LOCKHEED MARTIN

ORNL/ER-428

ENVIRONMENTAL RESTORATION PROGRAM

Completion Report for the Isolation and Remediation of Inactive Liquid Low-Level Radioactive Waste Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562 at Oak Ridge National Laboratory Oak Ridge, Tennessee

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FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Commodore Advanced Sciences, Inc.

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

DISCLAIMER

ORNL/ER-428

Completion Report for the Isolation and Remediation of Inactive Liquid Low-Level Radioactive Waste Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562 at Oak Ridge National Laboratory Oak Ridge, Tennessee

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Environmental Management Activities at
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Oak Ridge, Tennessee 37831
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PREFACE

The *Completion Report for the Isolation and Remediation of Inactive Low-Level Radioactive Waste Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562 at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (ORNL/ER-428) provides documentation of the maintenance action completion for remediation of Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562 at Oak Ridge National Laboratory. This report will serve as the remediation completion documentation for the request to remove these tanks from the Federal Facility Agreement Appendix F listing. This work was performed under Work Breakdown Structure 1.4.12.6.1.01.21 (Cost Center Activity Data Sheet 3300, "ORNL Environmental Management Program").

CONTENTS

TABLES

ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
HRE	Homogeneous Reactor Experiment
LLLW	liquid low-level waste
LMER	Lockheed Martin Energy Research Corporation
LMES	Lockheed Martin Energy Systems, Inc.
ORNL	Oak Ridge National Laboratory
P&E	Plant and Equipment
PRN	Project Record Number
TDEC	Tennessee Department of Environment and Conservation

EXECUTIVE SUMMARY

The Federal Facility Agreement (FFA) between the U.S. Environmental Protection Agency (EPA), Tennessee Department of Environment and Conservation (TDEC), and U.S. Department of Energy (DOE) requires that all liquid low-level waste tanks at Oak Ridge National Laboratory removed from service, designated in the FFA as Category D, be remediated in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

A human health risk screening assessment was conducted for inactive Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562 as part of an evaluation to determine the method of remediation necessary to safely and permanently isolate and remediate the tanks. Risk screening assessment results indicated that the health risks associated with these tanks were within or below the EPA range of concern of 1×10^{-4} to 1×10^{-6}. On the basis of these results and with regulators concurrence, it was determined that either no action or in-place stabilization of the tanks would satisfy risk-based remediation goals. Therefore, decisions were made and approved by DOE to remediate these tanks in-place as maintenance actions rather than actions under the CERCLA process. Letters documenting these decisions were approved by DOE and subsequently submitted to TDEC and EPA, who concurred with the maintenance actions.

Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562 were isolated from associated piping, electrical systems, and instrumentation and were grouted in-place. Tank 7562 was originally isolated from associated piping and instrumentation and left in-place empty for future remedial consideration. Upon further consideration, the decision was made by DOE, with concurrence by the regulators, to complete the maintenance action of Tank 7562 by grouting it in-place in March 1997.

Completion of these maintenance actions has satisfied the requirements of the FFA for remediation of inactive tank shells and contents for Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562. EPA and TDEC will be asked to approve a change to the FFA removing these tanks from the Appendix F list of inactive tanks needing remediation. Because the associated tank piping systems and any associated contaminated soil or groundwater were not included in the maintenance actions, it will further be requested that these systems remain as individual sites in Appendix C of the FFA for future remedial consideration to satisfy the remaining requirements of Section IX of the FFA.

1. INTRODUCTION AND SITE DESCRIPTION

1.1 BACKGROUND

The Federal Facility Agreement (FFA) between the U.S. Environmental Protection Agency (EPA), Tennessee Department of Environment and Conservation (TDEC), and U.S. Department of Energy (DOE) requires that all liquid low-level waste (LLLW) tanks at Oak Ridge National Laboratory (ORNL) removed from service, designated in the FFA as Category D, be remediated in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

A human health risk screening assessment was performed on inactive Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562 using available characterization data associated with each tank. In each case, the results indicated risks associated with these tanks were within or below the EPA range of concern of 1×10^{-4} to 1×10^{-6}. On the basis of these results and with regulators concurrence, it was determined that either no action or in-place stabilization of the tanks would satisfy risk-based remediation goals. Therefore, decisions were made and approved by DOE to remediate these tanks in-place as maintenance actions rather than actions under the CERCLA process. Letters documenting these decisions were subsequently submitted to TDEC and EPA, who concurred with the maintenance actions (Lingle 1996; Wilson 1997).

1.2 SITE DESCRIPTION

The following subsections describe the tank sites before maintenance action activities.

1.2.1 Tank WC-5

Tank WC-5 is a 1000-gal type 347 stainless-steel tank located south of Building 3503. The tank was installed in 1952 and received waste from development projects in Buildings 3508, 3503, 3541, and 3592. The tank is direct buried and vertically oriented with the top of the tank approximately 8 ft below grade. All tank piping is stainless steel. Tank system influent piping is routed underground from Building 3508 to Tank WC-5. Discharge piping is routed aboveground to Tank WC-9. Tank WC-5 contained variable amounts of liquid from inleakage, which were periodically removed by ORNL Waste Operations. The tank was empty before maintenance action activities.

1.2.2 Tank WC-6

Tank WC-6 is a 500-gal type 347 stainless-steel tank located south of Building 3503. The tank was installed in 1952 to receive waste from development projects in Buildings 3508, 3541, and 3592. The tank is direct buried and vertically oriented with the top of the tank approximately 8 ft below grade. All tank piping is stainless steel. Tank system influent piping is routed underground from Buildings 3508, 3541, and 3592 to Tank WC-6. Discharge piping is routed aboveground to Tank WC-9. Tank WC-6 contained variable amounts of liquid from inleakage, which were periodically removed by ORNL Waste Operations. The tank was empty before maintenance action activities.

1.2.3 Tank WC-8

Tank WC-8 is a 1000-gal type 347 stainless-steel tank located south of Building 3503. The tank was installed in 1952 to receive waste from development projects in Buildings 3503, 3508, 3541, and 3592. The tank is direct buried and is vertically oriented with the top of the tank approximately 8 ft below grade. All tank piping is stainless steel. Tank system influent piping is routed underground from Building 3503 to Tank WC-8. Discharge piping is routed aboveground to Tank WC-9. Tank WC-8 contained variable amounts of liquid from inleakage, which were periodically removed by ORNL Waste Operations. The tank was empty before maintenance action activities.

1.2.4 Tank WC-19

Tank WC-19 is a 2250-gal type 347 stainless-steel tank located directly north of Building 3047 in the main plant area of ORNL. The tank was installed in 1955 and was used to collect LLLW produced from development projects in Buildings 3001, 3002, 3003, 3004, 3010, 3019, 3042, 3004, and 3119. The tank also received condensate from off-gas high-efficiency particulate air filter pits associated with these buildings. In addition, the tank received inflow from the drain seal tank, which acted as an overflow from the Cell Ventilation Filter Pit. The tank is direct buried and horizontally oriented with the top of the tank approximately 13 ft below grade. Depth to groundwater in the area is 7 ft; therefore, the tank is totally submerged in the groundwater table. All associated tank piping is routed underground and is stainless steel, with the exception of a vitrified clay overflow pipe stemming from the tank riser. Tank WC-19 contained variable amounts of liquid from inleakage, which were periodically removed by ORNL Waste Operations. The tank was empty before maintenance action activities.

1.2.5 Tank 3002-A

Tank 3002-A is a 1600-gal type 347 stainless-steel tank located adjacent to the south side of filter house 3002. The tank was installed in 1943 and was used to collect condensate from the filter house (Building 3002), which served the Graphite Reactor, Building 3001. The tank is vertically oriented inside an in-ground concrete vault. It is supported on steel clips anchored to the concrete floor. The top of the tank lies approximately 16 ft below the top of the vault, which is at ground level. All associated tank piping is routed underground and is stainless steel. Tank 3002-A contained variable amounts of liquid from inleakage, which were periodically removed by ORNL Waste Operations. The tank was empty before maintenance action activities.

1.2.6 Tank 7560

Tank 7560 is a 1000-gal stainless-steel tank located in Melton Valley east of the Homogeneous Reactor Experiment (HRE) facility (Building 7500). The tank is direct buried under 4 to 6 ft of soil and served as a LLLW storage tank for HRE. Tank 7560 was originally used as a waste collection tank for HRE-1, with later use as the clean vapor condenser tank for HRE-2. Existing inlet, discharge, and sample piping associated with Tank 7560 is stainless steel and routed underground. The tank liquid level was manually monitored by the ORNL Surveillance and Maintenance Program on a yearly basis to determine the existence of any inleakage. No inleakage has been detected, and the tank was empty before maintenance action activities.

1.2.7 Tank 7562

Tank 7562 is a 12,000-gal stainless-steel tank located southeast of Building 7500 in Melton Valley. The tank was direct buried in 1957 under 4 to 6 ft of soil and served as a LLLW storage tank for the HRE facility. The tank also collected liquid from a decontamination pad located just west of the tank. Existing inlet, discharge, and sample piping associated with Tank 7562 is stainless steel and routed underground. Before remediation activities, the tank had a liquid inventory of 2300 gal, which was monitored daily to ensure there were no inputs to or leaks from the tank. This liquid was removed from the tank by ORNL Waste Operations before isolation activities in 1996.

2. MAINTENANCE ACTION OBJECTIVES

The main objective of these maintenance actions was to safely and permanently remove tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562 from service to eliminate the need for continued surveillance and maintenance of the tank systems. Meeting this objective involved isolating each tank to prevent future inleakage or introduction of nonprogrammatic wastes and securing each tank in-place by filling the tank with a controlled low-strength grout material. The grout consisted of a mixture of Type II cement, sand, Type-F fly ash, and water with a compressive strength of approximately 300 psi and a permeability of 2×10^{-5} cm/s. Closing the tanks in this manner will prevent inadvertent accumulation of any free liquids in the tanks. The low compressive strength of the grout will not preclude any future actions, and the low permeability will effectively prevent the movement of free liquids into the tank.

3. INITIAL ASSUMPTIONS

Initial planning assumptions were made concerning the status and configuration of each tank system. These assumptions and decisions were based on available system configuration information, sampling data, and engineering judgement.

Available sample data of tank contents was used for the human health risk screening assessment and characterization of contents for removal and proper disposal. On the basis of this characterization data, it was determined that health risks associated with the tanks were within or below the EPA range of concern of 1×10^{-4} to 1×10^{-6}.

The volume of fluid in each of the tanks was assumed based on available level measurement data from surveillance and maintenance activities. This data indicated that Tank 7562 had a volume of approximately 2300 gal, Tank 7560 was empty, and Tanks WC-5, WC-6, WC-8, WC-19, and 3002-A had variable liquid volumes that were periodically removed by ORNL Waste Operations. Any liquids existing in each tank were removed as a surveillance and maintenance activity before remediation and disposed of in the active LLLW system. Additionally, the tank interiors were rinsed and emptied before isolation and in-place stabilization activities.

Available engineering drawings were used to reflect tank and piping configurations that could not be visually verified before or during remediation activities. The engineering drawings listed in

Chap. 7 of this report will be revised to reflect "as-built" conditions as a result of the maintenance actions.

4. MAINTENANCE ACTION METHOD OF ACCOMPLISHMENT

Field work for Tanks WC-5, WC-6, WC-8, WC-19, and 3002-A was performed by MK-Ferguson direct-hire forces in accordance with construction specifications and related documentation prepared by Lockheed Martin Energy Systems, Inc. (LMES), as listed in Chap. 8. Field work for Tanks 7560 and 7562 was performed by the Lockheed Martin Energy Research Corporation (LMER) Plant and Equipment (P&E) Division in accordance with the applicable Maintenance Action Work Plan and related LMES documentation listed in Chap. 8. ORNL Waste Operations was responsible for pumping existing tank contents before isolation and grouting activities.

5. MAINTENANCE ACTION FIELD ACTIVITIES

Tables 1 through 4 provide a chronology of maintenance action field activities related to remediating Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562.

Table 1. Chronology of events for Tanks WC-5, WC-6, and WC-8

Date	Event
12/02/96	Mobilized to Tanks WC-5, WC-6, and WC-8 site
01/28/97	Completed isolation of piping systems with blind flanges in common pump pit west of tanks
01/31/97	Filled Tanks WC-5, WC-6, and WC-8 and associated discharge lines with grout
04/11/97	Covered WC-5, WC-6, and WC-8 tank risers with blind flanges. Demobilized from tank site and completed cleanup of the work area

Table 2. Chronology of events for Tanks WC-19 and 3002-A

Date	Event
05/19/97	Completed work on manhole at 3002-A and rerouting of pipelines inside 3002-A vault
05/22/97	Filled Tank 3002-A with grout
06/27/97	Removed tree and utility pole to allow access to Tank WC-19; completed field work on Tank WC-19
07/21/97	Filled Tank WC-19 with grout

Table 3. Chronology of events for Tank 7560

Date	Event
07/14/97	LMER P&E personnel mobilize to Tank 7560 site and begin excavating to expose top of tank and connected piping
07/16/97	Completed excavation; cut and capped associated pipelines
07/17/97	Filled Tank 7560 with grout and capped pipelines, which were left open for grout injection and venting purposes during grouting
07/18/97	Started backfilling Tank 7560 excavation with clean borrow material
07/21/97	Completed backfilling, graded and seeded surface area, and demobilized from site

Table 4. Chronology of events for Tank 7562

Date	Event
03/20/97	LMER P&E personnel mobilize to Tank 7562 site and prepare tank for grouting activities
03/21/97	Began filling Tank 7562 with grout
03/24/97	Completed grouting Tank 7562, backfilled excavation with soil cuttings from HRE cryogenics thermoprobe holes, and demobilized from Tank 7562 site. Surface soil layer remained to be backfilled at a later date
07/21/97	Completed backfilling Tank 7562 with clean fill/cover material to surface, graded and seeded surface area, and demobilized from site

6. REMOVAL FROM FEDERAL FACILITY AGREEMENT LIST

Completion of these maintenance actions has met the intent of the FFA for remediation of the shells and contents of inactive Tanks WC-5, WC-6, WC-8, WC-19, 3002-A, 7560, and 7562. EPA and TDEC will be asked to approve a change to the FFA removing these tanks from the Appendix F list of inactive tanks. Because the associated tank piping systems and any associated contaminated soil or groundwater were not included in the maintenance actions, these systems will remain as individual sites in Appendix C of the FFA for future remedial consideration in the watershed Records of Decision to satisfy the remaining requirements of Section IX of the FFA.

7. RETENTION OF MAINTENANCE ACTION RECORDS

Written documentation for these maintenance actions will be retained in the Engineering Records System as follows: Project Record Numbers (PRNs) X1996-0021 through X1996-0023 for Tanks WC-5, WC-6, and WC-8; PRNs X1996-0024 and X1996-0061 for Tanks WC-19 and 3002-A; PRN X1995-0010 for Tank 7560; and PRN X1995-0010 for Tank 7562. Documentation will be retained as described in the Project Records Plan for each tank. Copies of record documentation will

also be provided to the Environmental Management and Enrichment Facilities Document Management Center.

The engineering drawings identified in Table 5 will be revised and maintained in the Engineering Drawing Information System to show the as-built status of the piping systems remaining at each tank site.

Table 5. Tank reference drawings to be revised

Tank	Drawing number	Drawing title
WC-5, WC-6, WC-8	P3E020029C018, Rev. B	FFA LLLW Tank Isolation Isolation of Tank System WC-5, WC-6, and WC-8 Plan, Sections, Details, and Notes
WC-19 and 3002-A	P3E020029C019, Rev. 0	Isolation of Tank System WC-19 Plan, Sect., Details, and Notes
WC-19 and 3002-A	P3E020029C020, Rev. 0	Isolation of Tank System WC-19 and 3002-A Site Plan, Sect., and Details
WC-19 and 3002-A	P3E020029C021, Rev. 0	Isolation of Tank System WC-19 and 3002-A Plan, Details
7560	D-8309, Rev. G	Bldg. 7500 Waste and Vent System Flow Sheet
7562	E-24800	Outside Underground Waste & Vent System Piping
7562	D-7587	Evaporator Feed Tank Sheet #1
7562	D-20769	Building 7500 Waste Lagoon and Storage Tank
7562	D-24816	Waste Evap. Instrument Piping Arrgt. & Details
7562	Q-2529-78RO	Waste System Partial Plot Plan & Sections
7562	D-8309	Waste & Vent System Flow Sheet
7562	D-7588	Evaporator Feed Tank Details Sh. #2
7562	D-24804	Yard Piping Plan and Profile

8. REFERENCES

8.1 TANKS WC-5, WC-6, AND WC-8

Lingle, W. Nelson, August 27, 1996. U.S. Department of Energy, letter to Doug McCoy, Tennessee Department of Environment and Conservation and Tony Able, U.S. Environmental Protection

Agency, *Isolation and In-place Stabilization of Inactive Liquid Low Level Waste Tanks WC-5, WC-6, and WC-8 at Oak Ridge National Laboratory.*

Data Package for the Isolation and Remediation of Inactive Liquid Low-Level Radioactive Waste Tanks WC-5, WC-6, and WC-8 at Oak Ridge National Laboratory Oak Ridge, Tennessee, WMRA-FFAER-505, May 1997.

8.2 TANKS WC-19 AND 3002-A

Wilson, M. April 9, 1997. U.S. Department of Energy, letter to Doug McCoy, Tennessee Department of Environment and Conservation and Tony Able, U.S. Environmental Protection Agency, *Isolation and In-place Stabilization of Inactive Liquid Low Level Waste Tanks WC-19 and 3002-A at Oak Ridge National Laboratory.*

Data Package for the Isolation and Remediation of Inactive Liquid Low-Level Radioactive Waste Tanks WC-19 and 3002-A at Oak Ridge National Laboratory Oak Ridge, Tennessee, WMRA-FFAER-507, September 1997.

8.3 TANK 7560

Wilson, M. July 16, 1997. U.S. Department of Energy, letter to Doug McCoy, Tennessee Department of Environment and Conservation and Tony Able, U.S. Environmental Protection Agency, *Remediation of Oak Ridge National Laboratory Inactive Liquid Low-Level Waste Tank 7560.*

Maintenance Action Work Plan Addendum 3 of ORNL/ER-319 For Inactive LLLW Tanks 7560 at Oak Ridge National Laboratory, Oak Ridge, Tennessee, June 1997.

Addendum 1 to Health and Safety Plan, ORNL/ER-226 Specific Application Checklist for Maintenance Actions on Inactive Tanks 7562 and H-209 at Oak Ridge National Laboratory, Oak Ridge, Tennessee, ER/HSP-001-226/0011-0996, September 1996.

Addendum to ERWM Plan Checklist #001-288/0010-1296, *Project Waste Management Plan Checklist for Inactive Liquid Low-Level Waste Tanks 7562 and H-209*, June 5, 1997.

8.4 TANK 7562

Wilson, M. July 9, 1996. U.S. Department of Energy, letter to Doug McCoy, Tennessee Department of Environment and Conservation and Victor Weeks, U.S. Environmental Protection Agency, *Isolation and In-place Stabilization of Inactive Liquid Low Level Waste Tanks 7562 and H-209 at Oak Ridge National Laboratory.*

Maintenance Action Work Plan Addendum 1 and 2 of ORNL/ER-319 For Inactive LLLW Tanks 7562, H-209, and T-30 at Oak Ridge National Laboratory, Oak Ridge, Tennessee, July 1996 and August 1996.

Health and Safety Plan ORNL/ER-226, *Specific Application Checklist for Maintenance Actions on Inactive Tanks 7562 and H-209 at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ER/HSP-001-226/0011-0996, dtd Sept 1996.

Environmental Restoration (ER) Project Waste Management (WM) Plan Checklist for Inactive Liquid Low-Level Waste (LLLW) Tanks 7562 and H-209, No. 001-288/0010-1296.

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