LOCKHEED MARTIN

ORNL/ER-397

ENVIRONMENTAL RESTORATION PROGRAM

Project Health and Safety Plan for the Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee

ENERGY SYSTEMS ER

MANAGED BY
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Energy Systems Environmental Restoration Program

Project Health and Safety Plan for the Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee

J. P. Abston

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Life Sciences Division
Oak Ridge National Laboratory

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Environmental Management Activities at the
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Oak Ridge, Tennessee 37831
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LOCKHEED MARTIN ENERGY SYSTEMS, INC.
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DISCLAIMER

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PREFACE

This *Project Health and Safety Plan for the Gunite and Associated Tanks (GAAT) at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (ORNL/ER-397) was prepared as part of the Environmental Restoration Program activities. This report was prepared to ensure safety of personnel during operations conducted at the Gunite and Associated Tanks. This work was performed under Work Breakdown Structure 1.4.12.6.1.01.41.12, Activity Data Sheet 3300X, "ORNL Waste Area Grouping (WAG) 1." The report details required health and safety documentation, roles and responsibilities of health and safety personnel, general site hazards, site access requirements, frequency and types of monitoring, site work zones and control measures, decontamination procedures, standard operating procedures, and emergency contingency plans.

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ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
CAM	continuous air monitor
CCE	Center for Continuing Education
CFR	Code of Federal Regulations
CNS	central nervous system
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
D	daily
DAC	derived air concentration
dBA	decibels on the A-weighted scale
DHHS	U.S. Department of Health and Human Services
DOE	U.S. Department of Energy
dpm	disintegrations per minute
ECC	Emergency Communications Center
EM	Environmental Management
EMS	emergency medical services
Energy Research	Lockheed Martin Energy Research Corp.
Energy Systems	Lockheed Martin Energy Systems, Inc.
EPA	U.S. Environmental Protection Agency
EPD	electronic personal dosimeter
ER	Environmental Restoration
ES&H	environmental safety and health
eV	electron volts
EZ	exclusion zone
FID	flame ionization detector
GAAT	Gunite and Associated Tanks
GC	gas chromatography
GET	General Employee Training
GI	gastrointestinal tract
H&R	hoisting and rigging
HASP	health and safety plan
HAZCOM	hazard communication
HAZMAT	hazardous materials
HAZWOPER	hazardous waste operations and emergency response
HEPA	high efficiency particle absorber
HP	health physics or health physics technician
H&S	health and safety
HWP	hot work permit
IDLH	immediately dangerous to life and health
IH	Industrial Hygiene
LEL	lower explosive limit
LMER	Lockheed Martin Energy Research Corp.

LMES	Lockheed Martin Energy Systems, Inc.
LSS	Laboratory Shift Superintendent
MK-F	MK-Ferguson of Oak Ridge Company
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NIOSH	National Institute of Occupational Safety and Health
NTF	North Tank Farm
ORNL	Oak Ridge National Laboratory
ORP	ORNL Office of Radiation Protection
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
OSHP	Office of Safety and Health Protection
PA	public address
PCBs	polychlorinated biphenyls
PCM	personal contamination monitor
PEL	permissible exposure limit
PHASP	Project Health and Safety Plan
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
RCT	Radiological Control Technician
REAC/TS	Radiation Emergency Assistance Center/Training Site
RPPs	ORNL Radiological Protection Procedures
RSS	Radiation Surveillance Section
RWP	Radiological Work Permit
SCBA	self-contained breathing apparatus
S&H	safety and health
SHEST	Safety and Health Evaluation and Support Team
SOP	Standard Operating Procedure
SSHA	Site Safety and Health Addenda
SSHO	Site Safety and Health Officer
STEL	short-term exposure limit
STF	South Tank Farm
SWP	Safety Work Permit
TI	MK-F Task Instructions
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TRIC	tank riser interface confinement
TRU	transuranics
TWA	time-weighted average
VOCs	volatile organic compounds
W	weekly
WBGT	wet bulb globe thermometer
Y	yearly

EXECUTIVE SUMMARY

The Lockheed Martin Energy Systems, Inc. (Energy Systems) policy is to provide a safe and healthful workplace for all employees and subcontractors. The accomplishment of this policy requires that operations at the Gunite and Associated Tanks (GAAT) in the North and South Tank farms (NTF and STF) at the Department of Energy (DOE) Oak Ridge National Laboratory are guided by an overall plan and consistent proactive approach to health and safety (H&S) issues.

The policy and procedures in this plan apply to all GAAT operations in the NTF and STF. The provisions of this plan are to be carried out whenever activities identified as part of the GAAT are initiated that could be a threat to human health or the environment. This plan implements a policy and establishes criteria for the development of procedures for day-to-day operations to prevent or minimize any adverse impact to the environment and personnel safety and health and to meet standards that define acceptable management of hazardous and radioactive materials and wastes. The plan is written to utilize past experience and best management practices in order to minimize hazards to human health or the environment from events such as fires, explosions, falls, mechanical hazards, or any unplanned release of hazardous or radioactive materials to the air.

This plan explains additional task-specific health and safety requirements such as the Site Safety and Health Addendum and Activity Hazard Analysis, which should be used in concert with this plan and existing established procedures. This plan, and any addenda addressing H&S, shall be easily available for on-site inspection and review by all subcontractor, Energy Systems/Energy Research, and DOE personnel. During on-site activities, all personnel, including subcontractors and visitors, are expected to comply fully with the requirements of this plan and any addenda. Site activities shall be performed in accordance with applicable Occupational Safety and Health Administration Standards 29 CFR 1910 and 1926 and applicable Environmental Protection Agency requirements.

It is understood that it may not be possible to determine actual working conditions in advance of the work. Therefore, this plan allows the opportunity to provide a range of protection based upon actual working conditions that could be encountered while conducting on-site activities. Task-specific information will be presented in Site Safety and Health Addenda or Activity Hazard Analyses to the extent possible.

1. INTRODUCTION

This Project Health and Safety Plan (PHASP) is prepared for the safety of personnel during operations conducted at the Gunite and Associated Tanks (GAAT) in the North and South Tank farms (NTF and STF). This plan complies with the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER), for investigations and cleanup at hazardous waste sites and decontamination and decommissioning activities. This plan also complies with 10 CFR 835, *Occupational Radiation Protection; Final Rule,* and 29 CFR 1926, *Safety and Health Regulations for Construction.*

This PHASP provides information applicable to scheduled activities at the NTF and STF including (1) STF in-tank equipment removal, (2) STF external equipment removal and site preparation, (3) NTF treatability study, (4) STF tank remediation, (5) additional site characterization, (6) NTF and STF tank closure, (7) NTF and STF site closure, and (8) additional site activities. This project plan and subsequent task-specific documents will be specific to the GAAT NTF and STF facilities.

This PHASP will be reviewed and approved by personnel listed on the approval pages.

1.1 OBJECTIVE

The purpose of this PHASP is to define the interfaces and responsibilities for ensuring H&S for the GAAT Remediation Project, to briefly describe the types of hazards involved, and to define the methodology for implementing H&S requirements that mitigate and/or eliminate those hazards for each organization involved. This PHASP has been created using site characterization data and process knowledge to determine potential hazards.

The objective of this PHASP is to provide safe and healthful working conditions at the project site. This plan explains project H&S requirements in addition to those in referenced procedures. This PHASP shall be available for inspection and review by all personnel before they enter the project site.

All persons entering the project site or performing work to support the project are subject to the requirements of this plan and will be held responsible for adhering to the requirements specified herein. Further, each individual is responsible for bringing to the attention of management any unsafe or unhealthy conditions that he/she observes. Unsafe or unhealthy conditions shall be addressed immediately by the individual discovering them.

This PHASP promotes compliance with applicable sections of 29 CFR 1910 and 29 CFR 1926, and shall not be modified without written concurrence of the project team. Major changes in the scope of work or site conditions will result in an addendum to this PHASP.

1.2 SAFETY AND HEALTH METHODOLOGY

Completion of this project will bring multiple companies and their subcontractors together on the same work site. While many of their H&S programs are identical or have strong similarities, some technical, procedural, or training differences do exist. The methodology for addressing those differences and ensuring personnel H&S on this project is to clearly establish and communicate areas of responsibility for H&S.

1.3 FACILITY DESCRIPTION

A diagram of the NTF and STF is shown in Fig. 1.1. The NTF is located on the north side of Central Avenue; the STF is located south of the NTF and Central Avenue. The Gunite tanks were constructed in 1943–1944 to contain liquid radioactive wastes resulting from experimental reprocessing of irradiated fuel elements in Building 3019. The tanks received aqueous liquid waste containing fission products with traces of transuranics (TRU) and naphtha solvents. The wastes were neutralized (the pH increased) by the addition of caustics in order to precipitate strontium compounds and protect the concrete tanks from acid attack.

In the years following World War II, the gunite tanks were used as catch basins for wastes generated as the result of isotope production and experimental operations. During this period of service their contents were periodically transferred to waste processing and disposal systems.

When removed from service in the early 1980s, a program of final emptying was initiated. This process consisted of sluicing the tanks to suspend the waste with transfer of the slurry to other tanks and systems. Due to schedule constraints, all sludges and salts present in the tanks were not completely removed leaving a residue that is to be removed in this project.

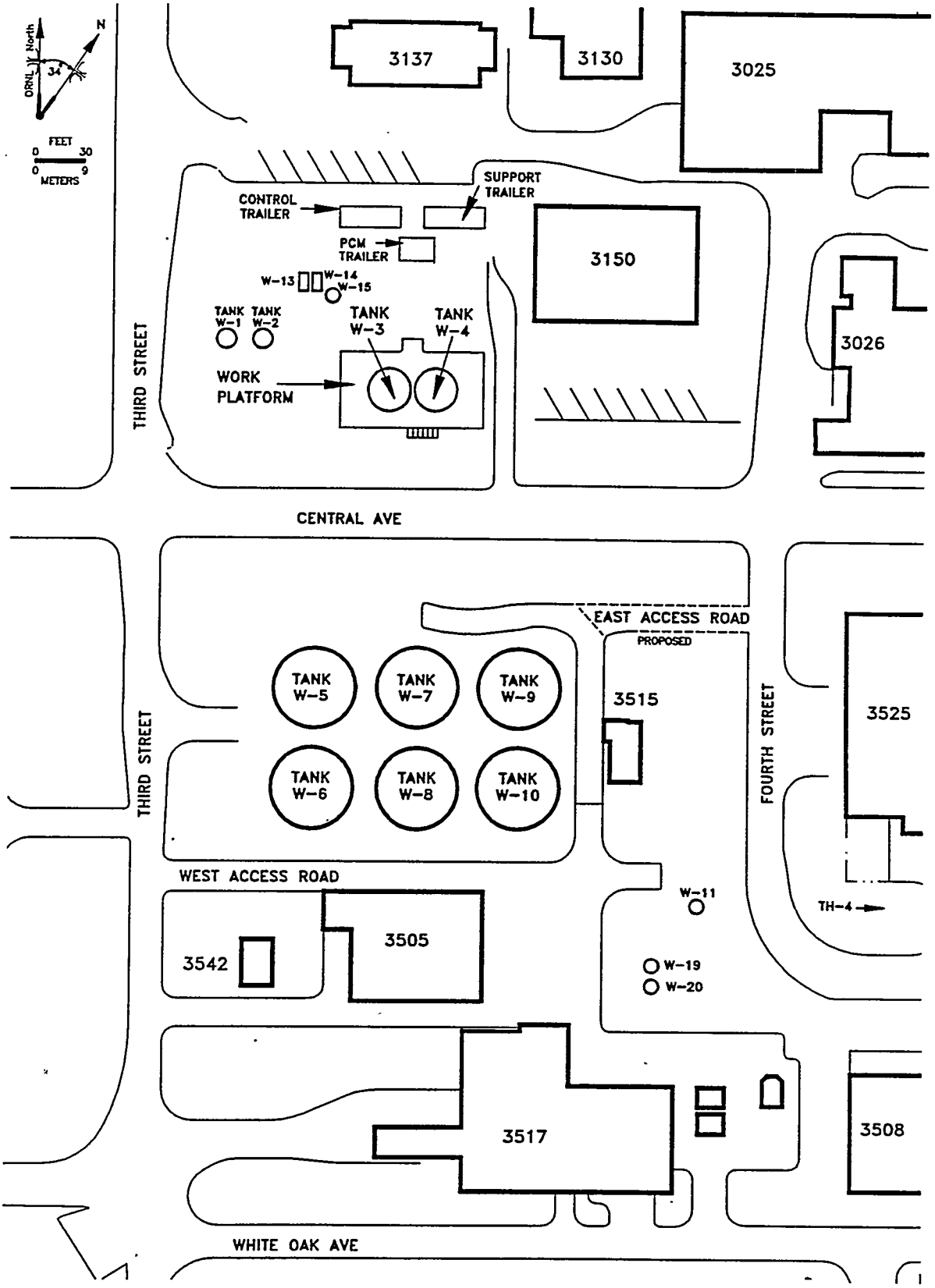

Fig. 1.1. Diagram of the North and South Tank Farm sites.

2. PROJECT DOCUMENTATION

2.1 SITE SAFETY AND HEALTH ADDENDUM (SSHA) OR ACTIVITY HAZARD ANALYSIS (AHA)

If the task meets criteria established by the ORNL HAZWOPER program with regard to (1) hazards associated with the task, (2) duration of the task, and (3) level of effort to accomplish the task, HAZWOPER requirements will be initiated. When a task falls under the scope of 29 CFR 1910.120 or 29 CFR 1926.65 and, therefore, under the ORNL HAZWOPER Program, a SSHA will be prepared. Conversely, if a task does **not** fall under the scope of 29 CFR 1910.120 or 29 CFR 1926.65, an Activity Hazard Analysis (AHA) will be prepared. MK-Ferguson of Oak Ridge Company (MK-F) and MK-F subcontractor(s) will also be required to prepare SSHAs, AHAs, ALARA Plans, etc., for the work activities they are to perform in accordance with MK-F procedures and current methods of operation.

SSHA and AHA development shall be a cooperative effort involving the GAAT Health and Safety Manager, MK-F ORNL Health and Safety Coordinator (for MK-F activities), the Site Safety and Health Officers (SSHOs), and the GAAT Radiological Control Technician (RCT) (see Sect. 3.3 for a description of site roles). SSHAs and AHAs serve as an extension to this PHASP and shall address all task-specific information including, but not limited to, the work location, standard operating instructions for the work effort, the anticipated hazards to health and safety, and the prescribed methods for controlling the task-specific hazards through controls and safe work practices. SSHAs and AHAs may include new data that have been received subsequent to the publication of this PHASP.

A unique SSHA or AHA GAAT document number must be obtained from the GAAT Health and Safety Manager before document development begins. The GAAT document number is entered on the cover sheet (see Appendix A), which becomes the first page of the SSHA or AHA. SSHAs and AHAs will be reviewed and approved by personnel listed in Table 2.1. This review and approval process ensures that all SSHAs and AHAs comply with regulations and procedures of the various environmental, safety, and health (ES&H) disciplines.

Table 2.1. Required sign-off for SSHA and AHA

Activity conducted by	SSHA	AHA
Lockheed Martin and Lockheed Martin subcontractor(s)	• GAAT Project Manager • NTF/STF Facility Manager • GAAT H&S Manager • ORNL Office of Radiation Protection (ORP) Representative	• NTF/STF Facility Manager • GAAT H&S Manager • ORNL Office of Radiation Protection (ORP) Representative
MK-Ferguson of Oak Ridge Company (MK-F) and MK-F subcontractor(s)	• GAAT Project Manager • MK-F Site Manager • MK-F Construct. Manager/Engineer • MK-F Construction Superintendent • MK-F ORNL H&S Coordinator • MK-F ORNL HP Coordinator • MK-F GAAT S&H Officer (SSHO)	• MK-F Constr. Manager/Engineer • MK-F Construct. Superintendent • MK-F ORNL H&S Coordinator • MK-F IH, if applicable • MK-F ORNL HP Coordinator • MK-F GAAT S&H Officer (SSHO)

2.2 HEALTH AND SAFETY LOGBOOK

Separate site-specific health and safety logbooks will be maintained by the Energy Systems/Energy Research SSHO and the MK-F SSHO. The observations to be recorded in the site health and safety logbook shall include, but are not limited to, the following: site conditions, weather conditions, site operations, instrumentation monitoring and calibration information, site entrants, accidents or injuries, and attendance at pre-entry and periodic health and safety briefings.

2.3 REQUIRED PROJECT DOCUMENTATION

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

- The PHASP.
- SSHA or AHA.
- Health and safety logbook.
- Site instrumentation monitoring and calibration logs. (MK-F instrument monitoring and calibration logs are maintained at central facilities.)
- Task-specific Radiological Work Permits (RWPs).
- Lockout/tagout permits/lock boxes, if applicable.
- Health and Safety Field Change Forms.
- MK-F Task Instructions (TI).
- Worker training matrix.
- Visitor's log (Energy Systems/Energy Research visitor's log is shown in Attachment B).

2.4 CORRECTIVE ACTIONS

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

2.4.1 Field Activities

Most corrective actions will be of short duration, such as failure to date and sign a monitoring form or properly document errors. Corrective action will be initiated by bringing the discrepancy to the attention of the appropriate personnel. For H&S concerns, corrections will be accomplished at the time of the disclosure under supervision of the SSHO and the RCT. Any actions that violate safety and health protocol [such as the use of ineffective PPE, or entering the Support Zone from the Contamination Reduction Zone (CRZ) without frisking] will be considered short-term events. Work specific to the violation shall be temporarily suspended until the corrective action has been taken. After corrective action, work directed by Energy Systems/Energy Research will resume under the direction of the SSHO, the Office of Safety and Health Protection (OSHP) through the Safety and Health Evaluation Team (SHEST) representative, the RCT, or the Project Manager. MK-F

suspended work will resume under direction of MK-F Project/Site Management with input from other principals.

2.4.2 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 and Processing System (ORPS) may be initiated any time an employee, contractor, or subcontractor reports problems, concerns, conditions, or events that have or could have adverse or negative impact on safety, the environment, health, quality, security, or site operations. The occurrence is to be reported to line management (in this case the Facility Manager) or the Laboratory Shift Superintendent (LSS), as appropriate. If the event involves a real-time occurrence that requires assistance from plant emergency services, on-site personnel should take action to mitigate the occurrence and immediately report the situation as described in Sect. 3.2, Chain-of-Command. For Energy Systems/Energy Research occurrences, any other ORNL procedures for occurrence reporting will also be followed. MK-F occurrences will be reported through existing MK-F procedures and reporting requirements with concurrent reporting to the Facility Manager.

2.4.3 Field Changes

Any deviation from the PHASP, SSHA, AHA, or any change in established work procedures or SOPs that affects health and safety or quality, must be recorded. A field change is a deviation that could adversely affect the health and safety of workers or the quality of data being generated. For Energy Systems/Energy Research tasks, minor deviations should be recorded (when the deviation occurs) in a specified section of the project logbook for field changes. For major changes, a Health and Safety Field Change Form (provided in Appendix C) will be completed and signed by the appropriate persons. For MK-F tasks, changes will be recorded directly on the SSHA or AHA by means of a Task Instruction appropriate to the change. MK-F task changes will require approvals or concurrences from MK-F disciplines and concurrences from GAAT project personnel.

Changes must be explained to all site personnel during daily health and safety briefings or during tailgate briefings called when site conditions change. Each person signing the form and each affected organization working on-site will receive a copy of the change that records the deviation, the substituted method or rationale for the change, and an explanation of how data quality will be affected.

2.5 RADIATION WORK PERMITS

An RWP will be initiated by the site RCT and shall be issued prior to the start of activities. The RWP shall contain task-specific radiological information including PPE, dose rates, sign-in sheets, and task description. The RCT may be required to revise the RWP as site conditions change. Additional RWPs may be generated to cover individual tasks. All RWPs shall be prepared in accordance with ORP or MK-F (for MK-F activities) procedures.

3. FACILITY ORGANIZATION

The GAAT project is currently being managed by Energy Systems as a part of the ER Program through a contract with DOE. The roles and responsibilities for facility and project operations should remain the same throughout the duration of the project. Task-specific individuals may change as different work activities are conducted.

3.1 KEY PERSONNEL

Key health and safety personnel for the GAAT project are provided in Table 3.1 and key project personnel in Table 3.2. Emergency contacts are listed in Table 3.3. Current versions of Tables 3.1, 3.2, and 3.3 should be posted on-site.

Table 3.1. GAAT health and safety personnel

Responsibility	Name	Telephone (pager number)
GAAT Project Manager	S. D. Van Hoesen	574-7264 (873-4153)
NTF/STF Facility Manager	L. Holder, Jr.	574-8312 (873-4981)
GAAT Health and Safety Manager Site Safety and Health Officer (SSHO)	J. P. Abston	574-4588 (873-9606)
Alternate SSHO	D. E. Rice	576-8565 (417-5488)
MK-F ORNL Health and Safety Coordinator	R. P. Beebe	241-3617 (873-7367)
Radiological Control Technician (RCT)	J. A. Miller	574-6700 (417-6372)
Radiation Surveillance Section (RSS) Complex Leader	J. E. Francis	574-6701 (873-7647)
Safety and Health Evaluation Support Team (SHEST) Representative[a]	M. M. Slater	576-7059 (873-5538)
Environmental Compliance	A. D. Reynolds	241-3715 (873-6456)

[a]Also serves as OSHP representative.

Table 3.2. GAAT project personnel

Responsibility	Name	Telephone (pager number)
GAAT Project Manager	S. D. Van Hoesen	574-7264 (873-4153)
GAAT Project Engineer	O. W. Hale	576-2892 (873-4919)
Construction Engineer	O. W. Hale	576-2892 (873-4919)
Environmental Compliance	A. D. Reynolds	241-3715 (873-6456)
Facility Manager	L. Holder, Jr.	574-8312 (873-4981)
Engineering Technical Lead	M. A. Johnson	576-9450 (417-6680)
GAAT Health and Safety Manager	J. P. Abston	574-4588 (873-9606)
Radiological Control Technician (RCT)	J. A. Miller	574-6700 (417-6372)
MK-F ORNL Construction Manager/Engineer	Bruce Womble	241-3615
MK-F ORNL Lead Construction Superintendent	C. D. Cardwell	576-0069
MK-F ORNL Health and Safety Coordinator	R. P. Beebe	241-3617 (873-7367)
MK-F ORNL Health Physics Coordinator	J. L. Richards	576-3404
MK-F ORNL GAAT Site Safety and Health Officer (SSHO)	F. W. Arp	576-3404 (215-0227)

Table 3.3. Emergency contacts

Responsibility	Name	Telephone (pager number)
EMERGENCY—Plant phone		**# 911**
—Cellular phone		**574-6606**
Laboratory Shift Superintendent		**574-6606 Station 103 Radio No. 295**
ORNL Fire Department (Fire Shift Captain)		576-5678
ORNL Environmental Compliance	A. D. Reynolds	241-3715 (837-6456)
ORNL Medical		574-7431
Protective Services (Fire, Security Patrol)		574-6277
NTF/STF Facility Manager	L. Holder, Jr.	574-8312 (873-4981)
Site Safety and Health Officer (SSHO)	J. P. Abston	574-4588 (873-9606)
Radiation Surveillance Section (RSS) Complex Leader	J. E. Francis	574-6701 (873-7647)
Radiation Protection (Off-Shift)		574-6700 Radio No. 152
ORNL SHEST Representative[a]	M. M. Slater	576-7059 (873-5538)
ORNL Nuclear Criticality Safety Section	J. F. Alexander	574-4340
Waste Certification	K. L. Deroos	241-2811 (873-4994)

[a]Also serves as OSHP representative.

3.2 CHAIN-OF-COMMAND

The ORNL chain-of-command is illustrated in Fig. 3.1. For H&S issues, the SSHO first contacts the GAAT H&S Manager and the NTF/STF Facility Manager. The NTF/STF Facility Manager will contact the GAAT Project Manager who will make the appropriate decision as to whether Environmental Management should be contacted. A consultation will be initiated involving the SSHO, the NTF/STF Facility Manager, the GAAT H&S Manager, and the appropriate ORNL discipline(s): HAZWOPER Program Coordinator or SHEST Representative, Office of Radiation Protection, Officer of Safety and Health Protection, Waste Management, or Environmental Compliance. For issues that cannot be resolved at this level, division managers of the appropriate disciplines (ES&H, Waste Management, or Environmental Compliance) will be contacted for assistance. In all cases, resolutions should be agreeable to all involved parties. For nonemergency situations, when the GAAT H&S Manager and the NTF/STF Facility Manager are unavailable, the SSHO should contact the appropriate discipline(s) directly. In an emergency contact the LSS (911 by Plant phone).

The MK-F chain-of-command is illustrated in Fig. 3.2. The SSHO first contacts the MK-F ORNL H&S Coordinator. The MK-F ORNL H&S Coordinator contacts MK-F ORNL Construction Manager/Engineer and MK-F project principals and site management concurrently with the GAAT H&S Manager and the NTF/STF Facility Manager. The NTF/STF Facility Manager will contact the GAAT Project Manager who will make the appropriate decision as to whether Environmental Management should be contacted. A consultation will be initiated involving the SSHO, the MK-F ORNL H&S Coordinator, the NTF/STF Facility Manager, the GAAT H&S Manager, and the appropriate ORNL discipline(s): HAZWOPER Program Coordinator or SHEST Representative, Office of Radiation Protection, Officer of Safety and Health Protection, Waste Management, or Environmental Compliance. For issues that cannot be resolved at this level, division managers of the appropriate disciplines (ES&H, Waste Management, or Environmental Compliance) will be contacted for assistance. In all cases, resolutions should be agreeable to all involved parties. For nonemergency situations, when the MK-F ORNL H&S Coordinator, the GAAT H&S Manager, and the NTF/STF Facility Manager are unavailable, the SSHO should contact the appropriate discipline(s) directly. In an emergency contact the LSS (911 by Plant phone or 574-6606 by cellular phone).

3.3 ROLES AND RESPONSIBILITIES

All individuals working at or visiting the GAAT must adhere to applicable Federal, State, and DOE orders and/or regulations and must abide by directions and instructions given by facility management and H&S individuals. It is important that managerial interfaces and responsibilities pertaining to H&S programs be clearly defined, documented, and understood. While it is recognized that each person is responsible for his or her own safety, the project will use trained H&S personnel to administer H&S oversight of project activities. This section details the H&S-related responsibilities of project personnel.

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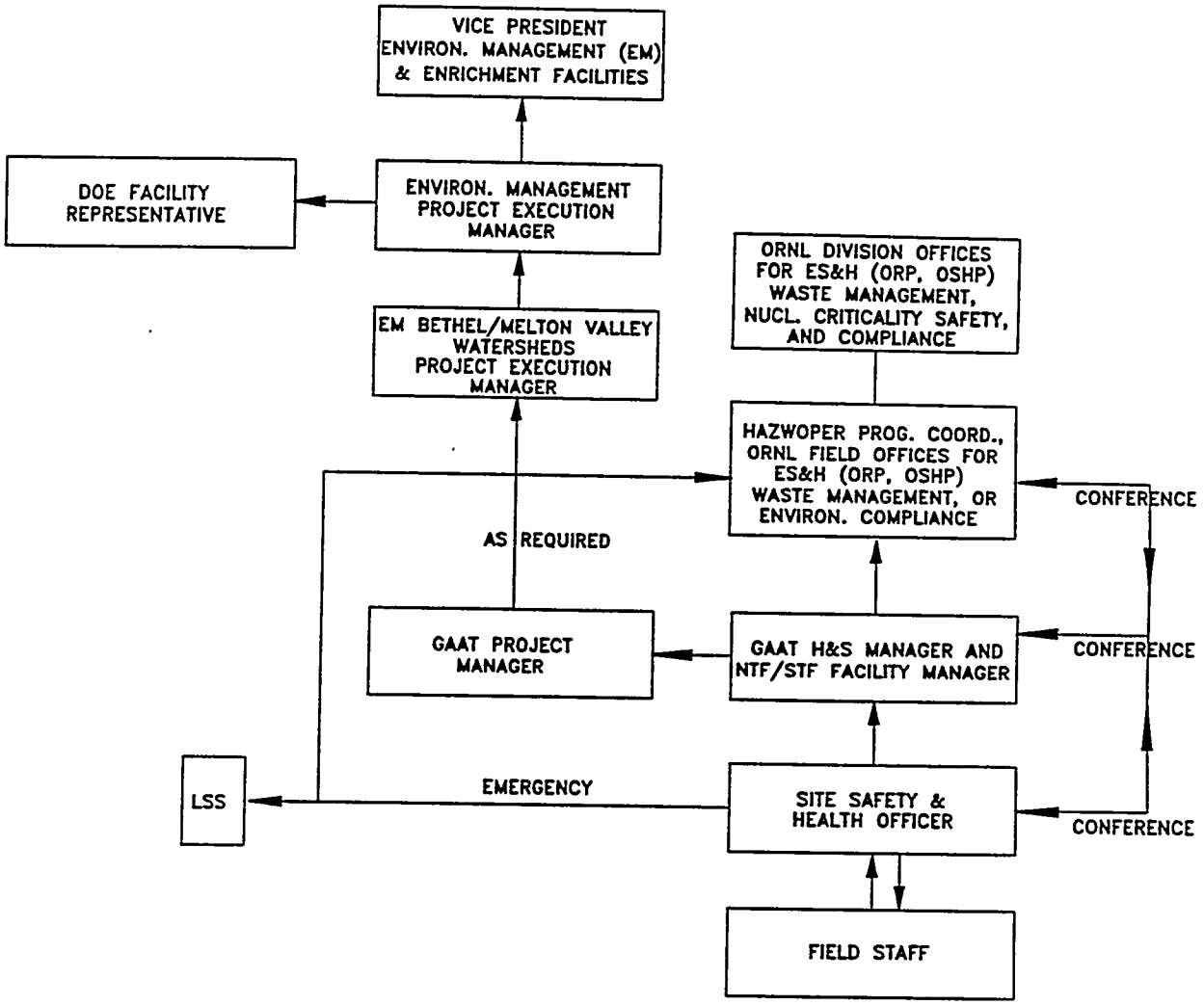

Fig. 3.1. Energy Systems/Energy Research chain of command for reporting health and safety issues at the NTF and STF facilities. The SSHO first contacts the GAAT H&S Manager and the NTF/STF Facility Manager. The NTF/STF Facility Manager will contact the GAAT Project Manager who is responsible for contacting Environmental Management, if required. A conference is initiated involving the SSHO, the GAAT H&S Manager, the NTF/STF Facility Manager, and the appropriate discipline(s): HAZWOPER Program Coordinator or SHEST Representative, Office of Radiation Protection, Office of Safety and Health Protection, Waste Management, or Environmental Compliance. In an emergency contact the LSS. For nonemergency situations when the GAAT H&S Manager and the NTF/STF Facility Manager are unavailable, the SSHO should contact the appropriate discipline(s) directly. The SSHO should contact the LSS when stop work conditions occur due to an unexpected hazard.

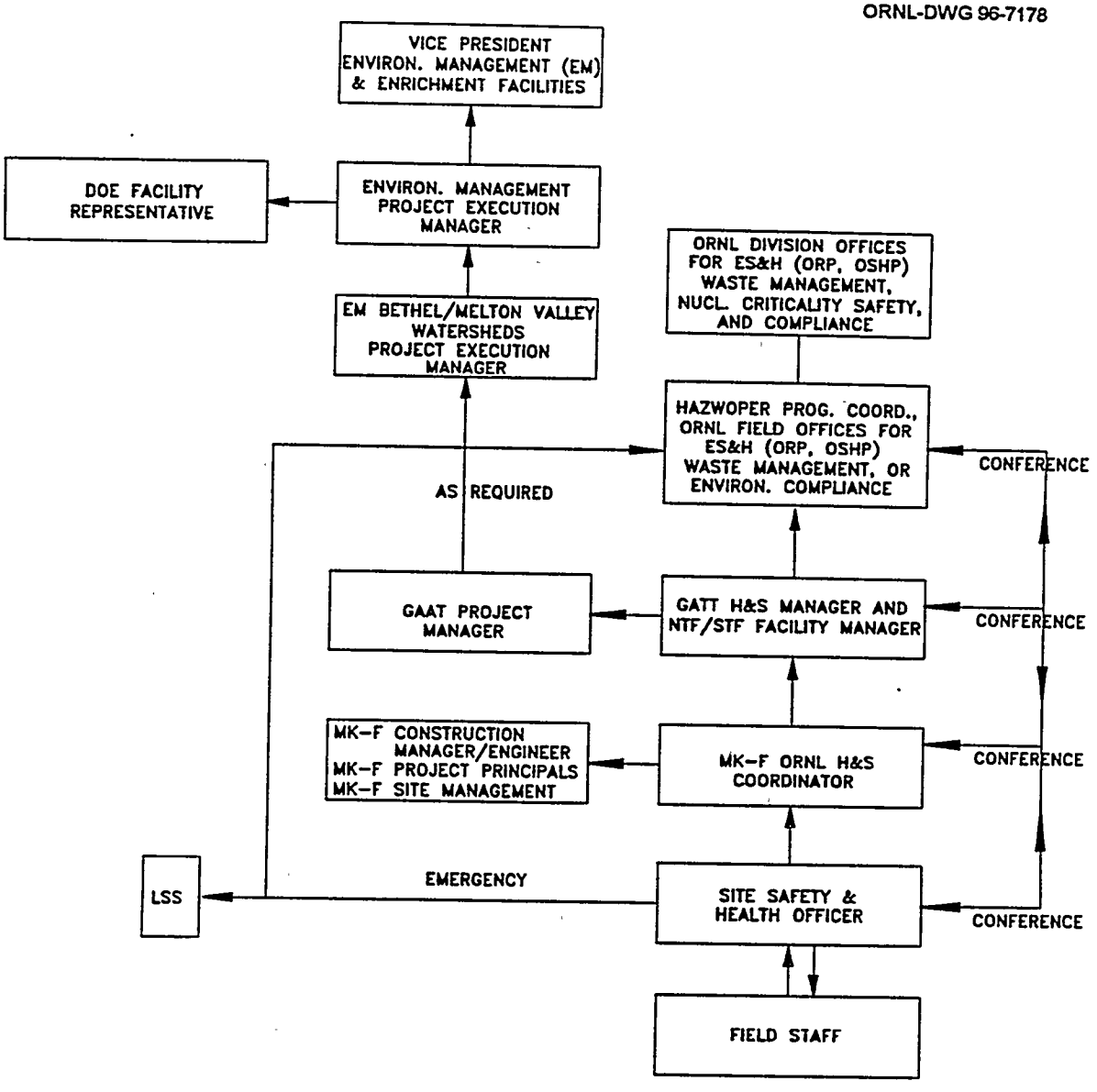

Fig. 3.2. MK-F chain of command for reporting health and safety issues at the NTF and STF facilities. The SSHO first contacts the MK-F ORNL H&S Coordinator. The MK-F ORNL H&S Coordinator contacts MK-F ORNL Construction Manager/Engineer and MK-F project principals and site management concurrently with the GAAT H&S Manager and the NTF/STF Facility Manager. The NTF/STF Facility Manager will contact the GAAT Project Manager who is responsible for contacting Environmental Management, if required. A conference is initiated involving the SSHO, MK-F ORNL H&S Coordinator, the GAAT H&S Manager, the NTF/STF Facility Manager, and the appropriate discipline(s): HAZWOPER Program Coordinator or SHEST Representative, Office of Radiation Protection, Office of Safety and Health Protection, Waste Management, or Environmental Compliance. In an emergency contact the LSS. For nonemergency situations when the MK-F ORNL H&S Coordinator, the GAAT H&S Manager, and the NTF/STF Facility Manager are unavailable, the SSHO should contact the appropriate discipline(s) directly. The SSHO should contact the LSS when stop work conditions occur due to an unexpected hazard.

3.3.1 Cessation of Work

According to ORNL and MK-F policies and procedures, 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 any work that seriously jeopardizes employee safety or health, that has potential for significant environmental insult, or that could have a serious adverse impact on the quality of operations or processes.

In regard to H&S, the term "stop work" applies to situations involving imminent danger to personnel. It should not be confused with brief interruptions to ongoing work or tasks for the purpose of reminding employees to observe H&S precautions or to consider safer methods of completing the job. Activities halted under stop work authority must be formally documented and must be approved for restart in accordance with existing procedures.

A concern must be brought to the attention of the on-site H&S representative(s). The respective SSHO and/or RCT will evaluate the situation and, based on results from specific instrumentation to detect hazardous environments or his/her professional judgement, will rectify the situation in question. This correction may be as simple as upgrading PPE or extending zones or as complex as implementing engineering or administrative controls. If the H&S representative cannot resolve the problem, work will be halted until conditions can be corrected. The H&S representative may need to confer with other related experts and arrive at a consensus on how to address the concern.

If stop work is instituted, the SSHO and/or the RCT must notify the appropriate people through the chain-of-command (Figs. 3.1 and 3.2). The Facility Manager, SSHO, or RCT is authorized to order the commencement of work activities once the subject of concern has been resolved to the satisfaction of all health and safety personnel consulted and the LSS.

3.3.2 GAAT Project Manager

The GAAT Project Manager is responsible directly to the Energy Systems ER Program for the safe and successful execution of the GAAT project. The project manager is responsible for technical integration and program management and planning; contract and project administration; and direction of all development, design, procurement, component fabrication, and testing. Programmatic guidance and funding direction are received from the ER Program.

3.3.3 NTF/STF Facility Manager

The NTF/STF Facility Manager is responsible to the GAAT Project Manager for readiness of the existing facilities to safely support execution of the remediation project activities. The Facility Manager will establish and maintain a configuration management program for the facility and will safely operate and maintain facility material and equipment during project execution. The Facility Manager will also provide site coordination between different organizations.

3.3.4 GAAT Health and Safety Manager

The GAAT H&S Manager shall be responsible for the coordination and oversight of all project environmental safety and health issues. The H&S Manager shall be responsible for the coordination of all task activities with the Facility Manager and other H&S personnel. The H&S Manager is required to have fulfilled the training and medical monitoring requirements for Exclusion Zone (EZ) access. Responsibilities of the H&S Manager may include, but are not limited to, the following:

- Acting in an oversite capacity to ensure the H&S of workers and to protect the environment.
- Assisting the SSHOs and RCT in establishing work zones and in selecting the level of PPE required to ensure that all anticipated activities can be safely performed.
- Confirming that the project is in compliance with the requirements of 29 CFR 1910.1200 for hazard communication training on all hazardous materials brought into the site for use in site operations.
- Providing oversight and supervision of all Energy Systems/Energy Research SSHOs.
- Developing the SSHAs or AHAs in a cooperative effort with the RCT, SSHO, the Project Manager, the HAZWOPER Program Coordinator, MK-F, and/or other authorities.

3.3.5 MK-F ORNL Construction Manager/Engineer

The MK-F ORNL Construction Manager/Engineer is responsible for all construction activities, including preparation of project-specific documents and compliance with H&S requirements during MK-F tasks in the NTF and STF. The construction manager/engineer will be responsible for maintaining MK-F project status and providing technical information to field personnel. This person will also be the primary contact for changes in scope of work and will coordinate efforts between MK-F, Energy Systems/Energy Research, and other project participants. The MK-F ORNL Construction Manager/Engineer will also be responsible for these aspects of MK-F project-related tasks:

- Managing and administrating construction.
- Ensuring worker H&S during construction and demolition activities.
- Administrating H&S surveillance.
- Investigating and reporting accidents.
- Recording injuries and/or illnesses.
- Ensuring that MK-F subcontractor activities are performed in a manner consistent with the project H&S plan.
- Ensuring that the subcontractor H&S plans are prepared/approved and properly implemented in a timely manner.
- Ensuring that subcontractor personnel comply with the project H&S plan.
- Maintaining effective communication with the project H&S coordinator and the project H&S officer on H&S matters.

3.3.6 MK-F ORNL Health and Safety Coordinator

The MK-F ORNL H&S Coordinator serves as the primary contact for H&S during MK-F field activities. The MK-F ORNL H&S Coordinator will report to the MK-F ORNL Construction Manager/Engineer for all H&S aspects of the project. The MK-F ORNL H&S Coordinator is responsible for supervision of the SSHO, provides assistance to the SSHO as needed, and may serve as an alternate SSHO, if required. This person will oversee the on-site execution of all MK-F field activities regarding MK-F H&S procedures.

Additionally, the project H&S coordinator will be responsible for these aspects of the project:

- Tracking H&S regulations and implementing improvements to the MK-F H&S program.
- Ensuring records are maintained pertaining to medical surveillance, training, fit testing, chemical exposure, and incidents.
- Managing the medical surveillance program.
- Ensuring appropriate H&S training is obtained by personnel entering the work site.
- Auditing key aspects of the MK-F H&S program and reporting effectiveness to the MK-F ES&H director and the project manager.
- Investigating reports of incidents or accidents and reporting accidents or incidents to the MK-F ES&H director and the project manager.
- Accessing project files to perform H&S audits or investigate accidents/incidents.
- Removing individuals from the project site if their conduct jeopardizes their H&S or that of coworkers.

3.3.7 MK-F ORNL Health Physics Coordinator

The MK-F ORNL Health Physics (HP) Coordinator serves as the primary on-site contact for MK-F health physics concerns, including health physics monitoring activities, during field activities. The MK-F ORNL HP Coordinator will report to the MK-F Radiological Engineering Department and the MK-F ORNL Construction Manager/Engineer for all health physics aspects of the project.

This person will also have the following responsibilities:

- Performing pre-entry and post-job surveys of work areas and personnel for radiation and contamination.
- Performing a pre-exit survey of all equipment and materials exiting the site and surveying as required throughout the duration of the project.
- Maintaining radiological zoning and posting, if required.
- Monitoring the air for airborne radionuclides, if required.
- Consulting with Radiological Engineering to determine PPE levels necessary for protecting personnel from radioactive contaminants, if required.
- Consulting with Radiological Engineering to set monitoring requirements necessary to maintain adequate protection for radioactive contaminants, if required.
- Initiating and controlling radiological work permits in accordance with MK-F Radiological Procedures, if required.
- Response-checking radiological instruments.
- Advising the H&S coordinator on site radiological conditions.

3.3.8 Energy Systems/Energy Research and MK-F GAAT Site Safety and Health Officer

The SSHO shall be designated to perform actual on-site health and safety supervision of all site activities. More than one SSHO may be used during a project if project operations are ongoing at more than one location within the facility. The SSHOs are required to have fulfilled the training requirements and medical monitoring requirements for exclusion zone (EZ) access, to have health and safety experience through work activities or education, and to have previously performed or been trained as a supervisor for hazardous waste sites. The approval or disapproval will be determined through a review of qualifications including those listed above. SSHOs providing support for Energy Systems/Energy Research activities will be approved by the GAAT Facility Manager and the GAAT H&S Manager. SSHOs providing support for MK-F activities will be provided by, subcontracted through, or approved by the MK-F ES&H Department. The responsibilities of the SSHO shall include, but are not limited to, the following:

- Maintaining and ensuring the availability of copies of H&S-related documentation.
- Ensuring that needed work permits are obtained and made available on site.
- Overseeing the selection, inspection, storage, and maintenance of personal protective clothing and equipment to be used in conjunction with the RCT.
- Ensuring that monitoring equipment is calibrated/source-checked daily and maintained in good working order.
- Establishing and maintaining work zones to prevent the potential spread of contamination during work and decontamination activities in accordance with the RCT.
- Controlling entry and exit of all personnel and observers into the CRZ and EZ and escorting visitors.
- Conducting and documenting periodic inspections (self assessments) to ensure the compliance of all facility entrants with health and safety measures outlined in the PHASP and other appropriate documents.
- Confirming each worker's suitability for HAZWOPER work based on a physician's recommendation, HAZWOPER physical (as required), and required training in accordance with 29 CFR 1910.120 and/or 29 CFR 1926.65. Also verifying with the GAAT Training Coordinator or MK-F Site Leads that each worker participates in the necessary medical surveillance programs and respiratory protection programs and has the appropriate training to perform the tasks.
- Ensuring that personnel obtain immediate medical attention in the case of a work-related injury or illness and that any injury or illness related to work performance is reported.
- Ensuring that monitoring of ambient site conditions is conducted for potential chemical and radiological exposures; ensuring that workers are monitored for symptoms of exposure or for conditions related to task hazards, including physical stresses such as temperature extremes.
- Conducting pre-entry and daily health and safety briefings.
- Advising emergency response personnel as needed.
- Conducting H&S briefings if site conditions change.
- Establishing and posting at the work area the emergency action plan, telephone numbers, and appropriate radio communication information.

3.3.9 Radiation Surveillance Section (RSS) Complex Leader, the RCT, and MK-F HP

The RCT shall have a working knowledge of the GAAT project. RCTs providing support for Energy Systems/Energy Research activities will be approved by the GAAT Facility Manager and the GAAT H&S Manager. RCTs providing support for MK-F activities will be provided by, subcontracted through, or approved by the MK-F ES&H Department. The responsibilities of the RCT or HP shall include, but are not limited to, the following:

- Reviewing the PHASP prior to mobilization of personnel and equipment and the commencement of project activities; granting written approval by signature or disapproval of the plan(s) on the basis of compliance with 10 CFR 835.
- Attending pre-entry and daily health and safety briefings and presenting radiation protection information to all site workers during the briefings.
- Being present during task operations that require RCT coverage.
- Ensuring that monitoring equipment is source-checked/calibrated daily and maintained in good working order.
- Conducting radiological surveys as needed during task activities and assuring that personnel and equipment are frisked for contamination before leaving Radiological Areas.
- Completing RWPs prior to the start of task.
- Assuring that equipment leaving the area has been properly bagged and tagged (i.e., radiation contamination tags, if needed).
- Monitoring and documenting radiological hazards at the site.
- Determining by task the estimated or possible exposure that might be received. For potentially high exposure, completing an ALARA review in accordance with MK-F Radiological Procedures or Radiological Review Requirements listed in RPP-310.
- Implementing and overseeing site operations to ensure that work is conducted in accordance with 10 CFR 835, ORNL RPPs, MK-F Radiological Procedures, and any other required SOPs and practices.
- Assisting the SSHOs in the selection of the appropriate PPE and respiratory protective equipment for use during each project task.
- Assisting the SSHO in establishing zones for work project activities.

3.3.10 HAZWOPER Program Coordinator or Safety and Health Evaluation Support Team

The HAZWOPER Program Coordinator or SHEST Representative is responsible for the oversight of all field activities with respect to compliance with the requirements of 29 CFR 1910.120 and 29 CFR 1926.The HAZWOPER Program Coordinator or SHEST Representative shall have the authority to perform on-site inspections of site operations. Responsibilities of the HAZWOPER Program Coordinator or SHEST Representative shall include, but are not limited to, the following:

- Reviewing the PHASP prior to mobilization of personnel and equipment and the commencement of project activities.

- Authorizing the commencement of work activities once the subject of concern has been resolved to the satisfaction of all health and safety personnel consulted.
- Assisting the SSHO and the RCT in the selection of PPE and respiratory protection, as needed.

3.3.11 Office of Safety and Health Protection

The OSHP at ORNL may be consulted for guidance on non-HAZWOPER tasks with respect to industrial hygiene and industrial safety concerns. Facility activities will be conducted in accordance with State and Federal regulations. OSHP may be called upon to perform site assessments or personnel monitoring of ORNL employees [dependent on work project activities (e.g., confined space entry)] as deemed necessary by the GAAT H&S Manager. In addition, OSHP may be required to assist the SSHOs and the RCT in the selection of appropriate PPE and respiratory protection.

3.3.12 Task Personnel

The responsibilities of all personnel (Energy Systems/Energy Research and their subcontractors, MK-F and MK-F subcontractors) involved in task 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 monitoring instruments to alert them of potentially harmful situations.
- Performing only those tasks that they are authorized to perform and that they believe can be done safely, and immediately reporting any accidents and unsafe conditions to the SSHO and/or the RCT.
- Notifying the SSHOs of any existing medical conditions (e.g., allergies, diabetes) that require special consideration. ORNL Health Division or MK-F Occupational Medical approval and/or a physician's recommendation may be required before an individual with a medical condition may be assigned specific tasks.
- Avoiding unnecessary or deliberate contact with any potentially contaminated substances (i.e., walking through pools) and avoiding unnecessary placement of equipment and tools on potentially contaminated surfaces.
- Avoiding the transfer of contaminated materials or equipment.
- Being familiar with the physical characteristics of the site, including
  - — Locations of available fire alarm boxes, telephones, and radios;
  - — Areas of known or suspected contaminations or hot zones;
  - — Facility access requirements; and
  - — Nearest facility resources (e.g., rest rooms and break rooms).
- Maintaining for proper disposal all wastes generated during project operations.
- Reporting all injuries, regardless how minor, to the SSHOs and the Project Manager.
- For Energy Systems/Energy Research personnel and associated subcontractors, reporting in person to the ORNL Health Division when any illness or injury related to work activities is incurred. (The SSHO must be notified first.)

- For MK-F personnel and MK-F subcontractors, reporting to the MK-F Site Office when illness or injury related to work activities is incurred. MK-F personnel and MK-F subcontractors will only report to ORNL Health Division for emergency conditions.
- Abiding by a buddy system, with each worker being responsible for keeping track of his or her partner in the event of an incident or emergency situation.
- Reporting to the RCT for frisking prior to egress from the CRZ or EZ as directed by the SSHO or RCT.
- Becoming familiar with the procedures required by the PHASP and addenda.
- Conducting all tasks in accordance with the PHASP and addenda.
- For MK-F and MK-F subcontractors, conducting all tasks in accordance with MK-F site documents and procedures.
- Reporting to the SSHO, the RCT, or their direct supervisor any information regarding facility operations or conditions that may have an impact on the health and safety of the project. The worker has the right to bring work to a halt and inform the proper representatives when he/she feels conditions warrant attention.

3.3.13 Visitors

The responsibilities of on-site visitors include, but are not limited to, the following:

- Contacting the SSHO before entering the site.
- Receiving a pre-entry briefing.
- Signing in and out on the visitor's log.
- Providing proof of training.
- Coordinating with the SSHO for a site escort.
- Becoming familiar with the site.
- Reporting any illness or injury.

4. PROJECT HAZARD ANALYSIS

The GAAT project consist of the following tasks: (1) STF in-tank equipment removal, (2) STF external equipment removal and site preparation, (3) NTF treatability study, (4) STF tank remediation, (5) additional site characterization, (6) NTF and STF tank closure, (7) NTF and STF site closure, and (8) additional site activities.

An overall description of the major efforts for each phase of the GAAT project is presented in this section along with related health and safety concerns and controls. Task-related hazards and controls not mentioned in the PHASP will be addressed by a SSHA (for tasks meeting the requirements of 29 CFR 1910.120 and/or 29 CFR 1926.65) or an AHA (for non-HAZWOPER tasks).

4.1 STF IN-TANK EQUIPMENT REMOVAL (ENERGY SYSTEMS)

The in-tank equipment removal task includes the removal of previously utilized equipment from the interior of the tanks. Equipment to be removed includes, but is not limited to, camera assemblies, pipes, riser seals, suction legs, and mixing jets. The work will be performed by Energy Research personnel from various organizations during the time frame February through April 1997.

Health and Safety Concerns. Major safety and health concerns associated with this task are chemical and radiological exposure and contamination during equipment removal. Additional hazards include hoisting and rigging and temperature extremes.

Controls. Engineering controls including shielding and containment devices will be developed. Administrative controls will include the SSHA or AHA, decontamination and containment procedures, and instituting ALARA principles.

4.2 STF EXTERNAL EQUIPMENT REMOVAL AND SITE PREPARATION (ENERGY SYSTEMS/ENERGY RESEARCH AND MK-F)

STF external equipment removal and site preparation will include modification/installation of new tank risers, grading a flat contour for platform installation, cutting and capping existing lines, installing utilities, modifying existing STF platforms, modifying drywells, installation of a new East Access Road, etc. The work will be performed by MK-F/MK-F direct hire and Energy Research and will be completed by September 1997.

Health and Safety Concerns. The STF is categorized as a Category III nuclear facility (see Sect. 7.3). Health and safety concerns for the tasks are chemical and radiological contamination and exposure. Additional hazards include general construction hazards, confined space entry (to remove equipment from the pits), asbestos, lead in paint, and possibly PCBs in wiring. Physical hazards include elevated work, noise, heat/cold stress, electrical hazards, and ergonomics.

Controls. The engineering controls developed for shielding and containment (Sect. 4.1) and the decontamination and containment procedures developed in Sect. 4.1 will be utilized during STF external equipment removal. A SSHA or AHA will be developed by both MK-F and Energy Research, as necessary.

4.3 NTF TREATABILITY STUDY (ENERGY SYSTEMS)

The third task of the GAAT Project includes testing equipment, removal of waste sludge, and scarifying and characterization of the tank walls in NTF tanks W-3 and W-4. The NTF Treatability Study will utilize a robotic track vehicle and a robotic arm to perform the waste removal activities. Sludge removal equipment will be remotely control from a control trailer. The task will also include sludge conditioning and transfer; equipment maintenance, removal, and reinstallation; and sludge transfer to the STF consolidation tank. The task is scheduled for March through September 1997.

Health and Safety Concerns. Primary hazards are radiological exposure and contamination from the transfer and removal of the sludge. Additional hazards include hoisting and rigging, temperature extremes, hazardous energy sources, and elevated work surfaces.

Controls. Engineering controls including glove boxes, decon spray rings, hose reels, and the tank riser interface confinement (TRIC) assembly have been developed to minimize contamination and exposure. Shielding will be used when appropriate to minimize additional exposure. All of the waste removal equipment is remotely operated to reduce exposure. A SSHA or AHA will be prepared to address the hazards present during this task.

4.4 STF TANK REMEDIATION ACTIVITIES (ENERGY SYSTEMS)

This task involves removal of waste sludge and scarifying of the walls in STF tanks W-5, W-6, W-7, W-8, W-9, and W-10. This effort will incorporate information gained during the NTF Treatability Study performed in Sect. 4.3. The STF remediation will utilize the same equipment used during the NTF Treatability Study although additional equipment and techniques may be used in the STF based on the results of the NTF effort. The task will also include equipment maintenance, removal, and reinstallation and sludge conditioning and transfer. The task is scheduled for October 1997 through July 2000.

Health and Safety Concerns. Primary hazards are radiological exposure and contamination from the transfer and removal of the sludge. Radiological hazards are significantly higher than those present during the NTF Treatability Study due to higher levels of radioactivity present in the STF tanks. Additional hazards include hoisting and rigging, temperature extremes, hazardous energy sources, and elevated work surfaces. Other hazards discovered during the NTF Treatability Study will be addressed prior to the start of the STF remediation.

Controls. Engineering controls including glove boxes, decon spray rings, hose reels, and the TRIC assembly have been developed to minimize contamination and exposure. Shielding will be used when appropriate to minimize additional exposure. All of the waste removal equipment is remotely operated to reduce exposure. A SSHA or AHA will be prepared to address the hazards present during this task. Additional engineering controls and administrative controls will be developed based on the NTF Treatability Study.

4.5 ADDITIONAL SITE CHARACTERIZATION

Additional site characterization (soil, sludge, supernate, or water samples) may be required during the GAAT project. Samples may be required prior to or post task for characterization of conditions. Samples will be collected by Energy Research or Energy Research subcontractors.

Health and Safety Concerns. Radiological hazards are of primary concern during sampling. Additional hazards include general hazards such as tripping/falling and ergonomics.

Controls. A SSHA or AHA will be prepared to cover the hazards present during sampling operations. Both administrative controls and engineering controls will be addressed in the SSHA or AHA.

4.6 NTF AND STF TANK CLOSURE

Closure of the tanks will involve filling the tanks with a fill mixture. Exact closure method and type fill will be determined based on the results of the NTF Treatability Study and the STF remediation effort.

Health and Safety Concerns. Primary hazards during tank closure will be radiological exposure and contamination. Radiological hazards will be evaluated based upon the success of the Treatability Study and the STF Remediation.

Controls. Controls will be addressed in the SSHA or AHA based upon the evaluation of hazards present after the completion of the Treatability Study and the STF Remediation.

4.7 NTF AND STF SITE CLOSURE

Final closure of the NTF and STF will be determined based upon the results of the Treatability Study, the STF Remediation, and the tank closure method. Final closure will be addressed in the Bethel/Melton Valley Watershed operable unit remedial action plan. Site closure alternatives include, but are not limited to, leveling the grade and turning the areas into additional parking or covering the areas with clean soil.

Health and Safety Concerns. Primary hazards associated with site closure are surface radiological hazards and general construction hazards. Additional hazards will be evaluated when the site closure method is determined.

Controls. Controls for the NTF and STF site closure will be addressed in a SSHA or AHA. Additional controls will be addressed when the site closure method is determined.

4.8 ADDITIONAL SITE ACTIVITIES

Additional site activities not previously mentioned may be identified as the GAAT Project progresses.

Health and Safety Concerns. Hazards will be identified when the activity is initiated.

Controls. Controls will be addressed in a SSHA or AHA.

4.9 SITE PHYSICAL HAZARDS

4.9.1 Noise

Hazard. The operation of large or heavy equipment such as cranes can create areas where noise levels exceed 85 decibels on the A-weighted scale (dBA). Exposure to excessive noise levels may lead to temporary or permanent hearing loss.

Controls. Hearing protection shall be worn by task 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 area for possible hazards. Areas where noise levels are greater than 85 dBA will be posted as "Noise Hazard Areas—Hearing Protection Required." Work supervisors will ensure compliance with posted warnings. Site workers should report to the SSHO when concerned with excessive sound levels in their work area.

4.9.2 Site Working Conditions Hazards

Hazards. Due to the nature of the site and the fact that the work will take place outdoors, there will be a large number of physical hazards due primarily to varying working conditions. These hazards include, but are not limited to, personnel encounters with objects and conditions that may cause slips, trips, falls, or cuts.

Controls. Personnel should be aware of task hazards and site conditions. PPE for task/site operations will be evaluated on a task-specific basis. For most activities, minimum PPE will include safety glasses with side shields or goggles, work clothing, gloves, and hard-toed footwear. PPE requirements for a particular task will be described in the SSHA or AHA.

4.9.3 Overhead Power Lines

Hazards. Overhead power lines pose a hazard for the operation of equipment when there is the possibility of contact.

Controls. A 10-ft minimum clearance (EPA 1992) shall be maintained from all lines 110 volts or greater. If the appropriate clearance cannot be maintained, the power lines shall be de-energized and grounded.

4.9.4 Electrical Hazards

Numerous electrical hazards may exist throughout the NTF and STF facilities, therefore personnel should always remain cognizant of the potential for electrocution or shock when conducting any activities. Common electrical hazards include undetected live wires, deteriorating wiring insulation, buried power lines, overhead power lines (see Sect. 4.9.3), transformers, circuit boxes, electrical generators, and lightning.

Hazards. Electrical hazards may include, but are not limited to, the following:

- standing water or puddles in the immediate area where work operations and power sources exist;
- conducting outside activities during electrical storms;

- operating booms, masts, or cranes within a 10-ft radius of overhead power lines;
- excavating in the immediate area of underground power lines;
- improper selection of tools for a work effort located near electrical power sources (tools should be nonconductive and/or grounded).

Controls. Various controls may be implemented in order to decrease or eliminate electrical hazards to personnel. Some control measures to consider are

- consulting blue prints, drawings, site maps, and/or penetration permits to locate potential power sources (underground power lines, overhead power lines, conduits, etc.) and performing an area walkover prior to commencing work activities;
- implementing lockout/tagout procedures or ground-fault-circuit interrupters prior to commencing work activities;
- assuring that all equipment that poses an electrical hazard is equipped with a ground-fault-circuit interrupter.
- recognizing hazardous work conditions (puddles or standing water) prior to commencing work activities;
- properly using PPE (rubber boots, gloves, etc.);
- ceasing outdoor activities prior to severe weather conditions (thunderstorms/lightning storms);
- utilizing nonconducting materials and tools when working in the vicinity of electrical power sources or equipment.

4.9.5 Lockout/Tagout of Hazardous Energy Sources

In order to ensure the safety of personnel during construction and/or maintenance of the waste removal equipment or related systems, the hazardous energy sources (hydraulics, water, electrical, steam, and pneumatic) shall be locked out and tagged out. The lockout/tagout will be the responsibility of the system lead, site/shift supervisor, or SSHO. For Energy Systems/Energy Research activities, the SSHO shall ensure that the systems undergoing repair have appropriately been locked out and tagged out in accordance with 29 CFR 1910.269 and 29 CFR 1910.147. For MK-F and MK-F subcontractors, lockout/tagout will be performed in accordance with MK-F procedures. Additionally, the supervisor of craft personnel (millwrights, pipe fitters, labors, etc.) may be asked to perform lockout/tagout responsibilities or inspections.

4.9.6 Temperature Extremes

Heat Stress. Working in protective clothing can greatly increase the likelihood of heat fatigue, heat exhaustion, and heat stroke, the latter being a life-threatening condition. If employees are dressed out in protective clothing and temperatures at the work site are above 80°F, the wet bulb globe thermometer (WBGT) shall be monitored to assess the potential for heat stress. Sufficient cool water will be made available in the support trailer. The SSHO will be responsible for briefing workers on the signs of heat stress when temperature conditions require it. This may be done during the daily H&S briefing. Work/rest schedules will be implemented, when necessary, within the guidelines of the American Conference of Governmental Industrial Hygienists WBGT Threshold Limit Values and the National Institute of Occupational Safety and Health (NIOSH 1986).

- **Heat Exhaustion**
  - **Symptoms:** Extreme fatigue, cramps, dizziness, headache, nausea, profuse sweating, pale clammy skin.
  - **Treatment:** Immediately remove victim from the work area. Allow victim to rest, cool off, and drink plenty of cool water. If the symptoms do not subside after a reasonable rest period, employees shall notify the SSHO and seek medical assistance.
- **Heat Stroke**
  - **Symptoms:** Initial symptoms often include headache, dizziness, nausea, oppression, and dryness of the skin and mouth. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly.
  - **Treatment:** Immediately evacuate the victim to a cool and shady area. Remove all outer clothing and lay the victim on his or her back with the head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels to the head. Sponge off the bare skin with cool water. Seek medical attention immediately.

Cold Stress. The primary hazards associated with working in the cold are hypothermia and frostbite.

- **Frostbite**
  - **Symptoms:** Frostbite is most likely to occur in the extremities, especially in the fingers, toes, cheeks, and ears. In very early stages of frostbite, the affected body parts may feel numb and appear white. As frostbite progresses, the individual may experience pain and a loss of flexibility in the affected body part and the affected skin may appear waxy or translucent.
  - **Treatment:** Mild frostbite can be treated by immersing the affected part in warm water. Frostbitten tissue should not be rubbed. Deep frostbite is a very serious condition that requires immediate medical treatment.
- **Hypothermia**
  - **Symptoms:** The first symptoms of hypothermia are uncontrollable shivering and the sensation of cold. The heartbeat slows and sometimes becomes irregular, the pulse weakens, and the blood pressure changes.
  - **Treatment:** Move the victim to a warm place. Cover the person with warm blankets, and warm the body slowly.

Controls. Employees who must work under cold conditions should

- Eat a proper diet and avoid alcohol,
- Wear layered clothing,
- Wear proper boots and socks,
- Wear warm gloves, if possible,
- Wear a hard hat liner that covers the ears, and
- Be aware of the conditions that are likely to cause frostbite and be prepared.

4.9.7 Confined Space Entry

A confined spaced is defined as an enclosed area with all of the following characteristics: not designed for human occupancy; entry and exit into the area is restricted in that it requires the entrant to contort his or her body or to use his or her hands in order to enter and/or exit the area; and the area contains known or potential hazards to the safety or health of the entrant. Examples of some potential hazards that may be encountered in a confined space are as follows: hazardous atmospheres, immediately-dangerous-to-life-or-health conditions, ionizing radiation, safety hazards, and hazardous energy sources.

All pits in the NTF and STF are confined spaces. If confined space entry is necessary during GAAT operations, the requirements of 29 CFR 1910.146 shall be fulfilled. For Energy Systems/Energy Research and their subcontractors, the provisions and requirements of the OSHP procedures for confined space entry shall also be followed. A representative from OSHP shall be contacted prior to any confined space entry, and OSHP shall conduct all required atmospheric testing in accordance with established ORNL procedures. For MK-F and MK-F subcontractors, the provisions and requirements of MK-F confined space entry procedures will be followed. A representative from MK-F IH shall be contacted prior to any confined space entry, and MK-F IH representative shall conduct all required atmospheric testing in accordance with established MK-F procedures. The SSHO, GAAT H&S Manager, MK-F ORNL H&S Coordinator, or the Facility Manager must be consulted prior to entering a suspect area.

4.10 SITE CHEMICAL HAZARDS

Many chemical hazards with various origins or functions may be present in NTF and STF tanks. Chemicals that have been identified as known or suspected site contaminants are listed in Table 4.1. The table also contains physical and chemical properties, toxicity, health effects, and symptoms of exposure.

Chemical hazards will be minimized through the use of engineering and work-practice controls (e.g., decontamination spray rings and HEPA systems) as mandated by the SSHO. Chemical hazards should not present an exposure hazard during operations due to the engineering controls in place. However, during some tasks, the SSHO will monitor for volatile organic compounds (VOCs) periodically to ensure that VOCs are below established limits.

Threshold limit values (TLVs) are established by the American Conference of Governmental Industrial Hygienists (ACGIH). TLVs refer to airborne concentrations of substances that a worker can be exposed to for an 8-hour period. Permissible exposure limits (PELs) are established by OSHA and are found in Table 2-1-A or Table 2-2 of the *OSHA General Industry Air Contaminants Standard* (29 CFR 1910.1000). PELs are time-weighted-average (TWA) concentrations that must not be exceeded during any 8-hour shift of a 40-hour workweek. TLVs and PELs are designed to be used by individuals trained in industrial hygiene/industrial safety.

Material Safety Date Sheets (MSDSs) for any chemicals brought on-site for site operations will be obtained by the SSHO or project supervisor of each company prior to the start of field activities. These MSDSs shall be obtained through the LMES Tracking System and entered in the site HAZCOM Binder. The MSDSs shall be available on-site during all operations.

Table 4.1. Characteristics of suspected chemical contaminants at NTF and STF tanks

Contaminant	TLV/PEL[a]	STEL/ IDLH[b]	Target organs/ miscellaneous information[c]	Signs and Symptoms	Physical and chemical properties
Lead (inorganic)	TLV: 0.05 mg/m^3	IDLH: 700 mg/m^3	GI tract, CNS, kidneys, blood	Anemia, weakness, insomnia, low weight	Soft, grey solid
Naphtha	TLV: 300 ppm PEL: 100 ppm	IDLH: 10,000 ppm	Respiratory system, eyes, skin	Skin irritant, dizziness	Watery liquid; colorless; gasoline-like odor; floats on water
Naphthalene	TLV: 10 ppm TLV: 1 ppm	IDLH: 500 ppm	Eyes, blood, liver, kidneys, skin	Skin and eye irritant	Solid; colorless; mothball-like odor; solidifies and sinks in water

[a]TLV - Threshold limit value, PEL - Permissible exposure limit. Values given in this column are continually updated as new information becomes available. Consult current literature before establishing site action levels.

[b]STEL - Short-term exposure limit, IDLH - Immediately dangerous to life and health. Values given in this column are continually updated as new information becomes available. Consult current literature before establishing site action levels.

[c]CNS - Central nervous system, GI - gastrointestinal tract.

Source: ACGIH 1995, NIOSH 1990, MSDS sheets, and NTF historical information.

4.11 SITE RADIOLOGICAL HAZARDS

Radiological contamination will be assessed by a review of site radiological survey information and anticipated work activities by the RCT. On-site radiological surveys will be performed by the RCT. A detailed evaluation of the radiological exposure present during each task will be included in a RWP. Radiological hazards will be minimized to as-low-as-reasonably-achievable (ALARA) levels by the use of time, distance, and shielding, as well as the use of PPE and on-site frisking, as mandated by the RCT.

Measured dose rates at the riser openings of NTF and STF tanks are given in Table 4.2. (**Note:** Exposure rates at a given tank may change due to a change in the level and amount of the supernate or sludge during removal activities. The radiological levels shall be checked by the RCT prior to the start of a task.) Maximum contamination guides for frisking equipment released to a Controlled Area are contained in Table 4.3. Skin and personal clothing contamination limits shall be the same as the total contamination limits in Table 4.3, except that averaging shall not be allowed. Personal clothing will not be worn in contaminated areas (underwear and socks excluded). Personnel will be provided the level of PPE deemed appropriate by the RCT and the SSHO. Table 4.4 details information on suspected or known radionuclide contaminants at the NTF and STF.

Table 4.2. Exposure rates at NTF and STF tanks[a]

Tank	Surface exposure rate (Tank riser opening)
	NTF tanks
W-3	4 mR/h
W-4	20 mR/h
	STF tanks
W-5	0.5 mR/h
W-6	1 mR/h
W-7	150 mR/h
W-8	10 mR/h
W-9	1.5 mR/h
W-10	60 mR/h

[a]Exposure levels at a given tank may change due to a change in the level of the supernate or during sludge removal activities. The radiological levels should be checked by the RCT prior to the start of a task.

Table 4.3. Surface radioactivity values

Nuclide[a]	Removable (dpm/100 cm^2)[b]	Total (fixed + removable) (dpm/100 cm^2)[c]	Maximum Total (fixed + removable) (dpm/100 cm^2)
U-natural, ^{235}U, ^{238}U, and associated decay products	1,000 alpha	5,000 alpha	15,000 alpha
Transuranics, ^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I	20	100[d]	300
Th-natural, ^{232}Th, ^{90}Sr, ^{223}Ra, ^{224}Ra, ^{232}U, ^{126}I, ^{131}I, ^{133}I	200	1,000	3,000
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	15,000 beta-gamma
Tritium organic compounds, surfaces contaminated by HT, HTO, and metal tritide aerosols	1,000	1,000	---

[a]The 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.

[b]The amount of removable radioactive material per 100 cm^2 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 cm^2, the entire surface should be smeared, and the activity per unit area should be based on the actual surface area. Except for transuranics, ^{228}Ra, ^{227}Ac, ^{228}Th, ^{230}Th, ^{231}Pa, 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.

[c]The levels may be averaged over 1 m^2 provided the maximum activity in any area of 100 cm is less than the Maximum Total column in Table 4.3.

[d]There is currently no DOE Order or Federal Regulation providing guidance for the release of transuranic contaminated material and equipment to uncontrolled areas. Until 10 CFR 834 is finalized, ORNL will adopt the guidance in Regulatory Guide 1.86 as directed by the DOE Site Office (R. O. Hultgren to M. W. Rosenthal, "Unrestricted Release Limits for Transuranic Contaminated Equipment and Property," June 8, 1992). It is generally conceded that radiation survey instruments are incapable of detecting 100 dpm/100 cm^2 in the scanning mode. Monitoring of equipment potentially contaminated with transuranics will be done in the scanning mode for the maximum limit and then the scaling mode will be used in areas identified as suspect in the scanning mode to ensure that the average limit is not exceeded.

Table 4.4. Characteristics of the predominant radionuclide contaminants at the NTF and STF

Contaminant	DAC[a] D[b] (μCi/mL)	DAC[a] Y[b] (μCi/mL)	Critical target organs[c]
MANMADE RADIONUCLIDES			
Cesium-137	7×10^{-8}		Whole body
Strontium-90	8×10^{-9}	2×10^{-9}	Whole body, bone, lung
NATURALLY OCCURRING RADIONUCLIDES			
Uranium-235		2×10^{-11}	Bone, lung, whole body

[a]Derived 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, whichever is more limiting.

[b]The DACs in this table include two lung retention classes: D - daily 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 and greater than 100 days for class Y.

[c]Critical 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.

4.12 OTHER HAZARDS

4.12.1 Illumination

Field activities at the GAAT project normally will be conducted during daylight hours, and a minimum of 5 footcandles will be required to conduct operations. (A footcandle is a unit of illumination equal to one lumen per square foot when measured at a surface that is everywhere one foot from a source of one candle power.) Supplemental lighting will be provided when required for after-daylight operations. Actual field measurements of illumination will not be taken. A conservative guideline may be that field work commence 15 minutes after sunrise and conclude 15 minutes prior to sunset. Adherence to the minimum 5-footcandles requirement will be based on the SSHO's best professional judgment.

4.12.2 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, improper body positioning, and negotiation of physical obstacles. 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 at a job site, may be avoided if site workers ask for assistance when they need it.

If any worker feels discomfort resulting from performing duties on-site, the worker should bring this information to the attention of the SSHO.

4.12.3 Hot Work

Hazards. Hot work (welding, burning, etc.) can be hazardous as an ignition source and as a source of release for airborne contamination or products of combustion.

Controls:

- All hot work will be done within the specification of the ORNL Safety Work Permit (SWP) and Hot Work Permit (HWP). The Facility Manager or Construction Manager is responsible for generating SWPs and HWPs for Energy Systems/Energy Research activities. HWPs and SWPs for MK-F activities will be issued by the ORNL SHEST Representative.
- A 10-lb cylinder of dry chemical fire extinguishing agents will be kept in the immediate area of hot work.
- To the extent possible, all combustible material will be removed from work area.
- A dedicated fire watch will be maintained during and for 30 minutes after all hot work activities.
- Fire watch personnel shall be trained on the use of fire extinguishers and the responsibilities of a fire watch.
- The material to be burned or welded upon and the atmosphere in the immediate area shall be examined by the SSHO prior to the commencement of work activities to assess the possibility of hazardous fumes being created during hot work operations.
- Clothing worn during burning/cutting shall be evaluated by the SSHO prior to use.
- A Hot Work Permit must be obtained and maintained on-site while work is in progress.

4.12.4 Heavy Equipment

Hazards. The hazards associated with the operation of heavy equipment such as cranes are, in general, personnel injury, equipment damage, hydraulic leaks, or property damage.

Controls:

- All heavy equipment shall be used in the manner intended. Drivers will operate all equipment in accordance with the manufacturers' instructions and within the safe operating parameters defined by the manufacturer.
- A heavy equipment operator shall be trained for the specific piece of equipment he/she is operating.
- Heavy equipment conducting hoisting and rigging (H&R) activities shall operate within the guidelines of the approved lift plan generated by the company performing the lift, if applicable.
- All heavy equipment shall have current annual inspection certifications before use.
- All heavy equipment shall be inspected daily by the operators and, as required, by certified inspectors before operations begin.
- All hydraulic equipment will be inspected daily for leaks or other problems.
- Applicable monthly, quarterly, and/or daily special inspections shall be completed prior to equipment operation.

- Where possible, heavy equipment in stationary operations should be barricaded (with hazard tape) at a sufficient distance for ground personnel to avoid moving cabs, counterweights, and booms. When ground personnel are working in the vicinity of heavy equipment, they should inform the flagman or equipment operator of their presence.

4.12.5 Hoisting and Rigging Operations

Operations that involve the use of cranes, forklifts, hoists, powered industrial trucks, and slings are subject to certain hazards that cannot be controlled by mechanical means. The possibility of serious accidents resulting in personal injury, death, or significant property damage exists whenever hoisting and rigging (H&R) activities take place. All operations involving hoisting and rigging operations shall be conducted in accordance with the provisions and requirements of all applicable sections of 29 CFR 1910, 29 CFR 1926, and ANSI B30 (hoisting and rigging design specifications only). In addition, proposed critical lift plans for hoisting and rigging activities shall be submitted to the ORNL H&R Program Manager for approval by the H&R Review Team. Hoisting and rigging operations performed by MK-F shall be performed in accordance with MK-F procedures. All applicable SOPs shall be maintained on-site for quick reference.

Possible site operations may involve, but are not limited to, rigging activities or the use of any of the following types of equipment:

- Overhead and gantry cranes.
- Mobile cranes.
- Forklift trucks.
- Hoists.
- Hooks.
- Wire rope, slings and rigging accessories.
- Below-the-hook lifting devices.

4.12.6 Elevated Work Surfaces

The installation and maintenance of the waste sludge removal equipment and related systems will require worker access to areas higher than 4 feet from the ground or work platform. All elevated work will be performed under the requirements of 29 CFR 1910 and 29 CFR 1926. The SSHO will ensure that the requirements of the 29 CFR 1910 and 29 CFR 1926 are followed and will contact the GAAT H&S Manager or the MK-F ORNL H&S Coordinator for guidance concerning elevated work.

4.12.7 Ladder Safety

The use of ladders may be required during some site activities. All work requiring the use of a ladder will be performed under the requirements of 29 CFR 1910 and 29 CFR 1926. The SSHO shall ensure that all ladders brought to the job site comply with ANSI standards. The SSHO will contact the GAAT H&S Manager or the MK-F ORNL H&S Coordinator for any additional guidance needed concerning the safe use of ladders.

5. SITE ACCESS REQUIREMENTS

Health and safety training must comply with the requirements specified in 29 CFR 1910.120 and 29 CFR 1926. The minimum requirements for access to the NTF and STF facilities are listed below.

- The NTF Facility Manager and/or Facility Coordinator(s) will have final control over site access.
- The GAAT H&S Manager or the MK-F ORNL H&S Coordinator (for MK-F activities) will determine the site access training requirements needed to perform each task.
- All personnel other than visitors to the facility are required to have General Employee Training (GET).
- All personnel who will be performing work at the GAAT NTF and STF facilities are required to have the proper training to do the work. In some instances, 24 hours of health and safety training and a radiation worker training course may be required. If respirators are used, or intrusive activities are performed, the workers must have 40 hours of health and safety training (HAZWOPER training, per 29 CFR 1910.120 and 29 CFR 1926.65) and Radiation Worker II training.
- All visitors who are granted site access and have business in the CRZ, EZ, or Radiological Areas are required to be escorted at all times by the SSHO, RCT, or approved alternates. If the area visited and time at the site pose a radiological concern, project management must arrange for a temporary thermoluminescent dosimeter (TLD), if required. Additionally, visitors must abide by all requirements of the PHASP, SSHA, AHA, and RWP. Visitors must also comply with site requirements and project or task requirements.
- Access to specific HAZWOPER zones by visitors is controlled by the SSHO.

5.1 TRAINING

5.1.1 General Employee Training (GET)

All ORNL and Energy Systems employees, prime contractors, students, interns, and subcontractors are required to complete GET and to also complete a GET refresher training session every 24 months. This requirement was established by ORNL and Energy Systems for all personnel. GET training describes the primary function of the various Energy Systems and ORNL sites and their responsibility to DOE. It covers the security system, emergency programs, various emergency signals, and appropriate actions that need to be taken by each individual. GET also covers general health and safety topics including the various radiation zones that can be found throughout each plant. GET explains the Hazardous Communication Program and how it affects the employee.

5.1.2 40-Hour HAZWOPER Training

All personnel who work or access at designated HAZWOPER work areas must recognize and understand the potential hazards to health and safety associated with task activities. Individuals may not participate in or supervise any HAZWOPER work activity until they have been properly trained.

The HAZWOPER standards within 29 CFR 1910.120(e) reflect a tiered approach to this training. The objectives of the HAZWOPER training program are to

- educate workers about the potential health and safety hazards they may encounter at the site;
- provide the knowledge and skill necessary to minimize risk to worker safety and health;
- provide thorough training in the proper use and potential limitation of safety and PPE; and
- ensure that workers can safely avoid or report potential emergencies.

The training program should include 40 hours of classroom instruction in a wide range of health and safety topics, demonstrations, and hands-on practices plus 3 days of supervised field experience at a hazardous waste site.

5.1.3 24-Hour HAZWOPER Training

HAZWOPER 24-hour training includes a minimum of 24 hours of classroom training plus 1 day of supervised field experience at a hazardous waste site. The 24-hour training is required for workers or supervisors who are on-site regularly and will only enter areas that have been fully characterized, indicating that exposures are under the PELs and published radiological exposure limits. If task requirements specify respiratory protection equipment, 24-hour HAZWOPER training will not suffice. An additional 16 hours classroom training and 2 days of field experience will be required to upgrade to the 40-hour training. A copy of the certificate or verification of completion of this training or the ORNL Special Access Training Badge must be maintained on-site to verify compliance.

5.1.4 8-Hour HAZWOPER Supervisor Training

An additional 8 hours of HAZWOPER supervisory training will be required for individuals who manage or supervise workers during HAZWOPER work activities. This training is in addition to either the 24-hour or 40-hour training required for the specific task. The supervisor training elaborates on supervisor roles and responsibilities under the health and safety program, the PPE program, the medical surveillance program, and the emergency response plan.

5.1.5 Radiological Worker Training

Radiation worker training is designed to meet the requirements stipulated in 10 CFR 835. A radiation worker is defined as an occupational worker whose job assignment involves exposure to radiation while working on, with, or in proximity to radiation-producing machines or radioactive materials and is likely to be exposed above 100 mrem per year (including external and internal sources). This also includes personnel who work in or have access to Contamination Areas, regardless of their dose.

The GAAT project requires that all facility workers have Radiation Worker II training. This training covers the use of PPE for protection against a radiological concern. Instruction includes the proper type of PPE and how to don and doff the protective articles. A certificate of completion is awarded upon satisfactory completion of the course, clothing demonstration, instrument laboratory, and examination. Retraining and recertification are required every two years. A copy of each workers' certificate must be available to verify compliance. In specific cases where PPE is not required, Radiation Worker I training may suffice. Visitors who need to access Radiological Areas

and need to don PPE may do so without meeting the requirement for Radiation Worker training if they are escorted by the RCT.

5.1.6 Worker/Visitor Training Requirements

The requirements for worker training for tasks conducted under this PHASP 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; controlled access area, CRZ, or EZ workers (Levels A, B, C, and D+ workers); on-site supervisors; and nonworkers or site visitors are listed below in Table 5.1. The regulatory basis for the requirements presented in Table 5.1 is located in 29 CFR 1910.120. The presentation of this information was adapted from the U.S. DOE document *OSHA Training Requirements for Hazardous Waste Operations* (DOE 1991) and updated to include additional training requirements.

Other worker training requirements, as stated above, will be project- and task-specific, and may include, but are not limited to, courses on the following subjects: respiratory protection, radiation worker, confined space entrant/attendant, and operation of specific equipment. 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 and the GAAT Training Coordinator will be responsible for verifying task-specific training for workers on certain equipment.

5.1.7 Waiver of Training or Medical Requirements

Specific training or medical requirements (e.g., bioassay program) may be waived for visitors requiring access to certain zones if specific hazards (such as airborne radioactivity) do not exist. Waivers will be enacted on a case-by-case basis and shall be granted and approved by the SSHO and RCT.

Personnel that do not meet the training or medical requirements will always be escorted by the SSHO, RCT, or other approved ES&H personnel. The safety and health of no individual will be compromised for site access. All site hazards shall be evaluated and controls in place (if needed) before access is granted.

5.1.8 Training Documentation

Site access training received outside ORNL or Energy Systems must be reviewed for compliance to the appropriate Federal regulations. 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 for Energy Systems/Energy Research and their subcontractors will be maintained by the GAAT Training Coordinator. Training Records for MK-F and MK-F subcontractors will be maintained by MK-F.

5.1.9 Equivalent Training

In special circumstances, according to the provisions of 29 CFR 1910.120 (e)(9), equivalent training such as hazardous waste site work experience, academic training, and/or other forms of certification or training may be considered acceptable for compliance with the training requirements of 29 CFR 1910.120(e)(1) through (e)(4).

Table 5.1. Site training requirements

Operation/ personnel	Site health & safety briefing	24-h	40-h	8-h super-visor	8-h refresher[a]	Rad worker II	GET	Medical surveil-lance	Whole body count	Bio-assay
Routine/occasional worker	X	X[b]	X		X	X	X	X	X	X
Routine/occasional worker (Level D)	X	X			X	X	X	X	X	X
On-site supervisor	X	X[c]	X	X	X	X	X	X	X	X
Nonworker/visitor[d,e]										
Level A or B PPE[f]	X		X		X	X[g]				
Level C PPE	X		X		X	X[g]				
Level D or No PPE	X	X[h]			X[h]					

[a]Annual 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.

[b]24-hour 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.

[c]Supervisors of on-site workers who require only the 24-hour course need only take the 24-hour initial and 8-hour supervisor courses.

[d]If the area visited and time at the site pose a radiological concern, as determined by the RCT or 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.

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

[f]PPE - Personal Protective Equipment

[g]Radiation Worker II required at radiological sites unless escorted by the RCT.

[h]24-hour training required at HAZWOPER sites, unless waived for visitors as described in Sect. 5.1.7.

5.2 PRE-ENTRY HEALTH AND SAFETY BRIEFING

All task personnel shall be required to attend a pre-entry health and safety briefing prior to entering the work area. This pre-entry health and safety briefing shall be conducted jointly by the SSHO and the RCT of the organization performing the work, or by designated representatives who have been approved by the SSHO and the RCT. The pre-entry health and safety briefing shall highlight the health and safety information presented in the PHASP, SSHA, AHA, and RWPs. This information may include, but is not limited to, the following:

- Reporting chain of command.
- Site or task location access requirements.
- Site chemical hazards and symptoms of exposure.
- Site physical and mechanical hazards and recognition of hazards.
- Personnel and equipment decontamination requirements.
- Location of the primary and secondary emergency assembly points.
- Emergency procedures.
- Spill response procedures.
- Location of the site emergency action plan.
- Location of clean areas or break areas and rest room facilities.
- Location of nearest communication equipment (telephone, fire alarm pull boxes).
- Location of emergency telephone numbers.
- Evacuation routes.
- Other information contained in the PHASP, SSHA, and AHA.

5.2.1 Documentation of Briefings

Attendance at the pre-entry health and safety briefings for HAZWOPER-designated tasks will be documented by the signature of all personnel present on the GAAT Project Health and Safety Plan Acceptance Form located in Attachment D.

5.2.2 Daily Safety and Health Briefings

Daily H&S briefings shall be held by the SSHO, and/or the RCT to summarize planned activities, to identify new hazards, or to clarify any task or project-related issues. All site personnel anticipated for the day's activities will be required to attend. Daily H&S briefings may include, but are not limited to, the following subjects:

- Worker safety issues.
- Task-specific PPE and respiratory requirements.
- Requirements for RWPs and/or SWPs.
- SOPs and any approved deviations to the prescribed procedures.
- Previous lessons learned.

5.3 PERSONAL PROTECTION REQUIREMENTS

5.3.1 Personal Protective Equipment

The SSHO and RCT shall specify the PPE required for specific activities, tasks, and work zones. This specification shall be based on possible site contaminants, chemical and radiological hazards information, OSHA requirements, ORNL RPPs, MK-F Radiological Procedures, and/or 10 CFR 835. The SSHO and/or the RCT shall instruct all site personnel in donning and doffing procedures prior to beginning any work activities.

As minimum, Level D PPE will be required for all site activities. This level of PPE includes ORNL or MK-F company-issued clothing*, hard-toed safety shoes, and safety glasses. Hard hats are required for construction activities, in all MK-F work areas**, and when overhead hazards are present. PPE levels for other tasks will be based upon radiological exposure and contamination listed on the RWP. A complete list of the PPE for each particular task will be included in the SSHA, TI, or other applicable permits/plans. Table 5.2 lists suggested protective ensembles.

5.3.2 PPE Upgrade and Downgrade Authority

5.3.2.1 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.

Under the direction of the RCT, the level of PPE ***may be downgraded*** for radiological issues. The change and reason or evidence for the change must be documented in the field logbook.

5.3.2.2 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.

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*MK-F currently requires company-issued clothing only when working under an RWP.

**MK-F SSHO is allowed to make exceptions, depending on work conditions.

Table 5.2. Suggested protective ensembles

Level of protection	Equipment	Protection provided	Should be used when:	Limiting criteria
A	RECOMMENDED: • Pressure-demand, full-facepiece SCBA or pressure-demand sup-plied-air respirator with escape SCBA. • Fully-encapsulating, chemical-resistant suit. • Inner chemical-resistant gloves. • Chemical-resistant safety boots/shoes. • Two-way radio communications. OPTIONAL: • Cooling unit. • Long cotton underwear. • Hard hat. • Disposable gloves and boot covers.	The highest available level of respiratory, skin, and eye protection.	• The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: - measured (or potential for) high concentration of atmospheric vapors, gases, or particulates or - site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin. • Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible. • Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined.	• Fully-encapsulating suit material must be compatible with the substances involved.

Table 5.2. Suggested protective ensembles

Level of protection	Equipment	Protection provided	Should be used when:	Limiting criteria
B	RECOMMENDED: • Pressure-demand, full-facepiece SCBA or pressure-demand sup-plied-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. • Two-way radio communications. OPTIONAL: • Coveralls. • Disposable boot covers. • Face shield. • Long cotton underwear.	The same level of respiratory protection but less skin protection than Level A. Level B protection is the minimum level recommended for initial site entries until the hazards have been further identified.	• 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 use of air-purifying respirators. • Atmosphere contains less than 19.5% oxygen. • Presence of incompletely identified vapors or gases is indicated by 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.	• Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin. • 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.

Table 5.2. Suggested protective ensembles

Level of protection	Equipment	Protection provided	Should be used when:	Limiting criteria
C	RECOMMENDED: • Full-facepiece, air-purifying, canister-equipped respirator. • 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. • Two-way radio communications. OPTIONAL: • Coveralls. • Disposable boot covers. • Face shield. • Escape mask. • Long cotton underwear.	The same level of skin protection as Level B, but a lower level of respiratory protection.	• The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin. • The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant. • All criteria for the use of air-purifying respirators are met.	• Atmospheric concen-trations of chemicals must not exceed IDLH levels. • The atmosphere must contain at least 19.5% oxygen.
D+	RECOMMENDED: • Coveralls. • Safety boots/shoes. • Safety glasses or chemical splash goggles. • Hard hat. OPTIONAL: • Gloves. • Escape mask. • Face shield.	No respiratory protection. Minimal skin protection.	• The atmosphere contains no known hazard. • Work functions preclude splashes, immersion, or the potential for unexpected inhalation of hazardous levels of any chemicals. • Contamination may be present but is not a respiratory hazard.	• The atmosphere must contain at least 19.5% oxygen.

Table 5.2. Suggested protective ensembles

Level of protection	Equipment	Protection provided	Should be used when:	Limiting criteria
D	RECOMMENDED: • Company-issued field clothes. • Hard-toed safety footwear. • Safety glasses or chemical splash goggles. • Cotton work gloves. • Hard hat (construction activities, MK-F work areas, and when overhead hazards are present).	No respiratory protection. Minimal skin protection.	• The atmosphere contains no known hazards. • Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.	• Atmosphere contains at least 19.5% oxygen.

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.

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

5.3.3 Respiratory Protection

All respiratory equipment shall be approved by the National Institute for Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA). 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, site personnel will abide by a single-use respiratory policy. 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 qualification of issuers.

At the GAAT project, Energy Systems/Energy Research personnel and associated subcontractors will comply with the ORNL respiratory protection program; MK-F personnel and subcontractors will comply with the MK-F respiratory protection program. Both programs meet the requirements of 29 CFR 1910.134 and 29 CFR 1926.103.

5.3.4 Donning and Doffing

5.3.4.1 Donning and doffing guidelines for Level D+ PPE

Donning Guidelines for Level D+ PPE

1. Visually inspect all clothing and equipment to be worn prior to donning.
2. If the ensemble includes a chemical protective suit, the suit should be worn over company-issued clothing.
3. While standing or sitting, step into the legs of the chemical protective suit. Tape leg cuffs to top of work boots (leaving a tab on the tape for easy removal).
4. Place arms in the sleeves of the chemical protective suit, and pull the suit over the shoulders.
5. Zip suit to the neck, and place tape over zipper to ensure closure (leave a tab on the tape for easy removal).
6. Don chemical protective overboots, and tape top of boot to outside of the suit (leave a tab on the tape for easy removal).
7. Don cotton liners and chemical resistant outer gloves. Place tape around top of outer glove (leaving a tab on the tape for easy removal).
8. Don safety glasses and hard hat (if appropriate).

Doffing Guidelines for Level D+ PPE

1. Remove all outer tape from the ensemble.
2. Remove chemical protective overboots while stepping to a step-off pad (if provided).
3. Remove contaminated outer gloves by pulling down on the inner cuff of the glove with the opposite hand, thereby turning the glove inside out. While still holding the partially removed glove, grasp the cuff of the glove on the other hand and pull down over the partially removed glove. One glove should be encapsulated in the other, with the contaminated side turned inward.
4. Remove tape from the top of work boots.
5. Unzip suit, and remove arms from suit. Roll suit downward to feet, turning inside out. Step out of suit, and place the suit in the appropriate waste receptacle.
6. Remove inner cotton gloves as described in step 3.
7. Remove safety glasses and hard hat.
8. Perform radiological frisking, if appropriate.
9. Wash hands before eating, drinking, or smoking.

5.3.4.2 Donning and doffing guidelines for Level C PPE

Donning Guidelines for Level C PPE

1. Inspect all clothing and respiratory equipment before donning.
2. Adjust hard hat to fit user's head.
3. While standing or sitting, step into the legs of the chemical protective suit. Tape leg cuffs to top of boots (leaving a tab on the tape for easy removal).

4. Put on chemical protective overboots, and tape the top of the boot to the suit (leaving a tab on the tape for easy removal).
5. Don skull cap.
6. Place arms in chemical protective suit, and pull suit over the shoulders and hood over head.
7. Don respirator and conduct positive and negative pressure tests.
8. Zip suit to neck, and place tape over zipper and around respirator and hood (leaving a tab on the tape for easy removal).
9. Don cotton inner gloves and chemical resistant outer gloves. Place tape around outer glove seam (leaving a tab on the tape for easy removal).
10. Don hard hat.

Doffing Guidelines for Level C PPE

1. Remove all exterior tape closures (from overboots, gloves, zipper, etc.).
2. Remove overboots while stepping to a step-off pad.
3. Remove outer gloves, rolling over hand inside out.
4. Unzip chemical protective suit, and pull hood off of head rolling suit inside out.
5. Slip suit off shoulders, and roll suit inside-out down to ankles.
6. Step out of suit and onto a second step-off pad (if available).
7. Remove respirator and place in designated plastic bag.
8. Remove skull cap.
9. Remove cotton gloves, rolling over hand inside out.
10. Perform whole body radiological frisk.

5.3.4.3 Donning and doffing guidelines for Level B PPE

Donning Guidelines for Level B PPE

1. Inspect all clothing and respiratory equipment before donning.
2. Adjust hard hat to fit user's head.
3. While standing or sitting, step into the legs of the chemical protective suit (Saranex or higher level). Tape leg cuffs to top of boots (leaving a tab on the tape for easy removal).
4. Put on chemical protective overboots, and tape the top of the boot to the suit (leaving a tab on the tape for easy removal).
5. Don skull cap.
6. Place arms in chemical protective suit, and pull suit over the shoulders and hood over head.
7. Don pressure-demand full-face SCBA or pressure-demand full-face supplied-air respirator with escape SCBA, and conduct positive and negative pressure tests.
8. Zip suit to neck, and place tape over zipper and around respirator and hood (leaving a tab on the tape for easy removal).
9. Don cotton inner gloves and chemical resistant outer gloves. Place tape around outer glove seam (leaving a tab on the tape for easy removal).
10. Don hard hat.

Doffing Guidelines for Level B PPE

1. Remove all exterior tape closures (from overboots, gloves, zipper, etc.).
2. Remove overboots while stepping to a step-off pad.
3. Remove outer gloves, rolling over hand inside out.
4. Remove SCBA harness and tank, unzip chemical protective suit, and pull hood off of head rolling suit inside out.
5. Slip suit off shoulders, and roll suit inside-out down to ankles.
6. Step out of suit and on to a second step-off pad (if available).
7. Remove respirator and place in designated plastic bag.
8. Remove skull cap.
9. Remove cotton gloves rolling inside out.
10. Perform whole body radiological frisk.

5.3.4.4 Donning and doffing guidelines for Level A PPE

Donning Guidelines for Level A PPE

1. Inspect the clothing and respiratory equipment before donning.
2. Adjust hard hat or headpiece if worn, to fit user's head.
3. Open back closure used to change air tank (if suit has one) before donning suit.
4. 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.
5. Put on chemical-resistant safety boots over the feet of the suit. 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.
6. Put on air tanks and harness assembly of the SCBA. Don the facepiece and adjust it to be secure, but comfortable. Do *not* connect the breathing hose. Open valve on air tank.
7. Perform negative and positive respirator facepiece seal test procedures.
8. 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.
9. Put sleeves of suit over arms as assistant pulls suit up and over the SCBA (if used). Have assistant adjust suit around SCBA and shoulders to ensure unrestricted motion.
10. Put on hard hat, if needed.
11. Raise hood over head carefully so as not to disrupt face seal of SCBA mask. Adjust hood to give satisfactory comfort.
12. Begin to secure the suit by closing all fasteners, leaving only enough room to connect the breathing hose. Secure all belts and/or adjustable leg, head, and waistbands.

13. Connect the breathing hose while opening the main valve.
14. Have assistant first ensure that wearer is breathing properly and then make final closure of the suit.
15. Have assistant check all closures.
16. Have assistant observe the wearer for a period of time to ensure that the wearer is comfortable, stable, and that the equipment is functioning properly.

Doffing Guidelines for Level A PPE

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

1. Remove any extraneous or disposable clothing, boot covers, outer gloves, and tape.
2. Have assistant loosen and remove the wearer's safety shoes or boots.
3. Have assistant open the suit completely and lift the hood over the head of the wearer and rest it on top of the SCBA tank.
4. Remove arms, one at a time, from suit. Once arms are free, have assistant lift the suit up and away from the SCBA backpack—and the wearer's body—and lay the suit out flat behind the wearer. Leave internal gloves on, if any.
5. Sitting, if possible, remove both legs from the suit.
6. Follow procedure for doffing SCBA.
7. After suit is removed, remove internal gloves by rolling them off the hand, inside out.
8. Remove internal clothing and thoroughly cleanse the body.

If the low-pressure alarm has sounded, signifying that approximately 5 min of air remain:

1. Remove disposable clothing.
2. Quickly scrub and hose off, especially around the entrance/exit zipper.
3. Open the zipper enough to allow access to the regulator and breathing hose.
4. Immediately attach an appropriate canister to the breathing hose (the type and fittings should be predetermined). Although this provides some protection against any contamination still present, it voids the certification of the unit.
5. Follow steps listed above for sufficient air supply. Take care to avoid contaminating the assistant and wearer.

These doffing guidelines 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 Physicals

According to the requirements of 29 CFR 1910.120 and 29 CFR 1926.65, site personnel who meet the criteria listed below must have a physical examination conducted by a physician who is board certified in occupational medicine in order to determine and document the qualification of the

worker to perform work at hazardous waste operations (EPA 1990). Criteria for inclusion in the medical surveillance program are listed below:

- 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 show symptoms of illness that may have resulted from exposure to hazardous substances.

At the GAAT project, all individuals subject to potential chemical/radiological exposure will be required to be placed on a HAZWOPER medical surveillance program. This includes all individuals involved with the installation, decontamination, maintenance, or removal of the waste sludge removal equipment.

The HAZWOPER Program Coordinator, in conjunction with the GAAT H&S Coordinator and the ORNL Health Division, will determine which Energy Systems/Energy Research workers, meeting the criteria listed above, will be required to participate in the ORNL hazardous waste worker medical surveillance program. MK-F ORNL H&S Coordinator, in conjunction with the MK-F Occupational Medical Office, will determine which MK-F workers, meeting the criteria listed above, will be required to participate in a hazardous waste worker medical surveillance program. Physicals shall be documented through a written approval by the examining physician.

5.4.2 Medical Monitoring

GAAT workers and project personnel who have the potential of receiving a radiological exposure will be placed on the bioassay program. The GAAT RSS Complex Leader and the MK-F ORNL HP Coordinator will determine which individuals need to be placed on this program.

Radionuclides identified at the GAAT project that require bioassay include ^{90}Sr, ^{238}Pu, ^{239}Pu, ^{244}Cm, ^{241}Am. The frequency of bioassay measurements for workers in radiological areas has been set for Energy Systems/Energy Research workers by ORNL ORP and for MK-F workers by MK-F Health Physics.

6. FREQUENCY AND TYPES OF MONITORING

6.1 EXPOSURE MONITORING

6.1.1 Area Monitoring

While operations are being conducted at the GAAT project, periodic real-time assessment of potentially hazardous chemical and radiological levels or measurements using direct-reading instruments will be performed by the SSHO and the RCT. While work is being performed in the EZ, monitoring will be performed routinely. Prior to the commencement of any task activities, background levels and levels near the area will be monitored and recorded in the project logbook or on the SWP and RWP. Background readings shall be taken into account before action levels are established by the RCT and SSHO. Monitoring frequency, equipment, and action levels will be described for each particular task in the SSHA and other task-specific permits/plans. Monitoring of air concentrations for any confined space entries will be conducted in accordance with 29 CFR 1910.146. Details concerning monitoring equipment are presented in Sect. 6.2.

6.1.2 Dosimetry

All site entrants shall be regulated by a radiation dosimetry program and shall comply with all provisions of the requirements of ORNL Radiation Protection or MK-F HP program. Based on the characterization of the site, the RCT or HP will inform the ORNL Internal Dosimetry Program or the MK-F HP Office of the radionuclides of concern. This will determine the type and frequency of the bioassays. The radionuclides of concern for this project are listed in Table 4.4.

6.2 MONITORING EQUIPMENT/ACTION LEVELS

Various types of monitoring equipment may be required to conduct worker exposure monitoring during GAAT operations. The SSHO shall ensure that adequate monitoring equipment is available prior to the start of work. 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. Persons performing monitoring shall be approved by ORNL Radiation Protection, GAAT H&S Manager, and/or MK-F ORNL H&S Coordinator. Work involving potential exposure to hazardous materials shall not be performed unless properly maintained and calibrated monitoring instruments are available for use. Required monitoring equipment, monitoring frequency, and action levels will be described for each task in the SSHA or other task-specific permits/plans.

The following instrumentation will be used to identify and/or quantify 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, carbon monoxide, and the lower explosive limit (LEL). The instrument shall be precalibrated with standard gases of known concentrations prior to field use.
- **High-Flow Air Sampling Pumps:** To sample and evaluate the air quality on-site. These instruments shall be calibrated before each use by the SSHO or qualified designee.

- **Personnel Air Sampling Pumps:** To collect personal samples if airborne contaminants are encountered. These instruments shall be calibrated before and after each use by the SSHO or qualified designee.
- **Continuous Air Monitor (CAM):** Samples and measures the levels of airborne radioactive materials on a real-time basis. The CAM has alarm capabilities at preset levels. This instrument is calibrated semi-yearly.
- **Total Organic Vapor Monitors:** Photoionization detector (PID) or flame ionization detector (FID) to survey the surrounding environment 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 for this monitor is 5 ppm measured within the breathing zone for 1 min duration unless the specific chemical TLV is known. In the event the action level is reached, the area will be evacuated by the SSHO. The SSHO will, in turn, notify the proper authorities (see Sect. 3.2).
- **Colorimetric Detector Tubes:** For field identification of the presence of specific chemical contamination and for providing a rough estimate of the concentration level. These instruments shall be leak-checked prior to each use. Action level is ½ PEL.
- **Noise Monitoring Equipment:** To identify problem noise areas and equipment. These instruments shall be calibrated prior to, and after, use. Action level is 85 dBA.
- **Wet Bulb Globe Thermometer (WBGT):** May be used to detect possible heat stress conditions. These instruments will be calibrated according to the manufacturer's specifications. The WBGT should be used at temperatures >70°F. Action levels follow ACGIH guidelines.
- **Personal Thermoluminescent Detection (TLD) Badges:** Issued to each employee through ORNL ORP programs to monitor worker beta/gamma exposures.
- **Extremity Dosimeters:** Issued to RCTs through ORNL ORP programs to monitor worker exposures to the extremities (hands and fingers).
- **Electronic Personal Dosimeter (EPD):** A supplemental dosimeter used in areas where gamma and beta radiations have the potential to exceed ALARA dose limits in a short time. EPDs give instant dose and dose-rate readout and have alarm capabilities at preset levels. This instrument is calibrated semi-yearly.
- **Portable Alpha and Beta-Gamma Survey Meters:** To survey for radioactive contamination on personnel and equipment. These instruments shall be source-checked daily and calibrated every 6 months. Action levels on surface radioactivity limits are listed in Table 4.3.
- **Beta/Gamma Exposure Rate Instrument:** An ion chamber used to survey for beta and/or gamma radiation in order to determine exposure rates. These instruments shall be routinely performance tested daily and calibrated every 6 months.
- **Direct-Reading Pocket Dosimeters:** Supplemental dosimeters that provide a real-time indication of exposure to radiation and assist in maintaining personnel doses less than Administrative Control Levels. These instruments are issued by RCTs.
- **Personnel Contamination Monitor (PCM-1B):** A microprocessor-based radiation detection system that performs quick detection of beta-gamma contamination with the option of alpha detection capabilities. It performs a two-part personnel whole body survey by performing a right side, then left side, personnel body survey.

- **Monitron:** A radiation detection instrument designed for use as a radiation hazard indicator in areas where potential radiation hazards exist. This instrument measures deep dose penetrating radiation and has alarm capabilities at preset levels (caution alarm at 7.5 mR/h, high level alarm at 22 mR/h). This instrument is calibrated yearly.
- **Air Sampling Equipment:** To identify and quantify airborne radioactivity or specific chemical contaminants through laboratory analysis of samples.

6.3 CALIBRATION OF MONITORING AND DETECTION INSTRUMENTS

All monitoring and detection instruments used during field operations shall be calibrated within the proper time frame and in accordance with the manufacturer's recommendations, guidelines, and specifications described in the manufacturer's SOPs. All Energy Systems/Energy Research instrumentation operation and calibration shall be conducted in accordance with ORNL Radiation Protection procedures and/or group-specific procedures, where applicable and available. All MK-F instrumentation operation and calibration shall be performed in accordance with MK-F procedures.

All chemical instrument calibration gas cylinders used in field calibrations must have a manufacturer's label with the lot number, the manufacturer's name, the type of gas, and the ppm or percent of gas concentration contained within the cylinder. Calibration readings, the lot number from the calibration gas cylinder, the calibration gas manufacturer, and each number of the radiological source will be recorded on the Daily Instrument Check Sheet, which is a section of the project logbook dedicated to daily instrumentation calibration, maintenance and use, as well as other information pertinent to field instruments.

6.4 MONITORING RESPONSE GUIDELINES

During site operations, the decisions to upgrade or downgrade PPE levels; to re-establish site EZs, CRZs, and/or Support Zones; or to cease work activities may be made on the basis of site monitoring results. These changes can only be authorized by site authorities including the SSHO, the RCT, the GAAT H&S Manager, and the MK-F ORNL H&S Coordinator. These response guidelines are dependant upon the type of work being conducted, the suspected contaminants, and the health effects and toxicity of the contaminants. However, there are some general guidelines for monitoring response. If the reading on any organic monitoring device stabilizes at 5 ppm and holds steady for 1 min within the breathing zone, workers should be withdrawn from the CRZ or EZ. ORNL OSHP or MK-F IH should be notified and the area should be sampled and the chemical identified before work continues. This can usually be done on-site without a long delay. If a known chemical is present at a specific task, the action level should be based on the known chemical, and workers should be withdrawn when that action limit is reached. If the monitoring instrument has a fluctuating reading that varies above the action limit, workers should be withdrawn from the area until the cause of the instrument's erratic readings can be determined. Conditions vary from task to task; therefore, monitoring response will vary due to these site conditions.

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, zones will be established to separate certain operations and to control the flow of personnel and equipment, as conditions require. The establishment of these zones or areas will also 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.

Site zones and control measures may be either Radiological Areas, HAZWOPER designated zones, or both. The decision to established Radiological Areas or HAZWOPER zones will be made by the RCT, the RSS Complex Leader, and/or the SSHO. The determination will be based on the hazards present, duration of the task to be performed, potential for exposure, location, and/or environmental impact. Zones will be established in accordance with 29 CFR 1910.120, 10 CFR 835, and 29 CFR 1926.65.

7.1 WORK ZONES

HAZWOPER determined work zones (EPA 1991, NIOSH et al. 1985) will be cordoned off with HAZWOPER (orange and black) tape or rope, and HAZWOPER signs will be placed to facilitate recognition of the zones. Typical HAZWOPER work zones include the EZ, the CRZ, and the Support Zone. The placement of these zones will be determined by the SSHO and the RCT. The posting of work zones may be modified to accommodate ORNL ORP procedures. In some cases, based on site conditions, the three separate zones may not be necessary. In such cases, the site will be posted as a HAZWOPER site and access will be controlled.

Because of site physical restrictions and limitations, the routine practice of establishing concentric zones around the work area may need to be abandoned. Work zones are also subject to change with the task due to exposures and contamination. The SSHO and the RCT shall establish these zones (to the best of their ability) based on the contamination present and the specific work to be performed. The SSHOs will modify these zones to meet the constraints of the facility. The SSHOs will also control access to each of the zones.

These zones will be isolated from the rest of the facility by use of tape and warning signs. No person will enter the EZ or CRZ without proof of sufficient training and appropriate medical clearance as required by this PHASP, the SSHA, OSHA 29 CFR 1910.120(e), and 29 CFR 1926.65. A daily log of all persons entering and leaving the CRZ will be maintained by the SSHO or designee in the project logbook. The location of particular zones for each task will be described in the SSHA.

7.1.1 Exclusion Zone

For HAZWOPER-designated work, 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 job site, the outer boundary of the EZ (also known as the hotline) shall be designated by the SSHO and the RCT 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 RCT. An entry and exit checkpoint will be visually defined at the periphery of the EZ to regulate the flow of personnel and equipment into and out of the zone.

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 takes place, if needed. This zone is designed to reduce the probability that the Support Zone will become contaminated or affected by other site hazards. Access requirements for personnel entering the CRZ are the same as those described for entrance to the EZ. Upon leaving the CRZ and before entering the Support Zone, each person will be monitored by the RCT or a designated representative properly trained to evaluate hazards. Equipment will also be surveyed for radiological contamination by the RCT, the RSS Complex Leader, or a designee before exiting the CRZ.

7.1.3 Support Zone

The Support Zone is defined as the uncontaminated area where workers or visitors should not be exposed to hazardous conditions. The zone will be marked with appropriate signs.

Because the Support Zone is free from contamination, personnel working within this zone may wear normal work clothes. Access to and from the area is not restricted. However, personnel regularly entering the Support Zone will receive instruction in the proper evacuation procedures in the event of an emergency.

7.2 RADIOLOGICAL ZONES

The radiological contamination postings will follow the requirements of 10 CFR 835, which are detailed in RPP-230 and MK-F procedure 3A-4.108/0.

- **Airborne Radioactivity Area:** Any area where airborne radioactivity concentrations exceed 10% of the Derived Air Concentrations (DAC).
- **Contamination Area:** Any area where surface contamination is >1 times the guides specified in Table 4.3 but ≤100 times those values.
- **High Contamination Area:** An area in which the contamination level is >100 times the guides specified in Table 4.3.
- **Fixed Contamination Area:** Removable contamination level less than Table 4.3 and total contamination levels greater than Table 4.3 values.
- **Soil Contamination Area:** Alpha contamination levels >20 dpm/g and beta-gamma contamination levels >200 dpm/g.
- **Very High Radiation Area:** Any area where an individual can receive a dose >500 rad/h at a distance of 1 m from the radiation source or from any surface through which the radiation penetrates.
- **High Radiation Area:** Any area where an individual can receive a dose equivalent >100 mrem/h at a distance of 30 cm from the radiation source or from any surface through which the radiation penetrates, but ≤500 rad/h at 1 m from the source.

- **Radiation Area:** Any area where an individual can receive a dose equivalent >5 mrem/h but ≤100 mrem/h at a distance of 30 cm from the radiation source or from any surface through which the radiation penetrates.
- **Radiological Buffer Area:** An area established within the controlled area, that provides secondary boundaries to minimize the spread of contamination and to limit doses to general employees who have not received training as a radiological worker.

  Radiological Area: An airborne radioactivity area, radiation area, radiological buffer area, high radiation area, very high radiation area, contamination area or high contamination area.
- **Radiologically Controlled Area:** Any area to which access is controlled in order to protect individuals from exposure to radiation or radioactive materials.

For the purpose of this document, radiological areas other than the Radiological Buffer Area will be considered EZ, and areas established for decontamination, donning/doffing, and frisking will be considered CRZ. The ORNL HAZWOPER signs and posting materials will be used to identify these zones.

The SSHO shall establish these zones based on the amount and nature of radioactive material present and the safety hazards associated with specific work activities. The SSHO will also control access to and from the CRZ.

No person will enter the EZ or CRZ without proof of sufficient training and medical requirements (as per OSHA 29 CFR 1910.120 or 29 CFR 1926.65), except as noted in Sect. 5.1.7. The RWP Exposure Tracking Sign-In Sheet (Attachment E) will be used to log employee entry to and exit from the EZ and CRZ.

Equipment will be surveyed for radiological contamination before exiting radiologically controlled areas and the CRZ. The technicians performing the survey will log the results of these surveys. All equipment will be tagged to show the results of the radiation survey.

7.3 EXCAVATION CLASSIFICATION CATEGORIES

Radiologically contaminated soil generated from excavation operations is divided into three categories.

Category I—Soil generated from excavation operations where alpha activity is near the lower limit of field instrument detection capabilities (< 300 dpm/100 cm^2), and/or beta-gamma measurements <1000 dpm/100 cm^2.

Category II—Waste (soil) generated from excavation operations where alpha activity is ≥300 dpm/100 cm^2 and <6000 dpm/100 cm^2 and beta-gamma readings are ≥1000 dpm/100 cm^2 but <5.0 mrad/h.

Category III—Waste (soil) generated from excavation operations where alpha activity is ≥6000 dpm/100 cm^2 and/or beta-gamma is ≥5.0 mrad/h.

Protective measures for the three excavation classification categories are described in Table 7.1.

Table 7.1. Protective measures for excavation classification categories

Class	Probability[a]	Protective measures
Category I	Low	Protective clothing will be needed only if radioactive or chemical contamination is anticipated. Generated waste will be disposed as nonradioactive and nonhazardous waste if neither radioactive nor chemical hazards (including oils and oily wastes) are encountered during operations. Health, safety, and environmental personnel will monitor operations during excavation activities and again at completion of construction.
Category II	Moderate	Protective clothing will be needed if radioactive or chemical contamination is anticipated. Measures will be taken to contain generated waste (e.g., use of plastic ground covers, use of pans to contain cuttings, tanks and/or lined pits to contain fluids especially for drilling operations). Surveillance for radiation will be continuous with periodic surveillance required for environmental compliance and industrial hygiene control throughout excavation activities. Proper disposal containers for radiological and/or chemically contaminated and/or oily waste will be available on site at all times.
Category III	High	Protective clothing will be required. Measures will be taken to contain generated waste (e.g., use of plastic ground covers, use of pans to contain cuttings, tanks and/or lined pits to contain fluids especially for drilling operations). The SSHO or RCT will perform continuous surveillance during all excavation activities. Proper disposal containers will be required. The RCT will determine when an RWP will be required.

[a] Probability of encountering radioactive and/or chemical contamination during excavation.

7.4 SITE COMMUNICATIONS

7.4.1 Two-Way Radios

Some personnel, such as the SSHO, the RCT, the RSS Complex Leader, and the Facility Manager may have two-way radios for use in plant-wide communications. Radio numbers of key personnel will be listed in the SSHA or AHA. 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 prior to entering a work area.

7.4.2 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). The nearest plant phone at the NTF facility is located in the Control Trailer. The nearest phones at the STF facility are located inside Building 3525 and outside on the south side of Building 3517.

7.4.3 The Buddy System and Hand Signals

The "buddy system" as described in 29 CFR 1910.120(a)(3) or 29 CFR 1926 shall be used during work operations and activities conducted during the GAAT. Hand signals will be used as the means of communication when distance, noise levels, or respirators prevent verbal communications. Basic hand signals and their meanings during 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!"

7.5 SANITATION

7.5.1 Housekeeping

The site shall be maintained in an orderly manner, free of congested construction debris and unnecessary combustible material. All uncontaminated waste shall be handled according to the project waste management plan. Disposable contaminated PPE will be checked and bagged by the RCT and placed in the proper containment system as per the waste management plan. Areas will be designated by the project Waste Management Plan to temporarily store various generated wastes.

7.5.2 Potable Water

Potable drinking water or other suitable liquid (e.g., Gatoraid™) will be brought on-site, labeled, and stored in the support area. All water coolers and fountains shall be cleaned periodically to ensure cleanliness.

7.5.3 Consumption of Food and Tobacco Products

Eating, drinking, chewing gum, and use of tobacco products will be permitted in designated areas in the support zone. Smoking will not be permitted in the support or control trailers. Designated areas shall be surveyed regularly for chemical and radiological contamination by the RCT and the SSHO.

No consumption of food, liquid, or use of tobacco products will be allowed in the CRZ or EZ of a HAZWOPER-designated area or in Radiological Areas.

7.5.4 Washing and Toilet Facilities

Change houses and restrooms located in nearby buildings will be utilized for NTF and STF activities. If portable restrooms are required, they shall be serviced by the vendor at least once weekly. All restrooms shall be positioned in the support zone.

8. DECONTAMINATION PROCEDURES

The primary concern for this site is controlling the spread of radiological and/or chemical contamination within the facility. It is of utmost importance that task personnel, visitors, equipment, and the environment be protected from the spread of contaminants. The strict use of contamination control methods should be employed on all tasks conducted in the GAAT. Whenever engineering controls are not feasible, PPE shall be used to reduce employee exposure levels and maintain the levels ALARA. All engineering controls and safe work practices must be documented in the SSHA and/or other specific plans/permits.

8.1 PERSONNEL DECONTAMINATION

Decontamination, the process of removing, containing, or neutralizing contaminants, is critical to safety and health at the facility. Decontamination protects workers from hazardous substances that can eventually permeate protective clothing, respiratory equipment, tools, and vehicles. Decontamination protects task personnel by minimizing the spread of hazardous substances into clean areas within the facility and protects the community by preventing the migration of contaminants from the worksite.

Protective clothing and respirators help prevent the wearer from becoming contaminated or inhaling hazardous substances, and good work practices help minimize contamination on PPE, tools, and equipment. But even with safeguards, contamination may occur. To prevent and minimize the severity of such incidences, regulations in 29 CFR 1910.120(k), 29 CFR 1926.65, ORNL RPP-540, and/or MK-F Radiological Procedures will be referred to in matters of contamination control.

The RCT or the RSS Complex Leader will determine the extent of radiological contamination present using radiological instruments and background information gathered from historical and process knowledge. Prior to beginning a task, the area in which a task is to be conducted will be surveyed by the on-site RCT, and a hazard determination for radiological concerns will be completed. With this information, the dose assessment levels will be determined for the radionuclides of concern. These levels will establish the trigger for possible decontamination purposes.

The appropriate level of PPE for radiological contaminants will be determined by the on-site RCT. Most articles of PPE are designed to be disposable. When egressing a Radiological Area, doffing procedures will be posted at the border of the Radiological Area and the Buffer area or at the border of the EZ and the CRZ for HAZWOPER operations. All disposable PPE will be placed in the appropriate containers for scanning by the RCT. Proper frisking procedures will also be posted. Individuals exiting the posted areas will either frisk themselves or be frisked by the RCT and then continue directly to the PCM for a supplemental whole-body survey. If any contamination is detected, the RCT must be notified at once. The RCT will then refrisk the individual in question to evaluate the level and extent of contamination and direct the individual on the proper decontamination techniques. Decontamination will take place in a designated area within the Radiological Area or the CRZ. The individual will be periodically monitored to determine the success of the decontamination effort. If field decontamination techniques fail, the individual will be escorted to Medical in Building 4500N.

For specific details on personnel decontamination, refer to ORNL ORP Radiological Protection Procedures (RPP-540, Handling Radiologically Contaminated Personnel) and MK-F Radiological Procedures.

8.2 EQUIPMENT DECONTAMINATION

A laydown area will be designated in the Radiological Area or the CRZ close to the egress point into the Clean or Support Zone. This area will contain a sheet of plastic large enough to protect the flooring from transferable contamination. The RCT, wearing the appropriate PPE, will survey all equipment, tools, sample containers, and other articles leaving the Radiological Area or the CRZ and entering the Clean Area/Support Zone. If any contamination is detected on any article, an attempt will be made to decontaminate the article. The article will be resurveyed to determine the progress of the effort. This process will be continued until the piece is free of contamination or the article is disposed of properly by authority of the RCT. If the piece of equipment cannot be decontaminated, the equipment will be wrapped in plastic or other suitable containment material, tagged appropriately, and transported to a decontamination facility or a designated storage area. Once the article has been decontaminated and determined to be free of contamination, the piece can be removed to the Clean Area/Support Zone.

Maximum ORNL limits for items given radiation and contamination clearance are presented in Table 4.3.

9. STANDARD OPERATING PROCEDURES

Task-specific SOPs shall be developed, reviewed and approved by appropriate GAAT project personnel, as necessary, and maintained at the job site. Specific ORNL or MK-F SOPs, if applicable, will be referenced.

10. EMERGENCY PREPAREDNESS AND CONTINGENCY PLANS

This section applies to any type of emergency, such as a fire, explosion, radiation release, radiological or chemical exposure, personal injury, or other types of emergencies that may be encountered by facility personnel involved in the GAAT project. 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 emergency contacts' telephone numbers and radio numbers shall be posted during all facility operations in a designated location that is easily accessible to all site personnel. Primary emergency telephone numbers shall include, but are not limited to, the following:

Emergency Personnel	Phone	Radio No.
ORNL Emergency Response (Plant Phone)	911	295
ORNL Emergency Response (Cellular Phone)	574-6606	
Laboratory Shift Superintendent	574-6606	Station 103 or 295
Fire Department	574-5678	295
Medical Center	574-7431	295
Security	574-6646	295
Office of Safety and Health Protection	576-8218	
Office of Radiation Protection	574-6701	152
Environmental Compliance	574-8770	650
HAZWOPER Program Coordinator	576-5064/576-7059	69
SHEST	576-7059	Pager: 873-5538
Nuclear Criticality Safety	574-4338	

NOTE: These phone and radio numbers are subject to change and **must be verified** before posting.

The LSS has responsibility for overall ORNL shift operations and acts as Site Emergency Director in the event of an emergency at ORNL facilities. The LSS evaluates emergency situations and directs remedial actions, taking into consideration risks versus benefits of specific emergency response actions, potential for exposure, possible biological consequences, and the anticipated number of persons potentially affected. The Emergency Communications 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 facility assembly point.
- 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 self-contained breathing apparatus, 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 and emergency contact list.

10.1.2 Reporting An Emergency

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

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	4-6606	KIN 294/295
	ECC	4-6646	KIN 294/295

2. The Emergency Medical Services (EMS) network on the plant telephone system serves as a direct method to contact 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 on a plant phone. (**NOTE:** When using a cellular phone, dial 574-6606 to contact ORNL emergency services.)

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 (to the caller's best knowledge).

   b. The location of the emergency (as specific as possible).

   c. The identity and location of the caller reporting the emergency.

   d. When personnel have been injured, tell whether an ambulance may be needed.

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.

10.1.3 Emergency Coordinator

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

If the event occurs when a task is being performed, the SSHO (for HAZWOPER tasks) or the Facility Manager will act as the emergency coordinator for that area or task. The SSHO will direct the cessation of work, ensuring that all open systems have been secured, and instruct the workers on doffing specifications, if needed. The SSHO will further supervise the safe evacuation to the facility assembly point and ensure the safe arrival of each worker.

10.1.4 Emergency Actions for Facility or Task-Related 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, Facility Manager or Project Manager, or other authority.

2. Bring the emergency under control, if this can be done safely.

3. 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 when applicable during an emergency, such as building evacuation and fire alarms, or when necessary, plant-wide alarms.

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 the following number from the plant system telephone:

SITE	NUMBER
ORNL	4-4462

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 fire 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. Facility 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

The location of the assembly point shall be addressed in the pre-entry health and safety briefing and in periodic health and safety briefings as a reminder throughout the course of the project.

NTF. The emergency assembly point for the NTF facility is located north of the Support Trailer in the Building 3137 parking lot (see Fig. 10.1).

STF. The emergency assembly points for the STF facility are located in the northeast corner of the proposed East Access Road and on the southwest corner of the existing West Access Road (see Fig. 10.2).

10.2.3 Evacuation Routes

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

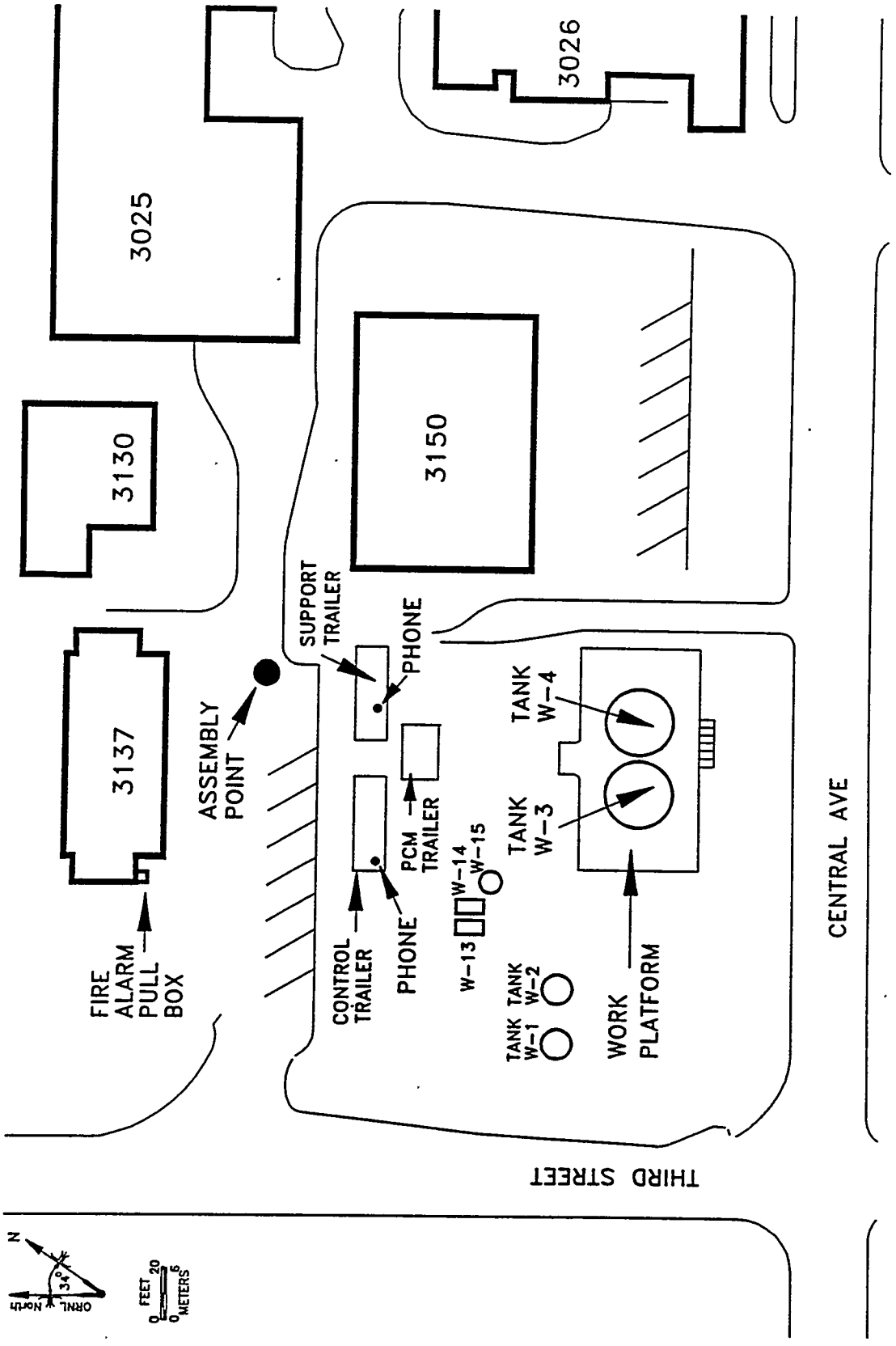

Fig. 10.1. Diagram showing telephones, fire alarm pull box, and assembly point at the North Tank Farm site.

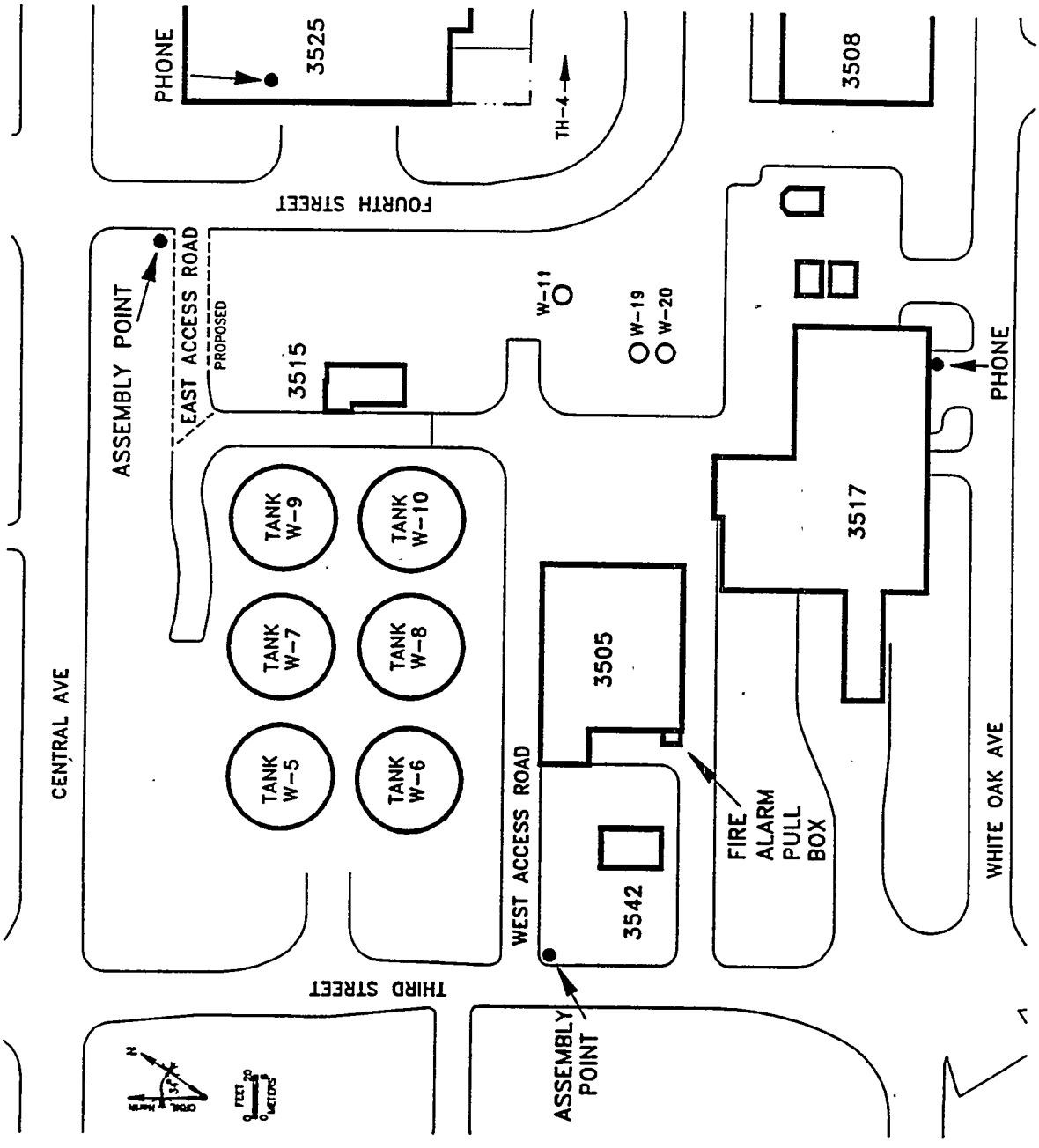

Fig. 10.2. Diagram showing telephones, fire alarm pull box, and assembly points at the South Tank Farm site.

1. Personnel should be familiar with the safest and shortest evacuation route from each job site and area in which they perform work.

2. When an evacuation alarm is sounded, personnel should quickly but calmly proceed to the closest 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 prior to 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.

If evacuation from the ORNL main plant area is required, two routes are available:

10.2.3.1 NTF Evacuation Routes

Route 1.

1. Exit the NTF onto Central Avenue.
2. Proceed west on Central Avenue, through the guard portal to First Street.
3. Turn north (right) on First Street.
4. Proceed to Bethel Valley Road.

Alternate Route.

1. Exit the NTF onto Central Avenue.
2. Proceed east on Central Avenue to the ORNL Main Entrance.
3. Exit through the main entrance and through the parking lot to Bethel Valley Road.

10.2.3.2 STF Evacuation Routes

Route From Tanks 5, 7, and 9.

1. Exit the tank farm on the East Access Road to the corner of Fourth Street and Central Avenue.
2. Proceed west on Central Avenue, through the guard portal to First Street.
3. Turn north (right) on First Street.
4. Proceed to Bethel Valley Road.

Route From Tanks 6, 8, and 10.

1. Exit the tank farm on the West Access Road to the corner of Third Street and White Oak Avenue.
2. Proceed west on White Oak Avenue through the Contractors' Portal (C Portal).
3. Turn north (right) on First Street.
4. Proceed to Bethel Valley Road.

10.2.4 Fire or Explosion

Fire suppression and response services shall be provided for GAAT activities by the ORNL Fire Department. Fire extinguishers will be installed on the work platform and in the control and support

trailers. Additional fire extinguishers will be installed near skid-mounted equipment, near other work areas, and on heavy equipment.

The ORNL Fire Department can be summoned through the LSS or ECC offices as described in Sect. 10.1.2 or by pulling a fire alarm pull box. When reporting a fire, specify the location of the fire so the Fire Department can respond with the appropriate equipment.

NTF Fire Alarm Pull Box. A fire alarm pull box can be found at the southwest corner of Building 3137 (see Fig. 10.1).

STF Fire Alarm Pull Box. A fire alarm pull box can be found at the southwest corner of Building 3505 (see Fig. 10.2)

Responsibilities of site personnel in the event of a fire:

1. De-energize the equipment utilizing the emergency stops or breakers.
2. Suppress the fire utilizing fire extinguishers if conditions are not immediately dangerous to life or health.
3. Summons Plant emergency personnel through Plant systems (i.e., fire alarm pull boxes, telephone, radios); see Sect. 10.1.2.

10.3 EMERGENCY MEDICAL SERVICES

10.3.1 Personnel Injuries

All injuries to project personnel, regardless how minor, must be reported to the SSHO. Job-related first-aid will be rendered by the SSHO, for emergency conditions, and transportation to EMS will be made at the discretion of the SSHO, or at the injured person's request. All injuries and the circumstances involved will be recorded in the project logbook by the SSHO. The completion of state worker compensation forms will be coordinated with the injured person, the person's supervisor, the SSHO, and the Project Manager. At least one person, generally the SSHO, shall be designated to perform first aid and CPR in the event of emergency conditions during task operations.

10.3.2 Emergency Medical Services

All work related injuries to Energy Systems/Energy Research personnel and subcontractors 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. For emergency conditions, injuries to MK-F personnel and subcontractors will be treated at ORNL Health Division. Minor injuries to MK-F personnel and subcontractors will be treated at MK-F Occupational Medical at Y-12. Emergency radioactive decontamination or treatment of personnel exposure to radiation will be performed by REAC/TS.

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 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 control the spread of contamination only if site personnel using the spill kit are properly protected from exposure to the spill constituents. Site personnel actions should be limited to shutting off equipment, closing valves, and blocking drains within the path of the spill using spill kit materials. If spill conditions exceed the control of the spill kit, the ORNL Spill Response Team should be summoned immediately to provide emergency services. The SSHO shall have the responsibility of maintaining and resupplying the spill response kit, as appropriate.

Responsibilities of site personnel if a spill occurs:

1. De-energize the equipment utilizing the emergency stops or breakers

2. Warn other site personnel and summons the plant emergency personnel through plant systems (i.e., fire alarm pull boxes, telephone, radios); see Sect. 10.1.2.

3. Isolate the area and contain the spill if properly protected from the spill constituents and conditions are not immediately dangerous to life and health.

11. REFERENCES

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ORNL Office Radiation Protection Procedures (RPP) (available on-line).

APPENDIX A

COVER SHEET FOR SSHA AND AHA

GUNITE AND ASSOCIATED TANKS

Site Safety and Health Addendum (SSHA)
or
Activity Hazard Analysis (AHA)

Type of Addendum (SSHA or AHA) : _____

GAAT Document Number: _____

Task: _____

_____

Brief Description of Task:

Prepared by (Company) : _____

Author: _____

APPENDIX B

GAAT PROJECT SITE VISITOR'S LOG

GATT Project Site Visitor's Log

Visitor's Agreement: I am requesting entry into an active GAAT project area. Based on health and safety requirements pertinent to the area to be visited, I have received the appropriate briefing. My signature below indicates that I have received the site-specific briefing and that I will abide by all the health and safety regulations that have been explained to me as they pertain to this site.

Date	Name	Badge No.	Organization	Time in	Time out

APPENDIX C

HEALTH AND SAFETY FIELD CHANGE FORM

HEALTH AND SAFETY FIELD CHANGE FORM

DATE: Change for Original Number:

PROJECT:

INITIATOR OF CHANGE FORM: _____

TASK OR HAZARD THAT INITIATED FIELD CHANGE:

PROJECT/FACILITY MANAGER NAME(s)/PHONE NUMBERS:

ADDITIONAL HAZARDS (IF DIFFERENT FROM ORIGINAL)

Physical Hazards

() Cold Stress
() Compressed Gases/Cylinders
() Confined Space
() Enclosed Space
() Ergonomics
() Explosive/Flammable
() Heat Stress
() High Pressure
() Manual Lift
() Noise
() Oxygen Deficient
() Oxygen Enriched
() Tripping/Falling
() Vibration
() Work in Boat/on Water

Safety/Construction Hazards

() Demolition
() Drum Handling
() Electrical
() Elevated Work
() Energized Sources (Lockout/Tagout)
() Excavation/Penetration
() Hoisting/Rigging
() Overhead Hazards
() Trenching/Shoring
() Underground Hazards
() Welding/Cutting/Burning

Chemical Hazards

() Asbestos
() Carcinogen
() Corrosive
() Inorganics
() Lead
() Manmade Mineral Fibers
() Mercury
() Metals
() Mutagen
() OSHA Specific
() PCBs
() Reproductive Toxicant
() Volatile Organic
() Other

Ionizing Radiological Hazards

() External Exposure
() Internal Exposure
Contamination Hazard Type _____
Types: ( )Ingestion, ( )Inhalation, ( )Absorption

Non-Ionizing Radiological Hazards

() High Voltage
() Laser
() Microwave
() RF
() UV

Biological/Vector Hazards

() Bacterial
() Medical Waste
() Parasites
() Plants (Allergens)
() Wildlife

CONTROLS (IF DIFFERENT FROM ORIGINAL)

Engineering Controls: _____

_____

_____

Administrative Controls: _____
(required permits, _____
training, etc.) _____

Permits

	Yes	No
RWP required?	☐	☐
Configuration Management Plan required?	☐	☐
Excavation/Penetration Permit required?	☐	☐
Hoisting and Rigging Plan required?	☐	☐
Lockout/Tagout Permit required?	☐	☐
PACSE required?	☐	☐
Radiation Work Permit required?	☐	☐
Welding/Hot Work Permit required?	☐	☐

	Yes	No
Are design/specification changes needed?	☐	☐

Other (Specify) _____

Are changes required in existing permits?

PERSONAL PROTECTIVE EQUIPMENT

Level of Protection:

( ) A ( ) C ( ) Modified
( ) B ( ) D

Respiratory Protection:

( ) SCBA ( ) Fullface ( ) 1/2 Face Respirator
( ) PAPR ( ) Other ( ) Supplied Air
Cartridge: _____

Protective Clothing:

( ) Apron ( ) Company Clothing (Khakis)
( ) C–zone ( ) Encapsulating Suit
( ) Impermerable Suit ( ) Lab Coat
( ) Saranex ( ) Splash Suit
( ) Tyvek ( ) Welded Saranex
( ) Other _____

Head/eye/ear:

( ) Ear Plugs ( ) Ear Muffs
( ) Face Shield ( ) Goggles
( ) Hard Hat ( ) Laser Eyewear
( ) Monogoggles ( ) Safety Glasses
( ) Splash Shield ( ) Welding Goggles

Gloves:

( ) Cotton
( ) Latex
( ) Neoprene
( ) PVC
( ) Welding Gloves
( ) Insulating
( ) Leather
( ) Nitrile
( ) Vinyl

Footwear:

( ) Chemical Overboots
( ) Steel–toed Leather
( ) Other
( ) Shoe Covers
( ) Steel–toed Rubber

Health and Safety Monitoring Requirements (if different from original)

Additional comments/changes:

APPROVALS:

FM

SSHO

HEALTH PHYSICS (if applicable)

SHEST (if applicable)

Other

APPENDIX D

GAAT PROJECT HEALTH AND SAFETY PLAN ACCEPTANCE FORM

GATT Project Health and Safety Plan Acceptance Form

Task: _____

My signature below indicates that the Project Health and Safety Plan (PHASP) and the Site Safety and Health Addendum (SSHA) or Activity Hazard Analysis (AHA) have been made available for my review. I have attended a pre-entry briefing and understand the project scope and task, the hazards at the site, the PPE requirements, the reporting chain of command, the emergency contacts, what actions to take during an emergency, and the evacuation routes. I have fulfilled all training and medical requirements and agree to abide by instructions and guidelines set forth in the PHASP and addenda.

Date	Name	Badge No.	Organization	Signature	Briefed by

APPENDIX E

RADIOLOGICAL WORK PERMIT EXPOSURE TRACKING SIGN-IN SHEET

RADIOLOGICAL WORK PERMIT SIGN-IN SHEET - EXPOSURE TRACKING

DATE________

By my signature below I state that I have read, understand and will comply with all requirements specified in the RWP Indicated.

										DRD TOTAL
Name	Badge #	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out	
Signature	RWP#	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD
Name	Badge #	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out	
Signature	RWP#	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD
Name	Badge #	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out	
Signature	RWP#	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD
Name	Badge #	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out	
Signature	RWP#	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD
Name	Badge #	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out	
Signature	RWP#	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD
Name	Badge #	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out	
Signature	RWP#	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD
Name	Badge #	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out	
Signature	RWP#	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD
Name	Badge #	Time In	Time Out	Time In	Time Out	Time In	Time Out	Time In	Time Out	
Signature	RWP#	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD In	DRD Out	DRD

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