

Energy Systems Waste Management Organization

**Site Health and Safety Plan/Work Plan for Further Characterization of
Waste Drums at Oak Ridge National Laboratory, Oak Ridge,
Tennessee**

**J. P. Abston
S. N. Burman
D. L. Jones**

Date Issued—October 1995

Prepared by
Health Sciences Research Division
Oak Ridge National Laboratory

Prepared for
U.S. Department of Energy
Office of Waste Management
under budget and reporting code EX3120011

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

Author Affiliations

J. P. Abston and S. N. Burman are members of the Measurement Application and Development (MAD) Group, Health Sciences Research Division at Oak Ridge National Laboratory. D. L. Jones formerly worked in the MAD Group as an employee of Midwest Technical, Inc.

APPROVALS

Site Health and Safety Plan/Work Plan for Further Characterization of Waste Drums at Oak Ridge National Laboratory Oak Ridge, Tennessee

J. L. Johnson 10/3/95
J. L. Johnson
Project Manager

K. G. Edgemon 10/03/95
K. G. Edgemon
HWOG Group Leader

D. G. Rowland 10/3/95
D. G. Rowland
ORNL HAZWOPER Program

J. P. Abston 10/3/95
J. P. Abston
Site Health and Safety
Officer

M. L. Conner 10/2/95
M. L. Conner
ORNL Applied Health Physicist

D. F. Hall 10/3/95
D. F. Hall
Facility Manager

D. G. Rowland 10/3/95
D. G. Rowland
ORNL SHEST Team

M. A. Johnson 10/3/95
M. A. Johnson
Project Engineer

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

AL

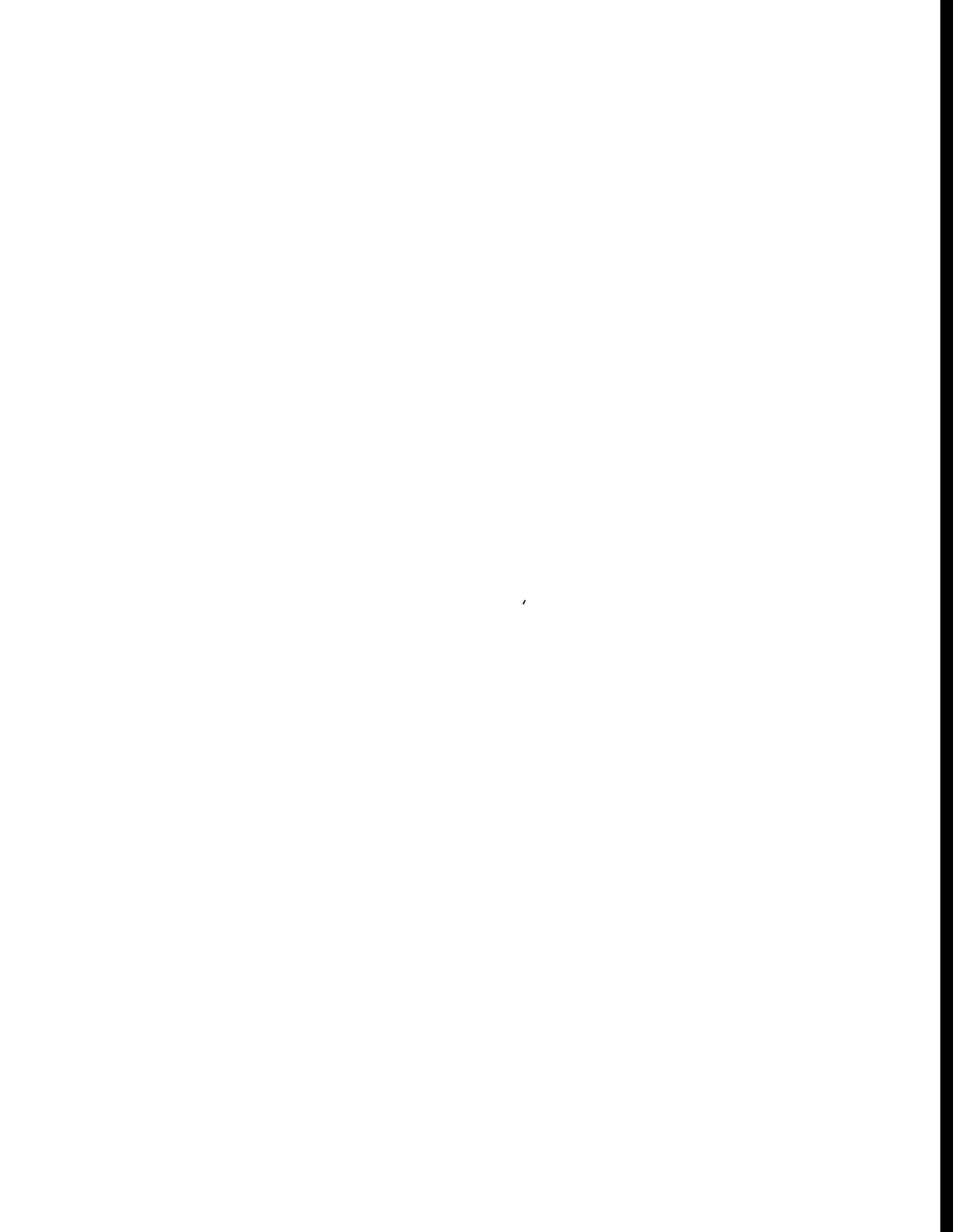


CONTENTS

FIGURES	vii
TABLES	ix
ABBREVIATIONS	xi
ACKNOWLEDGMENTS	xiii
EXECUTIVE SUMMARY	xv
1. INTRODUCTION	1
1.1 SITE HEALTH AND SAFETY PLAN COMPONENTS	1
1.2 SITE DESCRIPTION	1
1.2.1 Hazardous Waste Management Area	1
1.2.2 Building 7654, Long-Term Hazardous Waste Storage Facility	3
1.2.3 Building 7507W, Mixed Hazardous Waste Storage Facility	3
1.2.4 Building 7823, Waste Staging Facility	3
2. COMPREHENSIVE WORK PLAN	6
2.1 COMPREHENSIVE WORK PLAN	6
2.1.1 Facilities	6
2.1.2 Transportation	8
2.1.3 Sampling	8
2.2 PROJECT DOCUMENTATION	10
2.2.1 Site Logbook	10
2.2.2 Required Project Documentation	10
2.2.3 Corrective Actions	11
3. SITE ORGANIZATION	13
3.1 KEY PERSONNEL	13
3.2 SITE ROLES AND RESPONSIBILITIES	13
3.2.1 Site Project and Programmatic Manager	13
3.2.2 Site Safety and Health Officer	14
3.2.3 Radiation Protection and the Site RCT	16
3.2.4 HAZWOPER Program Coordinator (or designee)	16
3.2.5 Safety and Health Evaluation Support Team	17
3.2.6 Field Personnel	17
3.2.7 Facility Manager	19
3.2.8 Stop/Start Work Authority	19
4. RISK/HAZARD ANALYSIS	20
4.1 IDENTIFICATION AND ASSESSMENT OF POTENTIAL SITE HAZARDS	20
4.1.1 Physical Hazards	20

4.1.2	Chemical Hazards	21
4.1.3	Radiological Hazards	21
4.1.4	Other Hazards	21
5.	SITE ACCESS REQUIREMENTS	26
5.1	WORKER TRAINING REQUIREMENTS	26
5.1.1	Training Documentation	27
5.2	PRE-ENTRY HEALTH AND SAFETY BRIEFING	28
5.3	PERSONAL PROTECTION REQUIREMENTS	28
5.3.1	Respiratory Protection	28
5.3.2	Personal Protective Equipment	29
5.3.3	Revisions/Modifications to the HASP	30
5.3.4	Donning and Doffing Personal Protective Equipment	31
5.4	MEDICAL SURVEILLANCE	33
5.4.1	HAZWOPER Physical	33
5.4.2	Medical Monitoring	33
6.	FREQUENCY AND TYPES OF MONITORING	34
6.1	EXPOSURE MONITORING	34
6.1.1	Area Monitoring	34
6.1.2	Dosimetry	34
6.2	MONITORING EQUIPMENT/ACTION LEVELS	34
6.3	CALIBRATION REQUIREMENTS	35
6.4	MONITORING RESPONSE GUIDELINES	35
7.	SITE ZONES AND CONTROL MEASURES	37
7.1	WORK ZONES	37
7.1.1	Exclusion Zone	37
7.1.2	Contamination Reduction Zone	38
7.1.3	Support Zone	38
7.2	SITE COMMUNICATIONS	39
7.2.1	Two-Way Radios	39
7.2.2	Plant Telephone System	39
7.2.3	The Buddy System and Hand Signals	39
7.3	SANITATION	40
7.3.1	Housekeeping	40
7.3.2	Potable Water	40
7.3.3	Consumption of Food and Tobacco Products	40
7.3.4	Rest Room/Washing Facilities	40
8.	DECONTAMINATION PROCEDURES	41
8.1	PERSONNEL DECONTAMINATION	41
8.1.1	Level D Protection Decontamination	41
8.1.2	Level D+ Protection Decontamination	43
8.1.3	Level C Protection Decontamination	43
8.1.4	Level B Protection Decontamination	45

8.2 EQUIPMENT DECONTAMINATION	46
9. STANDARD OPERATING PROCEDURES	48
10. EMERGENCY PREPAREDNESS AND CONTINGENCY PLANS	49
10.1 EMERGENCY CONTACTS AND NOTIFICATIONS	49
10.1.1 Site Personnel Responsibilities	49
10.1.2 Reporting An Emergency	50
10.1.3 Emergency Coordinator	51
10.1.4 Emergency Actions for Site Personnel	51
10.2 EMERGENCY ACTION PLANS	51
10.2.1 Emergency Alarm Systems at ORNL	51
10.2.2 Emergency Assembly Points	52
10.2.3 Evacuation Routes	53
10.2.4 Fire or Explosion	54
10.2.5 Emergency Equipment	54
10.3 EMERGENCY MEDICAL SERVICES	54
10.3.1 Personnel Injuries	54
10.3.2 Emergency Medical Services	54
10.3.3 Transportation	54
10.4 EMERGENCY RESPONSE	54
10.5 SPILL CONTAINMENT	55
REFERENCES	56
Attachment A. FIELD CHANGE REQUEST/VARIANCE FORM	59



FIGURES

1 Hazardous Waste Management Area	2
2 Building 7507W, Mixed Hazardous Waste Storage Facility	4
3 Building 7823, Waste Staging Facility	5
4 Prefabricated building used for drum sampling	7
5 Chain of command for ES&H concerns	19



TABLES

1 Key project personnel	13
2 Surface radioactivity values	22
3 Characteristics of suspected radionuclide contaminants in the drums	23
4 Site training requirements	27



ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
CRC	contamination reduction corridor
CRZ	contamination reduction zone
DAC	derived air concentration
dBA	decibels on the A-weighted scale
DOE	U.S. Department of Energy
ECC	Emergency Control Center
EMS	emergency medical services
Energy Systems	Lockheed Martin Energy Systems, Inc.
EPA	Environmental Protection Agency
ES&H	environmental safety and health
EZ	exclusion zone
FID	flame ionization detector
GET	general employee training
HASP	health and safety plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HFIR	High Flux Isotope Reactor
HPRR	Health Physics Research Reactor
HWOG	Hazardous Waste Operations Group
IH	industrial hygiene or on-site industrial hygienist
LEL	lower explosive limit
LSS	Laboratory Shift Superintendent
MAD	Measurement Applications and Development Group
NIOSH	National Institute of Occupational Safety and Health
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OSHP	Office of Safety and Health Protection
PA	public address (system)
PID	photoionization detector
PPE	personal protective equipment
QA	quality assurance
RCT	radiation control technician
RI	remedial investigation
RP	Radiation Protection
RPP	Radiation Protection Procedures
S&H	safety and health
SAP	sampling and analysis plan
SCBA	self-contained breathing apparatus
SHEST	Safety and Health Evaluation Support Team
SSHO	Site Safety and Health Officer
SOP	standard operating procedure
SPM	Site Project Manager

SWSA	solid waste storage area
UL	Underwriters' Laboratory, Inc.
WAG	waste area grouping
WMRAD	Waste Management and Remedial Action Division

ACKNOWLEDGMENTS

The authors wish to acknowledge the support of J. L. Johnson of the Waste Management and Remedial Action Division, and members of his staff. The authors further acknowledge contributions from D. G. Rowland of the Office of Safety and Health Protection and the Safety and Health Evaluation Support Team.



EXECUTIVE SUMMARY

The Lockheed Martin Energy Systems (Energy Systems) policy is to provide a safe and healthy work place for all employees and subcontractors. In accordance with this policy, environmental restoration and waste management activities at the U.S. Department of Energy's (DOE's) Oak Ridge National Laboratory are guided by the Hazardous Waste Operations and Emergency Response Program, 29 CFR 1910.120, DOE orders, Energy Systems procedures and guidelines, and site-specific health and safety plans.

This health and safety plan/work plan describes a strategy for characterizing the contents of 172 liquid waste and 33 solid waste drums. It also addresses the control measures that will be taken to (1) prevent or minimize any adverse impact on the environment or personnel safety and health and (2) meet standards that define acceptable management of hazardous and radioactive materials and wastes. When writing this document, the authors considered past experiences, recommendations, and best management practices to minimize possible hazards to human health or the environment from events such as fires, explosions, falls, mechanical hazards, or unplanned releases of hazardous or radioactive materials to air, soil, or surface water.

This plan, and addenda (if needed), shall be available for site inspection and review by all subcontractor, Energy Systems, and DOE personnel and shall be easily accessible in the field for site personnel. During site activities, all personnel, including subcontractors and visitors, will be expected to comply fully with the requirements of this plan and other Energy Systems and DOE policies and procedures. Site activities shall be performed in accordance with all applicable DOE Orders, applicable Occupational Safety and Health Administration Standards 29 CFR 1910 and 1926, and applicable Environmental Protection Agency requirements and consensus standards.



1. INTRODUCTION

This site Health and Safety Plan (HASP) was prepared for the Waste Management and Remedial Action Division (WMRAD) of Oak Ridge National Laboratory (ORNL). The HASP will be used in conducting hazardous waste characterization of drums containing Resource Conservation and Recovery Act and radiologically contaminated waste. The plan follows the format recommended by the U.S. Environmental Protection Agency (EPA) for remedial investigations and feasibility studies and complies with the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR 1910.120 for investigations and cleanup at hazardous waste sites.

1.1 SITE HEALTH AND SAFETY PLAN COMPONENTS

This HASP provides information on the following topics:

- key health and safety personnel,
- site hazards,
- worker training,
- personal protective equipment,
- action levels and guidelines,
- medical surveillance requirements,
- frequency and types of monitoring,
- site control measures,
- contamination control measures,
- decontamination procedures,
- contingency plans,
- emergency evacuation, and
- spill control.

This HASP provides information applicable to drum content characterization activities for the ORNL Waste Management Program. These activities may consist of, but are not limited to, drum movement, drum breaching, visual evaluation of containers to determine if sampling is warranted, sampling of contents, chemical and radiological monitoring, and repackaging/repositioning.

1.2 SITE DESCRIPTION

1.2.1 Hazardous Waste Management Area

The Hazardous Waste Management Area (Fig. 1) is located on the Health Physics Research Reactor (HPRR) access road on the east end of ORNL and is operated by WMRAD. This facility is situated in a wooded area on level ground. Six permanent structures—Buildings 7651, 7652, 7653, 7654, 7666, and 7668—are on a paved pad that connects all the buildings. The facility is surrounded by a chain link fence for security. An office complex (Building 7666A) for this area is situated at the eastern end of the facility. All visitors and employees must check in at the office building before accessing the area. Telephones, rest rooms, and break facilities are located in the office building.

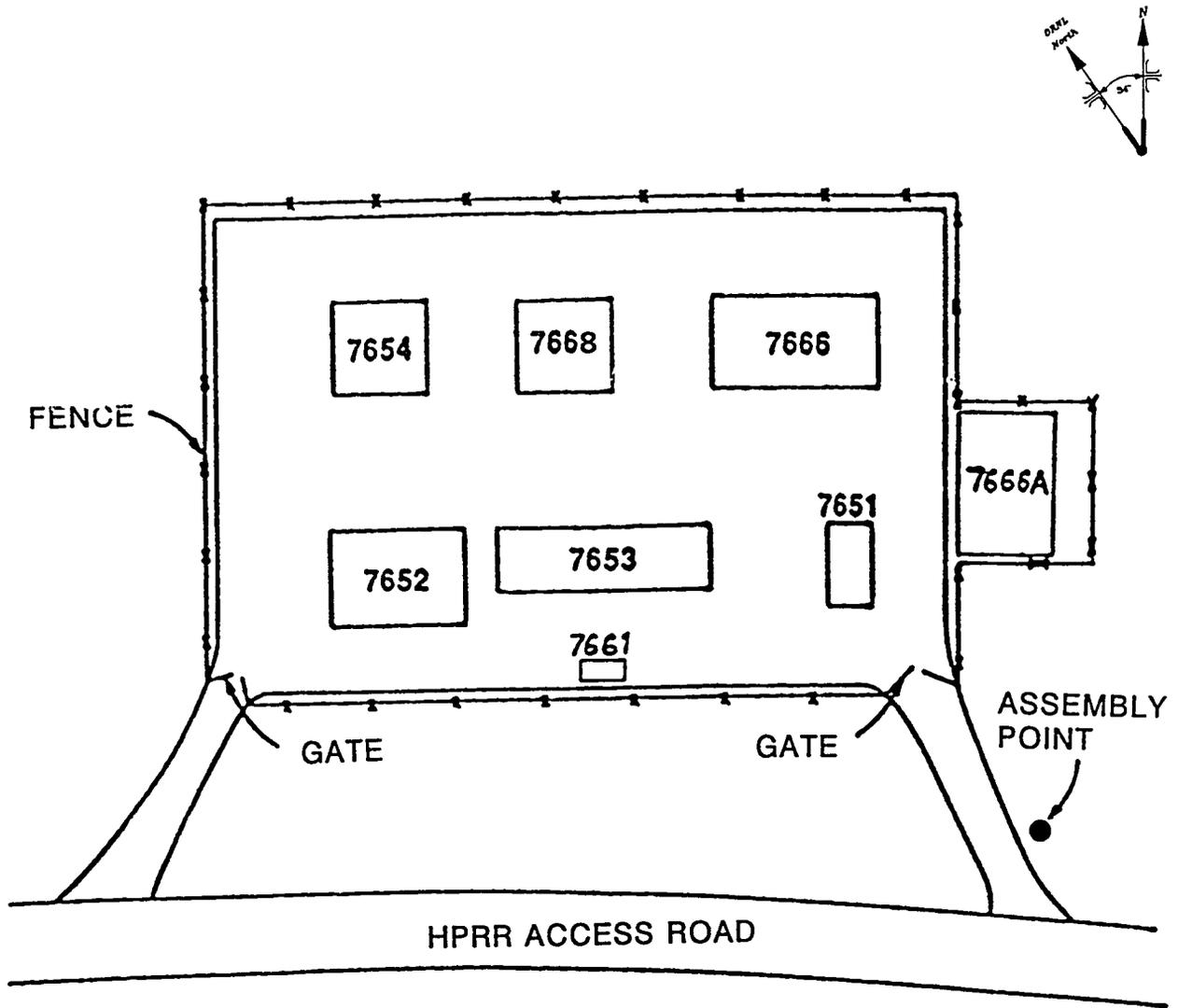


Fig. 1. Hazardous Waste Management Area

1.2.2 Building 7654, Long-Term Hazardous Waste Storage Facility

Building 7654 (Fig. 1), located at the western end of the Hazardous Waste Management Area, is approximately 1700 ft². The building consists of insulated, prefabricated panels built on a concrete floor surrounded by 6-in.-high curbing. This facility is used for the storage of mixed waste, the majority of which consists of bulk scintillation fluids and scintillation vials. Appropriate warning/hazard signs are posted outside the building. An emergency telephone is available outside the building along with emergency telephone numbers.

1.2.3 Building 7507W, Mixed Hazardous Waste Storage Facility

Building 7507W, Mixed Hazardous Waste Storage Facility, is located off Melton Valley Drive. Building 7507W (Fig. 2) is a limited-access metal siding structure over a 40-ft concrete pad. The facility grounds are surrounded by an 8-ft-high fence. The facility is used for the storage of boxes, 55-gal drums, and 30-gal drums of mixed hazardous radioactive waste. Emergency telephone numbers and appropriate warning signs are placed outside the building.

1.2.4 Building 7823, Waste Staging Facility

Building 7823 (Fig. 3) is located at Solid Waste Storage Area (SWSA) 5. It is a single-level, semi-underground building of approximately 4200 ft² with concrete floor, steel supports, wire fabric ceiling, and metal roof and walls. It is used to store mixed waste and PCB-contaminated mixed waste contained in 55-gal drums, 30-gal drums, and B-25 boxes. All bulk liquids waste drums are stored on steel pallets and are double stacked. The entrance is posted with emergency telephone numbers and the appropriate warning signs.

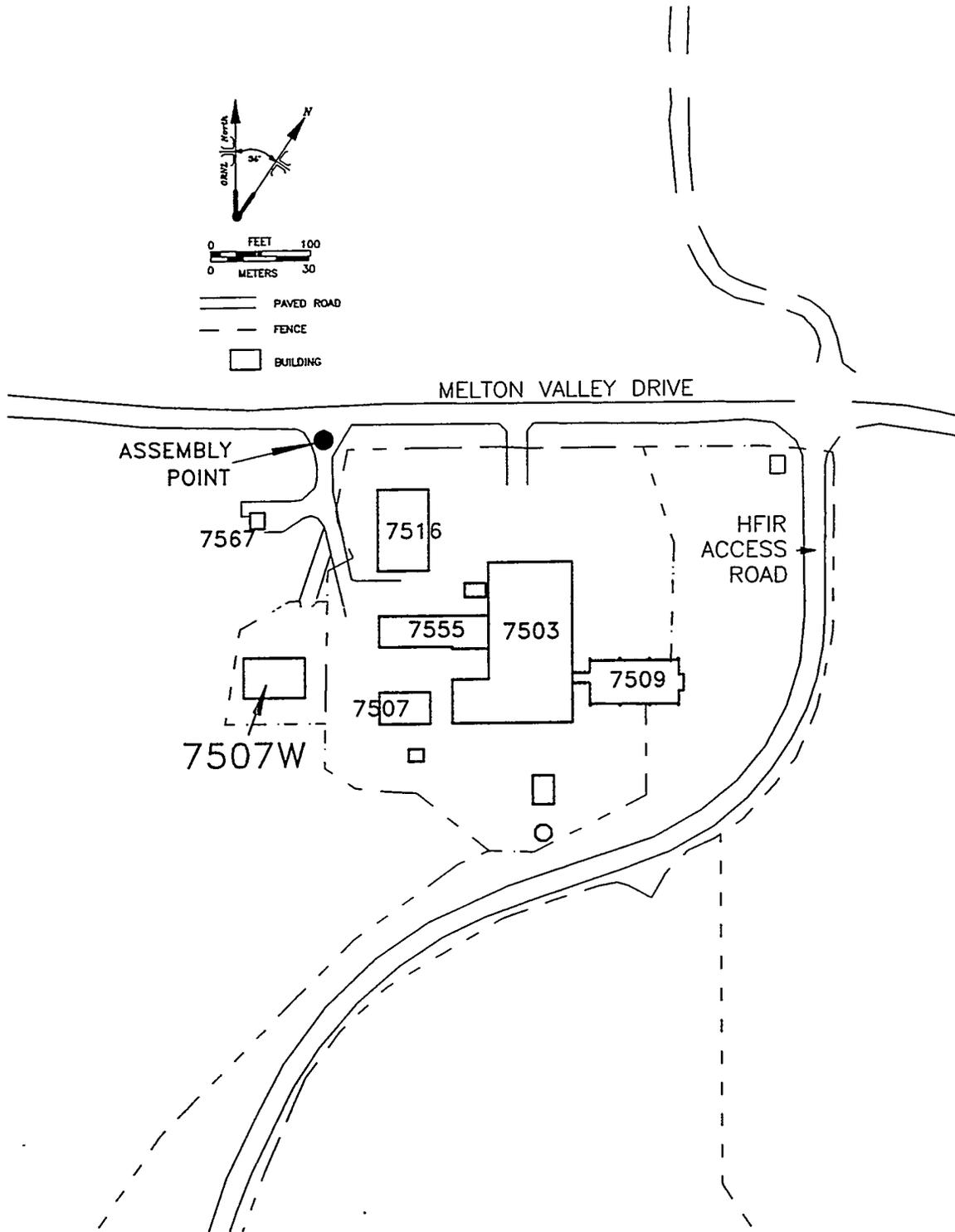


Fig. 2. Building 7507W, Mixed Hazardous Waste Storage Facility.

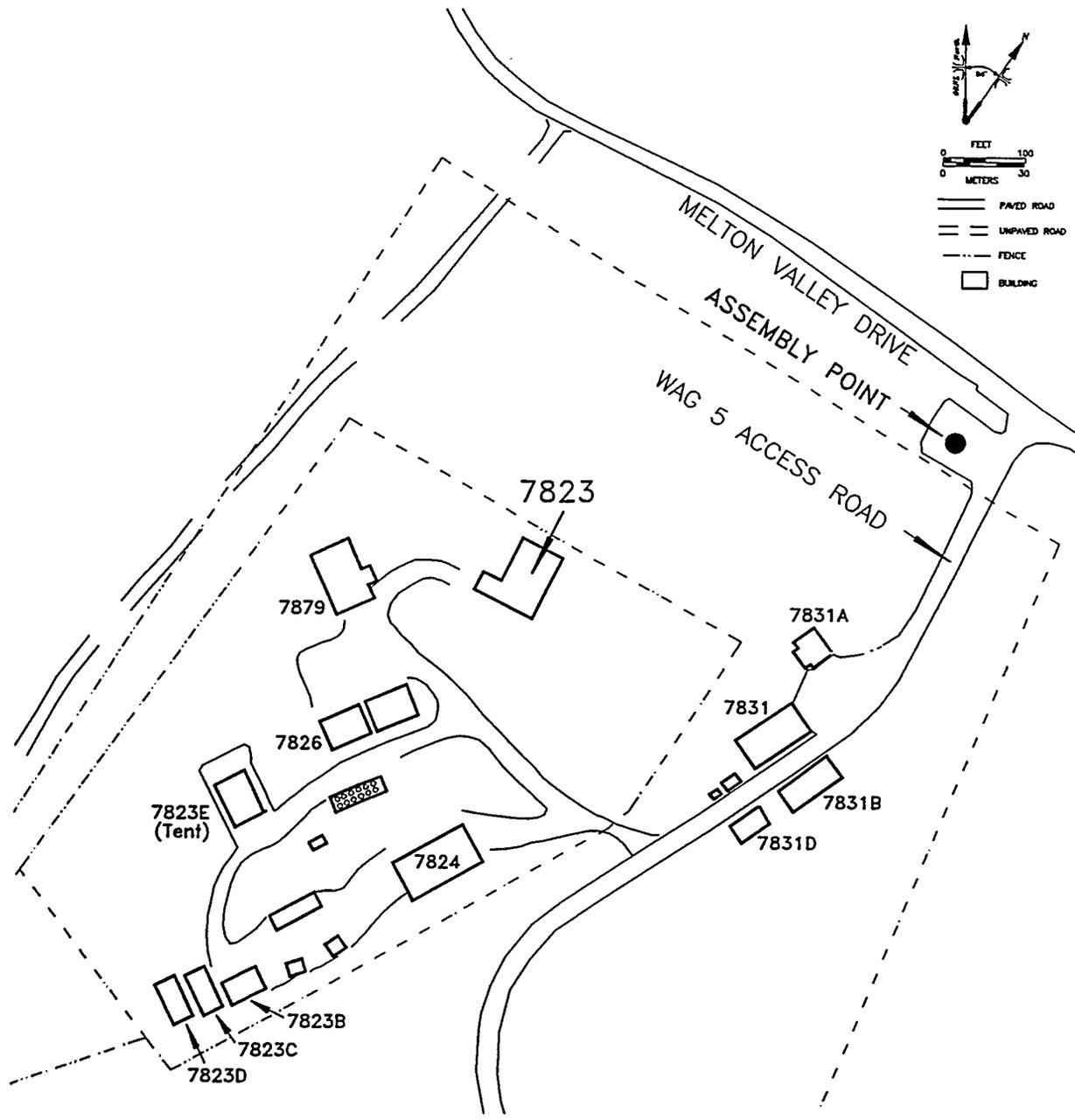


Fig. 3. Building 7823, Waste Staging Facility.

2. COMPREHENSIVE WORK PLAN

2.1 COMPREHENSIVE WORK PLAN

2.1.1 Facilities

This project involves the sampling of waste drums that require further characterization. The drums are located at three storage sites on the ORNL reservation: Building 7654, Long-Term Hazardous Waste Storage Facility; Building 7507W, Mixed Hazardous Waste Storage Facility; and Building 7823, Waste Staging Facility. A prefabricated containment building (Fig. 4) mounted on a trailer will be used for drum sampling. The building has an exterior dimension of 16 ft × 9 ft 6 in. × 11 ft 8 in. and an interior dimension of 14 ft 7 in. × 8 ft 1 in. × 10 ft. Exterior wall construction consists of 2-hour, fire-rated noncombustible construction in accordance with UL 263 and ASTM-E119.* Walls are constructed with heavy gauge steel and UL-classified, fire-resistant gypsum wallboard. The interior floor is a fiberglass grating made with fire-retardant isophthalic polyester resin, which is corrosion and ultraviolet resistant. The floor has a permanently bonded quartz grit/baked epoxy anti-skid surface with a 35% open area and will sustain a uniformly distributed load of 250 psf. The floor has a built-in 7-in.-deep secondary containment sump constructed of 2-hour, fire-rated noncombustible construction in accordance with UL 263 and ASTM-E119. The sump walls are constructed of heavy gauge steel with UL-classified, fire-resistant gypsum wallboard. The interior sump walls are clad with heavy gauge sheet steel that is continuously welded to the sump floor. The internal spill containment capacity is 500 gal.

The containment building will have a pre-engineered, dry chemical fire suppression system. The system includes two 190°F electric thermal detectors and two nozzles for total flooding application with automatic ventilation system shutdown upon system actuation. The agent storage cylinder is housed inside an exterior tamper-proof enclosure. Two air inlet vents equipped with a UL-classified fire damper having a 1.5-hour fire protection rating will be located at a height of 4 feet on the opposite wall of the exhaust ventilation system. An exterior, end wall mounted, electromechanical exhaust ventilation system with a UL-listed, Class 1, Group D, Division 1, totally enclosed motor (120 V, 4.5 A, 60 Hz, 1-Phase) with nonstatic 12-in.-diameter cast aluminum fan blade and high-efficiency particulate air filter is located opposite the air inlet vents. The total air exchange will be three times every minute. A Class 1, Groups C and D, Division 1 air conditioner (18,000 Btu/hr, 230 V, 8.2 A, 1-Phase) with adjustable temperature settings from 70°F to 100°F will be located opposite the exhaust ventilation system.

*UL = Underwriters' Laboratory, Inc.; ASTM = American Society for Testing and Materials (Philadelphia).

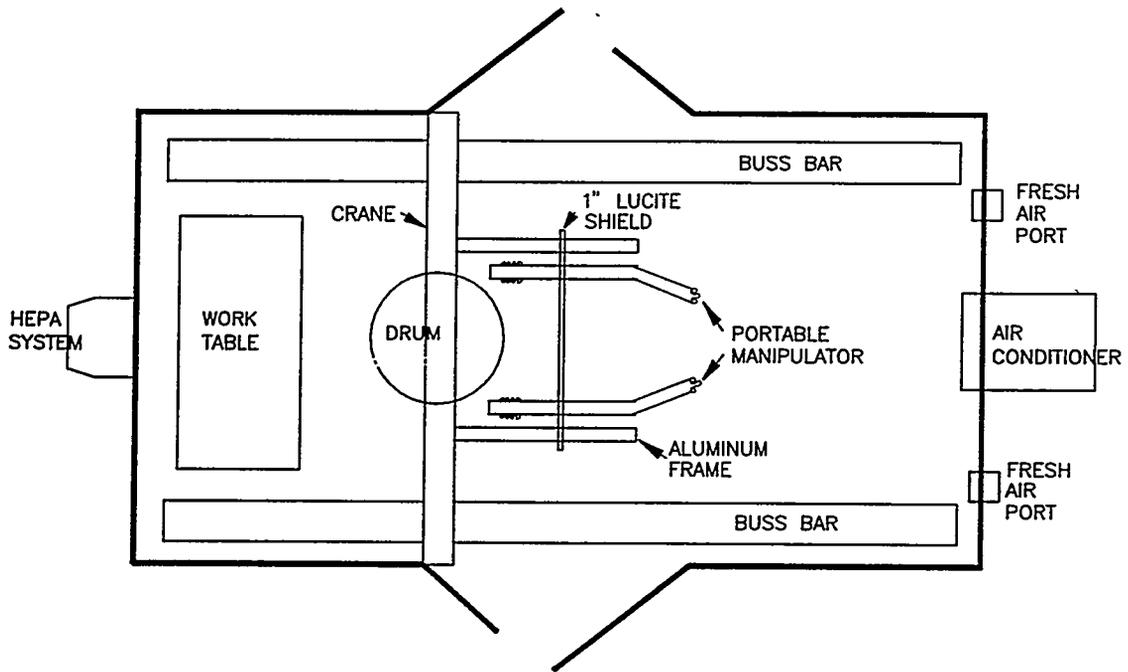


Fig. 4. Prefabricated building used for drum sampling.

A bridge crane system with telescoping device and nonsparking hoisting drum lifter is mounted to the inside roof of the building. The crane telescopes in/out of the doors. Double doors (60 in. by 80 in.) in the center of the building on both sides are equipped with a UL-listed automatic door closer and a UL-listed security lock with interior panic exit rim device. Four interior incandescent lighting fixtures (UL-listed, Class 1, Groups C and D, Division 1) with a 150-W lamp will be used. There will be an exterior UL-listed light switch located outside. Quick connections for air lines will be installed on the interior walls.

2.1.2 Transportation

Sampling is to be conducted at the three storage sites. The containment building will be transported on the trailer and placed with the air conditioner facing away from any permanent storage facility, as required by the Fire Department. All Department of Transportation requirements will be followed when transporting this structure over Energy Systems thoroughfares. A metal-framed containment pallet will be used to hold the drum inside the containment building. This containment pallet has a metal-grated floor under which a holding area is located to contain any spillage encountered.

The drums will be identified and segregated at each storage site before being sampled. All drums will be handled, identified, separated, transported, hoisted, and returned by the Hazardous Waste Operations Group in accordance with WMRAD procedures. As one drum is being sampled the forklift operator will identify the next drum to be sampled, access the drum, and transport it to the sample building. The drum number and any identifying markings, along with potential class of contents (corrosives, poisons, EPA number, etc.), will be noted in the site-specific logbook and on any forms needed for sample documentation.

2.1.3 Sampling

Once the drum has been placed on the metal containment pallet and put into the containment building, the Measurement Application and Development (MAD) Group will proceed with opening and sampling the drum. All necessary drum information will be recorded in the site records. Depending on the drum type and contents of the drum, the method used to sample the container will be determined. Sampling will be conducted in accordance with the Site-Specific Sampling and Analysis Plan (SAP). Samplers and all workers inside the exclusion zone (EZ) will be dressed in the appropriate personal protective equipment (PPE) for this operation (see Sect. 5).

There are 205 drums of waste needing further characterization. A visual inspection of the drums was conducted on March 30, 1995. Based on that inspection and a review of the drum logs, 172 drums were identified as containing liquid waste and 33 drums were identified as containing solid waste. The liquid waste drums will be segregated into the following groups: 35 drums of liquids containing oils; 116 drums of bulk scintillation liquids; 5 drums of liquids containing tritium; and 16 drums of other liquids. The 33 drums of solid waste may contain, but are not limited to containing, solids such as contaminated soils, compactible waste, or laboratory packs.

2.1.3.1 Drum Handling

All drums will be handled, identified, separated, transported, hoisted, and returned to the storage facility by the Hazardous Waste Operations Group in accordance with WMRAD procedures. Pressurized or bulging drums will be opened in the containment building by the Hazardous Waste Operations Group (HWOG) in accordance with WMRAD procedure WM-SWO-401.5. Pressurized drums will be placed in the building and opened before sampling by the MAD Group. All health and safety issues concerning the above listed drum handling activities are covered in the WMRAD procedures manual (*Hazardous Waste Operations Manual*), WM-SWO-401, rather than in this HASP.

2.1.3.2 Bung-topped Drums

Bung-topped drums are designed to be a complete unit to hold liquids and sludges. A small, indented, threaded port with a bolt-shaped plug is removed to add or extract fluids from the drum. Once the drum is filled, the bung plug is threaded in the port and the drum is secured. All nonpressurized bung-top drums will be opened with a nonsparking bung wrench. If the bung-top cannot be manually removed, the bung-top will be removed by a remote drum opener. The remote drum opener is a pneumatically operated device that will be attached to the drum and operated by HWOG in accordance with WMRAD procedures. Once the plug is unthreaded, any pressure or vapors contained within the drum will be dissipated. The samplers will remove the pneumatic apparatus and bung plug. Sampling will be conducted by using disposable coliwasa sample tubes in accordance with the SAP. After completion of sampling activities, the bung plug will be replaced and hand tightened using a nonsparking bung wrench. The drum will be labeled appropriately and transported back to the storage facility.

2.1.3.3 Open-Topped Drums

For drums with open-topped lids containing solids such as contaminated soils, compactible waste, or laboratory packs (e.g., expired chemicals, lab waste containers, etc), the samplers will physically remove the band securing the lid to the drum body using nonsparking bronze wrenches. The ring and lid will be removed and the samples collected. If the ring cannot be manually removed, the ring will be removed by a remote drum opener. The remote drum opener is a pneumatically operated device that will be attached to the drum and operated by HWOG in accordance with WMRAD procedures. After the ring is removed, the drum will be opened and sampled as specified in the SAP, and a new lid repositioned and secured.

2.1.3.4 Laboratory Packed Drums

Laboratory packed drums are used for the disposal of expired laboratory chemical and experimental process samples from throughout the ORNL complex. These drums could comprise many individual containers of unknown quantities and unknown chemicals. There could be chemicals that are incompatible with other chemicals within the same drum, shock-sensitive chemicals, and radioisotopes. Ideally, these containers will be packed in an absorbent material, like vermiculite. These drums and containers will have to be handled with extreme care with regard to health and safety and the protection of the environment.

Generally these laboratory packed drums will be open topped drums. The drum to be sampled will be opened in accordance with Sects. 2.1.3.1 and 2.1.3.3 of this HASP. A visual inspection of the contents of the drum by a chemist from WMRAD will determine if the containers inside will be sampled. All drums containing laboratory packs must be treated as shock-sensitive wastes and handled in accordance with 29 CFR 1910.120. Laboratory packs will be handled remotely with a pair of G-Model cable-driven manipulators. Drum contents will be removed, sampled, and replaced with the manipulators. After sampling is completed, the lid will be replaced on the drum and sealed, labeled, and returned to the storage facility.

2.2 PROJECT DOCUMENTATION

2.2.1 Site Logbook

A site-specific logbook shall be maintained for this project for the purpose of documenting and summarizing all pertinent site activities, work efforts, and events. Observations to be recorded in the site logbook shall include, but are not limited to, the following: site conditions, site operations, instrumentation monitoring and calibration information, site entrants, accidents or injuries, and attendance at pre-entry and periodic health and safety briefings. The Site Safety and Health Officer (SSHO) is responsible for maintaining the site logbook as a record of activities and events. A copy of the site logbook for the previous week's activities will be made available for WMRAD by the end of each working week. Additional permits and forms may be required as documentation of project activities.

2.2.2 Required Project Documentation

Required project documentation may include, but is not limited to, the following:

- The HASP
- Site-Specific SAP/Quality Assurance Plan,
- Site-Specific Project Logbook
- Safety Work Permits
- Radiation Work Permits
- Any addendum to this plan
- Safety and health self-assessment/surveillance plan
- Accident and illness reports
- Inspection reports (heavy equipment, etc.)
- Worker medical records
- Worker training records or special access training cards
- Waste Management Plan

These items shall be considered a part of the project documentation and shall be maintained on-site by the SSHO and site Radiation Control Technician (RCT) for the duration of the project. Upon completion of the project, all documentation will be maintained as historical records with the project manager and the Waste Management document control manager.

2.2.3 Corrective Actions

Corrective actions are those measures taken to rectify any site deficiency that was observed from self-assessments and surveillance. Corrective action may be initiated by any person performing work or involved in support of the project at any time.

2.2.3.1 Field activities

The majority of corrective actions will be of short duration. Examples include documentation errors or failure to date and/or sign any required field forms. Corrective action will be initiated by bringing the discrepancy to the attention of the appropriate personnel. Corrections will be accomplished at the time of the disclosure. Any actions that violate safety and health protocol, such as the use of ineffective PPE, entering the support zone from the contamination reduction zone (CRZ) without frisking, or failure to calibrate instruments before using them, will also be considered short-term events. Work shall be suspended until the corrective action is performed under the supervision of the SSHO or the Site Project Manager (SPM).

2.2.3.2 Occurrence reporting

Department of Energy (DOE) Order 5000.3B, *Occurrence Reporting and Processing of Operations Information*, became effective on February 22, 1993. The occurrence reporting system may be initiated any time an employee, contractor, or subcontractor reports problems, concerns, conditions, or events that could adversely affect safety, the environment, health, quality, security, or site operations. Any occurrence is to be reported to the Laboratory Shift Superintendent (LSS). If the event involves a real-time occurrence that requires assistance from plant emergency services, on-site personnel should first take actions to mitigate the occurrence, and the situation should be reported as described in Sect. 10.1 of this plan. Any other ORNL procedures for occurrence reporting should also be followed.

2.2.3.3 Field changes and variances

Any deviation from the HASP or SAP, or change in established work procedures, must be reported and recorded in a specified section of the field logbook for field changes and variances when the deviation occurs. A Field Change Request/Variance Form (provided as Attachment A) will be completed and signed by the appropriate persons in the event of any deviation from those documents.

A variance is a routine change in any aspect of the written procedure that would not affect the quality of data or analytical results. If a variance for the plan occurs, the box marked "Variance" is checked on the Field Change/Variance Form and the SPM is required to sign the form. A copy of the form is distributed to any project quality assurance (QA) representatives, and the original is maintained by the SPM. All personnel involved in the work process will be informed of these changes.

A field change is a deviation that could adversely affect the quality of data being generated. For major alterations or field changes, the "Field Change" box on the form is checked and the signatures of the Facility Manager and the Project Manager are required,

in addition to the signatures listed on the form (see Attachment A). Changes must be explained to all site personnel. Each signee will receive a copy of the Field Change/Variance Form, which records the deviation, the substituted method or rationale for the change, and an explanation of how data quality will be affected. All variances that affect the health and safety of the site workers shall require the approval of the Hazardous Waste Operations and Emergency Response (HAZWOPER) Program Coordinator.

3. SITE ORGANIZATION

The 205 drums in question are currently being managed by WMRAD for ORNL. The specification of names and telephone numbers for all site roles for the work project is required for the HASP.

3.1 KEY PERSONNEL

Key project personnel identified for this operation are listed in Table 1. The identity of the person or organization fulfilling the role and a phone number for each person or organization are supplied.

Table 1. Key project personnel

Responsibility	Name	Phone number	Pager/radio number
HWOOG Group Leader	K. G. Edgemon	574-1779	
Project Manager	Jim Johnson	576-5084	873-9091/
Facility Manager	Dave Hall	574-5901	
Project Engineer	Mark Johnson	571-4484	
Site Safety and Health Officer	Paul Abston	574-4588	873-9606/1131
ORNL Health Physics	Mitch Conner	574-1543	218
HAZWOPER Program	Greg Rowland	576-6445	873-5537/73
SHEST representative	Greg Rowland	576-6445	873-5537/73
WMRAD Chemist	Louis Wesley	574-7467	

3.2 SITE ROLES AND RESPONSIBILITIES

These sections contain descriptions of anticipated site roles and responsibilities. Site roles and responsibilities are not limited to those listed below. Additional site roles and responsibilities, or changes in key personnel, shall be added as an addendum to this plan if the roles are permanent for all site activities.

3.2.1 Site Project and Programmatic Manager

The Site Project (SPM) is primarily responsible for managing and coordinating all field activities related to the project. Responsibilities of the SPM may include, but are not limited to, the following:

- Coordinating support personnel required for field operations, including both Energy Systems and subcontractor personnel.
- Notifying the LSS of planned activities, as required.
- Notifying the facility manager of planned activities.
- Coordinating with ORNL the distribution and control of security access badges, if needed, for site access.
- Obtaining all required documentation and permits.
- Providing oversight of field activities.
- Determining and communicating site project objectives to all personnel involved in site activities.
- Requesting or coordinating weekly health and safety briefings to summarize planned activities, identify new hazards, or clarify any task or project-related issues.
- Ensuring that all site personnel have proper training and experience for their jobs.
- Ensuring that all personnel adhere to all Environmental Safety and Health (ES&H), QA, WMRAD, and any other procedures and guidelines appropriate to the project.

3.2.2 Site Safety and Health Officer

The SSHO shall be designated to perform actual on-site health and safety supervision of all site activities. With the consent of the ORNL HAZWOPER Program Coordinator, and because of the complexity of this effort, the project may require more than one SSHO. The SSHOs are required to have fulfilled the training requirements and medical monitoring requirements for exclusion zone access, to have been approved as a Level 3 SSHO (ORNL 1993) through a combination of health and safety experience through work activities or education, and to have previously performed or been trained as a supervisor for hazardous waste sites. Each SSHO must be approved in writing by the ORNL HAZWOPER Program Coordinator. The responsibilities of the SSHO shall include, but are not limited to, the following:

- Overseeing the selection, inspection, storage, and maintenance of personal protective clothing and equipment to be used on-site in conjunction with the site RCT.
- Establishing and maintaining work zones to prevent the potential spread of contamination during work and decontamination activities in accordance with the site RCT.
- Controlling entry and exit of all personnel and observers into the work zones.

- Conducting periodic inspections (self-assessments) to ensure the compliance of all site entrants with health and safety measures outlined in this HASP, and other appropriate documents.
- Confirming each worker's suitability for hazardous waste site work based on a physician's recommendation and HAZWOPER physical (as required), as well as maintaining written records to that effect on-site, including documentation of worker participation in the necessary medical surveillance programs and respiratory protection programs.
- Ensuring that any injury or illness related to work performance is reported to the SPM, Medical, and the Safety and Health Evaluation Support Team (SHEST) organization.
- Ensuring that training requirements for site access by individual workers have been met.
- Maintaining and inspecting records of each on-site worker's training required for each work effort in accordance with 29 CFR 1910.120. (*Note:* ORNL Special Access training badges will be used to verify training for ORNL employees).
- Ensuring that all prospective site personnel sign and date the field logbook to verify that the requirements for informing personnel of site-specific potential health hazards and other health and safety information covered in the HASP and applicable addenda have been met.
- Monitoring of ambient site conditions for potential chemical and radiological exposures, as well as monitoring of workers for symptoms of exposure or for conditions related to other on-site hazards, including physical stresses such as temperature extremes.
- Performing or ensuring performance of daily field calibrations of environmental monitoring equipment used to detect ambient site conditions and potential personnel exposures as outlined in this HASP and maintaining documentation of such instrument calibration in the site-specific project logbook. All calibration shall be performed in accordance with manufacturer's guidelines.
- Ensuring that all monitoring equipment is operating correctly according to the standard operating procedure or the manufacturer's instructions, and providing maintenance or ensuring maintenance is provided, if authorized.
- Conducting pre-entry and daily health and safety briefings that include, but are not limited to, subjects such as site hazard communications; information concerning the site emergency action plan and emergency response actions and responsibilities; and the locations of fire alarms, extinguisher, telephones, and sanitation facilities.
- Conducting S&H briefings if site conditions change.
- Establishing and posting at the site an emergency action plan, telephone numbers, and appropriate radio communication information.
- Notifying and keeping the LSS aware of any work stoppage in the EZ.

3.2.3 Radiation Protection and the Site RCT

All radiation protection (RP) monitoring and oversight services shall be provided through the ORNL Office of Radiation Protection. RCTs providing support to WMRAD will be providing coverage for this characterization effort. The responsibilities of the site RCT shall include, but are not limited to, the following:

- Reviewing, commenting on, and approving this HASP and all site addenda that might arise during the course of this project before activities addressed in these documents commence; granting written approval by signature, or disapproval of the plan(s), on the basis of compliance with 29 CFR 1910.120 and the adequate address of radiation protection concerns.
- Attending all pre-entry health and safety briefings and presenting radiation protection information to all site workers during the briefings.
- Being present when required during site operations.
- Ensuring that personnel and equipment are frisked for contamination before leaving the area.
- Ensuring that equipment and sample containers leaving the area have been properly tagged (rad/green tagged).
- Monitoring and documenting all radiological hazards at the site.
- Implementing and overseeing all site operations to ensure that work is conducted in accordance with all ORNL Radiation Protection procedures and practices.
- Assisting the SSHO in the selection of the appropriated PPE and respiratory protective equipment for use during each project task.
- Assisting the SSHO in establishing zones for work project activities.

3.2.4 HAZWOPER Program Coordinator (or designee)

The HAZWOPER Program Coordinator of the ORNL SHEST will provide written approval of all HASPs and any addenda to the plan, as well as oversight of field activities with respect to compliance with the requirements of 29 CFR 1910.120. The HAZWOPER Program Coordinator shall have the authority to perform on-site inspections of site operations at his or her discretion and shall have the authority to order the cessation of work activities. Responsibilities of the HAZWOPER Program Coordinator shall include, but are not limited to, the following:

- Reviewing, commenting on, and approving this HASP and all site addenda that might arise during the course of this project before activities addressed in these documents commence; granting written approval by signature, or disapproval of the plan(s), on the

basis of compliance with 29 CFR 1910.120 and the adequate address of industrial hygiene and industrial safety concerns.

- Assisting the SSHOs and the site RCT in selecting PPE and respiratory protection, as needed.
- After reviewing individual qualifications, granting to the SPM the written approval or disapproval of each SSHO to serve as an SSHO at the site.
- Determining in special circumstances whether equivalent training status as allowed by 29 CFR 1910.120 can be granted and documenting the same in writing, as detailed in Sect. 5.1.1. This is done in conjunction with the Center for Continuing Education.

3.2.5 Safety and Health Evaluation Support Team

The SHEST at ORNL shall be responsible for oversight and approval of field operations with respect to HAZWOPER, industrial hygiene, and industrial safety concerns. As all site activities will be conducted in accordance with ORNL procedures, SHEST may be called upon to perform site assessments or personnel monitoring of ORNL employees working on HAZWOPER sites. In addition, a representative of the SHEST organization may be required to assist the SSHOs and the site RCT in selecting appropriate PPE and respiratory protection, as necessary. SHEST shall review and approve or disapprove this HASPs (and any addenda) and safety work permits before personnel and equipment are mobilized and field activities commence. SHEST has the authority to order a cessation of any site activities that a SHEST representative perceives to be immediately dangerous to life, to the health of site personnel or the community, or to the environment. The SHEST representative is also authorized to order the commencement of work activities after the subject of concern has been resolved to the satisfaction of all health and safety personnel consulted.

3.2.6 Field Personnel

The responsibilities of all field personnel involved in site operations include, but are not limited to, the following:

- Taking all reasonable precautions to prevent injury to themselves and their fellow employees; using all of their senses and information collected from field instrumentation to alert them of potentially harmful situations.
- Performing only those tasks that personnel believe they can do safely, and immediately reporting any accidents and unsafe conditions to the SSHOs and the site RCT.
- Notifying the SSHOs of any existing medical conditions (e.g., allergies, diabetes) that require special consideration. ORNL Health Division approval and/or a physician's recommendation may be required before an individual with a medical condition may be assigned specific field tasks.

- Avoiding unnecessary or deliberate contact with any potentially contaminated substances (i.e., walking through puddles, pools, and mud) and avoiding placement of monitoring and sampling equipment on potentially contaminated surfaces.
- During the equipment decontamination process, preventing spillage of decontamination water, whenever possible. If a spill occurs, containing the liquid, if possible, and notifying the SPM, site RCT, and SSHOs.
- Should a spill occur during any phase of the characterization effort, containing the spill with the material in the spill kit and notifying the spill response team immediately.
- Avoiding splashing contaminated materials.
- Being familiar with the physical characteristics of the site, including
 - Wind direction;
 - Accessibility to site authorities, equipment, and vehicles;
 - Operation of available fire alarm boxes, fire extinguisher, telephones, and radios;
 - Established zones;
 - Site access;
 - Nearest site resources (e.g., rest rooms and break rooms);
 - Overhead power lines; and
 - Assembly point.
- Maintaining for proper disposal all wastes generated during site operations.
- Reporting all injuries, regardless how minor, to the SSHOs and the SPM.
- Reporting in person to the ORNL Health Division when an injury or illness related to work activities is incurred.
- Abiding by a buddy system, with each site worker being responsible for keeping track of his or her partner in the event of an incident or emergency situation.
- Reporting to the site RCT for frisking before egress from the CRZ or EZ as directed by the SSHOs or conducting self-frisking prior to existing into the support zone.
- Becoming familiar with the procedures required within the HASP and the SAP.
- Conducting all tasks in accordance with the HASP and the SAP for this project.
- Reporting to the SSHO, the site RCT, or their direct supervisor any information regarding site operations or conditions that may have an impact on the health and safety of the operation.

3.2.7 Facility Manager

The Facility Manager is a designated Energy Systems employee who is primarily responsible for the oversight and coordination of all drum operations and activities. The responsibilities of the Facility Manager include, but are not limited to, the following:

- Managing site access for all personnel entering the site (e.g., Energy System employees, subcontractors, and site visitors).
- Assembling and maintaining all drum operations, structures, and facilities.
- Approving all site activities and operations.
- Initiating and approving all radiation work permits as required for site operations.

3.2.8 Stop/Start Work Authority

According to Energy Systems Policy, all employees, contractors, subcontractors, and visitors have stop work authority. *All* individuals involved in any aspect of this project will have the authority and responsibility to stop work on this project for any serious threat to the safety and health of workers, other personnel, or the environment. Figure 5 demonstrates the proper chain of command for ES&H concerns.

Once work has been stopped for an ES&H concern, the SSHO or facility manager shall contact the LSS office. The LSS should contact the ES&H discipline of concern and receive confirmation that the hazard associated with the work stoppage has been eliminated. The LSS may then order activities to resume.

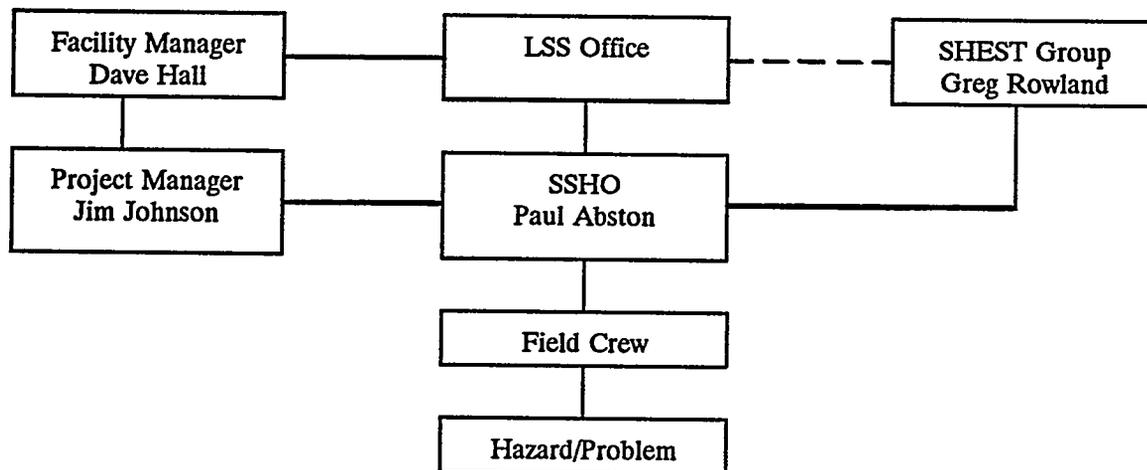


Fig. 5. Chain of command for ES&H concerns.

4. RISK/HAZARD ANALYSIS

4.1 IDENTIFICATION AND ASSESSMENT OF POTENTIAL SITE HAZARDS

4.1.1 Physical Hazards

4.1.1.1 Noise

Hazard: Exposure to excessive noise levels may lead to temporary or permanent hearing loss. Hearing protection should not be a concern for this project.

Controls: Hearing protection shall be worn by site personnel where noise levels are suspected or shown by noise level meter monitoring to exceed 85 dBA. In the event that a new noise hazard, such as a new piece of equipment, is brought on-site, the SSHO will test the equipment or work area for this hazard. Areas in which noise levels are greater than 85 dBA will be posted as “Noise Hazard Areas—Hearing Protection Required.”

4.1.1.2 Site working conditions hazards

Hazards: Because of the nature of the site and because the sampling work will take place indoors, physical hazards are limited. These hazards include, but are not limited to, slips, trips, and falls.

Controls: Personnel should be aware of site hazards and site conditions. Minimum PPE (Level D) for support zone operations should include work clothing, hard-toed footwear, and safety glasses. Level B PPE will be worn in the EZ during sampling activities.

4.1.1.3 Overhead power lines

Hazards: Overhead power lines pose a hazard for the operation of equipment when there is the possibility of contact. The overhead power lines will only be a concern in the project when moving the sample building to the next storage facility.

Controls: A 10-ft minimum clearance shall be maintained from all lines 50 kV or greater. If the appropriate clearance cannot be maintained, the power lines shall be de-energized. Positioning of the trailer will be the responsibility of the Facility Manager and the SSHO. Once in place, the containment building will be grounded at each site.

4.1.1.4 Temperature extremes

The prefabricated containment building will be equipped with heating and air conditioning and should provide an efficient temperature controlled atmosphere. The hazard of heat and cold stress should not be a concern. If however, the stresses associated with the use of Level B PPE cause heat stress to become a concern, American Conference of Governmental Industrial Hygienists (ACGIH) guidelines will be followed.

4.1.2 Chemical Hazards

Many different types of chemical hazards may be present in the waste drums undergoing characterization. Because of the lack of sufficient data on the drums to be sampled, detailed evaluation of the chemical hazards is not possible at this time. These chemical hazards will have various origins or functions and will be minimized through the use of engineering controls, chemical monitoring, work practice controls, and use of Level B PPE, as mandated by the SSHO and this HASP.

4.1.3 Radiological Hazards

Radiological contamination will be assessed by a review of site characterization information and anticipated work activities by the site RCT. On-site monitoring for detection of contamination levels will be performed by the site RCT or an approved representative. Radiological hazards will be minimized by the use of time, distance, and shielding, as well as the use of PPE and on-site frisking, as mandated by this HASP. Maximum contamination guides for frisking equipment released to a Controlled Area are contained in Table 2. Skin and personal clothing contamination limits shall be the same as the total contamination limits in Table 2, except that averaging shall not be allowed. Personal clothing will not be worn in contaminated areas (except for underwear and socks). Personnel will be provided the level of PPE deemed appropriate by the site RCT and the SSHO. Details of control methods, in addition to those listed above, to be used in site operations to reduce the potential for personnel exposure shall be included in this plan. See Table 3 for detailed information on suspected radionuclide contaminants.

4.1.4 Other Hazards

4.1.4.1 Ergonomics

The interaction of personnel with their working environment at this site may also present potential hazards such as the incorrect lifting of heavy loads, equipment vibrations, or improper body positioning. All of the aforementioned conditions are potential factors in site operations. Personnel should always position themselves properly, lift from the legs when lifting equipment or heavy objects, and rely on the buddy system for assistance in lifting loads that are too heavy for one person. Back strain, the most common ergonomic hazard in the field, may be avoided if site workers ask for assistance when they need it. A maximum one-person lift will be limited to 50 lbs.

Table 2. Surface radioactivity values

Nuclide ^a	Removable (dpm/100 cm ²) ^b	Total (fixed + removable) (dpm/100 cm ²) ^c
U-natural, ²³⁵ U, ²³⁸ U, and associated decay products	1,000 alpha	5,000 alpha
Transuranics, ²²⁶ Ra, ²²⁸ Ra, ²²⁸ Th, ²³⁰ Th, ²³¹ Pa, ²²⁷ Ac, ¹²⁵ I, ¹²⁹ I	20	500
Th-natural, ²³² Th, ⁹⁰ Sr, ²²³ Ra, ²²⁴ Ra, ²³² U, ¹²⁶ I, ¹³¹ I, ¹³³ I	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except ⁹⁰ Sr and others noted above. Includes mixed fission products containing ⁹⁰ Sr.	1,000 beta-gamma	5,000 beta-gamma
Tritium organic compounds, surfaces contaminated by HT, HTO, and metal tritide aerosols	10,000	10,000

^aThe values in this table apply to radioactive contamination deposited on, but not incorporated into, the interior of the contaminated item. Where contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for the alpha and beta-gamma emitting nuclides apply independently.

^bThe amount of removable radioactive material per 100 cm² of surface area should be determined by smearing the area with dry filter or absorbent paper while applying moderate pressure and then assessing the amount of radioactive material on the smear with an appropriate instrument of known efficiency. For objects with a surface area less than 100 cm², the entire surface should be smeared, and the activity per unit area should be based on the actual surface area. Except for transuranics, ²²⁸Ra, ²²⁷Ac, ²²⁸Th, ²³⁰Th, ²³¹Pa, and alpha emitters, it is not necessary to use smearing techniques to measure removable contamination levels if direct scan surveys indicate that the total residual contamination levels are below the values for removable contamination.

^cThe levels may be averaged over 1 m² provided the maximum activity in any area of 100 cm² is less than three times the values in Table 2.

Table 3. Characteristics of suspected radionuclide contaminants in the drums

Contaminant	DAC ^a			Critical target organs ^c
	D ^b ($\mu\text{Ci/mL}$)	W ^b ($\mu\text{Ci/mL}$)	Y ^b ($\mu\text{Ci/mL}$)	
MANMADE RADIONUCLIDES				
Tritium (water)	2×10^{-5}	2×10^{-5}	2×10^{-5}	Whole body

^aDerived air concentrations (DACs) for occupational exposure are based on either a stochastic (committed effective dose equivalent) of 5 rem/year or a nonstochastic (organ specific) dose limit of 15 rem/year to the lens of the eye and 50 rem/year to any other organ, tissue, or extremity of the body, which ever is more limiting.

^bThe DACs include three lung retention classes: D - daily, W - weekly, and Y - yearly. This classification refers to the approximate length of retention in the pulmonary region. Thus, the range of half-times is less than 10 days for class D, from 10 to 100 days for class W, and greater than 100 days for class Y.

^cCritical target organs based on exposure-to-dose conversion factors for inhalation.

Source for DACs: 10 CFR 835 December 14, 1993. *Occupational Radiation Protection; Final Rule.*

Source for critical target organs: Eckerman, K. F., et al. 1988. *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, Federal Guidance Report No. 11, EPA-520/1-88-020, U.S. EPA, Office of Radiation Programs, Washington, D.C.

4.1.4.2 Drum handling

Also see Sect. 2.1.3.

Hazards: Exposure to toxic/hazardous vapors, rupture of drums.

Controls:

- Use nonsparking hand tools.
- Use a drum lid containment device.
- Pressurized drums should not be handled until pressure can be relieved.
- Where explosive or shock-sensitive material is suspected, every effort should be made to handle the drum remotely.

4.1.4.3 Shock-Sensitive Material (Laboratory Packs)

Solid drums that contain laboratory packs and need further characterization must be treated as shock-sensitive wastes and handled in accordance with 29 CFR 1910.120, subpart j. The following criteria must be met:

- All nonessential employees shall be evacuated from the area of transport.

Control: The CRZ zone will be cleared of crew members during laboratory pack sampling efforts. Only the samplers and the SSHO will be allowed in the EZ.

- Material handling equipment shall be provided with protective shields to protect the operator.

Control: All laboratory packs will be handled remotely with G-Model manipulators. Two 0.5-in. pieces of Lexan™ will be used between the drum being sampled and the manipulator operator.

- An employee alarm system shall be used to signal the commencement and completion of handling activities.

Control: A small, hand-held air horn will be used by the samplers to signal the start of activities (1 blast) and the end of activities (2 blasts).

- Continuous communications (devices) shall be maintained between the employees in the handling area, the SSHO, and the people in the support area.

Control: Portable communication devices (radios/cellular phone) will be maintained in the containment trailer at all times.

- An individual knowledgeable in the inspection, classification, and segregation of the containers within the pack must be present on-site.

Control: A portable video camera will be mounted in the containment trailer, and all items removed from laboratory packs will be recorded. A monitor will be set up in the support zone and will be watched by a knowledgeable person. Information concerning segregation will be communicated to the samplers.

- All laboratory packs will be considered to contain shock-sensitive wastes until characterized.

Control: All drums containing laboratory packs will be labeled as shock-sensitive wastes until sample analysis is performed.

4.1.4.4 Flammable materials

Hazards: Flammable materials pose fire/explosion hazards if ignition sources are present.

Controls:

- No smoking or open flames shall be permitted within 50 ft of stored flammable materials.
- The area is to be evacuated if readings of 10% of the Lower Explosive Limit (LEL) are recorded.

4.1.4.5 Compressed gases and systems

The use of a pressure-demand, air-line respirator with an escape self-contained breathing apparatus (SCBA) will be required in the EZ during sampling activities. The air-line respirator will have an air line attached to air cylinders. Also, a cylinder connected to an air hose to power the remote pneumatic plunger will be used to breach any pressurized drums.

Hazards:

- Discharge of flying objects such as dust and dirt from the cylinder valve upon opening.
- Personnel being struck by a whipping air hose.
- Damaged cylinder or valve resulting in the cylinder becoming an airborne projectile.

Controls:

- Cylinders shall be stored upright and properly secured with chains, bar, brackets, or other approved devices to prevent them from falling.
- Segments of air hose shall be secured so they will not become separated.
- Safety glasses and gloves shall be worn by site personnel when handling and assembling compressed gas cylinders or systems.
- Hoses will not be located where they may be run over by vehicular or foot traffic.
- Cylinders shall be stored at least 20 ft from highly combustible materials.

5. SITE ACCESS REQUIREMENTS

The minimum requirements for site access are listed below. The health and safety training complies with the requirements specified in 29 CFR 1910.120. All training requirements presented in this HASP can be fulfilled only by taking training courses that have been reviewed for equivalency by the Energy Systems training program.

- The Facility Manager will have final control over site access.
- All personnel other than facility visitors at ORNL are required to have General Employee Training (GET).
- All visitors and guests are required to see the video, "Site Access Orientation for Visitors and Guests," shown in the lobby at Building 4500N.
- All personnel with access to the site are required to have a minimum of 24 hours of health and safety training per 29 CFR 1910.120(e) (HAZWOPER training) and a radiation worker training course.
- All personnel who will be performing work as hazardous waste site workers at the site are required to have a minimum of 24 hours of HAZWOPER training, one day of work experience, and a radiation worker training course. Sampling the drums will require use of a pressure demand supplied air respirator with an escape SCBA; therefore, the sampling crew must have 40 hours of HAZWOPER training, three days work experience, radiation worker training, respirator fit test and training, and training on pressure demand supplied air respirators with an escape SCBA.
- All visitors who are granted site access are required to be escorted at all times by a WMRAD representative who meets the above-stated access requirements. Additionally, visitors are to abide by all requirements of the HASP.

5.1 WORKER TRAINING REQUIREMENTS

The requirements for worker training for projects conducted under this HASP shall be determined by the anticipated role of the worker and the tasks that he or she is required to perform. Minimum training requirements for entry into a site for routine or occasional workers, CRZ or EZ workers (Levels B, C, and D workers), on-site supervisors, and nonworkers or site visitors are listed in Table 4. The regulatory basis for the requirements presented in Table 4 is stated in 29 CFR 1910.120. The presentation of this information was adapted from the *OSHA Training Requirements for Hazardous Waste Operations*, produced by DOE.

Training requirements shall be dictated by 29 CFR 1910.120(e), 29 CFR 1926, and any other regulatory standards that would be applicable to site operations. The SSHO will be responsible for verifying task-specific training for workers on certain equipment.

Table 4. Site training requirements

Operation/ personnel	Site health & safety briefing	SCBA air-line respir- ator	24-h	40-h	8-hr super- visor	8- refresh -er ^d	CPR/ first aid	Rad work er II
Routine/occasional worker	X		X ^b	X		X		X
Routine/occasional worker (Level D)	X		X			X		X
On-site supervisor/ SSHO	X	X	X ^c	X	X	X	X	X
Nonworker/visitor ^{d,e}								
Level A or B PPE ^f	X	X		X		X		X
Level C PPE	X			X		X		X
Level D or No PPE	X		X					

^aAnnual requirement; however, personnel not receiving refresher training within 3 years of initial training or last refresher course (at a minimum) should repeat the initial course.

^b24-h training is adequate for workers *only* for entry into areas where Level D PPE is sufficient. For routine workers, area must also have been monitored and fully characterized.

^cSupervisors of on-site workers who require only the 24-h course need only take the 24-h initial and 8-h supervisor courses.

^dIf the area visited and time at the site pose a radiological concern, as determined by the HP, visitors should be issued and instructed on the use of required PPE, receive a site-specific safety briefing, be escorted by trained personnel, and wear a personal dosimeter.

^eNonworkers are DOE employees and DOE contractors not directly involved with hazardous waste or MSRE operations (e.g., management, audit, and oversight personnel). Visitors include those covered and not covered by OSHA.

^fPPE - Personal Protective Equipment

5.1.1 Training Documentation

Training received outside ORNL or Energy Systems must be reviewed by the Center for Continuing Education. Acceptable forms of documentation of worker training will be up-to-date certificates of training for all completed courses that are required for site access and operations. An ORNL Special Access Training card and an up-to-date respiratory fit-test card will serve as acceptable forms of training documentation, as applicable. Training records will be maintained by the SSHOs.

5.2 PRE-ENTRY HEALTH AND SAFETY BRIEFING

As a requirement for access to the work site, all site personnel and any visitors shall be required to attend a pre-entry health and safety briefing. This pre-entry health and safety briefing shall be conducted jointly by the SSHO and the site RCT or by designated representatives who have been approved by the SSHO and the site RCT. The pre-entry health and safety briefing shall highlight the health and safety information presented in this HASP and the information contained in the work plan (Sect. 2). This information may include, but is not limited to,

- site history;
- site access requirements;
- site chemical hazards and symptoms of exposure;
- site physical and mechanical hazards and recognition of hazards;
- personnel and equipment decontamination requirements;
- key personnel;
- location of communications equipment, "clean" areas or break areas, and rest rooms;
- location of the site emergency assembly point and evacuation route;
- emergency contacts;
- emergency procedures;
- spill response procedures; and
- location of the site emergency action plan.

Attendance at the initial pre-entry health and safety briefings will be documented by signature of all personnel present at the briefing.

5.3 PERSONAL PROTECTION REQUIREMENTS

5.3.1 Respiratory Protection

All respiratory equipment shall be approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration. All personnel required to use respiratory protection shall have an up-to-date quantitative respirator fit test and will wear only those respirators approved by the quantitative fit test. In addition, training on pressure demand supplied air respirators with an escape SCBA will be required. Site personnel will abide by a single-use respiratory policy or other recommendations from the Office of Safety and Health Protection (OSHP) respiratory protection section. Once the face-to-facepiece seal of the respirator has been broken (e.g., for lunch and other breaks), a new respirator will be donned in place of the previous one. No site personnel will be issued a respirator without a valid respirator card. Respirators will only be issued by qualified issuing personnel. The SSHO will verify the qualifications of issuers.

Personnel at the site will comply with the ORNL respiratory protection program, which meets the requirements of 29 CFR 1910.134, as described in OSHP-006.

5.3.2 Personal Protective Equipment

The SSHO shall specify the PPE required for site activities, tasks, and work zones. This specification shall be based on possible site contaminants, OSHA guidelines, and chemical and radiological hazards information and guidance from the Office of Radiation Protection and the SHEST. The SSHO shall instruct all site personnel in donning and doffing procedures before beginning any site activities. Chemical PPE required may include, but is not limited to, the ensembles listed below.

5.3.2.1 Level B protection

Recommended equipment includes

- pressure-demand supplied-air respirator with escape SCBA;
- chemical-resistant clothing (overalls and long-sleeved jacket; hooded one- or two-piece chemical splash suit; disposable, chemical-resistant, one-piece suit);
- inner and outer chemical-resistant gloves;
- chemical-resistant safety boots/shoes;
- hard hat; and
- two-way radio communications.

Optional equipment includes

- coveralls,
- disposable boot covers,
- face shield, and
- long cotton underwear.

Protection provided includes

- the same level of respiratory protection, but less skin protection than that provided by Level A.

Level B protection is the minimum level recommended for initial site entry until the hazards have been further identified. Level B protection should be used when the type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres:

- with IDLH concentrations of specific substances that do not represent a severe skin hazard, *or* that do not meet the criteria for using air-purifying respirators;
- that contain less than 19.5 percent oxygen; and
- in which the presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

The criteria limiting use of Level B protection are:

- use only when the vapor or gases present are not suspected of containing high concentrations of chemicals harmful to the skin or are capable of being absorbed through the intact skin, and

- use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates or splashes of material that will affect exposed skin.

5.3.2.2 Level D protection

Recommended equipment includes

- coveralls,
- safety boots/shoes,
- safety glasses or chemical splash goggles,
- hard hat,
- gloves, and
- face shield.

Protection provided includes

- minimal skin protection; no respiratory protection.

Level D protection should be used when

- the atmosphere contains no known hazard, or
- work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

The criteria limiting use of Level D protection are:

- the atmosphere must contain at least 19.5 percent oxygen, and
- this level should not be worn in the exclusion zone.

5.3.3 Revisions/Modifications to the HASP

The following will warrant revision and approval of this plan by the appropriate health and safety disciplines.

- Change in tasks (or previously unidentified tasks) that would impact employee health and safety.
- Change in SSHO—if the SSHO is replaced with an individual who has not been reviewed/approved to serve as an SSHO.
- Changes in hazards (unknown or not previously addressed) *which require a significant change in, or addition to*, respiration protection, physical/barrier protection features, or other engineering controls.
- Occurrences as defined by DOE Order 5000.3B.

5.3.3.1 Modifications allowed for radiological conditions

Under the direction of the RCT, the level of PPE *may be upgraded*, including the use of air-purifying respirators, for radiological issues. The change and reason or evidence for the change must be documented in the field logbook. Any upgrade to the level of PPE beyond air-purifying respirators will require additional review/approval from the health and safety disciplines and revision of this plan.

Under the direction of the RCT, the level of PPE *may be downgraded*, except for downgrade from supplied air to air-purifying respirator protection, for radiological issues. The change and reason or evidence for the change must be documented in the field logbook. Any downgrades from supplied air respiratory protection will require additional review/approval from the health and safety disciplines and revision of this plan.

5.3.3.2 Modifications allowed for nonradiological conditions

The SSHO may upgrade PPE for nonradiological issues and contaminants, and these changes must be documented in the field logbook. The change and reason or evidence for the change must also be documented in the field logbook. For upgrades to include respiratory protection (including air-purifying and supplied air) for previously unidentified nonradiological issues or contaminants, the appropriate health and safety disciplines must be contacted. The SSHO will approve and document changes in PPE in the field logbook.

Upgrades to include respiratory protection will require the SSHO to ensure workers have 40-hour HAZWOPER training and to assess any additional medical surveillance requirements. Additionally, upgrades in PPE will require a review by the HAZWOPER Program Coordinator to ensure the SSHO meets the "level" of SSHO for the site.

All site workers will be made aware of the upgrade or downgrade and shall be provided updated procedures for donning/doffing and decontamination activities.

5.3.4 Donning and Doffing Personal Protective Equipment

Procedures for donning and doffing PPE will be dependent upon the type of ensemble required to control worker exposures during anticipated site operations. General donning and doffing procedures are listed below. Specific procedures shall be determined by the SSHO or RCT, and if different from the procedures listed here, a Field Change Request/Variance Form will be completed to address the changes in procedures.

5.3.4.1 Sample donning procedure

- Inspect the clothing and respiratory equipment before donning.
- Adjust hard hat or headpiece if worn, to fit user's head.
- Standing or sitting, step into the legs of the suit; ensure proper placement of the feet within the suit; then gather the suit around the waist.

- Put on chemical-resistant safety boots over the feet of the suit, and tape the leg cuff over the tops of the boots.
 - If additional chemical-resistant boots are required, put these on now.
 - Some one-piece suits have heavy-soled protective feet. With these suits, wear short, chemical-resistant safety boots inside the suit.
- Depending on type of suit,
 - Put on long sleeved inner gloves (similar to surgical gloves).
 - Secure gloves to sleeves, for suits with detachable gloves.
 - Additional overgloves, worn over attached suit gloves, may be donned later.
- Put sleeves of suit over arms, and pull suit up around the shoulders.
- Don respirator facepiece; perform positive and negative pressure facepiece seal test. When using MSA DUO-TWIN™ facepiece, don the mask with the D/P valve in the negative pressure position.
- Raise hood over head carefully so as not to disrupt face seal of respirator. Adjust hood to give satisfactory comfort.
- Put on hard hat, if needed.
- Connect the air line.
- Have assistant check all closures.
- Upon entering the EZ, switch the D/P valve to the positive pressure position.
- Have assistant observe the wearer for a period of time to ensure that the wearer is comfortable and stable and that the equipment is functioning properly.

5.3.4.2 Sample doffing procedure

If sufficient air supply is available to allow appropriate decontamination before removal,

- Remove any extraneous or disposable clothing, boot covers, outer gloves, and tape.
- Have assistant loosen and remove the wearer's safety shoes or boots.
- Have assistant open the suit completely and lift the hood over the head of the wearer.
- Remove arms, one at a time, from suit. Once arms are free, lay the suit out flat behind the wearer. Leave internal gloves on, if any.
- Sitting, if possible, remove both legs from the suit.

- After suit is removed, remove internal gloves by rolling them off the hand, inside out.
- Remove internal clothing and thoroughly cleanse the body.

These doffing procedures should be performed only after decontamination of the suited worker. They require a suitably attired assistant. Throughout the procedures, both worker and assistant should avoid any direct contact with the outside surface of the suit.

5.4 MEDICAL SURVEILLANCE

5.4.1 HAZWOPER Physical

According to the requirements of 29 CFR 1910.120, site personnel who meet the criteria listed below must have a physical examination conducted by a physician to determine and document the qualification of the worker to perform work at hazardous waste operations.

- Employees who are, or may be, exposed to PELs of hazardous substances or health hazards for 30 or more days a year;
- Employees who wear a respirator for 30 or more days a year;
- Members of organized HAZMAT teams; and
- Employees who are injured as a result of overexposure during a site emergency, or who show symptoms of illness that may have resulted from exposure to hazardous substances.

The HAZWOPER Coordinator or representative of the SHEST organization, in conjunction with the ORNL Health Division, will determine which workers meeting the criteria listed above will be required to participate in the hazardous waste worker medical surveillance program. Physical examinations shall be documented through a written approval by the examining physician.

5.4.2 Medical Monitoring

The requirements for additional medical monitoring of worker exposures shall be dictated by the requirements of 29 CFR 1910 and the procedures and exposure control programs of ORNL OSHP. Medical monitoring for ORNL employees shall be performed through the Health Services Division of ORNL and shall be coordinated with ORNL OSHP. Subcontractors must provide/obtain medical services elsewhere. The frequency of bioassay measurements has been set by Energy Systems for workers in radiological areas.

6. FREQUENCY AND TYPES OF MONITORING

6.1 EXPOSURE MONITORING

6.1.1 Area Monitoring

Continuous, real-time assessment of potentially hazardous chemical and radiological concentrations using direct-reading instruments will be performed by the SSHO or approved designee while operations are being conducted within the EZ. While work is being performed in the EZ, monitoring will be performed on a routine basis. Monitoring will be performed before opening a drum, while opening the drum, periodically during sampling, and before the drum is removed from the trailer. All readings will be recorded in the site logbook. To obtain accurate results, daily background readings shall be taken away from areas of potential contamination. Background readings shall be taken into account before action levels are established by the RCT and the SSHOs.

6.1.2 Dosimetry

All site entrants shall comply with all provisions of the requirements of the ORNL Radiation Dosimetry program. The facility RCT, based on the characterization of the site, will inform the workers of the radionuclides of concern.

6.2 MONITORING EQUIPMENT/ACTION LEVELS

Various types of monitoring equipment may be required to conduct worker exposure monitoring during these operations. The SSHO shall ensure that adequate monitoring equipment is available before work starts. The SSHO shall ensure that the instruments are used only by persons with training and experience in the care, operation, calibration, and limitations of the equipment. Work involving potential exposure to hazardous materials shall not be performed unless properly maintained and calibrated monitoring instruments are available for use.

Instrumentation such as the following may be used to identify the presence of and/or to quantify the potential health hazards in existence at the site:

- **Combustible Gas/Oxygen Meter:** To measure combustible gases and oxygen content in confined spaces, trenches, and other areas that may have limited ventilation. All instruments used should be fully automatic, self adjusting, and shall have the capability of detecting oxygen, hydrogen sulfide, and carbon monoxide concentrations. The instrument shall be precalibrated with standard gases of known concentrations prior to field use. The prescribed action limits for the instrument shall be as follows:

LEL	≥ 10% (5% LEL for confined spaces)
O ₂	≤ 19.5 % or ≥ 22%
H ₂ S	5.0 ppm
CO	12.5 ppm

- **Organic Vapor Monitors:** Photoionization detector (PID) or flame ionization detector (FID) to survey for possible organic contamination. The instrument is not chemical-specific; therefore, it can only indicate the presence of volatile organics that are detectable in the range of the instrument. Action level is 10 ppm for 30 sec in the breathing zone, or a reading of 50 ppm in the breathing zone. If the action level is reached, the area will be evacuated and the LSS and the SHEST organization will be notified.
- **Noise Monitoring Equipment:** To identify "problem" noise areas and equipment. These instruments will be calibrated before and after use. Action level is 85 dBA.
- **Personal Thermoluminescent Dosimeter and Direct-reading Pocket Dosimeters:** Issued to each employee through ORNL Radiation Protection programs to monitor worker beta/gamma exposures. The administrative limit for worker exposure is 20 mrem/day.
- **Portable Alpha and Beta-Gamma Survey Meters:** Used to survey for radioactive contamination on personnel and equipment. These instruments will be source checked daily and calibrated at least semi-annually. Action levels are surface radioactivity values listed in Table 2.

6.3 CALIBRATION REQUIREMENTS

All monitoring instruments used during field operations will be calibrated within the proper time-frame and in accordance with manufacturer's recommendations and specifications described in the manufacturer's standard operating procedures. All instrumentation operation and calibration will be conducted in accordance with MAD guidelines and RP and OSHP procedures, where applicable and available.

All chemical instrument calibration gas cylinders used in field calibrations must have a manufacturer's label containing lot number, manufacturer, type of gas, and the concentration or percent of gas contained within the cylinder. Calibration readings, information off of the gas cylinder label, and each number of the radiological source used will be recorded on the Daily Instrumentation Calibration Check Sheet section of the project logbook. Other instrumentation information such as instrument maintenance and instrument failures will also be recorded in this section.

6.4 MONITORING RESPONSE GUIDELINES

During site operations, the decision to upgrade or downgrade PPE levels, re-establish site zoning, or cease work activities may be made on the basis of site monitoring results. These changes can only be authorized by site personnel, including the SSHO, the site RCT, and a representative from the SHEST organization. These response guidelines are dependent upon the task being conducted, the suspected contaminants, and the health effects and toxicity of the contaminants. Given the level of PPE (Level B) used for this task, the following action levels will be used for the evaluation of the adequacy of the PPE and the continuation of work activities. A reading of 10 ppm for 30 seconds in the breathing zone, or 50 ppm in the

breathing zone, will cause an immediate withdrawal of the workers from the area. The LSS and the SHEST organization will be notified. The conditions of the work area will be sampled and the chemical identified before work will resume.

7. SITE ZONES AND CONTROL MEASURES

Where there is a potential for employee exposure to hazardous chemicals or radiation, or the accidental spread of hazardous substances to clean areas, work zones will be established to separate certain operations and to control the flow of personnel and equipment. The establishment of work zones will help ensure that personnel are properly protected against hazards at the work site, that work activities and contamination are confined to the appropriate area, and that personnel can be evacuated and accounted for in the event of an emergency.

7.1 WORK ZONES

Work zones will be cordoned off with HAZWOPER (orange and black) flagging, and HAZWOPER signs will be placed to facilitate recognition of each zone. The following sections will be used to determine the work zones for each site. The posting of work zones may be modified to accommodate ORNL RP procedures and requirements.

The SSHO and the facility RCT (if needed) shall establish these zones. The SSHO will modify these zones as necessary to meet the conditions of the site. The SSHO will also control access to and from the EZ and the CRZ. The SSHO and the facility RCT will periodically monitor the perimeter of the zones to ensure their effectiveness.

The site control zones will be isolated from the rest of the work site by use of rope, fences, barricades, or warning signs. No person will enter the EZ or CRZ without proof of sufficient training and appropriate medical clearance as required by this plan and 29 CFR 1910.120. A daily log of all persons entering and leaving the CRZ will be maintained by the SSHO or designee in the project logbook maintained in the support zone.

7.1.1 Exclusion Zone

The EZ is the area where contamination does or could occur and the greatest potential for exposure exists. To separate the EZ from the rest of the site, the outer boundary of the EZ (also known as the "hotline") shall be designated by the SSHO and clearly marked. All persons who enter the EZ will have the prescribed level of protective clothing and training and be placed on the medical monitoring program, as determined by the SSHO and specified in this plan. An entry and exit corridor will be visually defined at the periphery of the EZ to regulate the flow of personnel and equipment into and out of the zone.

Prohibited items and conduct in the EZ include, but are not limited to, the following:

- Beards, stubble, and long sideburns (for those for whom respiratory protection is required).
- Eating, drinking, tobacco products, or chewing gum.

- Failure to inform the SSHO of any personal illness that could affect safety or cause health-related complications.
- Personal clothing (with the exception of underclothing and socks) because potential contact with chemical/radiological contamination is possible; only company clothing will be allowed under PPE in these conditions.
- Removal of respiratory protective equipment except when exiting the EZ through the decontamination line set up in the contamination reduction corridor (CRC), if needed.
- Access to the EZ by any individual not having the required health and safety training or not in the medical monitoring program in accordance with OSHA regulations 29 CFR 1910.120(e)1 and (e)2.
- Any individual who does not possess the appropriate credentials to gain entrance to the work zones.
- Any conduct or item thought to be potentially dangerous to the well-being of personnel.
- Application of insect spray, sunscreen, or cosmetics (because of possible chemical interactions with substances on-site).

7.1.2 Contamination Reduction Zone

As the transition area between the contaminated area and the clean area, the CRZ is the area in which decontamination procedures take place. This zone is designed to reduce the probability that the support zone will become contaminated or affected by other site hazards. The SSHO will establish and clearly mark the CRC within the CRZ. Each person will be monitored by the site RCT or a designated representative properly trained to evaluate hazards upon leaving the CRZ and before entering the support zone. Access requirements for personnel entering the CRZ are the same as those described for entrance to the EZ. Prohibited activities within the CRZ are the same as for the EZ, which are listed in Sect. 7.1.1.

Equipment will be surveyed for radiological contamination by the SSHO, the facility RCT, or a designee before exiting the CRZ and possibly before entering the CRZ. The site RCT performing the survey will log the results of these surveys in the daily RP log and inform the person responsible for completion of the site logbook. All equipment will be tagged by the site RCT or approved designee to show the results of the survey for radiological contamination before anything leaves the zone.

7.1.3 Support Zone

The support zone is defined as the uncontaminated area in which workers should not be exposed to hazardous conditions. The zone will be marked with flagging and appropriate signs and protected against contamination from the work site. The primary functions of the support zone are to serve as

- an entry area for personnel, material, and equipment;
- an exit area for decontaminated personnel, materials, and equipment;
- a staging area for clean safety and work equipment; and
- an area for rest breaks, the consumption of food and beverages, and all other activities.

Because the Support Zone is free from contamination, personnel working within it may wear normal work clothes, and access to and from the area is not restricted for authorized site personnel. Such personnel, however, will receive instruction in the proper evacuation procedures in the event of an emergency.

7.2 SITE COMMUNICATIONS

Several means of communication will be available for use during site operations. A camera will be mounted inside the sample building to monitor all sampling activities from the support zone. The location of the means of communication shall be addressed in the pre-entry health and safety briefing.

7.2.1 Two-Way Radios

Some personnel, such as the SSHO, the site RCT, the HAZWOPER Program Coordinator, IH, and the SPM, will have two-way radios for use in plant-wide communications. The sample crew will wear two-way radios inside their air masks and have continuous communications with personnel in the support zone. Other site personnel who will have access to two-way radios should be identified during the pre-entry health and safety briefings. Radio checks will be performed before site entry.

7.2.2 Plant Telephone System

The ORNL plant telephone system can be used to communicate within the plant by dialing the last five digits of the telephone number (e.g., 4-xxxx, 6-xxxx, 1-xxxx).

7.2.3 The Buddy System and Hand Signals

The "buddy system" as described in 29 CFR 1910.120(a)(3) shall be used during site operations and activities conducted in the CRZ and the EZ. Hand signals shall be used as the means of site communication in the support zone, the CRZ, and the EZ when distance or noise levels prevent verbal communication. Basic hand signals and their meanings during site operations are listed below.

- | | |
|----------------------------|--|
| • Thumbs up | "Okay" or "I Understand" |
| • Thumbs down | "No," "Negative," or "I Do Not Understand" |
| • Grasping buddy's wrist | "Evacuate!" or "Leave The Site Now!" |
| • Hands on top of the head | "I Need Assistance" or "Help!" |
| • Hand on the throat | "I Am Choking" or "I Can't Breathe!" |

7.3 SANITATION

7.3.1 Housekeeping

The site shall be maintained in an orderly manner. All uncontaminated waste shall be handled according to the project waste management plan. Disposable contaminated PPE will be checked and bagged by the site RCT and placed in the proper containment system.

7.3.2 Potable Water

- Cool drinking water shall be made available in a designated “clean” area.
- Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a tap.
- Containers used to distribute drinking water shall be clearly marked as to their contents and not used for any other purpose.
- When single-service cups (to be used one time) are supplied, both a sanitary container for dispensing unused cups and a receptacle for disposing of the used cups shall be provided.

7.3.3 Consumption of Food and Tobacco Products

Eating, drinking, chewing gum, and use of tobacco products on the site are confined to designated areas only. These areas will be designated by the SSHO.

Food will be handled by “clean” personnel only. As a minimum control measure, all personnel who have been in the CRZ must wash their hands before handling food. Food and beverages will be allowed only in areas designated by the SSHO.

7.3.4 Rest Room/Washing Facilities

The rest room/washing facilities will be located in designated “clean” areas or break areas which will be indicated during pre-entry health and safety briefings.

8. DECONTAMINATION PROCEDURES

8.1 PERSONNEL DECONTAMINATION

Decontamination, the process of removing or neutralizing contaminants, is critical to safety and health at hazardous waste sites. Decontamination protects workers from hazardous substances that can eventually permeate protective clothing, respiratory equipment, tools, and vehicles. It protects site personnel by minimizing the spread of hazardous substances into clean areas on-site, prevents the mixing of incompatible wastes, and protects the community by preventing the migration of contaminants from the site. Personnel engaged in hazardous waste operations may become contaminated in a number of ways, including:

- contacting vapors, gases, mists, or particulates in the air;
- being splashed by materials while sampling or opening containers; and
- using contaminated instruments or equipment.

Protective clothing and respiratory protection help prevent the wearer from becoming contaminated or inhaling hazardous substances, and good work practices help minimize contamination of PPE, instruments, and equipment. However, even with these safeguards, contamination may occur. To prevent and minimize the severity of such incidences, the HAZWOPER regulations in 29 CFR 1910.120(k) require the development of a decontamination plan before site entry, the development of standard operating procedures to minimize contamination, full decontamination of employees and equipment, and the monitoring of decontamination procedures by the SSHO.

Cross contamination from protective clothing to the wearer, from equipment to personnel, and from one area to another can be minimized by combining decontamination, the correct methods for removing contaminated PPE, and the use of site work zones.

Personnel decontamination procedures are designed to eliminate or limit the contaminated materials that workers may encounter and to limit the spread of contamination from the EZ, the CRZ, or the HAZWOPER designated zone. Decontamination procedures for PPE Levels D, D+, C, and B are described in Sects. 8.1.1 through 8.1.4. These procedures have been provided only as *guides* for personnel decontamination. Actual site conditions, PPE ensembles, and conditions may differ from those described below.

8.1.1 Level D Protection Decontamination

Station 1: Work area (EZ)

This is the area of greatest potential for exposure to site contaminants.

Station 2: Scrubbing and rinsing tools or outer garment (if reusable), boots, gloves, hard hats, and safety glasses

Scrub outer boots and gloves with a laboratory-grade detergent (Liquinox or equivalent), and rinse with potable water. Disposable boots and gloves need not be scrubbed and may be disposed of in compatible waste drums. Clean safety glasses and hard hat in the same fashion. If boots must be decontaminated, all decontamination should take place while personnel are standing in large wash tubs so that decontamination solutions can be caught and drummed in accordance with this HASP and any project waste management plan.

Equipment necessary:

- two or three washtubs
- one hand-pump sprayer
- potable water
- detergent
- scrub brushes
- paper towels
- 55-gallon drum with liner for paper towel and protective clothing disposal

Station 3: Outer garment, boots, gloves, safety glasses, and hard hat removal (CRZ)

Remove boots, gloves, safety glasses, and hard hats.

Station 4: Inner glove removal

Remove inner gloves.

Station 5: Frisking

To ensure that no radiological contamination is transferred to the support zone, personnel shall be frisked (screened for radiological contamination) by the site RCT, or by the SSHO after approval from the site RCT, before leaving the CRZ/HAZWOPER designated zone for the support zone. Frisking will be performed according to ORNL RPP-220.

Equipment necessary:

- alpha detector
- beta-gamma detector

If contamination is detected on personnel, immediately notify the site RCT and await decontamination instructions. After decontamination, repeat the frisking procedure. If contamination is still detected on skin after repeating station 5, the LSS must be notified immediately, and the worker must be taken to the Health Division.

Station 6: Field wash

Thoroughly wash hands with a soft-bristle brush and wash face with soap and water. Shower as soon as possible.

Equipment necessary:

- water
- wash basin or bucket
- soap
- sprayer for rinsing
- soft-bristle brush

Proceed to Station 7.

Station 7: Step across line

Enter the designated support zone.

8.1.2 Level D+ Protection Decontamination

Follow the steps for Level D decontamination; the only difference occurs at station 3. Remove the disposable chemical protective coverall and deposit it in a lined, 55-gallon compatible waste drum. Level D+ protective clothing is deemed necessary when operations may produce excessive splashing of surface or subsurface materials, yet the action level does not require the use of a respirator and taped, protective, chemical-resistant suits.

8.1.3 Level C Protection Decontamination**Station 1: Work area (EZ)**

This is the area of greatest potential for exposure to site contaminants.

Station 2: Scrubbing and rinsing of outer garment, boots, and gloves

Scrub outer garment (if reusable), boots, and gloves with laboratory-grade detergent and water and rinse with potable water. All wash water and rinsing solutions will be disposed of in accordance with this HASP. *Note:* This station is not necessary when disposable PPE is used.

Equipment necessary:

- washtubs
- potable water
- detergent
- scrub brushes
- sprayer for rinsing

Station 3: Outer garment, boots, and gloves removal (CRZ)

Remove outer garment, boots, and outer gloves and accompanying tape. Tape and disposable gloves should be placed in a plastic trash bag and disposed of in accordance with procedures outlined in this HASP. Reusable outer garments and boots will be placed in plastic bags for screening by the site RCT. (*Note:* This step is not necessary when disposable

PPE is used.) This equipment must be scanned and green-tagged before it may be reused. Refer to Table 2 for release limits.

Equipment necessary:
plastic trash bags
bench or stool

Station 4: Respiratory protection and disposable inner glove removal

The respirator is the next-to-last item to be removed. Cartridges or canisters are placed in a plastic trash bag and disposed of in accordance with procedures contained within this plan. The respirator is placed in a plastic bag dedicated for used respirators. Because of the single-use respirator policy, respirators may not be reused until they have been scanned and tagged by site RCT, sent to the laundry and QA, and returned to ORNL OSHP. Finally, remove disposable inner gloves and deposit them in a plastic trash bag.

Equipment necessary:
plastic trash bags

Station 5: Frisking

To ensure that no radiological contamination is transferred to the support zone, personnel shall be frisked (screened for radiological contamination) by the site RCT or by the SSHO before leaving the CRZ/HAZWOPER designated zone for the support zone.

Equipment necessary:
alpha detector
beta-gamma detector

If contamination is detected on personnel, immediately notify the site RCT and await decontamination instructions. After decontamination, repeat the frisking procedure. If contamination is still detected on the skin after several attempts to remove it, the LSS must be notified immediately, and the worker must be taken to the Health Division.

Station 6: Field wash

Wash hands and face thoroughly with soap and water and a soft-bristle brush, if necessary.

Proceed to Station 7.

Station 7: Step across line

Enter the designated support zone.

8.1.4 Level B Protection Decontamination

Station 1: Work area (EZ)

This is the area of greatest potential for exposure to site contaminants. Deposit equipment used on-site on plastic drop cloths. Segregating equipment at the drop reduces the probability of cross contamination.

Station 2: Scrubbing and rinsing of outer garment, boots, and gloves

Scrub outer garment (if reusable), boots, and gloves with laboratory-grade detergent and water and rinse with potable water. All wash water and rinsing solutions will be disposed of in accordance with this HASP. *Note:* This station is not necessary when disposable PPE is used.

Equipment necessary:

- washtubs
- potable water
- detergent
- scrub brushes
- sprayer for rinsing

Station 3: Switch from supplied air (air line) to negative-pressure cartridge (EZ at the CRZ line)

With the containment trailer door (EZ/CRZ line) open, switch the D/P valve on the MSA DUO-TWIN™ respirator facepiece from positive pressure to negative pressure. Disconnect supplied air line and exit the trailer (EZ) into the CRZ.

Station 4: Outer boots and gloves removal

Remove outer boots, outer gloves, and accompanying tape. Tape and disposable gloves should be placed in a plastic trash bag and disposed of in accordance with procedures outlined in this HASP. Reusable outer garments and boots will be placed in plastic bags for screening by the site RCT. (*Note:* This step is not necessary when disposable PPE is used.) This equipment must be scanned and green-tagged before it may be reused. Refer to Table 2 for release limits.

Equipment necessary:

- plastic trash bags
- bench or stool

Station 5: Boots and outer garment removal

Boots and the chemical-resistant splash suit are removed and deposited in separate containers lined with plastic.

Station 6: Respiratory protection and disposable inner glove removal

The respirator is the next-to-last item to be removed. Cartridges or canisters are placed in a plastic trash bag and disposed of in accordance with procedures contained within this plan. The respirator is placed in a plastic bag dedicated for used respirators. Because of the single-use respirator policy, respirators may not be reused until they have been scanned and tagged by site RCT, sent to the laundry and QA, and returned to ORNL OSHP. Finally, remove disposable inner gloves and deposit them in a plastic trash bag.

Equipment necessary:
plastic trash bags

Station 7: Frisking

To ensure that no radiological contamination is transferred to the support zone, personnel shall be frisked (screened for radiological contamination) by the site RCT or by the SSHO before leaving the CRZ/HAZWOPER designated zone for the support zone.

Equipment necessary:
alpha detector
beta-gamma detector

If contamination is detected on personnel, immediately notify the site RCT and await decontamination instructions. After decontamination, repeat the frisking procedure. If contamination is still detected on the skin after several attempts to remove it, the LSS must be notified immediately, and the worker must be taken to the Health Division.

Station 8: Field wash

Wash hands and face thoroughly with soap and water and a soft-bristle brush, if necessary.

Proceed to Station 7.

Station 9: Step across line

Enter the designated support zone.

8.2 EQUIPMENT DECONTAMINATION

Equipment decontamination procedures will be performed under the direction of the site RCT. General decontamination procedures are listed below:

- In the decontamination area, instruments and hand tools will be cleaned with soap and water using a brush and rinsed in potable water. *Note:* Follow manufacturer's instructions for monitoring instruments.

- Tools will be placed in a specified area lined with plastic to air dry.
- After drying, the tools will be frisked by the IH/RP technician for contamination. Contamination levels must meet release limits listed in Table 2.
- If contamination remains, repeat the procedure using a diluted cleaner such as 409™.

9. STANDARD OPERATING PROCEDURES

All standard operating procedures shall be in accordance with established ORNL procedures and guidelines applicable to site operations.

10. EMERGENCY PREPAREDNESS AND CONTINGENCY PLANS

This section applies to any type of emergency, such as a fire or explosion, radiation, or chemical exposure, personal injury, or other types of emergencies, that may be encountered by site personnel during work efforts being conducted at the site. The information presented in this section was compiled from the Radiation Worker Training and the General Employee Training and should be in concert with the X-10 Site Emergency Plan, which defines emergency response requirements and responsibilities.

10.1 EMERGENCY CONTACTS AND NOTIFICATIONS

A listing of telephone and radio numbers for emergency contacts shall be provided and shall be posted during all site operations in a designated location that is easily accessible to all site personnel. These emergency telephone numbers shall include, but are not limited to, the following ORNL entities:

Emergency contacts	Phone number	Radio number
ORNL Emergency Response	911	295
Lab Shift Superintendent	574-6606	Station 103 or 295
Fire Department	574-5678	295
ORNL Medical	574-7431	295
Security	574-6646	401
Radiation Protection	574-6700	218
Environmental Compliance	574-8770	650
HAZWOPER Program	576-6445	73
SHEST Representative	576-6445	73
Facility Manager	574-5901	

The LSS has responsibility for overall site shift operations and acts as the emergency director in the event of an emergency. The LSS evaluates or determines how to evaluate an emergency situation and directs remedial actions, taking into consideration risks versus benefits of emergency response actions, potential for exposure, possible biological consequences, and the anticipated number of persons potentially affected. The Emergency Control Center (ECC) is the ORNL site control center to which emergency situations can be reported and from which emergency response activities are coordinated and dispatched.

10.1.1 Site Personnel Responsibilities

The minimum requirements of an individual during an emergency situation are to know the following about his or her work area:

- The location of site emergency exit routes.
- The location of the nearest fire alarm pull box and fire extinguisher. Fire extinguishers should only be used by personnel who know how to operate them safely, in addition to knowing the type of fire (e.g., electrical, petroleum product, wood) and the appropriate type of fire extinguisher to be used under the existing conditions.
- The location of other emergency equipment such as first aid kits, stretchers, emergency SCBA, eye wash stations, emergency showers, and spill kits or other spill containment supplies and equipment.
- The location of the nearest telephone or other means of communication such as radio or cellular telephone.

10.1.2 Reporting An Emergency

Upon discovering an emergency situation, an individual must immediately take action to initiate emergency response activities. This involves the individual first removing him or herself from immediate danger, then notifying the LSS and/or the laboratory ECC of the emergency situation so that the emergency response system can be activated.

10.1.2.1 Summoning assistance by telephone

1. The plant telephone system can be used to initiate emergency response actions by dialing the numbers listed below.

Site	Office	Number	Radio
ORNL	LSS	574-6606	294/295 or Station 103
	ECC	574-6646	294/295

2. The Emergency Medical Services (EMS) network on the plant telephone system serves as a direct method for contacting the ECC and is monitored during all shifts by the LSS and by the ORNL Health Services offices during day shift. The EMS network can be used as a method of communication and to summon emergency service units during emergencies at each facility by dialing 911.

3. Once the LSS office or the ECC has been contacted, the following information should be given over the telephone before the caller hangs up:

- a. A description of the type of emergency.
- b. The location of the emergency.
- c. The identity and location of the caller reporting the emergency.
- d. Whether an ambulance may be needed if personnel have been injured.

4. Before ending the conversation, the caller should listen for any instructions and answer any questions the LSS office may have. The LSS office should be the party that ends the communication.

10.1.2.2 Summoning assistance by fire alarm pull boxes

In addition, help can also be summoned immediately by pulling a fire alarm. Fire alarm pull boxes are generally located in every building, as well as in other posted areas. The exact location of fire alarm pull boxes should be addressed in the pre-entry health and safety briefings.

Pulling a fire alarm results in the automatic transmission of the location from which the alarm was sounded to the ORNL Fire Department, LSS Office, and the ECC, whose dispatcher immediately dispatches other emergency service units such as security, ambulance, and radiation protection. If conditions are not life-threatening to the person who sounded the alarm, he/she should remain at the location where the alarm was sounded to direct emergency personnel to the location of the emergency and to provide additional information as necessary.

10.1.2.3 Summoning assistance by radio

The LSS office can also be notified of emergency situations by radio. The LSS office monitors facility radio networks and can be contacted by announcing over the air on any network your identification and saying, "Emergency, emergency! Over." The information listed in Sect. 10.1.2.1, item 3, should be conveyed to the LSS office.

10.1.3 Emergency Coordinator

In the event of an emergency situation, the SSHO will act as the site emergency coordinator. Upon the arrival of ORNL emergency support staff (e.g., the Fire Department, the Health Division, or Spill Response), the SSHO will relinquish authority to the incident commander of the ORNL support staff.

10.1.4 Emergency Actions for Site Personnel

The immediate and appropriate actions required of an individual during an emergency situation are the following:

1. Summon help immediately by reporting the emergency to the LSS, SSHO, SPM, or other authority.
2. Bring the emergency under control, if it can be done safely.
3. Contact the local area or building emergency supervisor, warden, or searcher.
4. Sound the area, building, or facility evacuation alarm, as warranted.
5. Meet and orient emergency response units.

10.2 EMERGENCY ACTION PLANS

10.2.1 Emergency Alarm Systems at ORNL

It is the responsibility of any site personnel during an emergency situation to activate appropriate emergency alarm systems such as building evacuation and fire alarms, when applicable during an emergency, or plant-wide alarms, when necessary.

Personnel should be familiar with the correct actions to be taken in response to any plant, facility, or area alarm. To hear an audio tape of the alarms described below, dial 4-4462 from the plant system telephone.

10.2.1.1 Standard alerting tone

The standard alerting tone is an alternating high-low tone that is followed by a Public Address (PA) system announcement and/or instructions.

10.2.1.2 Laboratory evacuation alarm

The laboratory evacuation alarm is a continuous 30-second warbling wail that is followed by PA instructions for the safest exit routes from the laboratory.

10.2.1.3 Edwards horn alarm

The Edwards horn alarm is a loud, continuous buzzer that functions as a fire alarm or local building evacuation alarm. Building or area occupants should immediately exit to the local assembly point through the designated evacuation routes.

10.2.1.4 Radiation emergency alarm

The local radiation emergency alarm is a clarion siren which is similar to the sound of an air raid siren or a locomotive whistle. This alarm is the signal for immediate evacuation of an area or building. This alarm is often accompanied by flashing, rotating red or magenta beacon lights. Building occupants should exit by the shortest route and proceed to the local assembly point for further instructions. Site occupants should progress to the local assembly point through the designated evacuation route. Personnel should not re-enter the building or area under any circumstances.

10.2.1.5 All clear signal

The all clear signal is an announcement given over the PA system that indicates that it is safe for personnel to return to work areas and resume normal activities.

10.2.2 Emergency Assembly Points

An emergency assembly point shall be designated for each project. The location of the assembly point shall be addressed in the pre-entry health and safety briefing or in a periodic

health and safety briefing in the event that the location of the assembly point must be changed because of site activities.

- **Building 7654 and the Hazardous Waste Management Area:** The assembly point for this area is just outside of the main gate of the complex.
- **Building 7507W:** The assembly point for this building is at the entrance to the area off of Melton Valley Drive.
- **Building 7823:** The assembly point for this building is located at the SWSA 5 entry off of Melton Valley Drive.

10.2.3 Evacuation Routes

Evacuation routes shall be established for all site operations. EZ evacuation routes shall be through the CRC, if possible. The facility RCT shall designate the safest site operations evacuation route with the assistance of the SSHO. The location of the route and the recommended progression shall be discussed in the pre-entry health and safety briefing. In the event of an evacuation, personnel responsibilities are as follows:

1. Personnel should be familiar with the safest and shortest evacuation route from each site and area in which they perform work.
 2. When an evacuation alarm is sounded, personnel should quickly but calmly proceed to the area exit and to the designated assembly point to await further instructions from the LSS, the SSHO, or the incident commander.
 3. If possible and practical, equipment should be shut down before exit from the area. If undue risk of exposure is present, personnel will not attempt to shut down equipment.
 4. Personnel should follow the instructions given over the ORNL PA System, by the SSHO, or by the emergency response team incident commander upon his or her arrival.
 5. Personnel should remain at the assembly point until otherwise instructed.
- **Building 7654 and the Hazardous Waste Management Area.** The evacuation route for this area: North on the HPRR Access Road, through the Melton Valley Drive intersection, and north on the Melton Valley Access Road. Personnel shall assemble at the 7000 area guard station (Building 7072).
 - **Building 7507W.** The evacuation route for this building: Exit via the HFIR Access Road to Melton Valley Drive and go either west to Lagoon Road or east to the Melton Valley Access Road or Ramsey Drive.

- **Building 7823.** The evacuation route for this building: Exit via the main entrance gate at SWSA 5 to Melton Valley Drive and go either west to Lagoon Road or east to the Melton Valley Access Road or Ramsey Drive.

10.2.4 Fire or Explosion

Fire suppression and response services shall be provided for field activities by the ORNL Fire Department. The ORNL Fire Department can be summoned through the LSS or ECC offices as described in Sect. 10.1.2.1.

10.2.5 Emergency Equipment

The locations and types of emergency equipment available during site operations will be addressed in the pre-entry health and safety briefing.

10.3 EMERGENCY MEDICAL SERVICES

10.3.1 Personnel Injuries

All injuries to site personnel, regardless how minor, must be reported to the SSHO. First aid will be rendered by the designated SSHO, as necessary, and transportation to the EMS will be made at the discretion of the SSHO, or at the injured person's request. All site injuries and the circumstances involved will be recorded in the project logbook by the SSHO.

10.3.2 Emergency Medical Services

All work-related injuries will be treated by ORNL Health Division. Personnel with serious injuries requiring treatment beyond the capacity of ORNL Health Division services will be transported to the Methodist Medical Center of Oak Ridge, Tennessee, for further treatment and evaluation. Emergency radioactive decontamination or treatment of personnel exposure to radiation will be performed by the Radiation Emergency Assistance Center/ Training Site.

10.3.3 Transportation

Emergency transportation of site personnel to receive medical attention or emergency decontamination (whether to the ORNL Health Division or to outside facilities) will be provided through the LSS office.

10.4 EMERGENCY RESPONSE

All emergency response activities shall be performed by personnel trained according to the requirements of 29 CFR 1910.120 and ORNL procedures. The ORNL Emergency Response Team can be contacted through the LSS or ECC offices as described in Sect. 10.1.2.

10.5 SPILL CONTAINMENT

A spill control kit shall be available on-site for use in the event of the uncontrolled release of materials considered potentially hazardous to site personnel, the community, or the environment. The spill control kit is considered a temporary provision to be used by site personnel to control the spread of contamination. The spill kit should be used by personnel only if they are properly protected from exposure to the spill constituents. The ORNL Spill Response Team should be summoned immediately to provide emergency services by contacting the LSS or ECC offices as described in Sect. 10.1.2.

REFERENCES

- ACGIH. 1992. *1992-1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, ISBN:0-936712-99-6, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.
- Code of Federal Regulations (CFR). January 1, 1993. "Occupational Radiation Protection," 10 CFR 835.
- Code of Federal Regulations (CFR). July 1, 1994. "Hazardous Waste Operations and Emergency Response," 29 CFR 1910.
- Code of Federal Regulations (CFR). July 1, 1994. "Safety and Health Regulations for Construction," 29 CFR 1926.
- DOE. December 1991. *OSHA Training Requirements for Hazardous Waste Operations*, DOE/EH-0227P, U.S. Department of Energy, Office of Environment, Safety, and Health, Washington, D.C.
- DOE. April 1993. *Hoisting and Rigging Manual*, DOE/ID-10500, Assistant Secretary for Environment, Safety and Health, Department of Energy, Washington, D.C.
- DOE. April 1994. *Radiological Control Manual*, DOE/EH-0256T, Revision 1, U.S. Department of Energy, Assistant Secretary for Environment, Safety and Health, Washington, D.C.
- DOE Order 5000.3B. February 22, 1993. *Occurrence Reporting and Processing of Operations Information*, U.S. Department of Energy.
- Eckerman, K. F., et al. 1988. *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, Federal Guidance Report No. 11, EPA-520/1-88-020, U.S. EPA, Office of Radiation Programs, Washington, D.C.
- Energy Systems. December 1988. *You and Martin Marietta Energy Systems, Inc.*, Martin Marietta Energy Systems, Inc., Oak Ridge, Tennessee.
- Energy Systems. December 1992. *Radiological Control Manual*, K/HS-410, Martin Marietta Energy Systems, Inc., Radiological Control Organization.
- EPA. April 1991. *Establishing Work Zones at Uncontrolled Hazardous Waste Sites*, Office of Solid Waste and Emergency Response, Environmental Protection Agency.
- NIOSH, et al. October 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, DHHS(NIOSH) Publication No. 85-115, National Institute for Occupational Safety and Health.

NIOSH. June 1990. *NIOSH Pocket Guide to Chemical Hazards*, DHHS(NIOSH) Publication No. 90-117, National Institute for Occupational Safety and Health, Cincinnati, Ohio.

ORNL. April 1993. *ORNL HAZWOPER Program Manual*, ORNL/M-2716, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab.

ORNL. Radiation Protection Procedure Manual (available on-line).

ORNL. Waste Management and Remedial Action Division. *Hazardous Waste Operations Manual*, Manual No.: WM-SWO-401, Procedures Book, Waste Management Section, Hazardous Waste Operations, Oak Ridge Natl. Lab.



Attachment A

FIELD CHANGE REQUEST/VARIANCE FORM



FIELD CHANGE REQUEST / VARIANCE FORM

Field Change

Change Number: _____

Variance

Date: _____

Project: _____

Site: _____

Document: _____

Substituted Method: _____

Impact on Data Quality or Health and Safety: _____

Justification: _____

* † SSHO or Team Leader: _____ Date: _____

Approvals: (Field Changes Only)

* † Site Project Manager: _____ Date: _____

† QA Specialist/Officer: _____ Date: _____

† Analytical Representative: _____ Date: _____

* Other Approvals [ES&H Representative(s)]:

Name / Organization

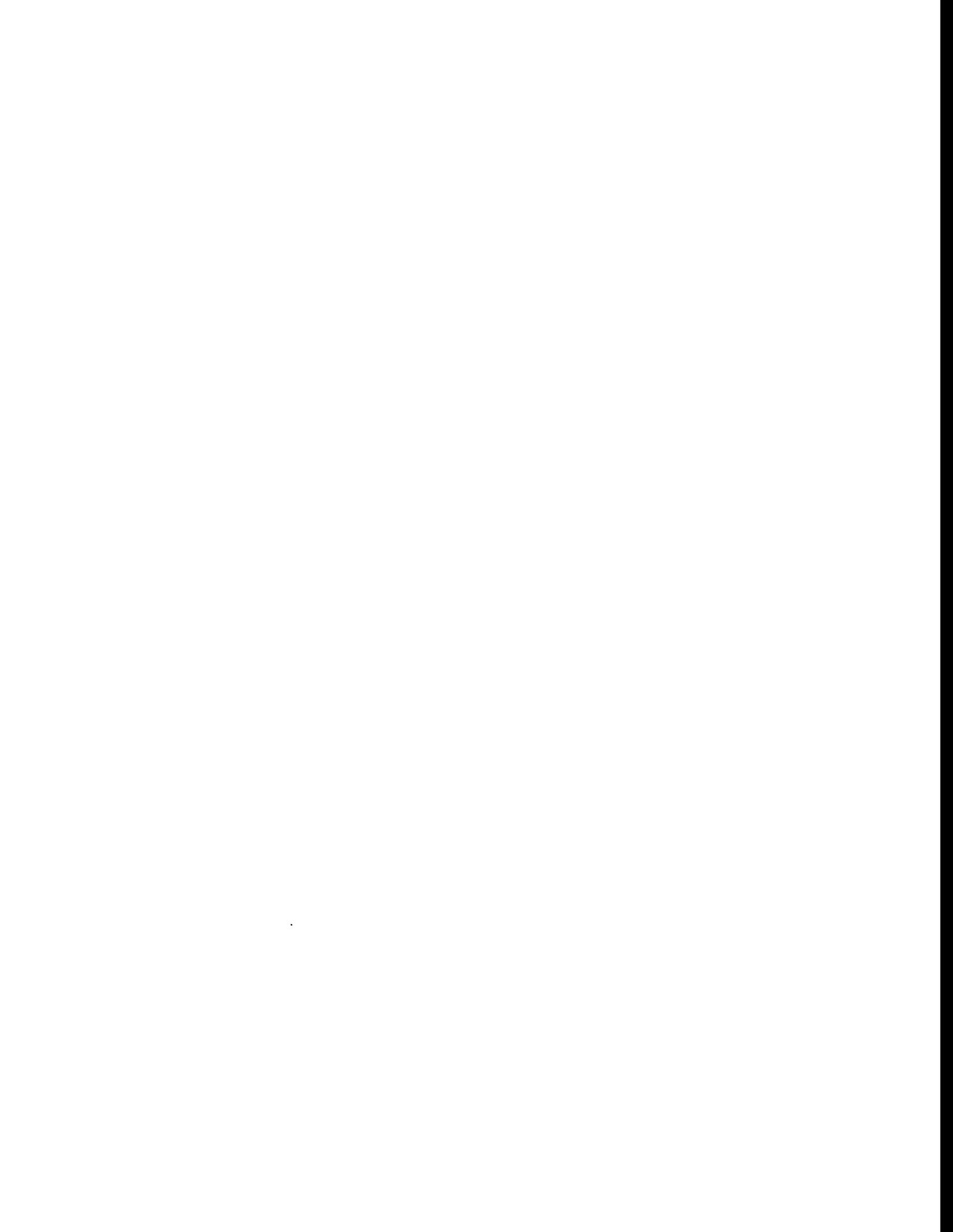
_____ Date: _____

_____ Date: _____

_____ Date: _____

* Signatures required for a health and safety issue or concern.

† Signatures required for a data quality issue or concern.



DISTRIBUTION

- | | |
|------------------------|------------------------------------|
| 1-10. J. P. Abston | 21. D. G. Rowland |
| 11. S. N. Burman | 22. A. W. Saulsbury |
| 12. M. L. Conner | 23. T. F. Scanlan |
| 13. D. D. Drake | 24. J. M. Terry, Jr. |
| 14. K. G. Edgemon, Jr. | 25. M. S. Uziel |
| 15. R. D. Foley | 26. L. C. Wesley III |
| 16. A. F. Frederick | 27-31. MAD Records Center |
| 17. J. Gilpin | 32. Central Research Library |
| 18. D. F. Hall | 33-34. Laboratory Records Dept.-RC |
| 19. J. L. Johnson | 35. ORNL Patent Section |
| 20. M. A. Johnson | |
36. Office of Assistant Manager for Energy Research and Development, DOE Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831-8600
- 37-38. Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831

