ORNL/ER-235

Energy Systems Environmental Restoration Program
ORNL Environmental Restoration Program

**Waste Management Plan for the Remedial Investigation of
Waste Area Grouping 2 at Oak Ridge National Laboratory,
Oak Ridge, Tennessee,**

Date Issued— October 1994

Prepared by
Environmental Sciences Division
Oak Ridge National Laboratory

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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ER-12-1505 (Effective 09-29-94)

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ABBREVIATIONS

ALARA	as low as reasonably achievable
ARARs	relevant and appropriate requirements
C-zone	contamination zone coverall
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DCG	Derived Concentration Guide
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
Energy Systems	Martin Marietta Energy Systems, Inc.
EPA	U.S. Environmental Protection Agency
EPO	Environmental Protection Officer
ER	Environmental Restoration
ESWMO	Energy Systems Waste Management Organization
GCO	Generator Certification Official
ES&H	environmental, safety, and health
ESD	Environmental Sciences Division
FS	feasibility study
IDW	investigation-derived waste
LCO	Laboratory Certification Official
NRWTP	Nonradiological Wastewater Treatment Plant
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PEL	permissible exposure limit
PPE	personal protective equipment
PWMP	project waste management plan
PWTP	process waste treatment plant
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RFDs	Request for Disposal Forms
RTR	real-time radiography
RSWO	Radioactive Solid Waste Operations
SARA	Superfund Amendments and Reauthorization Act
SHSO	Site Health and Safety Officer
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environment and Conservation
TLV	threshold limit value
TOC	total organic carbon
TSS	total suspended solids
TTO	total toxic organics
VLA	very low activity waste
WAG	waste area grouping
WMO	Waste Management Operations

WMRAD
WOC
WOCE
WOL

Waste Management and Remedial Action Division
White Oak Creek
White Oak Creek Embayment
White Oak Lake

EXECUTIVE SUMMARY

This Project Waste Management Plan defines the criteria and methods to be used for managing waste generated during activities associated with Waste Area Grouping 2 at Oak Ridge National Laboratory. The waste management strategy is based on the generation and management of waste on a systematic basis using the most appropriate combination of waste reduction, segregation, treatment, storage, and disposal practices while protecting the environment and human health, maintaining as low as reasonably achievable limits.

This plan contains provisions for safely and effectively managing soils and sediments, sampling water, decontamination fluids, and disposable personal protective equipment consistent with the U.S. Environmental Protection Agency guidance. This plan will be used in conjunction with the ORNL ER Program Waste Management Plan.

1. INTRODUCTION

This Project Waste Management Plan (PWMP) will be used in conjunction with the ORNL ER Program Waste Management Plan. This PWMP defines the criteria and methods to be used for managing waste generated during activities associated with Waste Area Grouping (WAG) 2 at Oak Ridge National Laboratory (ORNL). The waste management strategy is based on the generation and management of waste on a systematic basis using the most appropriate combination of waste reduction, segregation, treatment, storage, and disposal practices while protecting the environment and human health, maintaining as low as reasonably achievable (ALARA) limits.

This plan contains provisions for safely and effectively managing soils and sediments, sampling water, decontamination fluids, and disposable personal protective equipment (PPE) consistent with the U.S. Environmental Protection Agency (EPA) guidance in *Management of Investigation-Derived Waste During Site Investigation* (EPA 1991) and best management practices. Consistent with EPA guidance, this plan is designed to protect the environment and the health and safety of workers and the public. It therefore specifies that investigation-derived waste (IDW) and other wastes be managed to ensure that

- costs associated with sample storage, analysis, transportation, and disposal are minimized;
- additional pathways of contamination release are not created, and existing pathways are not enhanced;
- additional contaminated areas are not created; and
- potential worker exposures are not increased during the investigation and during the period before, during, and after remedial action.

The intent of this plan is to provide guidance for waste handling and disposal using both field screening (i.e., portable survey equipment) and media sampling and analysis in support of transferring waste to Martin Marietta Energy Systems, Inc. (Energy Systems), Waste Management Operations.

The provisions of this plan will be implemented through project procedures and other Energy Systems directives to ensure consistent waste management operations.

1.1 REGULATORY OVERVIEW

This plan was developed in accordance with published regulatory standards that are used as compliance documents at ORNL and other U.S. Department of Energy- (DOE-) owned or DOE-controlled sites. It incorporates elements of the standards and procedures that exhibit best management practices and guidelines for managing radioactive, mixed, and Resource Conservation and Recovery Act (RCRA) defined materials.

1.1.1 EPA

Management of Investigation-Derived Wastes During Site Investigations, EPA/540/G-91/009, (EPA 1991), provides direction for managing IDW under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This guidance is consistent with the applicable or relevant and appropriate requirements (ARARs) normally applied to remedial investigation/feasibility study (RI/FS) activities.

The guide requires that management techniques protect human health and the environment and comply with (or obtain waivers of) ARARs. The EPA guide states that RI/FS and remedial design actions must comply with ARARs "to the extent practicable considering the exigencies of the situation" (EPA 1990). This document is applicable to field activities associated with the ORNL RI/FS Project. It is presumed that adherence to the provisions of this guidance document will satisfy the requirements of CERCLA, RCRA, the Hazardous Solid Waste Amendments of 1984, and the Emergency Planning and Community Right-to-Know Act as they apply to IDW and other wastes generated by the ORNL RI/FS Project.

1.1.2 DOE Orders

DOE Order 5820.2A, *Radioactive Waste Management*, governs the handling and disposal of radioactive materials resulting from DOE activities. This order specifies four performance criteria that must be met in the management and disposal of low-level radioactive wastes: (1) protect public health and safety in accordance with standards specified in applicable Environmental Health Orders and other DOE orders; (2) ensure that exposures resulting from all credible pathways result in an effective dose equivalents that do not exceed 25 mrem/year to any member of the public and that releases to the atmosphere shall meet the requirements of 40 *Code of Federal Regulations* (CFR) 61 (EPA 1988); (3) ensure that the dose to an inadvertent intruder into the facility after loss of institutional controls (100 years) will not exceed 100 mrem/year for continuous exposure or 500 mrem/year for a single acute exposure; and (4) protect groundwater resources consistent with federal, state, and local requirements (DOE 1988a). This order is consistent with EPA guidance in specifying that actions taken with radioactive wastes must protect human health and the environment.

DOE Order 5480.11, *Radiation Protection for Occupational Workers*, establishes a regulatory limit of 5 rem/year for the combined internal and external exposures of occupational workers to ionizing radiation and radioactive materials (DOE 1988b). The order also calls for the establishment of ALARA goals and objectives for each facility and operation commensurate with its mission. The ALARA philosophy has been subsequently incorporated into ORNL Health Physics Procedure RP-3.1 (ORNL 1992a) in the form of an administrative limit of 2 rem/year. DOE Order 5480.11 has been revised to require implementation of the *DOE Radiological Control Manual* (see Sect. 1.1.4).

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, establishes standards and requirements for DOE activities to protect the public and the environment against undue risk from radiation. This order presents the derived concentration guides for radioactive material in air and water that will expose an individual to 100 mrem of annual effective dose equivalent under continuous exposure conditions. Chapter 4, "Residual Radioactive Material", presents radiological protection requirements and guidelines for

cleanup of residual radioactive material, management of the resulting wastes and residues, and release of property. It is the objective of this order that potential exposures to members of the public and workers be maintained ALARA (DOE 1990).

1.1.3 Occupational Safety and Health Administration (29 CFR 1910)

The Occupational Safety and Health Administration (OSHA) has established standards for limiting occupational exposures to hazardous materials. Presented in 29 CFR 1910 is a range of standards applicable to RI/FS activities and other ORNL operations. Subpart 120, which governs hazardous waste operations, and Subpart Z, which establishes the permissible exposure limits (PELs) for occupational exposure to listed hazardous chemical agents, apply to waste management operations involving IDW (OSHA 1991).

The requirements of 29 CFR 1910 are incorporated in the ORNL Industrial Hygiene Procedures and Policies (ORNL 1992b) and the RI/FS Environmental, Safety, and Health (ES&H) Project Procedures. Because the PEL list is not comprehensive, the procedures permit the use of the American Conference of Governmental Industrial Hygienists threshold limit values (TLVs) as standards (ACGIH 1991). TLVs are used during field operations when they are more conservative than PELs.

1.1.4 DOE Radiological Control Manual (DOE N 5480.6)

By order of the Secretary of Energy in December 1991, selected elements of DOE Headquarters Environmental Health and Nuclear Energy organizations were directed to develop guidance for uniform health physics practices among all DOE operation sites; in June 1992, DOE published the *Radiological Control Manual*. All DOE maintenance and operations contractors were directed by the Secretary to prepare an implementation strategy by August 1992, to issue site-specific radiological control manuals by December 1992, and to complete all required standardized DOE Core Radiological Controls training and qualification upgrades by June 1994 (DOE 1992).

1.2 HISTORY OF SITE

WAG 2 consists of White Oak Creek (WOC) and its tributaries downstream of the main ORNL site, White Oak Lake (WOL), White Oak Creek Embayment (WOCE) on the Clinch River, and the associated floodplain and subsurface environment (Fig. 1). The WOC system is the surface drainage for the major ORNL WAGs and has been exposed to a diversity of contaminants from operations and waste disposal activities in the WOC watershed. WAG 2 therefore acts as a conduit through which hydrologic fluxes carry contaminants from upgradient areas to the Clinch River. Water, sediment, soil, and biota in WAG 2 are contaminated and continue to receive contaminants from upgradient WAGs.

The contaminants found throughout the WOC watershed are primarily a result of radioactive effluents that have been released from ORNL for almost 5 decades. Contaminants of concern found in surface water are Tritium (H-3), Strontium (Sr-90), polychlorinated biphenyls (PCBs), and possibly some trace metals (e.g., As, Ba, Cr, Hg, Se). Aquatic sediments and floodplain soils are the primary pools for contaminants including radionuclides such as Cesium (Cs-137) and Cobalt (Co-60), metals, and organic compounds. A detailed history of the WOC system can be found in the *WAG 2 Remedial Investigation Plan* (1990),

ORNL-DWG 91M-15121R

Fig. 1 Location of waste area groupings (WAGs) and WAG 2 boundary.

including detailed descriptions of specific sampling tasks.

1.3 PURPOSE AND SCOPE OF ACTIVITY

The purpose of the RI of WAG 2 is based on a long-term sampling and analysis strategy aimed at four key goals

1. implement, in concert with other programs, long-term multimedia environmental monitoring and tracking of contaminants leaving other WAGs, entering WAG 2, and being transported off-site;
2. provide a conceptual framework to integrate and develop information at the watershed-level for pathways and processes that are key to contaminant movement, and so support remedial efforts at ORNL;
3. provide periodic updates of estimates of potential risk (both human health and ecological) associated with contaminants accumulating in and moving through WAG 2 to off-site areas; and
4. support the ORNL ER Program efforts to prioritize, remediate, and verify remedial effectiveness for contaminated sites at ORNL through long-term monitoring and continually updated risk assessments.

Remedial investigations and remediations are either under way or are planned for contaminated areas hydrologically upgradient of WAG 2. Therefore, contaminant inputs will change as individual upgradient areas are remediated and as natural decay processes occur. Because of this, implementation of corrective measures in WAG 2 will likely follow the completion of remediation of upgradient WAGs. A phased approach for the remedial investigation of WAG 2 has been initiated.

WAG 2 is complex and dynamic with diverse sources of contaminants and fluxes driven by changing environmental conditions. Rather than an exhaustive site characterization for all contaminants, media, and flow pathways, WAG 2 personnel will (1) focus on contaminants and pathways of greatest concern and (2) monitor and gather sufficient information for processes controlling or driving contaminant fluxes to construct an appropriate conceptual model for contaminant source areas and fluxes in WAG 2. This approach allows the early identification of remedial alternatives and focuses efforts on the gathering of data useful for evaluating alternatives to reduce risk (Miller 1993).

The multimedia environmental monitoring and characterization of WAG 2 includes the sampling and analysis of surface water, groundwater, sediment, floodplain soil, and biota. Tasks are defined in detail in the *Sampling and Analysis Plan for Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (ORNL 1992).

2. LINE OF RESPONSIBILITIES

The WAG 2 RI project will be accomplished with the joint resources of the following participants:

1. DOE
2. Energy Systems (facility manager)
3. WAG 2 personnel subcontractors

Details of the organizational structure for implementation of this project, key personnel and their project responsibilities are as defined in the *Remedial Investigation Plan for Waste Area Grouping 2* (ORNL 1990). For the purpose of this PWMP, a brief summary of responsibilities and duties is described in the following subsections.

2.1 DOE

DOE will furnish overall program management and provide project support as required through the DOE ORNL site office. Additionally, all coordination with EPA and the Tennessee Department of Environment and Conservation (TDEC) will be the responsibility of DOE.

2.2 ENERGY SYSTEMS

Energy Systems, as the facility manager, is responsible for managing and operating ORNL under prime contract to DOE. The WAG 2 RI Project will be monitored and operated by the Environmental Sciences Division (ESD) for the ORNL Environmental Restoration (ER) Program. WAG 2 personnel may consist of Energy Systems employees and subcontractors. Specific roles of WAG 2 personnel responsible for management of waste follow.

2.2.1 Project Manager

The project manager is responsible for ensuring implementation of the PWMP and revising the plan if necessary. The project manager is also responsible for contacting the site Waste Management Organization before generating waste and distributing the approved waste management plan to all involved organizations.

The project manager (or designee)

1. contacts the ORNL Waste Management Organization to determine the best approach for transfer and subsequent storage, disposal, and/or treatment options;
2. contacts the plant compliance office for guidance in managing all waste types generated as part of this project;
3. ensures that support staff have taken all proper training to sign and complete waste disposal forms and manage specific waste storage areas;

4. contacts the ORNL Waste Management Organization to reconfirm the availability of storage and disposal facilities (before the generation of waste).
5. ensures that a waste certification procedure has been prepared for this project, that it has undergone the appropriate review, and is implemented.

The project manager (or designee) distributes the PWMP and/or checklist for review to the ORNL Waste Management Organization, ORNL Environmental Compliance Organization, ORNL ER Program Waste Management Organization, the Central Waste Management Division, Laboratory Certification Official (LCO), Generator Certification Official (GCO) and other staff members or organizations that the project manager deems appropriate.

2.2.2 Energy Systems Waste Management Organization

Energy Systems Waste Management Organization (ESWMO) is responsible for providing overall guidance, waste acceptance criteria, policies, and certification requirements for conducting waste management activities and future disposal at the Central Waste Disposal Area. ESWMO coordinates multiplant treatment and storage facilities.

2.2.3 Energy Systems ORNL Waste Management Organization

The Waste Management Organization at ORNL is responsible for providing review and approval of the waste management plans. ORNL Waste Management organization is also responsible for picking up the waste material from the waste storage area after characterization of the waste has been performed, and after proper waste disposal forms have been completed by the generator and the GCO. The waste will be transported to an approved storage or treatment facility in accordance with regulatory requirements and Energy Systems policies and procedures.

2.2.4 ORNL Environmental Compliance Organization

ORNL Environmental Compliance Organization provides regulatory guidance towards successfully completing the specific project and reviews and approves the PWMP or checklist.

2.2.5 Environmental Restoration Central Waste Management Organization

The Central ER Waste Management Organization is responsible for providing overall guidance and policies for ER waste management activities and reviewing PWMPs and checklists.

2.2.6 ORNL ER Project Waste Management Manager

The ORNL ER Project Waste Management Manager (ERPWM) is responsible for implementation of ER waste management policies and procedure for ORNL ER projects. The ER Program WM Manager is also responsible for providing guidance in the preparation of waste management plans, and reviews and approves all PWMP or checklists.

2.2.7 Generator Certification Official

The GCO must be an Energy Systems employee (unless waived by the LCO) who successfully has completed waste generator training for Solid Low Level Waste, Satellite Accumulation Area, and GCO training module [24 to 40 h Superfund Amendments and Reauthorization Act (SARA)/Occupational Safety and Health Administration (OSHA) and Radiation Worker training I or II is optional.]. An appointment letter from the management of the generator organization must be on file with the Waste Minimization, Planning, and Certification (WMPC) Department for any individual assigned the duties of a GCO, prior to the commencement of these duties.

The GCO

1. serves as the interface between the project, LCO and ORNL Waste Management Organization in addressing generator problems and waste certification requirements;
2. ensures that weekly waste generator reports are completed with a copy sent to the ER WM manager;
3. ensures that monthly tabulated volume of waste generated is completed and mailed to the ER Central Office and a copy sent to the ORNL ER WM Manager;
4. certifies by signing waste disposal forms including: Waste Item Description, Container Packing List, and Waste Pickup Request [The GCO ensures that the waste was packaged in accordance with the waste acceptance criteria.];
5. completes or ensures that a Container Packing List (TX-5749) Form has been completed following the "Container Packing List (TX-5749) Form User Instructions (Appendix C);
6. ensures that generation of wastes is handled and disposed of in accordance with the ORNL waste certification program;
7. provides guidance to generator or packager who processes waste packages rejected by Real Time Radiography (RTR);
8. monitors waste generating and managing activities against an approved certification program by periodic inspections, or audits;
9. makes arrangements with the Radioactive Solid Waste Operations (RSWO) group for the acceptance, pickup, and transfer of the waste package to the disposal/storage site;
10. reviews and approves as specified: nonconformance reports and trends, log-in sheets, training records and facility-specific procedures for the proper packaging and handling of solid low-level waste;
11. ensures that appropriate action is taken within the generator organization to correct any deficiencies noted during reviews or audits of generator waste certification activities;
12. reviews and approves all waste management plans.

2.2.8 Laboratory Certification Official

The individual in the Waste Minimization, Planning, and Certification Department who serves as the point of contact for certification of a given waste stream, reviews and approves PWMPs, checklists, and waste certification procedures. The LCO also conducts inspections, audits, reviews, surveillances, and other assessments of the Solid Low Level Waste (SLLW) certification program.

The LCO for Liquid Waste:

1. Serves as the interface between the waste generator, Waste Management Operations (WMO), and the Office of Environmental Compliance and Documentation (OECD).
2. Develops and issues WAC for all ORNL liquid waste collection and treatment systems. Implements a program to oversee waste generators compliance with WAC.
3. Issues written authorization in answer to special requests with the concurrence of WMO and the Environmental Compliance Section (EC).
4. Conducts liquid waste stream surveys to obtain generation rates, volumes, constituents of waste streams, sources, and applicable RCRA waste codes.
5. Develops and conducts liquid waste certification training for liquid waste generators.

2.2.9 Generator

The generator is the responsible Energy Systems employee, subcontractor, or person who physically is generating the waste during remedial investigation or any waste generating activities affiliated with the WAG 2 project.

All persons responsible for packaging or placing waste in containers as part of WAG 2 activities are required to take ORNL Solid Low-Level Waste Generator Training, Hazardous Waste Identification Training and Satellite Accumulation Area Training.

All generators must practice proper waste minimization and comply with this PWMP.

The generator/packager is responsible for:

1. Properly containerizing, packaging, and segregating all waste generated as part of the WAG 2 project in addition to other requirements set forth in other documents;
2. Completes all parts of waste disposal forms (Waste Item Description, Container Packing List, Waste Pickup Request) of which they were responsible for obtaining information from Health Physics;
3. Certifies, by signature, on the Waste Item Description that the waste meets the waste acceptance criteria;
4. Maintaining active communication with the GCO to ensure that any issues in SLLW characterization or certification are promptly brought to the attention of the responsible

individuals and that any new certification requirements or procedures are promptly instituted in routine operations.

2.2.10 Radioactive Solid Waste Operations Group (RSWO)

RSWO is responsible for the following:

1. Provides the planning, organizing, and controlling activities relating to disposal/storage of radioactive solid waste.
2. Supervises the field services connected with the operation of the SWSA disposal/storage facilities.
3. Inspects the waste packages and reviews the generator's documentation for compliance with the Waste Acceptance Criteria (WAC).
4. Approves special packaging, as necessary.
5. Provides transportation of the waste package to the SWSA.
6. Reviews the generator's procedures for compliance to the ORNL on-site transportation manual.

2.2.11 Hazardous Waste Operation Group (HWOG).

1. Manages and performs all ORNL hazardous and mixed waste transportation functions and activities.
2. Ensures hazardous and mixed waste activities comply with all applicable EPA and TDEC rules and regulations, DOE orders, and DOT regulations.
3. Reviews Request For Disposal Forms (RFDs) and manifests received from generators or area operators, completes the HWOG portion of the document, and sends document to the Waste Management and Remedial Action Division (WMRAD) Document Management Center.
4. Ensures hazardous or mixed wastes meet the unit's WAC as defined in RCRA permits or WMRAD guidelines.
5. Resolves discrepancies noted on RFDs and manifests.
6. Investigates the origin and composition of wastes as necessary to verify proper characterization.
7. Packages or ensures proper packaging of wastes.
8. Prepares documents and coordinates shipments of hazardous or mixed waste to or from ORNL.

3. WASTE GENERATING ACTIVITIES

Activities that will generate waste are described in the *Remedial Investigation Plan for WAG 2* (ORNL 1990). Most of the wastes will be generated as the result of

- surface water and groundwater sampling,
- soil and sediment core sampling,
- developing and/or purging monitoring wells,
- biological sampling,
- disposing of PPE,
- disposing of contaminated glassware or sample containers,
- anticontamination covering,
- decontamination of sampling equipment, and
- sample residuals returned from the analytical laboratory (internal or external) following analysis.

WAG 2 wastes that cannot be classified or managed as IDW will be managed under best management practices and existing procedures by the Energy Systems/ORNL organizations. These wastes could include

- laboratory operations waste:
 - wash water for glassware, ISCO bottles, etc.,
 - sample residues,
 - disposable PPE,
 - dilute acids,
 - dilute bases,
 - sharps (needles), and
 - autoclaved animal blood.
- decontamination and cleaning facility operations wastes:
 - decontamination water,
 - dilute acids (HCL, HNO₃),
 - dilute bases (NaOH), and
 - contaminated wipes and rags.
- field instrument maintenance and standardization wastes:
 - expended alkaline batteries,
 - expended lead-acid batteries, and
 - pH buffers.

3.1 WASTE SOURCES

3.1.1 Soil/Sediment Core Sampling

Soil/sediment core sampling results in a volume of sample that is in excess of the volume needed for analysis. The surplus sample then becomes waste material. Other waste such as contaminated polyvinylchloride piping, wood, and disposable PPE are also generated. All

wastes are then placed in approved containers that will be transported to the radioactive waste collection area for final disposition. The expected volumes of liquid and solid compactible waste are listed in Table 1.

3.1.2 Developing and/or Purging Monitoring Wells

Groundwater removed from existing wells and from new monitoring wells may contain from <1 to >25% solids, depending on well construction parameters and the intercepted strata. The liquid fraction of these wastes may contain radionuclides, but no data are available on other potential hazardous contaminants. It is expected that solids generally will be larger than the respirable range of particulate size and settle rapidly in collection vessels. The expected volume of liquid and solid compactible waste is listed in Table 1.

3.1.3 Surface Water and Seep Sampling

The volume of surface water collected during sampling may be in excess of volumes necessary for laboratory analysis. Contaminated tubing, wipes, and disposable PPE are also generated during sampling activities. Expected volumes of liquid and solid compactible wastes are listed in Table 1.

3.1.4 Biological Sampling

Carcasses of small mammals and birds, which will not be used for analysis, shall be stored until further disposal information from the ESD Environmental Protection Officer (EPO). Processing of biota may result in waste needles that will be disposed of in an approved sharps container. Waste blood from trapped animals will be autoclaved and disposed of as autoclaved biological waste in accordance with guidance from the ORNL Industrial Waste Program Coordinator and EPM-6.1. Animal carcasses, which have originated in radiological areas, will be monitored for radioactivity (gamma) prior to disposal. The expected volumes of biological wastes have not been predicted due to the nominal amounts potentially produced.

3.1.5 Disposing of PPE

Field personnel wear PPE to prevent potentially radioactive materials from contacting the skin and entering the body. The basic set of PPE (Level 1) required in the field includes DOE khakis or washable cotton coveralls that shall be sent to laundry to be cleaned. If field clothing has become contaminated, the clothing must be placed in a yellow and magenta radioactive waste bag for Health Physics survey and tagging. Laundry then picks up contaminated clothing. Disposable gloves are disposed of as solid low-level compactible waste.

3.1.6 Decontaminating Small Tools By Hand Techniques

Sampling tools are subjected to initial gross decontamination at the sampling site before transport to a central decontamination or cleaning facility in the laboratory. Small volumes of deionized water and hand wipes are used to remove gross contamination in the field. Decontamination water may contain radiological contaminants, distilled water, or solvents. If waste contains methanol, the mixture shall contain levels < 10% by volume and will not demonstrate the characteristic of ignitibility. These wastes shall be treated as nonhazardous

waste or low level radiological waste. The decontamination water shall be contained in an approved carboy or container and the contaminated wipes shall be placed in a radioactive waste bag. Carboys will be stored in the laboratory's radioactive waste area. Expected volumes of liquid and solid compactible waste are listed in Table 1 by task.

3.1.7 Sample Residual from Analytical Laboratory

Sample residuals (e.g., soils, sediments, water) that are not consumed by the analytical laboratory (external or internal) will be transferred to Energy Systems Waste Operations for disposal when no longer needed or following archival.

Table 1. Estimated types and volume of waste

Task	Waste stream/source	Type	Category ^a	Volume (annual)	Suspected contaminants
Seeps and tributaries (water sampling)	Residual samples	Liquid	Radiological	8.7 ft ³	H-3, Sr-90, Co-60, Cs-137, U-238/234/232, Cm-243
	Laboratory analysis	Liquid	Radiological nonhazardous	0.5 ft ³	H-3, Sr-90, Co-60, Cs-137, U-238/234/232, Cm-243, KMnO ₄
			Radiological	1.1 ft ³	H-3
	Decontamination, personal protective equipment (PPE), sample containers	Plastic, paper, glass	Radiological	19.7 ft ³	Sr-90, Co-60, Cs-137, U-238/234/232, Cm-243
Hydrologic pathways	Well drilling decontamination	Liquid	Radiological	6.7 ft ³	H-3, Sr-90, Co-60, Cs-137
(groundwater sampling)	Drilling	Sludge/soil	Radiological	2.9 ft ³	Sr-90, Co-60, Cs-137
	Decontamination, PPE	Plastic, paper, glass	Radiological	10 ft ³	Sr-90, Co-60, Cs-137
	Water sampling residual samples	Liquid	Radiological	0.35 ft ³	H-3, Sr-90, Co-60, Cs-137
	Laboratory analysis		Radiological nonhazardous	0.35 ft ³	H-3, Sr-90, Co-60, Cs-137, KMnO ₄
			Radiological	0.7 ft ³	H-3
	Decontamination, PPE	Plastic, paper, glass	Radiological	6 ft ³	Sr-90, Co-60, Cs-137
Sediment transport	Water sampling residual samples	Liquid (storm water)	Radiological	55.1 ft ³	H-3, Sr-90, Co-60, Cs-137
(storm water sampling)	Decontamination	Liquid	Radiological	28.8 ft ³	H-3, Sr-90, Co-60, Cs-137
	Decontamination, PPE	Plastic, paper, glass, aluminum	Radiological	28.9 ft ³	Cs-137, Co-60, Sr-90
Hydraulic head monitoring stations	Well purging and water sampling	Liquid (possible pH > 12)	Radiological	86.1 ft ³	H-3, Sr-90, Co-60, Cs-137
Floodplain soil/sediment	Soil and sediment core residual samples	Soil and sediment	Radiological	2 ft ³	Sr-90, Co-60, Cs-137, Pu-239/240
	Decontamination, PPE	Plastic, paper, PVC piping, glass and wood	Radiological	9.8 ft ³	Sr-90, Co-60, Cs-137, Pu-239/240

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Table 1. (continued)

Task	Waste stream/source	Type	Category ^a	Volume (annual)	Suspected contaminants
Floodplain soil/sediment (cont.)	Decontamination	Liquid	Radiological	23.2 ft ³	Sr-90, Co-60, Cs-137, Pu-239/240
Tributary assessment task (water sampling)	Residual samples	Liquid	Radiological	24.4 ft ³	H-3, Sr-90, Co-60, Cs-137, U-238/234/232
	Laboratory analysis		Radiological nonhazardous	0.6 ft ³	H-3, Sr-90, Co-60, Cs-137, U-238/234/232, KMnO ₄
			Radiological	1.2 ft ³	H-3
	Decontamination, PPE, sample containers	Plastic, paper, glass	Radiological	35.5 ft ³	Sr-90, Co-60, Cs-137, U-238/234/232
Groundwater	Redevelopment of wells	Liquid	Radiological	100.3 ft ³	H-3, Sr-90, Co-60, Cs-137
		Plastic, paper, glass	Radiological	60 ft ³	Sr-90, Co-60, Cs-137

^a Hazardous, mixed, nonhazardous, radiological, transuranic, Toxic Substances Control Act, etc

4. TYPES AND VOLUME OF WASTE

Table 1 summarizes the waste types and quantities to be generated by each task within the WAG 2 and site inspection project in approximately a 1-year period. This information is an estimate based on current sampling frequency and practices. As applicable, the wastes are categorized as hazardous, radioactive, nonhazardous, or mixed wastes and information concerning their physical states (such as liquid, solid, or compactible) is included.

Tables 2 and 3 include a radiological characterization of the liquid and solid (soil/sediment) waste where data were available. As data becomes available it shall be incorporated into this plan. Toxicity Characteristic Leaching Procedure (TCLP) tests performed on soil and sediment samples collected on the WOC floodplain, WOL, WOC Weir and Melton Branch Weir indicate that hazardous material levels are well below guidelines for designation as Hazardous Waste (Table 4).

Table 2. Radiological characterization of liquid waste (Radiological concentrations of liquid waste will be based on a mixture of residual environmental samples and diluted decontamination water. This table includes data from environmental water samples that will be incorporated into the waste stream.)

Radionuclide	# of Samples ^a	Mean ^d (pCi/L)	Minimum ^e (pCi/L)	Maximum ^f (pCi/L)
H-3	253	4420900	0	126696000
Sr-90	253	11199.73	0	1181395
Co-60	112 (dissolved) ^b 109 (particulate) ^c	94.7 (dissolved) 6.1 (particulate)	0	1880 (dissolved) 208 (particulate)
Cs-137	112 (dissolved) ^b 109 (particulate) ^c	11.6 (dissolved) 10.4 (particulate)	<0.7 (dissolved) 0.1 (particulate)	216 (dissolved) 305.5 (particulate)
Gross alpha	287	1258.3	0	39350
Gross beta	287	55652.41	0	2816200
U-238	16	26.27	0.02	101
U-235	16	2.41	0	15
U-234	16	523.03	0.03	4140
U-232	7	60.46	0	225
Th-232	16	0.64	0	9.9
Th-230	16	0.90	0.02	12.7
Th-228	16	1.74	0	9.9
Pu-239	16	2.36	0	36.7
Pu-238	16	2.07	0	31.1
Cm-243	17	8.50	0	56.57
Am-241	17	3.02	0	22.04

^a # of samples= number of sample results used in summary.

^b Dissolved= Cobalt and Cesium concentrations for water samples that have been filtered.

^c Particulate= Cobalt and Cesium concentrations in suspended particulates contained in environmental water samples.

^d Mean= average concentrations of radionuclides present in residual environmental water samples.

^e Minimum= minimum radiological concentration found in environmental water samples added to waste stream.

^f Maximum= maximum radiological concentration found in environmental water samples added to waste stream.

Table 3. Radiological characterization of solid waste (soil/sediment) (Radiological concentrations found in soil/sediment included in solid low-level compactible waste.)

Radionuclide	# of Samples^a	Mean^b pCi/g	Minimum^c pCi/g	Maximum^d pCi/g
Co-60	334	36.17	0.47	431.58
Cs-137	334	1163.31	<1.1	25230.09
U-233/234	23	2.66	0.27	8.50
U-235	23	0.07	0.02	0.20
U-238	23	1.14	0.16	1.90
Total Radio-Sr	23	27.16	0.07	190.00
Th-228	23	2.09	0.38	6.50
Th-230	23	0.89	0.47	1.30
Th-232	23	1.03	0.43	1.60
Pu-238	23	0.43	0.01	1.60
Pu-239/240	23	6.07	0.02	71.00
Am-241	23	1.84	0.11	6.16
Cm-244	23	0.60	0.02	9.80

^a # samples = number of sample results used in summary.

^b Mean = average concentrations of radionuclides present in residual environmental soil/sediment samples.

^c Min = Minimum radiological concentrations found in environmental soil/sediment samples.

^d Max = Maximum radiological concentration found in environmental soil/sediment samples.

Table 4. Average results of Toxicity Characteristic Leaching Procedure tests performed on soil and sediment samples collected on the White Oak Creek floodplain, White Oak Lake, WOC Weir and Melton Branch Weir

Analyte	Maximum concentration (mg/kg)	Regulatory Level (mg/kg)
Benzene	<0.025	0.500
Carbon tetrachloride	<0.025	0.500
Chlorobenzene	<0.025	100.0
Chloroform	<0.025	6.000
1,2-Dichloroethane	<0.025	0.500
1,1-Dichloroethene	<0.025	0.700
Methyl Ethyl Ketone	<0.500	200.0
Tetrachloroethene	<0.025	0.700
Trichloroethene	<0.025	0.500
Vinyl Chloride	<0.050	0.200
1,4- Dichlorobenzene	<0.008	7.500
2-Methylphenol	<0.008	
3-Methylphenol	<0.008	
4-Methylphenol	<0.008	
Total-Methyl phenol	<0.008	
Hexachloroethane	<0.008	3.000

Table 4. (continued)

Analyte	Maximum concentration (mg/kg)	Regulatory Level (mg/kg)
Nitrobenzene	<0.008	2.000
Hexachlorobutadiene	<0.008	0.500
2,4,6-Trichlorophenol	<0.008	2.000
2,4,5-Trichlorophenol	<0.008	400.00
2,4-Dinitrotoluene	<0.008	0.130
Hexachlorobenzene	<0.008	0.130
Pentachlorophenol	<0.042	100.0
Pyridene	<0.008	5.000
Gamma-BHC	<0.00005	
Heptachlor	<0.00005	0.008
Endrin	<0.00010	0.020
Methoxychlor	<0.00005	10.00
Chlordane	<0.00010	0.030
Toxaphene	<0.00500	0.500
Aroclor 1016	<0.00208	
Aroclor 1221	<0.00333	
Aroclor 1232	<0.00208	
Aroclor 1242	<0.00208	

Table 4. (continued)

Analyte	Maximum concentration (mg/kg)	Regulatory Level (mg/kg)
Aroclor 1248	<0.00208	
Aroclor 1254	<0.00208	
Aroclor 1260	<0.00208	
2,4-D	<0.00200	10.0
2,4,5-TP(Silvex)	<0.00040	1.00
Arsenic	0.23	5.000
Barium	1.2	100.0
Cadmium	<0.002	1.000
Chromium	0.017	5.000
Lead	<0.0160	5.000
Mercury	<0.0003	0.200
Selenium	0.032	1.000
Silver	<0.0030	5.000

5. PROCEDURES FOR MANAGING WASTE

5.1 GENERATING

DOE and Energy Systems applicable control programs governing waste disposal activities will be implemented for this project. These programs include sampling and analysis, waste certification, waste minimization, hazardous waste and radiation worker training, QA, ES&H, health physics, and configuration management. These programs will ensure compliance with all applicable state, federal, and DOE regulatory requirements including RCRA, CERCLA, SARA, OSHA, and the Department of Transportation (DOT) for the proper handling and control of radioactive and hazardous wastes.

5.2 SEGREGATING

All generated waste from field and laboratory activities shall be segregated by each waste type as specified in Table 1. Waste will not be accepted by Waste Operations unless it is properly segregated, packaged, characterized and appropriate documentation is completed. Waste shall be segregated according to ORNL waste management policies and the Waste Acceptance Criteria (ORNL 1994). Waste can be classified according to the following types:

1. Hazardous waste (satellite accumulation area or 90 day area)
 - A. RCRA Hazardous Waste:
 1. Listed as a K, P, U, or F listed waste
 2. Exhibits one of the following characteristics
 - a. an ignitable waste is one with a flash point of 140°F or lower
 - b. a corrosive waste is one that either has a pH less than or equal to 2 or greater than or equal to 12.5
 - c. a reactive waste is one that is explosive, gives off toxic gases, or can violently react with water
 - d. a TCLP toxic waste is one that has the potential to leach certain metals, pesticides, or organics
 3. Is not excluded
 4. A mixture involving a hazardous waste
 - B. Mixed waste—hazardous waste and radioactive waste constituents
 - C. All aerosol cans

2. Nonhazardous waste
Any waste material that is not RCRA regulated but does not meet disposal standards of harmless to the public and the environment.
3. Radioactive waste
 - A. Solid radioactive waste: any dry solid material or combination of dry materials contaminated or suspected of being contaminated with radioactive material
 1. Compactible low-level waste: paper, plastic, cloth, rubber, small wood and lightweight metal items and glass containers up to 1 gal size.
 2. Noncompactible low-level waste: concrete, glass (>1 gal), metal, equipment components, tools, and other large items
 - B. Liquid radioactive waste: waste containing radioactive constituents exceeding the Derived Concentration Guide (DCG) values that are provided in DOE Order 5400.5 (Table 5)
 - C. Very low activity waste (VLA): waste that has no measurable external contamination and no specific knowledge of significant quantities of internally contained radioactivity. However, because of its origin or process knowledge cannot be certified as free of radioactivity and may have some identified potential for internal, undetectable radioactive contamination above free release limits. VLA waste must be handled as a category of radioactive waste and stored in a controlled area.
4. PCB(s) waste
Polychlorinated biphenyl(s); PCBs and PCB items that are subject to the disposal requirements of subpart D of 40 CFR 761.
5. Biological waste
Waste of biological nature (e.g., animal carcass, autoclaved animal blood).
6. Sanitary waste
Waste that contains nonhazardous and nonradioactive constituents to include no chemical wastes (e.g., paper, gloves)
7. Sharps
Examples include needles and razor blades. Needles must be autoclaved and packaged in a puncture-proof container which should be kept in the waste collection area. Containers are then discarded in locked medical/biological waste dumpster.

Any wastes generated in the field or laboratory which may be suspected of having radiological constituents or has originated in a radiologically contaminated area should be treated as Very Low Activity Waste. This waste may have **undetectable** radiological levels present.

5.3 LABELING

All waste containers must be labeled properly in the field and in the laboratory for contamination control, storage, and disposal. A label must be legible and visible on the primary container.

Table 5. Maximum allowable concentration of specific waste water contaminants for discharge to the Process Waste Treatment Plant

Contaminant	Concentration
Radionuclides	
Gross Alpha	175 Bq/L (4,725 pCi/L)
Gross Beta	10,000 Bq/L (270,000 pCi/L)
Sr-90	10,000 Bq/L (270,000 pCi/L)
Cs-137	400 Bq/L (10,800 pCi/L)
Co-60	185 Bq/L ^a (4,995 pCi/L)
Eu-152	740 Bq/L ^a (19,980 Pci/L)
Eu-154	740 Bq/L ^a (19,980 pCi/L)
Eu-155	3,700 Bq/L ^a (99,900 pCi/L)
Ru-106	222 Bq/L ^a (5,994 pCi/L)
ZrNb-95	1,480 Bq/L ^a (39,960 pCi/L)
Metals	
Ag	0.4 mg/L
As	40.0 mg/L
B	40.0 mg/L
Ba	120.0 mg/L
Be	0.2 mg/L
Cd	0.3 mg/L
Cr	7.5 mg/L
Cu	2.5 mg/L
Fe	500.0 mg/L
Hg	0.004 mg/L
Ni	65.0 mg/L
Pb	30.0 mg/L
Sb	65.0 mg/L
Se	15.0 mg/L
Zn	60.0 mg/L

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Table 5. (continued)

Others	
Chlorine (Cl)	20.0 ppm
Cyanide (CN)	0.2 ppm
Nitrate (NO ₃)	10.0 ppm
Oil and grease	100.0 ppm
pH	>6.0
Phosphate (PO ₄)	5.0 ppm
Sulfate (SO ₄)	3000.0 ppm
Total organic carbon	50.0 ppm
Total suspended solids	1000.0 ppm
Total toxic organics	100.0 ppm

^a DOE Order 5400.5 DCG values.

Each label must contain the following:

1. one of the following descriptions:
 - hazardous waste
 - hazardous waste, mixed waste
 - nonhazardous waste
 - radioactive waste
2. printed names of the chemical constituents (formulas optional)
 - concentration of chemical constituents should be included on the label (if known or best estimate).
3. start date if waste in 90 day area.

5.4 WASTE PACKAGING, HANDLING, AND DISPOSAL

Waste containers shall be stored in the designated waste collection area (radioactive collection area, satellite accumulation area, or 90 day area) within each laboratory or field site. Waste must be in approved containers, properly labeled, and appropriate disposal forms filed for waste acceptance by Energy Systems ORNL Waste Management Organization for treatment, storage, or disposal. All waste containers must be placed in secondary containers while in the waste collection areas to prevent spills. This secondary containment shall hold 10% of the total volume of the liquid waste stored in the area or the volume of the largest container (whichever is larger).

ESD personnel involved in storage and transfer of waste:

		Phone number
1.	ESD Environmental Protection Officer: Marilyn S. Hendricks	4-7296
2.	ESD Radiation Protection Officer: Monty Ross	4-7837
3.	ESD Generator Certification Officer: Marilyn S. Hendricks	4-7296
4.	ESD Health Physics Technician: George Houser	6-1408
5.	ESS Generator Certification Officer: Ramie Wilkerson	4-7260
6.	Environmental Biotechnology Section Generator Certification Officer: Tom Stephens	4-0226
7.	EASS Generator Certification Officers: Brian Spalding	4-7265
	John Switek	4-7415

5.4.1 Hazardous Or Nonhazardous Waste

Waste generators shall adhere to the following steps for waste disposal:

1. monitor the amount of waste accumulated (It can take 8-12 weeks for Hazardous Waste Operations Group to pick up waste, so estimate additions to waste accordingly while waiting for pick-up so limits are not exceeded.);
2. contact ESD EPO to obtain necessary forms for disposal of waste;
3. complete Waste Item Description Form (TX-5745)—follow "Waste Item Description (TX-5745) Form User Instructions" (Appendix C);
4. complete Waste Pickup Request Form (TX-5753)—follow "Waste Pickup Request (TX-5753) Form User Instructions" (Appendix C);
5. complete Container Packing List Form (TX-5749), if required—follow "Container Packing List (TX-5749) Form User Instructions" (Appendix C);
6. contact the Health Physics Technician to tag the waste for disposal and sign the Waste Item Description Form and Container Packing List;
7. photocopy completed forms to be kept in log book;
8. submit the Waste Pickup Request, Container Packing List and corresponding Waste Item Description Forms to the ESD EPO, who will review and submit forms to waste management; and
9. deposit waste in closed primary container that is properly labelled as hazardous or nonhazardous waste.

5.4.2 Liquid Radioactive Waste

Comply with the following steps:

1. Notify LCO (John Parrott) to determine acceptability of waste at ORNL Treatment Facility;
2. call Chris Scott (4-7057) for waste pick up if liquid waste is below the Derived Concentration Guide values given in DOE Order 5400.5;
3. contact the Radiation Officer for disposal forms if liquid waste is equal to or above the Derived Concentration Guide values given in DOE Order 5400.5;
4. complete Waste Item Description Form (TX-5745)—follow "Waste Item Description (TX-5745) Form User Instructions";
5. complete Waste Pickup Request Form (TX-5753)—follow "Waste Pickup Request (TX-5753) Form User Instructions";
6. complete Container Packing List Form (TX-5749). Follow "Container Packing List (TX-5749) Form User Instructions";
7. contact the Health Physics Technician to tag the waste for disposal and complete and sign appropriate sections of the Waste Item Description Form and Container Packing List;
8. photocopy completed forms to be kept in log book; and
9. submit the Waste Pickup Request, Container Packing List, and corresponding Waste Item Description Forms to the ESD EPO.

5.4.3 Compactible Low-Level Waste

Comply with the following steps:

1. segregate low-level waste and collect in a liquid-free container;
2. place bagged waste in a clear radioactive waste bag found in Room 144 and seal with radiation warning tape—do not seal until Health Physics has surveyed the waste (Note: Solid Radioactive Waste should be double bagged.);
3. complete Waste Item Description Form (TX-5745)—follow "Waste Item Description (TX-5745) Form User Instructions";
4. complete Waste Pickup Request Form (TX-5753)—follow "Waste Pickup Request (TX-5753) Form User Instructions"
5. complete Container Packing List Form (TX-5749)—follow "Container Packing List (TX-5749) Form User Instructions";

6. contact the Health Physics Technician to tag the waste for disposal and complete and sign appropriate sections of the Waste Item Description Form and Container Packing List;
7. photocopy completed Forms to be kept in log book; and
8. submit the Waste Pickup Request and corresponding Waste Item Description Forms to the ESD GCO who will ensure forms are properly submitted.

5.4.4 Noncompactible Low-Level Waste

Comply with the following:

contact the ESD Generator Certification Officer for disposal information.

5.4.5 PCB Waste

Contact the ESD EPO for disposal information. The production and management of PCB waste must be handled case by case because of strict regulations governing PCB research. Reference materials include EPM 3.6 and EPA 40 CFR 761.30(j).

5.4.6 Biological Waste

Complete the Waste Item Description Form (TX-5745) and contact ESD EPO for further disposal information.

5.4.7 Sanitary Waste

1. Most common items not acceptable for green dumpsters:
 - RCRA hazardous and/or mixed waste
 - TSCA waste (PCBs)
 - radioactive waste
 - liquid wastes
 - wastes containing free liquids
 - classified wastes
 - bulk metals (large quantities of metals—e.g., large pipe)
 - lead acid, Nickel/Cadmium, and Silver and Lithium batteries
 - Mercury-contaminated waste
 - tires
 - fluorescent light bulbs
 - incandescent light bulbs
2. Most common items that are acceptable for green dumpsters
 - paper
 - wood (< 6ft in length)
 - plastic and rubber
 - organic garbage (food, leaves, etc.)
 - textile products

- incidental metals (small amounts of metals—e.g., metal bottle cap)
- HVAC air filters
- alkaline batteries
- button-type batteries

White paper and cardboard are recyclable and should not be disposed of in green dumpsters.

3. Glass dumpsters

- glass [triple rinsed—only P listed or K, P, U, or F listed waste with a (H) Hazard Code containers need to be triple rinsed].

4. Waste requiring special handling and preapproval for disposal

- dead animals
 - asbestos waste
 - fiberglass with loose fibers
 - empty paint cans
 - empty pesticide containers
 - aerosol cans (should be routed through the WMOG for proper purging of contents and processing for scrap metal.)
 - autoclaved/packaged noninfectious medical waste (labelled with generation site, generator's name and phone number; contact Marilyn Hendricks for disposal)
4. For items not appearing on this list, contact the ESD EPO for proper disposal instructions.

5.5 RADIOACTIVE WASTE CHARACTERIZATION

Curie content must be determined and documented for each waste package. Following are some acceptable methods of determining curie content as directed by ER Program Waste Management.

Note: The type of instrument used to obtain exposure rates and any calculations performed for this purpose must be documented and retained with the generator's waste disposal records.

5.5.1 Isotope(s) is Known

If mixtures of isotopes are present, the ratio of the mixture must also be known to use the following methods:

Process Knowledge - This method is best suited to production operations. Process knowledge must be based on evaluation of the waste stream. Documentation determining curie content must be retained with associated disposal forms.

Materials Accountability - A known amount of radioactive material is introduced into the experiment (or process). A known amount of radioactive material is recovered from the experiment. The amount of radioactive material unaccounted for is assumed to be waste.

Disintegrations Per Minute to Curie Conversion (best suited to low levels of activity) - A known efficiency must exist (or be established) for the radioisotope and instrument combination to be used. Radiation emissions are measured in counts per minute (cpm) and converted to disintegrations per minute (dpm). If background cpm is a measurable portion of the total cpm, it must be subtracted from the total prior to converting to dpm. Once dpm is determined, curie content can be estimated.

Example: A portable beta-gamma instrument has been obtained that yields approximately 30 dpm/cpm at contact for ^{238}U . A waste package containing only ^{238}U is monitored with the same instrument to emit 1000 cpm beta-gamma above background. How many curies of ^{238}U are estimated to be in the waste?

$$\begin{aligned}\text{dpm} &= (1000 \text{ cpm}) \times (30 \text{ dpm/cpm}) \\ &= 30,000 \text{ dpm}\end{aligned}$$

$$\begin{aligned}\text{curies} &= \text{dpm} / 2.22 \times 10^{12} \\ &= 30,000 \text{ dpm} / 2.22 \times 10^{12} \\ &= 1.35 \times 10^{-8} \text{ } ^{238}\text{U}\end{aligned}$$

Exposure to Curie Conversion (best suited to point sources detectable at greater than one foot distances) - In order to estimate the number of curies, the **gamma** exposure rate from a single radioisotope at a distance of one foot from the source must be known.

5.5.2 Point Source Relationship

The distance at which an exposure rate can be measured must be at least five times the longest dimension of the point source. In other words, if the longest dimension of a point source is greater than 2.4 inches (1/5 x 12 inches), the exposure rate must be measured at a distance greater than one foot to remain accurate. Measuring and converting exposure rate from distances greater than one foot to a one foot distance can be done as follows:

$$R_2 = (d_1)^2(R_1)/(d_2)^2$$

where:

- R_2 = Unknown exposure rate (rads/hour) at desired distance
- d_1 = Measured distance (feet) of known exposure rate
- R_1 = Measure exposure rate (rads/hour) at known distance
- d_2 = Desired distance (feet) of unknown exposure rate

Example: A point source 4 inches in diameter has a gamma exposure rate of 0.010 rads/hour (10 millirads/hour) at a distance of 20 inches (5 x 4 inches x 1 ft/12 inches = 1.67 feet). What is the exposure rate at a distance of 1 foot?

$$\begin{aligned}R_2 &= (1.67 \text{ ft})^2 (0.010 \text{ rads/hour}) / (1 \text{ ft})^2 \\ &= 0.03 \text{ rads/hour} \\ &= 30 \text{ millirads/hour @ 1 foot away from the source}\end{aligned}$$

5.5.3 Determining the Number of Curies

For point source gamma emitters with energies between 0.07 and 4 MeV, the number of curies can be estimated within $\pm 20\%$. The MeV energies of known radionuclides can be obtained from various text, including Knolls Atomic Chart Of The Nuclides and the David C. Kocher Handbook of Radioactive Decay Data Tables. The following method is currently acceptable to estimate the number of curies contained in gamma contaminated radioactive waste:

$$C = R/6E$$

where:

C = Number of Curies

R = Exposure Rate (rads/hour) @ 1 foot

E = * Total MeV Energy of Isotope

6 = conversion factor

* Note: for an isotope which is decaying with more than one energy, each MeV energy must be multiplied by its own intensity. The sum of the energies will be used as E above.

Example: A package of waste containing ^{22}Na has a measured (or calculated) gamma exposure rate of 30 millirads/hour at a distance of 1 foot from the source. The most abundant gamma decay energy for ^{22}Na is 1.275 MeV. How many curies of ^{22}Na are contained in the waste?

$$\begin{aligned} C &= (0.03 \text{ rads/hour})/6(1.275 \text{ MeV}) \\ &= 3.92 \times 10^{-3} \text{ curies} \end{aligned}$$

5.5.4 Isotope(s) is Unknown

Sampling and analysis (radioassay) must be used whenever unknown isotopes or unknown mixtures of isotopes are present as follows:

Either the entire waste package, or an aliquot from a homogeneous waste package must be analyzed to either identify the isotope, or determine the curie content. If the analysis is used only to identify the isotope, one of the methods listed above can be used to determine the number of curies. Documented analytical results must be attached to applicable waste disposal forms.

6. WASTE MINIMIZATION

All efforts shall be taken to minimize generation of all wastes during the course of this project. As a minimum, the following actions will be taken:

1. All generated waste from field and laboratory activities shall be segregated as indicated in Table 1 to minimize the disposal of nonrecyclable noncontaminated, nonhazardous wastes. Wastes will not be accepted by Waste Operations unless it is properly segregated, labeled, characterized, and the appropriate paperwork completed.
2. Presampling planning, Health Physics and Industrial Hygiene contamination control measures, and worker awareness will support minimizing the mixing of waste types.
3. When possible, materials that may be contaminated with sediment will be cleaned to produce noncontaminated materials. The cleaning process will involve washing and rinsing of the materials to remove the radioactive contamination. Effectiveness of the cleaning will be demonstrated by field surveys of the material with the beta/gamma meter to show compliance with HP requirements. The liquid waste resulting from the washing should be containerized, stored, and disposed of as warranted. Wiping equipment with dry paper towels is preferred because it is efficient and minimizes waste generation. Steps will be taken to use as little water as possible in decontamination operations.
4. Field personnel shall wear Level 1 PPE that includes DOE khakis, washable cotton coveralls, disposable gloves, and boots. Activities (i.e., sediment coring) that can expose project personnel to higher levels of contaminants will require additional sets of clothing such as Contamination Zone coveralls (C-Zones) and an additional set of gloves that shall be taped to the C-Zones. Protective equipment will be chosen to minimize the amount of waste material generated and to enable recycling of as much PPE as possible.
5. Non-hazardous chemicals should be used whenever possible.

7. ENVIRONMENTAL HEALTH AND SAFETY

All issues concerning the ES&H of the WAG 2 RI project are defined in the *Health and Safety Plan for the Remedial Investigation of the Waste Area Grouping 2 at the Oak Ridge National Laboratory, Oak Ridge, Tennessee* (Cofer et al. 1993).

7.1 CONTAMINATION CONTROL

Surveillance by Health Physics or the WAG 2 Site Safety and Health Officer (SSHO) will be conducted during WAG 2 sampling and laboratory activities to identify any conditions that may indicate the presence of radioactive contamination or RCRA hazardous wastes. If warranted, appropriate tests and analysis will be conducted. The GCO as designated, authorized and qualified by ESD Waste Management, will be responsible for determining whether additional testing or sampling is required by Energy Systems. Wastes will be properly handled and segregated into carboys or radioactive material bags to prevent the spread, mixing, or loss of any soil or liquid containing radiologically contaminated material. Waste containers should be secondarily contained and placed over plastic sheeting when appropriate at laboratory or field sites. Contamination control will also be maintained by the utilization of proper PPE and frisking procedures to detect radiological contamination on project personnel and equipment.

7.2 PERSONNEL EXPOSURE CONTROL

The Health Physicist or the SSHO (or team leader) will accompany field sampling personnel in radiological areas to monitor and control exposure levels while performing sampling activities. The SSHO will perform periodic surveillances and audits during sampling activities to ensure compliance with health and safety procedures. All standard radiation protection measures defined in the WAG 2 Health and Safety Plan will be followed to ensure personnel safety. The degree of radiation protection needed in the field is dependent on the types of areas and sites that are sampled. For example, personnel sampling in radiation areas, >3 mRem/h, should decrease time spent at that site and may wear coveralls for extra protection from contamination. All work in contaminated areas or areas subject to radiation exposure shall be properly planned and executed so as to keep personnel exposure ALARA. All WAG 2 field sampling personnel shall be participants in the Baseline Bioassay Program and the Whole Body Monitoring Program to monitor internal exposure of radionuclides.

7.3 SPILL CONTROL

Spills will be controlled and cleaned up where and when they occur. The first responder shall perform the following basic steps:

- isolate the area;
- contain the spill (if possible);

- achieve containment using sorbent boom, diking material, silica absorbent material, or combination of these (other material may be used in an emergency but manufactured absorbent materials are preferred);
- pick up spilled material with appropriate absorbent (spill kits will be kept in a close proximity to the work site);
- decontaminate the area (if deemed necessary by the Health Physicist);
- containerize sorbent or waste material in DOT or disposal site approved container;
- arrange transportation, storage, and disposal with ESD;
- report spills to ORNL Environmental Compliance Division; and
- notify your immediate supervisor or Laboratory Shift Supervisor if a spill cannot be contained or poses any potential risk to personnel.

A spill control kit should contain an adequate amount of the following:

- absorbent pads,
- chemical resistant gloves,
- shovel, and
- broom.

8. WASTE COLLECTION AREAS

All waste collected during WAG 2 field and laboratory activities is stored in the waste collection areas within laboratories or designated field sites. These areas shall be inspected weekly by ESD personnel. The laboratory steward must ensure compliance with regulations and proper procedures for maintenance of these areas.

8.1 COMPONENTS, LIMITS, AND SETUP OF WASTE COLLECTION AREAS

The satellite accumulation areas within laboratories shall be designated with a sign and outlined with red tape. The maximum volume of waste is limited to a total of 55 gal of hazardous waste, of which 1 quart may be acutely hazardous waste (P listed waste or a K, F or U listed waste with a (H) Hazard Code).

The nonhazardous waste areas within laboratories shall be designated with a sign and outlined with blue tape. The generator should initiate disposal effort when container approaches capacity.

The radioactive waste area shall be designated with a sign and outlined with yellow tape. The generator should initiate disposal effort when container approaches capacity.

Contact the ESD EPO for instructions on PCB Waste Collection Area setup and instructions on limits.

8.2 TRAINING

Training for waste generators will be conducted and documented in accordance with ESD, Laboratory Certification Office, and ER Program policies. Training for all personnel shall include but are not limited to the following:

- Waste Generator Training for Solid Low-Level Waste and
- Waste Generator Training for Satellite Accumulation Area.
- 90 Day Area Training.

Additional training for Waste GCO shall include the following:

- GCO Training Module (only MMES personnel may serve as GCO).

WAG 2 field sampling personnel generating waste shall complete the following:

- 40 h SARA OSHA Training and
- Radiation Worker training II.

9. WASTE TRANSFERRED TO ENERGY SYSTEMS AND FINAL DISPOSITION

WAG 2 field or designated personnel are responsible for transporting liquid and solid low-level radioactive waste generated in the field to the waste collection areas. Contaminated solid waste will be transferred to Energy Systems Waste Management who will transport it from the waste collection areas to an approved waste disposal, treatment, or storage facility. Liquid waste will be transferred to Energy Systems WMO who will transport it as appropriate to the Nonradiological Wastewater Treatment Plant, Process Waste Treatment Plant, or the Low-Level Liquid Waste system. All transportation activities will be conducted in accordance with applicable MMES or DOT requirements.

10. QUALITY ASSURANCE

QA management considerations have been reviewed and requirements are included in the QA Plan for the WAG 2 project (Atwood and Miller 1992). Energy Systems, in its role as facility manager, will track participant activities and consolidate records, reports, etc., to ensure that project QA activities are performed and required documentation is complete. Surveillances will be conducted as defined in the plan by Energy Systems. All waste disposal forms shall be filled out by the generator and approved and authorized by the project GCO. The GCO shall maintain record copies of all waste disposal forms.

The WAG 2 GCO, in conjunction with ESD, shall also perform and document weekly audits of the field and laboratories maintaining waste collection areas. If a nonconformance is determined, the WAG 2 QA/Quality Control Coordinator shall be notified and formal nonconformance and corrective actions shall be filed with the individual.

REFERENCES

- ACGIH (American Conference of Governmental Industrial Hygienists) 1991. *Threshold Limit Values for Chemical Substances and Physical Agents*, Cincinnati, Ohio.
- Atwood, G. P. and Miller, D. E., 1992. *Quality Assurance Plan for the Remedial Investigation of Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee*. ORNL/ER-134, Oak Ridge, Tenn.
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- DOE (U.S. Department of Energy) 1988a. DOE Order 5820.2A, *Radioactive Waste Management*.
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- DOE (U.S. Department of Energy) 1992. *U.S. Department of Energy Radiological Control Manual*, DOE N 5480.6, DOE/EH-0256T.
- EPA (U.S. Environmental Protection Agency) 1988. 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants."
- EPA (U.S. Environmental Protection Agency) 1990. 40 CFR 300 (55 FR 8756), "National Oil and Hazardous Substances Pollution Contingency Plan: Final Rule."
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- ORNL (Oak Ridge National Laboratory) 1992a. *Health Physics Manual: Procedures and Practices for Radiation Protection and Radiation Monitoring*, Oak Ridge, Tenn.
- ORNL (Oak Ridge National Laboratory) 1992b. *Industrial Hygiene Manual: Procedures for ORNL Industrial Hygiene Programs, Industrial Hygiene Section*, Oak Ridge, Tenn.
- ORNL (Oak Ridge National Laboratory) 1994. *Waste Acceptance Criteria for Radioactive Solid Waste Disposal at SWSA-6, WMRA-WMPC-413*. Oak Ridge, Tennessee.

OSHA (Occupational Safety and Health Administration) 1991. 29 CFR 1910.120 "Hazardous Waste Operations and Emergency Response," *Waste Management Guidance Document*.

Appendix A

WASTE MANAGEMENT PLAN CHECKLIST
ORNL Environmental Restoration Program

1. **Project Name:** Waste Area Grouping 2 Remedial Investigation Project

Responsible Project/WAG Manager: Stephen Herbes

Phone: 574-7336

Address: Building 1505, Rm. 366, MS-6038

Location of Project: Waste Area Grouping 2, surrounding areas, and Laboratories located in Bldg 1505.

Organization/Subcontractor Performing Waste Generation Task: WAG 2 Project personnel (Martin Marietta Energy Systems employees and subcontractors).

Work Order Number for Waste Management/P&E Activities:

Rm 311: PX048E12

Rm 227: PX050U02

-
2. **Responsible field ORNL Construction Engineer/Prime or Subcontractor:**
Not applicable

Responsible field ES&H Officer: Virginia L. Holt

Phone: 241-5240

Address: Bldg 1506, MS-6351

Map of WAG 2 location may be found in the Project Waste Management Plan.

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3. **Project Description:** Detailed information found in Sections 1.2 and 1.3 within the Project Waste Management Plan.
4. **Completion and Signatures of Waste Management Forms:**

Project manager is to assure that a minimum of two individuals (laboratory stewards) have had the proper training which will authorize them to sign various waste disposal forms and or manage waste collection areas. All field and laboratory personnel assigned the task of packaging and placing waste in containers are required at a minimum to participate in the ORNL Solid Low Level Waste Generator Training.

Individual signing as "generator" of SLLW shall have been physically present at the time the waste was packaged.

Individuals who have not taken the proper training authorizing them to sign Waste Disposal forms should contact Fay Frederick at 576-1460 or B. Monty Ross (ESD) at 574-7837, for specific Training Requirements.

A. Waste Item Description Form (TX-5745) (Appendix A, attachment 1):

(Generator)

Marilyn S. Hendricks
(GCO, MMES Employee)

George Houser
(Health Physics Technician)

B. Container Packing List (TX-5749) (Appendix A, attachment 2):

Marilyn S. Hendricks
(Certification Officer: GCO)

to be assigned
(Waste Management Organization Officer: WMO)

George Houser
(Health Physics Technician)

C. Waste Pickup Request (Appendix A, attachment 3):

Requestor

Packager

5. **Person or organization responsible for completing the ER Waste Generation Report:**

This report is to be completed weekly and mailed to ORNL ER Waste Management Manager. This report is to be completed by the project manager, and the values are to be reported in cubic feet.

Project Manager: Steve Herbes

6. **Organization or person responsible for providing, MMES, prime or subcontractor with characterization data for waste transfer or dispositioning:**

Project Manager: Steve Herbes

7. **Organization or person responsible for obtaining samples from waste containers and transporting those samples to the analytical laboratory for characterization purposes:**

WAG 2 Analytical Services Coordinator

8. **Describe sampling plan for taking samples (from waste containers or the area of contamination) that are to be sent to the lab for characterization information which will be used in completing the waste disposal forms.**

All field areas which are sampled during monitoring activities shall be analyzed by laboratories and data shall be utilized for characterization waste disposal. Actual protocol for field sampling may be found in the *Field Sampling and Analysis Plan for the Remedial Investigation of Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (ORNL 1991).

9. **Organization or person responsible for performing analysis on waste samples for characterization purposes:**

Internal and external laboratories contracted through the Analytical Project Office will perform all analyses on environmental samples or waste samples for waste characterization.

10. **What analysis will be requested to characterize waste?**

Water samples are analyzed for contaminants including but not limited to: radionuclides (H-3, Sr-90, CO-60, Cs-137, gross alpha, gross beta, and transuranics- Am, Pu, Cm, Th, U), volatile organics, semi-volatile organics, and metals (Ag, Al, B, Ba, Be, Ca, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Sb, Si, Sr, Tl, V, Zn, As, Cd, Pb, Se, and Hg).

Sediment samples have been analyzed using a Toxicity Characterization Leaching Procedure (TCLP) in order to analyze for metals, volatiles, semi-volatiles, PCBs and Pesticides. Sediments and soils are also analyzed for radionuclides (Sr-90, Tc-99, gamma, and transuranics).

11. List the process knowledge available to characterize the waste:

The above analyses (#10) have been performed on environmental samples collected within WAG 2 and shall be used for waste characterization. Data may be found in Tables 2, 3, and 4 of the Project Waste Management Plan.

12. Is the available process knowledge enough to properly characterize the waste without having to perform analysis on the waste?

NO (However, if existent analytical knowledge of samples placed in waste stream is sufficient to properly characterize waste produced by the WAG 2 project, then documented processed knowledge will be used.)

13.

Estimated Types and Volume of Waste

TASK	WASTE STREAM/SOURCE	TYPE	CATEGORY ^c	VOLUME (Annual)	SUSPECTED CONTAMINANTS
Seeps and Tributaries (Water sampling)	Residual Samples	Liquid	Radiological	8 7 ft ³	H-3, Sr-90, Co-60, Cs-137, U-238/234/232, Cm- 243
	Laboratory Analysis	Liquid	Radiological NonHazardous	5 ft ³	H-3, Sr-90, Co-60, Cs-137, U-238/234/232, Cm- 243, KMnO ₄
			Radiological	1 1 ft ³	H-3
	Decontamination, Personal Protective Equipment (PPE), sample containers	Plastic, Paper, Glass	Radiological	19 7 ft ³	Sr-90, Co-60, Cs-137
Hydrologic Pathways (Groundwater sampling)	Well Drilling Decontamination	Liquid	Radiological	6 7 ft ³	H-3, Sr-90, Co-60, Cs-137
	Drilling	Sludge/Soil	Radiological	2 9 ft ³	Sr-90, Co-60, Cs-137
	Decontamination, PPE	Plastic, Paper, Glass	Radiological	10 ft ³	Sr-90, Co-60, Cs-137
	Water Sampling Residual samples	Liquid	Radiological	35 ft ³	H-3, Sr-90, Co-60, Cs-137
	Laboratory Analysis		Radiological Nonhazardous	.35 ft ³	H-3, Sr-90, Co-60, Cs-137, KMnO ₄
			Radiological	7 ft ³	H-3
Sediment Transport (Storm-water Sampling)	Decontamination, PPE	Plastic, Paper, Glass	Radiological	6 ft ³	Sr-90, Co-60, Cs-137
	Water Sampling Residual samples	Liquid (stormwater)	Radiological	55 1 ft ³	H-3, Sr-90, Co-60, Cs-137
	Decontamination	Liquid	Radiological	28.8 ft ³	H-3, Sr-90, Co-60, Cs-137
	Decontamination, PPE	Plastic, Paper, Glass, Aluminum	Radiological	28.9 ft ³	Cs-137, Co-60, Sr-90
Hydraulic Head Monitoring Stations (HHMS)	Well Purging and Water Sampling	Liquid (possible pH > 12)	Radiological	86.1 ft ³	H-3, Sr-90, Co-60, Cs-137
Floodplain Soil/Sediment	Soil and Sediment Core Residual Samples	Soil and Sediment	Radiological	2 ft ³	Sr-90, Co-60, Cs-137, Pu-239/240
	Decontamination, PPE	Plastic, Paper, PVC piping, Glass and Wood	Radiological	9 8 ft ³	Sr-90, Co-60, Cs-137, Pu-239/240
	Decontamination	Liquid	Radiological	23 2 ft ³	Sr-90, Co-60, Cs-137, Pu-239/240

TASK	WASTE STREAM/SOURCE	TYPE	CATEGORY ^c	VOLUME (Annual)	SUSPECTED CONTAMINANTS
Tributary Assessment Task	Residual samples	Liquid	Radiological	24.4 ft ³	H-3, Sr-90, Co-60, Cs-137, U-238/234/232
(Water Sampling)	Laboratory Analysis		Radiological Nonhazardous	.6 ft ³	H-3, Sr-90, Co-60, Cs-137, U-238/234/232 KMnO ₄
			Radiological	1.2 ft ³	H-3
	Decontamination, PPE, sample containers	Plastic, Paper, Glass	Radiological	35.5 ft ³	Sr-90, Co-60, Cs-137, U-238/234/232
Ground Water	Redevelopment of wells	Liquid	Radiological	100.3 ft ³	H-3, Sr-90, Co-60, Cs-137
		Plastic, Paper, Glass	Radiological	60 ft ³	Sr-90, Co-60, Cs-137

- ^a Coring, drilling, deconning, surface/ground water sampling, protective equipment, well urging, etc.
- ^b Liquid, metal, plastic, sediment, sludge, soil, etc.
- ^c Hazardous, mixed, nonhazardous, radiological, TRU, TSCA, etc.
- ^d ER Methodology for generating waste volume estimates is to be used in estimating waste volumes. Unless if you have an approved alternate methodology for estimating waste volume.

What Methodology was used to estimate your waste volumes?

Methodology used for estimation of waste volumes for each task was based on previous sampling experience.

Hydraulic Head Monitoring Stations (HHMS)- Well purging :

$$\text{Volume of borehole} = \frac{(D)^2 h}{(2)}$$

D= diameter of borehole

h= depth of borehole

$$\text{Waste} = (\text{volume of borehole}) \times (\# \text{ of boreholes})$$

$$\text{volume of borehole} = 28.7 \text{ ft}^3$$

$$\# \text{ boreholes} = 3$$

Surface Soil/Sediment sampling:

Soil/sediment is obtained from hand augers (sampling approximately up to 2 ft). Most of the soil collected shall be used for sample analysis. Small waste volumes are produced from residual sample. However, the volumes listed in # 13 were calculated as follows:

Soil/Sediment Waste = [(volume of core) (# cores)] x .25
(75% of soil collected will be shipped to analytical laboratories for analysis.)

Decontamination Liquid Waste = (# cores) x (3.5 L waste/core)

(3.5 L of liquid waste has been produced in the past, including decontamination of core and all stainless steel equipment.)

volume of core = .04 ft³
cores = 188

Seeps and Tributaries:

Liquid waste = (volume of residual samples) x (# samples)

Liquid waste (Laboratory analysis) =
(KMnO₄) = (50 mL waste/sample) x (# samples)
(H-3) = (100 mL waste/sample) x (# samples)

Compactible solid waste =
[(2 ft³/sampling event) x (sampling events)] + [(# sample containers) x (volume of each container)]

of samples: 300
sampling events: 3
sample containers: 1200 total (varying in size)
volume of each container: (1L) = .0353 ft³, (20 mL) = .00071 ft³, (250 mL) = .0088 ft³

Hydrologic Pathways:Well Drilling:

Sludge/Soil waste = (volume of well) x (# of wells)

Compactible solid waste = (5 ft³ waste/well) x (# of wells)

Decontamination Liquid waste = (3.34 ft³ waste/well) x (# of wells)

of wells: 2
volume of well: 1.47 ft³

Water Sampling:

Liquid waste = (volume of residual sample) x (# of samples)

Liquid waste (laboratory analysis)

(KMnO₄) = (50 mL/sample) x (# of samples)

(H-3) = (100 mL/sample) x (# of samples)

Compactible solid waste = (1 ft³ waste/sampling event) x (# of events)

volume of residual sample = 50 mL

of samples = 200

of events = 6

Tributary Assessment Task:

Liquid waste = [(volume of residual sample) x (# of samples)] + [(3L waste/ISCO tub) x (# ISCO tubs)]

Liquid waste (laboratory analysis) =

(KMnO₄) = (50 mL/sample) x (# of samples)

(H-3) = (100 mL/sample) x (# of samples)

Compactible solid waste = [(1/2 ft³ waste/sampling event) x (# of sampling events)] + [(# sample containers) x (volume of each container)]

volume of residual sample = 1.05 L

of samples = 350

ISCO tubs = 108

sampling events = 6

sample containers = 2100 total (varying in size)

volume of each container: (1L) = .0353 ft³, (20 mL) = .00071 ft³, (250 mL) = .0088 ft³, (100 mL) = .00355 ft³

Sediment Transport:

Liquid waste (storm water) = (# storm events) x {[(15 ISCO tubs/storm) x (24 L waste/tub)] + [(120 L waste (manual sampling)/storm)]}

Decontamination Liquid waste = [(15 ISCO tubs/storm) x (3L waste/tub) x (# storms)] + [(# sample containers and equipment) x (volume of waste produced for each container cleaning)]

storm events = 4 (Variable)

sample containers and equipment for 1 year : volume of waste produced for each container cleaning =

1,920 sample containers : 250 mL waste produced for each container
 200 filtration apparatuses : 500 mL waste produced for each
 50 bottom withdrawal tubes : 1.1 L waste produced for each

Compactible waste = $[(3.21 \text{ ft}^3 \text{ field waste/event}) + (4.01 \text{ ft}^3 \text{ lab waste/event})] \times (\# \text{ storm events})$

Ground Water Task:

Liquid Waste = $(6.68 \text{ ft}^3 \text{ waste/well}) \times (\# \text{ of wells})$

Compactible solid waste = $(4 \text{ ft}^3 \text{ waste/well}) \times (\# \text{ of wells})$

of wells = 15

14. Will a spill control kit be on-site during waste generation activities? YES

What will the spill control kit consist of?

A spill control kit at a minimum will contain an adequate supply of absorbent pads, chemical resistant gloves, shovel and a broom. The spill control kit container has large lettering on the outside of the container that spells out "spill control kit".

Is a first responder emergency action plan in place, in case of spill or a line puncture? This means in addition to contacting Laboratory Protection (911).

First responder emergency protocol may be found in Section 7.3 of the Project Waste Management Plan or the *Health and Safety Plan for the Remedial Investigation of Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (Cofer *et.al.* 1993).

15. What organization or person will be assigned the responsibility of properly containerizing the waste, labeling the waste containers, and labeling and bagging contaminated material?

This responsibility lies with WAG 2 waste generators and laboratory stewards maintaining waste in collection areas. The Health and Safety Officer or ES&H site oversight responsibility is to adhere to ORNL SWSA-6 WAC in addition to health physics manual.

16. Which of the following areas will be required to temporarily store the project waste until the waste can be transferred to ORNL Waste Management Operations?

A. Radiological Waste Storage Area: YES

Location: Laboratories 311 and 227 / Building 1505
Responsible organization or person that will manage areas:

Bonnie B. Lu

B. 90-Day Storage Facility for hazardous or mixed waste: NO

C. Satellite Accumulation Area: YES

Location: Laboratories 311 and 227

Responsible organization or person who will manage area:

Bonnie B. Lu

D. What is in place to protect the structural integrity and weatherability of drums and B-25 boxes.

Within Wag 5, waste filled drums will be stored on a platform and covered with plastic. Waste will be disposed of in a timely manner.

E. If any of the above areas will not be used to manage waste, please give specific details to how this waste will be managed.

Examples: stockpiling, solidification, incineration, synthetic or clay linings, in situ vitrification, leave waste in area of contamination, etc.

A 90-Day Storage Facility will not be utilized. Mixed or Hazardous waste will be collected in the Satellite Accumulation Areas which is limited to a maximum volume of 55 gallons of HAZARDOUS Waste, of which 1 quart may be acutely HAZARDOUS Waste (P listed waste or a K, F or U listed waste with a (H) Hazard Code.

Have training requirements (e.g., Satellite Accumulation Area and 90-Day Accumulation Area) been fulfilled to manage the storage area? YES

17. **Have you spoken to ORNL compliance personnel pertaining to your requirements for managing a temporary satellite, 90-day or radiological waste storage area?**

David Skipper 576-5748

Marilyn Hendricks (ESD) 574-7296
 Persons Contacted Phone

List the Specific Requirements:

Satellite Accumulation Area:

- The satellite accumulation area shall be outlined with red tape.
- Sign shall be posted reading Satellite Accumulation Area

- At a minimum, all RCRA requirements will be met.
- Containers of hazardous waste must be labeled properly in the field and in the laboratory with a label which is LEGIBLE and VISIBLE on the CLOSED PRIMARY container. Each label must contain the words "Hazardous Waste or Hazardous Waste, Mixed Waste" and the PRINTED NAMES of the Chemical Constituents (Formulas optional). It is recommended the concentration of chemical constituents be included on the label (if known or best estimate).
- Containers of hazardous waste must be in good condition (not leaking or damaged) and compatible with the waste being stored in them.
- Containers of hazardous waste must be kept closed unless waste is being added or removed. For solid wastes, a bag that is tied shut is sufficient. For liquid wastes, the lid must prevent a release if the container overturned.
- Containers of liquid hazardous waste should be secondarily contained to minimize the possibility of a spill. This secondary containment shall hold 10 percent of the total volume of the liquid waste stored in the area, or the volume of the largest container, whichever is larger.
- Training Requirements: Initial satellite accumulation training will be mandatory for all personnel generating hazardous waste. Retraining or successful completion of a "proficiency exam" will be required annually.

18A. Can the ORNL Hazardous Waste Group take charge of the hazardous or mixed waste generated? YES

List any specific requirements:

Requirements as stated in # 17.

Volume of Waste (cubic feet): 0 ft³

K.G. Edgemon 574-1779

<u>Marilyn Hendricks (ESD)</u>	<u>574-7296</u>
Persons Contacted	Phone

18B. Can the Solid radioactive Waste group accept the volume of radiological waste that will be generated? YES

List any specific requirements:

- Low level Compatible waste must be double bagged in radioactive materials bags.
- Waste must be free of liquid.
- Waste must be properly labeled, and characterized.

- Suspected radionuclides and estimation of concentration should be included on label.
- Waste must meet acceptance criteria.

Volume of Waste (cubic feet): 171.79 ft³

<u>Greg Larson</u>	<u>1-3273</u>
Person Contacted	Phone

- 18C. **Can the Liquid Gaseous Waste Group accept the liquid waste that will be generated? YES**

List any specific requirements:

- Waste containers must be labeled properly in the field and in the laboratory with a label which is **LEGIBLE** and **VISIBLE** on the **CLOSED PRIMARY** container. Each label should contain the words "Radioactive Waste" or "Hazardous Waste " as appropriate, and the **PRINTED NAMES** of the Constituents (Formulas optional). It is recommended the concentration of radionuclide constituents be included on the label (if known or best estimate).
- Waste must meet the acceptance criteria for Process Waste Treatment Plant or Low Level Liquid Waste System.
- Waste containers must be appropriately tagged by Health Physics.
- Appropriate disposal forms, signatures and waste certification must be completed.

Maintenance requirements for waste in the Radioactive Waste Collection Areas:

- Waste containers must be in good condition (not leaking or damaged) and compatible with the waste being stored in them.
- Waste containers must be kept closed unless waste is being added or removed. The lid must prevent a release if the container overturned.
- Waste containers should be secondarily contained to minimize the possibility of a spill. This secondary containment shall hold 10 percent of the total volume of the liquid waste stored in the area, or the volume of the largest container, whichever is larger.

Volume of Waste (cubic feet): 338.1 ft³

<u>Chris Scott</u>	<u>574-7057</u>
Person Contacted	Phone

- 18D. **Do you plan to generate any brine solution, sludge or sediment waste, if so how will you manage this waste?**

Sediment and soil waste shall be dewatered and disposed of appropriately through ORNL Waste Operations Group.

- 18E. Will any large volumes of uncontaminated spoils be generated? NO
- 18F. For waste that cannot be managed by any of the above ORNL Waste Operation Groups, what is your alternative for managing the waste?

All waste generated can be managed by the above ORNL Waste Operation Groups.

-
19. Will any TRU/or TRU Mixed Waste be generated? NO

-
20. What organization or person will be responsible for transporting the waste from the generation area to the temporary waste storage area to await final pickup by Martin Marietta Energy Systems (MMES)?

WAG 2 field personnel shall transport waste from the generation area to the temporary waste storage area within Building 1505 or designated areas. Regulated hazardous substances will not be transported on public roads.

The hydrologic pathway task will temporarily store waste at the generation area within WAG 5.

-
21. Will ORNL Waste Management Operations be responsible for transporting waste from site of waste generation or the waste storage area to a MMES storage, treatment or disposal facility? ORNL Waste Operation does not normally pick up waste from off-site.

ORNL Waste Management Operations transports waste from the temporary waste collection areas in the laboratory or the WAG 5 waste storage area as appropriate to the Process Waste Treatment Plant (PWTP), Non-Radiological Waste Water Treatment Plant (NRWTP), Low Level Liquid Waste (LLLW) system, or to silos or Tumulus Units in SWSA 6.

-
22. For waste that is generated off-site, who or what organization will transport that waste to ORNL Waste Operations? Give specific details as to how this waste will be transferred to ORNL Waste Operations?

Any waste which will be generated off-site will be transported to Building 1505 by WAG 2 project personnel.

23. A. Will waste require transporting over public roads? YES

Waste which shall be transported over public roads is not considered RCRA Hazardous or TSCA materials. Waste generated will not exceed the DOT regulatory limit of .002 $\mu\text{Ci/mL}$ for radioactive materials.

B. Will waste require transporting over DOE roads before 9 a.m. and after 4 p.m.? YES**C. List the Department of Transportation issues that are of concern in transporting this waste:**

none

D. Have you communicated those concerns of transporting the waste and associated resolutions to ORNL Transportation Operation Management Department and received their concurrence of how the waste may be transported? YES

<u>Greg Livengood</u>	<u>574-9458</u>
Person Contacted	Phone

E. List the resolutions to those concerns:

Reaffirmation of compliance with all DOT regulations.

24. Identify your waste minimization techniques in that will be implemented during this task.

Waste Minimization practices are addressed in Section 6.0 of the Project Waste Management Plan.

APPENDIX B

WASTE ITEM DESCRIPTION

WASTE ITEM IDENTIFICATION

11. Waste Item ID Number	12. Generator's Name (Print)	13. Badge No.	14. Generator's Phone No.	15. MS	16. Charge Number/MO
17. Origin Div.	18. Origin Date	19. Origin Site	110. Origin Facility	111. Origin Room/Area	112. Radiological Area? ☐ Yes ☐ No
113. Est. Net Volume	114. Units	115. Est. Gross Weight	116. Units	(Reserved)	

CONTAINER INFORMATION (1 of) If more than one attach Waste Container List (UCN-2109A)

C1. Container ID. No.	C2. Container Type	C3. Holding Site	C4. Holding Facility	C5. Holding Room/Area
-----------------------	--------------------	------------------	----------------------	-----------------------

WASTE CATEGORY

W1. Process Stream ID	W2. Process Category	W3. Process Activity	W8. Waste Category (Check all)					
W4. Physical Form	W5. Material Type	W6. AWA No.	Chemical	Yes	No	Biological	Yes	No
W7. Waste Description			Radioactive			Accountable		
			Asbestos			Carcinogen		
			Sol/Liq			Compackable		
			Const. Debris			Recyclable		
			Medical			Classified		

CHEMICAL WASTE

M1. RCRA? ☐ Yes ☐ No	M2. RCRA 90-day Start Date	M3. PCB? ☐ Yes ☐ No	M4. PCB Start Date	M5. PCB Conc. (PPM)
M6. Determination Method (Check ONE) ☐ Analysis ☐ Process Knowledge ☐ Reference	M7. Determination Document Number(s)			M8. Flash Pt.
M10. EPA Waste Code Numbers			M9. pH	
M11. Substance ID	M12. Vol %	M13. Substance Name		

RADIOACTIVE WASTE

R1. RAD Category (Check ONE) ☐ TRU ☐ High-Level ☐ Low-Level ☐ Special ☐ VLA			R2. RAD Handling Type ☐ Contact ☐ Remote		R3. UCN 2681 No.	
R4. Determination Method (Check ONE) ☐ Analysis ☐ Process Knowledge ☐ Reference		R5. Determination Document Number(s)			R6. Chemical Form	
			(Reserved)			
R7. Isotope	R8. Est. Qty	R9. Units	R7. Isotope	R8. Est. Qty	R9. Units	R7. Isotope

HANDLING INFORMATION

H1. Handling Instructions		H4. HP Tag Color	Surface Contamination (dpm/100 cm ²)		Dose Rate at Surface (mrem/hr)	Dose Rate at 1 Meter (mrem/hr)	Instrument Identification
		Alpha	Transfer	Direct Read			
		Beta/Gamma					
		Neutron					
H2. Respirator ☐ None ☐ Half ☐ Full		H3. Cartridge Type		H5. Pickup Site		H6. Pickup Facility	
						H7. Pickup Area	

SIGNATURES and APPROVALS

S1. Generator	Badge	Date	S2. HP Technician	Badge	Date
S3. Verification Officer	Badge	Date	S4. Derivative Classifier	Badge	Date

Sequence Number	Referenced from WID (UCN-2109)	
1	11. Waste Item ID Number	C1. Container ID. No.

[illegible][illegible]

S1. Certification Officer	Badge	Date	S2. HP Technician	Badge	Date
S3. WMO Officer	Badge	Date	S4.	Badge	Date

Appendix C

Waste Item Description (TX-5745) Form User Instructions

PURPOSE: The Waste Item Description (WID) form lists the identity and the characteristics of a waste item, the smallest trackable unit of waste. It also lists the identity of the shipping/storage container into which the waste item may have been placed, and any applicable handling information. All of the information on the form is required in order to register the waste item with the site waste management organization, however some of the information is only applicable to specific waste categories.

WASTE ITEM IDENTIFICATION

Form ID Number/Waste Item Barcode Label (upper right corner):

Each waste item is identified by attaching the pre-printed waste item ID barcode label to it. A duplicate barcode label is attached to the WID form that describes the waste item in the rectangular box located in the upper right corner of the form.

11. **Waste Item ID Number (Compulsory)**
Copy the ID number of the waste item from the barcode label attached to the waste item.
Example: X10I9300001
12. **Generator's Name (Compulsory)**
PRINT the name of the individual responsible for the generation of the waste item.
13. **Badge No. (Compulsory)**
The badge number of the waste generator.
Example: 99999
14. **Generator's Phone No. (Compulsory)**
The complete phone number where the waste generator can be reached.
Example: (999) 999-9999
15. **MS (Compulsory)**
The mail stop of the waste generator.
Format: 9999
16. **Charge Number/WO (Compulsory)**
A valid charge account or work order number for waste handling charges.
Format: 9999-9999 or A9999AAA
17. **Origin Div. (Compulsory)**
The numerical division code of the generating division.
Example: 27
18. **Origin Date (Compulsory)**
The date that the waste item was generated or declared waste.
Example: 4/1/93
19. **Origin Site (Compulsory)**
The site (plant) where the waste was generated.
Examples: X10, Y12, K25
110. **Origin Facility (Compulsory)**
The facility (building) where the waste was generated.
Example: 4500N
111. **Origin Room/Area (Compulsory)**
The room or area where the waste was generated.
Example: 125L
112. **Radiological Area? (Compulsory)**
Is the Origin Room/Area a radiological area (yes or no)?

- I13 Est Net Volume (Compulsory)
The estimated net volume of the waste item
Format number
- I14 Vol Units (Compulsory)
The estimated net volume units
Values CUIN, CUFT CUYD, CC, M3, OZ, PT, QT, GAL, ML, L
- I15 Est Gross Weight (Compulsory)
The estimated gross weight of the waste item
Format number
- I16 Wt Units (Compulsory)
The estimated net weight units
Values OZ, LB, TON, MG, G, KG

CONTAINER INFORMATION

If the waste item is placed in a standard shipping/storage container, the container will have it's own unique container ID barcode label attached to it. The container ID number on the container barcode label is independent of the waste item ID number on the waste item barcode label.

Waste generation activities often include the accumulation of waste in a location different from the generation location. When this is the case, the accumulation location is referred to as the 'holding' location. Complete the holding location information if applicable.

- C1 Container ID Number (Compulsory)
The unique ID number of the standard shipping/storage container for this waste item copied from the container barcode label.
Example X10C9300123
- C2 Container Type (Compulsory)
The container type code of the outer container of the waste item. Select the most detailed container type code available from the following list. If there is no suitable container type code or the waste item is self-contained, enter 'SELF' and provide any additional detailed packaging information in the WASTE DESCRIPTION.

Refer to the following page

CONTAINER TYPE LIST

DRUMS

DRUM6D55

DRUM6D30

DRUM6D15

DRUM6D5

DRUM17C55

DRUM17C30

DRUM17C10

DRUM17C5

DRUM17E55

DRUM17E30

DRUM17E10

DRUM17E5

DRUM17E1

DRUM17H30

DRUM17H55

DRUM17HA55

DRUMSS55

DRUMSS30

DRUMBI55

DRUMBI30

DRUMS110

DRUMS96

DRUMS85

DRUMS80

DRUMS55

DRUMS35

DRUMS30

DRUMS25

DRUMS

DRUMF55

DRUMF40

DRUMF30

DRUMF25

DRUMF10

DRUMF5

DRUMF

DRUMP

DRUM

Description

Drum, DOT 6D, Steel,

Poly-lined, 55 gal

Drum, DOT 6D, Steel,

Poly-lined, 30 gal

Drum, DOT 6D, Steel,

Poly-lined, 15 gal

Drum, DOT 6D, Steel,

Poly-lined, 5 gal

Drum, DOT 17C, Steel, 55 gal

Drum, DOT 17C, Steel, 30 gal

Drum, DOT 17C, Steel, 10 gal

Drum, DOT 17C, Steel, 5 gal

Drum, DOT 17E, Steel, 55 gal

Drum, DOT 17E, Steel, 30 gal

Drum, DOT 17E, Steel, 10 gal

Drum, DOT 17E, Steel, 5 gal

Drum, DOT 17E, Steel, 1 gal

Drum, DOT 17H, Steel, 30 gal

Drum, DOT 17H, Steel, 55 gal

Drum, DOT 17H-A, Stainless steel, 55 gal

Drum, Stainless Steel, 55 gal

Drum, Stainless Steel, 30 gal

Drum, Black Iron, 55 gal

Drum, Black Iron, 30 gal

Drum, Steel, 110 gal

Drum, Steel, 96 gal

Drum, Steel, 85 gal

Drum, Steel, 80 gal

Drum, Steel, 55 gal

Drum, Steel, 35 gal

Drum, Steel, 30 gal

Drum, Steel, 25 gal

Drum, Steel

Drum, Fiber, 55 gal

Drum, Fiber, 40 gal

Drum, Fiber, 30 gal

Drum, Fiber, 25 gal

Drum, Fiber, 10 gal

Drum, Fiber, 5 gal

Drum, Fiber

Drum, Polyethylene

Drum

BOXES

BOXB25

BOX8X8

BOX4X4

BOXM

BOXW

BOX F

BOX

TANKS

TANKP600

TANKP330

TANKP

TANKM

TANK

DUMPSTERS

DUMPSTER

ROLLBIN

TRUCKS

COMPTRUCK

DUMPTRUCK

TANKER

TRUCK

MISCELLANEOUS

GICAN

BAGPOLY

CARBOY

LEADCAR

CYLINDER

SELF

Description

Box, B-25, Metal

Box, Metal, 8x8x20 feet

Box, Metal, 4x4x6 feet

Box, Metal

Box, Wood

Box, Fiberboard

Box

Description

Tank, Polyethylene, 600 gal

Tank, Polyethylene, 330 gal

Tank, Polyethylene

Tank, Metal

Tank

Description

Dumpster, Steel

Roll bin

Description

Compactor truck

Dump truck

Tanker truck

Truck

Description

GI Can, 5 gal

Bag, Polyethylene, 4-mil

Carboy

Lead shielded carner

Gas cylinder

Self-contained

CANS

CANM1

CANM2

CANM5

CANM1

CANM20

Description

Can, Metal, 1 gal

Can, Metal, 2 gal

Can, Metal, 5 gal

Can, Metal, 10 gal

Can, Metal, 20 gal

CASKS

CASKC4

CASKC6

CASKC12

Description

Cask, Concrete, 4.5" wall

Cask, Concrete, 6" wall

Cask, Concrete, 12" wall

C3 Holding Site (Compulsory)

The site (plant) where the waste item/container was held during waste accumulation. If the waste was not held in a location during accumulation different from the generation location enter 'NA' and omit Holding Facility (C4) and Holding Room/Area (C5)
Examples: X10, Y12, K25

C4 Holding Facility (Conditional)

The facility (building) where the waste item/container was held during waste accumulation
Example: 4500N

C5 Holding Room/Area (Conditional)

The room/area identifier where the waste item/container was held during waste accumulation.
Example: 125L

WASTE CATEGORY

W1. Process Stream ID (Compulsory)

The identifier code of a registered process waste stream. If unknown enter "UNK"

W2. Process Category (Compulsory)

The generation process category code of the process or activity which generated this waste. Select the one that best describes the process category.

Values:

ABT - Abatement

CON - Construction/Demolition

DND - Decommission/Decontamination

EXC - Excess/out-of-spec material (ongoing)

MNT - Maintenance (ongoing)

OTP - One-time, planned

PRO - Process/production (ongoing)

RND - Research and development

REM - Remediation

TRE - Treatment

UNP - One-time, unplanned (eg, spill)

UNK - Unknown (legacy waste only)

W3. Process Activity (Compulsory)

The generation process activity code of the process or activity which generated this waste. Select the one that best describes the process activity from the following categories. When 'OTHER' is selected for any of the categories, provide a brief description of the process activity in the WASTE DESCRIPTION field.

PROCESS ACTIVITY CODES

CLEANING AND DEGREASING

A01 - STRIPPING

A02 - ACID CLEANING

A03 - CAUSTIC (ALKALI) CLEANING

A04 - FLUSH RINSING

A05 - DIP RINSING

A06 - SPRAY RINSING

A07 - VAPOR DEGREASING

A08 - PHYSICAL SCRAPING AND REMOVAL

A09 - CLEAN OUT PROCESS EQUIPMENT

A19 - OTHER CLEANING AND DEGREASING

SURFACE PREPARATION AND FINISHING

A21 - PAINTING

A22 - ELECTROPLATING

A23 - ELECTROLESS PLATING

A24 - PHOSPHATING

A25 - HEAT TREATING

A26 - PICKLING

A27 - ETCHING

A29 - OTHER SURFACE COATING/PREPARATION
(SPECIFY IN COMMENTS)

PROCESSES OTHER THAN SURFACE PREPARATION

A31 - PRODUCT RINSING

A32 - PRODUCT FILTERING

A33 - PRODUCT DISTILLATION

A34 - PRODUCT SOLVENT EXTRACTION

A35 - BY-PRODUCT PROCESSING

A36 - SPENT CATALYST REMOVAL

A37 - SPENT PROCESS LIQUIDS REMOVAL

A38 - TANK SLUDGE REMOVAL

A39 - SLAG REMOVAL

A40 - METAL FORMING

A41 - PLASTICS FORMING

A49 - OTHER PROCESSES OTHER THAN SURFACE
PREPARATION (SPECIFY IN COMMENTS)

ONE-TIME AND INTERMITTENT PROCESSES

A51 - LEAK COLLECTION
A52 - LEACHATE COLLECTION
A53 - CLEANUP OF SPILL RESIDUES
A54 - OIL CHANGES
A55 - FILTER/BATTERY REPLACEMENT
A56 - DISCONTINUE USE OF PROCESS EQUIPMENT
A57 - DISCARDING OFF-SPEC MATERIAL
A58 - DISCARDING OUT-OF-DATE PRODUCTS OR
CHEMICALS
A59 - LABORATORY WASTES
A60 - SLUDGE REMOVAL
A61 - CLOSURE OF WASTE OR INTERMITTENT PROCESSES
(SPECIFY IN COMMENTS)

POLLUTION CONTROL OR WASTE TREATMENT PROCESSES

A71 - FILTERING/SCREENING
A72 - METALS RECOVERY
A73 - SOLVENTS RECOVERY
A74 - INCINERATION/THERMAL TREATMENT
A75 - WASTEWATER TREATMENT
A76 - SLUDGE DEWATERING
A77 - STABILIZATION
A78 - AIR POLLUTION CONTROL DEVICES
A79 - OTHER POLLUTION CONTROL OR WASTE TREATMENT
(SPECIFY IN COMMENTS)

OTHER PROCESSES

A81 - CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT
A82 - ROUTINE CLEAN-UP WASTES (E G , FLOOR SWEEPINGS)
A89 - OTHER (SPECIFY IN COMMENTS)

W4 Physical Form (Compulsory)
 The physical form of the waste. (Select one)
 Values. SOLID, LIQUID, GAS, SLUDGE, SLURRY, EMULSION

W5 Material Type (Compulsory)
 The material type code(s) which further describe the physical form of the waste Select all that apply within a specific
 physical form that best describe the waste material A maximum of three (3) entries are allowed At least one entry must be
 specified.

Physical Form: SOLID

MT001 - ABSORBANT
MT002 - BIOLOGICAL
MT003 - CLOTH
MT004 - EQUIPMENT
MT005 - GLASS
MT006 - GRANULAR
MT007 - METALLIC
MT008 - PAPER
MT009 - PPE (personal protective equipment)
MT010 - PLASTIC
MT011 - RUBBLE
MT012 - SOIL
MT013 - WOOD
MT099 - OTHER

Physical Form: LIQUID

MT200 - GROUNDWATER
MT201 - OILBASED
MT202 - SOLVENT,HALOGENATED
MT203 - SOLVENT,NON-HALOGENATED
MT204 - WATERBASED
MT205 - WASTEWATER
MT206 - WELLWATER
MT299 - OTHER

Physical Form: SLUDGE

MT400 - BIOLOGICAL
MT401 - OILBASED
MT402 - METALLIC
MT403 - SOIL
MT404 - WATERBASED
MT499 - OTHER

Physical Form: SLURRY

MT600 - BIOLOGICAL
MT601 - OILBASED
MY602 - METALLIC
MT603 - SOIL
MT604 - SOLVENT, HALOGENATED
MT605 - SOLVENT, NON-HALOGENATED
MT606 - WATERBASED
MT699 - OTHER

Physical Form: EMULSION

MT800 - OILBASED
MT801 - WATERBASED
MT899 - OTHER

- W6 AWA No. (Compulsory)
The ID number of the ORNL Asbestos Work Authorization associated with this waste item Used for asbestos material only
[Enter NA if not applicable.]
Format: number
- W7 Waste Description (Compulsory)
A general description of the waste material and its packaging.
Examples: Oily rags in plastic bags; Excess chemical in one liter bottle
- W8. Waste Category (Compulsory)
Specific categories for the waste material. All categories must be checked either YES or NO to complete the form. If a particular category is questionable, refer to the waste acceptance criteria of the destination facility and/or site waste management procedures.

CHEMICAL

Does the waste contain potentially hazardous chemicals? If YES, complete the CHEMICAL WASTE section

RADIOACTIVE

Does the waste contain radioactive isotopes? If YES, complete the RADIOACTIVE WASTE section.

ASBESTOS

Does the waste contain asbestos?

SAN/IND

Is the waste suitable for sanitary/industrial landfill disposal?

CONST. DEBRIS

Is the waste 'clean' construction debris?

MEDICAL

Did the waste originate in a medical facility as a result of medical procedures and/or research.

BIOLOGICAL

Is the waste of biological origin (animal carcasses, landscaping refuse, etc.)?

ACCOUNTABLE

Does the waste contain accountable radioactive materials? If YES, complete the UCN 2681 No. field (R3) with the number of the ORNL Nuclear Material Intra-Laboratory Transfer form (UCN-2681).

CARCINOGEN

Does the waste contain known carcinogens?

COMPACTIBLE

Is the waste compactible?

RECYCLABLE

Is the waste potentially recyclable?

CLASSIFIED

Is the waste classified material? NOTE: Classified waste cannot be disposed of at ORNL.

CHEMICAL WASTE

M1 RCRA? (Required if Chemical waste)

Does the waste contain RCRA regulated material (40 CFR 261)?

If yes, complete RCRA 90-Day Start Date (M2) when applicable

M2 RCRA 90-Day Start Date (Conditional)

The date when hazardous or mixed waste is moved from a satellite accumulation area to a 90-day accumulation area, or the date when hazardous or mixed waste begins to accumulate in a 90-day accumulation area. This field should **NOT** be completed with the date waste is moved to a satellite accumulation area

Example 4/1/93

M3 PCB? (Required if Chemical waste)

Is the waste PCB (greater than 2 PPM) regulated (yes or no)?

If yes, complete PCB Start Date (M4) and PCB Concentration (M5)

M4 PCB Start Date (Required if PCB waste)

The date the PCB contaminated waste item was removed from service or declared waste

M5 PCB Concentration (PPM) (Required if PCB waste)

The PCB concentration in parts per million (If less than "nnn", enter "nnn")

NOTE. Do not use less than or greater than values. Enter the number that best characterizes your waste

M6 Determination Method (Required if Chemical waste)

Select from the three methods the one which was used to determine the chemical characteristics of the waste

Note: The chemical and radiological characteristics can be determined by independent methods

PROCESS KNOWLEDGE - Documented knowledge of the generation process parameters

ANALYSIS - Laboratory analysis of samples of this waste item.

REFERENCE - Reference to other laboratory analysis of similar waste (periodic sampling of a repetitive waste stream and/or batch sampling analysis)

M7 Determination Document Numbers (Required if Chemical waste)

The ID numbers of documents (lab reports, MSDS sheets, process analysis reports, facility permits, etc.) which substantiate the determination of the waste characteristics. A maximum of three (3) may be specified

Examples: MSDS8030, OAL1234

M8 Flash Point (Conditional)

The flash point of the waste material in degrees C when applicable.

Format: number

M9 pH (Conditional)

The relative acidity of the waste material (pH) when applicable.

Format: number

M10 EPA Waste Code Numbers (Required if RCRA waste)

The EPA waste code numbers determined from the waste characteristics (RCRA waste only). A maximum of twelve (12) may be specified. [40 CFR 261.30]

Examples: D001, U123

M11. Substance ID (Required if RCRA waste)

The ID numbers of the chemical constituents which significantly affect the characterization, handling and management of the waste. For a pure chemical, enter its Chemical Abstract Service (CAS) number. For a commercial mixture, enter the MMES MSDS record number.

Format: 999999-99-9 (CAS#) or 999999 (MSDS#)

NOTE: If additional space is needed use the Waste Item Continuation (WIC) sheet (TX-5746A), and enter a statement noting a WIC sheet is attached [e.g. "WIC (TX-5745A) attached."].

M12. Vol % (Required if RCRA waste)

The volume percentage of the substance in the waste. The value may range from 0 to 100. A value of zero (0) indicates a trace quantity. Format: number

M13. Substance Name (Required if RCRA waste)

The common name of the chemical constituent or commercial mixture.

Examples: Ethanol, Formaldehyde, Exxon 123 Solvent

NOTE: Do not use chemical formulas or symbols.

RADIOACTIVE WASTE

R1. Rad Category (Required if Radioactive waste)

Select one radioactive waste category code:

- a) TRU (Transuranic),
- b) High-Level,
- c) Low-Level,
- d) Special (Special Case Waste), or
- e) VLA (Very Low Activity).

Refer to the waste acceptance criteria of the destination facility and/or site waste management procedures for detailed information regarding radioactive waste categories.

R2. Rad Handling Type (Required if Radioactive waste)

The radioactive waste handling code.

Values:

CONTACT - Contact handled (≤ 200 mrem/hr)

REMOTE - Remotely handled (> 200 mrem/hr)

R3. UCN 2681 Number (Conditional)

The ID number of the ORNL Nuclear Material Intra-Laboratory Transfer Form (UCN-2681) form associated with this waste item. Used for Accountable Nuclear materials only.

R4. Determination Method (Required if Radioactive waste)

Select from the three methods the one which was used to determine the radiological characteristics of the waste.

Note: The chemical and radiological characteristics can be determined by independent methods.

PROCESS KNOWLEDGE - Documented knowledge of the generation process parameters.

ANALYSIS - Laboratory analysis of samples of this waste item.

REFERENCE - Reference to other laboratory analysis of similar waste (periodic sampling of a repetitive waste stream and/or batch sampling analysis).

R5. Determination Document Numbers (Required if Radioactive waste)

The ID numbers of documents (lab reports, process analysis reports, facility permits, etc.) which substantiate the determination of the waste characteristics. A maximum of three (3) may be specified.

Example: ORNL/TM-11652, LLL1234

R6 Chemical Form (Conditional)

The chemical form of the radioactive waste item

Specify the **ONE** which best describes the waste material. This is a partial listing only. If additional chemical forms are needed contact your Waste Management Organization representative

BICARBONATE	DICHROMATE	OXIDE
BISULFATE	DIOXIDE	PERCHLORATE
BISULFITE	DISULFIDE	PHOSPHATE
BROMATE	ELEMENTAL	SULFATE
BROMIDE	FLUORIDE	SULFIDE
CARBONATE	HYDRIDE	SULFITE
CHLORATE	HYDROXIDE	TETRAOXIDE
CHLORIDE	NITRATE	TRIOXIDE
CHLORITE	NITRIDE	
CHROMATE	NITRITE	

R7. Isotope ID (Required if Radioactive waste)

The ID of the radioisotopes contained in this waste item.

Example: PU-239, U-235, AG-110M (Refer to Appendix A)

NOTE: If additional space is needed use the Waste Item Continuation (WIC) sheet (TX-5746A), and enter a statement noting a WIC sheet is attached [e.g. "WIC (TX-5745A) attached."]

R8. Est. Quantity (Required if Radioactive waste)

The estimated quantity of the radioisotope in the waste. Note the corresponding UNITS of the quantity (curies or grams) for each isotope. Specify the quantity as a decimal number or in scientific notation (Refer to Appendix A)

Examples: .0001, .3E-3

R9. Quan. Units (Required if Radioactive waste)

The units for the radioisotope quantity.

Values: G (grams) or CI (curies) (Refer to Appendix A)

HANDLING INFORMATION

H1. Handling Instructions (Optional)

General handling instructions for the waste.

Examples: See MMES MSDS for instructions; Face shield required

H2. Respirator (Optional)

This is not completed for ORNL Generators.

H3. Cartridge (Optional)

This is not completed for ORNL Generators.

H4. HP Survey Data (completed by Health Physics technician)

HP Tag Color:	The color code of the survey tag (G, B, Y, & R)
Surface Contamination:	The transferrable and direct reading count rate (dpm/100 cm ²)
Dose Rate at Surface:	The fixed contamination dose rate measured at the surface (mrem/hr)
Dose Rate at 1 Meter:	The dose rate measured at 1 meter (mrem/hr)
Instrument ID:	The health physics instrument ID number. Format: A99999

H5. Pickup Site (Compulsory)

The site (plant) where the waste is to be picked up.

Examples: X10, Y12, K25

- H6 Pickup Facility (Compulsory)
The facility (building) where the waste is to be picked up
Example: 4500N
- H7 Pickup Room/Area (Compulsory)
The room number or area identifier where the waste is to be picked up
Example: 125L

SIGNATURES and APPROVALS

- S1 Generator
The signature, date and badge number of the waste generator, certifying that the information on the form is complete and accurate and that the waste is in compliance with the Waste Acceptance Criteria for the treatment, storage or disposal facility to which it is being submitted
- S2 H.P. Technician
The signature, date and badge number of the H.P. Technician certifying that the HP survey information is complete and accurate.
- S3. Verification Officer
The signature, date and badge number of the GCO who certifies that the form has been properly completed and that the waste was packaged in accordance with the treatment, storage, or disposal (TSD) facility Waste Acceptance Criteria by individuals with the appropriate training.
- S4 Derivative Classifier
This signature is not normally required at ORNL.

APPENDIX A

RADIOISOTOPES

The following is a list of the valid isotopes. The units of measurement (curies or grams) of the estimated quantity are also provided. When the units of measurement are dependent upon whether the concentration of the isotope is less than or equal to 100 nCi/g or greater than 100 nCi/g it is so noted. [G if < = 100 nCi/g else CI]

<u>Isotope</u>	<u>Units</u>	<u>Isotope</u>	<u>Units</u>	<u>Isotope</u>	<u>Units</u>
AC-225	CI	CD-113M	CI	FM-255	CI
AC-227	CI	CD-115	CI	FR-221	CI
AC-228	CI	CD-115M	CI	FR-223	CI
AG-108	CI	CE-131	CI	GA-67	CI
AG-108M	CI	CE-131M	CI	GA-68	CI
AG-109M	CI	CE-139	CI	GD-152	CI
AG-110	CI	CE-139M	CI	GD-153	CI
AG-110M	CI	CE-141	CI	GE-67	CI
AG-111	CI	CE-142	CI	GE-68	CI
AG-111M	CI	CE-143	CI	H-3	CI
AL-26	CI	CE-144	CI	HF-175	CI
AL-26M	CI	CF-249	G *	HF-181	CI
AM-239	CI	CF-250	CI	HG-197	CI
AM-240	CI	CF-251	G *	HG-197M	CI
AM-241	G *	CF-252	CI	HG-203	CI
AM-242	CI	CL-36	CI	I-123	CI
AM-242M	G *	CM-242	CI	I-125	CI
AM-243	CI	CM-243	G *	I-126	CI
AM-244	CI	CM-244	G *	I-129	CI
AM-244M	CI	CM-245	G *	I-131	CI
AM-245	CI	CM-246	CI	I-132	CI
AM-246	CI	CM-247	G *	I-132M	CI
AM-246M	CI	CM-248	CI	I-133	CI
AR-39	CI	CO-56	CI	I-133M	CI
AS-74	CI	CO-57	CI	I-134	CI
AS-76	CI	CO-58	CI	I-134M	CI
AU-195	CI	CO-58M	CI	I-135	CI
AU-195M	CI	CO-60	CI	IN-111	CI
AU-198	CI	CO-60M	CI	IN-111M	CI
AU-198M	CI	CR-51	CI	IN-113M	CI
BA-131	CI	CS-134	CI	IN-114	CI
BA-131M	CI	CS-134M	CI	IN-114M	CI
BA-133	CI	CS-135	CI	IN-115	CI
BA-133M	CI	CS-135M	CI	IN-115M	CI
BA-137M	CI	CS-136	CI	IR-190	CI
BA-139	CI	CS-136M	CI	IR-190M	CI
BA-140	CI	CS-137	CI	IR-192	CI
BE-10	CI	CS-138	CI	IR-192M	CI
BE-7	CI	CS-138M	CI	IR-194	CI
BI-207	CI	CS-139	CI	IR-194M	CI
BI-208	CI	CU-64	CI	K-40	CI
BI-210	CI	CU-67	CI	K-42	CI
BI-210M	CI	DY-166	CI	K-43	CI
BI-211	CI	ES-253	CI	KR-81	CI
BI-212	CI	ES-254	CI	KR-81M	CI
BI-212M	CI	ES-254M	CI	KR-85	CI
BI-213	CI	EU-150	CI	KR-85M	CI
BI-214	CI	EU-150M	CI	LA-138	CI
BK-249	CI	EU-152	CI	LA-140	CI
R-82	CI	EU-152M	CI	LU-172	CI
BR-82M	CI	EU-154	CI	LU-172M	CI
C-14	CI	EU-154M	CI	LU-177	CI
CA-41	CI	EU-155	CI	LU-177M	CI
CA-45	CI	EU-156	CI	MN-52	CI
CD-104	CI	EU-160	CI	MN-52M	CI
CD-109	CI	FE-55	CI	MN-54	CI
CD-113	CI	FE-59	CI	MN-56	CI

<u>Isotope</u>	<u>Units</u>
MO-99	CI
NA-22	CI
NA-24	CI
NA-25	CI
NB-92	CI
NB-92M	CI
NB-93M	CI
NB-94	CI
NB-94M	CI
NB-95	CI
NB-95M	CI
ND-144	CI
ND-147	CI
ND-149	CI
NI-56	CI
NI-59	CI
NI-63	CI
NP-233	CI
NP-235	CI
NP-236	G *
NP-236M	CI
NP-237	G *
NP-238	CI
NP-239	CI
NP-240	CI
NP-240M	CI
NP-241	CI
OS-185	CI
OS-190M	CI
OS-191	CI
OS-191M	CI
OS-193	CI
OS-194	CI
P-32	CI
P-33	CI
PA-230	CI
PA-231	CI
PA-232	CI
PA-233	CI
PA-234	CI
PA-234M	CI
PA-235	CI
PB-196	CI
PB-203	CI
PB-203M	CI
PB-204M	CI
PB-205	CI
PB-209	CI
PB-210	CI
PB-211	CI
PB-212	CI
PB-214	CI
PD-103	CI
PD-107	CI
PD-107M	CI
PD-109	CI
PD-109M	CI
PM-146	CI
PM-147	CI
PM-148	CI
PM-148M	CI
PM-149	CI
PO-210	CI
PO-211M	CI
PO-212M	CI
PO-218	CI
PR-142	CI
PR-142M	CI

<u>Isotope</u>	<u>Units</u>
PR-143	CI
PR-144	CI
PR-144M	CI
PT-185	CI
PT-185M	CI
PT-191	CI
PT-193	CI
PT-193M	CI
PT-195M	CI
PT-197	CI
PT-197M	CI
PU-236	CI
PU-237	CI
PU-238	G *
PU-239	G *
PU-240	CI
PU-241	G *
PU-242	CI
PU-243	CI
PU-244	CI
PU-245	CI
PU-246	CI
RA-222	CI
RA-223	CI
RA-224	CI
RA-225	CI
RA-226	CI
RA-228	CI
RA-229	CI
RB-86	CI
RB-86M	CI
RB-87	CI
RB-88	CI
RB-89	CI
RB-90	CI
RB-90M	CI
RE-183	CI
RE-186	CI
RE-186M	CI
RE-187	CI
RE-188	CI
RE-188M	CI
RH-103M	CI
RH-105	CI
RH-105M	CI
RH-106	CI
RH-106M	CI
RN-219	CI
RN-220	CI
RN-222	CI
RU-103	CI
RU-106	CI
S-35	CI
SB-122	CI
SB-122M	CI
SB-124	CI
SB-124M	CI
SB-125	CI
SB-126	CI
SB-126M	CI
SB-127	CI
SC-44	CI
SC-44M	CI
SC-46	CI
SC-46M	CI
SE-75	CI
SE-79	CI
SE-79M	CI

<u>Isotope</u>	<u>Units</u>
SM-147	CI
SM-148	CI
SM-149	CI
SM-151	CI
SM-153	CI
SN-113	CI
SN-113M	CI
SN-117M	CI
SN-119M	CI
SN-121	CI
SN-121M	CI
SN-123	CI
SN-123M	CI
SN-125	CI
SN-125M	CI
SN-126	CI
SR-85	CI
SR-85M	CI
SR-89	CI
SR-90	CI
TA-179	CI
TA-182	CI
TB-160	CI
TB-161	CI
TC-95	CI
TC-95M	CI
TC-99	CI
TC-99M	CI
TE-123	CI
TE-123M	CI
TE-125M	CI
TE-127	CI
TE-127M	CI
TE-129	CI
TE-129M	CI
TE-132	CI
TH-226	G
TH-227	G
TH-228	G
TH-229	G
TH-230	G
TH-231	G
TH-232	G
TH-233	G
TH-234	G
TL-201	CI
TL-204	CI
TL-206	CI
TL-206M	CI
TL-207	CI
TL-207M	CI
TL-208	CI
TL-209	CI
U-228	G
U-230	G
U-231	G
U-232	G
U-233	G *
U-234	G
U-235	G
U-235M	G
U-236	G
U-237	G
U-238	G
U-239	G
U-240	G
V-48	CI
V-49	CI

<u>Isotope</u>	<u>Units</u>
V-50	CI
W-181	CI
W-187	CI
W-188	CI
XE-129M	CI
XE-131M	CI
XE-133	CI
XE-133M	CI
Y-88	CI
Y-90	CI
Y-90M	CI
Y-91	CI
Y-91M	CI
YB-169	CI
YB-169M	CI
YB-175	CI
ZN-63	CI
ZN-65	CI
ZR-93	CI
ZR-95	CI

Container Packing List (TX-5749) Form User Instructions

PURPOSE: The Container Packing List (CPL) form is used to describe a single standard shipping/storage container which holds multiple, separately identified waste items. This type of packing is often referred to as 'lab-packing'. It differs from a 'bulking operation' in that the waste items, once packed, retain their original identities and characteristics. The CPL lists the type and identity of the standard shipping/storage container, the identities of all of the waste items packed inside it, and any applicable handling information.

Multiple, separately identified waste items which are being lab-packed in the field often originate from several different waste generators and locations within the generating organization. A Generator Certification Officer is responsible for ensuring that each waste item packed in the container is identified with a properly completed WID and attached barcode label, verifying that the container is properly sealed and labeled, and that the waste package meets all applicable site criteria for transfer to the site waste management organization.

CONTAINER IDENTIFICATION

C1. Container ID No. (Compulsory)

The unique ID number of the shipping/storage container copied from the container barcode label.

Example: X10C9300123

C2. Container Type (Compulsory)

The container type code of the shipping/storage container. Select the most detailed container type code available from the following list.

Examples: DRUMS55, DRUMS30

C3. Holding Site (Compulsory)

The site (plant) where the container was held during waste accumulation.

Examples: X10, Y12, K25

C4. Holding Facility (Compulsory)

The facility (building) where the waste container was held during waste accumulation.

Example: 4500N

C5. Holding Room/Area (Compulsory)

The room/area identifier where the waste container was held during waste accumulation.

Example: 125L

CONTAINER PACKING LIST

I1. Waste Item ID Number (Compulsory)

The unique ID number of each waste item in the container from the barcode labels attached to the waste items.

Example: X10I9300001

HANDLING INFORMATION

H1. Handling Instructions (Optional)

General handling instructions for the waste.

Examples: See MMES MSDS for instructions; Face shield required

H2. Respirator

This is not completed for ORNL generators.

H3. Cartridge

This is not completed for ORNL generators.

- H4. HP Survey Data (completed by Health Physics technician) (Compulsory)
- HP Tag Color:
 - The color code of the survey tag (G, Y, B, & R)
 - Surface Contamination:
 - The count rate from a surface swipe (dpm/100 cm²)
 - Dose Rate at Surface:
 - The fixed contamination dose rate measured at the surface (mrem/hr)
 - Dose Rate at 1 Meter:
 - The dose rate measured at 1 meter (mrem/hr)
 - Instrument ID:
 - The health physics instrument ID number.
 - Format: A99999

SIGNATURES and APPROVALS

- S1. Certification Officer (Compulsory)
The signature, date and badge number of the Generator Certification Officer, certifying that the information on the CPL is complete and accurate, that the waste package complies with waste acceptance criteria of the treatment, storage or disposal facility to which it is being submitted and that the waste was packaged by individuals with appropriate training.
- S2. H.P. Technician (Compulsory)
The signature and badge number of the H.P. Technician certifying that the HP survey information is complete and accurate.
- S3. WMO
The signature and badge number of the Waste Management Organization (WMO) officer verifying that the CPL and all associated WID forms have been completed properly.

APPENDIX D

ENVIRONMENTAL RESTORATION WASTE MANAGEMENT PROGRAM

TOTAL GENERATED WASTE

CONTAINER ID NOS.

CONTAINER TYPE

WASTE GENERATION DATE (mm/dd/yy)

☐ K-25
 ☐ ORNL
 ☐ Y-12
 ☐ PADUCAH
 ☐ PORTSMOUTH
 ☐ OFF-SITE

ACTIVITY

RA: ☐ PA/SI
 ☐ RI/FS-I
 ☐ RI/FS-II
 ☐ RD/RA
 D&D: ☐ PHASE I
 ☐ PHASE II
 ☐ PHASE III
 ☐ SURVEILLANCE & MAINTENANCE

PROJECT NUMBER

PROJECT NAME

VOLUME AND WEIGHT

SOLID: _____ cu. ft.
 WEIGHT: _____ lbs.
 LIQUID: _____ gal.
 WEIGHT: _____ lbs.

WASTE MATERIAL TYPE (Choose only one)

SOLID: ☐ SOIL e.g., excavated soil ☐ DEBRIS e.g., wood, roofing material, construction spoil, concrete, glass ☐ SLUDGE e.g., settling basin, tank, pipeline, equipment cleaning ☐ SEDIMENT e.g., contaminated environmental media from streams/lakes ☐ PPE/TRASH e.g., paper, shoe scuffs, Tyvek suits, respirators, wipes ☐ ASBESTOS e.g., Transite, insulation ☐ METAL e.g., shielding, ductwork, structural, drums ☐ METAL EQUIPMENT e.g., transformers, capacitors ☐ CLASSIFIED SOLIDS _____ ☐ MISC. OTHER SPECIFY _____	LIQUID: ☐ DECON SOLUTION e.g., decontamination and cleaning liquids ☐ WELL DEVELOP/PURGE e.g., well sampling liquids ☐ GROUND/SURFACE WATER e.g., contaminated groundwater, seeps, rainwater run-off ☐ SOLVENTS/OILS e.g., cleaning fluids, lube oils, degreasers, diesel fuel ☐ OTHER AQUEOUS e.g., acids, process solutions ☐ CLASSIFIED LIQUIDS _____ ☐ MISC. OTHER SPECIFY _____
--	--

WASTE CATEGORIES

☐ LLW
 ☐ TRU
 ☐ LLW/TSCA
 ☐ TRU/RCRA
 ☐ FREE - Hg
☐ RCRA
 ☐ SANITARY
 ☐ LLW/RCRA/TSCA
 ☐ TRU/TSCA
 ☐ SPECIAL NUCLEAR MATERIAL
☐ TSCA
 ☐ LLW/RCRA
 ☐ RCRA/TSCA
 ☐ TRU/LLW

CHEMICAL CONTAMINANTS (all known)

CONTAMINANT	CONCENTRATION/UNITS	☐ Process Knowledge ☐ Lab Analysis	Document No. Document No.
1 CONTAMINANT	CONCENTRATION/UNITS	☐ Process Knowledge ☐ Lab Analysis	Document No. Document No.
2 CONTAMINANT	CONCENTRATION/UNITS	☐ Process Knowledge ☐ Lab Analysis	Document No. Document No.
3 CONTAMINANT	CONCENTRATION/UNITS	☐ Process Knowledge ☐ Lab Analysis	Document No. Document No.
4 CONTAMINANT	CONCENTRATION/UNITS	☐ Process Knowledge ☐ Lab Analysis	Document No. Document No.
5 CONTAMINANT	CONCENTRATION/UNITS	☐ Process Knowledge ☐ Lab Analysis	Document No. Document No.

FORM COMPLETED BY (Name)

BADGE NUMBER

DATE (mm/dd/yy)

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