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ABSTRACT

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INTEGRATION OF REMEDIATION STRATEGY WITH WASTE MANAGEMENT CAPABILITIES AND REGULATORY DRIVERS FOR RADIOACTIVE WASTE STORAGE TANKS AT THE OAK RIDGE NATIONAL LABORATORY

This paper addresses the plans and strategies for remediation of the Liquid Low-Level Waste (LLLW) system tanks that have been removed from service at the Oak Ridge National Laboratory (ORNL).

The Superfund Amendments and Reauthorization Act of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires a Federal Facility Agreement (FFA) for federal facilities placed on the National Priorities List. The Oak Ridge Reservation was placed on that list on December 21, 1989, and the agreement was signed in November 1991 by the U. S. Department of Energy Oak Ridge Operations Office (DOE-ORO), the EPA–Region IV, and the Tennessee Department of Environment and Conservation (TDEC). The effective date of the FFA is January 1, 1992. One requirement of the FFA is that LLLW tanks that are removed from service must be evaluated and remediated through the CERCLA process.

The Environmental Restoration Program intends to meet this requirement by using a "streamlined" approach for selected tanks. This approach will combine the CERCLA Site Investigation, Remedial Action, Feasibility Study, and Proposed Plan requirements into a single Interim Proposed Plan document. This streamlined approach is expected to reduce the time required to complete the regulatory process while attaining acceptable risk reduction in a cost-effective way.

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INTEGRATION OF REMEDIATION STRATEGY WITH WASTE MANAGEMENT CAPABILITIES AND REGULATORY DRIVERS FOR RADIOACTIVE WASTE STORAGE TANKS AT THE OAK RIDGE NATIONAL LABORATORY*

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OAK RIDGE NATIONAL LABORATORY BACKGROUND

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

Since its establishment, ORNL has operated numerous facilities that generate LLLW. LLLW originates from radioactive liquid discarded into sinks and drains in research and development laboratories and from facilities such as the Radiochemical Processing Pilot Plant, nuclear reactors, radioisotope production facilities, and the Process Waste Treatment Plant.

The LLLW system is a complex system with multiple facilities, users, and operators. The system is used for collection, neutralization, transfer, and concentration of aqueous radioactive waste solutions from generator facilities. Waste solutions are typically accumulated at source buildings, often in collection tanks located inside the buildings, and discharged to below-grade collection

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tanks that may receive wastes from several different source buildings. However, in many instances, LLLW is transferred from laboratory and hot cell drains through unvalved piping directly to underground collection tanks or to the central waste collection header. A network of below-grade piping interconnects the various system components. The collected LLLW is transferred to an evaporator, where it is concentrated. The concentrates are transferred to storage tanks.

Most of the LLLW system was installed more than 30 years ago. The original system, installed during the early 1940s, and its subsequent modifications were designed to minimize radiation exposure to LLLW system users and operators. The system includes features such as unvalved, gravity-drained transfer lines to prevent waste backup into generator areas; shielded lines and tanks; and provisions for remote operations. As-built drawings for some of the older tank systems do not exist. Over the years, tank systems were removed from service as their integrity degraded or as programs were terminated. New tank systems installed during the past 10 to 15 years incorporate secondary containment and improved leak detection features. The LLLW system is thus a mix of singly and doubly contained tank systems. The portions of the system that have been removed from service consist almost exclusively of tanks without secondary containment.

OBJECTIVES

The objectives of the Environmental Restoration Program for the inactive LLLW tanks complement the objectives for a comprehensive environmental restoration of the Oak Ridge Reservation in keeping with the overall program mission.

ENVIRONMENTAL RESTORATION MISSION

> Our mission is to remediate contaminated sites and contaminant releases to reduce current and future risk to human health and the environment. Early actions focused on reducing current or potential off-site risk are conducted in parallel with efforts to select, implement, and verify final remedies for contaminated sites. Remedial efforts are prioritized and innovative approaches are developed to support cost-effective risk reduction. All efforts are conducted with an emphasis on worker health and safety and with the goals of meeting regulatory requirements and the expectations of the public.

As stated in the FFA,

> DOE shall remediate all tank system(s) removed from service. To the extent practicable, DOE shall remove or decontaminate or otherwise remediate all residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment associated with the tank system(s).

A primary objective of the Environmental Restoration Program is to remediate all LLLW tanks that have been removed from service to the extent practicable in accordance with CERCLA requirements. In addition to risk and risk reduction, applicable or relevant and appropriate requirements (ARARs) will be addressed in choosing a remediation alternative. Preference will be given to remedies that are highly reliable and provide long-term protection. Efforts will be directed toward permanently and significantly reducing the volume, toxicity, or mobility of

hazardous substances, pollutants, and contaminants associated with the tank systems. Where indicated by operational or other restraints, interim measures short of full and complete remediation may be taken to maintain human health and ecological risks at acceptable levels until full remediation can be accomplished.

Environmental restoration requires decision making with available data containing uncertainties and traditional approaches can sometimes be very time consuming, expensive, and inefficient. Therefore, the environmental restoration process for LLLW tanks that have been removed from service will consider (1) employing innovative and technically sound approaches to tank remedial actions; (2) balancing short-term needs to protect health and the environment with long-term future use objectives for the Oak Ridge reservation; (3) remediating the inactive tank systems in a logical order that is integrated with other remedial actions; (4) attaining cost-effective risk reduction; (5) meeting environmental regulations; and (6) addressing the expectations and requirements of all stakeholders.

REMEDIATION STRATEGY

Background

The management strategy for timely and efficient remediation of all sites at ORNL is to divide the waste units into waste area groupings (WAGs), which are areas that are either geographically contiguous or hydrologically confined units. Within each WAG, one or more operable units (OUs) have been defined. These OUs are smaller, more manageable units chosen on the basis of contaminant pathways analysis, application of similar remediation technology, geographical consideration, assessment of early or time-phased action, and remediation efficiency or simplicity considerations. The designation of all OUs for the Oak Ridge Reservation is shown in the FFA.

Remediation Plan

As of December 1994, FFA Appendix F identified a total of 55 tanks that had been removed from service and designated these tanks as Category D. Eighteen tanks considered to pose the highest risk were assigned to WAG 1 OU 1, Gunite and Associated Tanks (GAAT), which will be remediated under a separate project. These 18 tanks will undergo the complete remedial action process including a remedial investigation and feasibility study (RI/FS) leading to a proposed plan and a record of decision (ROD) as required by CERCLA. Treatability studies are currently being conducted on these tanks.

In parallel with the ongoing activities associated with remedial actions for the GAAT OU, a "streamlined" CERCLA process is being applied to the remaining 37 Category D tanks. These 37 tanks were preliminarily screened according to risk, remediation technology required, interferences with other piping and equipment, location, and available sludge removal techniques and storage requirements. On the basis of this preliminary screening, the tanks were assigned to one of five "batches" (I through V) for consideration of remedial action alternatives and these batches were tentatively scheduled for remedial actions. This prioritization will be further refined on the basis of results from the prioritization risk assessment and site investigation results.

For each batch of tanks, documentation will be prepared that incorporates all the requirements of the CERCLA remediation process leading to an expedited record of decision (ROD). The

specific remediation alternative will be chosen on the basis of risk as described in EPA guidance manuals. This streamlined approach will combine the CERCLA Site Investigation, Remedial Investigation, Feasibility Study, and Proposed Plan requirements into a single Interim Proposed Plan document. The Interim Proposed Plan will clearly define the tank system components, both piping and containment (tank, vault, etc.), that will be included in the interim remedial action. The Interim Proposed Plan will also describe the means taken to safely secure the components not immediately remediated and will clearly indicate to which OUs these components will be assigned. Following the selection of a preferred remedial action alternative and its documentation in the ROD, remedial design and remedial actions will proceed. The goal will be to arrive at final remediation for each tank system, although in some cases interim actions may be indicated.

The Environmental Restoration Program recognizes that other tanks are scheduled to be removed from service as projects are completed to bring the active LLLW system into full FFA compliance. Active tanks whose removal from service is pending have also been tentatively assigned to batches. The same preliminary screening factors that were used for the initial batch assignment of the inactive tanks were applied to these currently active LLLW tanks. As they are removed from service and transferred to the Environmental Restoration Program, the tanks will be emptied and made to meet program acceptance criteria. As the program moves forward and more information becomes available, these tanks may be reassigned to other batches or they may be remediated as a separate batch or batches.

A team has been assembled to address remediation of the Batch I tanks. The team is a group of technical representatives from all involved organizations. The team, which meets regularly to coordinate and plan remedial action activities for the tanks that have been removed from service, provides a mechanism for integrated responses on remedial action issues to DOE, EPA, and TDEC.

The approach to remediation of each tank or batch of tanks can and should be viewed as a dynamic, flexible, customized process that must be adapted in response to the specific circumstances of individual tank and sites. Thus, the approach will be tailored to accommodate feedback on lessons learned from previous remediation actions and will not be a rigid step-by-step approach that must be conducted identically for every tank system.

Tank parameters have been examined and an initial ranking made to determine the first tanks or batches of tanks to undergo remediation through the CERCLA process as required by the FFA. Remedial actions for the Batch I tanks are scheduled to begin in FY 1995. All of the tanks in Batch I have previously been emptied and are thought to have no inflow.

Although the specific remedial action alternatives for a tank system, which will reduce the risk to acceptable levels, will be described in the Interim Proposed Plan, four general alternatives that are applicable to both direct-buried tanks and tanks located in vaults have been identified.

Alternative	Merits and limitations
Remove and dispose of tank and isolate piping.	Remediation of the tank will be complete. Adverse impacts on other OU's will be minimized. Risk reduction or other cost benefit ratio must justify cost of removal and disposal. Removed tank may require treatment to meet appropriate waste acceptance criteria.
Leave tank in place and isolate piping.	To complete successful CERCLA remediation, risk posed by tank must be below EPA risk acceptability range. Future deterioration of tank could cause problems. Tank may require acceptance into the remedial action program of other OU's. Tank may require continued surveillance and maintenance.
Fill tank with stabilizing medium.	Stabilizing medium could minimize the accumulation of liquid in the tank. The tank must be cleaned prior to placing stabilizing medium. Any remaining contaminants could be leached from stabilizing medium if tank wall is breached. Added mass and volume of stabilizing medium might increase future excavation and waste disposal costs.
Leave tank as is.	If tank risk falls below EPA acceptable range, the tank can be removed from CERCLA consideration. The tank could remain under CERCLA, a surveillance and maintenance program, or both because of potential for inleakage and contamination.

Following successful remediation of the Batch I tanks, and using the lessons learned in these projects, as well as lessons from the GAAT OU project, the plan is to proceed to increasingly more complex or difficult tank or tank site remedial actions on the basis of knowledge and skills developed on these initial tank remedial action projects.