**Design Demonstrations for the Remaining 19 Category B
Tank Systems at Oak Ridge National Laboratory,
Oak Ridge, Tennessee**

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Energy Systems Environmental Restoration Program
ORNL Environmental Restoration Program

**Design Demonstrations for the Remaining 19 Category B Tank
Systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee**

Date Issued—January 1995

Prepared by
Foster Wheeler Environmental Corporation
and
Parsons Engineering Science, Inc.
Oak Ridge, Tennessee
under DOE contract DE-AC05-91OR21928

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management
under budget and reporting code EW 20

Environmental Restoration and Waste Management Programs
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6285
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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ACRONYMS

ACI	American Concrete Institute
ACGIH	American Conference of Governmental Industrial Hygienists
ACPA	American Concrete Pipe Association
AEC	Atomic Energy Commission
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CFM	cubic foot per minute
CRSI	Concrete Reinforcing Steel Institute
DOE	United States Department of Energy
EPA	Environmental Protection Agency
FFA	Federal Facility Agreement
fpn	foot per minute
HEPA	High Efficiency Particulate Air
HFIR	High Flux Isotope Reactor
HOG	Hot Offgas
HVAC	heating, ventilation, and air conditioning
ISA	Instrument Society of America
LLLW	liquid low-level waste
NFPA	National Fire Protection Association
NHF	New Hydrofracture Facility
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Office
OSHA	Occupational Safety and Health Administration
psi	pound per square inch
psig	pound per square inch, gauge
PVC	polyvinyl chloride
PWTP	Process Waste Treatment Plant
RDF	Radiochemical Development Facility
REDC	Radiochemical Engineering Development Center
RHD	Radioactive Hot Drain
RHD-HOG	Radioactive Hot Drain-Hot Offgas
RHDR	Radioactive Hot Drain Recoverable
RPP	Radiochemical Processing Plant
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SS	stainless steel
TDEC	Tennessee Department of Environment and Conservation
UCC-ND	Union Carbide Corporation-Nuclear Division
wg	water gauge

EXECUTIVE SUMMARY

Demonstration of the design of the tank 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 19 tank systems designated in the FFA as Category B (i.e., existing tank systems with secondary containment). Based on the findings of these design demonstrations, three tank systems originally designated as Category B have been redesignated as Category C (i.e., existing tank systems without secondary containment) and one tank system originally designated as Category B has been redesignated as Category D (i.e., existing tank systems without secondary containment that are removed from service). 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 tank system.

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) 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 transported and stored 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 Without Secondary Containment That are Removed from Service

This document provides a design demonstration of the secondary containment and ancillary equipment of 19 tank systems listed in the FFA as Category B. Three tank systems originally designated as Category B have been redesignated as Category C and one tank system originally designated as Category B has been redesignated as Category D. The design demonstration for each tank is presented in Section 2. The 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 tank 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 systems of 19 FFA Category B tank systems are included in Sections 2.1 through 2.19. Four tank systems originally designated as Category B have been redesignated. If additional information is identified for a specific tank system, the section containing the assessment of that tank 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. Tank System T-13 meets the requirements of the FFA. Fourteen tank systems (N-71, P-3, P-4, C-1, C-2, L-11, B-2-T, B-3-T, C-6-T, F-111, F-126, S-223, S-324, and S-523) have minor deficiencies for which there are one or more mitigating design features that adequately resolve the deficiency. Four tank systems (WC-20, F-201, F-501, and LA-104) have deficiencies which do not fully meet the secondary containment requirements; three (WC-20, F-201 and F-501) have been redesignated as Category C and one (LA-104) has been redesignated as Category D.

2.1 Tank N-71

2.1.1 Tank Summary

Tank N-71 is a nominal, 325-gal, vertical tank installed in 1954 in the Radiochemical Development Facility (RDF) (Building 3019) at the main Bethel Valley Complex (Figures 2.1-1 and 2.1-2). The tank is in Cell 7, one of several cells in an underground concrete vault at the lowest level of the building. The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an SS-lined, reinforced concrete vault. Tank N-71 is used as a collection tank in the radioactive liquid low-level waste (LLLW) system of Building 3019 and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.1.2 Standards for Design Demonstration

2.1.2.1 Tank Description and Design Standards

Tank Description

Tank N-71 is located in the southwest corner of the lower level of Cell 7 in Building 3019. The tank is used and managed by the Oak Ridge National Laboratory (ORNL) Chemical Technology Division and is part of the Bethel Valley LLLW System.

Tank N-71 is a vertically oriented SS tank with a nominal capacity of 325 gal. The tank measures 3'6" in outside diameter and 4'6" in overall height.

Design Standards

The applicable codes and standards used for Tank System N-71 and its associated vault and piping 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 (ASTM);

American Concrete Institute (ACI);

Atomic Energy Commission (AEC) General Design Criteria;

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Underwriters Laboratories Inc.;

American Society of Mechanical Engineers (ASME);

National Fire Protection Association (NFPA);

National Plumbing Code; and

Instrument Society of America (ISA).

2.1.2.2 Generic Description of Tank Contents

Tank N-71 is designed to serve as a radioactive LLLW laboratory collection tank for the Building 3019 west drain header. LLLW includes raffinates from extraction processes; overheads from evaporation processes; and liquids left after analyses, decontamination solutions, and bench-scale experimental processes (Figure 2.1-3). The wastes may also include a variety of laboratory-generated acids and bases, typically nitric and caustic.

The analytical data (Figure 2.1-9) of waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank N-71.

2.1.2.3 Corrosion Protection Measures

Tank N-71 is located in the lower level of Building 3019 in a 304L SS-lined, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.1.2.4 Documented Age

Tank N-71 was placed in operation in 1954.

2.1.3 Standards for Containment/Release Detection

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

Tank N-71 is constructed of type 304L SS. The vault bottom is lined with 11-gauge (1/8"), 304L SS which projects 4" up the vault sidewall (Figure 2.1-4).

The assessment concludes that the SS vault lining material is compatible with the stored waste and designed to prevent migration of waste into the concrete.

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

Tank N-71 is located in an underground, 304L SS-lined, reinforced concrete vault (Figure 2.1-5). The floor of the vault is an 18" thick, reinforced concrete base slab which was designed with a minimum allowable 28-day compressive strength of 3000 psi. The vault floor elevation is 830'4", which is 9'8" below grade.

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

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

Tank N-71 is provided with a tank level monitor and is located in a 304L SS-lined vault. Any leakage from Tank N-71 is gravity fed to a floor drain which is routed to a sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of Building 3019.

The assessment concludes that Tank System N-71 is provided with a leak detection system.

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

The Tank N-71 vault floor is sloped to a floor drain which is routed 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.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.1.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank N-71 is located in an SS-lined, reinforced concrete vault. The following items address specific components of the vault system.

Containment

Tank N-71 is located in a vault with a 304L SS liner designed to be leaktight. The vault includes five process areas that have one continuous SS liner. Each process area has a 1-1/2", schedule 40, 304L SS floor drain embedded in the concrete floor and welded to the SS liner. The drain lines are routed to a common 304L SS-lined, instrumented sump. The lined portion of the vault provides containment for 900 gal of liquid compared with a nominal full tank content of 325 gal for Tank N-71.

The assessment concludes that the SS-lined portion of the vault is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of Building 3019, which contains Tank N-71, provides for surface water runoff to prevent any buildup of surface water during rainfall. Building 3019 is located near the crest of a hill with site grades sloping away from the building conveying rainwater to storm drain catch basin inlets (Figure 2.1-6). The tank vault finished floor elevation is 830'4", which is 9'8" below grade. Three of the four tank vault walls have no direct contact with the soil or water. The remaining tank vault wall is in direct contact with the soil and water. The use of an external waterproofing system to minimize the potential for infiltration of groundwater is not included in the design drawings or construction specifications. However, the site drainage system is designed to minimize the potential for infiltration of groundwater; and in the unlikely event that any infiltration occurs, it will be contained and removed by the secondary containment system.

The assessment concludes that the vault is designed to minimize the potential for infiltration.

Water Stops

The use of water stops in the secondary containment structure is not included in the design drawings or construction specifications. However, it is unlikely that water from outside the system or LLLW from inside the system will penetrate the below-grade construction joints because the vault utilizes an external site drainage system and is internally lined and provided with an alarmed leak detection and removal system. Therefore, the lack of water stops in the below-grade construction joints is not considered significant.

Vapor Protection, Vessel Vent System

Tank N-71 is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system).

Tank N-71 is vented through an offgas system that scrubs and HEPA-filters the offgas and keeps the tank under negative pressure relative to the vault pressure. The vault structure is ventilated with a cell exhaust ventilation system that generates a sweep flow rate of approximately 2500 CFM through Cells 6 and 7. This exhaust system was designed to keep the cell at -1" to -3" of water gauge (wg) pressure (Figures 2.1-7 and 2.1-8).

The assessment concludes that Tank System N-71 is provided with a means to protect against the formation and ignition of vapors.

2.1.4 Supplemental Information

2.1.4.1 Ancillary Equipment

The material of construction for the inlet and discharge piping is 304L SS, which is the same material as that used in Tank N-71. The transfer piping and support equipment are exposed to the same liquids as Tank N-71. The piping within the confines of the vault has secondary containment.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.1.4.2 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 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 that includes Tank N-71.

2.1.5 References

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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-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-14535, Equipment Layout Make-Up Area Section A-A, Revision 2.

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

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Sears, M. B., et al. 1990. *Sampling and Analysis of Radioactive Liquid Waste and Sludges in the Melton Valley and Evaporator Facility Storage Tanks at ORNL*. ORNL/TM-11652. Oak Ridge National Laboratory.

Figure 2.1-1 Location of Building 3019

Figure 2.1-2 Layout of Tank N-71 in Cell 7

REF DWG. M-12229-CP-047-D

Figure 2.1-3 Schematic of the Liquid Low-Level Waste System

Architectural floor plan showing various rooms and structural details. Key annotations include:

- Top Left:** "SLOPE" with a dimension of 3'-11".
- Top Center:** "CONCRETE" and "SLOPE" with a dimension of 3'-11".
- Top Right:** "PLATEFORM ABOVE" with a dimension of 3'-11".
- Center:** "ALL FLOOR SURFACES 11 GA. SS" and "LINE ON PLATEFORM ABOVE".
- Bottom Left:** "SLOPE" with a dimension of 3'-11".
- Bottom Center:** "CONCRETE" and "SLOPE" with a dimension of 3'-11".
- Bottom Right:** "PLATEFORM ABOVE" with a dimension of 3'-11".
- Right Side:** "ALL FLOOR SURFACES 11 GA. SS" and "LINE ON PLATEFORM ABOVE".
- Far Right:** "CONCRETE" and "SLOPE" with a dimension of 3'-11".

REF. DWG. D14165

Figure 2.1-5 Tank N-71 Vault and Liner

SECTION 5.5
3'0" x 1'0"

REF DWG. D14161, D14167, D14169

Figure 2.1-6 Building 3019 Grading Plan

REF. DWG. D10615

Figure 2.1-7
Tank N-71 H&V Diagram (Cell 7)

RPP Ventilation system.

Figure 2.1-8
Tank N-71 H&V Diagram (Cell 7)

Schematic diagram of VOG system.

**Figure 2.1-9
Analytical Data For Liquid**

WASTE STREAM CONTAMINANTS:

(a)	Isotopes:	Sr-90	(b)	Quantities	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

2.2 Tank P-3

2.2.1 Tank Summary

Tank P-3 is a nominal, 200-gal, vertical tank installed in 1954 in the Radiochemical Development Facility (RDF) (Building 3019) at the main Bethel Valley Complex (Figures 2.2-1 and 2.2-2). The tank is in Cell 6, one of several cells in an underground concrete vault at the lowest level of the building. The tank is constructed of ASME SA-240, type 347 stainless steel (SS) and is located in an SS-lined, reinforced concrete vault. Tank P-3 is used as a process collection tank in the radioactive liquid low-level waste (LLLW) system of Building 3019 and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.2.2 Standards for Design Demonstration

2.2.2.1 Tank Description and Design Standards

Tank Description

Tank P-3 is located in the southeast corner of the lower level of Cell 6 in Building 3019. The tank is used and managed by Oak Ridge National Laboratory (ORNL) Chemical Technology Division and is part of the Bethel Valley LLLW System.

Tank P-3 is a vertically oriented SS tank with a nominal capacity of 200 gal. The tank measures 3'0" in outside diameter and 4'0" in overall height and is constructed of 3/16" thick, type 347 SS.

Design Standards

The applicable codes and standards used for Tank System P-3 and its associated vault and piping 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 (ASTM);

American Concrete Institute (ACI);

Concrete Reinforcing Steel Institute (CRSI);

American Welding Society (AWS);

Atomic Energy Commission (AEC) General Design Criteria;

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Underwriters Laboratories Inc.;

American Society of Mechanical Engineers (ASME);

National Fire Protection Association (NFPA);

National Plumbing Code; and

Instrument Society of America (ISA).

2.2.2.2 Generic Description of Tank Contents

Tank P-3 is designed to serve as a radioactive LLLW process collection tank for the Building 3019 east drain header. LLLW includes raffinates from extraction processes, overheads from evaporation processes, and liquids left after analyses and bench-scale experimental processes (Figure 2.2-3). The wastes may also include a variety of laboratory-generated acids and bases, typically nitric and caustic.

The analytical data (Figure 2.2-9) of waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank P-3.

2.2.2.3 Corrosion Protection Measures

Tank P-3 is located in the lower level of Building 3019 in a 304L SS-lined, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.2.2.4 Documented Age

Tank P-3 was placed in operation in 1954.

2.2.3 Standards for Containment/Release Detection

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

Tank P-3 is constructed of type 347 SS. The vault bottom is lined with 11-gauge (1/8"), 304L SS which projects 4" up the vault sidewall (Figure 2.2-4).

The assessment concludes that the SS vault lining material is compatible with the stored waste and designed to prevent migration of waste into the concrete.

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

Tank P-3 is located in an underground, 304L SS-lined, reinforced concrete vault (Figure 2.2-5). The floor of the vault is an 18" thick, reinforced concrete base slab which was designed with a minimum allowable 28-day compressive strength of 3000 psi. The vault floor elevation is 830'4", which is 9'8" below grade.

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

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

Tank P-3 is provided with a tank level monitor and is located in a 304L SS-lined vault. Any leakage from Tank P-3 is gravity fed to a floor drain which is routed to a sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of Building 3019.

The assessment concludes that Tank System P-3 is 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

The Tank P-3 vault floor is sloped to a floor drain which is routed 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.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.2.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank P-3 is located in an SS-lined, reinforced concrete vault. The following items address specific components of the vault system.

Containment

Tank P-3 is located in a vault with a 304L SS liner designed to be leaktight. The vault includes six process areas that have one continuous SS liner. Each process area has a 1-1/2", schedule 40, 304L SS floor drain embedded in the concrete floor and welded to the SS liner. The drain lines are

routed to a common 304L SS-lined, instrumented sump. The lined portion of the vault provides containment for 800 gal of liquid compared with a nominal full tank content of 200 gal for Tank P-3.

The assessment concludes that the SS-lined portion of the vault is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of Building 3019, which contains Tank P-3, provides for surface water runoff to prevent any buildup of surface water during rainfall. Building 3019 is located near the crest of a hill with site grades sloping away from the building conveying rainwater to storm drain catch basin inlets (Figure 2.2-6). The tank vault finished floor elevation is 830'4", which is 9'8" below grade. Three of the four tank vault walls have no direct contact with the soil or water. The remaining tank vault wall is in direct contact with the soil and water. The use of an external waterproofing system to minimize the potential for infiltration of groundwater is not included in the design drawings or construction specifications. However, the site drainage system is designed to minimize the potential for infiltration of groundwater; and in the unlikely event that any infiltration occurs it will be contained and removed by the secondary containment system.

The assessment concludes that the vault is designed to minimize the potential for infiltration.

Water Stops

The use of water stops in the secondary containment structure is not included in the design drawings or construction specifications. However, it is unlikely that water from outside the system or LLLW from inside the system will penetrate the below-grade construction joints because the vault utilizes an external site drainage system and is internally lined and provided with an alarmed leak detection and removal system. Therefore, the lack of water stops in the below-grade construction joints is not considered significant.

Vapor Protection, Vessel Vent System

Tank P-3 is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system).

Tank P-3 is vented through an offgas system that scrubs and HEPA-filters the offgas and keeps the tank under negative pressure relative to the vault pressure. The vault structure is ventilated with a cell exhaust ventilation system that generates a sweep flow rate of approximately 2500 CFM through Cells 6 and 7. This exhaust system was designed to keep the cell at -1" to -3" of water gauge (wg) pressure (Figures 2.2-7 and 2.2-8).

The assessment concludes that Tank System P-3 is provided with a means to protect against the formation and ignition of vapors.

2.2.4 Supplemental Information

2.2.4.1 Ancillary Equipment

The material of construction for the inlet and discharge piping is 347 SS, which is the same material as that used in Tank P-3. The transfer piping and support equipment are exposed to the same liquids as Tank P-3. The piping within the confines of the vault has secondary containment.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.2.4.2 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 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 that includes Tank P-3.

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.

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-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-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 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.)

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*. Department of Waste Minimization Planning and Certification. WM-WMCO-201.

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 Number X-OE-23.

Figure 2.2-2 Layout of tanks P-3 and P-4 in Cell 6

REF. DWG. M-12229-CP-047-D

EBASCO/MAIN

Figure 2.2-3 Schematic of the Liquid Low-Level Waste System

Figure 2.2-4 Tanks P-3 and P-4 Vault and Liner

FLOOR PLAN
CELL No. 6:

REF. DWG. D14165

Hand-drawn floor plan of a building. The plan shows a rectangular structure with a central corridor and several rooms. Dimensions are given in feet and inches. Labels include "C. 2 1/2'", "10' 0\"", "10' 5\"", "12 1/2\"", "3' 1 1/2\"", "3' 1 1/2\"", "7' 0\"", "5' 0\"", "5' 10 1/2\"", "5' 10 1/2\"", "3' 4 1/2\"", "2' 0 1/2\"", "5' 0\"", "12 1/2\"", "10' 5\"", "2' 9\"", "2' 9\"", "10' 0\"", "C. 2 1/2'", "10' 5\"", "12 1/2\"", "3' 1 1/2\"", "3' 1 1/2\"", "7' 0\"", "5' 0\"", "5' 10 1/2\"", "5' 10 1/2\"", "3' 4 1/2\"", "2' 0 1/2\"", "5' 0\"", "12 1/2\"", "10' 5\"", "2' 9\"", "2' 9\"", "10' 0\"", "C. 2 1/2'", "10' 5\"", "12 1/2\"", "3' 1 1/2\"", "3' 1 1/2\"", "7' 0\"", "5' 0\"", "5' 10 1/2\"", "5' 10 1/2\"", "3' 4 1/2\"", "2' 0 1/2\"", "5' 0\"", "12 1/2\"", "10' 5\"", "2' 9\"", "2' 9\"", "10' 0\"", "C. 2 1/2'".

$$\begin{array}{r} 5100.50 \\ 31.10 \\ \hline 5131.60 \end{array}$$

REF. DWG. D14161, D14167, D14169

EBASCO MAIN

Figure 2.2-6 Building 3019 Grading Plan

REF. DWG. D10615

BRASCO/MAN

Figure 2.2-7
Tanks P-3 and P-4 H&V Diagram (Cell 6)

RPP Ventilation system.

**Figure 2.2-8
Tanks P-3 and P-4 H&V Diagram (Cell 6)**

Schematic diagram of VOG system.

**Figure 2.2-9
Analytical Data For Liquid**

WASTE STREAM CONTAMINANTS:

(a)	Isotopes:	Sr-90	(b)	Quantities	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

2.3 Tank P-4

2.3.1 Tank Summary

Tank P-4 is a nominal, 200-gal, vertical tank installed in 1954 in the Radiochemical Development Facility (RDF) (Building 3019) at the main Bethel Valley Complex (Figures 2.3-1 and 2.3-2). The tank is in Cell 6, one of several cells in an underground concrete vault at the lowest level of the building. The tank is constructed of ASME SA-240, type 347 stainless steel (SS) and is located in an SS-lined, reinforced concrete vault. Tank P-4 is used as a process collection tank in the radioactive liquid low-level waste (LLLW) system of Building 3019 and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.3.2 Standards for Design Demonstration

2.3.2.1 Tank Description and Design Standards

Tank Description

Tank P-4 is located along the south wall of the lower level of Cell 6 in Building 3019. The tank is used and managed by the Oak Ridge National Laboratory (ORNL) Chemical Technology Division and is part of the Bethel Valley LLLW System.

Tank P-4 is a vertically oriented SS tank with a nominal capacity of 200 gal. The tank measures 3'0" in outside diameter and 4'0" in overall height. The tank is constructed of 3/16" thick, type 347 SS.

Design Standards

The applicable codes and standards used for Tank System P-4 and its associated vault and piping 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 (ASTM);

American Concrete Institute (ACI);

Concrete Reinforcing Steel Institute (CRSI);

American Welding Society (AWS);

Atomic Energy Commission (AEC) General Design Criteria;

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Underwriters Laboratories Inc.;

American Society of Mechanical Engineers (ASME);

National Fire Protection Association (NFPA);

National Plumbing Code; and

Instrument Society of America (ISA).

2.3.2.2 Generic Description of Tank Contents

Tank P-4 is designed to serve as a radioactive LLLW process collection tank for the Building 3019 east drain header. LLLW includes raffinates from extraction processes, overheads from evaporation processes, and liquids left after analyses and bench-scale experimental processes (Figure 2.3-3). The wastes may also include a variety of laboratory-generated acids and bases, typically nitric and caustic.

The analytical data (Figure 2.3-9) of waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank P-4.

2.3.2.3 Corrosion Protection Measures

Tank P-4 is located in the lower level of Building 3019 in a 304L SS-lined, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.3.2.4 Documented Age

Tank P-4 was placed in operation in 1954.

2.3.3 Standards for Containment/Release Detection

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

Tank P-4 is constructed of type 347 SS. The vault bottom is lined with 11-gauge (1/8"), 304L SS which projects 4" up the vault sidewall (Figure 2.3-4).

The assessment concludes that the SS vault lining material is compatible with the stored waste and designed to prevent migration of waste into the concrete.

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

Tank P-4 is located in an underground, 304L SS-lined, reinforced concrete vault (Figure 2.3-5). The floor of the vault is an 18" thick, reinforced concrete base slab which was designed with a minimum allowable 28-day compressive strength of 3000 psi. The vault floor elevation is 830'4", which is 9'8" below grade.

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

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

Tank P-4 is provided with a tank level monitor and is located in a 304L SS-lined vault. Any leakage from Tank P-4 is gravity fed to a floor drain which is routed to a sump where any accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of Building 3019.

The assessment concludes that Tank System P-4 is provided with a leak detection system.

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

The Tank P-4 vault floor is sloped to a floor drain which is routed 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.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.3.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank P-4 is located in an SS-lined, reinforced concrete vault. The following items address specific components of the vault system.

Containment

Tank P-4 is located in a vault with a 304L SS liner designed to be leaktight. The vault includes six process areas that have one continuous SS liner. Each process area has a 1-1/2", schedule 40,

304L SS floor drain embedded in the concrete floor and welded to the SS liner. The drain lines are routed to a common 304L SS-lined, instrumented sump. The lined portion of the vault provides containment for 800 gal of liquid compared with a nominal full tank content of 200 gal for Tank P-4.

The assessment concludes that the SS-lined portion of the vault is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of Building 3019, which contains Tank P-4, provides for surface water runoff to prevent any buildup of surface water during rainfall. Building 3019 is located near the crest of a hill with site grades sloping away from the building conveying rainwater to storm drain catch basin inlets (Figure 2.3-6). The tank vault finished floor elevation is 830'4", which is 9'8" below grade. Three of the four tank vault walls have no direct contact with the soil or water. The remaining tank vault wall is in direct contact with the soil and water. The use of an external waterproofing system to minimize the potential for infiltration of groundwater is not included in the design drawings or construction specifications. However, the site drainage system is designed to minimize the potential for infiltration of groundwater; and in the unlikely event that any infiltration occurs, it will be contained and removed by the secondary containment system.

The assessment concludes that the vault is designed to minimize the potential for infiltration.

Water Stops

The use of water stops in the secondary containment structure is not included in the design drawings or construction specifications. However, it is unlikely that water from outside the system or LLLW from inside the system will penetrate the below-grade construction joints because the vault utilizes an external site drainage system and is internally lined and provided with an alarmed leak detection and removal system. Therefore, the lack of water stops in the below-grade construction joints is not considered significant.

Vapor Protection, Vessel Vent System

Tank P-4 is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system).

Tank P-4 is vented through an offgas system that scrubs and HEPA-filters the offgas and keeps the tank under negative pressure relative to the vault pressure. The vault is ventilated with a cell exhaust ventilation system that generates a sweep flow rate of approximately 2500 CFM through Cells 6 and 7. This exhaust system was designed to keep the cell at -1" to -3" of water gauge (wg) pressure (Figures 2.3-7 and 2.3-8).

The assessment concludes that Tank System P-4 is provided with a means to protect against the formation and ignition of vapors.

2.3.4 Supplemental Information

2.3.4.1 Ancillary Equipment

The material of construction for the inlet and discharge piping is 347 SS, which is the same material as that used in Tank P-4. The transfer piping and support equipment are exposed to the same liquids as Tank P-4. The piping within the confines of the vault has secondary containment.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.3.4.2 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 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 that includes Tank P-4.

2.3.5 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.

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-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-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 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.).

LLW 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*. Department of Waste Minimization Planning and Certification. WM-WMCO-201.

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 Number X-OE-23.

Figure 2.3-2 Layout of Tanks P-3 and P-4 in Cell 6

REF. DWG. M-12229-CP-047-D

EBASCO/MAIN

Figure 2.3-3 Schematic of the Liquid Low-Level Waste System

[illegible]

DETAIL OF PUMP

10.554 TO 2.3.
MIP CAP

10.554 TO 2.3.
MIP

10.554 TO 2.3.
MIP

[illegible]

EBASCO MAIN

Figure 2.3-6 Building 3019 Grading Plan

REF. DWG. D10615

Figure 2.3-7
Tanks P-3 and P-4 H&V Diagram (Cell 6)

RPP Ventilation system.

Figure 2.3-8
Tanks P-3 and P-4 H&V Diagram (Cell 6)

Schematic diagram of VOG system.

**Figure 2.3-9
Analytical Data For Liquid**

WASTE STREAM CONTAMINANTS:

(a)	Isotopes:	Sr-90	(b)	Quantities	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

2.4 Tank C-1

2.4.1 Tank Summary

Tank C-1 is a nominal 50,000-gal, horizontal tank installed in 1964 near the liquid low-level waste (LLLW) Evaporator (Building 2531) and near the center of the main Bethel Valley Complex (Figures 2.4-1 and 2.4-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank C-1 is used as a concentrate collection tank for the LLLW Evaporator and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.4.2 Standards for Design Demonstration

2.4.2.1 Tank Description and Design Standards

Tank Description

Tank C-1 is located north of Evaporator Building 2531 in a reinforced concrete vault with Tank C-2. The tank is used and managed by the Waste Management and Remedial Actions Division. The Oak Ridge National Laboratory (ORNL) coordinates for Tank C-1 center lines are E 30600 and N 21850.

Tank C-1 is a nominal 50,000-gal, horizontal tank constructed of type 304L SS. The tank has an outside diameter of 12'0" with ASME flanged and dished heads and an overall length of 61'0". The shell and heads have a nominal thickness of 1/2". The tank operates at slightly less than atmospheric pressure.

Design Standards

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

Specifications for The Construction of Improvements to Radioactive Liquid Waste System Phase II, Building 2531, Specification No. 10851-E-206-S;

American Society for Testing and Materials (ASTM) A15, A53, A120, A167, A181, A182, A185, A200, A213, A214, A234, A240, A245, A269, A276, A312, A371, A376, A403, B68, C94, C175, E94, E142, and E165;

National Electric Code;

Atomic Energy Commission (AEC) Safety Code;

Underwriters Laboratories Inc.; and

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels (1962 edition).

2.4.2.2 Generic Description of Tank Contents

Tank C-1 was designed to collect high-level waste generated at ORNL. However, because no significant quantities of high-level waste were ever generated, this tank was repiped to serve as an LLLW concentrate storage tank (Figure 2.4-3). 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 the 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. This pH adjustment causes most of the transuranic waste components and heavy metals to precipitate out of solution. 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.

Due to 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 the waste stored in Tank 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 2.4-8). Based on radiation levels found in Tank W-23 and the historical use of Tank C-1 as an evaporator feed tank, Tank C-1 may contain radioactive materials (Figure 2.4-9).

2.4.2.3 Corrosion Protection Measures

Tank C-1 is located in an underground, epoxy-coated, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.4.2.4 Documented Age

Tank C-1 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 Substances(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness To Prevent Failure

Tank C-1 is constructed of type 304L SS. The interior of the tank vault (floor and walls) is provided with a three-coat system of Amercoat 74S epoxy (Figure 2.4-4).

The assessment concludes that, according to manufacturer's specifications, the vault's epoxy coating is compatible with the stored 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 C-1 is located in an underground, reinforced concrete vault (Figure 2.4-5). Tank C-1 shares the vault with Tank C-2. The tank vault foundation is a 30'2" × 67'4" × 2'0" thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the vault foundation is properly designed to support the secondary containment system.

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

Tank C-1 is provided with a tank level monitor and is situated within an epoxy-coated, concrete vault. The floor of the vault is sloped to a 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 Tank System C-1 is provided with a leak detection system.

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

The Tank C-1 vault floor slopes to a 2'6" × 2'6" × 1'6" deep, epoxy-coated sump with a containment capacity of 70 gal. The sump provides a low point within the tank vault to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank C-1 has a nominal capacity of 50,000 gal with tank inlet and outlet nozzles located on the top of the tank preventing accidental tank leakage from piping attachment failure. The secondary containment is designed to minimize the potential for rainwater inleakage; however, the vault is known to leak occasionally. This inleakage is contained and subsequently removed from the secondary containment system.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.4.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank C-1 is located in a below-grade, epoxy-coated, reinforced concrete vault. The following items address specific components of the vault system.

Containment

Tank C-1 is located in a below-grade, epoxy-coated, reinforced concrete vault designed to be leaktight. The epoxy-coated portion of the vault measures 28'2" × 65'4" × 14'6" high, which represents a total volume of 199,580 gal. Of that total volume, 50,000 gal are occupied by Tank C-2, leaving an available containment volume of 149,580 gal. The nominal full tank content of Tank C-1 is 50,000 gal.

The assessment concludes that the epoxy-coated portion of the vault is sufficient to contain the full tank volume along with the occasional roof plug leakage.

Infiltration

Site and storm drainage design around the perimeter of the vault provides for surface water runoff to prevent buildup of surface water during rainfall. Site grades around Tank C-1 slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the tank vault are maintained at a minimum of 6" below perimeter walls to prevent run-on (Figure 2.4-6). The 14", reinforced concrete tank vault walls have an external asphalt or coal tar type felt membrane forming a waterproofing system. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 793'6", which is 10'0" below grade. The highest water table elevation at the Tank C-1 vault is 802.88' per Well No. 563 measurements.

The tank vault is designed with a 6" pipe located around the foundation base to provide a foundation drain system. The pipe header is routed to the storm sewer system.

The vault roof consists of reinforced concrete shielding plugs covered by a layer of polyethylene and a 6" concrete slab. The vault is also provided with an access hatch that is sealed with a continuous 1/2" thick by 6" wide neoprene gasket to minimize the potential for leakage.

The assessment concludes that the vault is designed to minimize the potential for infiltration.

Water Stops

The Tank C-1 secondary containment structure is constructed with 16-oz, cold-rolled copper water stops and 2" × 4" keyways in all below-grade construction joints, but the water stops are not chemical resistant. However, it is unlikely that water from outside the system or LLLW from inside the system will come in contact the water stops because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of chemical resistance is not considered significant.

Vapor Protection, Vessel Vent System

Tank C-1 is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system). The primary system consists of six gas-lift circulators. Routinely, a small flow of approximately 1 CFM is put through two circulators in each tank, which serve to dilute and sweep out any radiolytic gas that may be present. Circulator air is vented through the tank offgas connection (Figure 2.4-7).

The tank vault is maintained at a pressure of -1" to -4" of water gauge (wg) with a flow of 1400 CFM.

Exhaust gas from both the tank and vault is disposed of through the Central Laboratory Gaseous Waste Disposal System. Prior to discharge into this system, gaseous streams are filtered to reduce the level of particulate activity to a minimum. The filter system consists of a HEPA filter preceded by a 95% efficiency prefilter. The filter system is designed to provide an efficiency of 99.95% for 0.3 micron particles at a velocity of 250 fpm.

The assessment concludes that Tank System C-1 is provided with a means to protect against the formation and ignition of vapors.

2.4.4 Supplemental Information

2.4.4.1 Ancillary Equipment

Single-wall piping associated with Tank C-1 is located within the confines of the vault system that provides secondary containment. The piping is fabricated from type 304L SS, which is the same material as that used in Tank C-1. The transfer piping is exposed to the same liquids as Tank C-1; therefore, 304L SS is an acceptable material for the support equipment.

The assessment concludes that the ancillary equipment is properly designed for leak detection and secondary containment.

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 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 that includes Tank C-1.

2.4.5 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.

Energy Systems Drawing E-S-52712, Tank Storage Vault and Retaining Wall Details, Revision 2.

Energy Systems Drawing D-34551, High Level Waste Facility Engineering Flowsheet No. 4, Dated 5/17/61 (No Revision No.).

Energy Systems Drawing D-52563, 50,000-gal High-Level Liquid Waste Tanks C-1 and C-2 Detail Sheet No. 1, Revision 2.

Energy Systems Drawing E-S-52711, Cells No. 1 and 2 Stainless Steel Liners and Tank Vault Details, Revision 2.

Energy Systems Drawing C-20237-EA001-D, Grading Plan, Dated 12/62 (No Revision No.).

Energy Systems Drawing S3E-20237-B013, Extended Vault Plan Sections and Details, Revision 0.

Energy Systems Drawing D-52750, Sampling Room Foundation Plan and Sections, Dated 3/23/62 (No Revision No.).

Energy Systems Drawing E-F-52685, Footing Tunnel Drains and Sump Pit, Revision 1.

Energy Systems Drawing D-52757, Tank Vault Cover Plug Location Plan and Details, Revision 1.

Energy Systems Drawing D-52761, Off-Gas and Cell Ventilation Filter Pits, Revision 1.

Energy Systems Drawing C-40307, Criteria Storage Tank Vault, Dated 1/30/62 (No Revision No.).

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*. Department of Waste Minimization Planning and Certification. WM-WMCO-201.

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

Procurement Specification. 1963. XSP-68A. *High Level Liquid Waste Tanks C-1 and C-2*.

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Sears, M. B., et al. 1990. *Sampling and Analysis of Radioactive Liquid Waste 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 2.4-2
Layout of Tank C-1

REF. DWG. E-S-52712

EBASCO/MAIN

Figure 2.4-3 Schematic of the Liquid Low-Level Waste System

Architectural drawing showing the West Elevation of a vault structure containing two tanks, C-1 and C-2.

Key dimensions and features:

- Tanks:** C-2 TANK (left) and C-1 TANK (right). C-2 TANK width is 7'-6". C-1 TANK width is 7'-0".
- Structure:** Vault floor and walls. Concrete floor and curbs are 6" thick.
- Dimensions:**
 - Overall width: 14'-6" (7'-6" + 7'-0").
 - Overall height: 11'-0" (EL 811'-0" - EL 793'-6").
 - Right side height: 13'-0" (EL 813'-0" - EL 793'-6").
 - Right side width: 1'-0" (top) and 2'-0" (bottom).
 - Left side width: 1'-2" (top) and 1'-0" (bottom).
 - Bottom width: 1'-0" (left) and 1'-0" (right).
- Labels:**
 - EL 811'-0"
 - EL 813'-0"
 - EL 793'-6"
 - 6" CONCRETE FLOOR & CURBS
 - 16 OZ. COLD ROLLED COPPER STRIP (TYP.)
 - COAT THE VAULT FLOOR AND WALLS WITH A THREE-COAT SYSTEM OF AMERCOAT #74S EPOXY
 - 3/4" PREMOLDED EXPAN. JOINT (TYP.)
 - WEST ELEVATION
 - FLOOR BLDG 2531 CRANE BAY

Figure 2.4-5 Tank C-1 Vault

REF. DWG. S3E-20237-B013

Figure 2.4-6 Tank Vault Grading Plan

REF. DWG. C-20237-EA-001-D

Figure 2.4-7 Tank C-1 H&V Diagram

Figure 2.4-8
Analytical Data For Liquid and Sludge Samples

**ANALYTICAL DATA FOR
LIQUID SAMPLE**

**ANALYTICAL DATA FOR
SLUDGE SAMPLE**

Characteristic JAN, 1990 * WZ-1 REPRESENTATIVE SAMPLE

Characteristic JAN, 1990 * WZ-3 REPRESENTATIVE SAMPLE

Physical properties and microanalysis 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)	8.42
Hg (mg/L)	0.07
Ni (mg/L)	3.0
Pb (mg/L)	2.7
Se (mg/L)	<2.3
Ti (mg/L)	<0.94

Trace 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)	-

Radionuclide 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
¹³⁷ Cs (Bq/mL)	4.63e+03
¹³⁷ Cs (Bq/mL)	4.36e+05
¹⁵² Eu (Bq/mL)	<2.1e+02
¹⁵² Eu (Bq/mL)	<1.6e+02
¹⁵² Eu (Bq/mL)	<8.5e+02
³ H (Bq/mL)	1.19e+02
⁹⁰ Nb (Bq/mL)	<1.0e+02
¹⁰⁶ Ru (Bq/mL)	3.78e+03
⁹⁰ Sr (Bq/mL)	4.12e+02
⁹⁰ Zr (Bq/mL)	<1.0e+02

Alpha emitters

²³⁵ U (Bq/mL)	4.00e+00
²³⁸ U (Bq/mL)	6.00e+00
²³⁹ Pu/ ²⁴⁰ Pu (Bq/mL)	6.00e+00
²³⁹ Pu/ ²⁴¹ Am (Bq/mL)	3.90e+01
²⁴⁴ Cm (Bq/mL)	4.00e+00

Physical properties and microanalysis data

TS (mg/g)	544
Density (g/mL)	1.34
IC (mg/g)	18100
TC (mg/g)	22200
TOC (mg/g)	4120

RCRA metals

Ag (mg/g)	(28)
As (mg/g)	(<50)
Ba (mg/g)	43
Cd (mg/g)	32
Cr (mg/g)	190
Hg (mg/g)	19
Ni (mg/g)	110
Pb (mg/g)	(450)
Se (mg/g)	<39
Ti (mg/g)	<16

Trace metals

Al (mg/g)	2800
B (mg/g)	<10
Ca (mg/g)	55000
Co (mg/g)	-
Fe (mg/g)	1900
K (mg/g)	18000
Mg (mg/g)	16000
Na (mg/g)	82000
Sr (mg/g)	290
Th (mg/g)	15000
U (mg/g)	17000

Radionuclide 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
¹³⁷ Cs (Bq/g)	<6.5e+03
¹³⁷ Cs (Bq/g)	4.95e+05
¹⁵² Eu (Bq/g)	7.22e+05
¹⁵² Eu (Bq/g)	5.14e+05
¹⁵² Eu (Bq/g)	1.21e+05
⁹⁰ Nb (Bq/g)	<7.0e+03
¹⁰⁶ Ru (Bq/g)	<6.2e+04
⁹⁰ Sr (Bq/g)	2.28e+06
⁹⁰ Zr (Bq/g)	<4.5e+04

Alpha emitters

²³⁵ U (Bq/g)	-
²³⁸ U (Bq/g)	1.18e+04
²³⁸ U (Bq/g)	<2.8e+04
²³⁹ Pu/ ²⁴⁰ Pu (Bq/g)	1.18e+04
²³⁹ Pu/ ²⁴¹ Am (Bq/g)	3.21e+04
²⁴⁴ 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 FOR TANK C-1, TANK WZ3 SHOWN AS A REP. SAMPLE

Figure 2.4-9 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	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
	Nov. 85	Solids ^d	237,000	205,000	1.35E+07	73,700	6,510	880	12,100	8,220	2,550	3,400	

REPRESENTATIVE
SAMPLE

^aAll data from the TRU laboratory except RHAL gross beta and Sr-90.

^bTRU data: Request No. 45764, received 1/30/86, completed 2/6/86.

^cRHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.

^dnCi/g for solid samples.

^enCi/mL for liquid samples.

^fA 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

^aAll data from the TRU laboratory except RHAL gross alpha.

^bTRU data: Request No. 45764, received 1/30/86, completed 2/6/86.

^cRHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.

^dnCi/g for solid samples.

^enCi/mL for liquid samples.

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

2.5 Tank C-2

2.5.1 Tank Summary

Tank C-2 is a nominal 50,000-gal, horizontal tank installed in 1964 near the liquid low-level waste (LLLW) Evaporator (Building 2531) and near the center of the main Bethel Valley Complex (Figures 2.5-1 and 2.5-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank C-2 is used as a concentrate collection tank for the LLLW Evaporator and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.5.2 Standards for Design Demonstration

2.5.2.1 Tank Description and Design Standards

Tank Description

Tank C-2 is located north of Evaporator Building 2531 in a reinforced concrete vault with Tank C-1. The tank is used and managed by the Waste Management and Remedial Actions Division. The Oak Ridge National Laboratory (ORNL) coordinates for Tank C-2 centerlines are E 30600 and N 21863.58.

Tank C-2 is a nominal 50,000-gal, horizontal tank constructed of type 304L SS. The tank has an outside diameter of 12'0" with ASME flanged and dished heads and an overall length of 61'0". The shell and heads have a nominal thickness of 1/2". The tank operates at slightly less than atmospheric pressure.

Design Standards

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

Specifications for The Construction of Improvements to Radioactive Liquid Waste System Phase II, Building 2531, Specification No. 10851-E-206-S;

American Society for Testing and Materials (ASTM) A15, A53, A120, A167, A181, A182, A185, A200, A213, A214, A234, A240, A245, A269, A276, A312, A371, A376, A403, B68, C94, C175, E94, E142, and E165;

National Electric Code;

Atomic Energy Commission (AEC) Safety Code;

Underwriters Laboratories Inc.; and

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels, (1962 edition).

2.5.2.2 Generic Description of Tank Contents

Tank C-2 was designed to collect high-level waste generated at ORNL. However, because no significant quantities of high-level waste were ever generated, this tank was repiped to serve as an LLLW concentrate storage tank (Figure 2.5-3). 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 the 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. This pH adjustment causes most of the transuranic waste components and heavy metals to precipitate out of solution. 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.

Due to 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 stored in Tank 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 2.5-8). Based on radiation levels found in Tank W-23 and the historical use of the Tank C-2 as an evaporator feed tank, Tank C-2 may contain radioactive materials (Figure 2.5-9).

2.5.2.3 Corrosion Protection Measures

Tank C-2 is located in an underground, epoxy-coated, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.5.2.4 Documented Age

Tank C-2 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 Substances(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness To Prevent Failure

Tank C-2 is constructed of type 304L SS. The interior of the tank vault (floor and walls) is provided with a three-coat system of Amercoat 74S epoxy (Figure 2.5-4).

The assessment concludes that, according to manufacturer's specifications, the vault's epoxy coating is compatible with the stored waste and designed to prevent migration of waste in the concrete.

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

Tank C-2 is located in an underground, reinforced concrete vault (Figure 2.5-5). Tank C-2 shares the vault with Tank C-1. The tank vault foundation is a 30'2" × 67'4" × 2'0" thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the vault foundation is properly designed to support the secondary containment system.

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

Tank C-2 is provided with a tank level monitor and is situated within an epoxy-coated, concrete vault. The floor of the vault is sloped to a 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 Tank System C-2 is provided with a leak detection system.

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

The Tank C-2 vault floor slopes to a 2'6" × 2'6" × 1'6" deep, epoxy-coated sump with a containment capacity of 70 gal. The sump provides a low point within the tank vault to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

Tank C-2 has a nominal capacity of 50,000 gal with tank inlet and outlet nozzles located on the top of the tank preventing accidental tank leakage from piping attachment failure. The secondary containment is designed to minimize the potential for rainwater inleakage; however, the vault is known to leak occasionally. This inleakage is contained and subsequently removed from the secondary containment system.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.5.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank C-2 is located in a below-grade, epoxy-coated, reinforced concrete vault. The following items address specific components of the vault system.

Containment

Tank C-2 is located in a below-grade, epoxy-coated, reinforced concrete vault designed to be leaktight. The epoxy-coated portion of the vault measures 28'2" × 65'4" × 14'6" high, which represents a total volume of 199,580 gal. Of that total volume, 50,000 gal are occupied by Tank C-1, leaving an available containment volume of 149,580 gal. The nominal full tank content of Tank C-2 is 50,000 gal.

The assessment concludes that the epoxy-coated portion of the vault is sufficient to contain the full tank volume along with the occasional roof plug leakage.

Infiltration

Site and storm drainage design around the perimeter of the vault provides for surface water runoff to prevent buildup of surface water during rainfall. Site grades around Tank C-2 slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the tank vault are maintained at a minimum of 6" below perimeter walls to prevent run-on (Figure 2.5-6). The 14", reinforced concrete tank vault walls have an external asphalt or coal tar type felt membrane forming a waterproofing system. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 793'6", which is 10'0" below grade. The highest water table elevation at the Tank C-2 vault is 802.88' per Well No. 563 measurements.

The tank vault is designed with a 6" pipe located around the foundation base to provide a foundation drain system. The pipe header is routed to the storm sewer system.

The vault roof consists of reinforced concrete shielding plugs covered by a layer of polyethylene and a 6" concrete slab. The vault is also provided with an access hatch that is sealed with a continuous 1/2" thick by 6" wide neoprene gasket to minimize the potential for leakage.

The assessment concludes that the vault is designed to minimize the potential for infiltration.

Water Stops

The Tank C-2 secondary containment structure is constructed with 16-oz cold-rolled copper water stops and 2" × 4" keyways in all below-grade construction joints, but the water stops are not chemical resistant. However, it is unlikely that water from outside the system or LLLW from inside the system will come in contact with the water stops because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of chemical resistance is not considered significant.

Vapor Protection, Vessel Vent System

Tank C-2 is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system). The primary system consists of six gas-lift circulators. Routinely, a small flow of approximately 1 CFM is put through two circulators in each tank, which serve to dilute and sweep out any radiolytic gas that may be present. Circulator air is vented through the tank offgas connection (Figure 2.5-7).

The tank vault is maintained at a pressure of -1" to -4" of water gauge (wg) with a flow of 1400 CFM.

Exhaust gas from both the tank and vault is disposed of through the Central Laboratory Gaseous Waste Disposal System. Prior to discharge into this system, gaseous streams are filtered to reduce the level of particulate activity to a minimum. The filter system consists of a HEPA filter preceded by 95% efficiency prefilter. The filter system is designed to provide an efficiency of 99.95% for 0.3 micron particles at a velocity of 250 fpm.

The assessment concludes that Tank System C-2 is provided with a means to protect against the formation and ignition of vapors.

2.5.4 Supplemental Information

2.5.4.1 Ancillary Equipment

Single-wall piping associated with Tank C-2 is located within the confines of the vault system that provides secondary containment. The piping is fabricated from type 304L SS, which is the same material as that used in Tank C-2. The transfer piping is exposed to the same liquids as Tank C-2; therefore, 304L SS is an acceptable material for the support equipment.

The assessment concludes that the ancillary equipment is properly designed for leak detection and secondary containment.

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 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 that includes Tank C-2.

2.5.5 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 E-S-52711, Cells No. 1 and 2 Stainless Steel Liners and Tank Vault Details, Revision 2.

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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 C-2

Figure 2.5-2
Layout of Tank C-2

REF. DWG. E-S-52712

EBASCO/MAIN

Figure 2.5-3 Schematic of the Liquid Low-Level Waste System

Figure 2.5-4 Tank C-2 Vault

Figure 2.5-5 Tank C-2 Vault

REF. DWG. S3E-20237-B013

Figure 2.5-6 Tank Vault Grading Plan

REF. DWG. C-20237-EA-001-D

EBASCO, MAINE

Figure 2.5-8
Analytical Data For Liquid and Sludge Samples

**ANALYTICAL DATA FOR
LIQUID SAMPLE**

**ANALYTICAL DATA FOR
SLUDGE SAMPLE**

Characteristic JAN. 1990 * W23-L1 REPRESENTATIVE SAMPLE

Characteristic JAN. 1990 * W23-S REPRESENTATIVE SAMPLE

Physical properties and microflaporous data

TDS (mg/mL)	331
TS (mg/mL)	383
Density (g/mL)	1.2423
IC (mg/L)	8340
TC (mg/L)	9100
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
Ti (mg/L)	<0.94

Trace 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)	-

Actinide/uranium emitters

Gross alpha (Bq/mL)	8.20e+01
Gross beta (Bq/mL)	4.62e+05
¹⁴ C (Bq/mL)	6.35e+01
¹⁴ 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
¹⁵⁹ Eu (Bq/mL)	<8.5e+02
¹⁶² Hf (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
⁹⁵ Zr (Bq/mL)	<1.0e+02

Alpha emitters

²³⁵ U (Bq/mL)	4.00e+00
²³⁸ U (Bq/mL)	6.00e+00
²³² Pu/ ²³⁸ Pu (Bq/mL)	6.00e+00
²³⁹ Pu/ ²⁴¹ Am (Bq/mL)	3.90e+01
²⁴⁰ Cm (Bq/mL)	4.00e+00

Physical properties and microflaporous data

TS (mg/g)	514
Density (g/mL)	1.34
IC (mg/g)	18100
TC (mg/g)	22200
TOC (mg/g)	4120

RCRA metals

Ag (mg/g)	(20)
As (mg/g)	(<50)
Ba (mg/g)	63
Cd (mg/g)	32
Cr (mg/g)	190
Hg (mg/g)	19
Ni (mg/g)	110
Pb (mg/g)	(450)
Se (mg/g)	<39
Ti (mg/g)	<16

Trace metals

Al (mg/g)	2800
B (mg/g)	<10
Ca (mg/g)	55000
Co (mg/g)	-
Fe (mg/g)	1100
K (mg/g)	18000
Mg (mg/g)	16000
Na (mg/g)	82000
Sr (mg/g)	290
Th (mg/g)	12000
U (mg/g)	17000

Actinide/uranium emitters

Gross alpha (Bq/g)	2.23e+05
Gross beta (Bq/g)	6.67e+06
¹⁴ C (Bq/g)	3.45e+02
¹⁴ 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
¹⁵⁹ 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
⁹⁵ Zr (Bq/g)	<4.5e+04

Alpha emitters

²³⁵ U (Bq/g)	1.18e+04
²³⁸ U (Bq/g)	<2.8e+04
²³² Pu/ ²³⁸ Pu (Bq/g)	1.18e+04
²³⁹ Pu/ ²⁴¹ Am (Bq/g)	3.21e+04
²⁴⁰ Cm (Bq/g)	<2.6e+04
²⁴² 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 FOR TANK C-2, TANK W23 SHOWN AS A REP. SAMPLE

Figure 2.5-9 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	Ca-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
	Nov. 85	Solids ^d	237,000	205,000	1.35E+07	73,700	6,510	880	12,100	8,220	2,550	3,400	

REPRESENTATIVE
SAMPLE

^aAll data from the TRU laboratory except RHAL gross beta and Sr-90.

^bTRU data: Request No. 45764, received 1/30/86, completed 2/6/86.

^cRHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.

^dnCi/g for solid samples.

^enCi/mL for liquid samples.

^fA blank space means no data available.

Radiochemical analyses of alpha emitters
in the Evaporator Service Tanks^a

Tank	Sample date	Sample location	Gross alpha		Ca-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

^aAll data from the TRU laboratory except RHAL gross alpha.

^bTRU data: Request No. 45764, received 1/30/86, completed 2/6/86.

^cRHAL data: Request No. 34529, received 11/12/85, completed 11/22/85.

^dnCi/g for solid samples.

^enCi/mL for liquid samples.

* = NO DATA FOR TANK C-2, TANK W23
SHOWN AS A REPRESENTATIVE SAMPLE

2.6 Tank L-11

2.6.1 Tank Summary

Tank L-11 is a nominal, 500-gal, vertical tank installed in 1974 in the Process Waste Treatment Plant (PWTP) (Building 3544) and is part of the main Bethel Valley Complex (Figures 2.6-1 and 2.6-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an aboveground, reinforced concrete vault. Tank L-11 is used as a liquid low-level waste (LLLW) collection tank for the evaporation bottoms from the L-10 PWTP Evaporator and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.6.2 Standards for Design Demonstration

2.6.2.1 Tank Description and Design Standards

Tank Description

Tank L-11 is located at the south wall of Building 3544 in the Ion Exchange and Evaporator Room. The tank is used and managed by the Waste Management and Remedial Actions Division and is part of the Bethel Valley LLLW System. The Oak Ridge National Laboratory (ORNL) coordinates for the Tank L-11 centerlines are N 21280 and E 30830.

Tank L-11 is a vertically oriented SS tank with a nominal capacity of 500 gal. The tank has an outside diameter of 4'0" and an overall height of 6'0".

Design Standards

The applicable codes and standards used for Tank System L-11 and its associated vault and piping 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 (ASTM) C39, C78, C138, C143, and D1752;

American Standards Association (ASA) Safety Code for Building Construction;

American Concrete Institute (ACI);

American Concrete Pipe Association (ACPA);

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

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Occupational Safety and Health Administration (OSHA);

American Society of Mechanical Engineers (ASME);

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

American Conference of Governmental Industrial Hygienists (ACGIH);

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

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

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

NFPA No. 91—Blower and Exhaust Systems;

National Electric Code;

Underwriters Laboratories Inc.;

Factory Mutual Engineering Corporation;

American National Standards Institute (ANSI); and

Instrument Society of America (ISA).

2.6.2.2 Generic Description of Tank Contents

Tank L-11 is designed to serve as an LLLW process collection tank for the Building 3544 Evaporator. The tank collects evaporator bottoms from the L-10 PWTP Evaporator (Figure 2.6-3). These wastes may include a variety of dilute acids, bases, and organics. The residence time for acids is low. After each waste transfer, Tank L-11 is neutralized with a high pH solution and flushed with water. The tank may contain radioactive materials from Building 3544.

The analytical data (Figure 2.6-8) of waste stream contaminants from the generators are representative of the waste transferred to and from Tank L-11.

2.6.2.3 Corrosion Protection Measures

Tank L-11 is located at the south wall of Building 3544 in an aboveground, coated, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.6.2.4 Documented Age

Tank L-11 was constructed in 1974.

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 Substances(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness To Prevent Failure

Tank L-11 is constructed of type 304L SS. The floor of the tank vault is provided with a 40-mil-thick system of Quantum Polymorphic Resin. The walls of the vault are provided with a three-coat system of Amercoat 66 epoxy. According to manufacturer's specifications, the vault floor resin coating and the vault walls epoxy coating are compatible with the waste and designed to prevent migration of waste into the concrete. The sump to which Tank Vault L-11 drains is lined with type 304L SS (Figure 2.6-4).

The assessment concludes that the secondary containment system coatings and linings are compatible with the stored 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 L-11 is located in an aboveground, coated, reinforced concrete vault (Figure 2.6-5). The floor of the vault is an 8" thick, reinforced concrete base slab which was designed with a 28-day compressive strength of 4000 psi.

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

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

Tank L-11 is provided with a tank level monitor and is located in a coated vault. Any leakage from Tank L-11 is gravity fed to a floor drain which is routed to a sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of Building 3544.

The assessment concludes that Tank System L-11 is provided with a leak detection system.

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

The Tank L-11 vault floor is sloped to a floor drain which is routed 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.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.6.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank L-11 is located in a coated, reinforced concrete vault. The following items address specific components of the vault system.

Containment

Tank L-11 is located in an aboveground vault designed to be leaktight. The vault includes one process area that has two, 4", PVC floor drains embedded in the concrete floor. The drain lines are routed to a common 304L SS-lined instrumented sump. The 304L SS-lined portion of the sump provides containment for 1150 gal of liquid compared with a nominal full tank content of 500 gal for Tank L-11. *The Effects of Nuclear Radiations on Elastomers and Plastic Components and Materials* dated 1964 qualifies the 4", PVC drain lines as appropriate for this application.

The assessment concludes that the SS-lined portion of the sump is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of Building 3544, which contains Tank L-11, provides for surface water runoff to prevent any buildup of surface water during rainfall. Site grades slope away from the building conveying rainwater to storm drain catch basin inlets (Figure 2.6-6). The tank vault finished floor elevation is 782'6", which is 6" above ground elevation and includes a foundation drain system. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank L-11 secondary containment structure is constructed with 2" x 4" keyways with continuous water stops in all below-grade construction joints, but the design drawings and construction specifications do not indicate that the water stops are chemical resistant. However, it is unlikely that water from outside the system or LLLW from inside the system will come in contact with the water stops because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of chemical resistance is not considered significant.

Vapor Protection, Vessel Vent System

Tank L-11 is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system).

Tank L-11 is vented through a HEPA-filtered tank offgas system that keeps the tank under negative pressure relative to the vault pressure. The vault is ventilated with a HEPA-filtered vault exhaust ventilation system that generates a sweep flow rate of approximately 1700 CFM through the vault. This exhaust system was designed to maintain the vault at a negative pressure (Figure 2.6-7).

The assessment concludes that Tank System L-11 is provided with a means to protect against the formation and ignition of vapors.

2.6.4 Supplemental Information

2.6.4.1 Ancillary Equipment

Piping associated with Tank L-11 is single wall. Piping and related equipment such as jet ejectors, pumps, and valves are fabricated from 304L SS, which is the same material as that used in Tank L-11. The transfer piping and associated equipment are exposed to the same liquids as Tank L-11; therefore, 304L SS is acceptable for the support equipment. Within the confines of the vault system, any piping and related equipment is provided secondary containment by the coated vault and 304L SS-lined sump.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.6.4.2 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 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 that includes Tank L-11.

2.6.5 References

Energy Systems Drawing S-21246-EB-014D, Concrete Sections Sheet 2, Revision A.

Energy Systems Drawing S-21246-EB0-15D, Concrete Sections Sheet 3, Revision 0.

Energy Systems Drawing A-21246-EB0-18D, General Structural Notes, Revision 0.

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

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

Energy Systems Drawing P-21246-EE-032D, Ion Exchange Room Process Piping Elevation G-G and H-H, Revision 3.

Energy Systems Drawing M-21246-EE-028D, Process Equipment Layout Plan, Revision 0.

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LLLW Generator Survey 1990 for Building 3544.

Oak Ridge National Laboratory. *Specification for the Construction of Process Waste Treatment Plant Building 3544*. Invitation No. 401-74-13A.

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

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.

Figure 2.6-1 Location of Building 3544

Figure 2.6-2 Layout of Tank L-11

Figure 2.6-3
Schematic of the Liquid Low-Level Waste System

Figure 2.6-4 Tank L-11 Vault

REF. DWG. 5-21246-1B-012-D

Figure 2.6-5 Tank L-11 Vault

REF. CWG. 1-11-6-EE-029-D
S-21246-EB-014-D

Figure 2.6-6
Building 3544 Grading Plan

Figure 2.6-7 H&V Diagram

FLOW DIAGRAM

NO SCALE

REF. DWG. H-21246-EG-003-L

EBASCO MAIN

Figure 2.6-8
Analytical Data For Liquid

9. 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

2.7 Tank B-2-T

2.7.1 Tank Summary

Tank B-2-T is a nominal, 1870-gal, vertical tank installed in 1965 near the Radiochemical Engineering Development Center (REDC) (Building 7930) in the Melton Valley High Flux Isotope Reactor (HFIR) Complex (Figures 2.7-1 and 2.7-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank B-2-T is used as a process collection tank for the Radioactive Hot Drain-Hot Offgas (RHD-HOG) System and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.7.2 Standards for Design Demonstration

2.7.2.1 Tank Description and Design Standards

Tank Description

Tank B-2-T is located near the southwest corner of Building 7930 in an underground vault with Tanks B-3-T and C-6-T. The tank is under the control of the REDC and operated by the Chemical Technology Division. The Oak Ridge National Laboratory (ORNL) coordinates for the Tank B-2-T centerlines are N 17697.33 and E 32577.0.

Tank B-2-T is a nominal, 1870-gal, vertical tank constructed of type 304L SS. The tank has an outside diameter of 7'0" and an overall height of 8'10-7/8". The shell and the heads have a nominal thickness of 3/8" and 5/16", respectively. The tank operates under a pressure of approximately -15" of water gauge (wg).

Design Standards

The applicable codes and standards used for Tank System B-2-T and its associated vault and piping 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 (ASTM) A93, A244, A307, C39, C78, C138, C143, and D1752;

American Standards Association (ASA) Safety Code for Building Construction;

American Concrete Institute (ACI);

American Concrete Pipe Association (ACPA);

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

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Occupational Safety and Health Administration (OSHA);

American Society of Mechanical Engineers (ASME), Sections II, IV, VIII, and IX;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

American Conference of Governmental Industrial Hygienists (ACGIH);

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

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

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

NFPA No. 91—Blower and Exhaust Systems;

National Electric Code;

Underwriters Laboratories Inc.;

Factory Mutual Engineering Corporation;

American National Standards Institute (ANSI); and

Instrument Society of America (ISA).

2.7.2.2 Generic Description of Tank Contents

Tank B-2-T is designed to serve as an LLLW collection tank for the Building 7930 RHD-HOG System. The primary source of LLLW in the building is from Cell G (Figure 2.7-3). These wastes may include a variety of dilute acids, bases, and organics. The tank may contain radioactive materials from the REDC. The analytical data (Figure 2.7-8) of waste stream contaminants from the generators are representative of wastes transferred to and stored in Tank B-2-T.

2.7.2.3 Corrosion Protection Measures

Tank B-2-T is located near the southwest corner of Building 7930 in an underground, coated, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.7.2.4 Documented Age

Tank B-2-T was installed in 1965.

2.7.3 Standards for Containment/Release Detection

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

Tank B-2-T is constructed of type 304L SS. The tank vault floor is provided with a 30-mil-thick system of Amercoat 66 epoxy, and the tank vault walls are provided with a 5-mil-thick system of Amercoat 99 vinyl emulsion (Figure 2.7-4).

The assessment concludes that, according to manufacturer's specifications, the vault's epoxy-coated floor and vinyl-emulsion-coated walls are compatible with the stored 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 B-2-T is located in an underground, reinforced concrete vault (Figure 2.7-5). Tank B-2-T shares the vault with Tanks B-3-T and C-6-T. The vault inside dimensions are 10'0" × 25'6" × 19'3" high. The floor slab and three walls are 2'0" thick; and the east wall is 3'0" thick, reinforced concrete. The roof is constructed of three, removable, reinforced concrete plugs that are 4'6" thick. The vault floor elevation is 825'0", which is 23'0" below grade (EL. 848'0").

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

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

Tank B-2-T is provided with a tank level monitor and is located in a coated vault. Any leakage from Tank B-2-T is gravity fed to a sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of Building 7930.

The assessment concludes that Tank System B-2-T is 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

The Tank B-2-T vault bottom slopes to a 1'0" × 1'0" × 1'0" deep, epoxy-coated sump with a capacity of 7.5 gal. The sump provides a low point within the tank vault to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The secondary containment is designed to minimize the potential for rainwater leakage; however, the removable plugs located on the containment roof are known to leak occasionally. This leakage is contained and subsequently removed from the secondary containment system.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.7.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank B-2-T is located in a coated, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank B-2-T is located in a below-grade vault with coatings designed to be leaktight. The epoxy-coated portion of the vault measures 10'0" × 25'6" × 19'3" high, which represents a total volume of 36,700 gal. Of that total volume, 1870 gal are occupied by Tank B-3-T; and 375 gal are occupied by Tank C-6-T, leaving an available containment volume of 34,455 gal. The nominal full tank content of Tank B-2-T is 1870 gal.

The assessment concludes that the coated vault is sufficient to contain the full tank volume along with the occasional roof plug leakage.

Infiltration

Site and storm drainage design around the perimeter of the vault containing Tank B-2-T provides for surface water runoff to prevent any buildup of surface water during rainfall. Site grades around the vault containing Tank B-2-T slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the vault containing Tank B-2-T are maintained at a minimum of 8" below perimeter walls to prevent water run-on. The 2'0" thick, reinforced concrete tank vault walls have an external, three-ply application of coal tar pitch type membrane coating; and the floor slab has a 6-mil-thick, polyethylene membrane, which comprise the waterproofing system. The pipe penetrations through the walls were sealed to the waterproof membrane, and the roof plug joints are caulked with resilient type sealer. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 825'0", which is 23'0" below grade (EL. 848'0") (Figure 2.7-6).

The tank vault is designed with a 6" diameter, 16-gauge, galvanized, perforated pipe located around the foundation base to provide a foundation drain system. The pipe header is routed to the storm water sewer.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank B-2-T secondary containment structure is constructed with 16-oz, cold-rolled copper water stops and 2" x 6" keyways in all below-grade construction joints, but the water stops are not chemical resistant. However, it is unlikely that water from outside the system or LLLW from inside the system will come in contact with the water stops because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of chemical resistance is not considered significant.

Vapor Protection, Vessel Vent System

Tank B-2-T is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system). Both the tank and the vault are vented to the atmosphere via a HEPA-filtered exhaust system and the 7911 Stack. The tank ventilation flow rate is approximately 40 CFM, and the vault ventilation flow rate is approximately 100 CFM. The ventilation system is designed to maintain the tank at a more negative pressure than the vault, which is at a negative pressure relative to the atmosphere (Figure 2.7-7).

The assessment concludes that Tank System B-2-T is provided with a means to protect against the formation and ignition of vapors.

2.7.4 Supplemental Information

2.7.4.1 Ancillary Equipment

Piping associated with Tank B-2-T is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from 304L SS, which is the same material as that used in Tank B-2-T. The transfer piping and associated equipment are exposed to the same liquids as Tank B-2-T; therefore, 304L SS is acceptable for the support equipment. Piping and related equipment within the confines of the vault system is provided secondary containment by the coated vault.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.7.4.2 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 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 that includes Tank B-2-T.

2.7.5 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.

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

Energy Systems Drawing C-20998-Y-012-E, Civil Site Plan Details, Sheet 1, Revision 2.

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

Energy Systems Drawing H-20998-Y-304-E, Control Diagram Exhaust System, Revision A.

Energy Systems Drawing H-20998-Y-305-E, Control Diagram Hot Offgas Exhaust System, Revision A.

Energy Systems Drawing 20999-U-X02-E, Details Waste Pit Tanks, Revision 1.

Energy Systems Drawing H-20998-Y-302-E, 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 S-20998-Y-223E, Radioactive Waste and Filter Pits, Sheet 1, Dated 1/15/65 (No Revision No.).

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

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

Energy Systems Drawing 20999-U-X01-E, Waste Pit Tanks, Revision 2.

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

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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*. Department of Waste Minimization Planning and Certification. WM-WMCO-201.

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

Figure 2.7-1 Location of Radiochemical Engineering Development Center

Figure 2.7-2
Layout of the Waste Pit Tanks

REF. DWG. P-20998-Y-428-E-1

Figure 2.7-3 Schematic of the Liquid Low-Level Waste System

- FCV - FLOW CONTROL VALVE (REMOTE OPERATION)
 RHDR - RADIOACTIVE HOT DRAIN RECOVERABLE
 RHD-HOG - RADIOACTIVE HOT DRAIN-HOT OFF-GAS
 TE - TEMPERATURE ELEMENT
- STEAM JET

Figure 2.7.4 Tanks B-2-T, B-3-T and C-6-T Vault

REF. DWG. S-20998-Y-223-E

BRASCO. MAIN

Figure 2.7-5 Tanks B-2-T, B-3-T and C-6-T Vault

SECTION B-B

REF. DWG. S-20998-Y-223-E

Filter and Waste Pit (Building 7930) Grading Plan

Figure 2.7-7 Tanks B-2-T, B-3-T and C-6-T H&V Diagram

Figure 2.7-8
Analytical Data For Liquid

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	<u>Cf-252</u>	(b) Quantities	<u>0.5 mg/year</u>
	<u>Other Cf</u>		<u>Trace</u>
	<u> </u>		<u> </u>
(b) Others (i.e. acids, bases, organics, cleaners, etc.)			
	<u>acidified butyrates</u>		<u>824.9 g/year</u>
	<u>nitric acid (dilute)</u>		<u>Trace</u>
	<u>palladium tetrammine di-hydrate</u>		<u>Trace</u>
	<u>hydrazine decomposition products</u>		<u>Trace</u>
	<u> </u>		<u> </u>

2.8 Tank B-3-T

2.8.1 Tank Summary

Tank B-3-T is a nominal, 1870-gal, vertical tank installed in 1965 near the Radiochemical Engineering Development Center (REDC) (Building 7930) in the Melton Valley High Flux Isotope Reactor (HFIR) Complex (Figures 2.8-1 and 2.8-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank B-3-T is used as a process collection tank for the Radioactive Hot Drain-Hot Offgas (RHD-HOG) System and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.8.2 Standards for Design Demonstration

2.8.2.1 Tank Description and Design Standards

Tank Description

Tank B-3-T is located near the southwest corner of Building 7930 in an underground vault with Tanks B-2-T and C-6-T. The tank is under the control of the REDC and operated by the Chemical Technology Division. The Oak Ridge National Laboratory (ORNL) coordinates for the Tank B-3-T centerlines are N 17697.33 and E 32568.5.

Tank B-3-T is a nominal, 1870-gal, vertical tank constructed of type 304L SS. The tank has an outside diameter of 7'0" and an overall height of 8'10-7/8". The shell and the heads have a nominal thickness of 3/8" and 5/16", respectively. The tank operates under a pressure of approximately -15" of water gauge (wg).

Design Standards

The applicable codes and standards used for Tank System B-3-T and its associated vault and piping 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 (ASTM) A93, A244, A307, C39, C78, C138, C143, and D1752;

American Standards Association (ASA) Safety Code for Building Construction;

American Concrete Institute (ACI);

American Concrete Pipe Association (ACPA);

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

Minimum Safety Requirement, AEC-Oak Ridge Office (ORO);

Occupational Safety and Health Administration (OSHA);

American Society of Mechanical Engineers (ASME), Sections II, IV, VIII, and IX;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

American Conference of Governmental Industrial Hygienists (ACGIH);

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

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

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

NFPA No. 91—Blower and Exhaust Systems;

National Electric Code;

Underwriters Laboratories Inc.;

Factory Mutual Engineering Corporation;

American National Standards Institute (ANSI); and

Instrument Society of America (ISA).

2.8.2.2 Generic Description of Tank Contents

Tank B-3-T is designed to serve as an LLLW overflow tank for Tank B-2-T. The primary source of LLLW in the building is from Cell G (Figure 2.8-3). These wastes may include a variety of dilute acids, bases, and organics. The tank may contain radioactive materials from the REDC.

The analytical data (Figure 2.8-8) of waste stream contaminants from the generators are representative of waste that may be transferred to and stored in Tank B-3-T.

2.8.2.3 Corrosion Protection Measures

Tank B-3-T is located near the southwest corner of Building 7930 in an underground, coated, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.8.2.4 Documented Age

Tank B-3-T was installed in 1965.

2.8.3 Standards for Containment/Release Detection

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

Tank B-3-T is constructed of type 304L SS. The tank vault floor is provided with a 30-mil-thick system of Amercoat 66 epoxy, and the tank vault walls are provided with a 5-mil-thick system of Amercoat 99 vinyl emulsion (Figure 2.8-4).

The assessment concludes that, according to manufacturer's specifications, the vault's epoxy-coated floor and vinyl-emulsion-coated walls are compatible with the stored 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 B-3-T is located in an underground, reinforced concrete vault (Figure 2.8-5). Tank B-3-T shares the vault with Tanks B-2-T and C-6-T. The vault inside dimensions are 10'0" × 25'6" × 19'3" high. The floor slab and three walls are 2'0" thick; and the east wall is 3'0" thick, reinforced concrete. The roof is constructed of three, removable, reinforced concrete plugs that are 4'6" thick. The vault floor elevation is 825'0", which is 23'0" below grade (EL. 848'0").

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

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

Tank B-3-T is provided with a tank level monitor and is located in a coated vault. Any leakage from Tank B-3-T is gravity fed to a sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of Building 7930.

The assessment concludes that Tank System B-3-T is provided with a leak detection system.

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

The Tank B-3-T vault bottom slopes to a 1'0" × 1'0" × 1'0" deep, epoxy-coated sump with a capacity of 7.5 gal. The sump provides a low point within the tank vault to drain liquids to an instrumented location. A pump system is provided to remove liquids that accumulate in the sump.

The secondary containment is designed to minimize the potential for rainwater inleakage; however, the removable plugs located on the containment roof are known to leak occasionally. This inleakage is contained and subsequently removed from the secondary containment system.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.8.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank B-3-T is located in a coated, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank B-3-T is located in a below-grade vault with coatings designed to be leaktight. The epoxy-coated portion of the vault measures 10'0" × 25'6" × 19'3" high, which represents a total volume of 36,700 gal. Of that total volume, 1870 gal are occupied by Tank B-2-T; and 375 gal are occupied by Tank C-6-T, leaving an available containment volume of 34,455 gal. The nominal full tank content of Tank B-3-T is 1870 gal.

The assessment concludes that the coated vault is along with the occasional roof plug inleakage sufficient to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of the vault containing Tank B-3-T provides for surface water runoff to prevent any buildup of surface water during rainfall. Site grades around the vault containing Tank B-3-T slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the vault containing Tank B-3-T are maintained at a minimum of 8" below perimeter walls to prevent water run-on. The 2'0" thick, reinforced concrete tank vault walls have an external, three-ply application of coal tar pitch type membrane coating; and the floor slab has a 6-mil-thick, polyethylene membrane, which comprise the waterproofing system. The pipe penetrations through the walls were sealed to the waterproof membrane; and the roof plug joints are caulked with resilient type sealer. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 825'0", which is 23'0" below grade (EL. 848'0") (Figure 2.8-6).

The tank vault is designed with a 6" diameter, 16-gauge, galvanized, perforated pipe located around the foundation base to provide a foundation drain system. The pipe header is routed to the storm water sewer.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank B-3-T secondary containment structure is constructed with 16-oz, cold-rolled copper water stops and 2" x 6" keyways in all below-grade construction joints, but the water stops are not chemical resistant. However, it is unlikely that water from outside the system or LLLW from inside the system will come in contact with the water stops because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of chemical resistance is not considered significant.

Vapor Protection, Vessel Vent System

Tank B-3-T is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system). Both the tank and the vault are vented to the atmosphere via a HEPA-filtered exhaust system and the 7911 Stack. The tank ventilation flow rate is approximately 40 CFM, and the vault ventilation flow rate is approximately 100 CFM. The ventilation system is designed to maintain the tank at a more negative pressure than the vault, which is at a negative pressure relative to the atmosphere (Figure 2.8-7).

The assessment concludes that Tank System B-3-T is provided with a means to protect against the formation and ignition of vapors.

2.8.4 Supplemental Information

2.8.4.1 Ancillary Equipment

Piping associated with Tank B-3-T is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from 304L SS, which is the same material as that used in Tank B-3-T. The transfer piping and associated equipment are exposed to the same liquids as Tank B-3-T; therefore, 304L SS is acceptable for the support equipment. Piping and related equipment within the confines of the vault system is provided secondary containment by the coated vault.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.8.4.2 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 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 that includes Tank B-3-T.

2.8.5 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 C-20998-Y-012-E, Civil Site Plan Details, Sheet 1, Revision 2.

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

Energy Systems Drawing H-20998-Y-304-E, Control Diagram Exhaust System, Revision A.

Energy Systems Drawing H-20998-Y-305-E, Control Diagram Hot Offgas Exhaust System, Revision A.

Energy Systems Drawing 20999-U-X02-E, Details Waste Pit Tanks, Revision 1.

Energy Systems Drawing H-20998-Y-302-E, 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 S-20998-Y-223E, Radioactive Waste and Filter Pits, Sheet 1, Dated 1/15/65 (No Revision No.).

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

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

Energy Systems Drawing 20999-U-X01-E, Waste Pit Tanks, Revision 2.

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

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

Figure 2.8-1 Location of Radiochemical Engineering Development Center

Figure 2.8-2
Layout of the Waste Pit Tanks

REF. DWG. P-20998-Y-428-E-1

EBASCO/MAIN

Figure 2.8-3 Schematic of the Liquid Low-Level Waste System

- FCV - FLOW CONTROL VALVE (REMOTE OPERATION)
 RHDR - RADIOACTIVE HOT DRAIN RECOVERABLE
 RHD-HOG - RADIOACTIVE HOT DRAIN-HOT OFF-GAS
 TE - TEMPERATURE ELEMENT
- STEAM JET

Figure 2.8-4 Tanks B-2-T, B-3-T and C-6-T Vault

REF. DWG. S-20998-Y-223-E

EBASCO/MAIN

Filter and Waste Pit (Building 7930) Grading Plan

Figure 2.8-7 Tanks B-2-T, B-3-T and C-6-T H&V Diagram

Figure 2.8-8
Analytical Data For Liquid

WASTE STREAM CONTAMINANTS:

(a)	Isotopes:	<u>Cf-252</u>	(b)	Quantities	<u>0.5 mg/year</u>
		<u>Other Cf</u>			<u>Trace</u>
		<u> </u>			<u> </u>
(b)	Others (i.e. acids, bases, organics, cleaners, etc.)				
		<u>acidified butyrates</u>			<u>824.9 g/year</u>
		<u>nitric acid (dilute)</u>			<u>Trace</u>
		<u>palladium tetrammine di-hydrate</u>			<u>Trace</u>
		<u>hydrazine decomposition products</u>			<u>Trace</u>
		<u> </u>			<u> </u>

2.9 Tank C-6-T

2.9.1 Tank Summary

Tank C-6-T is a nominal, 710-gal (375 gal usable), vertical tank installed in 1965 near the Radiochemical Engineering Development Center (REDC) (Building 7930) in the Melton Valley High Flux Isotope Reactor (HFIR) Complex (Figures 2.9-1 and 2.9-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank C-6-T is used as a process collection tank for the Radioactive Hot Drain Recoverable (RHDR) System and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.9.2 Standards for Design Demonstration

2.9.2.1 Tank Description and Design Standards

Tank Description

Tank C-6-T is located near the southwest corner of Building 7930 in an underground vault with Tanks B-2-T and B-3-T. The tank is under the control of the REDC and operated by the Chemical Technology Division. The Oak Ridge National Laboratory (ORNL) coordinates for Tank C-6-T centerlines are N 17697.33 and E 32561.5.

Tank C-6-T is a nominal, 710-gal (375 gal usable), vertical tank constructed of type 304L SS. The tank has an outside diameter of 4'0" and an overall height of 8'10-7/8". The shell and the heads have a nominal thickness of 5/16". The tank operates under a pressure of about -15" of water gauge (wg).

Design Standards

The applicable codes and standards used for Tank System C-6-T and its associated vault and piping 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 (ASTM) A93, A244, A307, C39, C78, C138, C143, and D1752;

American Standards Association (ASA) Safety Code for Building Construction;

American Concrete Institute (ACI);

American Concrete Pipe Association (ACPA);

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

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Occupational Safety and Health Administration (OSHA);

American Society of Mechanical Engineers (ASME), Sections II, IV, VIII, and IX;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

American Conference of Governmental Industrial Hygienists (ACGIH);

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

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

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

NFPA No. 91—Blower and Exhaust Systems;

National Electric Code;

Underwriters Laboratories Inc.;

Factory Mutual Engineering Corporation;

American National Standards Institute (ANSI); and

Instrument Society of America (ISA).

2.9.2.2 Generic Description of Tank Contents

Tank C-6-T is designed to serve as an LLLW collection tank for the Building 7930 RHDR System. The primary source of LLLW in the building is from Cell G (Figure 2.9-3). These wastes may include a variety of dilute acids, bases, and organics. The tank may contain radioactive materials from the REDC.

The analytical data (Figure 2.9-8) of waste stream contaminants from the generators are representative of wastes transferred to and stored in Tank C-6-T.

2.9.2.3 Corrosion Protection Measures

Tank C-6-T is located near the southwest corner of Building 7930 in an underground, coated, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.9.2.4 Documented Age

Tank C-6-T was installed in 1965.

2.9.3 Standards for Containment/Release Detection

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

Tank C-6-T is constructed of type 304L SS. The tank vault floor is provided with a 30-mil-thick system of Amercoat 66 epoxy, and the tank vault walls are provided with a 5-mil-thick system of Amercoat 99 vinyl emulsion (Figure 2.9-4).

The assessment concludes that, according to manufacturer's specifications, the vault's epoxy-coated floor and vinyl-emulsion-coated walls are compatible with the stored waste and designed to 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 C-6-T is located in an underground, reinforced concrete vault (Figure 2.9-5). Tank C-6-T shares the vault with Tanks B-3-T and B-2-T. The vault inside dimensions are 10'0" × 25'6" × 19'3" high. The floor slab and three walls are 2'0" thick; and the east wall is 3'0" thick, reinforced concrete. The roof is constructed of three, removable, reinforced concrete plugs which are 4'6" thick. The vault floor elevation is 825'0", which is 23'0" below grade (EL. 848'0").

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

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

Tank C-6-T is provided with a tank level monitor and is located in a coated vault. Any leakage from Tank C-6-T is gravity fed to a sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of Building 7930.

The assessment concludes that Tank System C-6-T is provided with a leak detection system.

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

The Tank C-6-T vault bottom slopes to a 1'0" × 1'0" × 1'0" deep, epoxy-coated sump with a capacity of 7.5 gal. The sump provides a low point within the tank vault to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The secondary containment is designed minimize the potential for rainwater inleakage; however, the removable plugs located on the containment roof are known to leak occasionally. This inleakage is contained and subsequently removed from the secondary containment system.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.9.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank C-6-T is located in a coated, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank C-6-T is located in a below-grade vault with coatings designed to be leaktight. The epoxy-coated portion of the vault measures 10'0" × 25'6" × 19'3" high, which represents a total volume of 36,700 gal. Of that total volume, 1870 gal are occupied by Tank B-2-T; and 1870 gal are occupied by Tank B-3-T, leaving an available containment volume of 32,960 gal. The nominal full tank content of Tank C-6-T is 710 gal (375 gal usable).

The assessment concludes that the coated vault is sufficient to contain the full tank volume along with the occasional roof plug inleakage .

Infiltration

Site and storm drainage design around the perimeter of the vault containing Tank C-6-T provides for surface water runoff to prevent any buildup of surface water during rainfall. Site grades around the vault containing Tank C-6-T slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the vault containing Tank C-6-T are maintained at a minimum of 8" below perimeter walls to prevent water run-on. The 2'0" thick, reinforced concrete tank vault walls have an external, three-ply application of coal tar pitch type membrane coating; and the floor slab has a 6-mil-thick, polyethylene membrane, which comprise the waterproofing system. The pipe penetrations through the walls were sealed to the waterproof membrane and the roof plug joints are caulked with resilient type sealer. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 825'0", which is 23'0" below grade (EL. 848'0") (Figure 2.9-6).

The tank vault is designed with a 6" diameter, 16-gauge, galvanized, perforated pipe located around the foundation base to provide a foundation drain system. The pipe header is routed to the storm water sewer.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank C-6-T secondary containment structure is constructed with 16-oz, cold-rolled copper water stops and 2" x 6" keyways in all below-grade construction joints, but the water stops are not chemical resistant. However, it is unlikely that water from outside the system or LLLW from inside the system will come in contact with the water stops because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of chemical resistance is not considered significant.

Vapor Protection, Vessel Vent System

Tank C-6-T is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system). Both the tank and the vault are vented to the atmosphere via a HEPA-filtered exhaust system and the 7911 Stack. The tank ventilation flow rate is approximately 40 CFM, and the vault ventilation flow rate is approximately 100 CFM. The ventilation system is designed to maintain the tank at a more negative pressure than the vault, which is at a negative pressure relative to the atmosphere (Figure 2.9-7).

The assessment concludes that Tank System C-6-T is provided with a means to protect against the formation and ignition of vapors.

2.9.4 Supplemental Information

2.9.4.1 Ancillary Equipment

Piping associated with Tank C-6-T is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from 304L SS, which is the same material as that used in Tank C-6-T. The transfer piping and associated equipment are exposed to the same liquids as Tank C-6-T; therefore, 304L SS is acceptable for the support equipment. Piping and related equipment within the confines of the vault system is provided secondary containment by the coated vault.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.9.4.2 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 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 that includes Tank C-6-T.

2.9.5 References

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Figure 2.9-1 Location of Radiochemical Engineering Development Center

Figure 2.9-2
Layout of the Waste Pit Tanks

Figure 2.9-3 Schematic of the Liquid Low-Level Waste System

- FCV - FLOW CONTROL VALVE (REMOTE OPERATION)
 RHDR - RADIOACTIVE HOT DRAIN RECOVERABLE
 RHD-HOG - RADIOACTIVE HOT DRAIN-HOT OFF-GAS
 TE - TEMPERATURE ELEMENT
- STEAM JET

Figure 2.9-4 Tanks B-2-T, B-3-T and C-6-T Vault

REF. DWG. S-20998-Y-223-E

EBASCO, MAIN

Figure 2.9-5 Tanks B-2-T, B-3-T and C-6-T Vault

SECTION B-B

REF. DWG. S-20998-Y-223-E

Figure 2.9-6
Filter and Waste Pit (Building 7930) Grading Plan

Figure 2.9-7 Tanks B-2-T, B-3-T and C-6-T H&V Diagram

**Figure 2.9-8
Analytical Data For Liquid**

WASTE STREAM CONTAMINANTS:

(a)	Isotopes:	<u>Cf-252</u>	(b)	Quantities	<u>0.5 mg/year</u>
		<u>Other Cf</u>			<u>Trace</u>
		<u> </u>			<u> </u>
(b)	Others (i.e. acids, bases, organics, cleaners, etc.)				
		<u>acidified butyrates</u>			<u>824.9 g/year</u>
		<u>nitric acid (dilute)</u>			<u>Trace</u>
		<u>palladium tetrammine di-hydrate</u>			<u>Trace</u>
		<u>hydrazine decomposition products</u>			<u>Trace</u>
		<u> </u>			<u> </u>

2.10 Tank F-111

2.10.1 Tank Summary

Tank F-111 is a nominal, 125-gal, vertical tank installed in 1966 in the Transuranium Processing Plant (Building 7920) at the Melton Valley High Flux Isotope Reactor (HFIR) Complex (Figures 2.10-1 and 2.10-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, Hastelloy "C" lined, reinforced concrete vault. Tank F-111 is used to collect liquid low-level waste (LLW) from Building 7920 and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.10.2 Standards for Design Demonstration

2.10.2.1 Tank Description and Design Standards

Tank Description

Tank F-111 is located in the lower level of Building 7920 with Tanks F-115 and F-126. The tank is under the control of the Radiochemical Engineering Development Center (REDC) and operated by the Chemical Technology Division. The Oak Ridge National Laboratory (ORNL) coordinates for the Tank F-111 centerlines are N 17464.75 and E 32608.09.

Tank F-111 is a nominal, 125-gal, vertical tank constructed of type 304L SS. The tank has an outside diameter of 2'3", a vertical straight sidewall length of 4'0" with ASME flanged and dished heads, and an overall length of 5'1". The shell and the heads have a nominal thickness of 5/16". The tank has an integral external water-cooled jacket. The tank is designed for full vacuum, with atmospheric pressure in the jacket at 200°F and atmospheric pressure with 55 psig in the jacket at 200°F, and operates at a pressure of -4" to -12" of water gauge (wg).

Design Standards

The applicable codes and standards used for Tank System F-111 and its associated vault and piping 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 (ASTM) A93, A245, A307, C39, C144, D1190, and D1751;

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

American Concrete Pipe Association (ACPA);

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

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Occupational Safety and Health Administration (OSHA);

American Society of Mechanical Engineers (ASME), Sections II, V, IV, VIII, and IX;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

American Conference of Governmental Industrial Hygienists (ACGIH);

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

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

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

NFPA No. 91—Blower and Exhaust Systems;

National Electric Code;

Underwriters Laboratories Inc.;

Factory Mutual Engineering Corporation;

American National Standards Institute (ANSI); and

Instrument Society of America (ISA).

2.10.2.2 Generic Description of Tank Contents

Tank F-111 is designed to serve as an LLLW process collection tank for Building 7920. The primary source of LLLW is from water used in equipment flushing procedures, condensate transferred from Tank T-34, and high pH de jacketing waste solutions transferred from Tank T-70 (Figure 2.10-3). 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 2.10-8) of waste stream contaminants from the generators are representative of the wastes transferred to and stored in Tank F-111.

2.10.2.3 Corrosion Protection Measures

Tank F-111 is located in the lower level of Building 7920 in a Hastelloy "C" lined, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.10.2.4 Documented Age

Tank F-111 was installed in 1966.

2.10.3 Standards for Containment/Release Detection

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

Tank F-111 is constructed of type 304L SS. The vault bottom is lined with 1/4", Hastelloy "C" plate with sidewalls lined with 1/8", Hastelloy "C" plate (Figure 2.10-4). The vault walls above the Hastelloy "C" liner are coated with a 30-mil-thick system of Amercoat 66 epoxy.

The assessment concludes that the Hastelloy "C" lining material is compatible with the stored waste and designed to prevent migration of waste into the concrete. The assessment also concludes that, according to manufacturer's specifications, the vault's epoxy-coated walls are compatible with the stored 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 F-111 is located in the lower level of Building 7920 in a Hastelloy "C" lined, reinforced concrete vault (Figure 2.10-5). Tank F-111 shares the vault with Tanks F-115 and F-126. The tank vault foundation is a 17'6" x 22'8" x 2'6" thick, reinforced concrete base slab which supports Tanks F-111, F-115, and F-126. The tank vault floor elevation is 835'6", which is 11'6" below finished grade (EL. 847'0").

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

2.10.3.3 Provide with a Leak Detection System to Operate or Detect Failure of Either Primary or Secondary Containment or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents.

Tank F-111 is provided with a tank level monitor and is located in a Hastelloy "C" lined vault. Any leakage from Tank F-111 is gravity fed to a Hastelloy "C" lined sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of the Transuranium Processing Plant (Building 7920).

The assessment concludes that Tank System F-111 is provided with a leak detection system.

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

The Tank F-111 vault bottom slopes to a 6" diameter by 1'0" deep, Hastelloy "C," schedule 10S lined sump. The sump provides a low point within the tank vault to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The Tank F-111 inlet and outlet nozzles are located on the top head of the tank preventing accidental tank leakage from piping attachment failure.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.10.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency.

Tank F-111 is located in a Hastelloy "C" lined, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank F-111 is located in a below-grade vault with a Hastelloy "C" liner designed to be leaktight. The 8'6" × 15'8" × 6" high (from finished vault floor) vault liner provides containment for 600 gal of liquid compared with a nominal full tank content of 125 gal for Tank F-111.

The assessment concludes that the Hastelloy "C" lined vault is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage around the perimeter of Building 7920 provides for surface water runoff to prevent any buildup of surface water during rainfall. Site grades around the building containing Tank F-111 slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the vault containing Tank F-111 are maintained at 3'6" below perimeter walls preventing water run-on (Figure 2.10-6). The 4'0" thick, reinforced concrete tank vault walls have an external, five-ply asphalt or tar-type vapor-barrier membrane forming a waterproofing system. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 835'6", which is 11'6" below finished grade (EL. 847'0").

The building is designed with subsurface drainage around the foundation base to provide a foundation drain system. The perforated vitrified clay pipe discharges to the storm water sewer.

The maintenance access plugs located in the vault ceiling are caulked with resilient type sealer to minimize the potential for water leakage.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank F-111 secondary containment structure is constructed with 6" water stops in all below-grade construction joints; but, neither the design drawings nor the construction specifications indicate that they are chemical resistant. However, it is unlikely that water from outside the system or LLLW from inside the system will come in contact with the water stops because the vault is externally waterproofed, internally lined, and provided with an alarmed leak detection and removal system. Therefore, the lack of chemical resistance is not considered significant.

Vapor Protection, Vessel Vent System

Tank F-111 is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system).

Tank F-111 is vented through a HEPA-filtered offgas system that keeps the tank under a negative pressure relative to the vault pressure. The vault is ventilated with a cell exhaust ventilation system that generates a sweep flow rate of approximately 400 CFM through the vault. The cell exhaust system was designed to keep the vault at a negative pressure and is HEPA filtered (Figure 2.10-7).

The assessment concludes that Tank System F-111 is provided with a means to protect against the formation and ignition of vapors.

2.10.4 Supplemental Information

2.10.4.1 Ancillary Equipment

Piping associated with Tank F-111 is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from type 304L SS or Hastelloy "C." Tank F-111 is constructed of type 304L SS and the tank vault is lined with Hastelloy "C." The transfer piping and associated equipment are exposed to the same liquids as Tank F-111. Therefore, type 304L SS and Hastelloy "C" are acceptable for the support equipment. Within the confines of the vault system, the vault provides secondary containment; and any leakage from piping and related equipment collects in the Hastelloy "C" lined sump.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.10.4.2 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 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 that includes Tank F-111.

2.10.5 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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Figure 2.10-2 Layout of the Waste Pit Tanks

REF. DWG. 2397-V-303

EBASCO, MAIN

Figure 2.10-3
Schematic of the Liquid Low-Level Waste System

REF. DWG. E-58088

EBASCO/MAIN

Figure 2.10-4
Tank Vault Hastelloy "C" Liner

Figure 2.10-5
Tank Vault Hastelloy "C" Liner

SECTION J-J

REF. DWG. 2397-V-248

This is a detailed site plan for the Transuranium Processing Plant. The plan includes the following features and annotations:

- TRANSURANIUM-PROCESSING PLANT:** The central building complex, with a note indicating "FINISHED FIRST FLOOR ELEV. 850.50" and "BUILDING 7720".
- PARKING AREA:** Located to the left of the main building complex.
- MAINTENANCE SHOP ADDITION:** A structure to the right of the main plant, with a note "FOR ALTERATIONS TO STORAGE AREA" and a reference "REF DWG. 2397-V-52".
- EXHAUST STACK AND FAN:** Located in the lower right corner, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** Another structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A third structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A fourth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A fifth structure in the lower right, with a note "FUTURE PLANS".
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- EXHAUST STACK AND FAN:** A tenth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** An eleventh structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A twelfth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirteenth structure in the lower right, with a note "FUTURE PLANS".
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- EXHAUST STACK AND FAN:** A sixteenth structure in the lower right, with a note "FUTURE PLANS".
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- EXHAUST STACK AND FAN:** A twenty-third structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A twenty-fourth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A twenty-fifth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A twenty-sixth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A twenty-seventh structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A twenty-eighth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A twenty-ninth structure in the lower right, with a note "FUTURE PLANS".
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- EXHAUST STACK AND FAN:** A thirty-first structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirty-second structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirty-third structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirty-fourth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirty-fifth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirty-sixth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirty-seventh structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirty-eighth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A thirty-ninth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A fortieth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-first structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-second structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-third structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-fourth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-fifth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-sixth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-seventh structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-eighth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A forty-ninth structure in the lower right, with a note "FUTURE PLANS".
- EXHAUST STACK AND FAN:** A fiftieth structure in the lower right, with a note "FUTURE PLANS".

The plan also includes various other annotations such as "LOADING DOCK", "EXHAUST WALKWAY TEMPORARILY EXCLUDED", and "FOR ALTERATIONS TO STORAGE AREA". The drawing is identified as "REF. DWG. 2397-V-52".

EBASCO, MAIN

Figure 2.10-7 Tanks F-111 and F-126 H&V Diagram

REF. DWG. 2397-V-03

**Figure 2.10-8
Analytical Data For Liquid**

WASTE STREAM CONTAMINANTS:

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

(b) Others (i.e. acids, bases, organics, cleaners, etc.)	
<u>sodium nitrate</u>	<u>Trace</u>
<u>nitric acid</u>	<u>Trace</u>
<u>sodium hydroxide</u>	<u>Trace</u>
<u>potassium iodide</u>	<u>Trace</u>
<u>ferrous chloride</u>	<u>Trace</u>
<u>ferrous sulfate</u>	<u>Trace</u>
<u>thenoyltrifluoroacetone (TTA)</u>	<u>Trace</u>
<u> </u>	<u> </u>

2.11 Tank F-126

2.11.1 Tank Summary

Tank F-126 is a nominal, 1200-gal, vertical tank installed in 1966 in the Transuranium Processing Plant (Building 7920) at the Melton Valley High Flux Isotope Reactor (HFIR) Complex (Figures 2.11-1 and 2.11-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, Hastelloy "C" lined, reinforced concrete vault. Tank F-126 is used to collect liquid low-level waste (LLLW) from Building 7920 and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.11.2 Standards for Design Demonstration

2.11.2.1 Tank Description and Design Standards

Tank Description

Tank F-126 is located in the lower level of Building 7920 with Tanks F-111 and F-115. The tank is under the control of the Radiochemical Engineering Development Center (REDC) and operated by the Chemical Technology Division. The Oak Ridge National Laboratory (ORNL) coordinates for the Tank F-126 centerlines are N 17466.34 and E 32612.84.

Tank F-126 is a nominal, 1200-gal, vertical tank constructed of type 304L SS. The tank has an outside diameter of 5'6", a vertical straight sidewall length of 5'5-1/2" with ASME flanged and dished heads, and an overall length of 7'8-1/2". The shell and the heads have a nominal thickness of 5/16". The tank has an integral external water-cooled jacket. The tank is designed for full vacuum, with atmospheric pressure in the jacket at 200°F and atmospheric pressure with 55 psig in the jacket at 200°F, and operates at a pressure of -4" to -12" of water gauge (wg).

Design Standards

The applicable codes and standards used for Tank System F-126 and its associated vault and piping 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 (ASTM) A93, A245, A307, C39, C144, D1190, and D1751;

American National Standards Institute (ANSI);

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

American Concrete Pipe Association (ACPA);

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

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Occupational Safety and Health Administration (OSHA);

American Society of Mechanical Engineers (ASME), Sections II, IV, V, VIII, and IX;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

American Conference of Governmental Industrial Hygienists (ACGIH);

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

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

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

NFPA No. 91—Blower and Exhaust Systems;

National Electric Code;

Underwriters Laboratories Inc.;

Factory Mutual Engineering Corporation; and

Instrument Society of America (ISA).

2.11.2.2 Generic Description of Tank Contents

Tank F-126 is designed to serve as an LLLW process collection tank for Building 7920. The primary source of LLLW is spent caustic from the scrubber, aqueous acidic wastes from Tank F-115, and neutralized organic wastes (Figure 2.11-3). 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 2.11-8) of waste stream contaminants from the generators are representative of the waste that may be transferred to and stored in Tank F-126.

2.11.2.3 Corrosion Protection Measures

Tank F-126 is located in the lower level of Building 7920 in a Hastelloy "C" lined, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.11.2.4 Documented Age

Tank F-126 was installed in 1966.

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 Substances(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness To Prevent Failure

Tank F-126 is constructed of type 304L SS. The vault bottom is lined with 1/4", Hastelloy "C" plate with sidewalls lined with 1/8", Hastelloy "C" plate (Figure 2.11-4). The vault walls above the Hastelloy "C" liner are coated with a 30-mil-thick system of Amercoat 66 epoxy.

The assessment concludes that the Hastelloy "C" lining material is compatible with the stored waste and designed to prevent migration of waste into the concrete. The assessment also concludes that, according to manufacturer's specifications, the vault's epoxy-coated walls are compatible with the stored waste and designed to prevent migration of waste into the concrete.

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

Tank F-126 is located in the lower level of Building 7920 in a Hastelloy "C" lined, reinforced concrete vault (Figure 2.11-5). Tank F-126 shares the vault with Tanks F-111 and F-115. The tank vault foundation is a 17'6" x 22'8" x 2'6" thick, reinforced concrete base slab which supports Tanks F-111, F-115, and F-126. The tank vault floor elevation is 835'6", which is 11'6" below finished grade (EL. 847'0").

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

2.11.3.3 Provided with a Leak Detection System to Operate or Detect Failure of Either Primary or Secondary Containment or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents.

Tank F-126 is provided with a tank level monitor and is located in a Hastelloy "C" lined vault. Any leakage from Tank F-126 is gravity fed to a Hastelloy "C" lined sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in the operating area of the Transuranium Processing Plant (Building 7920).

The assessment concludes that Tank System F-126 is provided with a leak detection system.

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

The Tank F-126 vault bottom slopes to a 6" diameter by 1'0" deep, Hastelloy "C," schedule 10S, lined sump. The sump provides a low point within the tank vault to drain liquids to an instrumented location. A pumping system is provided to remove liquids that accumulate in the sump.

The Tank F-126 inlet and outlet nozzles are located on the top head of the tank preventing accidental tank leakage from piping attachment failure.

The assessment concludes that the secondary containment is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.11.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency.

Tank F-126 is located in a Hastelloy "C" lined, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank F-126 is located in a below-grade vault with a Hastelloy "C" liner and epoxy-coated walls designed to be leaktight. The 8'6" × 15'8" × 6" high (from finished vault floor) vault liner provides containment for 600 gal of liquid in the liner. The vault walls above the liner are coated with a 30-mil-thick system of Amercoat 66 epoxy. This coating allows for an additional liquid holding capacity of 10,400 gal. Tank F-126 has a nominal tank content of 1200 gal.

The assessment concludes that the Hastelloy "C" lined vault along with the epoxy-coated walls is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage around the perimeter of Building 7920 provides for surface water runoff to prevent any buildup of surface water during rainfall. Site grades around the building containing Tank F-126 slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the vault containing Tank F-126 are maintained at 3'6" below perimeter walls preventing water run-on (Figure 2.11-6). The 4'0" thick, reinforced concrete tank vault walls have an external, five-ply asphalt or tar-type vapor-barrier membrane forming a waterproofing system. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 835'6", which is 11'6" below finished grade (EL. 847'0").

The building is designed with subsurface drainage around the foundation base to provide a foundation drain system. The perforated vitrified clay pipe discharges to the storm water sewer.

The maintenance access plugs located in the vault ceiling are caulked with resilient type sealer to minimize the potential for water inleakage.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank F-126 secondary containment structure is constructed with 6" water stops in all below-grade construction joints; but neither the design drawings nor the construction specifications indicate that they are chemical resistant. However, it is unlikely that water from outside the system or LLLW from inside the system will come in contact with the water stops because the vault is externally waterproofed, internally lined, and provided with an alarmed leak detection and removal system. Therefore, the lack of chemical resistance is not considered significant.

Vapor Protection, Vessel Vent System

Tank F-126 is provided with a tank offgas system (primary system) and a vault space ventilation system (secondary system).

Tank F-126 is vented through a HEPA-filtered offgas system that keeps the tank under a negative pressure relative to the vault pressure. The vault is ventilated with a cell exhaust ventilation system that generates a sweep flow rate of approximately 400 CFM through the vault. The cell exhaust system was designed to keep the vault at a negative pressure and is HEPA filtered (Figure 2.11-7).

The assessment concludes that Tank System F-126 is provided with a means to protect against the formation and ignition of vapors.

2.11.4 Supplemental Information

2.11.4.1 Ancillary Equipment

Piping associated with Tank F-126 is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from type 304L SS or Hastelloy "C." Tank F-126 is constructed of type 304L SS and the tank vault is lined with Hastelloy "C." The transfer piping and associated equipment are exposed to the same liquids as Tank F-126. Therefore, type 304L SS and Hastelloy "C" are acceptable for the support equipment. Within the confines of the vault system, the vault provides secondary containment; and any leakage from piping and related equipment collects in the Hastelloy "C" lined sump.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.11.4.2 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 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 that includes Tank F-126.

2.11.5 References

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

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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.

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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 Offgas and Cell Cubicle Vents, Revision 5.

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LLLW Generator Survey 1990 for Building 7920.

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Figure 2.11-1 Location of Transuranium Processing Plant (Building 7920) at ORNL

Figure 2.11-2 Layout of the Waste Pit Tanks

REF. DWG. 2397-V-303

EBASCO, MAIN

15'-8" REF. OUTSIDE PAN (INSIDE PIT)

8'-0" REF. OUTSIDE PAN (INSIDE PIT)

EDGE OF H. TYP.

EDGE OF COV. TYP.

PC-10

PC-11

PC-12

PC-13

PC-14

PC-15

PC-16

PC-17

PC-18

PC-19

PC-20

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Figure 2.11-5
Tank Vault Hastelloy "C" Liner

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Figure 2.11-7 Tanks F-111 and F-126 H&V Diagram

REF. DWG. 2397-V-03

**Figure 2.11-8
Analytical Data For Liquid**

WASTE STREAM CONTAMINANTS:

(a)	Isotopes: <u>Cm-244,245,246,247</u>	(b)	Quantities	<u>Trace</u>
	<u>Cf-250,251,252</u>			<u>Trace</u>
	<u>Sr-90</u>			<u>Trace</u>
	<u>Tc-99</u>			<u>Trace</u>
	<u>Cs-137</u>			<u>Trace</u>
	<u>Am-241,242,243</u>			<u>Trace</u>
	<u> </u>			<u> </u>
(b)	Others (i.e. acids, bases, organics, cleaners, etc.)			
	<u>sodium nitrate</u>			<u>Trace</u>
	<u>nitric acid</u>			<u>Trace</u>
	<u>sodium hydroxide</u>			<u>Trace</u>
	<u>potassium iodide</u>			<u>Trace</u>
	<u>ferrous chloride</u>			<u>Trace</u>
	<u>ferrous sulfate</u>			<u>Trace</u>
	<u>thenoyltrifluoroacetone (TTA)</u>			<u>Trace</u>

2.12 Tank WC-20

Based on the findings of this document, Tank 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.

2.12.1 Tank Summary

Tank WC-20 is a nominal, 10,000-gal, horizontal tank installed in 1976 near the Melton Valley Storage Tank Facility Building 7569 (Figures 2.12-1 and 2.12-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, SS-lined, reinforced concrete vault. Tank WC-20 is used as a collection tank for liquid low-level waste (LLLW) generated from Buildings 7920 and 7930 and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.12.2 Standards for Design Demonstration

2.12.2.1 Tank Description and Design Standards

Tank Description

Tank WC-20 is located adjacent to the Building 7569 Control House and is used and managed by the Waste Management and Remedial Actions Division. The tank is a part of the Melton Valley LLLW System. The Oak Ridge National Laboratory (ORNL) coordinates for the Tank WC-20 centerlines are N 18997.7 and E 32600.5.

Tank WC-20 is a nominal, 10,000-gal, horizontal tank constructed of type 304L SS with dished heads. The shell and heads have a nominal thickness of 3/8". The tank has an outside diameter of 10'0", a straight sidewall length of 15'7-7/8", and an overall length of 19'5-5/8". The tank is stamped as an ASME Section VIII pressure vessel to 15 psig with a design temperature of 150°F and operates at slightly negative pressure relative to the vault.

Design Standards

The applicable codes and standards used for Tank System WC-20 and its associated vault and piping 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 (ASTM) A48, A262-70, C91, C139, C144, and D1751;

Union Carbide Corporation-Nuclear Division (UCC-ND) Standards, Sections 303, 401, 411, 702, and 914.04;

UCC-ND Engineering Standard Y-EF-538;

American Concrete Institute (ACI), 301-72;

American Concrete Pipe Association (ACPA);

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

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Occupational Safety and Health Administration (OSHA);

UCC-ND Technical Specifications;

UCC-ND General Design Criteria, Y-EF-53;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

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

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

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;

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

NFPA No. 91—Blower and Exhaust Systems

National Electric Code;

Design, Construction, and Testing of High Efficiency Air Filtration Systems for Nuclear Applications—Nuclear Safety Information Center 65;

Underwriters Laboratories Inc.;

Factory Mutual Engineering Corporation; and

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Codes, Sections II, V, VIII, and IX.

2.12.2.2 Generic Description of Tank Contents

Tank WC-20 is designed to serve as an LLLW collection tank for Buildings 7920 and 7930. LLLW is produced from radiochemical operations designed to recover isotopes produced from irradiated HFIR targets and other sources. These wastes may include a variety of dilute acids, bases, and organics. The pH of Tank WC-20 is maintained at alkaline levels. The tank may contain radioactive materials from the Radiochemical Engineering Development Center, which is the main contributor of transuranic radionuclides in the LLLW System (Figure 2.12-3).

The analytical data (Figure 2.12-8) of waste stream contaminants from the generators are representative of waste that may be transferred to and stored in Tank WC-20.

2.12.2.3 Corrosion Protection Measures

Tank WC-20 is located in an underground, 304L SS-lined, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.12.2.4 Documented Age

Tank WC-20 was installed in 1976.

2.12.3 Standards for Containment/Release Detection

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

Tank WC-20 is constructed of 304L SS. The vault bottom is lined with 11-gauge (1/8"), 304L SS with sidewalls of 16-gauge (1/16"), 304L SS (Figures 2.12-4 and 2.12-5).

The assessment concludes that the SS lining material is compatible with the stored waste and designed to prevent migration of waste into the concrete.

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

Tank WC-20 is located in an underground 304L SS-lined, reinforced concrete vault adjacent to the Control House (Building 7569). The tank vault measures 18'0" × 25'0" with 2'0" thick, reinforced concrete base slab and walls. The tank vault floor elevation is 845'6", which is 17'9" below finished grade (EL. 863'3"). The base slab for the vault is set on the rock line with approximately 6" of stabilizing aggregate for leveling purposes.

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

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

Tank WC-20 is provided with a tank level monitor and is located in a 304L SS-lined vault. Any leakage from Tank WC-20 is gravity fed to the sump where accumulation of liquid will be detected by a pneumatic level indicator, and an alarm will sound in Building 7569. The alarm is also telemetered to the Waste Operations Control Center (Building 3130).

The assessment concludes that Tank System WC-20 is provided with a leak detection system.

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

The Tank WC-20 vault bottom slopes to a 2'0" × 2'0" × 2'0" deep, 304L SS-lined sump with a capacity of 60 gal. The sump provides a low point within the tank vault 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 is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.12.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank WC-20 is located in an SS-lined, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank WC-20 is located in a below-grade vault with a 304L SS liner designed to be leaktight. The 14'0" × 21'0" × 5'0" high (from finished vault floor) vault liner provides containment for 10,995 gal of liquid compared with a nominal full tank content of 10,000 gal for Tank WC-20.

The assessment concludes that the SS-lined vault is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of the Tank WC-20 vault provides for surface water runoff to prevent any buildup of surface water during rainfall. Site grades around the Tank WC-20 vault slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the Tank WC-20 vault are maintained at a minimum of 6" below perimeter walls to prevent water run-on. The 2'0" thick, reinforced concrete tank vault walls have an external vapor barrier membrane with an asphalt composition of oxidized asphalt and mineral aggregate forming a waterproofing system. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 845'6", which is 17'9" below finished grade (Figure 2.12-6). The maximum water table elevation at the Tank WC-20 vault is 847'4" per groundwater measurements.

The tank vault is designed with a 6", polyvinyl chloride (PVC) pipe located around the foundation base to provide a foundation drain system. The PVC pipe header is routed to the storm water sewer. The 3'0" thick, reinforced concrete vault roof slab is sloped to channel water to a drainage collection system minimizing water buildup. A maintenance access plug is normally sealed in place to minimize the potential for leakage to the vault containment.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank WC-20 secondary containment structure is constructed with chemical-resistant PVC water stops in all below-grade construction joints.

The assessment concludes that the secondary containment structure is constructed with chemical-resistant water stops.

Vapor Protection, Vessel Vent System

Tank WC-20 is provided with a tank offgas system (primary system). A vault space ventilation system (secondary system) is not provided.

Tank WC-20 is vented through a HEPA-filtered tank offgas system with an air flow of 100 CFM, which maintains the tank at a negative pressure relative to the vault pressure (Figure 2.12-7). The tank offgas system has an explosive gas analyzer that is checked daily and also has an alarm which is telemetered to the Waste Operations Control Center (Building 3130)

The assessment concludes that Tank WC-20 is provided with a means to protect against the formation and ignition of vapors; however, a vault space ventilation system is not provided.

2.12.4 Supplemental Information

2.12.4.1 Ancillary Equipment

Piping associated with Tank WC-20 is constructed of type 304L SS. Tank WC-20 is constructed of type 304L SS. The transfer piping is exposed to the same liquids as Tank WC-20; therefore, type 304L SS is acceptable for the support equipment. Within the confines of the vault system, the vault provides secondary containment; and any leakage from the piping is collected in the SS-lined sump.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

2.12.4.2 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 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 that includes Tank WC-20.

2.12.5 References

Energy Systems Drawing C-20854-YA-002E, Melton Valley Collection Tank Excavation and Sections, Revision D.

Energy Systems Drawing I-20854-YE-001-E, Melton Valley Collection Tank, Instrument Flow Diagram Process, Revision G.

Energy Systems Drawing I-20854-YE-001-E, Melton Valley Collection Tank, Instrument Flow Diagram Ventilation, Revision G.

Energy Systems Drawing S-20854-YB-002E, Melton Valley Collection Tank, Sections of Concrete Vault and Valve Pit, Revision E.

Energy Systems Drawing C-20854-YA-001E, Melton Valley Collection Tank Site and Grading Plan, Revision F.

Energy Systems Drawing S-20854-YB-006E, Melton Valley Collection Tank, Tank Plan, Section and Detail, Revision 3.

Energy Systems Drawing P-20854-YC-001-E, Melton Valley Collection Tank, Tank WC-20 Control Room and Valve Pit Tank Piping Plan and Sections, Revision C.

Energy Systems Drawing C-20854-EA-003-D, Site Plan Auger Hole, Location TRU-Turf Collection Tank WC-20, Revision O.

Energy Systems Drawing X-20854 EE 001-D, TRU and TURF 10,000 Gal Tank Flow Sheet, Dated 2/5/73 (No Revision No.).

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

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.

Samborn, Steketee, Otis, and Evans, Inc. 1975. *Intermediate Level Waste Management Facilities Title I Report (Book 1 and 2)*, Holifield National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Laboratory.

Waste Generator Survey for Buildings 7920 and 7930.

Figure 2.12-1
Location of Tank WC-20

Figure 2.12-2
Layout of Tank WC-20

PLAN VIEW

Figure 2.12-3
Schematic of the Liquid Low-Level Waste System

REF. DWG. X-20854-EE-001-D

Figure 2.12-4 Tank WC-20 Vault and Liner

Figure 2.12-5 Tank WC-20 Vault and Liner

REF. DWG. S-20854-YB-002-E

EBASCO. MAIN

Figure 2.12-6 Tank Vault Grading Plan

REF. DWG. C-20854-YA-001-E

Figure 2.12-7 Tank WC-20 H&V Diagram

REF. DWG. I-20854-YE-001-E

**Figure 2.12-8
Analytical Data For Liquid**

WASTE STREAM CONTAMINANTS:

(a) Isotopes: <u>Cm-244,245,246,247</u>	(b) Quantities <u>Trace</u>
<u>Cf-250,251,252</u>	<u>Trace</u>
<u>Sr-90</u>	<u>Trace</u>
<u>Tc-99</u>	<u>Trace</u>
<u>Cs-137</u>	<u>Trace</u>
<u>Am-241,242,243</u>	<u>Trace</u>
<u> </u>	<u> </u>
(b) Others (i.e. acids, bases, organics, cleaners, etc.)	
<u>sodium nitrate</u>	<u>Trace</u>
<u>nitric acid</u>	<u>Trace</u>
<u>sodium hydroxide</u>	<u>Trace</u>
<u>potassium iodide</u>	<u>Trace</u>
<u>ferrous chloride</u>	<u>Trace</u>
<u>ferrous sulfate</u>	<u>Trace</u>
<u>thenoyltrifluoroacetone (TTA)</u>	<u>Trace</u>

2.13 Tank F-201

Based on the findings of this document, Tank 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.

2.13.1 Tank Summary

Tank F-201 is a nominal, 50-gal, vertical tank installed in 1962 near the High Radiation Level Examination Laboratory (Building 3525) at the main Bethel Valley Complex (Figures 2.13-1 and 2.13-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank F-201 is used as a storage well drain transfer tank for the liquid low-level waste (LLLW) system drains from the charging area of Building 3525 and is classified as a Federal Facility Agreement (FFA) Category B tank. Tank System F-201 will be removed from service upon completion of the Bethel Valley LLLW Collection and Transfer System Upgrade project in FY 1997.

2.13.2 Standards for Design Demonstration

2.13.2.1 Tank Description and Design Standards

Tank Description

Tank F-201 is located near Building 3525 in an underground vault. The tank is used and managed by the Oak Ridge National Laboratory (ORNL) Metals and Ceramics Division and is part of the Bethel Valley LLLW System. The ORNL coordinates for the Tank F-201 centerlines are N 21925 and E 31238.

Tank F-201 is a nominal, 50-gal, vertical tank constructed of type 304L SS. The tank has an outside diameter of 1'6" with ASME flanged and dished heads and a length of 3'0".

Design Standards

The applicable codes and standards used for Tank System F-201 and its associated vault and piping 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 (ASTM) A240, A403, A298, A106, A234, A217, A181, A53, A120, A338, B75, A74, A40.1, A182, A193, A312, C76, C33, D155, A15, A185, C94, C31, C192, and C39;

American Concrete Institute (ACI) 318, 315, and 604;

Federal Specifications HHF191, SSC192, UUP264, HHF341, SSS164, QQS632, and SSA281;

American Society of Mechanical Engineers (ASME) Section VIII; and

National Fire Prevention Association.

2.13.2.2 Generic Description of Tank Contents

Tank F-201 is designed to serve as a storage well drain transfer tank for the LLLW system drains from the charging area of Building 3525. LLLW is produced from the decontamination and cleanup of the hot cells used in the disassembly and examination process (Figure 2.13-3). The tank may contain radioactive materials from Building 3525.

The analytical data (Figure 2.13-6) of the waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank F-201.

2.13.2.3 Corrosion Protection Measures

Tank F-201 is located in an underground concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.13.2.4 Documented Age

Tank F-201 was installed in 1962.

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 Substances(s) to Be Placed in the Tank System and Shall Have Sufficient Strength and Thickness To Prevent Failure

Tank F-201 is constructed of type 304L SS. The vault containing Tank F-201 is constructed of reinforced concrete but is not provided with a liner, nor does it have a protective coating on the concrete.

The assessment concludes that the vault containing Tank F-201 is not constructed of or lined with materials that are compatible with the stored waste.

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

Tank F-201 is located in an underground, reinforced concrete vault (Figure 2.13-4). The tank vault foundation is a 7'0" × 8'9" × 1'0" thick, reinforced concrete base slab. The tank vault floor elevation

is 788'1", which is 12'5" below finished grade (EL. 800'6"). The concrete base slab is designed with a minimum allowable 28-day compressive strength of 3000 psi.

The assessment concludes that the vault foundation supporting the secondary containment system is properly designed.

2.13.3.3 Provided with a Leak Detection System to Operate or Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank F-201 is provided with a tank level monitor and is located in an underground vault. Any leakage from Tank F-201 is gravity fed to a 1'0" × 1'0" × 1'0" deep sump. The sump is not provided with a leak detection system.

The assessment concludes that Tank F-201 is provided with a tank level monitor; however, the tank vault is not 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

The Tank F-201 vault bottom slopes to a 1'0" × 1'0" × 1'0" deep sump. The sump provides a low point within the tank vault to drain liquids. A pumping system is provided to remove liquids that accumulate in the sump.

The assessment concludes that the secondary containment system is designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.13.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank F-201 is located in a reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank F-201 is located in a below-grade vault with dimensions of 4'0" × 5'9" × 13'5" high (from finished vault floor) and provides containment for 2300 gal of liquid compared with a nominal full tank content of 50 gal for Tank F-201. A 1" drain line, however, connects the vault containing Tank F-201 with an adjacent vault that contains Tank F-202 and provides an additional 1800 gal of capacity.

The assessment concludes that the vault is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage around the perimeter of the vault containing Tank F-201 provides for surface water runoff to prevent buildup of surface water during rainfall. Site grades around the vault containing Tank F-201 slope away from the vault conveying rainwater to storm drain catch basin inlets (Figure 2.13-5). Finished grades around the vault are maintained at a minimum of 2'0" below perimeter walls to prevent water run-on. The 1'0" thick, reinforced concrete tank vault walls have an external waterproofing membrane and the roof plug joints are caulked with a resilient type sealer. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 788'1", which is approximately 12'5" below grade (EL. 800'6").

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank F-201 secondary containment structure is constructed with 2" x 4" keyways and chemical-resistant, polyvinyl chloride (PVC) water stops in all below-grade construction joints.

The assessment concludes that the secondary containment structure is constructed with chemical-resistant water stops.

Vapor Protection, Vessel Vent System

Tank F-201 is provided with a tank offgas system (primary system); however, a vault space ventilation system (secondary system) is not provided.

Tank F-201 is vented through a HEPA-filtered tank offgas system with an airflow of 100 CFM, which maintains the tank at a negative pressure relative to the vault pressure (Figure 2.13-3).

The assessment concludes that Tank F-201 is provided with a means to protect against the formation and ignition of vapors; however, a vault space ventilation system is not provided.

2.13.4 Supplemental Information

2.13.4.1 Ancillary Equipment

Single-wall piping and transfer equipment associated with Tank F-201 are located inside the vault, which provides secondary containment. Piping and support equipment are fabricated from 304L SS, which is the same material as that used in Tank F-201. The transfer piping and support equipment are exposed to the same liquids as Tank F-201; therefore, 304L SS is an acceptable material for the support equipment.

The assessment concludes that the ancillary equipment is properly designed for secondary containment.

2.13.4.2 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 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 that includes Tank F-201.

2.13.5 References

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

Energy Systems Drawing S-20566-Y-108-E, Concrete Sections and Details, Dated 3/24/60 (No Revision No.).

Energy Systems Drawing H-20566-Y-203-E, Flow Diagram Cell Exhaust System and Radioactive Offgas System, Revision 1.

Energy Systems Drawing H-20566-Y-202-E, Flow Diagram, Cells, Hot Equipment, Storage Area, Decontamination Area, and Maintenance Room, Revision 1.

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

Energy Systems Drawing H-20566-Y-218-E, Radioactive Offgas Pit and RHD Pit, Revision 2.

Energy Systems Drawing A-20566-Y-002-E, Plan-Basement, Revision 1.

Energy Systems Drawing H-20566-Y-225-E, Radioactive Off-Gas System, Revision 2.

Energy Systems Drawing S-20566-Y-101-E, Plot Plan and Boring Data, Revision 2.

LLLW Generator Survey 1990 for Building 3525.

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

Figure 2.13-1 Location of Building 3525

Figure 2.13-2
Layout of Tank F-201

REF. DWG. H-20566-Y-218-E

Figure 2.13-3 Schematic of the Liquid Low-Level Waste System

Figure 2.13-4 Tank F-201 Vault

Figure 2.13-5 Grading Plan

REF. DWG. S-20566-Y-101-E-R2

EBASCO/MAIN

**Figure 2.13-6
Analytical Data**

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	U-233	(b) Quantities	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

2.14 Tank F-501

Based on the findings of this document, Tank 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.

2.14.1 Tank Summary

Tank F-501 is a nominal, 400-gal, vertical tank installed in 1964 near the High Radiation Level Examination Laboratory (Building 3525) at the main Bethel Valley Complex (Figures 2.14-1 and 2.14-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank F-501 is used as a storage tank for the liquid low-level waste (LLLW) system of Building 3525 and is classified as a Federal Facility Agreement (FFA) Category B tank. Tank System F-501 will be removed from service upon completion of the Bethel Valley LLLW Collection and Transfer System Upgrade Project in FY 1997.

2.14.2 Standards for Design Demonstration

2.14.2.1 Tank Description and Design Standards

Tank Description

Tank F-501 is located near Building 3525 in an underground vault. The tank is used and managed by the Oak Ridge National Laboratory (ORNL) Metals and Ceramics Division and is part of the Bethel Valley LLLW System. The ORNL coordinates for the Tank F-501 centerlines are N 21890 and E 31246.

Tank F-501 is a nominal, 400-gal, vertical tank constructed of type 304L SS. The tank has an outside diameter of 4'0" and a length of 3'10".

Design Standards

The applicable codes and standards used for Tank System F-501 and its associated vault and piping 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 (ASTM) A15, A40.1, A53, A74, A106, A107, A120, A181, A182, A185, A193, A217, A234, A240, A298, A312, A338, A403, B75, C31, C33, C39, C76, C94, C192, and D155;

American Concrete Institute (ACI) 315, 318, and 604;

Federal Specifications HHHF191, SSC192, UUP264, HHHF341, SSS164, QQS632, and SSA281;

American Society of Mechanical Engineers (ASME), Section VIII; and

National Fire Prevention Association.

2.14.2.2 Generic Description of Tank Contents

Tank F-501 is designed to serve as a storage tank for the LLLW system of Building 3525. LLLW is produced from the decontamination and cleanup of the hot cells used in the disassembly and examination process (Figure 2.14-3). The tank may contain radioactive materials from Building 3525.

The analytical data (Figure 2.14-6) of the waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank F-501.

2.14.2.3 Corrosion Protection Measures

Tank F-501 is located in an underground concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.14.2.4 Documented Age

Tank F-501 was installed in 1964.

2.14.3 Standards for Containment/Release Detection

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

Tank F-501 is constructed of type 304L SS. The vault containing Tank F-501 is constructed of reinforced concrete but is not provided with a liner, nor does it have a protective coating on the concrete.

The assessment concludes that the vault containing Tank F-501 is not constructed of or lined with materials that are compatible with the stored waste.

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

Tank F-501 is located in an underground, reinforced concrete vault (Figure 2.14-4). The tank vault foundation is a 8'6" × 9'0" × 1'0" thick, reinforced concrete base slab. The tank vault floor elevation is 790'0", which is 10'6" below finished grade (EL. 800'6"). The concrete base slab is designed with a minimum allowable 28-day compressive strength of 3000 psi.

The assessment concludes that the vault foundation supporting the secondary containment system is properly designed.

2.14.3.3 Provided with a Leak Detection System to Operate or Detect Failure of Either Primary or Secondary Containment Structure or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank F-501 is provided with a tank level monitor and is located in an underground vault. Any leakage from Tank F-501 is gravity fed to a 1'0" × 1'0" × 1'0" deep sump where accumulation of liquid will be detected by a moisture probe that will activate an alarm locally and in the Waste Operations Control Center.

The assessment concludes that Tank System F-501 is provided with a leak detection system.

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

The Tank F-501 vault bottom slopes to a 1'0" × 1'0" × 1'0" deep sump. The sump provides a low point within the tank vault 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 system is designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.14.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank F-501 is located in a reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank F-501 is located in a below-grade vault with dimensions of 6'6" × 7'0" × 7'0" high (from finished vault floor) and provides containment for 2382 gal of liquid compared with a nominal full tank content of 400 gal for Tank F-501.

The assessment concludes that the vault is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage around the perimeter of the vault containing Tank F-501 provides for surface water runoff to prevent buildup of surface water during rainfall. Site grades around the vault containing Tank F-501 slope away from the vault conveying rainwater to storm drain catch basin

inlets (Figure 2.14-5). Finished grades around the vault are maintained at a minimum of 1'0" below perimeter walls to prevent water run-on. The 1'0" thick, reinforced concrete tank vault walls have an external waterproofing membrane and the roof plug joints are caulked with a resilient type sealer. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 790'0", which is 10'6" below grade (EL. 800'6").

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank F-501 secondary containment structure is constructed with 2" x 4" keyways and chemical-resistant, polyvinyl chloride (PVC) water stops in all below-grade construction joints.

The assessment concludes that the secondary containment structure is constructed with chemical-resistant water stops.

Vapor Protection, Vessel Vent System

Tank F-501 is provided with a tank offgas system (primary system); however, a vault space ventilation system (secondary system) is not provided.

Tank F-501 is vented through a HEPA-filtered tank offgas system with an airflow of 100 CFM, which maintains the tank at a negative pressure relative to the vault pressure (Figure 2.14-3).

The assessment concludes that Tank F-501 is provided with a means to protect against the formation and ignition of vapors; however, a vault space ventilation system is not provided.

2.14.4 Supplemental Information

2.14.4.1 Ancillary Equipment

Single-wall piping and transfer equipment associated with Tank F-501 are located inside the vault, which provides secondary containment. Piping and support equipment are fabricated from 304L SS, which is the same material as that used in Tank F-501. The transfer piping and support equipment are exposed to the same liquids as Tank F-501; therefore, 304L SS is an acceptable material for the support equipment.

The assessment concludes that the ancillary equipment is properly designed for leak detection and secondary containment.

2.14.4.2 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 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 that includes Tank F-501.

2.14.5 References

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

Energy Systems Drawing S-20566-Y-108-E, Concrete Sections and Details, Dated 3/24/60 (No Revision No.).

Energy Systems Drawing H-20566-Y-203-E, Flow Diagram Cell Exhaust System and Radioactive Offgas System, Revision 1.

Energy Systems Drawing H-20566-Y-202-E, Flow Diagram, Cells, Hot Equipment, Storage Area, Decontamination Area, and Maintenance Room, Revision 1.

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

Energy Systems Drawing S-20566-Y-101-E, Plot Plan and Boring Data, Revision 2.

Energy Systems Drawing A-20566-Y-002-E, Plan-Basement, Revision 1.

Energy Systems Drawing H-20566-Y-218-E, Radioactive Offgas Pit and RHD Pit, Revision 2.

Energy Systems Drawing H-20566-Y-225-E, Radioactive Offgas System, Revision 2.

LLLW Generator Survey 1990 for Building 3525.

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

Figure 2.14-1 Location of Building 3525

Figure 2.14-2
Layout of Tank F-501

PLAN VIEW
(SHOWING PIT COVER)

REF. DWG 51587

EBASCO/MAIN

Figure 2.14-3 Schematic of the Liquid Low-Level Waste System

Figure 2.14-4 Tank F-501 Vault

REF. DWG. 51588

ERASCO, IAIN

PLOT PLAN

**Figure 2.14-6
Analytical Data**

WASTE STREAM CONTAMINANTS:

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

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

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

2.15 Tank T-13

2.15.1 Tank Summary

Tank T-13 is a nominal, 4000-gal, vertical tank installed in 1979 at the New Hydrofracture Facility (NHF) near Building 7860 (Figures 2.15-1 and 2.15-2). Tank T-13 is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, type 304L SS-lined, reinforced concrete vault. Tank T-13 is used as a liquid low-level waste (LLLW) storage tank at the NHF and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.15.2 Standards for Design Demonstration

2.15.2.1 Tank Description and Design Standards

Tank Description

Tank T-13 is located near Building 7860 in an underground vault. The tank is used and managed by the Waste Management and Remedial Actions Division and is part of the Melton Valley NHF area.

Tank T-13 is a nominal, 4000-gal, vertical tank constructed of 304L SS. The tank has an outside diameter of 7'0" and a vertical straight sidewall length of 12'3" with an ASME dished lower head and a flat plate upper head. The lower head and shell have a nominal thickness of 1/2". The upper head has a nominal thickness of 7/8". The tank operates under negative pressure.

Design Standards

The applicable codes and standards used for Tank System T-13 and its associated vault and piping 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 (ASTM) A48, C91, C139, C144, and D1751;

American Concrete Institute (ACI) 301-72;

American Concrete Pipe Association (ACPA);

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

Minimum Safety Requirements, AEC-Oak Ridge Office (ORO);

Occupational Safety and Health Administration (OSHA);

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

ASHRAE Handbook—Systems;

American Conference of Governmental Industrial Hygienists (ACGIH);

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

AMCA Fans and Systems—Publication 201;

AMCA Directory—Publication 261;

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

NFPA No. 91—Blower and Exhaust Systems;

National Electric Code;

Design, Construction, and Testing of High Efficiency Air Filtration Systems for Nuclear Applications—Nuclear Safety Information Center 65;

Underwriters Laboratories Inc.;

Factory Mutual Engineering Corporation;

American National Standards Institute (ANSI);

Instrumentation Society of America (ISA); and

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Codes.

2.15.2.2 Generic Description of Tank Contents

Tank T-13 is designed to serve as a waste tank for the NHF and was previously used to store concentrated LLLW for disposal (Figure 2.15-3). The contents of Tank T-13 have not been characterized.

2.15.2.3 Corrosion Protection Measures

Tank T-13 is located in an underground, 304L SS-lined, reinforced concrete vault. The tank shell has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.15.2.4 Documented Age

Tank T-13 was installed in 1979.

2.15.3 Standards for Containment/Release Detection

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

Tank T-13 is constructed of type 304L SS. The vault bottom and sides are lined with type 304L SS (Figure 2.15-4).

The assessment concludes that the SS lining material is 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

Tank T-13 is located in an underground, 304L SS-lined, reinforced concrete vault. The vault foundation is 14'9" x 20'0" x 1'8" thick (Figure 2.15-5). The slab was designed to withstand a compressive stress of 4000 psi. The tank vault floor elevation is 767'6", which is 20'0" below grade.

The assessment concludes that the vault foundation supporting the tank secondary containment system is properly designed.

2.15.3.3 Provided with a Leak Detection System to Operate or Detect Failure of Either Primary or Secondary Containment or the Presence of Any Measurable Release of Hazardous or Radioactive Constituents

Tank T-13 is provided with a tank level monitor and is located in a 304L SS-lined vault. Any leakage from Tank T-13 is gravity fed to an SS-lined sump where accumulation of liquid will be detected by a level indicator, and an alarm will sound in Building 7860.

The assessment concludes that Tank System T-13 is provided with a leak detection system.

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

The Tank T-13 vault floor slopes to a 1'2" × 3'10" × 3'0" deep, 304L SS-lined sump. The sump provides a low point within the tank vault 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 is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.15.3.5 Secondary Containment for Tank Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank T-13 is located in an SS-lined, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank T-13 is located in an underground, SS-lined, vault designed to be leaktight. The SS-lined portion of the vault is 9'8" × 14'6" × 4'3" high (from finished vault floor) and provides a containment volume of approximately 4456 gal compared with a nominal full tank content of 4000 gal for Tank T-13.

The assessment concludes that the SS-lined portion of the vault is sufficient to contain the full tank volume.

Infiltration

Site and storm drainage around the perimeter of the vault containing Tank T-13 provides for surface water runoff to prevent any buildup of surface water during rainfall. Site grades around the vault containing Tank T-13 slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the vault are maintained at a minimum of 6" below perimeter vault walls to prevent run-on (Figure 2.15-6). The 2'6" thick, reinforced concrete tank vault walls are provided with an external waterproof fiber boarding and a waterproof coating to prevent infiltration. All piping penetrations were made using cast-in-place sleeves and an external sealant. The vault roof consists of a system of 2'6" thick, removable, reinforced concrete shield plugs. The joints between the plugs are sealed to minimize the potential for inleakage. The use of a waterproofing system minimizes the potential for infiltration of groundwater into the vault. The tank vault finished floor elevation is 767'6", which is 20'0" below grade.

The tank vault is designed with a 4", polyvinyl chloride (PVC) pipe located around the foundation base to provide a foundation drainage system. The pipe header is routed to the storm water sewer.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The Tank T-13 secondary containment structure is constructed with chemical-resistant PVC water stops in all below-grade construction joints.

The assessment concludes that the secondary containment structure is constructed with chemical-resistant water stops.

Vapor Protection, Vessel Vent System

Tank T-13 is vented to the SS-lined vault via an open overflow/ventilation pipe. The vault is maintained at a pressure of $-1.0''$ water gauge (wg) by drawing air through a roughing filter and a HEPA filter (normal flow rate through the filter system is negligible because the only source of inlet air is leakage through the vault walls). The HEPA-filtered air is exhausted in the well cell, which is also maintained at a pressure of $-1.0''$ wg (Figure 2.15-7).

The assessment concludes that the Tank System T-13 is provided with a means to protect against the formation and ignition of vapors.

2.15.4 Supplemental Information

2.15.4.1 Ancillary Equipment

Single-wall piping associated with Tank T-13 is located inside the vault, which provides secondary containment for the piping. Any leaking fluid is captured in an SS-lined sump. Piping and related equipment such as pumps, jet ejectors, and valves are fabricated from 304L SS, which is the same material as that used in Tank T-13 and the vault liner. The transfer piping and associated equipment are exposed to the same liquids as Tank T-13; therefore, 304L SS is acceptable for the support equipment.

The assessment concludes that the ancillary equipment is properly designed for leak detection and secondary containment.

2.15.4.2 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 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 that includes Tank T-13.

2.15.5 References

Energy Systems Drawing S3E-21255-B028, General Structural Notes, Revision B.

Energy Systems Drawing H3E-21255-G003, Hydrofracture Building 7860 Environmental Control Plans and Sections, Revision F.

Energy Systems Drawing S3E-21255-B001, Hydrofracture Building 7860 Foundation Plan, Revision C.

Energy Systems Drawing A3E-21255-B015, Hydrofracture Building 7860 Removable Concrete Shield Plugs Plan and Details, Revision C.

Energy Systems Drawing A3E-21255-B011, Hydrofracture Building 7860 Sections, Revision F.

Energy Systems Drawing I3E-21255-E003, Instrumentation Diagram Liquid Process, Revision H.

Energy Systems Drawing P3E-21255-C017, Liquid Flow Diagram, Revision D.

Energy Systems Drawing P3E-21255-CO38, Process Piping Slotting Waste Collection Tank T-13, Revision D.

Energy Systems Drawing C3E-21255-A010, Site Plan Grading Sections No. 1, Revision B.

Energy Systems Drawing S3E-21255-B010, Slotting Waste Pit and Metering Pit Plan and Wall Elevations, Revision C.

Energy Systems Drawing S3E-21255-B011, Slotting Waste Pit and Metering Pit Sections and Details, Revision C.

Oak Ridge National Laboratory. *The Specifications for the Construction of New Hydrofracture Facility*. Invitation No. DE-AC05-79OR20319.

Oak Ridge National Laboratory. 1991. *Waste Acceptance Criteria for Liquid Waste Treatment Systems at the Oak Ridge National Laboratory*. Department of Waste Minimization Planning and Certification. WM-WMC0-201.

Figure 2.15-1 Location of the New Hydrofracture Facility at ORNL

Figure 2.15-2
Layout of Tank T-13

Figure 2.15-3
Schematic of the Liquid Low-Level Waste System

Figure 2.15-4 Tank Vault Stainless Steel Liner

Figure 2.15-5 Tank Vault Stainless Steel Liner

Figure 2.15-6 New Hydrofracture Facility Grading Plan

REF. DWG. C3E21255-A009

Figure 2.15-7 Tank T-13 H&V Diagram

REF. DWG. H3E21255-G002

2.16 Tank S-223

2.16.1 Tank Summary

Tank S-223 is a nominal, 3000-gal, horizontal tank installed in 1955 near the Fission Product Development Laboratory (Building 3517) at the main Bethel Valley Complex (Figures 2.16-1 and 2.16-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank S-223 is used to collect liquid low-level waste (LLLW) from Building 3517 and inleakage from tank-farm cell sumps and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.16.2 Standards for Design Demonstration

2.16.2.1 Tank Description and Design Standards

Tank Description

Tank S-223 is located in a reinforced concrete vault with Tank S-523. The tank is used and managed by the Chemical Technology Division. The Oak Ridge National Laboratory (ORNL) coordinates for Tank S-223 are approximately E 30975 and N 21775. Tank S-223 is a 3000-gal, horizontal tank constructed of type 304L SS. The tank has an outside diameter of 7'0" and an overall length of 10'6". The shell and heads have a nominal thickness of 1/4". The tank operates at slightly less than atmospheric pressure.

Design Standards

The applicable codes and standards used for Tank System S-223 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;

Federal Specifications LLL-F-321, Class A LLLF321;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

American Society of Mechanical Engineers (ASME);

American Welding Society; and

Underwriters Laboratories Inc.

2.16.2.2 Generic Description of Tank Contents

Tank S-223 is designed to collect LLLW from a variety of operations such as supernate from cesium and strontium precipitation operations, raffinates from a cesium-144 extraction process, and general decontamination solutions (Figure 2.16-3).

The analytical data (Figure 2.16-4) of waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank S-223.

2.16.2.3 Corrosion Protection Measures

Tank S-223 is located in an underground, epoxy-coated, reinforced concrete vault and has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.16.2.4 Documented Age

Tank S-223 was installed in 1955.

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 S-223 is constructed of type 304L SS. The interior of the tank vault is provided with a three-coat system of Amercoat 23 and 33 epoxy (Figure 2.16-5).

The assessment concludes that, according to manufacturer's specifications, the vault's epoxy coating is compatible with the stored 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 S-223 is located in an underground, reinforced concrete vault (Figure 2.16-6). Tank S-223 shares the vault with Tank S-523. The vault foundation is a 14'0" × 32'0" × 1'3" thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the vault foundation is properly designed to support the secondary containment system.

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 S-223 is provided with a tank level monitor and is located within an epoxy-coated, reinforced concrete vault. The vault floor is sloped to a sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

The assessment concludes that the secondary containment system is provided with a leak detection system.

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

The Tank S-223 vault floor slopes to a 1'0" × 1'0" × 2'0", epoxy-coated sump with a containment volume of 15 gal. The sump provides a low point within the tank vault 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 is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.16.3.5 Secondary Containment for Tank System Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank S-223 is located in a below-grade, epoxy-coated, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank S-223 is located in a below-grade, epoxy-coated, reinforced concrete vault designed to be leaktight. The vault measures 12'0" × 30'0" × 12'0" high, providing a containment volume of approximately 32,300 gal of liquid compared to a full tank content of 3000 gal for Tank S-223.

The assessment concludes that the epoxy-coated portion of the vault provides sufficient containment to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of the vault provides for surface water runoff to prevent buildup of surface water during rainfall. Site grades around Tank Vault S-223 slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the tank vault are maintained at a minimum of 6" below perimeter walls to prevent run-on (Figure 2.16-7). The reinforced concrete external walls are provided with an asphalt or coal tar type

felt membrane forming a waterproofing system that minimizes the potential for infiltration of groundwater into the vault. Prevention of inleakage into the secondary containment system is accomplished by sealed, 3'0" thick, reinforced concrete roof plugs.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The secondary containment structure is constructed with keyways in the below-grade construction joints. The use of water stops is not included in the design drawings or construction specifications. However, it is unlikely that water from outside the system or LLLW from inside the system will penetrate the construction joints because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of water stops is not considered significant.

Vapor Protection, Vessel Vent System

Building 3517 is provided with a ventilation system that is designed to maintain a negative pressure within Tank Vault S-223. Tank S-223 is provided with a tank offgas system that maintains the tank at a negative pressure. Exhaust gases pass through a high-efficiency particulate air (HEPA)-filtered treatment system before being exhausted to the atmosphere (Figure 2.16-8).

The assessment concludes that Tank System S-223 is provided with a means to prevent the formation and ignition of vapors.

2.16.4 Supplemental Information

2.16.4.1 Ancillary Equipment

Piping within the confines of the vault is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from 304L SS, which is the same material as that used for Tank S-223. The transfer piping and associated equipment are exposed to the same liquids as Tank S-223; therefore, 304L SS is acceptable for the support equipment. Piping and related equipment within the confines of the vault system are provided secondary containment by the coated vault.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

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 S-223.

2.16.5 References

Construction Specification, Multicurie Fission Products Pilot Plant in Building 3517. Invitation No. 401-55-8A.

Energy Systems Drawing P3E-20013-C017, Building 3517 Low-Level Waste Collection Underground Piping and Pit Location, Revision 0.

Energy Systems Drawing P3E-20013-C018, Building 3517 Low-Level Waste Collection Profile Double Contained Pipe, Revision 0.

Energy Systems Drawing P3E-20013-C019, Building 3517 Low-Level Waste Collection Partial Plan, Section and Details, Revision 0.

Energy Systems Drawing P3E-20013-C020, Building 3517 Low-Level Waste Collection Double Contained Pipe Detail, Revision 0.

Energy Systems Drawing P3E-20013-C021, Building 3517 Low-Level Waste Collection, Piping Details, Revision 0.

Energy Systems Drawing E3E-20013-D027, Building 3517 Low-Level Waste Collection, ORNL Signal System Sections and Details, Revision 0.

Energy Systems Drawing S3E-20013-B002, Building 3517 Low-Level Waste Collection, Valve Pit 2A Section and Detail, Revision 0.

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 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 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.

LLW Generator Survey 1990 for Building 3517.

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.

Figure 2.16-1 Location of Tank S-223

Figure 2.16-2 Layout of Tank S-223

Figure 2.16-3 Schematic of the LLLW System

KEY PLAN (N.T.S.)

D-26835 Rev 3
D-24398 Rev 3
D-26833 Rev 3
D-26832 Rev 4
ORNL 84-14497R
C-15898
E3E-20013-D031
P3E-20013-C017
P3E-20013-C018
P3E020013SK03 Rev 0
REFERENCE DRAWING LIST

Figure 2.16-4
Analytical Data For Liquid

LLW GENERATOR SURVEY - 1990
(Tank System S-223)

Isotopes: <u>Cs-137</u>	Quantities: <u>500.00 Ci/year</u>
<u>Sr-90</u>	<u>500.00 Ci/year</u>
<u> </u>	<u> </u>

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

<u>nitric acid</u>	<u>25.0 gal/year</u>
<u>turco decon 4502</u>	<u>25.0 lbs/year</u>
<u>oxalic acid</u>	<u>25.0 lbs/year</u>
<u>sodium hydroxide</u>	<u>25.0 lbs/year</u>
<u>Mr. Clean</u>	<u>Unknown</u>
<u>Ajax liquid</u>	<u>Unknown</u>
<u>Planisol</u>	<u>Unknown</u>
<u> </u>	<u> </u>

SECTION A-A

SECTION A-A.

N

Z-----

Figure 2.16-8 Tank S-223 H&V Diagram

2.17 Tank S-324

2.17.1 Tank Summary

Tank S-324 is a nominal, 1000-gal, horizontal tank installed in 1955 near the Fission Product Development Laboratory (Building 3517) at the main Bethel Valley Complex (Figures 2.17-1 and 2.17-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank S-324 is used to collect liquid low-level waste (LLLW) from Building 3517 and inleakage from tank-farm cell sumps and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.17.2 Standards for Design Demonstration

2.17.2.1 Tank Description and Design Standards

Tank Description

Tank S-324 is located in a reinforced concrete vault. The tank is used and managed by the Chemical Technology Division. The Oak Ridge National Laboratory (ORNL) coordinates for Tank S-324 are approximately E 30975 and N 21775. Tank S-324 is a 1000-gal, horizontal tank constructed of type 304L SS. The tank has an outside diameter of 5'4" and an overall length of 6'0". The shell and heads have a nominal thickness of 1/4". The tank operates at slightly less than atmospheric pressure.

Design Standards

The applicable codes and standards used for Tank System S-324 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;

Federal Specifications LLL-F-321, Class A LLLF321;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

American Society of Mechanical Engineers (ASME);

American Welding Society; and

Underwriters Laboratories Inc.

2.17.2.2 Generic Description of Tank Contents

Tank S-324 is designed to collect LLLW from a variety of operations such as supernate from cesium and strontium precipitation operations, raffinates from a cesium-144 extraction process, and general decontamination solutions (Figure 2.17-3).

The analytical data (Figure 2.17-4) of waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank S-324.

2.17.2.3 Corrosion Protection Measures

Tank S-324 is located in an underground, epoxy-coated, reinforced concrete vault and has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.17.2.4 Documented Age

Tank S-324 was installed in 1955.

2.17.3 Standards for Containment/Release Detection

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 S-324 is constructed of type 304L SS. The interior of the tank vault is provided with a three-coat system of Amercoat 23 and 33 epoxy (Figure 2.17-5).

The assessment concludes that, according to manufacturer's specifications, the vault's epoxy coating is compatible with the stored waste and designed to prevent migration of waste into the concrete.

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

Tank S-324 is located in an underground, reinforced concrete vault (Figure 2.17-6). The vault foundation is a 14'0" × 32'0" × 1'3" thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the vault foundation is properly designed to support the secondary containment system.

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 S-324 is provided with a tank level monitor and is located within an epoxy-coated, reinforced concrete vault. The vault floor is sloped to a sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

The assessment concludes that the secondary containment system is provided with a leak detection system.

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

The Tank S-324 vault floor slopes to a 1'0" × 1'0" × 2'0", epoxy-coated sump with a containment volume of 15 gal. The sump provides a low point within the tank vault 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 is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.17.3.5 Secondary Containment for Tank System Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank S-324 is located in a below-grade, epoxy-coated, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank S-324 is located in a below-grade, epoxy-coated, reinforced concrete vault designed to be leaktight. The vault measures 12'0" × 30'0" × 12'0" high, providing a containment volume of approximately 32,300 gal of liquid compared to a full tank content of 1000 gal for Tank S-324.

The assessment concludes that the epoxy-coated portion of the vault provides sufficient containment to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of the vault provides for surface water runoff to prevent buildup of surface water during rainfall. Site grades around Tank Vault S-324 slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the tank vault are maintained at a minimum of 6" below perimeter walls to prevent run-on (Figure 2.17-7). The reinforced concrete external walls are provided with an asphalt or coal tar type

felt membrane forming a waterproofing system that minimizes the potential for infiltration of groundwater into the vault. Prevention of inleakage into the secondary containment system is accomplished by sealed, 3'0" thick, reinforced concrete roof plugs.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The secondary containment structure is constructed with keyways in the below-grade construction joints. The use of water stops is not included in the design drawings or construction specifications. However, it is unlikely that water from outside the system or LLLW from inside the system will penetrate the construction joints because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of water stops is not considered significant.

Vapor Protection, Vessel Vent System

Building 3517 is provided with a ventilation system that is designed to maintain a negative pressure within Tank Vault S-324. Tank S-324 is provided with a tank offgas system that maintains the tank at a negative pressure. Exhaust gases pass through a high-efficiency particulate air (HEPA)-filtered treatment system before being exhausted to the atmosphere (Figure 2.17-8).

The assessment concludes that Tank System S-324 is provided with a means to prevent the formation and ignition of vapors.

2.17.4 Supplemental Information

2.17.4.1 Ancillary Equipment

Piping within the confines of the vault is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from 304L SS, which is the same material as that used for Tank S-324. The transfer piping and associated equipment are exposed to the same liquids as Tank S-324; therefore, 304L SS is acceptable for the support equipment. Piping and related equipment within the confines of the vault system are provided with secondary containment by the coated vault.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

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 S-324.

2.17.5 References

Construction Specification, Multicurie Fission Products Pilot Plant in Building 3517. Invitation No. 401-55-8A.

Energy Systems Drawing P3E-20013-C017, Building 3517 Low-Level Waste Collection Underground Piping and Pit Location, Revision 0.

Energy Systems Drawing P3E-20013-C018, Building 3517 Low-Level Waste Collection Profile Double Contained Pipe, Revision 0.

Energy Systems Drawing P3E-20013-C019, Building 3517 Low-Level Waste Collection Partial Plan, Section and Details, Revision 0.

Energy Systems Drawing P3E-20013-C020, Building 3517 Low-Level Waste Collection Double Contained Pipe Detail, Revision 0.

Energy Systems Drawing P3E-20013-C021, Building 3517 Low-Level Waste Collection, Piping Details, Revision 0.

Energy Systems Drawing E3E-20013-D027, Building 3517 Low-Level Waste Collection, ORNL Signal System Sections and Details, Revision 0.

Energy Systems Drawing S3E-20013-B002, Building 3517 Low-Level Waste Collection-Valve Pit 2A Section and Detail, Revision 0.

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 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 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.

LLLW Generator Survey 1990 for Building 3517.

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.

Figure 2.17-1 Location of Tank S-324

Figure 2.17-2 Layout of Tank S-324

Figure 2.17-3 Schematic of the LLLW System

Figure 2.17-4
Analytical Data For Liquid

LLLW GENERATOR SURVEY - 1990
(Tank System S-324)

Isotopes: <u>Cs-137</u>	Quantities: <u>500.00 Ci/year</u>
<u>Sr-90</u>	<u>500.00 Ci/year</u>
<u> </u>	<u> </u>
Others (i.e. acids, bases, organics, cleaners, etc.)	
<u>nitric acid</u>	<u>25.0 gal/year</u>
<u>turco decon 4502</u>	<u>25.0 lbs/year</u>
<u>oxalic acid</u>	<u>25.0 lbs/year</u>
<u>sodium hydroxide</u>	<u>25.0 lbs/year</u>
<u>Mr. Clean</u>	<u>Unknown</u>
<u>Ajax liquid</u>	<u>Unknown</u>
<u>Planisol</u>	<u>Unknown</u>
<u> </u>	<u> </u>

Figure 2.17-5 Tank S-324 Vault

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Figure 2.17-7 Tank S-324 Grading Plan

Figure 2.17-8 Tank S-324 H&V Diagram

2.18 Tank S-523

2.18.1 Tank Summary

Tank S-523 is a nominal, 1000-gal, horizontal tank installed in 1955 near the Fission Product Development Laboratory (Building 3517) at the main Bethel Valley Complex (Figures 2.18-1 and 2.18-2). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in an underground, reinforced concrete vault. Tank S-523 is used to collect liquid low-level waste (LLLW) from Building 3517 and inleakage from tank-farm cell sumps and is classified as a Federal Facility Agreement (FFA) Category B tank.

2.18.2 Standards for Design Demonstration

2.18.2.1 Tank Description and Design Standards

Tank Description

Tank S-523 is located in a reinforced concrete vault with Tank S-223 and is used and managed by the Chemical Technology Division. The Oak Ridge National Laboratory (ORNL) coordinates for Tank S-523 are approximately E 30975 and N 21775. Tank S-523 is a 1000-gal, horizontal tank constructed of type 304L SS. The tank has an outside diameter of 5'4" and an overall length of 6'0". The shell and heads have a nominal thickness of 1/4". The tank operates at slightly less than atmospheric pressure.

Design Standards

The applicable codes and standards used for Tank System S-523 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;

Federal Specifications LLL-F-321, Class A LLLF321;

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

ASHRAE Guide and Data Book—Applications;

ASHRAE Guide and Data Book—Equipment;

American Society of Mechanical Engineers (ASME);

American Welding Society; and

Underwriters Laboratories Inc.

2.18.2.2 Generic Description of Tank Contents

Tank S-523 is designed to collect LLLW from a variety of operations such as supernate from cesium and strontium precipitation operations, raffinates from a cesium-144 extraction process, and general decontamination solutions (Figure 2.18-3).

The analytical data (Figure 2.18-4) of waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank S-523.

2.18.2.3 Corrosion Protection Measures

Tank S-523 is located in an underground, epoxy-coated, reinforced concrete vault and has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.18.2.4 Documented Age

Tank S-523 was installed in 1955.

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 S-523 is constructed of type 304L SS. The interior of the tank vault is provided with a three-coat system of Amercoat 23 and 33 epoxy (Figure 2.18-5).

The assessment concludes that, according to manufacturer's specifications, the vault's epoxy coating is compatible with the stored waste and designed to prevent migration of waste into the concrete.

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

Tank S-523 is located in an underground, reinforced concrete vault (Figure 2.18-6). Tank S-523 shares the vault with Tank S-223. The vault foundation is a 14'0" × 32'0" × 1'3" thick, reinforced concrete base slab that rests on limestone.

The assessment concludes that the vault foundation is properly designed to support the secondary containment system.

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 S-523 is provided with a tank level monitor and is located within an epoxy-coated, reinforced concrete vault. The vault floor is sloped to a sump where accumulation of liquid will be detected by a level sensor that will activate an alarm in the operating area of Building 3517.

The assessment concludes that the secondary containment system is 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

The Tank S-523 vault floor slopes to a 1'0" × 1'0" × 2'0", epoxy-coated sump with a containment volume of 15 gal. The sump provides a low point within the tank vault 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 is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.18.3.5 Secondary Containment for Tank System Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank S-523 is located in a below-grade, epoxy-coated, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank S-523 is located in a below-grade, epoxy-coated, reinforced concrete vault designed to be leaktight. The vault measures 12'0" × 30'0" × 12'0" high, providing a containment volume of approximately 32,300 gal of liquid compared to a full tank content of 1000 gal for Tank S-523.

The assessment concludes that the epoxy-coated portion of the vault provides sufficient containment to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of the vault provides for surface water runoff to prevent buildup of surface water during rainfall. Site grades around Tank Vault S-523 slope away from the tank vault conveying rainwater to storm drain catch basin inlets. Finished grades around the tank vault are maintained at a minimum of 6" below perimeter walls to prevent run-on (Figure 2.18-7). The reinforced concrete external walls are provided with an asphalt or coal tar type

felt membrane forming a waterproofing system that minimizes the potential for infiltration of groundwater into the vault. Prevention of inleakage into the secondary containment system is accomplished by sealed, 3'0" thick, reinforced concrete roof plugs.

The assessment concludes that the system is designed to minimize the potential for infiltration.

Water Stops

The secondary containment structure is constructed with keyways in the below-grade construction joints. The use of water stops is not included in the design drawings or construction specifications. However, it is unlikely that water from outside the system or LLLW from inside the system will penetrate the construction joints because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. Therefore, the lack of water stops is not considered significant.

Vapor Protection, Vessel Vent System

Building 3517 is provided with a ventilation system that is designed to maintain a negative pressure within Tank Vault S-523. Tank S-523 is provided with a tank offgas system that maintains the tank at a negative pressure. Exhaust gases pass through a high-efficiency particulate air (HEPA)-filtered treatment system before being exhausted to the atmosphere (Figure 2.18-8).

The assessment concludes that Tank System S-523 is provided with a means to prevent the formation and ignition of vapors.

2.18.4 Supplemental Information

2.18.4.1 Ancillary Equipment

Piping within the confines of the vault is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from 304L SS, which is the same material as that used for Tank S-523. The transfer piping and associated equipment are exposed to the same liquids as Tank S-523; therefore, 304L SS is acceptable for the support equipment. Piping and related equipment within the confines of the vault system are provided with secondary containment by the coated vault.

The assessment concludes that the ancillary equipment inside the vault is properly designed for leak detection and secondary containment.

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 S-523.

2.18.5 References

Construction Specification, Multicurie Fission Products Pilot Plant in Building 3517. Invitation No. 401-55-8A.

Energy Systems Drawing P3E-20013-C017, Building 3517 Low-Level Waste Collection Underground Piping and Pit Location, Revision 0.

Energy Systems Drawing P3E-20013-C018, Building 3517 Low-Level Waste Collection Profile Double Contained Pipe, Revision 0.

Energy Systems Drawing P3E-20013-C019, Building 3517 Low-Level Waste Collection Partial Plan, Section and Details, Revision 0.

Energy Systems Drawing P3E-20013-C020, Building 3517 Low-Level Waste Collection Double Contained Pipe Detail, Revision 0.

Energy Systems Drawing P3E-20013-C021, Building 3517 Low-Level Waste Collection, Piping Details, Revision 0.

Energy Systems Drawing E3E-20013-D027, Building 3517 Low-Level Waste Collection, ORNL Signal System Sections and Details, Revision 0.

Energy Systems Drawing S3E-20013-B002, Building 3517 Low-Level Waste Collection-Valve Pit 2A Section and Detail, Revision 0.

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 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 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.

LLLW Generator Survey 1990 for Building 3517.

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.

The map illustrates the Hilltop Circle area, featuring a grid of streets and various buildings. Key streets include Hilltop Circle, Reactor Drive, Hillside Avenue, Central Avenue, White Oak Ave., First Street, Third Street, and Fifth Street. Buildings are labeled with numbers, and a specific building at the intersection of Hillside Avenue and Central Avenue is highlighted with a hatched pattern. A compass rose in the top left corner indicates the orientation, showing True North and Grid North.

ERASCO, MAIN

Figure 2.18-2 Layout of Tank S-523

Figure 2.18-3 Schematic of the LLLW System

Figure 2.18-4
Analytical Data For Liquid

LLLW GENERATOR SURVEY - 1990
(Tank System S-523)

Isotopes: <u>Cs-137</u>	Quantities: <u>500.00 Ci/year</u>
<u>Sr-90</u>	<u>500.00 Ci/year</u>
<u> </u>	<u> </u>
Others (i.e. acids, bases, organics, cleaners, etc.)	
<u>nitric acid</u>	<u>25.0 gal/year</u>
<u>turco decon 4502</u>	<u>25.0 lbs/year</u>
<u>oxalic acid</u>	<u>25.0 lbs/year</u>
<u>sodium hydroxide</u>	<u>25.0 lbs/year</u>
<u>Mr. Clean</u>	<u>Unknown</u>
<u>Ajax liquid</u>	<u>Unknown</u>
<u>Planisol</u>	<u>Unknown</u>
<u> </u>	<u> </u>

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[illegible]

Figure 2.18-8 Tank S-523 H&V Diagram

2.19 Tank LA-104

Based on the findings of this document, Tank LA-104, originally designated as Category B, was redesignated as Category C by FFA Modification Request Change Control Number FFA-PM/93-008, June 23, 1994. Tank LA-104 was subsequently redesignated as Category D by FFA Modification Request Change Control Number FFA-PM/94-021, November 15, 1994. However, this section of the original Design Demonstrations has been retained for reference.

2.19.1 Tank Summary

Tank LA-104 is a nominal, 296-gal, horizontal tank installed in 1960 in the Radioisotope Development Laboratory (Building 3047) at the main Bethel Valley Complex (Figure 2.19-1). The tank is constructed of ASME SA-240, type 304L stainless steel (SS) and is located in the vacuum jet pit in the basement of Building 3047. Tank LA-104 was designed as a vacuum surge tank for use in nonradiological experiments requiring vacuum. Tank LA-104 is classified as a Federal Facility Agreement (FFA) Category B tank.

2.19.2 Standards for Design Demonstration

2.19.2.1 Tank Description and Design Standards

Tank Description

Tank LA-104 is located in the basement of Building 3047. The tank is used and managed by the Oak Ridge National Laboratory (ORNL) Chemical Technology Division and is part of the Bethel Valley Liquid Low-Level Waste (LLLW) System. Tank LA-104 is a 296-gal, horizontal tank constructed of type 304L SS. The tank has an outside diameter of 3'0" and an overall length of 5'0". The shell and heads have a nominal thickness of 3/16". The tank operates at slightly less than atmospheric pressure.

Design Standards

American Society for Testing and Materials (ASTM) A 15-52T, A 160-52T, A 305-53T, A 185-37, C 39-49, C 192-52T, C31-49, C 33-52T, C 39-49, C 40-38, C 42-49, C 94-48, C 150-53, and D 544-52T.

Federal Specifications LLL-F-231 Class A LLLF34

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

ASHRAE Guide and Data Book—Applications

ASHRAE Guide and Data Book—Equipment

American Society of Mechanical Engineers (ASME)

American Welding Society (AWS)

Underwriters Laboratories Inc.

2.19.2.2 Generic Description of Tank Contents

Tank LA-104 was designed as a vacuum surge tank for use in nonradiological experiments requiring vacuum (Figure 2.19-2).

The analytical data (Figure 2.19-3) of the waste stream contaminants from the generators are representative of the waste transferred to and stored in Tank LA-104.

2.19.2.3 Corrosion Protection Measures

Tank LA-104 is located in an underground, reinforced concrete vault and has no direct contact with the soil or water. Cathodic protection measures are not required for external corrosion.

2.19.2.4 Documented Age

Tank LA-104 was installed in 1960.

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 LA-104 is constructed of type 304L SS. The vault containing Tank LA-104 is constructed of reinforced concrete but is not provided with a liner, nor does it have a protective coating on the concrete.

The assessment concludes that the vault is not constructed of or lined with materials that are compatible with the stored waste and is not 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

Tank LA-104 is located in an underground, reinforced concrete vault (Figure 2.19-4). The vault foundation is a 9'9" × 14'9" × 8" thick, reinforced concrete slab.

The assessment concludes that the vault foundation is properly designed to support the secondary containment system.

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

Tank LA-104 is provided with a tank level monitor and is located in an underground reinforced concrete vault. The vault floor is sloped to a sump where accumulation of liquid will be detected by a moisture probe.

The assessment concludes that the secondary containment system is provided with a leak detection system.

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

The Tank LA-104 vault floor slopes to a 1'0" × 1'0" × 1'0", sump with a containment volume of 7.48 gal. The sump provides a low point within the tank vault 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 is sloped and designed to drain and remove liquids resulting from leaks, spills, or precipitation.

2.19.3.5 Secondary Containment for Tank System Shall Include One or More of the Following: A Liner, a Vault, a Double-Walled Tank, or an Equivalent Device Approved by the United States Environmental Protection Agency

Tank LA-104 is located in a below-grade, reinforced concrete vault. The following sections address specific components of the vault system.

Containment

Tank LA-104 is located in a below-grade, reinforced concrete structure. The vault measures 8'0" × 12'3" × 10'0" high, providing a containment volume of approximately 7330 gal of liquid compared to a full tank content of 296 gal for Tank LA-104.

The assessment concludes that the containment structure provides sufficient containment to contain the full tank volume.

Infiltration

Site and storm drainage design around the perimeter of Building 3047, which contains Tank LA-104, provides for surface water runoff to prevent buildup of surface water during rainfall. Site grades around Building 3047 slope away from the building conveying rainwater to storm drain catch basin inlets. Finished grades around Building 3047 are maintained at a minimum of 6" below perimeter

walls to prevent run-on. The reinforced concrete walls are provided with an external waterproofing membrane system that minimizes the potential for infiltration of groundwater.

Water Stops

The secondary containment structure is constructed with keyways in the below-grade construction joints. The use of water stops is not included in the design drawings or construction specifications. However, it is unlikely that water from outside the system or LLLW from inside the system will penetrate the construction joints because the vault is externally waterproofed and provided with a leak detection and removal system. Therefore, the lack of water stops is not considered significant.

Vapor Protection, Vessel Vent System

Building 3047 is provided with a ventilation system that is designed to maintain a negative pressure within Tank Vault LA-104. Tank LA-104 is provided with a tank offgas system that is designed to maintain the tank at a negative pressure.

The assessment concludes that Tank System LA-104 is provided with a means to prevent the formation and ignition of vapors.

2.19.4 Supplemental Information

2.19.4.1 Ancillary Equipment

Piping within the confines of the vault is single wall. Piping and related equipment such as jet ejectors and valves are fabricated from 304L SS, which is the same material as that used for Tank LA-104. The transfer piping and associated equipment are exposed to the same liquids as Tank LA-104; therefore, 304L SS is acceptable for the support equipment. Piping and related equipment within the confines of the vault system are provided secondary containment by the vault.

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 LA-104.

2.19.5 References

Energy Systems Drawing S-20399-Y-20, Concrete First Floor Plan and Details, Revision 1.

Energy Systems Drawing 40060-310, Piping Equipment Isometrics, Instrumentation Details, and Hot Drain Shielding, Revision 2.

Energy Systems Drawing N3E020399A102, Ventilation Systems Flow Diagram, Revision 0.

Energy Systems Drawing M-20399-Y-069-B, Radioisotope Development Laboratory Vacuum Surge Tank, No revision number.

Energy Systems Drawing P-20399-Y-008-E1, Engineering Flow Diagram, Revision 1.

Energy Systems Drawing S-20399-Y-004-B, Civil Site Development, No revision number.

Energy Systems Drawing D-37735, Site Topography, No revision number.

Energy Systems Drawing S-10979, Construction and Operation Areas, No revision number.

Robinson, S. M., 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.

Construction Specifications, Radioisotope Development Laboratory Building 3047.

Figure 2.19-1
Location of Tank LA-104

Figure 2.19-2 Schematic of the LLLW System

Figure 2.19-3
Analytical Data For Liquid

LLLW SURVEY

WASTE STREAM CONTAMINANTS:

(a) Isotopes:	<u>Co-60</u>	Quantities:	<u>Trace</u>
	<u>Gd-153</u>		<u>Trace</u>
	<u>Eu-152</u>		<u>Trace</u>
	<u>Eu-154</u>		<u>Trace</u>
	<u> </u>		<u> </u>
(b) Others (i.e. acids, bases, organics, cleaners, etc.)			
	<u>nitric acid (3M)</u>		<u>60.0 l/year</u>
	<u>ammonium hydroxide</u>		<u>Trace</u>
	<u>potassium permanganate</u>		<u>60.0 lbs/year</u>
	<u>oxalic acid</u>		<u>72.0 lbs/year</u>
	<u>citric acid</u>		<u>24.0 lbs/year</u>
	<u>Ajax liquid</u>		<u>48.0 gal/year</u>

Figure 2.19-4
Tank LA-104 Vault

APPENDIX - EPA/TDEC/DOE Correspondence

- September 9, 1993, letter from McCoy (TDEC) to Lingle (DOE)
- October 15, 1993, letter from Rivera (EPA) to Lingle (DOE), w/attachment
- January 14, 1994, letter from Lingle (DOE) to Brown (EPA), McCoy (TDEC), w/attachment
- May 2, 1994, letter from Carreras (EPA) to Lingle (DOE)
- May 11, 1994, letter from McCoy (TDEC) to Lingle (DOE)

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DOE OVERSIGHT DIVISION
761 EMORY VALLEY DRIVE
OAK RIDGE, TENNESSEE 37830-7072

September 9, 1993

Mr. Nelson Lingle
Environmental Restoration Division
Department of Energy
P.O. Box 2001
Oak Ridge, Tennessee 37831-8541

RE: Design Demonstrations for the Remaining 19 Category B Tank
Systems at Oak Ridge National Laboratory, Oak Ridge, TN
DOE/OR/03-1150&D1
June, 1993

Dear Mr. Lingle:

The Tennessee Department of Environment and Conservation, DOE Oversight Division has reviewed the above referenced document pursuant to the Federal Facilities Agreement for the Oak Ridge Reservation. The following are comments relevant to that document review.

The following tank systems have deficiencies which do not fully meet the secondary containment requirements of Appendix F, Section C of the FFA. Specific deficiencies are listed for each tank grouping.

Tanks N71, P3, and P4

1. The vault for tanks N71, P3, and P4 is not equipped with chemical resistant water stops. The FFA requires vault systems to be constructed with chemical-resistant water stops, an interior lining, and an exterior moisture barrier design.
2. The vault also has one vault wall in direct contact with soil and water. This wall has no exterior moisture barrier or external waterproofing system. Sections 2.1.3.5, 2.2.3.5, and 2.3.3.5 state, "the site drainage system is designed to minimize the potential for infiltration of groundwater; and in the unlikely event that any infiltration occurs; it will be contained and removed by the secondary containment system."

This vault system does not meet the requirements under the FFA for exterior moisture barriers.

3. The vault has a lining of 11-gauge, 304L SS on the bottom with sidewalls that project 4" up the vault. Even though the lining is designed to contain 800 gallons of liquid, the entire vault wall should be lined to prevent migration of waste into the concrete.

Tanks C1 and C2

1. The vault for tanks C1 and C2 is designed to prevent run-on or infiltration of precipitation into the secondary containment; however, Section 2.4.3.4 states, "the vault is known to leak occasionally." The vault does not meet requirements in the FFA to prevent infiltration of precipitation.
2. The vault is also constructed with water stops in all below grade construction joints, but these water stops are not chemical resistant. Section 2.4.3.5 and 2.5.3.5 states that chemical resistant water stops are "not considered significant" because of interior and exterior linings. The FFA requires chemical resistant water stops in all joints.

Tank L-11

1. The above ground concrete vault for tank L-11 is designed to prevent surface water buildup during rainfall and includes a foundation drain system. However, the waterproofing system lacks an exterior moisture barrier on the concrete vault as required by the FFA.
2. The vault is constructed with water stops in all below grade construction joints, but are not chemical-resistant. There should be chemical-resistant water stops in all joints, regardless of waterproofing, leak detection and removal systems.

Tanks B-2-T, B-3-T, and C-6-T

1. The vault for B-2-T, B-3-T, and C-6-T does not meet infiltration system requirements. Sections 2.7.3.4, 2.8.3.4, and 2.9.3.4 state that "the removable plugs located on the containment roof are known to leak occasionally."
2. The vault is also constructed with water stops in all below grade construction joints, but are not chemical resistant. There should be chemical resistant water stops in all joints to meet requirements in the FFA.

Tanks F-111 and F-126

1. The vaults for tanks F-111 and F-126 is constructed with 6" water stops in all below grade construction joints. However, there is uncertainty whether these stops are chemical resistant. To meet FFA requirements, DOE must ensure the existing water stops are chemical resistant and place them in all joints in the vault.

Tank WC-20

1. The vault for tank WC-20 lacks chemical resistant water stops in above grade construction joints.
2. The vault also lacks means to protect against formation of and ignition of vapors within the vault.

Tank F-201

1. The vault for tank F-201 is not provided with a lining or interior coating to prevent migration of waste into the vault walls and flooring.
2. The vault also has no type of leak detection system.
3. Ventilation of vault space to protect against formation and ignition of vapors is also not provided in current system.
4. Ancillary equipment (piping) does not have secondary containment because the vault does not have an interior lining.

Tank F-501

1. The vault for tank F-501 is not provided with a lining or interior coating to prevent migration of waste into the vault walls and flooring.
2. Also, ventilation of vault space to protect against formation and ignition of vapors is not provided in current system.
3. Ancillary equipment (piping) does not have secondary containment because the vault does not have an interior lining.

Tank T-13

1. The vault for tank T-13 has chemical resistant water stops in all below grade joints. All joints should have chemical resistant water stops required by the FFA.

Tanks S-223, S-324, and S-523

1. The vault for tanks S-223, S-324, and S-523 has no chemical resistant water stops in any of the joints.

Tank LA-104

1. The vault for tank LA-104 is not provided with a lining or interior coating to prevent migration of waste into the vault walls or flooring.
2. The vault also has no chemical resistant water stops in any of the joints.

Comments/Questions

1. On all leak detection systems, how much liquid must leak and accumulate in the sump before alarm sounds?
2. Section 2.9.2.1 states that Tank C-6-T has a capacity of 710 gallons but only 375 gallons usable. Why are only 375 gallons usable?
3. Section 1.0 states, "The assessments assume that each tank system was constructed in accordance with the design drawings and construction specifications for that system." Rather than assume, can these secondary containment systems be inspected or tested to assure TDEC that each system and its components are built to standard and will not fail during operation? For example, Tank C-1 is designed with a three-coat system of Amercoat 745 epoxy. The tank was installed in 1964. Section 2.4.3.1 states, "according to manufacturers specifications, the vault's epoxy coating is compatible with stored waste and designed to prevent migration." Given the tanks age, can DOE ensure that the epoxy system will not fail?
4. The document mentions several tanks (i.e., T-34, T-70, F-115) that transfer LLLW to the Category B tanks. Why are these tanks not included in the LLLW program?
5. Tank F-201 should be considered a Category C tank system. Among other deficiencies, F-201 does not have a leak detection system; therefore, it should be scheduled for leak tests with Category C tanks.
6. For the deficiencies noted in this correspondence, DOE shall meet the requirements of the FFA by providing one or both of the following:
 - a. The design demonstrations should include plans and schedules for any retrofitting necessary to remediate deficiencies; and/or

- b. Within ninety (90) days of the date on which TDEC disapproves of a design demonstration, DOE should submit a schedule for approval for providing all available information concerning structural integrity of tank systems.

Questions or comments concerning the contents of this letter should be directed to Randy Young or Curt Myers at the above address or by phone at (615) 481-0995.

Sincerely,

R. Doug McCoy
Manager
Environmental Restoration Section

RDM:sar

cc: Craig Brown, EPA
Pat Halsey, MMES

er0247.10

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

OCT 15 1993

4WD-FFB

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. W. Nelson Lingle
Department of Energy
Oak Ridge Remedial Branch
P.O. Box 2001
Oak Ridge, TN 37831-8541

RE: Design Demonstration for the Remaining 19 Category B Tank
Systems at Oak Ridge National Laboratory, Oak Ridge, TN,
DOE/OR/03-1150&D1

Dear Mr. Lingle:

The Environmental Protection Agency (EPA) has reviewed the above referenced document pursuant to the Federal Facility Agreement (FFA) for the Oak Ridge Reservation.

EPA finds that this submission has addressed almost all of the requirements of Appendix F, Section C of the FFA; however, it did not include sufficient support for many of the tank assessments. Despite the lack of support, for which in most cases is judged to be of minor importance, most tank systems comply with the requirements of the FFA.

Tanks F-201, F-501 and LA-104 do not meet the requirements of the FFA (see attached comments). Therefore, EPA requests that Department of Energy (DOE) present a schedule to upgrade those systems within 90 days of the receipt of this letter. If DOE is unable to upgrade the tank systems, they must be removed from service unless a justifiable reason is given.

Tank WC-20 does not fully meet the requirements since it does not have a vault space ventilation system as required by the FFA for the storage of ignitable or reactive wastes. However, EPA considers this tank not to be in violation at this time since it is used to store inorganics and it has an off gas system on the primary system.

The waste contained in Tank T-13 has not been characterized. This impacts the issue of the compatibility of the vault liner with the waste but will have a more serious impact on the tank

review which was not part of this task. EPA does not specifically ask for a waste characterization since the liner is the same material as the tank.

If you have any questions, please contact me at (404)347-3016.

Sincerely,

Fernando Rivera
Remedial Manager
Federal Facilities Branch

cc: John Sweeney, DOE
Cavanaugh Mims, DOE
Doug McCoy, TDEC
Pat Halsey, MMES

Enclosure

**OAK RIDGE NATIONAL LABORATORIES
LLW TANK CONTAINMENT SYSTEMS
Design Demonstration Review**

General Comments

There is inadequate support for many of the assessments. Provide information or data supporting statements in the following areas:

- Confirming the compatibility of the vault liner materials with the stored waste;
- Describing the extent (height) of the epoxy wall coating and the method of sealing the joint between the epoxy wall coating and the floor or metal floor pan (where present);
- Describing how spillage is prevented from contacting water stops that are not resistant to the wastes stored (e.g. caulking materials and methods);
- Describing the leak detection devices located in the sumps; and
- Correcting computational errors and confirming the capacity of the vaults to contain the contents of the largest tank.

The FFA requires that any measurable release of hazardous or radioactive materials or accumulated liquid be detected within 24 hours and that liquid exceeding the capacity of the sump be removed within 24 hours. Liquids may be accumulated in the sump for up to one week before removal. A description of the procedure(s) used to ensure that the spilled or leaked material is removed as required must be provided. If this procedure is used throughout the facility, it needs to be included only once in the demonstration document and may be referenced as needed.

It has been stated that level detectors are installed on the sumps, but these devices have not been described. It is necessary to provide descriptions of the level detectors and to show the level at which each high level alarm is actuated. It is also necessary to describe how the existence of liquid depths exceeding the capacity of the sumps is identified (unless all spillage will be removed within 24 hours).

The descriptions of the vaults do not confirm that they are free from cracks or gaps, nor are any details of the methods used for sealing such breaks in the integrity of the unit described. Provide either statements that the vaults are free from cracks or gaps, or provide descriptions of the methods used to seal them.

The assessments did not address the containment system for the ancillary piping located outside of the vaults. Secondary containment is required for these pipelines, except as noted, by paragraph 1.f.iv of Section C of Appendix F of the FFA. This subject must be addressed to describe the containment, establish exemption, or show that the subject is covered in another submission.

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Specific Comments

All comments reference the FFA Appendix F, Section C, Standards for Containment/Release Detection.

Tank N-71

N-71-1.c. Leak detection system

It is stated that the sump in the vault is equipped with a level indicator but no description of the unit is provided, nor is the route of drainage from the floor drain in the corner of the cubicle containing the tank to the sump described or shown on the drawings provided. Provide a description of the level indicator in the sump and show how the drainage from the cubicle reaches the sump and the level at which the alarm is activated. Describe the procedure that is in place to ensure that liquid spillage in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

N-71-1.f.ii.A Capacity to contain the capacity of the largest tank

The assessment concludes that the capacity of the containment system is larger than the capacity of this tank but does not support this conclusion, nor does it say whether this tank is the largest tank within the containment system. Provide dimensions and calculations supporting the 900-gallon capacity figure and give the size of the largest tank within the containment system.

N-71-1.f.ii.B Prevention of Infiltration

Figure 2.1-6 does not support the statement that the grading around the vault will prevent any buildup of surface water adjacent to the building. No contours are provided on the downhill side of the building where the vault is located. Since external waterproofing was used on the vault, this is not considered a serious defect.

N-71-1.f.ii.B.1 Water stops at joints

The assessment says that it is unlikely that water will penetrate the construction joints, but no statement has been made as to the history of leakage into these vaults. If no infiltration is detected during rain events, this should be indicated.

N-71-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank P-3

P-3-1.c. Leak detection system

It is stated that the sump in the vault is equipped with a level indicator but no description of the unit is provided, nor is the route of drainage from the floor drain in the corner of the cubicle containing the tank to the sump described or shown on the drawings provided. Describe the level indicator in the sump and show how the drainage from the cubicle reaches the sump and the level at which the alarm is activated. Describe the procedure that is in place to ensure that liquid spillage in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

P-3-1.f.ii.A Capacity to contain the capacity of the largest tank

The assessment concludes that the capacity of the containment system is larger than the capacity of this tank but does not support this conclusion, nor does it say whether this tank is the largest tank within the containment system. Provide dimensions and calculations supporting the 800-gallon capacity figure and give the size of the largest tank within the containment system.

P-3-1.f.ii.B Prevention of Infiltration

Figure 2.2-6 does not support the statement that the grading around the vault will prevent any buildup of surface water adjacent to the building. No contours are provided on the downhill side of the building where the vault is located. Since external waterproofing was used on the vault, this is not considered a serious defect.

P-3-1.f.ii.B.1 Water stops at joints

The assessment says that it is unlikely that water will penetrate the construction joints, but no statement has been made as to the history of leakage into these vaults. If no

infiltration is detected during rain events, this should be indicated.

P-3-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank P-4

P-4-1.c. Leak detection system

It is said that the sump in the vault is equipped with a level indicator but no description of the unit is provided nor is the route of drainage from the floor drain in the corner of the cubicle containing the tank to the sump described or shown on the drawings provided. Provide a description of the level indicator in the sump and show how the drainage from the cubicle reaches the sump and the level at which the alarm is activated. Describe the procedure that is in place to ensure that liquid spillage in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

P-4-1.f.ii.A Capacity to contain the capacity of the largest tank

The assessment concludes that the capacity of the containment system is larger than the capacity of this tank but does not support this conclusion, nor does it say whether this tank is the largest tank within the containment system. Provide dimensions and calculations supporting the 800-gallon capacity figure and give the size of the largest tank within the containment system.

P-4-1.f.ii.B Prevention of Infiltration

Figure 2.3-6 does not support the statement that the grading around the vault will prevent any buildup of surface water adjacent to the building. No contours are provided on the downhill side of the building where the vault is located. Since external waterproofing was used on the vault, this is not considered a serious defect.

P-4-1.f.ii.B.1 Water stops at joints

The assessment says that it is unlikely that water will penetrate the construction joints but no statement has been made as to the history of leakage into these vaults. If no infiltration is detected during rain events, this should be indicated.

P-4-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank C-1

C-1-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 74S epoxy liner is compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturer's literature or other information establishing the compatibility of this epoxy coating with the stored waste.

C-1-1.c. Leak detection system

It is stated that the sump in the vault is equipped with a level sensor but no description of the unit is provided. Provide a description of the level sensor in the sump and give the level at which the alarm will actuate.

C-1-1.d. Slope for drainage

It is stated that the floor slopes to the sump but the drawings provided do not confirm the slope. Provide support for this statement and show that the tank supports do not obstruct drainage to the sump. Describe the procedure that is in place to ensure that infiltration or liquid spillage in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

C-1-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping

located outside of the vault or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank C-2

C-2-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 74S epoxy liner is compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturer's literature or other information establishing the compatibility to this epoxy coating with the stored waste.

C-2-1.c. Leak detection system

It is stated that the sump in the vault is equipped with a level sensor but no description of the unit is provided. Provide a description of the level sensor in the sump and indicate the level at which the alarm will actuate.

C-2-1.d. Slope for drainage

It is stated that the floor slopes to the sump but the drawings provided do not confirm the slope. Provide support for this statement and show that the tank supports do not obstruct drainage to the sump. Describe the procedure that is in place to ensure that infiltration or liquid spillage in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

C-2-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank L-11

L-11-1.a Compatibility of containment with waste

The assessment has concluded that the Quantum Polymorphic resin, the Amercoat 66 epoxy, and the PVC drain line are compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturers' literature or other information establishing

the compatibility to these materials with the stored waste.

L-11-1.b Foundation capable of supporting system

Figure 2.6-5 shows this tank and several others standing on legs supported on the concrete slab. The type of soil supporting the slab is not given. It is not immediately obvious that this slab is adequate to support the loads imposed. Demonstrate that the slab and underlying soil have the capacity to support these loads without cracking or otherwise damaging the slab.

L-11-1.c. Leak detection system

It is said that the tank vault drains to a sump that is equipped with a level indicator, but the indicator is not described or shown on the drawings provided. If sump S-1 is to collect the drainage from this tank, provide material showing the route of drainage to the sump. Provide also a description of the level indicator and the point at which the alarm will actuate.

L-11-1.d. Slope for drainage

Describe any slope of the floor (other than the local depressed area around the drain) that would direct spills to the floor drains and the routing of the floor drains to the sump. Describe the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

L-11-1.f.ii.A Capacity to contain the capacity of the largest tank

The assessment concludes that the capacity of the sump is adequate to contain the contents of Tank L-11 but does not mention whether this tank is the largest contained within the area served by the sump. Confirm that the sump shown in Sect. 14-14 and 15-15 on Figure 2.6-5 is the sump to which spills from Tank L-11 will drain. The SS lined portion of this sump appears to be roughly 6 feet by 4 feet by 3 feet or approximately 540 gallons. This does not correspond to the 1150-gallon figure given on p. 2.6-4. Provide additional details on the method of calculating the capacity of this sump.

L-11-1.f.ii.B.1 Water stops at joints

Figure 2.6-8 shows significant quantities of nitric acid may be contained in this tank. The composition data is inadequate to tell what concentrations of nitric acid may

occur in the tank. Provide additional composition data for the waste including the maximum concentration of nitric acid and of caustic soda that may be contained in this tank. In addition provide support for the statement that the stored waste is unlikely to come in contact with the water stops by showing the drainage patterns of a spill in relation to the location of construction joints containing water stops or showing that the water stops are adequately protected against corrosion by the waste.

L-11-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank B-2-T

B-2-T-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 66 epoxy and the Amercoat 99 vinyl emulsion are compatible with the stored waste, but no support for that conclusion has been presented. Supply a copy of the manufacturers' literature or other information establishing the compatibility to these materials with the stored waste.

B-2-T-1.c. Leak detection system

It is said that any leakage is gravity fed to a sump where accumulation of liquid will be detected by a level indicator, but the indicator is not described or shown on the drawings provided. Provide additional material describing the level indicator and the point at which the alarm will actuate. Provide the approximate frequency and amount of roof plug leakage described in Section 2.7.3.4.

B-2-T-1.d. Slope for drainage

It is said that the floor slopes to the sump but the drawings provided do not confirm the slope. Provide support for this statement. Describe the procedure that is in place to ensure that infiltration or liquid spillage in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours, or demonstrate that such removal cannot be accomplished.

The material contained in Section 2.7.3.4 and Figure 2.7-3 are contradictory. The text says that the pumping system will remove liquids accumulated in the sump but the figure shows only a jet pump that returns the liquid to Tank B-2-T. If that tank is leaking, returning the material to the tank does not remove it from the system. Describe how spilled or leaked material will be removed from the system.

B-2-T-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank B-3-T

B-3-T-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 66 epoxy and the Amercoat 99 vinyl emulsion are compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturers' literature or other information establishing the compatibility to these materials with the stored waste.

B-3-T-1.c. Leak detection system

It is said that any leakage is gravity fed to a sump where accumulation of liquid will be detected by a level indicator, but the indicator is not described or shown on the drawings provided. Provide additional material describing the level indicator and the level at which the alarm will actuate. Provide the approximate frequency and amount of roof plug leakage described in Section 2.8.3.4.

B-3-T-1.d. Slope for drainage

It is said that the floor slopes to the sump but the drawings provided do not confirm the slope. Provide support for this statement. Describe the procedure that is in place to ensure that infiltration or liquid spillage in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours, or demonstrate that such removal cannot be accomplished.

See similar comment for Tank B-2-T. Describe how spilled or leaked material will be removed from the system.

B-3-T-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank C-6-T

C-6-T-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 66 epoxy and the Amercoat 99 vinyl emulsion are compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturers' literature or other information establishing the compatibility to these materials with the stored waste.

C-6-T-1.c. Leak detection system

It is said that any leakage is gravity fed to a sump where accumulation of liquid will be detected by a level indicator, but the indicator is not described or shown on the drawings provided. Provide additional material describing the level indicator and the level at which the alarm will actuate. Provide the approximate frequency and amount of roof plug leakage described in Section 2.9.3.4.

C-6-T-1.d. Slope for drainage

It is said that the floor slopes to the sump but the drawings provided do not confirm the slope. Provide support for this statement. Describe the procedure that is in place to ensure that infiltration or liquid spillage in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours, or demonstrate that such removal cannot be accomplished.

See similar comment for Tank B-2-T. Describe how spilled or leaked material will be removed from the system.

C-6-T-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank F-111

F-111-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 66 epoxy is compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturers' literature or other information establishing the compatibility to these materials with the stored waste.

F-111-1.c. Leak detection system

It is said that the tank vault drains to a sump equipped with a level indicator but the indicator is not described. Provide additional material describing the level indicator and giving the level at which the alarm will actuate.

F-111-1.d. Slope for drainage

The drainage is well described. Describe the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

F-111-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank F-126

F-126-1.a. Compatibility of containment with waste

The assessment has concluded that the Amercoat 66 epoxy vault lining material is compatible with the stored waste but no support for that conclusion has been presented. Provide a copy of the manufacturer's literature or other data supporting the suitability of the epoxy.

F-126-1.c. Leak detection system

It is said that the tank vault drains to a sump equipped with a level indicator but the indicator is not described. Provide additional material describing the level indicator and giving the level at which the alarm will actuate.

F-126-1.d. Slope for drainage

The drainage is well described. Describe the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

F-126-1.f.11.A Capacity to contain the capacity of the largest tank

The assessment concludes that the combination of the Hastelloy pan and the epoxy coating on the walls is sufficient to contain the capacity of this tank. The weakest point in this composite system will be the joint between the pan and the epoxy. Describe the method used to seal between the pan and the coated vault wall so that there is no crack or gap at that point. Provide details of how the 10,400-gallon capacity of the vault was determined.

F-126-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank WC-20

WC-20-1.c. Leak detection system

Identify the level at which the level indicator in the sump will actuate the alarm.

WC-20-1.d. Slope for drainage

Describe the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

WC-20-1.f.ii.A Capacity to contain the capacity of the largest tank

The assessment concludes that the lined portion of the vault will contain 10,995 gallon. This capacity does not allow for the volume taken up by the tank supports. While this is not likely to be enough volume to cause the capacity to drop below 10,000 gallons, the procedure used in the calculation is not accurate.

WC-20-1.f.ii.C Means to protect against ignition of vapors

This vault does not have a ventilation system installed, although the tank does have such a system that should maintain it under negative pressure relative to the vault and sound an alarm if a flammable mixture is detected. This would be acceptable if the system had controls to prevent

pressurization of the tank. Either show that the existing ventilation system has controls to prevent the nitrogen bleed from pressurizing the tank in case of filter blinding or other mishap, or show that the tank will not contain materials that could generate flammable vapors. The waste analysis given in Figure 2.12-8 is inadequate to show that this is the case. Alternatively, provide data showing that the stored waste does not meet the definition of ignitable or reactive where an ignitable vapor may be produced as provided in FFA, Appendix F, Section C, Paragraph i.f.ii.C.

WC-20-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank F-201

F-201-1.a. Compatibility of containment with waste

The assessment has concluded that the vault containing this tank is not constructed of or lined with materials that are compatible with the stored waste. It is therefore necessary to submit a compliance schedule to bring the tank into compliance, or to submit a schedule to close the tank. In paragraph 2.13.1 it says that this tank will be removed from service in 1997, so closure of the tank is anticipated.

F-201-1.c. Leak detection system

The assessment has concluded that the vault containing this tank does not have a method of detecting leakage from the tank or infiltration through the vault. It is therefore necessary to submit a compliance schedule to bring the tank into compliance, or to submit a schedule to close the tank. In paragraph 2.13.1 it says that this tank will be removed from service in 1997, so closure of the tank is anticipated.

F-201-1.d. Slope for drainage

It is said that the vault bottom slopes to a small sump but the drawings provided do not substantiate the existence of a slope. Provide documentation showing that the vault is sloped as claimed. Describe also the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump

capacity is removed within 24 hours.

F-201-1.f.ii.C Means to protect against ignition of vapors

This vault does not have a ventilation system installed, although the tank is stated to have a system that should maintain it under negative pressure relative to the vault. The drawings provided do not substantiate the presence of this ventilation system. The tank vent system would, if substantiated, be acceptable if the system had controls to prevent pressurization of the tank, or if the tank does not contain flammable materials or gases. Either show that the existing ventilation system has controls to prevent the pressurizing of the tank in case of filter blinding or other mishap, or show that the tank will not contain materials that would generate flammable vapors. The waste analysis given in Figure 2.13-6 is inadequate to show that this is the case. Provide data showing that the stored waste does not meet the definition of ignitable or reactive where an ignitable vapor may be produced as provided in the FFA, Appendix F, Section C, Paragraph i.f.ii.C.

F-201-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank is located inside the vault but this cannot be confirmed from the drawings provided. Provide drawings showing that the feed and discharge piping from this tank are located entirely within the vault, or address the piping outside of the vault and provide a description of the secondary containment provided for the feed and discharge piping located

outside of the vault. Alternatively, demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank F-501

F-501-1.a. Compatibility of containment with waste

The assessment has concluded that the vault containing this tank is not constructed of or lined with materials that are compatible with the stored waste. It is therefore necessary to submit a compliance schedule to bring the tank into compliance, or to submit a schedule to close the tank. In paragraph 2.14.1 it says that this tank will be removed from service in 1997, so closure of the tank is anticipated.

F-501-1.c. Leak detection system

It is said that the tank vault drains to a sump equipped with a moisture probe but the probe is not described. Provide additional material describing the probe and giving the level at which the alarm will actuate.

F-501-1.d. Slope for drainage

Describe the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

F-501-1.f.ii.B Prevention of infiltration

It is said that the site grades around the vault slope away from the vault. The drawings provided do not support this statement. Figure 2.14-2 and 2.14-4 appear to show a concrete pad surrounding the vault. Figure 2.14-5 does not show the location of the vault. The concrete curb shown in Section B-B in Figure 2.14-4 is not dimensioned but scales to approximately 6 inches, not the 1'0" stated. Provide data or drawings establishing the proper situation.

F-501-1.f.ii.C Means to protect against ignition of vapors

This vault does not have a ventilation system installed, although the tank is stated to have a system that should maintain it under negative pressure relative to the vault. The drawings provided do not substantiate the presence of this ventilation system. The tank vent system would, if substantiated, be acceptable if the system had controls to prevent pressurization of the tank, or if the tank does not contain flammable materials or gases. Either show that the existing ventilation system has controls to prevent the

pressurizing of the tank in case of filter blinding or other mishap, or show that the tank will not contain materials that would generate flammable vapors. The waste analysis given in Figure 2.14-6 is inadequate to show that this is the case. Provide data showing that the stored waste does not meet the definition of ignitable or reactive where an ignitable vapor may be produced as provided in the FFA, Appendix F, Section C, Paragraph i.f.ii.C.

F-501-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank is located inside the vault but this cannot be confirmed from the drawings provided. Provide drawings showing that the feed and discharge piping from this tank are located entirely within the vault, or address the piping outside of the vault and provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault. Alternatively, demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank T-13

T-13-1.c. Leak detection system

It is said that the tank vault drains to a sump equipped with a level indicator but the indicator is not described. Provide additional material describing the level indicator and giving the level at which the alarm will actuate.

T-13-1.d Slope for drainage

It is said that the vault bottom slopes to a sump but the drawings provided do not substantiate the existence of a slope. Provide documentation showing that the vault is sloped as claimed. Describe also the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

T-13-1.f.ii.C Means to protect against ignition of vapors

It is said that the vault is vented with a fan and filter system; however, there is no means of admitting air to sweep flammable vapors out of the vault and the normal airflow is minimal. This system would be acceptable only if it is shown that the tank does not contain flammable materials or gases. Show that the tank will not contain materials that would generate flammable vapors. Provide data showing that the stored waste does not meet the definition of ignitable or reactive, where an ignitable vapor may be produced as

provided in the FFA, Appendix F, Section C, Paragraph i.f.ii.C.

T-13-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank is located inside the vault but this cannot be confirmed from the drawings provided. Provide drawings showing that the feed and discharge piping from this tank are located entirely within the vault, or address the piping outside of the vault and provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault. Alternatively, demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank S-223

S-223-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 23 and 33 epoxy are compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturers' literature or other information establishing the compatibility of these materials with the stored waste.

S-223-1.c Leak detection system

It is said that any leakage is gravity fed to a sump where accumulation of liquid will be detected by a level sensor, but the sensor is not described or shown on the drawings provided. Provide additional material describing the level indicator and the level at which the alarm will actuate.

S-223-1.d Slope for drainage

It is said that the vault bottom slopes to a sump but the drawings provided do not substantiate the existence of a slope. Provide documentation showing that the vault is sloped as claimed. Describe also the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

S-223-1.f.ii.A Capacity to contain the capacity of the largest tank

The capacity of the vault given in paragraph 2.16.3.5 (32,300 gal) is the gross volume of the vault and does not discount the volumes of the other two tanks located in the vault. The 2000-gallon capacity of these tanks is not sufficient to make a difference in the determination of whether the vault capacity is sufficient, but the methodology used is in error.

S-223-1.f.ii.B Prevention of Infiltration

It is said that the site grades around the vault are a minimum of 6 inches below the walls. The drawings provided do not substantiate this. Provide information substantiating this statement.

S-223-1.f.ii.B.1 Water stops at joints

The assessment says that it is unlikely that water will penetrate the construction joints, but no statement has been made as to the history of leakage into these vaults in the time since construction and no water table heights are given. The presence or absence of infiltration should be indicated.

S-223-1.f.ii.C Means to protect against ignition of vapors

The vault is shown to have an exhaust duct but no method of admitting air to sweep flammable vapors out of the vault has been shown. Either show that an entry point for exhaust air is present, or show that the tank does not contain flammable materials or gases that would generate flammable vapors. Provide data showing that the stored waste does not meet the definition of ignitable or reactive, where an ignitable vapor may be produced as provided in the FFA, Appendix F, Section C, Paragraph i.f.ii.C.

S-223-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this

tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank S-324

S-324-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 23 and 33 epoxy are compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturers' literature or other information establishing the compatibility of these materials with the stored waste.

S-324-1.c. Leak detection system

It is said that any leakage is gravity fed to a sump where accumulation of liquid will be detected by a level sensor, but the sensor is not described or shown on the drawings provided. Provide additional material describing the level indicator and the level at which the alarm will actuate.

S-324-1.d Slope for drainage

It is said that the vault bottom slopes to a sump but the drawings provided do not substantiate the existence of a slope. Provide documentation showing that the vault is sloped as claimed. Describe also the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

S-324-1.f.ii.A Capacity to contain the capacity of the largest tank

The capacity of the vault given in paragraph 2.17.3.5 (32,300 gallons) is the gross volume of the vault and does not discount the volumes of the other two tanks located in the vault. The 3000-gallon capacity of these tanks is not sufficient to make a difference in the determination of whether the vault capacity is sufficient, but the methodology used is in error.

S-324-1.f.ii.B Prevention of Infiltration

It is said that the site grades around the vault are a minimum of 6 inches below the walls. The drawings provided

do not substantiate this. Provide information substantiating this statement.

S-324-1.f.ii.B.1 Water stops at joints

The assessment says that it is unlikely that water will penetrate the construction joints, but no statement has been made as to the history of leakage into these vaults in the time since construction. The presence or absence of infiltration should be indicated.

S-324-1.f.ii.C Means to protect against ignition of vapors

The vault is shown to have an exhaust duct but no method of admitting air to sweep flammable vapors out of the vault has been shown. Either show that an entry point for exhaust air is present, or show that the tank does not contain flammable materials or gases that would generate flammable vapors. Provide data showing that the stored waste does not meet the definition of ignitable or reactive, where an ignitable vapor may be produced as provided in the FFA, Appendix F, Section C, Paragraph i.f.ii.C.

S-324-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank S-523

S-523-1.a Compatibility of containment with waste

The assessment has concluded that the Amercoat 23 and 33 epoxy are compatible with the stored waste but no support for that conclusion has been presented. Supply a copy of the manufacturers' literature or other information establishing the compatibility of these materials with the stored waste.

S-523-1.c. Leak detection system

It is said that any leakage is gravity fed to a sump where accumulation of liquid will be detected by a level sensor, but the sensor is not described or shown on the drawings provided. Provide additional material describing the level indicator and the level at which the alarm will actuate.

S-523-1.d Slope for drainage

It is said that the vault bottom slopes to a sump but the drawings provided do not substantiate the existence of a slope. Provide documentation showing that the vault is sloped as claimed. Describe also the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

S-523-1.f.ii.A Capacity to contain the capacity of the largest tank

The capacity of the vault given in paragraph 2.18.3.5 (32,300 gal) is the gross volume of the vault and does not discount the volumes of the other two tanks located in the vault. The 6000-gallon capacity of these tanks is not sufficient to make a difference in the determination of whether the vault capacity is sufficient, but the methodology used is in error.

S-523-1.f.ii.B Prevention of Infiltration

It is said that the site grades around the vault are a minimum of 6 inches below the walls. The drawings provided do not substantiate this. Provide information to substantiate this statement.

S-523-1.f.ii.B.1 Water stops at joints

The assessment says that it is unlikely that water will penetrate the construction joints, but no statement has been made as to the history of leakage into these vaults in the time since construction. The presence or absence of infiltration should be indicated.

S-523-1.f.ii.C Means to protect against ignition of vapors

The vault is shown to have an exhaust duct but no method of admitting air to sweep flammable vapors out of the vault has been shown. Either show that an entry point for exhaust air is present, or show that the tank does not contain flammable materials or gases that would generate flammable vapors. Provide data showing that the stored waste does not meet the definition of ignitable or reactive, where an ignitable vapor may be produced as provided in the FFA, Appendix F, Section C, Paragraph i.f.ii.C.

S-523-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary

containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

Tank LA-104

LA-104-1.a. Compatibility of containment with waste

The assessment has concluded that the vault containing this tank is not constructed of or lined with materials that are compatible with the stored waste. It is therefore necessary to submit a compliance schedule to bring the tank into compliance, or to submit a schedule to close the tank.

LA-104-1.b Foundation capable of supporting system

The information and drawings supplied do not show the location or method of support of this tank. Provide drawings showing the location and method of support of the tank. The type of soil supporting the slab is not given. It is not immediately obvious that this slab is adequate to support the loads imposed. Demonstrate that the slab and underlying soil have the capacity to support these loads without cracking or otherwise damaging the slab.

LA-104-1.c. Leak detection system

It is said that the tank vault drains to a sump equipped with a moisture probe but the probe is not described. Provide additional material describing the probe and giving the level at which the alarm will actuate.

LA-104-1.d. Slope for drainage

It is said that the vault bottom slopes to a small sump but the drawings provided do not substantiate the existence of a slope. Provide documentation showing that the vault is sloped as claimed. Describe also the procedure that is in place to ensure that liquid spillage contained in the sump is removed within one week and liquid in excess of the sump capacity is removed within 24 hours.

LA-104-1.f.ii.B Prevention of infiltration

It is said that the site grades around the building slopes away from the walls. No drawings have been provided to support this statement. Provide drawings showing the location of the vault in the building basement and confirming the site grading around the building.

LA-104-1.f.ii.B1 Water stops at joints

The vault does not contain water stops in the joints and the assessment says that it is unlikely that water will penetrate the construction joints, but no statement has been made as to the history of leakage into the vault in the time since construction and no water table elevations have been provided. The presence or absence of infiltration should be indicated.

LA-104-1.f.ii.C Means to protect against ignition of vapors

It is said that the vault is equipped with a ventilation system but no information is provided describing this system. Provide information and/or drawings describing the ventilation system.

LA-104-1.f.ii.D Exterior moisture barrier

It is said that the vault walls are provided with an external waterproofing system but the drawing provided does not confirm the presence of waterproofing. Provide information further describing the waterproofing system.

LA-104-1.f.iv Ancillary equipment containment

The assessment says that the piping associated with this tank located inside the vault is provided with secondary containment, but it does not address the piping outside of the vault. Provide a description of the secondary containment provided for the feed and discharge piping located outside of the vault, or demonstrate that the piping is excepted according to Section C.1.f.iv.A through D of the FFA.

bc w/o enclosure: Dave Hopkins, EPA

10/12/93

____ Rivera

____ Warren

Department of Energy

Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831-8542

January 14, 1994

Mr. Craig Brown
Environmental Protection Agency
Region IV
345 Courtland Street, NE
Atlanta, Georgia 30365

Mr. Doug McCoy, FFA Project Manager
DOE Oversight Division
Tennessee Department of Environment
and Conservation
761 Emory Valley Road
Oak Ridge, Tennessee 37830-7072

Dear Gentlemen:

FEDERAL FACILITY AGREEMENT - RESPONSES TO COMMENTS ON DESIGN DEMONSTRATIONS FOR CATEGORY B TANKS - OAK RIDGE NATIONAL LABORATORY

- References:
1. U. S. Department of Energy, Design Demonstrations for the Remaining 19 Category B Tank Systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee, DOE/OR/03-1150&D1, June 1993.
 2. Fernando Rivera's October 15, 1993, letter to W. Nelson Lingle.
 3. R. Doug McCoy's September 9, 1993, letter to W. Nelson Lingle.

The enclosed matrix provides responses to the comments made by both the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC) regarding Design Demonstrations for the Remaining 19 Category B Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee, DOE/OR/03-1150&D1 (Reference 1). Specifically, the matrix is divided into two parts: the first part addresses comments made by EPA in a letter dated October 15, 1993, (Reference 2); and the second part addresses comments made by TDEC in a letter dated September 9, 1993, (Reference 3).

In an effort to respond most effectively and efficiently to the comments, each specific comment was placed in a group of general comments. The general comments are shown in the first column of the matrix. The second column is entitled "Occurrence," and shows the following:

Mr. Craig Brown
Mr. Doug McCoy

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1. The tank system(s) to which the comment pertains.
2. For EPA comments, one of the following:
 - a portion of the cover letter,
 - a "General Comment" from Pages 1 or 2 of the enclosure, or
 - a "Specific Comment" from Pages 3-25 of the enclosure.
3. For TDEC comments, either the tank system(s) or the item under "Comments/Questions."

The third column presents our responses to each comment. Where appropriate, these are formatted so that a single discussion can be applied to all relevant tank systems.

In response to EPA's request for additional backup data, we are enclosing a package of information for Tank System L-11. We feel that this system is representative of the other systems, and that the information used to prepare the secondary containment design demonstration for Tank L-11 is representative of that used for the remaining Category B tanks. The package includes design drawings, building specifications, manufacturers' literature on coatings/liners and leak-detection equipment, and Procedure WM-LGWO-611.3.1 used for cell ventilation at Oak Ridge National Laboratory.

Your questions and the Department of Energy's responses furnish a considerable amount of information. Accordingly, we recommend that, if questions remain after your review of this submittal, a meeting be scheduled to resolve the open issues. Either Cavanaugh Mims at (615) 576-9481 or Mac Roddy at (615) 576-1801 will coordinate a mutually agreeable time and place for such a meeting, if it is deemed necessary. Should you have any questions in the interim, please feel free to call either Mr. Mims or Mr. Roddy.

Sincerely,

W. Nelson Lingle, Chief
Oak Ridge Remediation Branch

Enclosures

cc w/o enclosure: (matrix only)
C. Mims, EW-911
L. Radcliffe, EW-92
M. Roddy, EW-921
P. Halsey, 1310-J, MS 7256
C. Manrod, 3047, MS 6023
D. Turner, 3503, MS 6316

EXPLANATION TO MATRIX

The following matrix provides responses to comments made by the Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC) regarding the Design Demonstrations for the Remaining 19 Category B Tank Systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee, DOE/OR/03-1150&D1. Specifically, the matrix is divided into two parts; the first part addresses comments made by EPA in a letter dated October 15, 1993 while the second part addresses comments made by TDEC in a letter dated September 9, 1993.

In an effort to most effectively and efficiently respond to the comments, each of the specific comments was grouped into general comments. The general comments are shown in the first column of the attached matrix. The matrix then lists the tank systems of which the comments were made. This listing is shown in the second column. In addition, the second column describes where the comments occurred. For the EPA comments, either the cover letter to the comments; the section of the comment letter entitled General Comments; or the section of the comment letter entitled Specific Comments is referenced. For the TDEC comments either the tank system or the section of the TDEC comment letter entitled Comments/Questions is referenced. The third column presents the responses by DOE to the comments.

The responses to the comments are made such that the general comment is responded to with a discussion that can be applied to all of the tank systems for which the comment was made. However, where there are specific instances where a unique comment was made about a single tank or a like group of tanks, this comment is responded to such that the particular circumstance is addressed.

In response to the comment made by EPA requesting additional and back-up data, a package of information for Tank System L-11 is enclosed. It is felt that Tank System L-11 is representative of the other tank systems and that the information used to prepare the secondary containment design demonstration for Tank L-11 is representative of the information used to prepare the design demonstrations for the remaining Category B tanks. The information package includes design drawings, building specifications, manufacturers' literature on coatings/liners and leak detection equipment, and a procedure used by the Liquid and Gaseous Waste Operations Department of the Waste Management and Remedial Action Division at ORNL.

RESPONSES TO EPA COMMENTS

COMMENT	OCCURRENCE	RESPONSE
Provide additional information and back-up data	<p><u>EPA Comment Package - Cover letter - 2nd Paragraph</u>, "... this submission has addressed almost all of the requirements of Appendix F, Section C of the FFA; however, it did not include sufficient support for many of the tank assessments."</p> <p><u>EPA Comment Package - General Comments</u> First general comment asks DOE to provide additional information and data supporting several areas including:</p> <ul style="list-style-type: none"> • liner compatibility • extent of coatings • description of leak detection devices • removal of spilled or leaked materials 	Please find attached the package of information used to complete the demonstration for the design of the secondary containment for Tank L-11, which is included in Section 2.6 of the subject document. The package of information is representative of the information used to make the secondary containment design demonstrations for the remaining 18 Category B tanks. The information package includes design drawings, building specifications, manufacturers' literature on coatings/liners and leak detection equipment, and a Waste Operations procedure for pumping sumps.
Tanks F-201, F-501 and LA-104 do not meet the requirements of the FFA.	<u>EPA Comment Package - Cover Letter 3rd Paragraph</u>	Tanks F-201, F-501 and LA-104 will be moved to Category C. Attachment 1 provides schedules for replacement projects, submittal of SIA, and leak testing.
Ensure the vaults are free from cracks or gaps	<p><u>EPA Comment Package - General Comments</u></p> <p>4th Paragraph</p>	The intent of the design demonstration documents is to demonstrate that the original design of the secondary containment systems meet the requirements of Appendix F, Section C of the FFA. In most cases, the access to the vaults is extremely limited due primarily to radiological hazards. This lack of access prohibits any routine visual inspections. However, due to the leak detection and liquid removal capabilities provided in the vaults, if a tank were to fail, the facility operators would know immediately and could mitigate the problem before any release to the environment occurred.

RESPONSES TO EPA COMMENTS

COMMENT	OCCURRENCE	RESPONSE
<p>Leak detection equipment specs, and leak removal methods and level at which alarm activates</p>	<p>EPA Comment Package - General Comments 3rd Paragraph</p> <p>N-71 F-111 P-3 F-126 P-4 WC-20 C-1 F-201 C-2 F-501 L-11 T-13 B-2-T S-223 B-3-T S-324 C-6-T S-523 LA-104</p> <p>EPA Comment Package - Specific Comments</p>	<p>As discussed in the first response, a package of design information is enclosed for Tank L-11. The leak detection information is shown on Drwgs. P3E21246-C021, P3E21246-C023, and P21246EC011D. For the sump which serves Tank L-11, a pump is activated automatically by an on/off level switch. For the other tank vaults which were commented on, there are generally three different types of leak detection equipment in use. These are conductivity probes, differential pressure sensors, and on/off switches for activating pumps. The design drawings do not generally specify which type of leak detection equipment was installed. In addition, the level at which an alarm is sounded or a pump is switched on is not specified. This information must be obtained directly from facility personnel. DOE will provide the instrumentation type and level at which an alarm is sounded or a pump is switched on for every vault system if desired by EPA. The information package provides manufacturers' literature describing conductivity probes and differential pressure sensors. In addition, an example procedure for pumping liquid from a sump is provided. This Waste Operations Procedure is for the 2533 Sump in the Evaporator Complex area. This procedure is representative of procedures for pumping liquids from other sumps that are not pumped automatically. Automatically pumped sumps do not generally have written procedures.</p>
<p>Capacity to contain contents of largest tank - provide dimensions and calculations</p>	<p>EPA Comment Package - General Comments - First Paragraph - 5th bullet</p> <p>EPA Comment Package - Specific Comments</p> <p>N-71 F-126 P-3 S-223 P-4 S-324 L-11 S-523</p>	<p>The sump shown in Sections 14-14 and 15-15 on Figure 2.6-5 as well as on Drawing #S21246EB014D of the information package is the sump which provides secondary containment for Tank L-11. Tank L-11 is the largest LLLW tank served by the sump, however, several process areas within Building 3544 drain to this sump. The sump, as shown in the original design drawing (S21246EB014D) has an epoxy coating extending approximately 3 feet up the side walls. During an upgrade project, the entire sump was lined with stainless steel.</p>

RESPONSES TO EPA COMMENTS

COMMENT	OCCURRENCE	RESPONSE
Capacity to contain contents of largest tank - provide dimensions and calculations (Continued)	<p><u>EPA Comment Package - General Comments - First Paragraph - 5th bullet</u></p> <p><u>EPA Comment Package - Specific Comments</u></p> <p>N-71 F-126 P-3 S-223 P-4 S-324 L-11 S-523</p>	<p>Therefore, the dimensions of the stainless steel lined portion of the sump is 6 feet by 4 feet by 6.5 feet high which provides 1150 gallons of containment.</p> <p>The capacity of the vault containing F-126 was calculated from the following: Hastelloy "C" lined portion (8'6" by 15'8" by 6" high) providing 600 gallon capacity and epoxy lined portion (8'6" by 15'8" by 10'4" high) providing the additional 10,400 gallon capacity. The height of the epoxy coating (10'4") is from the top of the Hastelloy "C" liner to the top of the vault as specified by the building specifications for Building 7920. A description of how the epoxy was applied, especially in the area of the joint between the Hastelloy "C" liner and the epoxy coating is not available since a formal installation assessment was not conducted after the construction of Building 7920.</p> <p>The capacity of the containment area for Tank N-71 was determined from the stainless steel lined area of Cell 7 in the vault in Building 3019. Due to the interconnecting stainless steel pipelines which drain the 5 areas of Cell 7 (shown in Figure 2.1-4 of the subject documents) to a common sump the capacities of the sump, the drain lines, and the 5 stainless steel lined areas of Cell 7 were used in determining the capacity of the containment system for N-71. The stainless steel liner projects 6 inches up each wall in the containment area and using the dimensions shown in Figures 2.1-4 and 2.1-5 (taken from Drawings D14161, D14165, D14167, and D14169) the capacity of the area is 900 gallons. Tank N-71 is the only LLLW tank in Cell 7.</p> <p>The capacity of the containment area for Tanks P-3 and P-4 was determined from the stainless steel lined area of Cell 6 in the vault in Building 3019. Due to the interconnecting stainless steel pipelines which drain the 6 areas of Cell 6 (shown in Figures 2.2-2 and 2.3-2 of the subject document) to a common sump, the capacities of the sump, the drain lines, and the 6 stainless steel lined areas of Cell 6 were used in determining</p>

RESPONSES TO EPA COMMENTS

COMMENT	OCCURRENCE	RESPONSE
Capacity to contain contents of largest tank - provide dimensions and calculations (Continued)	<p><u>EPA Comment Package - General Comments - First Paragraph - 5th bullet</u></p> <p><u>EPA Comment Package - Specific Comments</u> N-71 F-126 P-3 S-223 P-4 S-324 L-11 S-523</p>	<p>the capacity of the containment system for P-3 and P-4. The stainless steel liner projects 6 inches up each wall in the containment area and using the dimensions shown in Figures 2.2-4, 2.3-4, 2.2-5, and 2.3-5 (taken from Drawings D14161, D14165, D14167, and D14169) the capacity of the area is 800 gallons. Tanks P-3 and P-4, each 200 gallons, are the largest LLLW tanks in Cell 6.</p> <p>For the determination of the capacity of the vault which contains S-223, S-324, and S-523, DOE concurs that the vault capacity is sufficient, but that the volumes of each tank in the vault should be subtracted from the total volume when determining the containment capacity of the vault.</p>
Prevention of Infiltration	<p><u>EPA Comment Package - Specific Comments</u> N-71, P-3, P-4</p>	<p>External waterproofing is <u>not</u> specified in design drawings used for the vaults that contain N-71, P-3 and P-4, however, only one of the four vault walls is in contact with soil. (The EPA comment states external waterproofing was used). The other three vault walls are internal to the building. The vault wall which is in direct contact with soil is protected against infiltration by the fact that the site drainage system is designed to minimize the potential for infiltration of groundwater, and in the unlikely event that any infiltration occurs, it will be contained and removed by the secondary containment system. Building 3019 is situated near the crest of a hill. The one wall in direct contact with soil is on the side of the building which faces downhill.</p>

RESPONSES TO EPA COMMENTS

COMMENT	OCCURRENCE	RESPONSE
Water Stops	<p><u>EPA Comment Package - General Comments</u> 1st Paragraph, 3rd bullet</p> <p><u>EPA Comment Package - Specific Comments</u> N-71, P-3, P-4, L-11, S-223, S-324, S-523, LA-104</p>	<p>Drawing #S21246EB013D shows the waterstops used in the below-grade construction joints for the containment structure for Tank L.11. Although the use of chemical resistant waterstops was not identified in the design drawings or construction specifications, it is unlikely that water from outside of the secondary containment system or LLLW from inside of the vault could penetrate the construction joints because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system.</p> <p>The support for the statement that the stored waste is unlikely to come in contact with the waterstops is provided by the principal by which the water stop is used (as depicted by the diagram included as Attachment 2.)</p>
Ancillary equipment containment	<p><u>EPA Comment Package - General Comments</u> 5th Paragraph</p> <p><u>EPA Comment Package - Specific Comments</u> N-71, P-3, P-4 C-1, C-2, L-11, B-2-T, B-3-T, C-6-T, F-111, F-126 WC-20, F-201, F-501, T-13, S-223, S-324, S-523, LA-104</p>	<p>In accordance with <u>FFA Plans and Schedules for LLLW Tank Systems at ORNL, DOE/OR/01-1135 & D2</u>, the design demonstrations for the ancillary equipment (pipelines) will be submitted to EPA and TDEC by March 31, 1994.</p>

RESPONSES TO EPA COMMENTS

COMMENT	OCCURRENCE	RESPONSE
Compatibility of containment with waste - supply a copy of the manufacturer's literature or other information establishing the compatibility to this epoxy coating with the stored waste	<u>EPA Comment Package - Specific Comments</u> C-1, C-2, L-11, B-2-T, B-3-T, C-6-T, F-111, F-126, F-201, F-501, S-223, S-324, S-523, LA-104	The manufacturers' literature for the coating used in the vault containing L-11 is included in the information package. As described in the enclosed literature, the coating is compatible with the waste contained in L-11. In addition to Tank L-11, Tanks B-2-T, B-3-T, C-6-T, F-111 and F-126 all use Amercoat 66 for coating the concrete vaults. The literature for this coating is supplied in the attached information package. The literature for the coatings used in the vaults for C-1 and C-2 (Amercoat 74s), and S-223, S-324, and S-523 (Amercoat 23 and 33) is similar to the literature for Amercoat 66 and will be supplied if desired. Tanks F-201, F-501, and LA-104 are in vaults which are unlined and therefore will be moved to Category C.
<ul style="list-style-type: none"> Sloped for drainage Provide support confirming slope and describe spills, leaks or infiltration is removed from sump within one week 	<u>EPA Comment Package - General Comments 2nd Paragraph</u> <u>EPA Comment Package - Specific Comments</u> C-1, C-2, L-11, B-2-T, B-3-T, C-6-T, F-111, F-126, WC-20, F-201, F-501, T-13, S-223, S-324, S-523, LA-104	The drawings which show the slope of the vault floor is included in the information package as Drawings S21246EB012D and P21246EC010D. Drawings P3E21246-C021, P3E21246-C023, and P21246EC011D show the sumps and pump which is used to remove any liquids (spills, leaks, and infiltration) which may collect in the sump. The sump for Tank L-11 is pumped automatically when liquid reaches a level at which an on/off switch is triggered.

RESPONSES TO EPA COMMENTS

COMMENTS	OCCURRENCE	RESPONSE
<p>Foundation capable of supporting system</p> <ul style="list-style-type: none"> • "Demonstrate that the slab and underlying soil have the capacity to support these loads without cracking or otherwise damaging the slab." 	<p><u>EPA Comment Package - Specific Comments</u> L-11</p>	<p>Drawings A21246EB009D, A21246EB010D, S21246EB012D, S21246EB013D, S21246EB014D, S21246EB015D, and A21246EB018D show the foundation of the L-11 vault structure. Based on sound engineering judgement, it is clear that the 8" thick concrete foundation is capable of supporting Tank L-11.</p>
<p>Protection against ignition of vapors</p> <ul style="list-style-type: none"> • tank ventilation only is acceptable • provide data supporting lack of ignitable or reactive wastes 	<p><u>EPA Comment Package - Specific Comments</u> F-201, F-501, T-13, S-223, S-324, S-523, WC-20, LA-104</p> <p><u>EPA Comment Package - Cover letter</u> WC-20 - 4th Paragraph</p>	<p>Drawing # H21246EG003 shows the location of the entry point for exhaust air for Tank System L-11. The exhaust system for Tank Systems T-13, S-223, S-324, S-523 and LA-104 are similar to the exhaust system shown in Drawing # H21246EG003 for Tank System L-11.</p> <p>The primary ventilation for WC-20 is monitored for explosive vapors and an alarm is telemetered to the WOCC. Tanks F-201 and F-501 will be moved to Category C.</p>

RESPONSES TO TDEC COMMENTS

COMMENTS	OCCURRENCE	RESPONSE
<p>Water stops</p> <ul style="list-style-type: none"> • must be chemical resistant • must have water stops in above grade construction joints as well as below grade 	<p><u>TDEC Comments</u></p> <p>N-71, P-3, P-4, C-1, C-2, B-2-T, B-3-T, C-6-T, L-11, WC-20, T-13, S-223, S-324, S-523, LA-104, F-111, F-126</p>	<p>Although the use of chemical resistant waterstops was not identified in the design drawings or construction specifications, it is unlikely that water from outside of the secondary containment system or LLLW from inside of the vault could penetrate the construction joints because the vault is externally waterproofed, internally coated, and provided with an alarmed leak detection and removal system. The support for the statement that the stored waste is unlikely to come in contact with the waterstops is provided by the principal by which the water stop is used (as depicted by the diagram included as Attachment 2.) In addition, for non-water bearing structures, water stops are not typically used in the construction industry. Water stops are used to prevent ground water infiltration in below grade joints.</p>
Lack of exterior moisture barrier	<p><u>TDEC Comments</u></p> <p>N-71, P-3, P-4, L-11</p>	<p>The site drainage system around the one vault wall that is in contact with soil is designed to minimize the potential for infiltration of groundwater, and in the unlikely event that any infiltration occurs, it will be contained and removed by the secondary containment system.</p>
Entire vault wall should be lined to prevent migration of waste into the concrete	<p><u>TDEC Comments</u></p> <p>N-71, P-3, P-4</p>	<p>The lined portion of the vault is designed to hold the capacity of the largest tank in the vault. In the case of the vaults for Tanks P-3 and P-4, each tank is 200 gallons and the lined portion of the vault will hold 800 gallons. Therefore, there is no potential for waste migrating into the concrete in the unlined portion of the vault from waste retained from any leaking tank. The tank vault for N-71 will hold 900 gallons of liquid and Tank N-71 is a 325 gallon tank, therefore, even if the entire contents of the Tank N-71 were placed in the tank vault, the waste would not reach above the lined concrete, thus eliminating the potential for waste migrating into the concrete wall.</p>

RESPONSES TO TDEC COMMENTS

COMMENTS	OCCURRENCE	RESPONSE
Prevention of infiltration or precipitation <ul style="list-style-type: none"> • Vault is known to leak occasionally 	<u>TDEC Comment</u> C-1, C-2, B-2-T, B-3-T, C-6-T	Due to the sump collection system and the ability to remove inleakage from the sump, it is not felt that the inleakage into the vault for C-1 and C-2 or the vault for B-2-T, B-3-T, and C-6-T represents a risk of release to the environment. In addition, it is believed that inleakage is occurring through plugs in the vault roof and not through cracks or other defects in the vaults, further reinforcing the lack of release potential. A cover will be constructed over the vault containing B-2-T, B-3-T, and C-6-T to prevent precipitation from contacting the roof plugs. Construction on the FY-93 GPP, 7930 Filter Pit Cover, will be initiated 2nd Quarter FY-94 and is planned to be finished 4th Quarter FY-94.
Lack of means to protect against formation of and ignition of vapors within the vault	<u>TDEC Comments</u> WC-20, F-201, F-501	Tanks WC-20, F-201, and F-501 are provided with a ventilation system for the tank (primary system) and the primary ventilation for Tank WC-20 is monitored for explosive vapors and an alarm is telemetered to the Waste Operations Control Center. Therefore, the lack of ventilation in the vault is not felt to be a safety issue. Tanks F-201 and F-501 will be moved to Category C.
Vault not provided with a lining or interior coating	<u>TDEC Comment</u> F-201, F-501, LA-104	Due to lack of a liner in the tank vaults for F-201, F-501, and LA-104, these tanks will be moved to Category C.
Lack of leak detection system	<u>TDEC Comment</u> F-201	Tank F-201 will be moved to Category C.

RESPONSES TO TDEC COMMENTS

COMMENTS	OCCURRENCE	RESPONSE
Ancillary equipment	<u>TDEC Comment</u> F-201, F-501	The ancillary equipment (piping) will be addressed in a separate document to be submitted to EPA and TDEC by March 31, 1994 in accordance with <u>FFA Plans and Schedules for LLLW Tank Systems at ORNL, DOE/OR/01-1135 & D2.</u>
On all leak detection systems, how much liquid must leak and accumulate in the sump before alarm sounds	<u>TDEC Comments</u> Comments/Questions #1.	In general, there are three different types of leak detection equipment located in the various sumps serving the secondary containment systems for the 19 Category B Tank System. The three types are conductivity probes, differential pressure sensors, and float type liquid sensors. The conductivity probes trigger an alarm when the probe comes in contact with liquid. The differential pressure sensor measures the depth of liquid in inches in the sump. The float type sensors turn on a pump automatically when the level of liquid reaches the level of the floats. In the enclosed information package, there are manufacturers' literature describing the conductivity probe and the differential pressure sensor. The depth of liquid which must accumulate in a sump before an alarm sounds or a pump is automatically switched on varies depending on the size of the sump and the number of inputs to the sump. The level at which an alarm sounds or a pump is switched on is not generally specified on the design drawings. This information is available in most cases from facility personnel and will be provided to TDEC if desired.

RESPONSES TO TDEC COMMENTS

COMMENTS	OCCURRENCE	RESPONSE
Why are only 375 gallons of the 710 gallon capacity of Tank C-6-T usable?	<u>TDEC Comments</u> Comments/Questions #2.	Tank C-6-T only has 375 usable gallons out of a total capacity of 710 gallons because the tank was originally filled with boroated glass Raschig rings. The Raschig rings were placed in the tank to serve as nuclear poisoning for a process for which the tank was originally planned for use. However, the tank was never used for this process, but used instead as an LLLW collection tank. Due to the difficulties involved in removing the Raschig rings, the rings were left in place.
Inspection of secondary containment systems .. to ensure the systems were built according to design and that the systems will not fail	<u>TDEC Comment</u> Comments/Questions #3.	The purpose of the design demonstration document is to demonstrate that the design of the secondary containment system meets requirements for secondary containment set forth in Appendix F, Section C of the FFA. In most cases, the access to the vaults is extremely limited due primarily to radiological hazards. This lack of access prohibits any routine visual inspections. However, due to the leak detection and liquid removal capabilities provided in the vaults, if a tank were to fail, the facility operators would know immediately and could mitigate the problem before any release to the environment occurred.

RESPONSES TO TDEC COMMENTS

COMMENT	OCCURRENCE	RESPONSE
Why are Tanks T-34, T-70, and F-115 not included in the LLLW program	<u>TDEC Comments</u> Comments/Questions #4.	<p>Tanks T-34, T-70, and F-115 are not included in the LLLW program because these tanks are used for specific process functions.</p> <p>Tank T-70 is the dissolver vessel for irradiated target material, including the transuranium element production targets irradiated in the HFIR. The first step is caustic dejacketing (or dissolution of the aluminum cladding and matrix in sodium hydroxide). The aluminum is dissolved along with some soluble fission products while the actinide oxides are not dissolved. The dejacketing liquid, containing the aluminum, is sent through a filter to remove any actinides (which are returned to T-70) and then to Tank F-111. The actinides (i.e., Cm, Bk, Cf, Es, Fm) retained in T-70 are then dissolved in acid for additional processing to separate and purify the individual actinides elements. These actinide elements are used in research, medical applications, industry, and/or for further irradiations.</p> <p>Tank F-115 is used as a batch liquid-liquid extraction vessel for the recovery of actinides from dilute process streams. An organic layer, which extracts the actinides, is retained in the tank while the aqueous layer is sent to Tank F-126 as waste.</p> <p>Process condensates collected in T-34 are no longer sent to F-111. Instead they are sent to the recovery stage in F-115.</p>
Tank F-201 should be considered a Category C tank system	<u>TDEC Comments</u> Comments/Questions #5	<p>DOE agrees that F-201, F-501, and LA-104 do not meet requirements for Category B tank systems. Therefore, DOE has provided schedules for replacement or upgrade, leak testing, and submittal of structural integrity assessments in Attachment 1.</p>

ATTACHMENT 1

SCHEDULES FOR REPLACEMENT PLANS, SIAs, AND LEAK TESTING FOR TANKS MOVED TO CATEGORY C

Provided below are the schedules for the upgrade or replacement, leak testing, and submittal of structural integrity assessments (SIAs) for the three tanks which do not meet secondary containment requirements and are being moved to Category C. These three tanks, as identified by EPA and TDEC, are F-201, F-501, and LA-104.

For Tank F-201, the following apply:

Replacement plan: To be replaced by the Monitoring and Control Station (MCS) in the Bethel Valley FFA Line Item in September 1997.

Leak Testing: Monthly leak testing in accordance with the Detailed Leak Detection Test Plan and Schedule will be initiated in March 1994. Monthly testing will be conducted until the tank is taken out of service and replaced by the MCS.

Structural Integrity Assessment: The SIA, including leak testing results, will be submitted by September 1995.

For Tank F-501, the following apply:

Replacement plan: To be replaced by the MCS in the Bethel Valley FFA Line Item in September 1997.

Leak Testing: Monthly leak testing in accordance with the Detailed Leak Detection Test Plan and Schedule will be initiated in March 1994. Monthly testing will be conducted until the tank is taken out of service and replaced by the MCS.

Structural Integrity Assessment: The SIA, including leak testing results, will be submitted by September 1995.

For LA-104, the following apply:

Replacement or Upgrade Plan: There are no current plans to upgrade this tank to meet Category B requirements or to replace the tank with a new system.

Leak Testing: The tank is not currently in use. If the tank is needed during the Isotope Facility Shutdown Program, Tank LA-104 will be leak tested until it is removed from service.

Structural Integrity Assessment:

The SIA will be submitted by September 1995 unless it is moved to Category D prior to September 1995. In the event it is moved to Category D, the FFA requirements as discussed in Chapter 7 of FFA Plans and Schedules for LLLW Systems at ORNL will be followed.

ATTACHMENT 2

Waterstop Usage Diagram

NOTES:

1. THE PURPOSE OF THE LINER OR COATING IS TO KEEP WASTE FROM REACHING THE CONCRETE .
2. THE PURPOSE OF THE WATER STOPS IS TO PREVENT GROUND WATER FROM PENETRATING INTO THE VAULT. DUE TO THE LINER, WASTE WILL NOT REACH THE WATER STOPS.
3. WATERSTOPS ARE TYPICALLY NOT USED IN ABOVE GRADE CONSTRUCTION JOINTS FOR NON-WATER BEARING STRUCTURES.

Reading 114

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

1000 CENTRAL STREET
ATLANTA, GEORGIA 30333

MAY 02 1994

10/27/94

ATTN: Amber Clay, Debbie May,
Tom Ehrhardt, Mark Peet.

Tom Mark

4WD-FFB

W. Nelson Lingle
Environmental Restoration Division
U.S. Department of Energy
Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831-8541

SUBJ: Design Demonstrations for the Remaining 19 Category B
Tanks Systems at Oak Ridge National Laboratory,
Oak Ridge Tennessee (DOE/OR/03-1150&D1)

Dear Mr. Lingle:

The Environmental Protection Agency (EPA) has reviewed the subject document and the Department of Energy's (DOE) responses to comments submitted by EPA and the Tennessee Department of Environment and Conservation (TDEC) in accordance with the requirements of Section IX.C.3. of the Federal Facility Agreement (FFA). This document contains the design demonstrations for 19 tank systems.

Appendix F, Section C.1.(e)(iv) states that secondary containment for tanks shall include one or more of the following: a liner, vault, double-wall tank, or an equivalent device approved by EPA. In DOE's design demonstrations, a number of deviations from the requirements for vault systems were noted. In general these deviations included interior coatings, chemical resistant water stops, and ventilation systems. As a result of these deviations, DOE has downgraded tanks F-201, F-501, and LA-104 from Category B status to Category C status. For the remaining items DOE provided additional information to show how the intent of the requirements were met through alternate methods.

EPA is approving the design demonstrations for the tanks contained within this document, with the above noted exceptions of tanks F-201, F-501, and LA-104. These demonstrations are being approved in accordance with Section IX.C.3. of the FFA utilizing the provision of Section C.1.(e)(iv) of Appendix F of the FFA: an equivalent device approved by EPA.

2

In DOE's response to comments, DOE included the schedules for the replacement or upgrade of tanks F-301, F-501, and LA-104. These schedules should be incorporated into the updated plans and schedules document scheduled for submission on June 30, 1994.

If you have any questions concerning this matter, I may be contacted at (404) 347-3016.

Sincerely,

Edward M. Carreras
Remedial Project Manager

cc: Doug McCoy, DOE
Pat Halsey, MIES

COPY

R.O.M

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DOE OVERSIGHT DIVISION
781 EMORY VALLEY ROAD
OAK RIDGE, TENNESSEE 37830-7072

May 11, 1994

Mr. Nelson Lingle
Environmental Restoration Division
U.S. Department of Energy
P.O. Box 2001
Oak Ridge, TN 37831-8541

Dear Mr. Lingle

DESIGN DEMONSTRATIONS FOR THE REMAINING 19 CATEGORY B TANKS SYSTEMS
OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE
DOE/OR/03-11504D1

The Tennessee Department of Environment and Conservation, DOE Oversight Division (TDEC/DOE-O) has reviewed the above referenced document and the Department of Energy's (DOE) responses to comments submitted by TDEC and EPA in accordance with the requirements of Section IX.C.3 of the Federal Facility Agreement (FFA).

Appendix F, Section C.1(e)(iv) states that secondary containment for tanks shall include one or more of the following: a liner, vault, double wall tank, or an equivalent device approved by EPA. In DOE's design demonstration, a number of deviations from the requirements for vault systems were noted. In general, these deviations included chemical resistant water-stops, ventilation systems, exterior moisture barriers, and interior coatings. As a result of these deviations, DOE has downgraded tanks F-201 and F-501 to category C and tank LA-104 to category D. For the remaining items DOE provided additional information to show how the intent of the requirements were met through alternate methods.

TDEC is approving the design demonstrations for the tanks contained within this document, with the above noted exceptions of tanks F-201, F-501, and LA-104. These demonstrations are being approved in

10/14/94
ATTN: Debbie May, Amber
Clegg, Tom Etzinger, Randy
Clark

FYI

Regards
Tom

Mr. Nelson Lingle
May 11, 1994
Page Two

accordance with Section IX.C.3 of the FFA utilizing the provision of Section C.1(a)(iv) of Appendix F of the FFA: an equivalent device approved by EPA.

Questions or comments concerning the contents of this letter should be directed to Curt Myers or Kandy Young at the above address or by phone at (615) 481-0163.

Sincerely

R. Doug McCoy
Environmental Restoration Program

SAC
cc Victor Weeks - EPA
Pat Halsey - MMES

cr0373.08

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