room and Tunnel Piping Plan, Revision E.

Energy Systems Drawing P-21247-YC-011-E, Waste Storage Tanks, Tanks, Pump Room Piping Section, Sheet 2, Revision D.

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Risk Evaluation of Embedded, Single-Walled Liquid Low-Level Waste Piping at Oak Ridge National Laboratory.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.24-1
Location of Tank System W-29 Piping

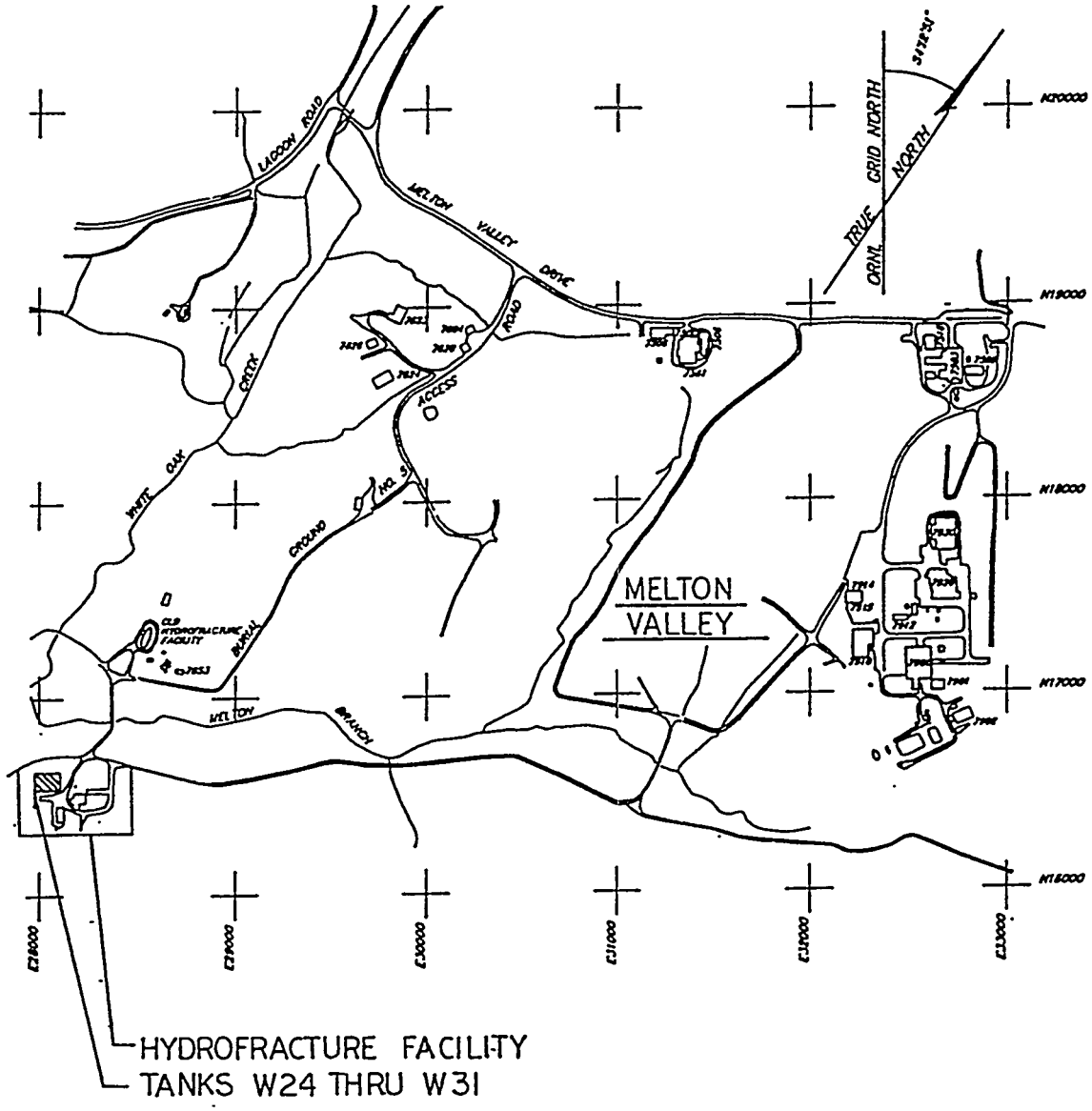
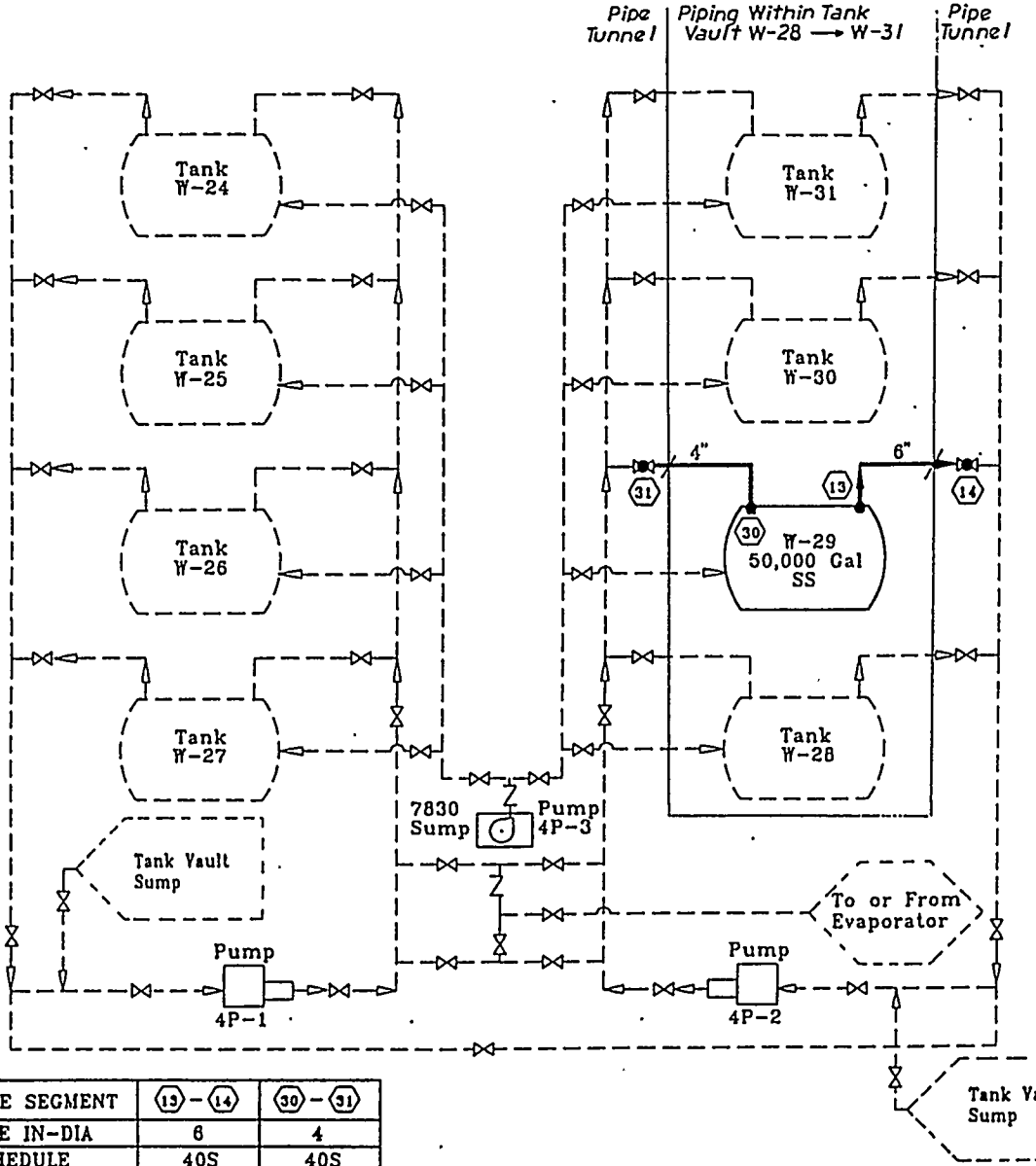
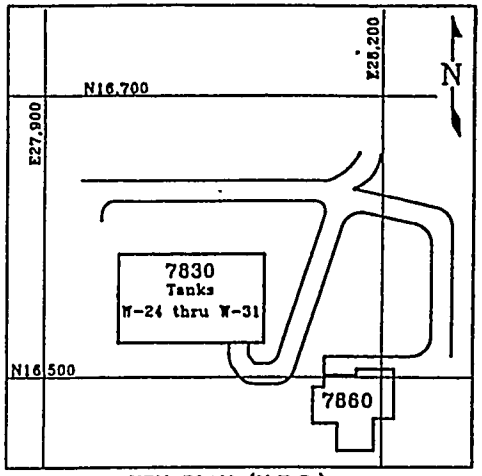


Figure 2.24-2 Tank System W-29 Piping Diagram



LINE SEGMENT	(13) - (14)	(30) - (31)
SIZE IN-DIA	6	4
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	86	43
VOLUME (GAL)	129	29



KEY PLAN (N.T.S.)

REFERENCE DRAWING LIST
P-21247-YC-011-E Rev D
P-21247-YC-005-E Rev B
P-21247-YC-003-E Rev G
P-21247-YC-002-E Rev B
P-21247-YC-001-E Rev E
P-21247-YE-027-E Rev C
P-21247-YE-026-E Rev G

TANK SYSTEM W-29 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.24-3
Analytical Data for Liquid Samples (Tank System W-29)

ANALYTICAL DATA FOR
LIQUID SAMPLE

Characteristic JAN. 1990		W29-L1	W29-L2	W29-L4
Physical properties and miscellaneous data				
TDS	(mg/mL)	375	376	375
TS	(mg/mL)	377	379	382
Density	(g/mL)	1.225	1.2277	1.2254
IC	(mg/L)	478	477	456
TC	(mg/L)	985	1040	833
TOC	(mg/L)	507	563	377
RCRA metals				
Ag	(mg/L)	<0.69	<0.69	<0.69
As	(mg/L)	<3.7	<3.7	<3.7
Ba	(mg/L)	1.0	1.1	1.0
Cd	(mg/L)	<0.12	<0.12	<0.12
Cr	(mg/L)	2.4	2.4	2.3
Hg	(mg/L)	0.09	0.08	0.09
Ni	(mg/L)	<0.38	<0.38	<0.38
Pb	(mg/L)	<2.1	<2.1	2.3
Se	(mg/L)	<4.7	<4.7	<4.7
Tl	(mg/L)	<1.4	<1.4	<1.4
Process metals				
Al	(mg/L)	18	18	17
B	(mg/L)	0.50	0.47	0.36
Ca	(mg/L)	4.1	5.5	3.6
Fe	(mg/L)	<2.6	<2.6	<2.6
K	(mg/L)	10000	10000	10000
Mg	(mg/L)	<1.3	<1.3	<1.3
Na	(mg/L)	110000	110000	110000
Si	(mg/L)	<1.0	<1.0	<1.0
Sr	(mg/L)	1.9	2.1	1.9
Th	(mg/L)	<1.0	<1.0	<1.0
U	(mg/L)	4.5	4.3	4.3
Anions				
Chloride	(M)	0.082	0.078	0.082
Fluoride	(M)	<0.026	<0.026	<0.026
Nitrate	(M)	4.52	4.52	4.52
Phosphate	(M)	<0.053	<0.053	<0.053
Sulfate	(M)	<0.052	<0.052	<0.052
Alkalinity				
pH		13.0	13.0	13.0
OH^-	(M)	0.064	0.069	0.074
CO_3^{2}	(M)	0.043	0.040	0.054
HCO_3	(M)	<0.01	<0.01	<0.01
Beta/gamma emitters				
Gross alpha	(Bq/mL)	<1.0e+01	<1.0e+01	<1.0e+01
Gross beta	(Bq/mL)	2.11e+05	1.98e+05	2.09e+05
^{14}C	(Bq/mL)	1.43e+02	7.3e+01	5.6e+01
^{144}Ce	(Bq/mL)	<1.4e+03	<1.3e+03	<1.3e+03
^{60}Co	(Bq/mL)	6.44e+02	5.99e+02	6.26e+02
^{134}Cs	(Bq/mL)	2.51e+03	2.57e+03	2.53e+03
^{137}Cs	(Bq/mL)	2.21e+05	2.22e+05	2.16e+05
^{152}Eu	(Bq/mL)	<1.6e+02	<2.0e+02	<2.7e+02
^{154}Eu	(Bq/mL)	<1.5e+02	<1.6e+02	<1.2e+02
^{155}Eu	(Bq/mL)	<7.2e+02	<7.1e+02	<7.2e+02
^{3}H	(Bq/mL)	2.01e+02	2.01e+02	2.01e+02
^{95}Nb	(Bq/mL)	<6.4e+01	<6.2e+01	<6.3e+02
^{106}Ru	(Bq/mL)	<2.1e+03	<2.0e+03	<2.0e+03
^{90}Sr	(Bq/mL)	7.13e+03	7.00e+03	7.11e+03
^{95}Zr	(Bq/mL)	<9.3e+01	<1.1e+02	<1.0e+02

LEGEND: PHYSICAL PROPERTIES
TDS – TOTAL DISSOLVED SOLIDS
TS – TOTAL SOLIDS
IC – INORGANIC CARBON
TC – TOTAL CARBON
TOC TOTAL ORGANIC CARBON

Figure 2.24-4 General Characteristics of Waste Samples (Tank System W-29)

	Liquid samples:		Sludge samples:		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-28	0.480	No	.1/soft sludge	1.2	Fluid (weight of to the bottom handle carried took second sampler to the sample for more bottom of thematerial (tank) Sludge (W-28-S1): deep yellow; seems homogeneous Sonicated sludge: very finely divided with a few dark flakes
W-29	0.110	NA	NA	NA	No sludge sample data for tanks W-29 and W-30 is available; however, the contents of tanks W-29 and W-30 should be very similiar to the contents of the tank W-28.
W-30	0.110	NA	NA	NA	

2.25 Tank System W-30 Piping

2.25.1 Tank System Summary

Tank System W-30 is located at the Melton Valley Storage Tank Facility (Building 7830) (Figures 2.25-1 and 2.25-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from a pipe tunnel to Tank Vault W-28 through W-31. Tank System W-30 piping is used to transfer concentrate from the Evaporator to Tanks W-24 through W-31 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.25.2 Standards for Pipe Assessment of Tank Systems

2.25.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-30 piping is located at Building 7830 and is routed from a pipe tunnel to Tank Vault W-28 through W-31. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-30 piping is constructed of 6″ and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 150°F for the 6″ line and 300 psig and 150°F for the 4″ line. Tank System W-30 piping has the capacity to contain a maximum volume of 76 gal.

Design Standards

The applicable codes and standards used for Tank System W-30 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72;

American Concrete Pipe Association;

American Society for Testing and Materials A48, A262-70, C91, C139, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX.

ASHRAE Guide and Data Book—Application;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electrical Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration; and

Underwriters Laboratories Inc.

2.25.2.2 Generic Description of Piping Contents

Tank System W-30 piping was designed to serve as part of an interim storage tank system for the hydrofracture facility. The waste concentrates stored in Tank W-30 were being disposed of as a cement-waste mixture (grout) by injection into shale formations located 800′ to 1100′ below the ground surface using hydrofracture. However, hydrofracture was terminated in 1984, and Tank W-30 has become a waste concentrates storage tank for the liquid low-level waste (LLLW) system. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the LLLW Evaporator for concentration, with transfer of evaporator bottoms to Tanks W-24 through W-31 for storage.

Tank System W-30 piping transfers LLLW to and from Tank W-30. The analytical data (Figure 2.25-3) of waste samples are representative of the waste received by Tank W-30. The liquid waste supernate sampled in Tank W-30 ranges in color from pale to deep yellow with high Ph (11–13) sodium/potassium nitrate salt solutions. The sludge in Tank W-30 has not been sampled; however, the contents of Tank W-30 should be very similar to the contents of Tank W-28. The principal metals found in the Tank W-28 sludge were sodium, potassium, calcium, magnesium,

uranium, and thorium. The sludge contains radioactive materials that produce a radiation level of 1.2 rem per hour (R/h) (Figure 2.25-4).

2.25.2.3 Pipe Corrosion Protection Measures

Piping inside the pipe tunnel and Tank Vault W-28 through W-31 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.25.2.4 Documented Age of Tank System

Tank System W-30 piping was installed in 1980.

2.25.3 Standards for Containment/Release Detection

2.25.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-30 piping is constructed of single-wall, schedule 40S, type 304L SS that is routed from a pipe tunnel to Tank Vault W-28 through W-31. Each area is discussed below. The piping penetrations from the pipe tunnel to Tank Vault W-28 through W-31 are singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes embedded in the concrete wall to a length of 3′0″.

Pipe Tunnel

The bottom of the pipe tunnel is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used for the piping and which projects 3′0″ up the pipe tunnel sidewall. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that Tank Vault W-28 through W-31 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe tunnel and tank vault are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.25.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Pipe Tunnel

The pipe tunnel foundation is a 20′3″ × 133′6″ × 1′6″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe tunnel and tank vault foundations are properly designed to support the secondary containment systems.

2.25.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Pipe Tunnel

The pipe tunnel floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a pneumatic level indicator that will activate alarms in the Evaporator Service Tanks Control Room and Waste Operations Control Center (Building 3130).

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault is provided with a leak detection system.

The assessment concludes that the pipe tunnel and tank vault are provided with leak detection.

2.25.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Pipe Tunnel

The pipe tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe tunnel and the tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.25.4 Supplemental Information

2.25.4.1 Ancillary Equipment

Tank W-30 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-28 through W-31, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.25.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-30.

2.25.5 References

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Energy Systems Drawing P-21247-YE-027-E, Waste Storage Tanks, Piping Flow Diagram, Process, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-002-E, Waste Storage Tanks, Piping Plan, Revision B.

Energy Systems Drawing S-21247-YB-002-E, Waste Storage Tanks, Plan and Detail for Control House and Pump Room, Revision D.

Energy Systems Drawing S-21247-YB-001-E, Waste Storage Tanks, Plan Concrete Vault, Revision C.

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Energy Systems Drawing S-21247-YB-003-E, Waste Storage Tanks, Sections and Details of Concrete Vault, Revision D.

Energy Systems Drawing P-21247-YC-004-E, Waste Storage Tanks, Tank Piping Section, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-012-E, Waste Storage Tanks, Tank Piping Section, Sheet 2, Revision B.

Energy Systems Drawing P-21247-YC-001-E, Waste Storage Tanks, Tanks, Pump Room and Tunnel Piping Plan, Revision E.

Energy Systems Drawing P-21247-YC-011-E, Waste Storage Tanks, Tanks, Pump Room Piping Section, Sheet 2, Revision D.

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Figure 2.25-1
Location of Tank System W-30 Piping

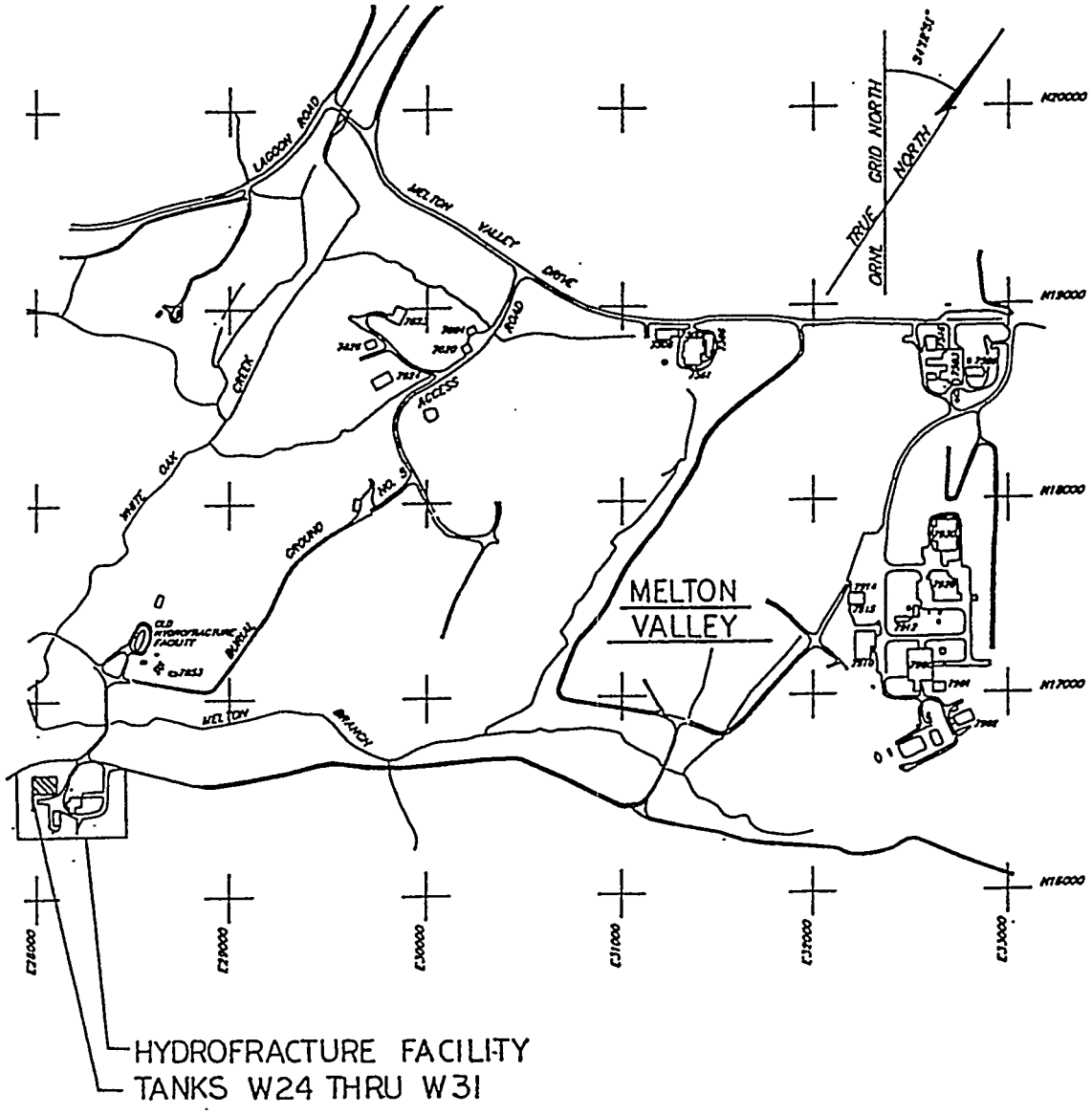
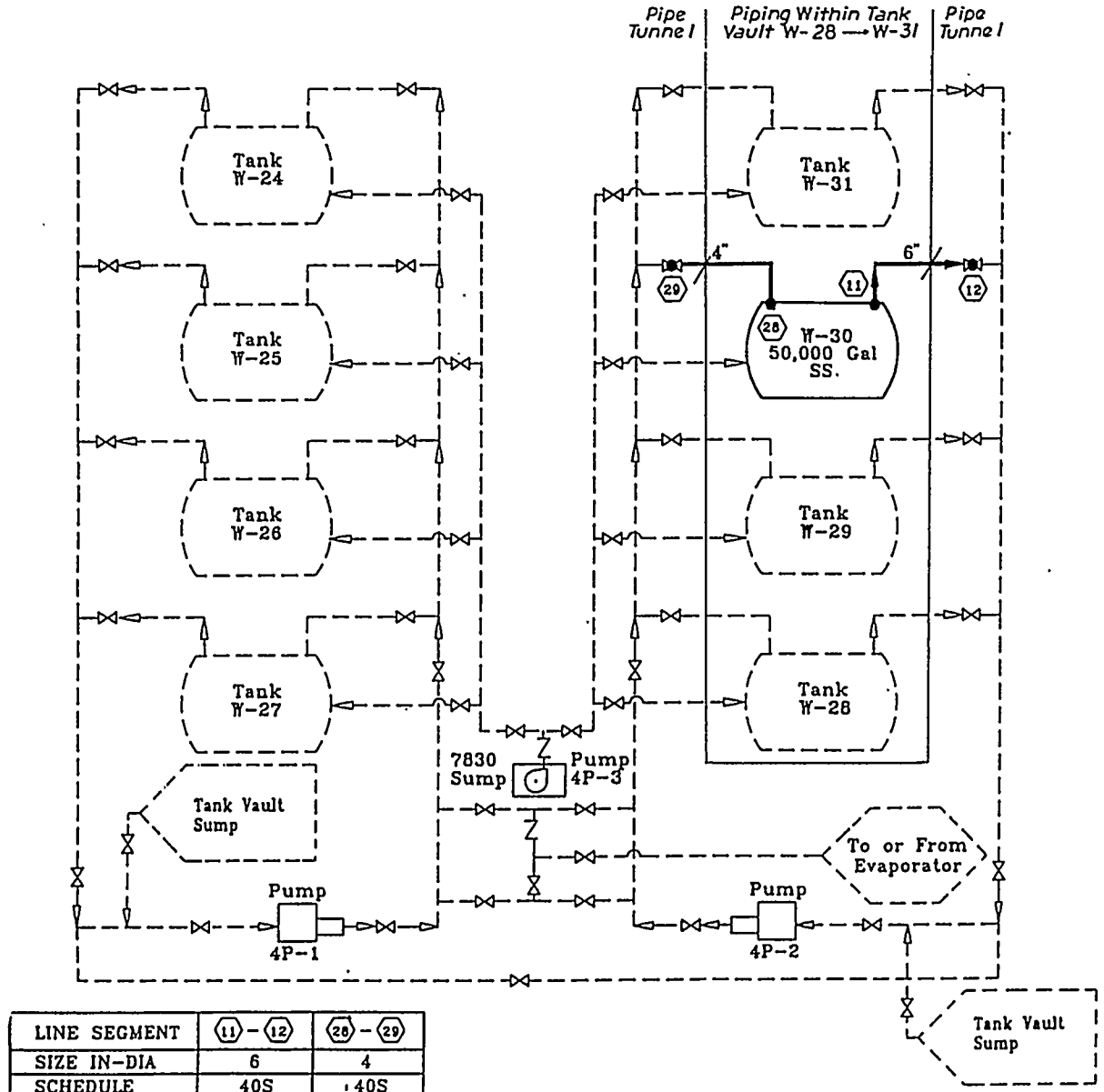
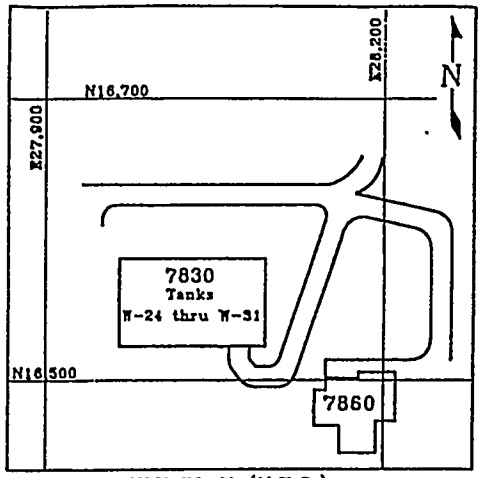


Figure 2.25-2 Tank System W-30 Piping Diagram





KEY PLAN (N.T.S.)

LINE SEGMENT	(11) - (12)	(28) - (29)
SIZE IN-DIA	6	4
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	37	32
VOLUME (GAL)	55	21

REFERENCE DRAWING LIST
P-21247-YC-011-E Rev D
P-21247-YC-005-E Rev B
P-21247-YC-003-E Rev G
P-21247-YC-002-E Rev B
P-21247-YC-001-E Rev E
P-21247-YE-027-E Rev C
P-21247-YE-026-E Rev G

TANK SYSTEM W-30 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

EBASCO/MAIN

Figure 2.25-3
Analytical Data for Liquid Samples (Tank System W-30)

ANALYTICAL DATA FOR
LIQUID SAMPLE

Characteristic JAN. 1990		W30-L1	W30-L2	W30-L4
Physical properties and miscellaneous data				
TDS	(mg/mL)	371	377	370
TS	(mg/mL)	396	391	374
Density	(g/mL)	1.2225	1.2218	1.2211
IC	(mg/L)	602	596	600
TC	(mg/L)	805	695	799
TOC	(mg/L)	203	99	199
RCRA metals				
Ag	(mg/L)	<0.69	<0.69	<0.69
As	(mg/L)	<3.7	<3.7	<3.7
Ba	(mg/L)	0.80	0.84	0.79
Cd	(mg/L)	<0.12	<0.12	<0.12
Cr	(mg/L)	3.0	2.9	2.9
Hg	(mg/L)	0.10	0.10	0.10
Ni	(mg/L)	<0.38	<0.38	<0.38
Pb	(mg/L)	3.0	2.9	2.3
Se	(mg/L)	<4.7	<4.7	<4.7
Tl	(mg/L)	<1.4	<1.4	<1.4
Process metals				
Al	(mg/L)	34	33	34
B	(mg/L)	0.49	0.42	0.42
Ca	(mg/L)	10	9.4	11
Fe	(mg/L)	<2.6	<2.6	<2.6
K	(mg/L)	9200	9300	9400
Mg	(mg/L)	<1.3	<1.3	<1.3
Na	(mg/L)	100000	100000	110000
Si	(mg/L)	<1.0	<1.0	<1.0
Sr	(mg/L)	1.7	1.8	1.9
Th	(mg/L)	<1.0	<1.0	<1.0
U	(mg/L)	5.5	5.8	5.9
Anions				
Chloride	(M)	0.078	0.082	0.078
Fluoride	(M)	<0.026	<0.026	<0.026
Nitrate	(M)	4.35	4.35	4.35
Phosphate	(M)	<0.053	<0.053	<0.053
Sulfate	(M)	<0.052	<0.052	<0.052
Alkalinity				
pH		13.2	13.3	13.3
OH^-	(M)	0.13	0.13	0.13
CO_3^{2-}	(M)	0.054	0.052	0.052
HCO_3^-	(M)	<0.01	<0.01	<0.01
Beta/gamma emitters				
Gross alpha	(Bq/mL)	<1.0e+01	<1.0e+01	<1.0e+01
Gross beta	(Bq/mL)	1.97e+05	1.93e+05	1.92e+05
^{14}C	(Bq/mL)	6.8e+01	8.6e+01	1.10e+02
^{144}Ce	(Bq/mL)	<1.2e+03	<1.2e+03	<1.3e+03
^{60}Co	(Bq/mL)	4.93e+02	4.83e+02	4.91e+02
^{134}Cs	(Bq/mL)	2.05e+03	2.03e+03	1.96e+03
^{137}Cs	(Bq/mL)	1.86e+05	1.87e+05	1.90e+05
^{152}Eu	(Bq/mL)	<1.7e+02	<2.2e+02	<2.1e+02
^{154}Eu	(Bq/mL)	<1.5e+02	<1.1e+02	<1.0e+02
^{155}Eu	(Bq/mL)	<6.7e+02	<6.6e+02	<6.6e+02
^{3}H	(Bq/mL)	2.04e+02	2.01e+02	2.01e+02
^{93}Nb	(Bq/mL)	<5.1e+01	<5.5e+01	<5.5e+01
^{106}Ru	(Bq/mL)	<1.9e+03	<1.9e+03	<1.9e+03
^{90}Sr	(Bq/mL)	6.75e+03	6.70e+03	6.70e+03
^{95}Zr	(Bq/mL)	<9.5e+01	<1.1e+02	<9.3e+01

LEGEND: PHYSICAL PROPERTIES
TDS - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC - TOTAL ORGANIC CARBON

Figure 2.25-4 General Characteristics of Waste Samples (Tank System W-30)

Liquid samples:			Sludge samples		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-28	0.480	No	.1/soft sludge	1.2	Fluid (weight of to the bottom handle carried took second sampler to the sample for more bottom of thematerial (tank) Sludge (W-28-S1): deep yellow; seems homogeneous Sonicated sludge: very finely divided with a few dark flakes
W-29	0.110	NA	NA	NA	No sludge sample data for tanks W-29 and W-30 is available; however, the contents of tanks W-29 and W-30 should be very similiar to the contents of the tank W-28.
W-30	0.110	NA	NA	NA	

2.26 Tank System W-31 Piping

2.26.1 Tank System Summary

Tank System W-31 is located at the Melton Valley Storage Tank Facility (Building 7830) (Figures 2.26-1 and 2.26-2). The tank system piping is schedule 40S, ASME SA-240, type 304L stainless steel (SS) and is routed from a pipe tunnel to Tank Vault W-28 through W-31. Tank System W-31 piping is used to transfer concentrate from the Evaporator to Tanks W-24 through W-31 and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.26.2 Standards for Pipe Assessment of Tank Systems

2.26.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System W-31 piping is located at Building 7830 and is routed from a pipe tunnel to Tank Vault W-28 through W-31. The piping system is used and managed by the Waste Management and Remedial Actions Division.

Tank System W-31 piping is constructed of 6″ and 4″, 304L SS with a maximum design pressure and temperature of 150 psig and 150°F for the 6″ line and 300 psig and 150°F for the 4″ line. Tank System W-31 piping has the capacity to contain a maximum volume of 185 gal.

Design Standards

The applicable codes and standards used for Tank System W-31 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

AEC-Oak Ridge Office, Minimum Safety Requirements;

Air Moving and Conditioning Association (AMCA) Standards Handbook—Publication 99;

AMCA Directory—Publication 261;

AMCA Fans and Systems—Publication 201;

American Concrete Institute 301-72 and 318-71;

American Concrete Pipe Association;

American Society for Testing and Materials A48, A262-70, C91, C139, C144, and D1751;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections II (SA-240), V, VIII, and IX;

ASHRAE Guide and Data Book—Application;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Atomic Energy Commission (AEC) General Design Criteria, Appendix 63;

Factory Mutual Engineering Corporation;

National Electrical Code;

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilating Systems;

NFPA No. 91—Blower and Exhaust Systems;

Occupational Safety and Health Administration;

UCC-ND Engineering Standards Y-EF-538;

Underwriters Laboratories Inc.; and

Union Carbide Corporation Nuclear Division (UCC-ND) Standards, Sections 303, 401, 411, 702, and 914.04.

2.26.2.2 Generic Description of Piping Contents

Tank System W-31 piping was designed to serve as part of an interim storage tank system for the hydrofracture facility. The waste concentrates stored in Tank W-31 were being disposed of as a cement-waste mixture (grout) by injection into shale formations located 800′ to 1100′ below the ground surface using hydrofracture. However, hydrofracture was terminated in 1984, and Tank W-31 has become a waste concentrates storage tank for the liquid low-level waste (LLLW) system. LLLW is generated from a variety of facilities at the Oak Ridge National Laboratory (ORNL) including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to the LLLW Evaporator for concentration, with transfer of evaporator bottoms to Tanks W-24 through W-31 for storage.

Tank System W-31 piping transfers LLLW to and from Tank W-31. The analytical data (Figure 2.26-3) of the waste samples are representative of the waste received by Tank W-31. The liquid waste supernate sampled in Tank W-31 ranges in color from pale to deep yellow with high pH (11–13) sodium/potassium nitrate salt solutions. The principal metals found in the tank sludge were sodium, potassium, calcium, magnesium, uranium, and thorium. The sludge contains radioactive materials that produce a radiation level of 1.5–2.8 rem per hour (R/h) (Figure 2.26-4).

2.26.2.3 Pipe Corrosion Protection Measures

Piping inside the pipe tunnel and Tank Vault W-28 through W-31 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.26.2.4 Documented Age of Tank System

Tank System W-31 piping was installed in 1980.

2.26.3 Standards for Containment/Release Detection

2.26.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System W-31 piping is single-wall, schedule 40S, type 304L SS that is routed from a pipe tunnel to Tank Vault W-28 through W-31. Each area is discussed below. The piping penetrations from the pipe tunnel to Tank Vault W-28 through W-31 are singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes embedded in the concrete wall to a length of 3′0″.

Pipe Tunnel

The bottom of the pipe tunnel is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used for the piping and which projects 3′0″ up the pipe tunnel sidewall. The SS pipe tunnel lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that Tank Vault W-28 through W-31 is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe tunnel and tank vault are lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.26.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Pipe Tunnel

The pipe tunnel foundation is a 20'3" × 133'6" × 1'6" thick, reinforced concrete base slab that rests on limestone.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe tunnel and tank vault foundations are properly designed to support the secondary containment systems.

2.26.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Pipe Tunnel

The pipe tunnel floor is sloped to a 16-gauge (1/16"), 304L SS-lined sump where accumulation of liquid will be detected by a pneumatic level indicator that will activate alarms in the Evaporator Service Tanks Control Room and Waste Operations Control Center (Building 3130).

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault is provided with a leak detection system.

The assessment concludes that the pipe tunnel and tank vault are provided with leak detection.

2.26.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Pipe Tunnel

The pipe tunnel floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pipe tunnel to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe tunnel and the tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.26.4 Supplemental Information

2.26.4.1 Ancillary Equipment

Tank W-31 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault W-28 through W-31, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.26.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System W-31.

2.26.5 References

Binford, F. T., and S. D. Orfi. 1979. *The Intermediate Level Liquid Waste System at the Oak Ridge National Laboratory Description and Safety Analysis.* ORNL/TM-6959. Oak Ridge National Laboratory.

Ebasco, and Main. July 20, 1992. *Design Demonstrations—Category B Tank Systems,* Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory.

Energy Systems Drawing P3E-21247-C012, Melton Valley Waste Storage Tanks, Piping Modifications Pump Room and Pipe Gallery Modifications, Revision A.

Energy Systems Drawing P3E-21247-C013, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P3E-21247-C014, Melton Valley Waste Storage Tanks, Piping Modifications, Sections, Revision A.

Energy Systems Drawing P-21247-YE-026-E, Waste Storage Tanks, Piping Flow Diagram-Process, Sheet 1, Revision G.

Energy Systems Drawing P-21247-YE-027-E, Waste Storage Tanks, Piping Flow Diagram-Process, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-002-E, Waste Storage Tanks, Piping Plan, Revision B.

Energy Systems Drawing S-21247-YB-002-E, Waste Storage Tanks, Plan and Detail for Control Hose and Pump Room, Revision D.

Energy Systems Drawing S-21247-YB-001-E, Waste Storage Tanks, Plan Concrete Vault, Revision C.

Energy Systems Drawing P-21247-YC-003-E, Waste Storage Tanks, Pump Room Piping Plan, Revision G.

Energy Systems Drawing S-21247-YB-003-E, Waste Storage Tanks, Sections and Details of Concrete Vault, Revision D.

Energy Systems Drawing P-21247-YC-004-E, Waste Storage Tanks, Tank Piping Section, Sheet 1, Revision C.

Energy Systems Drawing P-21247-YC-012-E, Waste Storage Tanks, Tank Piping Section, Sheet 2, Revision B.

Energy Systems Drawing P-21247-YC-001-E, Waste Storage Tanks, Tanks, Pump Room and Tunnel Piping Plan, Revision E.

Energy Systems Drawing P-21247-YC-011-E, Waste Storage Tanks, Tanks, Pump Room Piping Section, Sheet 2, Revision D.

Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

Peretz, F. J., et al. 1986. *Characterization of Low-Level Liquid Wastes at the Oak Ridge National Laboratory.* ORNL/TM-10218. Oak Ridge National Laboratory.

Risk Evaluation of Embedded, Single-Walled Liquid Low-Level Waste Piping at Oak Ridge National Laboratory.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.26-1
Location of Tank System W-31 Piping

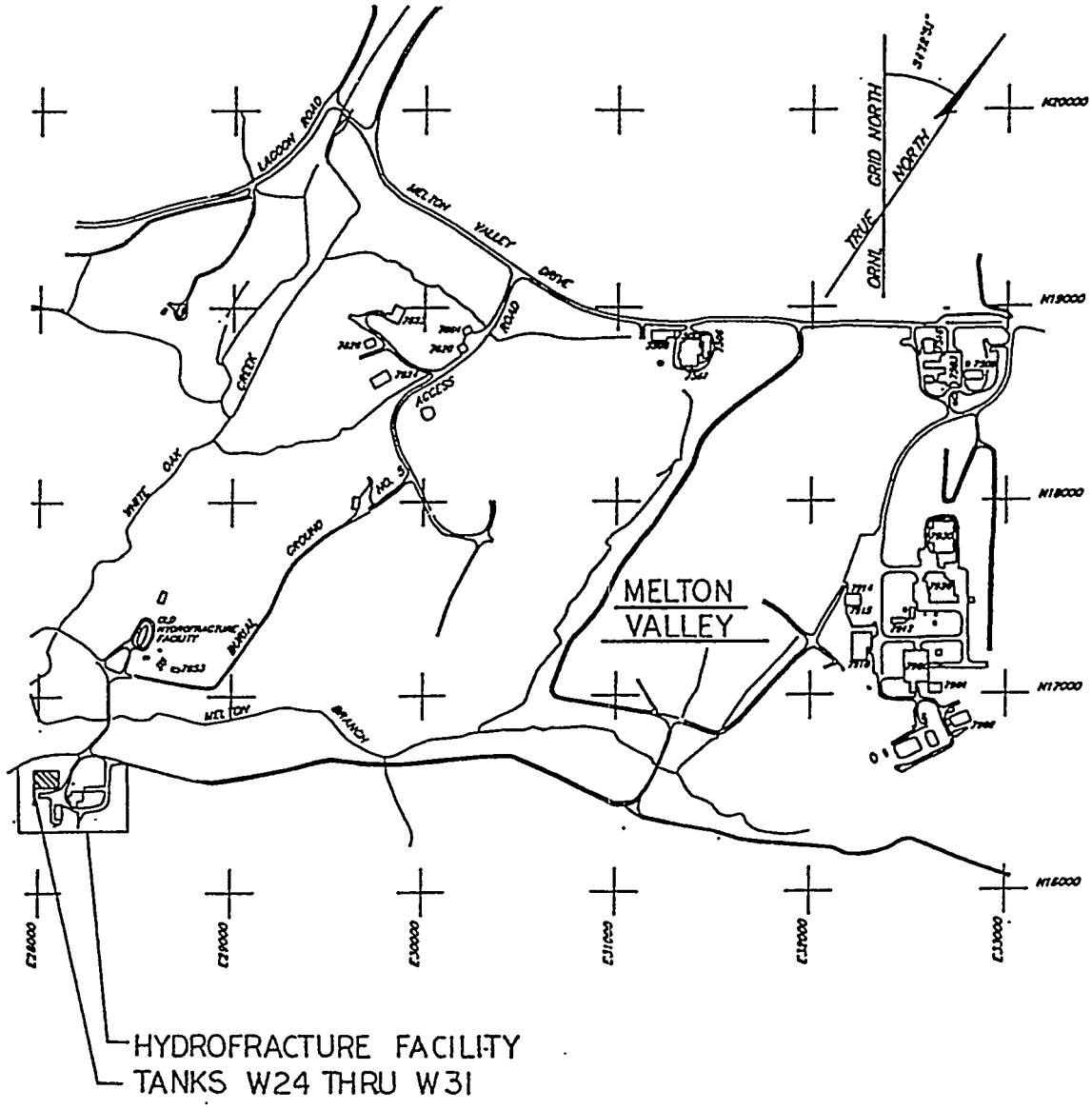
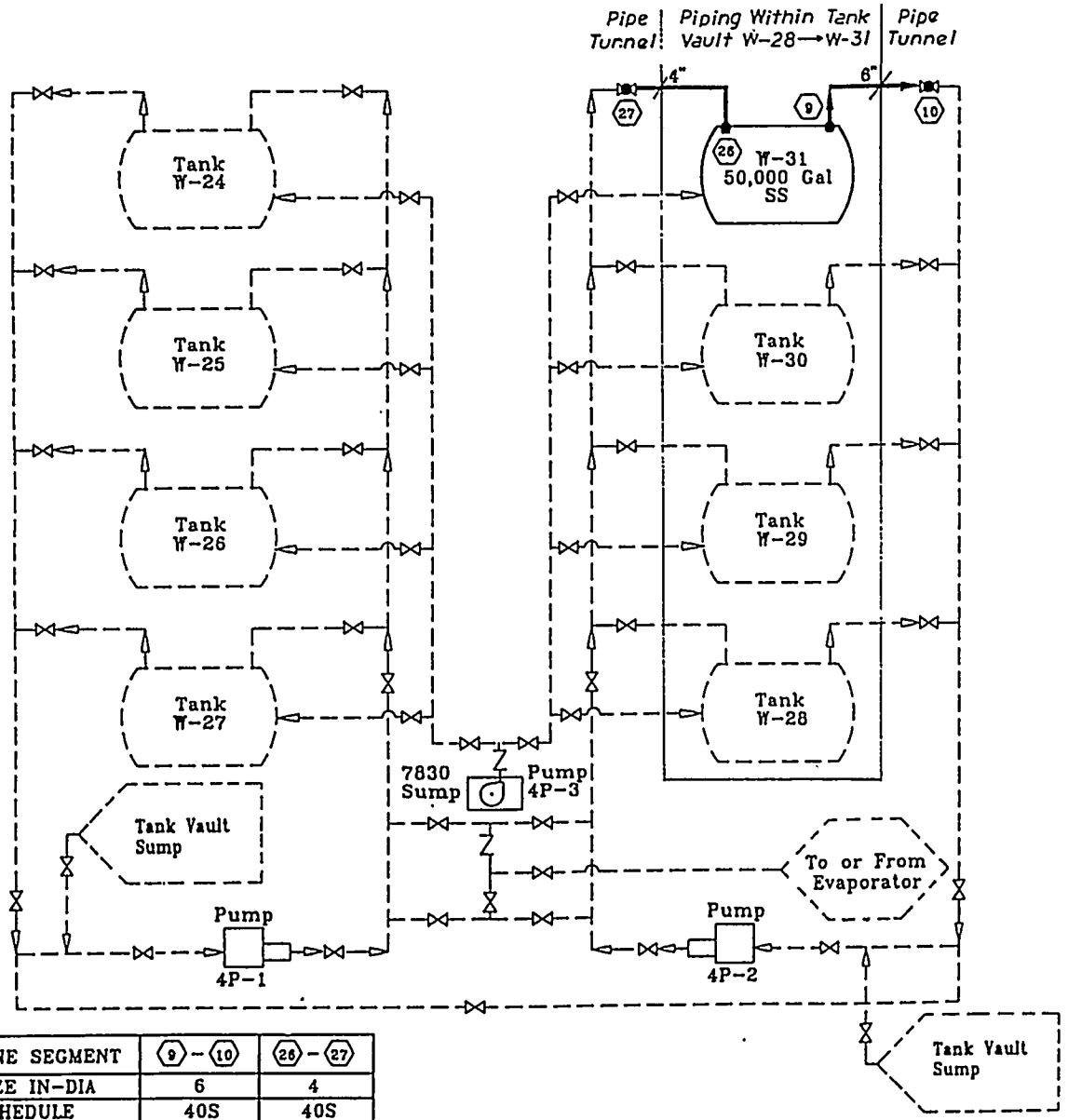
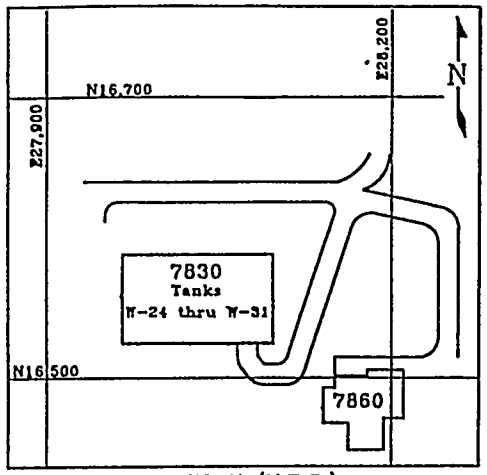


Figure 2.26-2 Tank System W-31 Piping Diagram



LINE SEGMENT	9 - 10	26 - 27
SIZE IN-DIA	6	4
SCHEDULE	40S	40S
MATERIAL	SS	SS
LENGTH (FT)	86	85
VOLUME (GAL)	129	56



KEY PLAN (N.T.S.)

P-21247-YC-011-E Rev D
P-21247-YC-005-E Rev B
P-21247-YC-003-E Rev G
P-21247-YC-002-E Rev B
P-21247-YC-001-E Rev E
P-21247-YE-027-E Rev C
P-21247-YE-026-E Rev G
REFERENCE DRAWING LIST

TANK SYSTEM W-31 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.26-3
Analytical Data for Liquid and Sludge Samples (Tank System W-31)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic JAN. 1990		W31-L2
Physical properties and miscellaneous data		
TDS	(mg/mL)	351
TS	(mg/mL)	349
Density	(g/mL)	1.2075
IC	(mg/L)	18.9
TC	(mg/L)	464
TOC	(mg/L)	445
RCRA metals		
Ag	(mg/L)	<0.69
As	(mg/L)	<3.7
Ba	(mg/L)	3.5
Cd	(mg/L)	<0.12
Cr	(mg/L)	6.0
Hg	(mg/L)	0.15
Ni	(mg/L)	<0.38
Pb	(mg/L)	<2.1
Se	(mg/L)	<4.7
Tl	(mg/L)	<1.4
Process metals		
Al	(mg/L)	4.2
B	(mg/L)	0.20
Ca	(mg/L)	79
Co	(mg/L)	<0.57
Fe	(mg/L)	<2.6
K	(mg/L)	9500
Mg	(mg/L)	<1.3
Na	(mg/L)	94000
Si	(mg/L)	8.57
Sr	(mg/L)	12
Th	(mg/L)	<2.2
U	(mg/L)	0.25
Anions		
Chloride	(M)	0.073
Fluoride	(M)	<0.026
Nitrate	(M)	4.52
Phosphate	(M)	<0.053
Sulfate	(M)	<0.052
Alkalinity		
pH		11.7
H^+	(M)	0.01
OH^-	(M)	<0.01
CO_3^{2-}	(M)	<0.01
HCO_3^-	(M)	
Beta/gamma emitters		
Gross alpha	(Bq/mL)	<1.0e+00
Gross beta	(Bq/mL)	3.58e+05
^{14}C	(Bq/mL)	1.12e+02
^{144}Ce	(Bq/mL)	<7.5e+02
^{60}Co	(Bq/mL)	3.23e+02
^{134}Cs	(Bq/mL)	5.01e+03
^{137}Cs	(Bq/mL)	2.29e+05
^{152}Eu	(Bq/mL)	<9.3e+01
^{154}Eu	(Bq/mL)	<6.7e+01
^{155}Eu	(Bq/mL)	<4.2e+02
^{3}H	(Bq/mL)	1.56e+02
^{95}Nb	(Bq/mL)	<3.3e+01
^{106}Ru	(Bq/mL)	<1.1e+03
^{90}Sr	(Bq/mL)	7.38e+04
^{95}Zr	(Bq/mL)	<5.7e+01

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic JAN. 1990		W31-S
Physical properties and miscellaneous data		
TS	(mg/g)	369
Density	(g/mL)	1.26
IC	(mg/kg)	1410
TC	(mg/kg)	1820
TOC	(mg/kg)	410
RCRA metals		
Ag	(mg/kg)	(<6.1)
As	(mg/kg)	<33
Ba	(mg/kg)	17
Cd	(mg/kg)	1.7
Cr	(mg/kg)	27
Hg	(mg/kg)	14
Ni	(mg/kg)	17
Pb	(mg/kg)	170
Se	(mg/kg)	<41
Tl	(mg/kg)	<13
Process metals		
Al	(mg/kg)	1400
B	(mg/kg)	<1.2
Ca	(mg/kg)	5600
Cs	(mg/kg)	<1.1
Fe	(mg/kg)	420
K	(mg/kg)	7900
Mg	(mg/kg)	870
Na	(mg/kg)	69000
Sr	(mg/kg)	30
Th	(mg/kg)	2790
U	(mg/kg)	3000
Beta/gamma emitters		
Gross alpha	(Bq/g)	2.31e+04
Gross beta	(Bq/g)	3.18e+06
^{14}C	(Bq/g)	3.14e+02
^{144}Ce	(Bq/g)	<9.4e+03
^{60}Co	(Bq/g)	8.10e+03
^{134}Cs	(Bq/g)	3.64e+03
^{137}Cs	(Bq/g)	2.35e+05
^{152}Eu	(Bq/g)	<1.7e+04
^{154}Eu	(Bq/g)	5.86e+03
^{155}Eu	(Bq/g)	<5.9e+03
^{95}Nb	(Bq/g)	<9.2e+02
^{106}Ru	(Bq/g)	<1.4e+04
^{90}Sr	(Bq/g)	1.42e+06
^{95}Zr	(Bq/g)	<4.7e+03
Alpha emitters		
^{237}U	(Bq/g)	
^{233}U	(Bq/g)	5.08e+02
^{235}U	(Bq/g)	<9.7e+03
$^{238}Pu/^{239}Pu$	(Bq/g)	8.78e+02
$^{241}Pu/^{241}Am$	(Bq/g)	2.43e+03
^{243}Cm	(Bq/g)	<8.4e+03
^{244}Cm	(Bq/g)	1.71e+04

LEGEND: PHYSICAL PROPERTIES
TDS – TOTAL DISSOLVED SOLIDS
TS – TOTAL SOLIDS
IC – INORGANIC CARBON
TC – TOTAL CARBON
TOC – TOTAL ORGANIC CARBON

Figure 2.26-4 General Characteristics of Waste Samples (Tank System W-31)

	Liquid samples:		Sludge samples		
Tank	Radiation level (R/h)	Organic layer	Number/type	Radiation level (R/h)	Comments
W-31	0.180	No	2/soft sludge	1.5-2.2	Sonicated soft sludge: medium tan, watery sludge; fine and very fine particles separated during centrifugation
			1/hard sludge	2.8	Hard sludge: appearance of clay or mud with a little grit

2.27 Transfer Lines Piping System

2.27.1 Pipe System Summary

The Transfer Lines Piping System connects the eight Melton Valley Waste Storage Tanks with the five Bethel Valley Evaporator Service Tanks (Figures 2.27-1, 2.27-2, and 2.27-3). The Transfer Lines Piping System is single wall except for the piping that is routed in the South Parking Lot Valve Box (also known as the Incinerator Drive Valve Box) at Bethel Valley, the Interconnecting Pipe Line (ICPL) Valve Box No. 1, and outside underground, which is constructed of double-wall pipe. The core pipe is schedule 40S, ASME SA-240, type 304L stainless steel (SS); and the jacket is schedule 10S, ASME SA-240, type 304L SS. The Transfer Lines Piping System is routed from the Control House Pump Pit through Pipe Tunnel 2 where it penetrates outside underground and continues to the Valve Box at Tank W-6, the South Parking Lot Valve Box, and ICPL Valve Box No. 1. The piping then proceeds outside underground to the Waste Storage Tanks Pipe Tunnel and Pump Pit and further to Tank Vaults W-24 through W-27 and W-28 through W-31. The Transfer Lines Piping System is used to transfer concentrate to and from the above locations and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.27.2 Standards for Pipe Assessment of Tank Systems

2.27.2.1 Tank System Piping Description and Design Standards

Transfer Lines Piping System Description

The Transfer Lines Piping System connects the Melton Valley Waste Storage Tanks to the Bethel Valley Evaporator Service Tanks and is routed from the Control House Pump Pit through Pipe Tunnel 2 where it penetrates outside underground and continues to the Valve Box at Tank W-6, the South Parking Lot Valve Box, and ICPL Valve Box No. 1. The piping then proceeds outside underground to the Waste Storage Tanks Pipe Tunnel and Pump Pit and further to Tank Vaults W-24 through W-27 and W-28 through W-31. The piping system is used and managed by the Waste Management and Remedial Actions Division.

The Transfer Lines System core piping is constructed of 2″, 4″, and 6″; schedule 40S; type 304L SS with maximum design pressures of 150 and 300 psig at a temperature of 150°F. The Transfer Lines System jacket piping is 3″, schedule 10S, type 304L SS with a design pressure and temperature of 300 psig and 60°F. The Transfer Lines Piping System has the capacity to contain a maximum volume of 1611 gal.

Design Standards

The applicable codes and standards used for the Transfer Lines Piping System and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

Air Moving and Air Conditioning Association (AMCA) Standards Handbook—Publications 99, 201, and 261;

American Concrete Institute Standards;

American Conference of Government Industrial Hygienists, Industrial Ventilation;

American National Standards Institute;

American Society for Testing and Materials Standards A31, A444, A449, A563, A615, C31, C33, C94, C150, C260, D256, D1190, D1751, and D2729;

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section II (SA-240);

American Standards Association;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

Duct Construction Standards;

Energy Research and Development Administration General Design Criteria, Appendix 6301;

Factory Mutual Engineering Corporation;

Federal Materials Specifications ES-XEM-2023 452, 454, 456, 459, and 460;

Federal Test Method Standard No. 141;

Filtration Systems for Nuclear Applications;

National Electrical Code;

National Electrical Manufacturers' Association.

National Fire Protection Association (NFPA) No. 90A—Air Conditioning and Ventilation Systems;

NFPA No. 91—Blower and Exhaust Systems;

Nuclear Safety Information Center 65—Design, Construction, and Testing of High Efficiency Air

Occupational Safety and Health Administration Safety Regulations;

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) High Velocity

SMACNA Ducted Electric Heat Guide for Air Handling Systems;

SMACNA Low Velocity Duct Construction Standards;

Tennessee Department of Highways Specification, Sections 303, 307, 402, 403, 411, 607, 801, and 910;

UCC-ND Engineering Standards Specifications;

UCC-ND Nondestructive Examinations Procedures NDE-21, NDE-30, and NDE-41;

UCC-ND Technical Specifications A-3.1, A-7.1, CV-1.3, CV-2.1, and CV-2.3;

UCC-ND Welding Procedure Specifications;

Underwriters Laboratories Inc.; and

Union Carbide Corporation Nuclear Division (UCC-ND) Engineering Standard Y-ES-4.11-12.

2.27.2.2 Generic Description of Piping Contents

The Transfer Lines Piping System was designed to transport high-level waste generated at the Oak Ridge National Laboratory (ORNL). However, because no significant quantities of high-level waste were ever generated, this system was repiped to serve as a liquid low-level waste (LLLW) concentrate transfer system. LLLW is generated from a variety of facilities at ORNL including reactors, radioactive fuel processing areas, radioisotope processing areas, decontamination operations, hot cells, and radiochemical laboratories. The waste generators collect the waste, which is then transferred to LLLW Evaporator Feed Tank W-22. Any waste found to be acidic is adjusted to basic with sodium hydroxide in the generator collection tanks or in the evaporator feed tank which precipitates most of the transuranic waste components and heavy metals. The waste is then processed through the evaporator; and the concentrate is transferred to Tanks C-1, C-2, W-21, and W-23 before it is sent to the Melton Valley Waste Storage Tanks via the ICPL: a double-wall, type 304L SS pipeline connecting the two areas.

The Transfer Lines Piping System transfers LLLW between the Evaporator Service Tanks and the Melton Valley Waste Storage Tanks. The Transfer Lines Piping System contents have not been sampled; however, Tank W-23, including the Tank System W-23 piping, has been sampled.

Because Tank System W-23 piping connects with the Transfer Lines Piping System, it is logical to assume that the characteristics of the waste stored in Tank W-23 should be similar to those of the waste transferred through the Transfer Lines Piping System (Figures 2.27-4 and 2.27-5).

The supernate liquid waste sampled in Tank W-23 ranges in color from pale to deep yellow with high pH (11–13) sodium/potassium nitrate salt solutions, which should be similar to the waste concentrate expected to be found in the Transfer Lines Piping System. Based on radiation levels found in Tank W-23, the Transfer Lines Piping System may contain radioactive materials.

2.27.2.3 Pipe Corrosion Protection Measures

Piping inside the Control House Pump Pit, Pipe Tunnel 2, the Valve Box at Tank W-6, the South Parking Lot Valve Box, ICPL Valve Box No. 1, the Waste Storage Tanks Pipe Tunnel and Pump Pit, Tank Vault W-24 through W-27, and Tank Vault W-28 through W-31 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The outside underground piping of the Transfer Lines System consists of three, doubly contained, cathodically protected systems of pipe.

The first system is between the South Parking Lot Valve Box and the Valve Box at Tank W-6, which is included in the Facility Manager's Cathodic Protection System No. 6A. The system consists of magnesium anodes, test stations, and connecting wire as shown on drawings C20013EA005, C20013EA006, and C20013EA007. The cathodic protection system was installed in May 1972 and modified in 1986. The installation drawings called for the use of electrical isolating devices at both ends of the piping run. The cathodic protection system design as shown on the drawings reviewed is considered to be adequate. However, the cathodic protection test report and survey performed in 1990 and 1991 indicate that extensive sections of the piping are not effectively receiving corrosion protection. This can be attributed to electrically shorted piping segments and depleted anode beds. In 1991, Harco completed the engineering design to upgrade the existing system. Energy Systems' upgrade is shown in Table 2.0-1.

The second system is between the Waste Storage Tanks Facility and the South Parking Lot Valve Box, which is included in the Facility Manager's Cathodic Protection System No. 14. The system consists of magnesium anodes, test station, and connecting wire as shown on drawings E20013ED003, E20013ED004, and E20013ED005. The cathodic protection system was installed in June 1976. The installation drawings called for the use of electrical isolating devices at both ends of the piping. The cathodic protection system design as shown on the drawings reviewed is considered to be adequate. However, the cathodic protection test report and survey performed in 1990 and 1991 indicate that two sections of this piping are not receiving effective cathodic protection. This can be attributed to an electrically shorted piping connection and inadequate anode placement. In 1991, Harco completed the engineering design to upgrade the existing system. Energy Systems' upgrade is shown in Table 2.0-1.

The third section is between the Valve Box at Tank W-6 and Pipe Tunnel 2, which is included in the Facility Manager's Cathodic Protection System No. 16. The impressed current system

consists of a manually controlled, air-cooled rectifier in conjunction with graphite anodes and connecting wire as shown on drawing E20237ED008. The cathodic protection system was installed in May 1976. The installation drawings called for the use of electrical isolating devices at both ends of the piping. The cathodic protection system design as shown on the drawings reviewed is not considered to be adequate because test stations are not shown on the installation drawings. The cathodic protection test report and survey performed in 1990 and 1991 indicate that test stations were not installed during construction of the system and that sections of pipe may not be bonded together. In 1991, Harco completed the engineering design to upgrade the existing system. Energy Systems' upgrade is shown in Table 2.0-1.

2.27.2.4 Documented Age of Tank System

The initial Transfer Lines Piping System was installed in 1972. Additional portions of the piping were installed in 1976.

2.27.3 Standards for Containment/Release Detection

2.27.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

The Transfer Lines Piping System is constructed of single-wall, schedule 40S, type 304L SS that is routed from the Control House Pump Pit through Pipe Tunnel 2 where it penetrates outside underground in double-wall, schedule 40S (core pipe) and schedule 10S (jacket), type 304L SS. The double-wall pipe continues to the Valve Box at Tank W-6 and further outside underground through the South Parking Lot Valve Box and ICPL Valve Box No. 1 to the Waste Storage Tanks Pipe Tunnel and Pump Pit. The piping is single wall from the Pipe Tunnel and Pump Pit to Tank Vault W-24 through W-27 and Tank Vault W-28 through W-31. Each area is discussed below. The pipe penetration from Pipe Tunnel 2 to the Control House Pump Pit is a singly contained, 2″, schedule 40S, type 304L SS pipe that is embedded in the concrete wall a length of 2′0″. The pipe penetration from the outside underground piping into the Valve Box at Tank W-6 is a singly contained, 2″, schedule 40S, type 304L SS pipe that is embedded in the concrete wall to a length of 6″. Pipe penetrations from the Waste Storage Tank Pipe Tunnel to the tank vaults consist of singly contained, 4″ and 6″, schedule 40S, type 304L SS pipes and are embedded in the concrete wall to a length of 3′0″.

Control House Pump Pit

The bottom of the pump pit is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project 3′0″ up the pump pit. The pump pit walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS pump pit lining material, which is the same material as that used for the piping, is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the pump pit's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Pipe Tunnel 2

The bottom of Pipe Tunnel 2 is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project up to the pipe tunnel roof. This SS pipe tunnel lining material, which is the same material as that used for the piping, is compatible with the waste and designed to prevent migration of waste into the concrete.

Outside Underground Piping

The jacket of the double-wall pipe is 3″, 304L SS. This secondary containment material is compatible with the waste.

Valve Box at Tank W-6

The bottom of the valve box is lined with 16-gauge (1/16″), 304L SS, which projects 3′0″ up the sidewalls of the valve box. The valve box walls above the SS liner are provided with a system of Amercoat 66 epoxy. The SS valve box lining material, which is the same material as that used for the piping, is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve box's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

South Parking Lot Valve Box

The South Parking Lot Valve Box is not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

ICPL Valve Box No. 1

The bottom of the valve box is lined with 16-gauge (1/16″), 304L SS, which projects 3′0″ up the sidewalls of the valve box. The valve box walls above the SS liner are provided with a system of Carboline 193 epoxy. The SS valve box lining material, which is the same material as that used for the piping, is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the valve box's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Waste Storage Tanks Pipe Tunnel and Pump Pit

The bottom of the pipe tunnel and pump pit is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project 3′0″ up the walls. The walls above the SS liner are provided with a 30-mil-thick system of Amercoat 66 epoxy. The SS lining material, which is the same material as that used for the piping, is compatible with the waste and designed to prevent migration of waste into the concrete. According to manufacturer's specifications, the epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault is lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the Control House Pump Pit, Pipe Tunnel 2, the Valve Box at Tank W-6, ICPL Valve Box No. 1, the Pipe Tunnel and Pump Pit, and the Tank Vaults are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. The assessment concludes that the jacket of the outside underground piping is compatible with the waste. The South Parking Lot Valve Box, however, is not coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.27.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Control House Pump Pit

The pump pit foundation is a 21′0″ × 40′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

Pipe Tunnel 2

The pipe tunnel foundation is a 9′6″ × 63′8″ × 1′0″ thick, reinforced concrete base slab that rests on limestone.

Valve Box at Tank W-6

The valve box foundation is a 4′0″ × 6′0″ × 1′0″ thick, reinforced concrete base slab.

South Parking Lot Valve Box

The valve box foundation is a 5′0″ × 5′0″ × 1′0″ thick, reinforced concrete base slab.

ICPL Valve Box No. 1

The valve box foundation is a 5′0″ × 5′0″ × 1′0″ thick, reinforced concrete base slab.

Waste Storage Tanks Pipe Tunnel and Pump Pit

The pipe tunnel foundation is a 16′0″ × 133′6″ × 1′6″ thick, reinforced concrete slab. The pump pit foundation is a 6′0″ × 66′6″ × 1′0″ thick, reinforced concrete slab. The pipe tunnel and the pump pit are adjoined as one area and rest on a limestone base.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the Control House Pump Pit, Pipe Tunnel 2, the Valve Box at Tank W-6, the South Parking Lot Valve Box, ICPL Valve Box No. 1, the Pipe Tunnel and Pump Pit, and the Tank Vaults have properly designed foundations to support the secondary containment system.

2.27.3.3 Provided with a Leak Detection System That is Design and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Control House Pump Pit

The pump pit floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Pipe Tunnel 2

The Pipe Tunnel 2 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump. Liquid that flows to the Pipe Tunnel 2 sump will continue to flow to the Control House Pump Pit sump through a 4″, schedule 40S, type 304L SS sump drain pipe. The pump pit sump is lined with 16-gauge

(1/16″), 304L SS; and accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Outside Underground Piping

The outside underground, double-wall piping is provided with a nitrogen-blanketed annulus leak detection system.

Valve Box at Tank W-6

The valve box floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

South Parking Lot Valve Box

A leak detection system for the South Parking Lot Valve Box could not be identified from the design drawings or construction specifications.

ICPL Valve Box No. 1

The valve box floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Waste Storage Tanks Pipe Tunnel and Pump Pit

The pipe tunnel and pump pit floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump. Liquid that flows from the pump pit will continue to flow by gravity to a 16-gauge, 304L SS-lined sump in the pipe tunnel. Accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the tank vault is provided with leak detection.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the tank vault is provided with leak detection.

The assessment concludes that the Control House Pump Pit; Pipe Tunnel 2; the outside underground, double-wall piping; the Valve Box at Tank W-6; ICPL Valve Box No. 1; the Pipe Tunnel and Pump Pit; and the Tank Vaults are provided with leak detection. The South Parking Lot Valve Box, however, is not provided with a leak detection system.

2.27.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Control House Pump Pit

The pump pit floor is sloped to a 304L SS-lined sump. The sump provides a low point within the pump pit to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Pipe Tunnel 2

The pipe tunnel floor is sloped to a 304L SS-lined sump. Liquid that flows to the pipe tunnel sump will continue to flow to the pump pit sump through a sump drain pipe. The pump pit sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Outside Underground Piping

The outside underground, double-wall piping is sloped to low points and is provided with 1/2" drain test connections to remove liquids resulting from leaks.

Valve Box at Tank W-6

The valve box floor is sloped to a 304L SS-lined sump. The sump provides a low point to drain liquids to an instrumented location. A pumping system is not provided to remove liquids that accumulate in the sump. However, a portable system may be used to remove liquids upon detection from the alarmed level sensor located in the sump.

South Parking Lot Valve Box

The valve box floor is sloped to a sump. The sump provides a low point to drain liquids. A pumping system is not provided to remove liquids that accumulate in the sump.

ICPL Valve Box No. 1

The valve box floor is sloped to a 304L SS-lined sump. The sump provides a low point to drain liquids to an instrumented location. A pumping system is not provided to remove liquids that accumulate in the sump. However, a portable system may be used to remove liquids upon detection from the alarmed level sensor located in the sump.

Waste Storage Tanks Pipe Tunnel and Pump Pit

The pipe tunnel and pump pit floor is sloped to a 304L SS-lined sump. The sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault W-24 Through W-27

The assessments of the secondary containment system for Tank Vault W-24 through W-27 are presented in the Design Demonstrations for Tanks W-24 through W-27. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Tank Vault W-28 Through W-31

The assessments of the secondary containment system for Tank Vault W-28 through W-31 are presented in the Design Demonstrations for Tanks W-28 through W-31. Those assessments conclude that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the Control House Pump Pit; Pipe Tunnel 2; the outside underground, double-wall piping; the Pipe Tunnel and Pump Pit; and the Tank Vaults are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation. The Valve Box at Tank W-6, the South Parking Lot Valve Box, and ICPL Valve Box No. 1 are sloped and designed to drain liquids. Pumping systems are not provided to remove liquids that accumulate in the sumps; however, portable systems may be used to remove liquids upon detection from the alarmed level sensors located in the sumps of the Valve Box at Tank W-6 and ICPL Valve Box No. 1.

2.27.4 Supplemental Information

2.27.4.1 Ancillary Equipment

Tanks W-24 through W-31 are constructed of 304L SS, which is the same material as that used in the piping system, and are located in tank vaults, which provide secondary containment. The pumps associated with the Transfer Lines Piping System are constructed of 304L SS, which is the same material as that used in the tanks and piping system, and are located in the pump pits, which provide secondary containment. The support equipment is exposed to the same liquids as other components of the piping system; therefore, 304L SS is an acceptable material for the support equipment.

2.27.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes the Transfer Lines Piping System.

2.27.5 References

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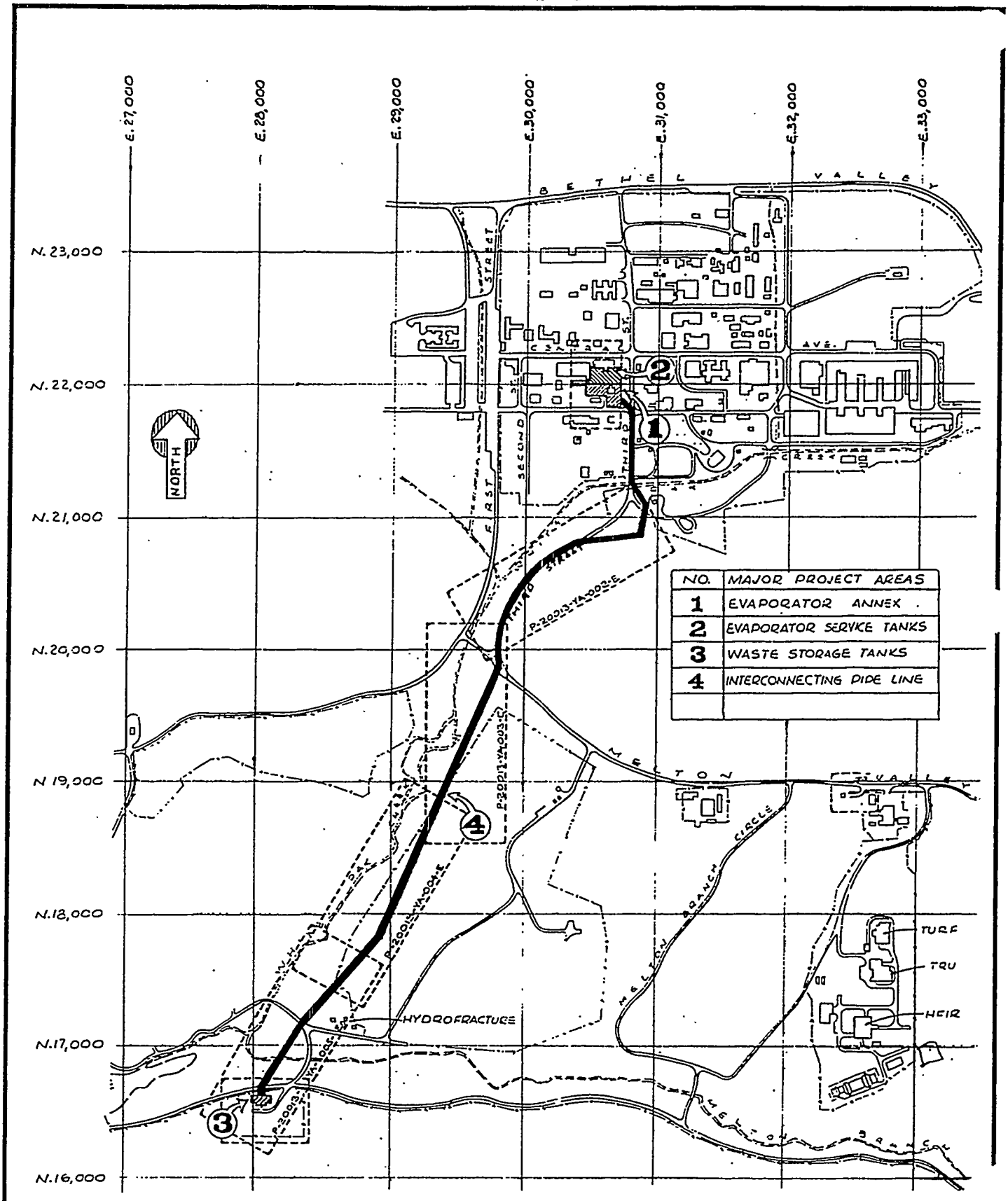
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Figure 2.27-1
Location of Transfer Lines Piping System



NO.	MAJOR PROJECT AREAS
1	EVAPORATOR ANNEX
2	EVAPORATOR SERVICE TANKS
3	WASTE STORAGE TANKS
4	INTERCONNECTING PIPE LINE

Figure 2.27-2
Transfer Lines Piping System Diagram (Sheet 1)

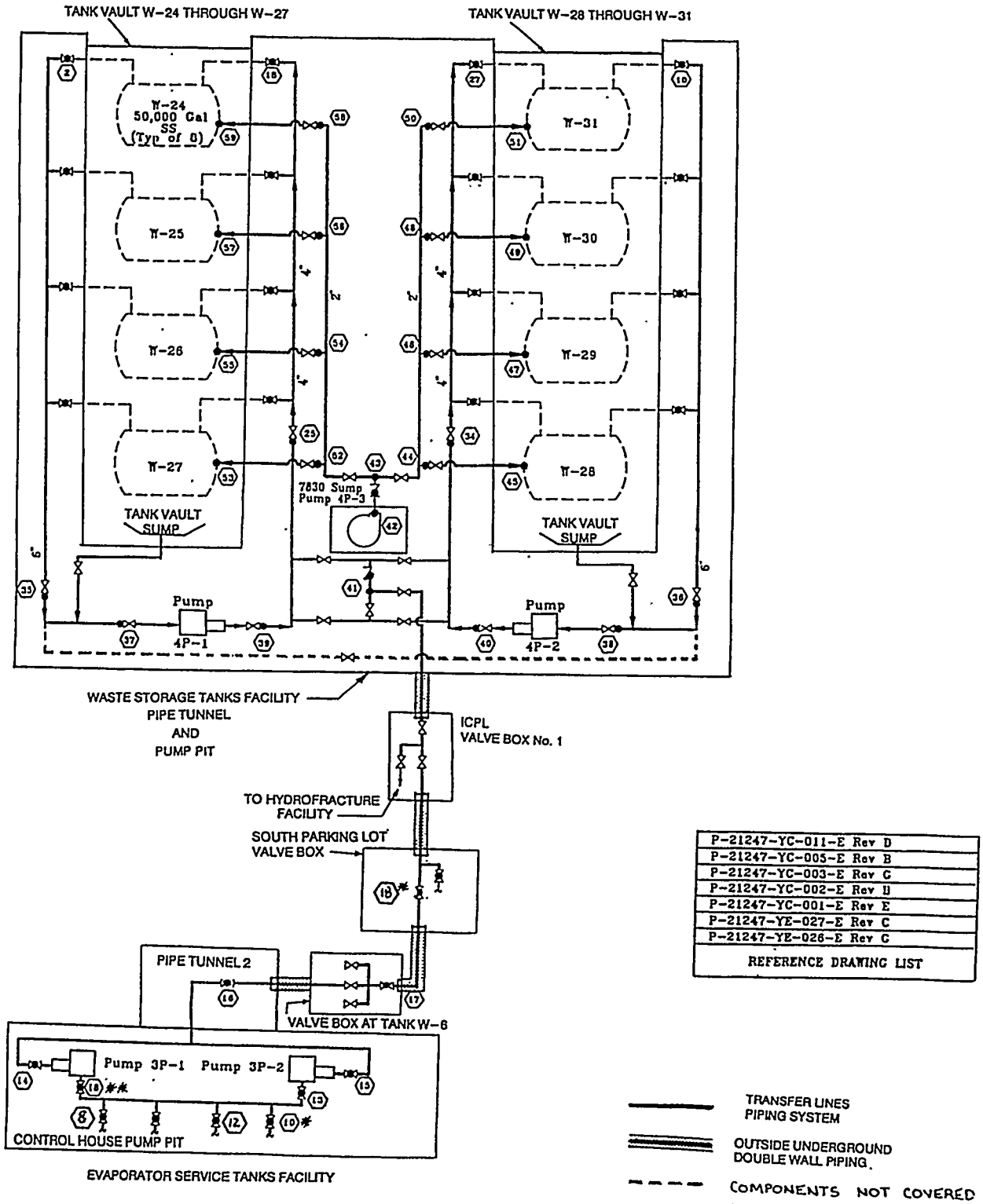


Figure 2.27-3 Transfer Lines Piping System Diagram (Sheet 2)

LINE SEGMENT	② - ㉟	㉟ - ㊲	㊴ - ㉕	㉕ - ⑱	⑩ - ㊱	㊱ - ㊳	㊵ - ㉞	㉞ - ㉗	㊶ - ⑱*
SIZE IN-DIA	6	6	4	4	6	6	4	4	2
SCHEDULE	40S	40S	40S	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS	SS	SS	SS
LENGTH (FT)	50	36	25	60	50	36	25	60	4724
VOLUME (GAL)	75	54	17	40	75	54	17	40	824

LINE SEGMENT	⑰ - ⑱*	⑯ - ⑰	⑮ - ⑯	⑭ - ⑯	⑧ - ⑱**	⑧ - ⑫
SIZE IN-DIA	2	2	2	2	4	4
SCHEDULE	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS
LENGTH (FT)	1214	343	4	4	14	17
VOLUME (GAL)	211	60	1	1	9	11

LINE SEGMENT	⑩* - ⑫	⑩* - ⑬	㊷ - ㊸	㊸ - ㊿	㊸ - ㊽	(Note 1)
SIZE IN-DIA	4	4	2	2	2	2
SCHEDULE	40S	40S	40S	40S	40S	40S
MATERIAL	SS	SS	SS	SS	SS	SS
LENGTH (FT)	5	12	8	63	63	64
VOLUME (GAL)	3	8	1	11	11	11

Notes:
(1) Typical for segments defined by Nodes 44 - 45, 46 - 47, 48 - 49, 50 - 51, 52 - 53, 54 - 55, 56 - 57 and 58 - 59.

Figure 2.27-4 Radiochemical Analyses in the Evaporator Service Tanks

Radiochemical analyses of beta emitters in the Evaporator Service Tanks[a]

	Tank	Sample date	Sample location	Gross beta TRU[b]	Gross beta RHAL[c]	Gross gamma (c/min-mL)	Sr-90	Cs-137	Co-60	Eu-152	Eu-154	Eu-155	Zr-95	Nb-95
	W-21	Nov. 85	Solids[d]	84,900	68,300	1.49E+07	16,400	6,760	1,060	11,600	5,840	2,400	2,660	200
	W-22	Nov. 85	Solids[d]	56,500	53,700	1.18E+07	10,200	5,050	740	10,900	5,350	2,060	2,920	330
REPRESENTATIVE* SAMPLE	W-23	Nov. 85	Liquid[e]	66,800	49,800	1.25E+07	9,400	2,040	760	13,000	[f]	2,250		200
		Nov. 85	Solids[d]	237,000	205,000	1.35E+07	73,700	6,510	880	12,100	8,220	2,550	3,400	

[a] All data from the TRU laboratory except RHAL gross beta and Sr-90.
[b] TRU data: Request No. 45764, received 1/30/86, completed 2/6/86.
[c] RHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.
[d] nCi/g for solid samples.
[e] nCi/mL for liquid samples.
[f] A blank space means no data available.

Radiochemical analyses of alpha emitters in the Evaporator Service Tanks[a]

Tank	Sample date	Sample location	Gross alpha TRU[b]	Gross alpha RHAL[c]	Cm-244	Am-241	Pu-239 & Pu-240	Pu-238	U-233
W-21	Nov. 85	Solids[d]	5110	1900	810	70	380	830	50
W-22	Nov. 85	Solids[d]	3510	2260	1100	100	190	280	58
W-23	Nov. 85	Liquid[e]	870	710	280	50	50	90	38
	Nov. 85	Solids[d]	6970	3190	2190	<30	580	500	130

[a] All data from the TRU laboratory except RHAL gross alpha.
[b] TRU data: Request No. 45764, received 1/30/86, completed 2/6/86.
[c] RHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.
[d] nCi/g for solid samples.
[e] nCi/mL for liquid samples.

* = NO DATA SHOWN FOR TRANSFER LINES SYSTEM PIPING
TANK W-23 SHOWN AS A REPRESENTATIVE SAMPLE.

Figure 2.27-5
Analytical Data For Liquid and Sludge Samples (Evaporator Service Tanks)

ANALYTICAL DATA FOR LIQUID SAMPLE

Characteristic JAN, 1990		W23-L1 * REPRESENTATIVE SAMPLE
Physical properties and miscellaneous data		
TDS	(mg/mL)	331
TS	(mg/mL)	383
Density	(g/mL)	1.2423
IC	(mg/L)	8340
TC	(mg/L)	9500
TOC	(mg/L)	1160
RCRA metals		
Ag	(mg/L)	<0.44
As	(mg/L)	<3.0
Ba	(mg/L)	<0.19
Cd	(mg/L)	1.7
Cr	(mg/L)	0.42
Hg	(mg/L)	0.07
Ni	(mg/L)	3.0
Pb	(mg/L)	2.7
Se	(mg/L)	<2.3
Tl	(mg/L)	<0.94
Process metals		
Al	(mg/L)	1.8
B	(mg/L)	10
Ca	(mg/L)	18
Co	(mg/L)	-
Fe	(mg/L)	0.70
K	(mg/L)	78000
Mg	(mg/L)	3.4
Na	(mg/L)	82000
Si	(mg/L)	<1
Sr	(mg/L)	0.40
Th	(mg/L)	15.8
U	(mg/L)	17
Anions		
Chloride	(M)	0.10
Fluoride	(M)	<0.053
Nitrate	(M)	3.23
Phosphate	(M)	<0.053
Sulfate	(M)	0.081
Alkalinity		
pH		12.8
H^+	(M)	-
OH^-	(M)	0.15
CO_3^{2-}	(M)	0.70
HCO_3^-	(M)	
Beta/gamma emitters		
Gross alpha	(Bq/mL)	8.20e+01
Gross beta	(Bq/mL)	4.62e+05
^{14}C	(Bq/mL)	6.35e+01
^{144}Ce	(Bq/mL)	<1.4e+03
^{60}Co	(Bq/mL)	6.21e+02
^{134}Cs	(Bq/mL)	4.63e+03
^{137}Cs	(Bq/mL)	4.36e+05
^{152}Eu	(Bq/mL)	<2.1e+02
^{154}Eu	(Bq/mL)	<1.6e+02
^{155}Eu	(Bq/mL)	<8.5e+02
^{3}H	(Bq/mL)	1.19e+02
^{93}Nb	(Bq/mL)	<1.0e+02
^{106}Ru	(Bq/mL)	3.78e+03
^{90}Sr	(Bq/mL)	4.12e+02
^{93}Zr	(Bq/mL)	<1.0e+02
Alpha emitters		
^{234}U	(Bq/mL)	4.00e+00
^{238}U	(Bq/mL)	6.00e+00
$^{239}Pu/^{240}Pu$	(Bq/mL)	6.00e+00
$^{238}Pu/^{241}Am$	(Bq/mL)	3.90e+01
^{244}Cm	(Bq/mL)	4.00e+00

ANALYTICAL DATA FOR SLUDGE SAMPLE

Characteristic JAN, 1990		W23-S * REPRESENTATIVE SAMPLE
Physical properties and miscellaneous data		
TS	(g/g)	544
Density	(g/mL)	1.34
IC	(mg/kg)	18100
TC	(mg/kg)	22200
TOC	(mg/kg)	4120
RCRA metals		
Ag	(mg/kg)	(28)
As	(mg/kg)	(<50)
Ba	(mg/kg)	63
Cd	(mg/kg)	32
Cr	(mg/kg)	190
Hg	(mg/kg)	19
Ni	(mg/kg)	110
Pb	(mg/kg)	(450)
Se	(mg/kg)	<39
Tl	(mg/kg)	<16
Process metals		
Al	(mg/kg)	2500
B	(mg/kg)	<10
Ca	(mg/kg)	55000
Co	(mg/kg)	
Fe	(mg/kg)	1900
K	(mg/kg)	18000
Mg	(mg/kg)	16000
Na	(mg/kg)	82000
Sr	(mg/kg)	290
Th	(mg/kg)	12000
U	(mg/kg)	17000
Beta/gamma emitters		
Gross alpha	(Bq/g)	2.23e+05
Gross beta	(Bq/g)	6.67e+06
^{14}C	(Bq/g)	3.65e+02
^{144}Ce	(Bq/g)	<2.7e+04
^{60}Co	(Bq/g)	2.52e+05
^{134}Cs	(Bq/g)	<6.5e+03
^{137}Cs	(Bq/g)	4.95e+05
^{152}Eu	(Bq/g)	7.22e+05
^{154}Eu	(Bq/g)	5.14e+05
^{155}Eu	(Bq/g)	1.21e+05
^{93}Nb	(Bq/g)	<7.0e+03
^{106}Ru	(Bq/g)	<6.2e+04
^{90}Sr	(Bq/g)	2.28e+06
^{93}Zr	(Bq/g)	<4.5e+04
Alpha emitters		
^{234}U	(Bq/g)	
^{238}U	(Bq/g)	1.18e+04
^{239}U	(Bq/g)	<2.8e+04
$^{239}Pu/^{240}Pu$	(Bq/g)	1.18e+04
$^{238}Pu/^{241}Am$	(Bq/g)	3.21e+04
^{243}Cm	(Bq/g)	<2.6e+04
^{244}Cm	(Bq/g)	1.67e+05

LEGEND:
TSD - TOTAL DISSOLVED SOLIDS
TS - TOTAL SOLIDS
IC - INORGANIC CARBON
TC - TOTAL CARBON
TOC - TOTAL ORGANIC CARBON

* = NO DATA SHOWN FOR TRANSFER LINES SYSTEM PIPING
TANK W-23 SHOWN AS A REPRESENTATIVE SAMPLE.

2.28 Tank System S-223 Piping

2.28.1 Tank System Summary

Tank System S-223 is located near the Fission Product Development Laboratory (Building 3517) at the main Bethel Valley Complex (Figures 2.28-1 and 2.28-2). The tank system piping is schedule 40S, ASME SA-240, type 304L and type 347 stainless steel (SS) and is routed from Tank Vault S-223 (Cell 23) to the Cell 25 Pipe Tunnel and then outside underground through Valve Box 2A to Valve Box No. 2. Tank System S-223 piping is used to transfer liquid low-level waste (LLLW) from Building 3517 and waste from tank-farm cell sumps to Tank S-223 and is classified as Federal Facility Agreement (FFA) Category B tank system.

2.28.2 Standards for Pipe Assessment of Tank Systems

2.28.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System S-223 piping is located near Building 3517 and is routed from Tank Vault S-223 to Cell 25 Pipe Tunnel and then outside underground through Valve Box 2A to Valve Box No. 2. The piping system is used and managed by the Chemical Technology Division.

Tank System S-223 piping is constructed of 1-1/2″ and 2″, schedule 40S, type 304L and 347 SS with a maximum design pressure and temperature of 150 psig and 125°F. The outside underground jacket is constructed of 3", schedule 10S, type 304L SS with a maximum design pressure and temperature of 150 psig and 32°F. Tank System S-223 piping has the capacity to contain a maximum volume of approximately 82 gal.

Design Standards

The applicable codes and standards used for Tank System S-223 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

American Society for Testing and Materials A15-52T, A160-52T, A16-52T, A305-53T, A185-37, C39-49, C192-52T, C31-49, C33-52T, C39-49, C40-48, C42-49, C94-48, C150-53, and D544-52T;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section II (SA-240);

American Standards Association;

American Welding Society;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

Atomic Energy Commission Safety Code;

Federal Specifications LLL-F-321, Class A LLLF321;

National Electric Code; and

Underwriters Laboratories Inc.

2.28.2.2 Generic Description of Piping Contents

Tank System S-223 piping is designed to transfer LLLW from a variety of operations such as supernate from cesium and strontium precipitation, raffinates from a cesium-144 extraction process, and general decontamination solutions. Tank System S-223 piping may contain radioactive materials.

The analytical data (Figure 2.28-3) of waste stream contaminants from the generators are representative of the waste transferred through Tank System S-223 piping.

2.28.2.3 Pipe Corrosion Protection Measures

Piping inside Tank Vault S-223, the Cell 25 Pipe Tunnel, Valve Box 2A, and Valve Box No. 2 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The pipe routed outside underground from the Cell 25 Pipe Tunnel to Valve Box 2A and from Valve Box 2A to Valve Box 2 is approximately 440′ in length and is double-wall piping with cathodic protection (with the exception of a segment of singly contained piping approximately 10′ in length located just outside the Cell 25 Pipe Tunnel). The cathodic protection for the outside underground piping is included in the Facility Manager's Cathodic Protection System No. 21. The cathodic protection system consists of magnesium anodes, test stations, and connection wire as shown on drawing E3E20013D031. The piping and cathodic protection system were designed and installed in 1985. The use of electrical isolation devices could not be identified on the design drawings. The cathodic protection system design as shown on the drawings reviewed is not considered to be adequate. The cathodic protection survey and test report performed in 1990 and 1991 yielded data that demonstrate a lack of effective overall cathodic protection on this piping system. This is due mainly to the lack of electrical isolation of the outside underground portion of the piping. In 1991, Harco completed the engineering design to upgrade the existing system.

2.28.2.4 Documented Age of Tank System

A portion of Tank System S-223 piping was installed in 1955. The underground, double-wall piping was installed in 1985.

2.28.3 Standards for Containment/Release Detection

Tank System S-223 piping incorporates approximately 10′ of outside underground piping at the Cell 25 Pipe Tunnel that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.28.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System S-223 piping is 1-1/2″ and 2″, schedule 40S, type 304L and type 347 SS piping that is routed from Tank Vault S-223 (Cell 23) to the Cell 25 Pipe Tunnel and then outside underground through Valve Box 2A to Valve Box No. 2. The areas of secondary containment are discussed below. The piping penetrations from Tank Vault S-223 to Cell 25 and from Cell 25 to outside underground are singly contained, 1-1/2″, schedule 40S, type 304L SS pipes that are embedded in the concrete wall to a length of 2′0″ and 1′0″, respectively.

The piping routed from the Cell 25 Pipe Tunnel to Valve Box 2A is double wall with a 1-1/2″, schedule 40S, type 304L SS core pipe and 3″, schedule 10S, type 304L SS jacket. The piping routed from Valve Box 2A to Valve Box No. 2 is double wall with a 2″, schedule 40S, type 304L SS core pipe and a 3″, schedule 10S, type 304L SS jacket.

Tank Vault S-223

The assessment of the secondary containment system for Tank Vault S-223 is presented in the Design Demonstrations for Tank S-223. That assessment concludes that Tank Vault S-223 is coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Cell 25 Pipe Tunnel

The interior surfaces of Cell 25 are provided with a system of Amercoat 23 and 33 epoxy coating. According to manufacturer's specifications, the cell's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box 2A

The bottom of Valve Box 2A is lined with 16-gauge (1/16″), 304L SS, with sidewalls that project 2′0″ up the valve box. The SS valve box lining material, which is the same material as that used for the piping, is compatible with the waste and designed to prevent migration of waste into the concrete.

Valve Box No. 2

The bottom of Valve Box No. 2 is lined with 16-gauge (1/16″), 304L SS, which is the same material as that used for the piping, and projects 2′0″ up the sidewalls of the valve box. The SS valve box lining material is compatible with the waste and designed to prevent migration of waste into the concrete.

Outside Underground Piping

The jacket of the outside underground, double-wall pipe is 304L SS. The secondary containment material is compatible with the waste.

The assessment concludes that Tank Vault S-223, Cell 25, Valve Box 2A, and Valve Box No. 2 are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete. The assessment concludes that the jacket of the underground piping is compatible with the waste.

2.28.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault S-223

The assessment of the secondary containment system for Tank Vault S-223 is presented in the Design Demonstrations for Tank S-223. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Cell 25 Pipe Tunnel

The Cell 25 foundation is a 6′6″ × 63′8″ × 1′3″ thick, reinforced concrete base slab that rests on limestone.

Valve Box 2A

The valve box foundation is an 8′0″ × 12′0″ × 1′0″ thick, reinforced concrete base slab that rests on crushed stone.

Valve Box No. 2

The valve box foundation is a 6′8″ × 14′4″ × 10″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that Tank Vault S-223, Cell 25, Valve Box 2A, and Valve Box No. 2 are properly designed to support the secondary containment systems.

2.28.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault S-223

The assessment of the secondary containment system for Tank Vault S-223 is presented in the Design Demonstrations for Tank S-223. That assessment concludes that the vault is provided with a leak detection system.

Cell 25 Pipe Tunnel

The Cell 25 floor is sloped to an epoxy-coated sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

Valve Box 2A

The Valve Box 2A floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Valve Box No. 2

The Valve Box No. 2 floor is sloped to a 16-gauge (1/16″), 304L SS-lined sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the Waste Operations Control Center (Building 3130).

Outside Underground Piping

The outside underground, double-wall piping is provided with a nitrogen-blanketed leak detection system.

The assessment concludes that Tank Vault S-223, Cell 25, Valve Box 2A, Valve Box No. 2, and the outside underground piping are provided with leak detection.

2.28.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault S-223

The assessment of the secondary containment system for Tank Vault S-223 is presented in the Design Demonstrations for Tank S-223. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Cell 25 Pipe Tunnel

The Cell 25 floor is sloped to an epoxy-coated sump. The sump provides a low point within Cell 25 to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Box 2A

The Valve Box 2A floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve box to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Valve Box No. 2

The Valve Box No. 2 floor is sloped to a 304L SS-lined sump. The sump provides a low point within the valve box to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Outside Underground Piping

The outside underground, double-wall piping is provided with 1/2" drain test connections to remove liquids resulting from leaks.

The assessment concludes that Tank Vault S-223, Cell 25, Valve Box 2A, Valve Box No. 2, and the outside underground piping are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.28.4 Supplemental Information

2.28.4.1 Ancillary Equipment

Tank S-223 is constructed of 304L SS, which is the same material as that used in the piping system, and is located in Tank Vault S-223, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.28.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at ORNL are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System S-223.

2.28.5 References

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Energy Systems Drawing D24327, Building 3517, Phase II, Piping Schedule, Process Line, Revision 3.

Energy Systems Drawing D24341, Building 3517, Phase II, Piping Schedule, Service Line, Revision 3.

Energy Systems Drawing D24398, Building 3517, Phase II, Piping Plan Cell 23, Revision 3.

Energy Systems Drawing D26832, Building 3517, Phase II, Piping Cell 25 Plan 1, Revision 4.

Energy Systems Drawing D26833, Building 3517, Phase II, Piping Cell 25 Plan 2, Revision 3.

Energy Systems Drawing D26834, Building 3517, Phase II, Piping Cell 25 Plan 3, Revision 3.

Energy Systems Drawing D26835, Building 3517, Phase II, Piping Cell 25 Section A-A, Revision 3.

Energy Systems Drawing D26836, Building 3517, Phase II, Piping Cell 25 Section C-C, Revision 6.

Energy Systems Drawing D26837, Building 3517, Phase II, Piping Cell 25 Section D-D, Revision 5.

Energy Systems Drawing D26838, Building 3517, Phase II, Piping Plan Cell 26, Revision 2.

Energy Systems Drawing D22811, Building 3517, Plan, Tank Farm Sleeves, Revision 5.

Energy Systems Drawing D22812, Building 3517, Sections and Details, Tank Farm Sleeves, Revision 6.

Energy Systems Drawing D22808, Building 3517, Tank Farm, Sections and Details, Revision 2.

Energy Systems Drawing D22809, Building 3517, Tank Farm, Sections and Details, Revision 1.

Energy Systems Drawing D22810, Building 3517, Tank Farm, Sections and Details, Revision 2.

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Harco Technologies Corporation. August 1991. *Cathodic Protection System Upgrade Design*

LLLW Generator Survey 1990 for Building 3517

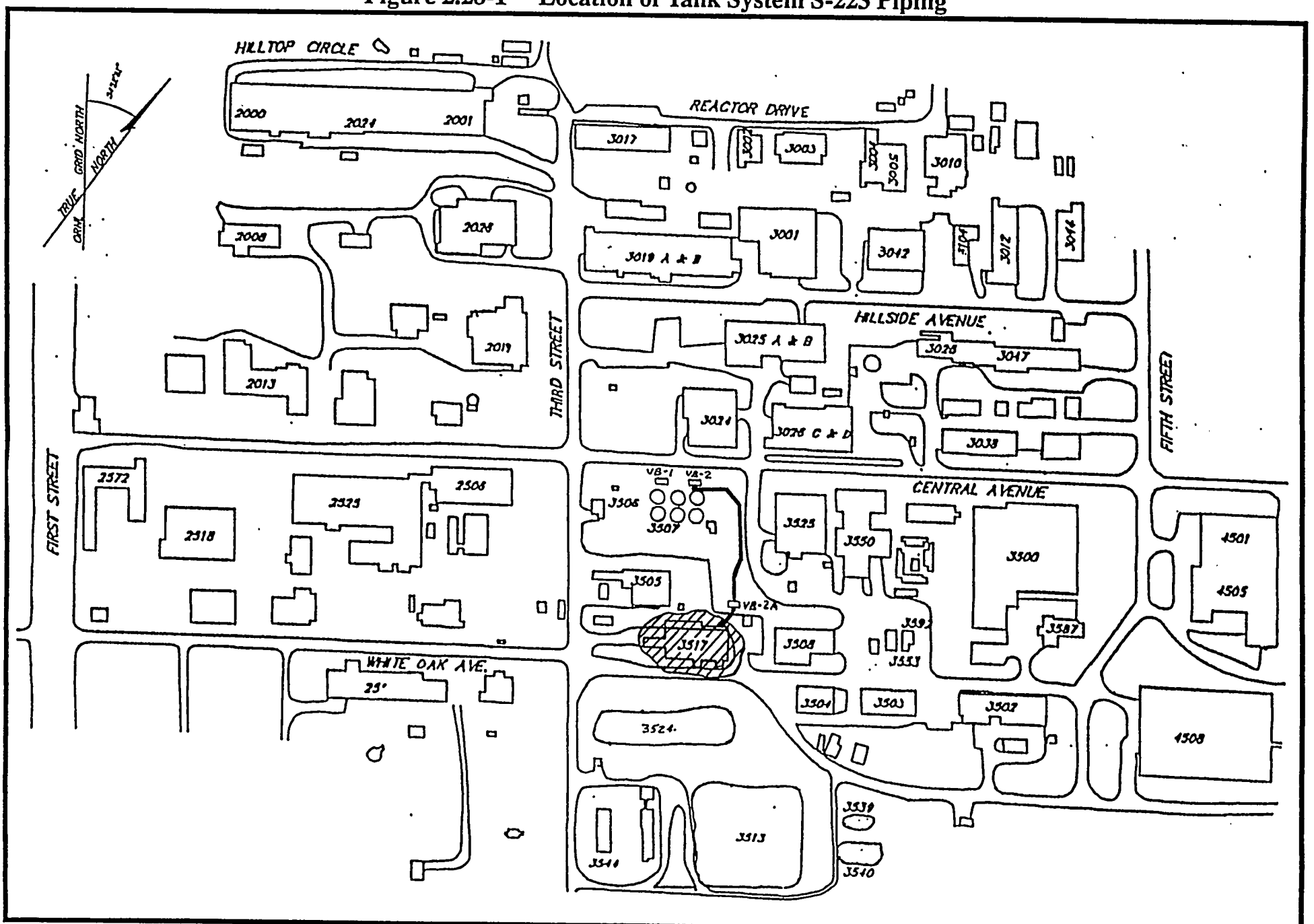
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Risk Evaluation of Embedded, Single-Walled Liquid Low-Level Waste Piping at Oak Ridge National Laboratory.

Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

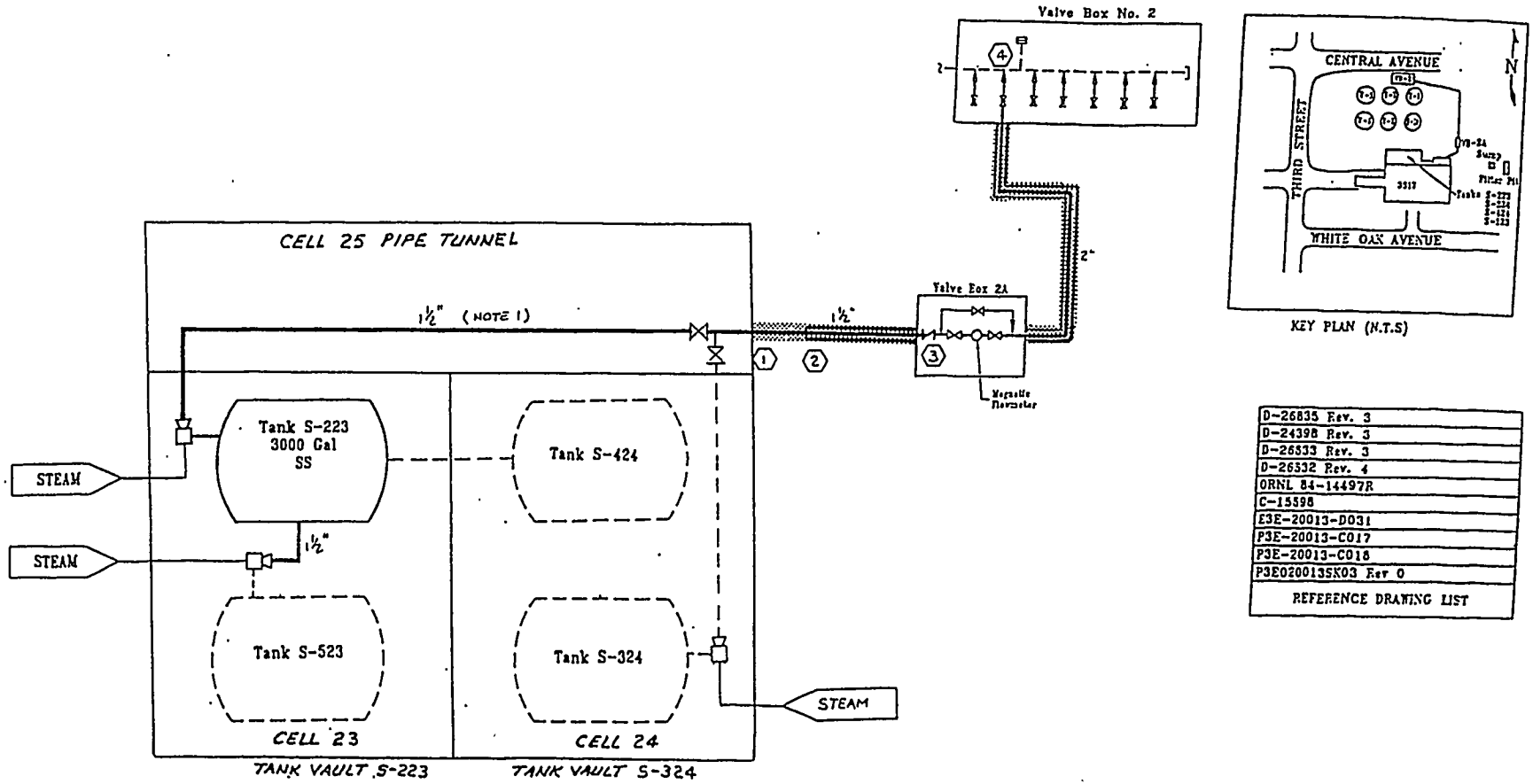
Underground ILW Lines, Building 3517 to VLV Box 2, System No. 21, Oak Ridge National Laboratories, United States Department of Energy, Oak Ridge, Tennessee. Martin Marietta Energy Systems, Inc.

Figure 2.28-1 Location of Tank System S-223 Piping



EBASCO/MAIN

Figure 2.28-2 Tank System S-223 Piping Diagram



REFERENCE DRAWING LIST
D-26835 Rev. 3
D-24398 Rev. 3
D-26533 Rev. 3
D-26532 Rev. 4
ORNL 84-14497R
C-15598
E3E-20013-D031
P3E-20013-C017
P3E-20013-C018
P3E020013SK03 Rev 0

LINE SEGMENT	① - ②	② - ③	③ - ④
SIZE IN-DIA	1½"	1½"	2"
SCHEDULE	40S	40S	40S
MATERIAL	SS	SS	SS
LENGTH (FT)	10	70	360
VOLUME (GAL)	1	7	63

Notes:

(1) Drain and transfer piping lengths within tank farm cells 23, 24 & 25 are indeterminate from available piping drawings. The functional flow arrangement is as shown in the Bldg. 3517 Safety Analysis Report.

TANK SYSTEM S-223 PIPING

UNDERGROUND PIPE (SINGLE WALL)

UNDERGROUND PIPE DOUBLY CONTAINED

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.28-3
Analytical Data for Liquid (Tank System S-223)

LLLW GENERATOR SURVEY - 1990

Isotopes:	Cs-137	Quantities:	500.00 Ci/year
	Sr-90		500.00 Ci/year

Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid	25.0 gal/year
turco decon 4502	25.0 lbs/year
oxalic acid	25.0 lbs/year
sodium hydroxide	25.0 lbs/year
Mr. Clean	Unknown
Ajax liquid	Unknown
Planisol	Unknown

2.29 Tank System S-324 Piping

2.29.1 Tank System Summary

Tank System S-324 is located near the Fission Product Development Laboratory (Building 3517) at the main Bethel Valley Complex (Figures 2.29-1 and 2.29-2). The tank system piping is schedule 40S, ASME SA-240, type 347 stainless steel (SS) and is routed from the Electro Polisher and Offgas Scrubber System floor drains through the Cells 1 through 9 Pipe Trench, the Building 3517 Pipe Trench, and the Cell 25 Pipe Tunnel to Tank Vault S-324. Tank System S-324 piping is used to transfer liquid low-level waste (LLLW) from the Electro Polisher and Offgas Scrubber System floor drains to Tank S-324 and further to the Evaporator and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.29.2 Standards for Pipe Assessment of Tank Systems

2.29.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System S-324 piping is located near Building 3517 and is routed from the Electro Polisher and Offgas Scrubber System floor drains through the Cells 1 through 9 Pipe Trench, the Building 3517 Pipe Trench and the Cell 25 Pipe Tunnel to Tank Vault S-324. The piping system is used and managed by the Chemical Technology Division.

Tank System S-324 piping is constructed of 1-1/2″ and 2″, schedule 40S, type 347 SS with a maximum design pressure and temperature of 150 psig and 125°F. Tank System S-324 piping has the capacity to contain a maximum volume of approximately 50 gal.

Design Standards

The applicable codes and standards used for Tank System S-324 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

American Society for Testing and Materials A15-52T, A160-52T, A16-52T, A305-53T, A-185-37, C39-49, C192-52T, C31-49, C33-52T, C39-49, C40-48, C42-49, C94-48, C150-53, and D544-2T;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section II (SA-240);

American Welding Society;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

Atomic Energy Commission Safety Code;

Federal Specifications LLL-F-321, Class A LLLF321;

National Electric Code; and

Underwriters Laboratories Inc.

2.29.2.2 Generic Description of Piping Contents

Tank System S-324 piping is designed to transfer LLLW from a variety of operations, such as supernate from cesium and strontium precipitation, raffinates from a cesium-144 extraction process, and general decontamination solutions. Tank System S-324 piping may contain radioactive materials.

The analytical data (Figure 2.29-3) of waste stream contaminants from the generators are representative of the waste transferred through Tank System S-324 piping.

2.29.2.3 Pipe Corrosion Protection Measures

Piping inside the Cells 1 through 9 Pipe Trench, the Building 3517 Pipe Trench, the Cell 25 Pipe Tunnel, and Tank Vault S-324 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.29.2.4 Documented Age of Tank System

Tank System S-324 piping was installed in 1955.

2.29.3 Standards for Containment/Release Detection

Tank System S-324 piping incorporates approximately 24′ of embedded floor drain and wall penetration piping that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.29.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System S-324 piping is single-wall, schedule 40S, type 347 SS that is routed from the Electro Polisher and Offgas Scrubber floor drains in Building 3517 through the Cells 1 through 9

Pipe Trench, the Building 3517 Pipe Trench, and the Cell 25 Pipe Tunnel to Tank Vault S-324. Each area is discussed below.

Cells 1 Through 9 Pipe Trench

The bottom of the pipe trench is lined with 1/4″, 304L SS, with 11-gauge (1/8″), 304L SS sidewalls that project up to the cell's roof. The SS cell lining material, which is a similar material as that used for the piping, is compatible with the waste and designed to prevent migration of waste into the concrete.

Building 3517 Pipe Trench

The interior surfaces of the pipe trench are provided with a system of Amercoat 23 and 33 epoxy coating. According to manufacturer's specifications, the pipe trench's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Cell 25 Pipe Tunnel

The interior surfaces of the cell are provided with a system of Amercoat 23 and 33 epoxy coating. According to manufacturer's specifications, the cell's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Tank Vault S-324

The assessment of the secondary containment system for Tank Vault S-324 is presented in the Design Demonstrations for Tank S-324. That assessment concludes that Tank Vault S-324 is coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that the pipe trenches, cell, and tank vault are coated or lined with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.29.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Cells 1 Through 9 Pipe Trench

The pipe trench foundation is a 29′6″ × 89′0″ × 2′0″ thick, reinforced concrete base slab that rests on limestone.

Building 3517 Pipe Trench

The pipe trench foundation is a 7′6″ × 40′0″ × 11″ thick, reinforced concrete base slab that rests on limestone.

Cell 25 Pipe Tunnel

The cell foundation is a 6′6″ × 63′8″ × 1′3″ thick, reinforced concrete base slab that rests on limestone.

Tank Vault S-324

The assessment of the secondary containment system for Tank Vault S-324 is presented in the Design Demonstrations for Tank S-324. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

The assessment concludes that the pipe trenches, cell, and tank vault foundations are properly designed to support the secondary containment systems.

2.29.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Cells 1 Through 9 Pipe Trench

The pipe trench floor is sloped to the epoxy-coated Building 3517 Pipe Trench, which is sloped to the epoxy-coated Cell 25 Pipe Tunnel. Accumulation of liquid will flow from the pipe trenches to the Cell 25 sump and will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

Building 3517 Pipe Trench

The pipe trench floor is sloped to the epoxy-coated Cell 25 Pipe Tunnel. Accumulation of liquid will flow by gravity from the pipe trench to the Cell 25 sump and will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

Cell 25 Pipe Tunnel

The cell floor is sloped to an epoxy-coated sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

Tank Vault S-324

The assessment of the secondary containment system for Tank Vault S-324 is presented in the Design Demonstrations for Tank S-324. That assessment concludes that the vault is provided with a leak detection system.

The assessment concludes that the pipe trenches, cell, and tank vault are provided with leak detection.

2.29.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Cells 1 Through 9 Pipe Trench

The pipe trench floor is sloped to the Building 3517 Pipe Trench, which slopes into the epoxy-coated Cell 25 sump. The cell sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Building 3517 Pipe Trench

The pipe trench floor is sloped to the epoxy-coated Cell 25 sump. The cell sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Cell 25 Pipe Tunnel

The cell floor is sloped to an epoxy-coated sump. The sump provides a low point within the cell to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank Vault S-324

The assessment of the secondary containment system for Tank Vault S-324 is presented in the Design Demonstrations for Tank S-324. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

The assessment concludes that the secondary containments for the pipe trenches, cell, and tank vault are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.29.4 Supplemental Information

2.29.4.1 Ancillary Equipment

Tank S-324 is constructed of 304L SS, which is a similar material as that used for the piping system, and is located in Tank Vault S-324, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.29.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System S-324.

2.29.5 References

Construction Specification, Multicurie Fission Products Pilot Plant in Building 3517. Invitation No. 401-55-8A.

Ebasco, and Main. May 14, 1993. *Design Demonstrations—Category B Tank Systems*, Revision 2. DOE Contract No. DE-AC05-91OR21928. Oak Ridge National Laboratory

Energy Systems Drawing D20836, Multicurie Fission Product Pilot Plant, Cell Bank Building 3517, Hot Drain Line, Isometric Detail, Revision 2.

Energy Systems Drawing D20850, Multicurie Fission Product Pilot Plant, Cell Bank Building 3517, Plan of Hot Drain and Condensate Drain, Revision 1.

Energy Systems Drawing D20862, Multicurie Fission Product Pilot Plant, Cell Bank Building 3517, Ventilation, Revision 1.

Energy Systems Drawing D20863, Multicurie Fission Product Pilot Plant, Cell Bank Building 3517, Ventilation Sections, Revision 1.

Energy Systems Drawing E31394, Building 3517, Phase II, Jet and Piping Schedule, Dated 4/10/58 (No Revision No.).

Energy Systems Drawing D24327, Building 3517, Phase II, Piping Schedule, Process Line, Revision 3.

Energy Systems Drawing D24341, Building 3517, Phase II, Piping Schedule, Service Line, Revision 3.

Energy Systems Drawing D24407, Building 3517, Phase II, Piping Plan Cell 24, Revision 2.

Energy Systems Drawing D24408, Building 3517, Phase II, Piping Elevation Cell 24, Revision 2.

Energy Systems Drawing D26832, Building 3517, Phase II, Piping Cell 25 Plan 1, Revision 4.

Energy Systems Drawing D26833, Building 3517, Phase II, Piping Cell 25 Plan 2, Revision 3.

Energy Systems Drawing D26834, Building 3517, Phase II, Piping Cell 25 Plan 3, Revision 3.

Energy Systems Drawing D26835, Building 3517, Phase II, Piping Cell 25 Section A-A, Revision 3.

Energy Systems Drawing D26836, Building 3517, Phase II, Piping Cell 25 Section C-C, Revision 6.

Energy Systems Drawing D26837, Building 3517, Phase II, Piping Cell 25 Section D-D, Revision 5.

Energy Systems Drawing D26838, Building 3517, Phase II, Piping Plan Cell 26, Revision 2.

Energy Systems Drawing D22805, Building 3517, Foundation Plan and Detail, Revision 3.

Energy Systems Drawing D22806, Building 3517, Elevations, Foundation Walls, Revision 4.

Energy Systems Drawing D22807, Building 3517, Elevations, Foundation Plan Tank Farm, Revision 2.

Energy Systems Drawing D22808, Building 3517, Tank Farm, Sections and Details, Revision 2.

Energy Systems Drawing D22809, Building 3517, Tank Farm, Sections and Details, Revision 1.

Energy Systems Drawing D22810, Building 3517, Tank Farm, Sections and Details, Revision 2.

Energy Systems Drawing D22811, Building 3517, Plan Tank Farm Sleeves, Revision 5.

Energy Systems Drawing D22812, Building 3517, Sections and Details, Tank Farm Sleeves, Revision 6.

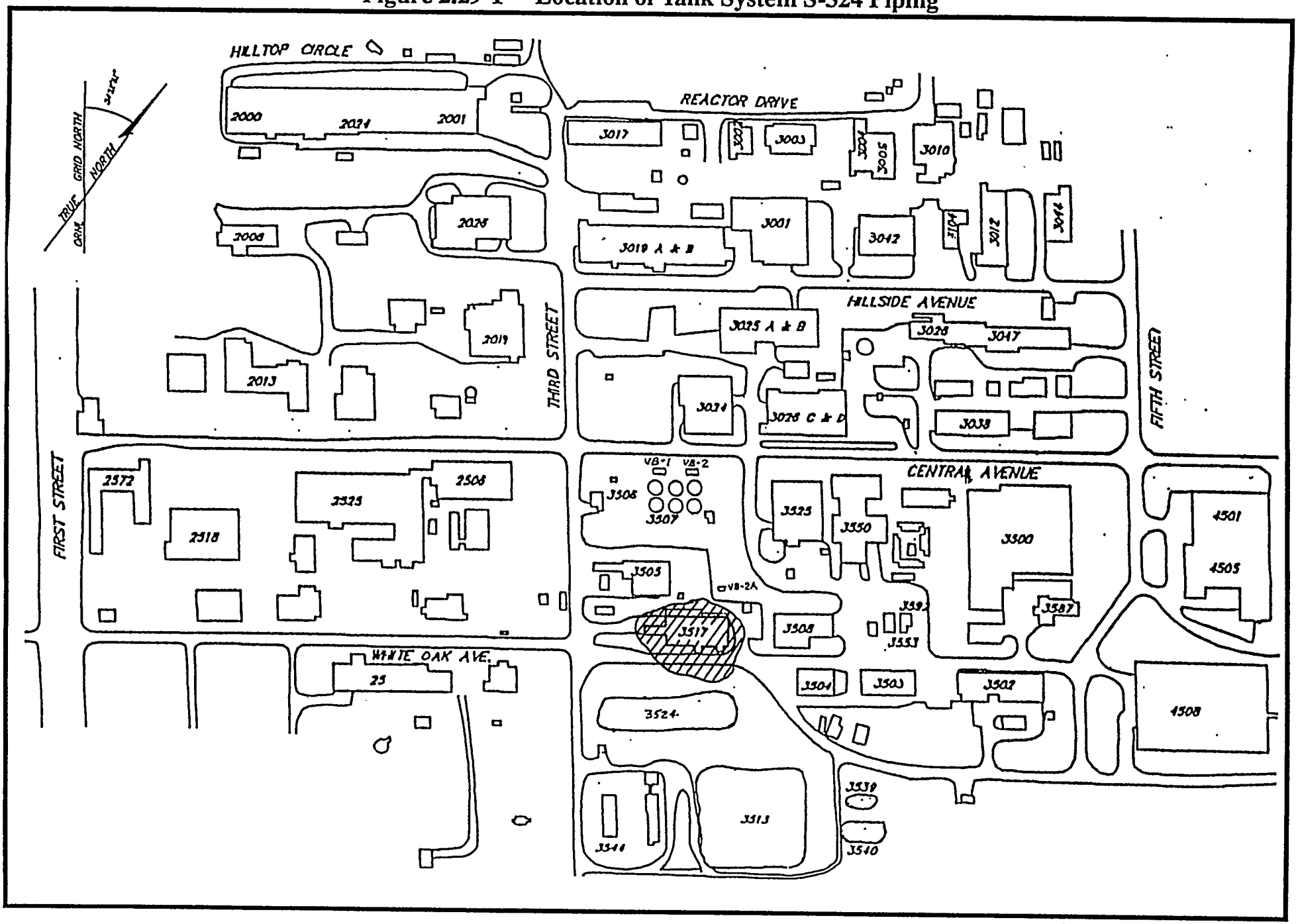
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Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory.* WM-WMCO-201. Department of Waste Minimization Planning and Certification.

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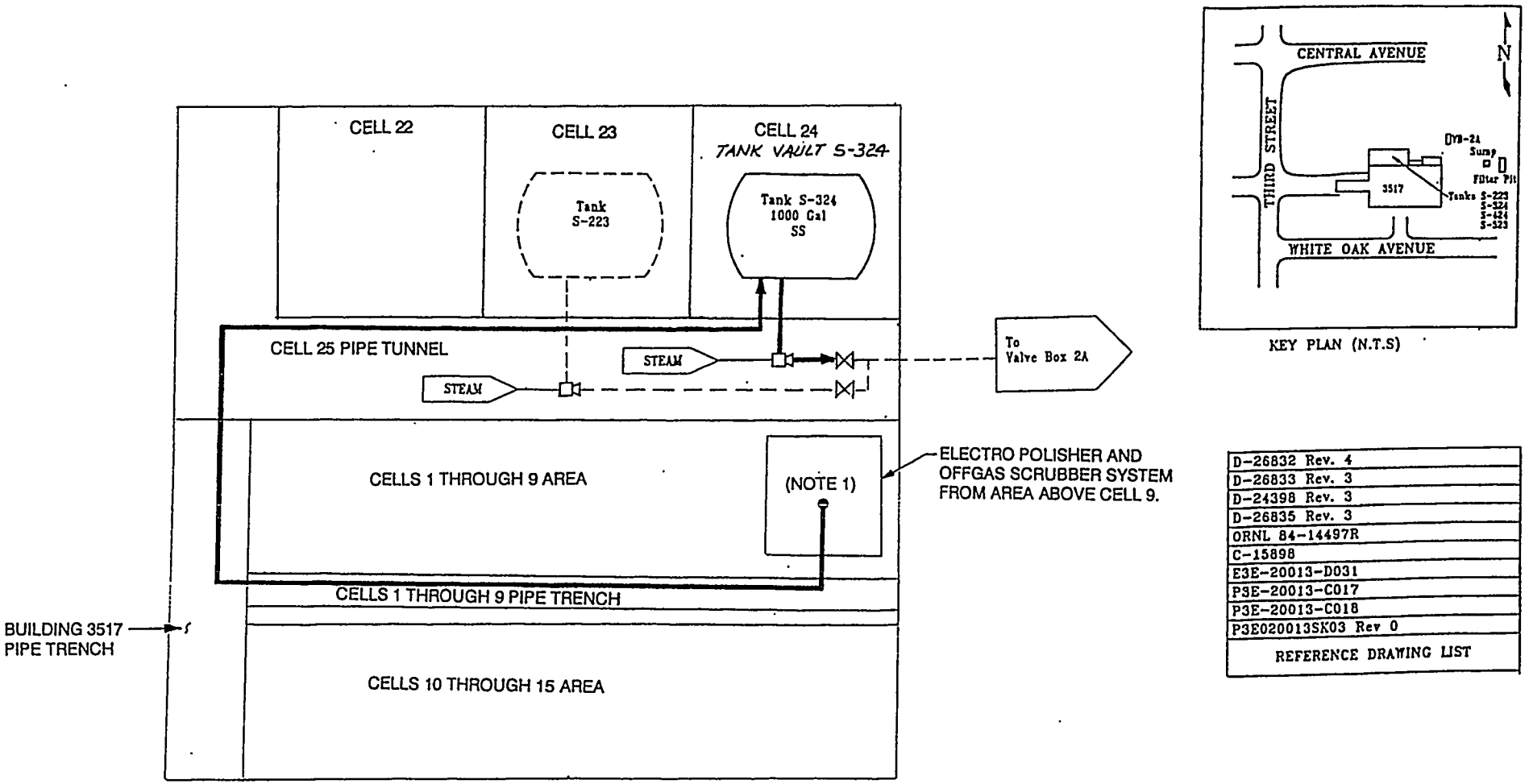
Robinson, S. M., S. M. DePaoli, and A. B. Walker. 1991. *Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System.* ORNL/TM-11795. Oak Ridge National Laboratory.

Figure 2.29-1 Location of Tank System S-324 Piping



EBASCO/MAIN

Figure 2.29-2 Tank System S-324 Piping Diagram



REFERENCE DRAWING LIST
D-26832 Rev. 4
D-26833 Rev. 3
D-24398 Rev. 3
D-26835 Rev. 3
ORNL 84-14497R
C-15898
E3E-20013-D031
P3E-20013-C017
P3E-20013-C018
P3E020013SK03 Rev 0

NOTES:
(1) Drain and transfer piping lengths within tank farm cells are indeterminate from available piping drawings. The functional flow arrangement is as shown in the "Bldg. 3517 Safety Analysis Report."

TANK SYSTEM S-324 PIPING

COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.29-3
Analytical Data for Liquid (Tank System S-324)

LLLW GENERATOR SURVEY - 1990

Isotopes:	Cs-137	Quantities:	500.00 Ci/year
	Sr-90		500.00 Ci/year

Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid	25.0 gal/year
turco decon 4502	25.0 lbs/year
oxalic acid	25.0 lbs/year
sodium hydroxide	25.0 lbs/year
Mr. Clean	Unknown
Ajax liquid	Unknown
Planisol	Unknown

2.30 Tank System S-523 Piping

2.30.1 Tank System Summary

Tank System S-523 is located at the Fission Product Development Laboratory (Building 3517) at the main Bethel Valley Complex (Figures 2.30-1 and 2.30-2). The tank system piping is schedule 40 and 80, ASME SA-240, type 304L and type 347 stainless steel (SS) and is routed from the embedded Hot Cell floor drains in Building 3517 through the Building 3517 Pipe Trench and the Cell 25 Pipe Tunnel to Tank Vault S-523. Tank System S-523 piping is used to transfer liquid low-level waste (LLLW) from Building 3517 and waste from tank-farm cell drains and is classified as a Federal Facility Agreement (FFA) Category B tank system.

2.30.2 Standards for Pipe Assessment of Tank Systems

2.30.2.1 Tank System Piping Description and Design Standards

Tank System Piping Description

Tank System S-523 piping is located at Building 3517 and is routed from the embedded Hot Cell floor drains in Building 3517 through the Building 3517 Pipe Trench and the Cell 25 Pipe Tunnel to Tank Vault S-523. The piping system is used and managed by the Chemical Technology Division.

Tank System S-523 piping is constructed of 1-1/2″, 2″, and 4″; schedule 40 and 80; type 304L and type 347 SS with a maximum design pressure and temperature of 150 psig and 125°F. Tank System S-523 piping has the capacity to contain a volume of approximately 100 gal.

Design Standards

The applicable codes and standards used for Tank System S-523 piping and its associated secondary containment systems are identified herein. The codes and standards listed are those identified on either the design drawings or the construction specifications.

American Society for Testing and Materials A15-52T, A160-52T, A16-52T, A305-53T, A185-37, C39-49, C192-52T, C31-49, C33-52T, C39-49, C40-48, C42-49, C94-48, C150-53, and D544-52T;

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals;

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section II (SA-240);

American Welding Society;

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

Atomic Energy Commission Safety Code;

Federal Specifications LLL-F-321, Class A LLLF321;

National Electric Code; and

Underwriters Laboratories Inc.

2.30.2.2 Generic Description of Piping Contents

Tank System S-523 piping is designed to transfer LLLW from a variety of operations such as supernate from cesium and strontium precipitation, raffinates from a cesium-144 extraction process, and general decontamination solutions. Tank System S-523 piping may contain radioactive materials.

The analytical data (Figure 2.30-3) of waste stream contaminants from the generators are representative of the waste transferred through Tank System S-523 piping.

2.30.2.3 Pipe Corrosion Protection Measures

Piping inside the Building 3517 Pipe Trench, the Cell 25 Pipe Tunnel, and Tank Vault S-523 has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

The piping routed from the Hot Cell floor drains to the Building 3517 Pipe Trench is singly contained and embedded in the concrete floor.

2.30.2.4 Documented Age of Tank System

Tank System S-523 piping was installed in 1955.

2.30.3 Standards for Containment and Release Detection

Tank System S-523 piping incorporates approximately 185′ of embedded floor drain and wall penetration piping that is singly contained. The singly contained areas are omitted from discussion in the following sections that address secondary containment.

2.30.3.1 Constructed of or Lined with Materials That are Compatible with Stored Waste(s) or Substance(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness to Prevent Failure

Tank System S-523 piping is single-wall, schedule 40 and 80, type 304L and type 347 SS and is routed from the embedded Hot Cell floor drains in Building 3517 through the Building 3517 Pipe Trench and the Cell 25 Pipe Tunnel to Tank Vault S-523. The areas of secondary containment are discussed below.

Tank Vault S-523

The assessment of the secondary containment system for Tank Vault S-523 is presented in the Design Demonstrations for Tank S-523. That assessment concludes that Tank Vault S-523 is coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

Cell 25 Pipe Tunnel

The interior surfaces of Cell 25 are provided with a system of Amercoat 23 and 33 epoxy coating. According to manufacturer's specifications, the cell's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

Building 3517 Pipe Trench

The interior surfaces of the pipe trench are provided with a system of Amercoat 23 and 33 epoxy coating. According to manufacturer's specifications, the pipe trench's epoxy coating is compatible with the waste and designed to prevent migration of waste into the concrete.

The assessment concludes that Tank Vault S-523, Cell 25, and the Building 3517 Pipe Trench are coated with materials that are compatible with the waste and designed to prevent migration of waste into the concrete.

2.30.3.2 Placed on Foundation or Base Capable of Providing Support to the Secondary Containment System

Tank Vault S-523

The assessment of the secondary containment system for Tank Vault S-523 is presented in the Design Demonstrations for Tank S-523. That assessment concludes that the vault foundation is properly designed to support the secondary containment system.

Cell 25 Pipe Tunnel

The Cell 25 foundation is a 6′6″ × 63′8″ × 1′3″ thick, reinforced concrete base slab that rests on limestone.

Building 3517 Pipe Trench

The pipe trench foundation is a 7′6″ × 40′0″ × 11″ thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that Tank Vault S-523, Cell 25, and the Building 3517 Pipe Trench foundations are properly designed to support the secondary containment systems.

2.30.3.3 Provided with a Leak Detection System That is Designed and Operated to Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank Vault S-523

The assessment of the secondary containment system for Tank Vault S-523 is presented in the Design Demonstrations for Tank S-523. That assessment concludes that Tank Vault S-523 is provided with a leak detection system.

Cell 25 Pipe Tunnel

The Cell 25 floor is sloped to an epoxy-coated sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

Building 3517 Pipe Trench

The pipe trench floor is sloped to the epoxy-coated Cell 25 Pipe Tunnel. Accumulation of liquid will flow from the pipe trench to the Cell 25 sump and will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

The assessment concludes that Tank Vault S-523, Cell 25, and the Building 3517 Pipe Trench are provided with leak detection.

2.30.3.4 Sloped or Otherwise Designed or Operated to Drain and Remove Liquids Resulting from Leaks, Spills, or Precipitation

Tank Vault S-523

The assessment of the secondary containment system for Tank Vault S-523 is presented in the Design Demonstrations for Tank S-523. That assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

Cell 25 Pipe Tunnel

The Cell 25 floor is sloped to an epoxy-coated sump. The sump provides a low point within Cell 25 to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Building 3517 Pipe Trench

The pipe trench floor is sloped to the epoxy-coated Cell 25 sump. The cell sump provides a low point to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that Tank Vault S-523, Cell 25, and the Building 3517 Pipe Trench are sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.30.4 Supplemental Information

2.30.4.1 Ancillary Equipment

Tank S-523 is constructed of 304L SS, which is the same material as that used for the piping system, and is located in Tank Vault S-523, which provides secondary containment. The support equipment is exposed to the same liquids as other components of the tank system; therefore, 304L SS is an acceptable material for the support equipment.

2.30.4.2 Waste Acceptance Criteria

Radioactively contaminated liquid wastes at the Oak Ridge National Laboratory (ORNL) are generated by various activities within the research and operating divisions. These activities include radiochemical processing, routine hot cell operations and decontaminations, and various waste treatment and environmental protection processes. The variations in composition of the waste streams are limited by the waste acceptance criteria that specify activity and concentration limits for waste discharged into the LLLW system. The *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory* (Oak Ridge National Laboratory, 1991), dated July 1991, is a guide for liquid waste generators to determine the proper

means of disposal for LLLW. The criteria provide future discharge guidelines for the LLLW system, which includes Tank System S-523.

2.30.5 References

Construction Specification, Multicurie Fission Products Pilot Plant in Building 3517. Invitation No. 401-55-8A.

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Energy Systems Drawing D26836, Building 3517, Phase II, Piping Cell 25 Section C-C, Revision 6.

Energy Systems Drawing D26837, Building 3517, Phase II, Piping Cell 25 Section D-D, Revision 5.

Energy Systems Drawing D26838, Building 3517, Phase II, Piping Plan Cell 26, Revision 2.

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Energy Systems Drawing D22806, Building 3517, Elevations, Foundation Walls, Revision 4.

Energy Systems Drawing D22807, Building 3517, Elevations, Foundation Plan Tank Farm, Revision 2.

Energy Systems Drawing D22808, Building 3517, Tank Farm, Sections and Details, Revision 2.

Energy Systems Drawing D22809, Building 3517, Tank Farm, Sections and Details, Revision 1.

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Figure 2.30-1 Location of Tank System S-523 Piping

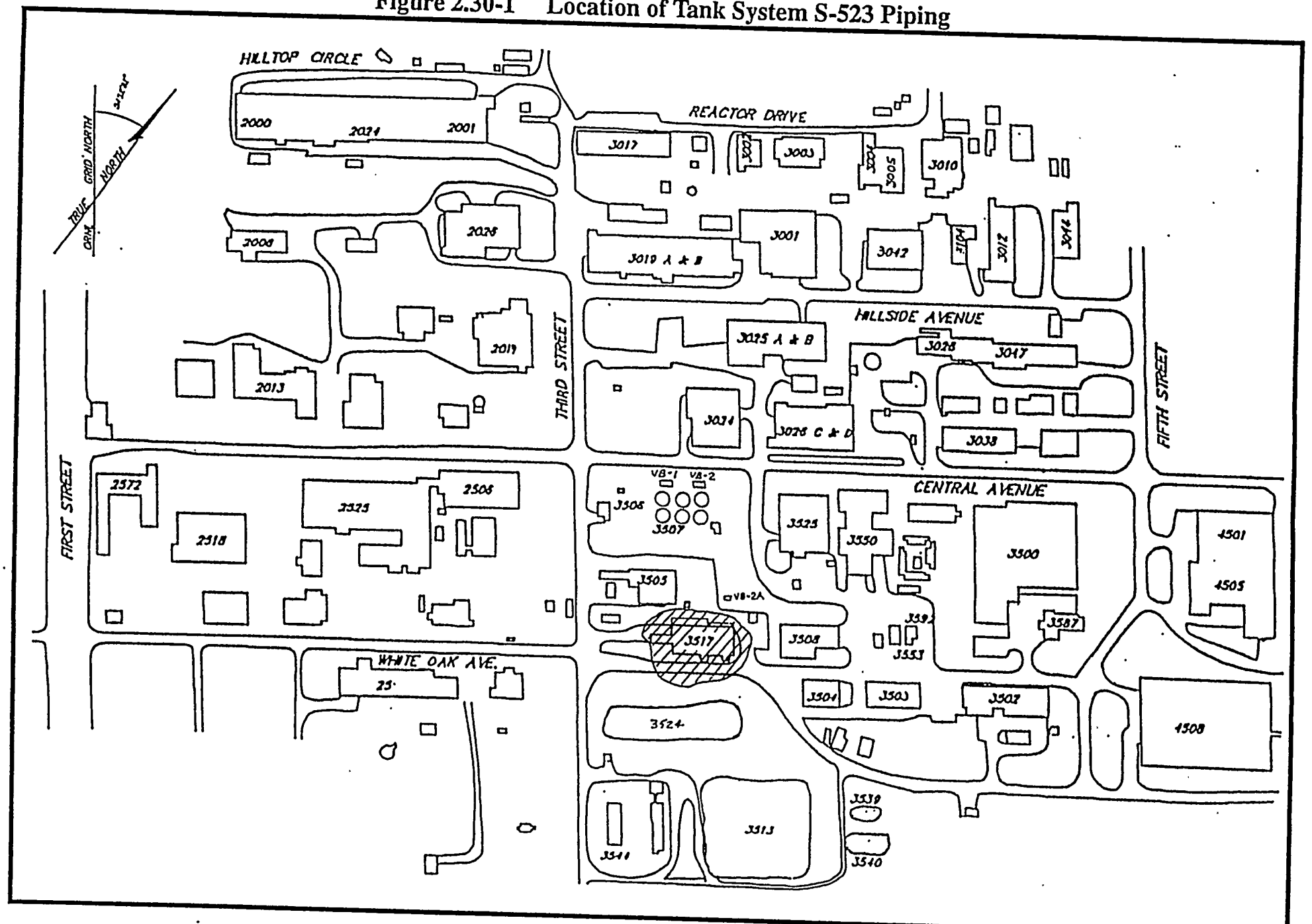
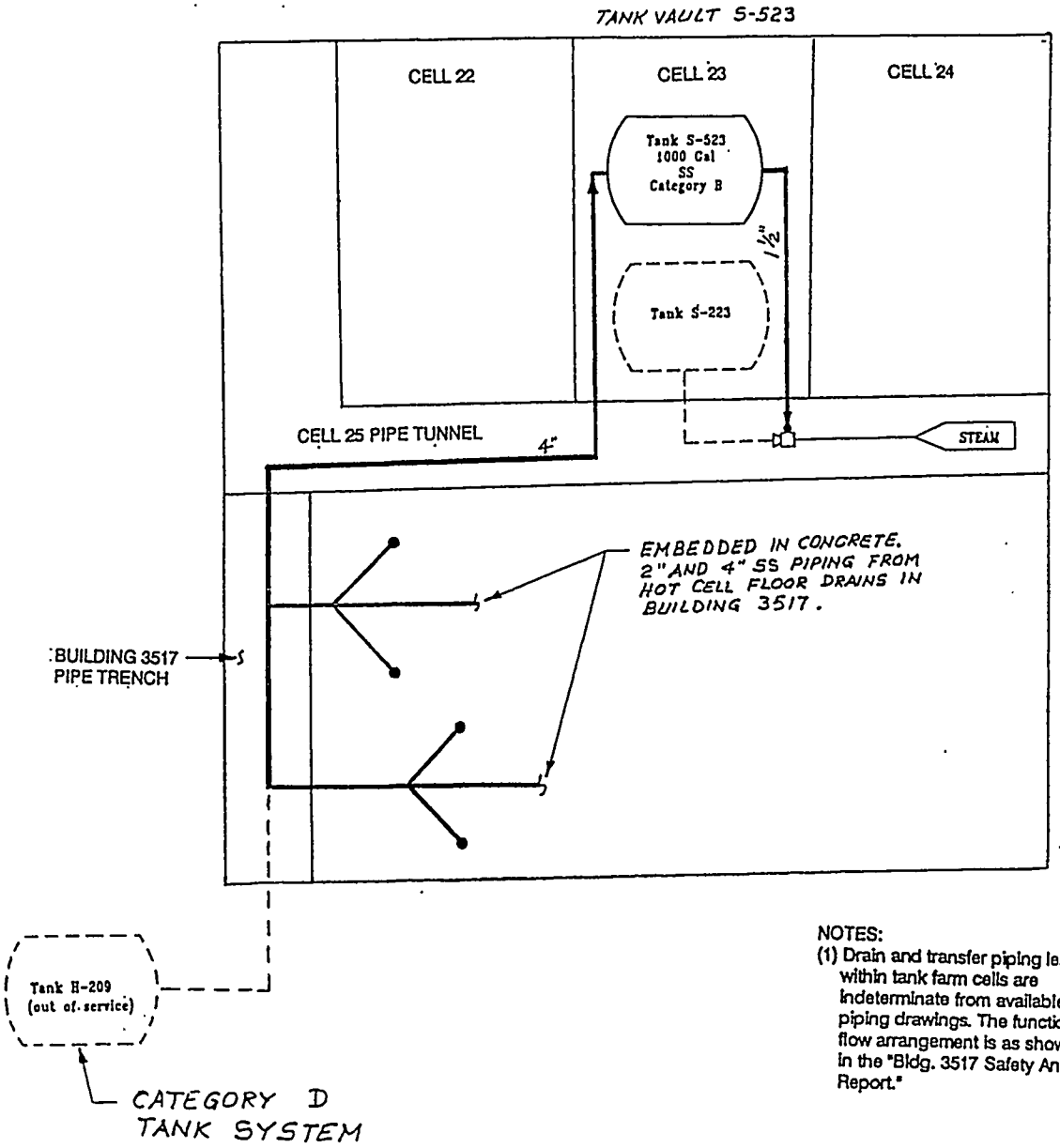
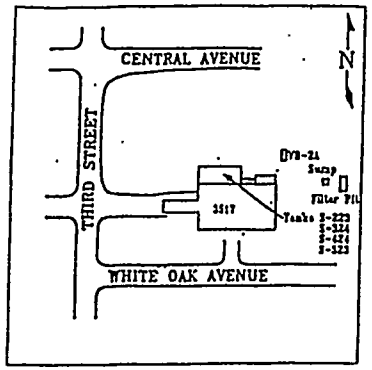


Figure 2.30-2 Tank System S-523 Piping Diagram





KEY PLAN (N.T.S)

REFERENCE DRAWING LIST
D-26832 Rev. 4
D-26833 Rev. 3
D-24398 Rev. 3
D-26835 Rev. 3
ORNL 84-14497R
C-15898
E3E-20013-D031
P3E-20013-C017
P3E-20013-C018
P3E020013SK03 Rev 0

NOTES:
(1) Drain and transfer piping lengths within tank farm cells are indeterminate from available piping drawings. The functional flow arrangement is as shown in the "Bldg. 3517 Safety Analysis Report."

——— TANK SYSTEM S-523 PIPING

– – – COMPONENTS NOT COVERED IN THIS SECTION

Figure 2.30-3
Analytical Data for Liquid (Tank System S-523)

LLLW GENERATOR SURVEY - 1990

Isotopes:	Quantities:
Cs-137	500.00 Ci/year
Sr-90	500.00 Ci/year

Others (i.e. acids, bases, organics, cleaners, etc.)

nitric acid	25.0 gal/year
turco decon 4502	25.0 lbs/year
oxalic acid	25.0 lbs/year
sodium hydroxide	25.0 lbs/year
Mr. Clean	Unknown
Ajax liquid	Unknown
Planisol	Unknown