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MARTIN MARIETTA

ENVIRONMENTAL RESTORATION PROGRAM

Environmental, Safety, and Health Plan for the Remedial Investigation/Feasibility Study of Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee

ENERGY SYSTEMS ER

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

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ENVIRONMENTAL SAFETY, AND HEALTH PLAN

FOR THE WASTE AREA GROUPING 5

REMEDIAL INVESTIGATION/FEASIBILITY STUDY AT

OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE

Bechtel Job 19118

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CONCURRENCE: _____ 3/19/92
C. M. Davis, Environmental Safety, and Health Manager — Date

CONCURRENCE: _____ 3/23/92
O. E. El-Messidi, Project Quality Assurance Manager — Date

CONCURRENCE: _____ 3/23/92
G. R. Eidam, Deputy Program Manager — Date

APPROVED BY: _____ 3/23/92
J. R. Kannard, Program Manager — Date

CONCURRENCE: _____ 4/2/92
S. DeFalco, Environmental and Health Division Subcontractor Interface Manager — Date

CONCURRENCE: _____ 4/1/92
A. S. Will III, ORNL Environmental Restoration Program RI/FS Project Manager — Date

CONCURRENCE: _____ 4/13/92
C. Clark, Jr., ORNL Environmental Restoration Program Field Coordination Manager: WAG 5 QAAs and QAAPs are to be attached to this plan as part of my approval — Date

CONCURRENCE: _____ 4-21-92
L. E. May, Environmental Restoration Division Health and Safety Manager — Date

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Environmental Restoration Division
ORNL Environmental Restoration Program

Environmental, Safety, and Health Plan for the Remedial Investigation/Feasibility Study of Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee

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Oak Ridge, Tennessee 37831-6285
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
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Bechtel National, Inc./CH2M Hill/Ogden/PEER
Oak Ridge, Tennessee

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

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ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AE	actual exposure
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
BNI	Bechtel National, Inc.
CAA	controlled access area
CFR	Code of Federal Regulations
CSL	Close Support Laboratory
DAC	derived air concentration
DOE	Department of Energy
DOT	Department of Transportation
ES&H	Environmental, Safety, and Health
ES&HC	Environmental, Safety, and Health Compliance Directorate
FHSS	Field Health and Safety Supervisor
FOF	Field Operations Facility
FSS	field services and support
GC	gas chromatograph
HWP	hazardous work permit
IDLH	immediately dangerous to life or health
IDN	identification number
LSS	Laboratory Shift Supervisor
MSDS	material safety data sheet
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association
NHF	New Hydrofracture Facility
NIOSH	National Institute for Occupational Safety and Health
NRC	Nuclear Regulatory Commission
OHF	Old Hydrofracture Facility
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PE	potential exposure
PEL	permissible exposure limit
PF	protection factor
PP	project procedure
PPE	personal protective equipment
QA/QC	quality assurance/quality control
REAC/TS	Radiation Emergency Assistance Center/Training Site
REL	recommended exposure limit
RI/FS	remedial investigation/feasibility study
SCBA	self-contained breathing apparatus
SOP	standard operating procedure
SRD	self-reading dosimeter

ACRONYMS (continued)

SWMU	solid waste management unit
SWSA	solid waste storage area
TLD	thermoluminescent dosimeter
TLV	threshold limit value
WAG	waste area grouping
WBC	whole-body count

EXECUTIVE SUMMARY

This document outlines the environmental, safety, and health (ES&H) approach to be followed for the remedial investigation/feasibility study (RI/FS) of Waste Area Grouping (WAG) 5 at Oak Ridge National Laboratory. This ES&H Plan will be used in determining the program elements required to maintain minimal exposures to personnel and to reduce the potential for environmental insults during field operations.

The plan discusses the structure of the RI/FS Project ES&H Department, including the reporting chain within the ES&H Department and contacts made with Martin Marietta Energy Systems (Energy Systems). Each job title that carries the authority to halt work activities is listed.

The hazards evaluation for WAG 5 is presented in Sect. 3. This section includes the potential hazards (i.e., radiological, chemical, and physical) that may be encountered. Previous sampling results suggest that the primary contaminants of concern will be radiological (strontium-90, hydrogen-3, and possibly transuranic radioisotopes). External and internal exposures to radioactive materials will be controlled by using both engineering (e.g., ventilation, containment, isolation) and administrative (e.g., procedures, training, postings, protective clothing) controls.

Sections 4 and 5 discuss internal environmental assessments, readiness reviews, and project procedures. These sections present two areas where compliance with federal or state regulations and Energy Systems recommended guidance is attained. Internal environmental assessments and readiness reviews will be conducted at WAG 5 prior to initiation of work. Project procedures are reviewed to ensure that field operations are in compliance with federal regulations and site guidance documents on a routine basis.

Sections 6 and 7 discuss personal protective equipment and respiratory protection requirements. Both sections guide the selection of clothing and other protective equipment to perform tasks in a safe manner.

Subsequent sections generally describe site and contamination control, personnel and equipment decontamination, and personnel training requirements. Section 12 describes hazardous work permits (HWPs), one of the most important elements of the ES&H program. HWPs are written to control access to areas within WAG 5 where elevated levels of exposure may occur and present safety requirements for entering controlled access areas (CAAs). These safety requirements ensure that exposures to project personnel and the environment are minimal.

The medical surveillance, bioassay, external radiation dosimetry, personnel air monitoring, as low as reasonably achievable (ALARA), and perimeter monitoring sections detail monitoring of project personnel. Baseline monitoring by an occupational physician before entering a CAA ensures that previous personnel exposures are documented. Annual

medical examinations thereafter are performed to detect physiological changes in the individual.

Section 20 describes the documentation that is kept in each individual's personnel file. Records are kept up to date and readily retrievable.

The final sections discuss the packaging and shipping requirements for samples, the hazard communication program, and the chemical hygiene plan in use at the Close Support Laboratory on the Field Operations Facility.

1. INTRODUCTION

1.1 DESCRIPTION

This Environmental, Safety, and Health (ES&H) Plan presents the concepts and methodologies to be followed during the remedial investigation/feasibility study (RI/FS) for Oak Ridge National Laboratory (ORNL) to protect the health and safety of employees, the public, and the environment at Waste Area Grouping (WAG) 5. The RI/FS project ES&H Plan acts as a management extension for ORNL and Martin Marietta Energy Systems, Inc. (Energy Systems) to direct and control implementation of the project ES&H program. This ES&H Plan for WAG 5, a supplemental document to the project ES&H Plan, is intended for use in the WAG 5 investigation area. The subsections that follow describe the program philosophy, requirements, quality assurance measures, and methods for applying the ES&H program to WAG 5 remedial investigations. Hazardous work permits (HWPs) will be used to provide task-specific health and safety requirements.

1.2 PROGRAM PHILOSOPHY

Bechtel National, Inc. (BNI) and its subcontractors are committed to limiting exposures to hazardous materials to levels that are as low as reasonably achievable (ALARA). The ORNL RI/FS Project radiation safety policy also applies ALARA principles to activities at the Close Support Laboratory (CSL) at the Field Operations Facility (FOF). Personnel working on the RI/FS Project in WAG 5 will be informed of known and potential hazards associated with the tasks to be performed so that they can effectively apply required safety precautions. Training programs and HWPs are developed to maintain consistency with the application of ALARA principles.

Because of the difficulties associated with quantifying the potential hazards at many of the RI sites, a conservative approach will be used for protection of employees, members of the general public, and the environment. This conservative application of protective measures and proper training will limit exposures to ALARA levels.

1.3 ADHERENCE TO SAFETY REQUIREMENTS

Maintaining a safe and healthful work environment is the responsibility of all team members. Through a comprehensive training program, team members will be informed of hazard potential, proper use of personal protective equipment (PPE), applicable procedural requirements, and their responsibilities for maintaining safe working environments. Trained personnel are required to adhere to all safety requirements.

Environmental protection, health, and safety violations will not be tolerated. Personnel who develop a history of safety violations or who blatantly or willfully violate environmental

protection, safety, and health procedures will be reprimanded by the RI/FS ES&H Manager, which may include permanent removal from the project based on the seriousness of the violation.

1.4 REGULATORY REQUIREMENTS, STANDARDS, AND GUIDELINES

The ES&H protection requirements applicable to the ORNL RI/FS Project are set forth in Department of Energy (DOE) orders, Energy Systems and ORNL procedures, and applicable federal, state, and local regulations and standards. Applicable DOE orders, ORNL implementing documents, and Bechtel corporate safety and health standards, as most recently revised, include the following:

- DOE Order 1540.1, "Materials Transportation and Traffic Management";
- DOE Order 3790.1A, "Federal Employees Occupational Safety and Health Program";
- DOE Order 5000.3A, "Occurrence Reporting and Processing of Operations Information";
- DOE Order 5480.1B, "Environment, Safety, and Health Program for DOE Operations";
- DOE Order 5480.3, "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes";
- DOE Order 5480.4, "Environmental Protection, Safety, and Health Protection Standards";
- DOE Order 5480.10, "Contractor Industrial Hygiene Program";
- DOE Order 5480.11, "Radiation Protection for Occupational Workers";
- DOE Order 5481.1B, "Safety Analysis and Review System";
- DOE Order 5482.1B, "Environment, Safety, and Health Appraisal Program";
- DOE Order 5483.1A, "Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities";
- DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements";
- DOE Order 5500.1A, "Emergency Management System";
- ORNL Health Physics Manual;
- ORNL Safety Manual;
- ORNL Industrial Hygiene Manual;
- ORNL Environmental Protection Manual;
- Bechtel Safety Manual; and
- Bechtel Safety and Health Procedures.

As a matter of policy (DOE Order 5480.10), DOE and its contractors have committed to be in compliance with applicable Occupational Safety and Health Administration (OSHA) regulations [specifically, Title 29, Code of Federal Regulations (CFR), Part 1910: *Occupational Safety and Health Standards*]. Concurrently, DOE and its contractors have adopted exposure guidelines listed in relevant American Conference of Governmental

Industrial Hygienists (ACGIH) publications [specifically, *Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices*, most current edition]. Where 29 CFR Pt. 1910 is silent for a particular chemical substance or physical agent, the values listed in the following will be used in the order given:

- ACGIH TLVs, and
- National Institute of Occupational Safety and Health (NIOSH) recommended exposure limits (RELs).

For exposures to airborne radioactive material, the limiting values or derived air concentration (DAC) limits from DOE Order 5480.11 will be applied.

Where more than one limiting value exists, whether it is from regulatory values or recommended values, the most conservative value [DAC, permissible exposure limit (PEL), TLV, or REL] will be applied.

The ES&H Plan for WAG 5, coupled with HWPs, meets requirements set forth in 29 CFR Pt. 1910.120, "Hazardous Waste Operations and Emergency Response," and applicable regulatory requirements of the State of Tennessee. The packaging and shipment of samples to and from laboratory facilities will be performed in accordance with federal Department of Transportation (DOT) regulations set forth in 49 CFR and with Tennessee DOT Regulations, Sect. 17 Annotated. Other regulations applicable to safe operations include National Fire Protection Association (NFPA) codes and federal and local fire codes.

1.5 ADHERENCE TO QUALITY ASSURANCE PROGRAM

The philosophies of the RI/FS Project ES&H program, its activities, and the project procedures that implement the programs's requirements comply with and complement the requirements of the project Quality Assurance/Quality Control (QA/QC) Plan. The specific ES&H procedures controlled by the QA/QC Plan are listed therein. WAG 5 ES&H field activities will comply with requirements of task-specific QA project plans developed for WAG 5.

1.6 ES&H PLAN FOR WAG 5

Potential physical, radiological, and toxic chemical hazards that may be specific to WAG 5 are addressed in Sect. 3, "Hazards Evaluation." The ES&H Plan for WAG 5 and HWPs specify the ES&H requirements necessary to protect the safety of on-site investigators, the public, and the environment. (Task-specific field work guides for WAG 5 are also written, reviewed, and approved to ensure that personnel understand the purpose and scope of the tasks.)

If similar field activities are scheduled in the future, the ES&H Manager will be contacted to determine whether an approved ES&H Plan is applicable or whether a new plan must be developed.

2. ORGANIZATION, RESPONSIBILITIES, AND AUTHORITIES

2.1 ORGANIZATION

The BNI Team ES&H Department is an autonomous group within the RI/FS Project organization. As shown in Fig. 2.1, the BNI Team ES&H Manager reports to the corporate ES&H organization and works with the Program Manager to implement ES&H requirements and activities on the RI/FS Project. The BNI Team ES&H Department supports field operations and directs field safety decisions through the Field Health and Safety Supervisor (FHSS). The FHSS draws upon Health and Safety Specialists as required to ensure that field operations are conducted in accordance with field safety requirements, manuals, procedures, and plans.

2.2 RESPONSIBILITIES AND AUTHORITIES

ORNL management is ultimately responsible for environmental protection, safety, and health on the Oak Ridge Reservation. This responsibility includes "stop-work" authority. For the RI/FS Project, this management responsibility is extended through the ORNL ES&H Compliance Directorate (ES&HC) to the BNI ES&H Manager. The ES&H program is routinely audited by the ORNL ES&HC Contractor Interface Manager (or designee) to ensure compliance with ORNL policies and procedures.

The ES&H Manager reports directly to the Bechtel corporate ES&H organization and is responsible for compliance with all applicable DOE orders; federal, state, and local environmental protection, safety, and health protection statutes; permits and regulations; and Energy Systems and ORNL policies and procedures.

2.2.1 Bechtel Corporate ES&H Organization

Responsibility for safety and health programs rests with Bechtel's Corporate Safety and Health Services Department, which operates under the direction of the Safety Services Manager and the Health Services Manager. The Health Services Manager is responsible for all programmatic elements of radiation safety and industrial hygiene. The Safety Services Manager is responsible for all programmatic elements of construction and industrial safety.

The corporate ES&H organization is responsible for ensuring that Bechtel projects are conducted in compliance with federal, state, and local laws as well as Bechtel safety and health policies and procedures. These corporate responsibilities and authorities are delegated to project ES&H managers. The corporate ES&H organization conducts timely audits of project activities and records and distributes audit reports to appropriate Bechtel staff and project management.

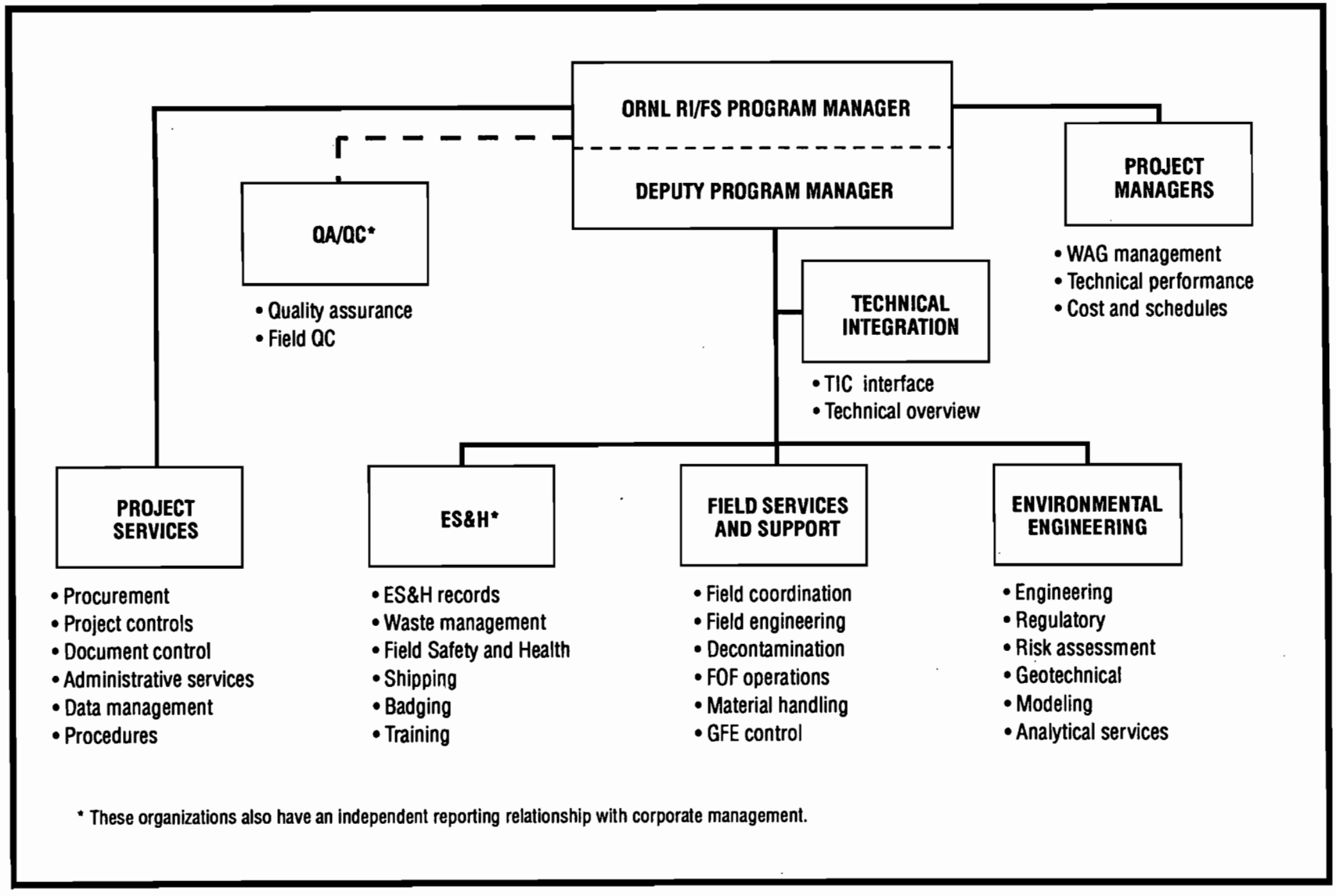

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Fig. 2.1. ORNL RI/FS program organization.

2.2.2 Program Manager

The Program Manager, the senior BNI manager for the ORNL RI/FS Project, oversees the technical and programmatic activities of the ES&H program. The Program Manager assigns sufficient resources to maintain and implement the ES&H program and is responsible for ensuring that adequate ES&H systems (policy, plans, procedures, materials, etc.) are in place and operational.

2.2.3 Environmental, Safety, and Health Manager

The ES&H Manager is responsible for the preparation, implementation, and maintenance of the project's ES&H program and its supporting elements. The ES&H Manager maintains communications with Energy Systems ES&H organizations and representatives to ensure that ORNL and Energy Systems management directions are incorporated into ES&H activities. Additionally, the ES&H Manager is directly responsible to the Program Manager and the corporate ES&H organization for all technical and regulatory aspects of environmental protection, safety, and health on the RI/FS Project.

In carrying out his responsibilities, the ES&H Manager has autonomy within the project organization and has the authority to immediately halt any activity that may pose a danger to employees, the public, or the environment. He can also revise operations or designs as necessary to keep radiation exposures, hazardous substances exposures, or environmental releases within established requirements and ALARA levels.

The ES&H Manager is responsible for developing ES&H plans, including supporting procedures, which are incorporated by reference into the WAG 5 plan.

2.2.4 Field Health and Safety Supervisor

The FHSS is responsible for implementing the ES&H program in the field. He evaluates environmental protection, safety, and health concerns at the site level and applies the requirements of the WAG 5 ES&H Plan and project procedures. In performing his evaluations, the FHSS ensures that the ES&H Manager is informed of his concerns about potential hazardous exposures. The ES&H Manager in turn communicates directly with the ORNL ES&HC Contractor Interface Manager. When conditions arise that are not covered by existing plans and procedures, the FHSS will halt work and inform the ES&H Manager, who will then coordinate proposed solutions with ORNL management through the ORNL ES&HC Contractor Interface Manager. If survey results indicate that PPE (Sect. 6) requirements may be downgraded in an HWP, the FHSS or ES&H Manager will contact the ORNL ES&HC Contractor Interface Manager before changing the PPE needs.

Through discussions with the Field Services and Support (FSS) Manager, the FHSS also determines the schedule of project ES&H support from the BNI Team for field activities and deploys available resources to provide required environmental, health, and safety coverage.

Full-time safety and health coverage will be provided for operations in WAG 5 requiring entry into or establishment of controlled access areas (CAAs). Tasks performed at locations where the potential for exposure to hazardous materials is low may not warrant full-time coverage.

The FHSS has the authority to halt operations that endanger the health and safety of workers, the public, or the environment. When site conditions differ from those on which the RI Plan is based, the FHSS will stop field activities and assess the conditions to determine whether work can proceed or whether the site needs to be reevaluated. Any changes to requirements in an HWP will be approved and documented by the FHSS.

The FHSS will designate a Health and Safety Specialist who understands and is able to respond to potential hazards of field activities when the FHSS is off site.

2.2.5 Health and Safety Specialists

The Health and Safety Specialists (health physics, industrial hygiene, and safety technicians) report directly to the FHSS. To the extent practical, these technicians will be experienced in all disciplines, but in no case will technicians' responsibilities include areas for which they are not trained. Specialists responsible for performing radiation monitoring will be required to demonstrate qualifications by passing the ORNL examination for health physics technicians before beginning site activities. The BNI Team Health and Safety Specialists are at WAG 5 at all times during execution of field activities and are responsible for monitoring these activities to detect and quantify hazardous materials that may be encountered. They also assist personnel in the proper use of PPE; perform release surveys of personnel and equipment; and verify adherence to environmental, health, and safety requirements.

Health and Safety Specialists also have stop-work authority. When field conditions develop that are not according to plan, appear unsafe, or may cause environmental insult, the Health and Safety Specialists will immediately stop operations and inform the FHSS.

2.2.6 Industrial Hygienist

The Industrial Hygienist reports directly to the ES&H Manager and is responsible for developing industrial hygiene procedures, overseeing the medical surveillance programs, and maintaining the quality of industrial hygiene-related field measurements and records. The Industrial Hygienist periodically audits RI/FS Project field activities to verify compliance with federal regulations, DOE orders, ORNL and Energy Systems policies and procedures, and Bechtel policies and procedures. He also conducts training as required for personnel in his disciplines.

The Industrial Hygienist has the authority to halt operations that endanger workers, the public, or the environment.

2.2.7 Health Physicist

The Health Physicist reports directly to the ES&H Manager and is responsible for developing health physics and health physics-related procedures; performing radiation hazards analyses, risk assessments, and radiation exposure assessments; and maintaining the quality of radiation field measurements and exposure records. The Health Physicist audits RI/FS Project field activities to verify compliance with DOE orders, Energy Systems and ORNL policies and procedures, and Bechtel policies and procedures. Project safety training is also conducted by the Health Physicist. The Health Physicist has the authority to halt operations that endanger the health and safety of workers, the public, or the environment.

2.2.8 Industrial Safety Specialist

The Industrial Safety Specialist reports directly to the ES&H Manager and is responsible for developing safety procedures, performing safety training, maintaining records related to worker illnesses and accidents, and reporting workman's compensation. The Industrial Safety Specialist audits RI/FS Project field activities for compliance with federal regulations, DOE orders, Energy Systems and ORNL policies and procedures, and Bechtel policies and procedures. The Industrial Safety Specialist has the authority to halt operations that endanger the health and safety of workers, the public, or the environment.

2.3 INTERFACES WITH ENERGY SYSTEMS SAFETY ORGANIZATION

The ORNL ES&HC Contractor Interface Manager is the primary contact between the ES&H Manager and the ORNL Environmental Restoration Division and Energy Systems Central Staff Office of Environment and Safety Activities. (See the ORNL RI/FS Project Management Plan for other interfaces with the Energy Systems safety organization.) The ORNL ES&HC Contractor Interface Manager provides the ES&H Manager with information pertaining to appropriate DOE orders, state and federal regulations, Energy Systems and ORNL requirements, and lines of communication. This information is then incorporated into RI/FS plans and procedures as appropriate. The ORNL ES&HC Contractor Interface Manager also provides review and approval of the plans and coordinates the ongoing safety program audit of the plan and procedure implementation.

Through the ORNL ES&HC Contractor Interface Manager, the ORNL Office of Environmental and Health Protection will verify that the RI/FS Project ES&H program is conducted in accordance with ORNL procedures and policies. ORNL will provide bioassay, external dosimetry, air purifying respiratory protection, in vivo counting, primary radiation detection instrument calibration, and general employee and radiation worker training for RI/FS Project personnel. (The course content for both general employee and radiation worker training is given in DOE Order 5480.11, "Radiation Protection for Occupational Workers.") Radiation detection instrument calibration records associated with portable radiation detection instruments are retained by the Office of Radiation Protection

(Bldg. 2007). All RI/FS radiation detection instrument calibration records will be maintained by ORNL; copies of results will be provided to the ES&H Manager on a routine and timely basis. (Equipment used to perform industrial hygiene/safety surveys is calibrated by RI/FS health and safety personnel or by the manufacturer.)

All instrumentation used by the BNI Team ES&H Department was purchased on behalf of DOE/Energy Systems and is government equipment. The services supplied by Energy Systems, as applied to this equipment, are approved in accordance with Energy Systems guidelines. Costs are covered internally via the Environmental Restoration Division annual budget process. Other short-term equipment not supplied by Energy Systems is subject to lease/purchase arrangements as part of the cost proposal for each work release.

3. HAZARDS EVALUATION

This section discusses the radiological, chemical, and physical hazards that may be encountered during the WAG 5 RI and outlines the ES&H requirements necessary to protect on-site investigators, the public, and the environment. Before remedial investigations are begun, the ES&H Manager will ensure that a hazards analysis is performed for proposed WAG 5 activities in accordance with Project Procedure (PP) 1308, "Quality Assurance Assessments." The following hazards evaluation is based on information available from ORNL documents and the March 1988 WAG 5 RI Plan (BNI 1988). Additional information to be gathered during initial site surveys will be used to specify the protective requirements and work limitations applicable to each task. These protective measures will be specified and documented in individual HWPs (see Sect. 12) controlling WAG 5 tasks. Excavation/penetration permits will be received from ORNL before intrusive investigations begin.

A listing of radionuclide inventories, radiological surface contaminants and levels, and chemical contaminants and inventories is contained in Appendixes A, B, and C, respectively, of this plan.

3.1 INTRODUCTION

WAG 5 is in Melton Valley, south of the main ORNL plant area. It contains 17 solid waste management units (SWMUs) to be evaluated during the RI. Table 3.1 lists the SWMUs (FFA 1990), and Fig. 3.1 shows their locations. The SWMUs include three burial areas, two hydrofracture facilities, two settling ponds, eight tanks, and two low-level liquid waste leak sites.

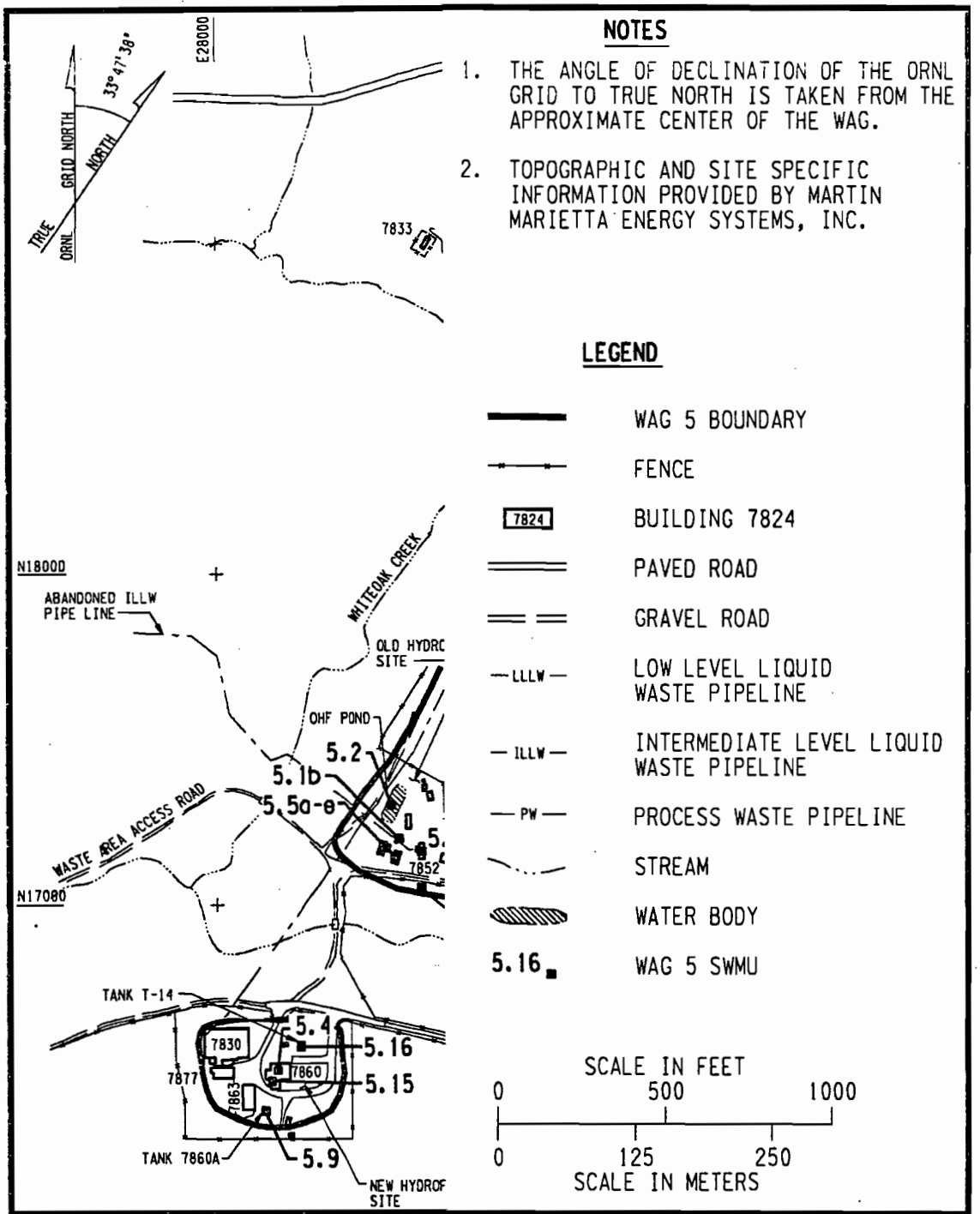
The WAG 5 RI includes nonintrusive investigations (e.g., general area inspections, radiation walkover surveys, electromagnetic ground conductivity surveys, and grab samples) and a series of intrusive activities requiring ground penetration (e.g., soil sampling and well installation). Although potential hazards may vary among SWMUs, the ES&H practices and procedures will be consistent. Because of the potential for encountering radioactive materials or chemicals during intrusive surface and subsurface investigations (e.g., drilling, sampling, and well installation), comprehensive monitoring will be carried out by qualified Health and Safety Specialists. All field work at WAG 5 will be controlled through the use of HWPs.

Table 3.1. WAG 5 SWMUs

SWMU	Description[a]
5.1a	Leak site—OHF observation well
5.1b	Leak site—OHF grout release
5.2	OHF Pond (7852A)
5.3	OHF site surface facilities (7852)
5.4	NHF site surface facilities (7860)
5.5a–e	Inactive OHF waste storage tanks (T1, T2, T3, T4, T9)
5.6	Process Waste Sludge Basin (7835)
5.7	SWSA 5 (7802)
5.9	Radioactively contaminated waste oil storage tank (7860A)
5.10i	TRU Waste Storage Area and TRU Direct Burial Trenches
5.14	Old landfill in the northeast edge of SWSA 5
5.15	Active LLLW slotting tank T-13
5.16	Inactive LLLW tank T-14

Source: Proposed Federal Facility Agreement for the Oak Ridge Reservation, 1990.

[a]OHF—Old Hydrofracture Facility; NHF—New Hydrofracture Facility; SWSA—solid waste storage area; TRU—transuranic; LLLW—low-level liquid waste.



WAG5 05F005.DGN

3.2 RADIOLOGICAL HAZARDS

3.2.1 External Radiation Hazards

Throughout the WAG 5 burial areas, surface gamma exposures are expected to exceed background radiation levels. A report written by ORNL's Measurement Applications and Development Group suggests that average gamma exposure rates are several tens of μR/h above background throughout the 50-acre Solid Waste Storage Area (SWSA) 5 South burial area. Several hot spots (up to 55 mR/h) have been located (Uziel et al. 1989), and project personnel will be required to limit time spent in those areas. Although activities concentrated around the groundwater seep areas at the southern edge of the SWSA 5 burial area may cause elevated external dose equivalents for personnel, it is not expected that the administrative external radiation dose control levels given in Sect. 15.3 will be exceeded at any time throughout the project. (The dose equivalent limits in Sect. 15.3 are the administrative limits used on the RI/FS Project and regulatory limits provided by DOE.)

Each activity associated with WAG 5 RI work will be planned according to PP 1132, "Preparation of Project Field Work Guides," and controlled by an HWP (PP 1235). ALARA evaluation and planning will be conducted for WAG 5 to assess the degree of potential external exposure and methods by which exposures may be maintained at ALARA levels and within applicable guidelines and administrative limits. Administrative external radiation exposure limits established as part of the planning process will become part of the task HWP.

Before each field task, the ES&H Department will conduct radiation surveys of the work area to determine initial conditions and establish protection levels for workers. WAG 5 work will be monitored by qualified Health and Safety Specialists using appropriate and calibrated absorbed dose rate instrumentation. Individuals conducting WAG 5 work will be individually equipped with calibrated self-reading dosimeters (SRDs). Alarming and recording SRDs will be supplied, when available, to minimize the potential for ALARA goals and administrative limits to be exceeded.

3.2.2 Internal Radionuclide Exposure

Based on the limited documentation of radioactive materials buried in the WAG 5 trenches (Stewart et al. 1989), the potential exists for worker uptake of a variety of radionuclides, including strontium-90 and hydrogen-3. Exposure to these radionuclides could result through inhalation, ingestion, or absorption; inhalation is the most likely route for internal exposure to radioactive material at WAG 5.

Nonintrusive operations in WAG 5 should not create increased levels of airborne radioactive contaminants because general area inspections, radiation walkover surveys, and geophysical surveys are not expected to resuspend radioactive materials in the surface soil or vegetation.

Well installation and soil sampling activities could increase concentrations of airborne radioactive materials during the exhumation of contaminated subsurface soil and groundwater. Drilling spoils will be kept damp or packaged to minimize the potential for radioactive materials to become airborne. Personal and ambient air sampling will be performed to determine airborne contaminant levels during all subsurface soil and groundwater sampling.

ALARA evaluation and planning will be conducted for WAG 5 to assess the degree of potential contamination, the potential for generation of airborne radioactivity, and methods by which exposures may be maintained ALARA and within applicable guidelines and administrative limits. Combined external and internal radiation administrative dose equivalent limits are established by PP 1280.3, "External Radiation Dosimetry." Individual work task ALARA goals and, as necessary, uptake mitigation methods will be established as part of the planning process and will become part of the controlling instruction guide.

Before each field task, the ES&H Department will conduct radiation surveys to determine initial conditions and establish protection levels for workers. WAG 5 work will be monitored by qualified Health and Safety Specialists using appropriate and calibrated air monitoring or sampling devices to assess airborne radioactivity conditions. Individuals conducting WAG 5 work will participate in the project's in vivo bioassay program. Bioassay will be conducted according to guidance provided in PP 1280.4, "Internal Dosimetry." Personal air monitoring will be used to assess internal exposure potentials where airborne radioactivity is probable.

3.3 TOXIC AND HAZARDOUS CHEMICAL EXPOSURES

Investigations in WAG 5 may expose field personnel to toxic metals and hazardous organic compounds through the oral, skin, or respiratory routes. The WAG 5 RI Plan (BNI 1988) lists amounts of chemical contaminants present (if known) in each SWMU (see Appendix C). These data, as well as any additional data that become available, will be used for planning purposes for tasks covered under this ES&H Plan.

ALARA evaluation and planning will be conducted for WAG 5 to assess the degree of potential contamination and the potential for personal exposure to toxic metals and hazardous organic compounds and methods by which these exposures may be maintained within ALARA levels and PELs or other applicable guidelines and administrative limits. Exposure limits are established by PP 1270, "Industrial Hygiene Practices," to the most limiting value available (OSHA PEL, NIOSH REL, or ACGIH TLV). Individual work task ALARA goals and uptake mitigation methods will be established as part of the planning process and will become part of the controlling instruction guide.

Before beginning field tasks in WAG 5, the ES&H Department will conduct chemical and hazardous materials surveys, including ambient air monitoring or sampling of environmental media, to determine initial conditions and establish protection levels for

workers. WAG 5 work will be monitored by qualified Health and Safety Specialists using appropriate and calibrated chemical detection instrumentation. Individuals conducting WAG 5 work will be equipped with appropriate detection devices or air sampling devices to assess exposure potentials where conditions indicate.

3.4 PHYSICAL HAZARDS

3.4.1 Fire and Explosions

Although no tanks will be entered or opened during the WAG 5 RI, tasks will be conducted in the vicinity, and the potential for fire or explosion may exist as the result of:

- explosive atmospheres from organic chemicals or gases stored or contained in tank residues,
- explosive atmospheres in tanks or trenches resulting from decay of organics and formation of methane or hydrogen,
- use or transfer of fuels for powering equipment, and
- welding or burning (see safety requirements in 29 CFR Pt. 1926.352).

Each activity associated with WAG 5 work will be planned according to PP 1132, "Preparation of Project Field Work Guides." Evaluation and planning will be conducted to assess the potential for fire or explosion and establish methods by which these potentials may be minimized or eliminated. Individual work task fire and explosion prevention methods will be established as part of the planning process and will become part of the controlling instruction guide.

Each field activity associated with WAG 5 work will be controlled by an HWP. Fire and explosion prevention planning will become part of the controlling limitations stated in each HWP for these tasks.

Before and during drilling operations, monitoring for explosive atmospheres will be conducted by a qualified Health and Safety Specialist using appropriate and calibrated detection instrumentation. Fuels and other flammables will be handled according to OSHA requirements, NFPA guidelines, and state and local fire codes.

3.4.2 Confined Spaces and Excavations

Some WAG 5 containments (e.g., spill basins) may require that workers enter areas where they could be exposed to confined space or excavation hazards.

Each activity associated with WAG 5 work will be planned according to PP 1132, "Preparation of Project Field Work Guides." Where confined space entry or excavation is necessary to accomplish mission goals, evaluation and planning will be conducted to assess the degree of hazard to workers. Individual work task safety methods (ventilation, shoring, rescue devices, etc.) will be established as part of the planning process and will become part of the controlling instruction guide. In cases of potential confined space or excavation, required personnel will be trained and potentially hazardous work will be planned, conducted, controlled, and monitored according to 29 CFR Pt. 1926 and PPs 1275.8, "Confined Space Entry and Work," and 1275.3, "Excavation and Trenching."

Each field activity (or similar activities) associated with WAG 5 work will be controlled by an HWP. Safety methods established in planning will become part of the controlling limitations stated in each HWP for these tasks.

Before each field task, the ES&H Department will conduct necessary monitoring to determine initial conditions and establish protection levels for workers. WAG 5 work will be monitored by qualified Health and Safety Specialists.

3.4.3 Noise Hazards

Long-term exposure to noise from equipment operation in excess of 85 dBA has been determined to cause hearing impairment. Therefore, noise levels will be routinely monitored, and those operations with sound levels in excess of 85 dBA will require hearing protection. Additional hearing protection will be provided or equipment modifications implemented, as appropriate, to maintain acceptable noise levels. Noise monitoring and control and hearing conservation procedures outlined in PP 1270, "Industrial Hygiene Practices," will be followed.

3.4.4 Other Physical Hazards

Exposure to heat or cold can cause severe stress and, possibly, death. The procedures outlined in PP 1270 will be followed to control heat and cold stress hazards.

Improper operation of equipment or equipment malfunctions may result in injury and physical damage. Engineering controls, periodic inspections, and strict adherence to safe practices will be used to minimize the potential for injury and impairment.

3.5 SUMMARY

When the presence and concentrations of specific chemical and radiological materials are confirmed, the resulting hazards will be reassessed, as necessary, to reevaluate the hazards

classification. This is accomplished by reference to standards and guidelines; key guidelines are listed in Table 3.2. Table 3.3 identifies health and safety equipment that will be used at WAG 5.

Table 3.2. Guidelines for assessing chemical, physical, and radiological hazards

Hazard	Guideline	Explanation	Source[a]
Inhalation of airborne contaminants	Threshold limit value (TLV)	One of three categories of chemical exposure levels, defined as follows:	
	• TLV, time-weighted average	Time-weighted average concentration for a normal 8-h workday and a 40-h work week, to which nearly all workers may be repeatedly exposed without adverse effect. Should be used as an exposure guide rather than absolute threshold.	ACGIH
	• TLV, short-term exposure limit	A 15-min time-weighted average exposure that should not be exceeded at any time during the work day.	ACGIH
	• TLV, ceiling	The concentration that should not be exceeded even momentarily.	ACGIH
	Permissible exposure limit (PEL)	Time-weighted averages and ceiling concentrations similar to (and in many cases derived from) the TLVs published in 1968.	OSHA
	Recommended exposure limit (REL)	Time-weighted averages and ceiling concentrations based on NIOSH evaluations.	NIOSH
	Immediately dangerous to life or health (IDLH)	Maximum level from which a worker could escape within 30 min without any escape-impairing symptoms or irreversible health effects.	NIOSH
Dermal absorption of chemicals through airborne or direct contact	Designation "skin"	Designation "skin" in the ACGIH, OSHA, and NIOSH references indicates that a substance may be readily absorbed through the intact skin; however, it is not a threshold for safe exposure. Direct exposure should be avoided. Biological monitoring should be considered to determine the relative contribution of dermal exposure to the total dose.	ACGIH/OSHA/ NIOSH
Dermal irritation		Many substances irritate the skin. Consult standard references.	
Carcinogens	TLV	Some carcinogens have an assigned TLV.	ACGIH
	PEL	OSHA has individual standards for some specific carcinogens.	OSHA
			NIOSH

Table 3.2 (continued)

Hazard	Guideline	Explanation	Source[a]
	REL	NIOSH makes recommendations regarding exposures to carcinogens.	
Noise	TLV	Sound pressure levels and durations of exposure that represent conditions to which it is believed that nearly all workers may be repeatedly exposed without an adverse effect on their ability to hear and understand normal speech.	ACGIH
	PEL	Limits for acceptable noise exposure.	OSHA
	REL	Limits for acceptable noise exposure.	NIOSH
Ionizing radiation	Derived air concentration (DAC)	DAC is the concentration of any given radionuclide in air, which, if inhaled continuously during a working year (2000 hours), would irradiate a person to the annual dose equivalent limit.	DOE
	Derived concentration guide (DCG)	DCG is the concentration of any given radionuclide in water or air, which, if ingested at reference man values, would result in an effective dose equivalent of 1 mSv (100 mrem). The DCGs are generally applied to environmental exposures.	DOE
	Annual limiting values for occupational workers	Annual dose equivalent limit for occupational exposures.	DOE
Explosion	Lower explosive limit	Minimum concentration of vapor in air below which propagation of a flame will not occur in the presence of an ignition source.	NFPA
	Upper explosive limit	Maximum concentration of vapor in air above which propagation of a flame will not occur in the presence of an ignition source.	NFPA
Fire	Flash point	The lowest temperature at which the vapor of a combustible liquid can be made to ignite momentarily in air.	NFPA

[a]*Source:* ACGIH, 1990–1991, *Threshold Limit Values for Chemical Substances and Physical Agents in the Workplace Environment and Biological Exposure Indices*, Cincinnati, Ohio; DOE Order 5400.5, 1990, *Radiation Protection of the Public and the Environment*; DOE Order 5480.11, 1988, *Radiation Protection for Occupational Workers*; NIOSH, Centers for Disease Control, *NIOSH Recommendations for Occupational Health Standards, Morbidity and Mortality Weekly Report Supplement*; NIOSH, 1990, *Pocket Guide to Chemical Hazards*, Cincinnati, Ohio; NFPA, 1990, *Fire Protection Guide on Hazardous Materials*, Boston, Massachusetts; OSHA, 29 CFR Part 1910 (OSHA standards are legally binding). (The most current standards and guidelines in the references will be used.)

Table 3.3. Health and safety equipment

Equipment name or type	Contaminant or hazard to be detected
Ion chamber	Radiation exposure rate
Pancake-type Geiger Mueller detector	Beta-gamma contamination
Alpha scintillation detector	Alpha contamination
NaI scintillation detector	Gamma radiation
High-purity germanium detector	Gamma-emitter identification and quantification
Liquid scintillation counter	Tritium and carbon-14
Proportional counters	Smear and air sample analysis
Air samples	Radioactive particle
Organic vapor analyses	Organic vapors
Oxygen/LEL meter	Oxygen and explosive vapors
Sound level meter	High noise areas and equipment
Heat stress monitor	Hot or cold temperatures
Sorbent tubes	Organic vapors, mercury, etc.

4. INTERNAL ENVIRONMENTAL ASSESSMENT, NEPA DOCUMENTATION, AND READINESS REVIEWS

Both an environmental review and a readiness review will be conducted for WAG 5 before field activities are begun. These reviews are required to ensure that RI field activities are conducted in a manner that is safe, that is in accordance with ALARA principles, and that is cost-effective. Programmatic requirements for each type of review are summarized in the following subsections.

4.1 INTERNAL ENVIRONMENTAL ASSESSMENT AND NEPA DOCUMENTATION

The purpose of the internal environmental assessment is to promote compliance with all applicable environmental permits, rules, regulations and statutes; to promote environmental protection by implementation of ORNL's ALARA policy; and to maintain the quality of the environment throughout all activities, operations, and projects carried out at ORNL.

The RI/FS Project is subject to the ORNL Internal Environmental Assessment and National Environmental Protection Act (NEPA) Documentation Program requirements; appropriate environmental reviews will be conducted by Energy Systems.

4.2 READINESS REVIEW

The purpose of the readiness review is to ensure, by identifying and minimizing the risks associated with mission success, that a given activity is ready to proceed to the next increment of work. It will promote compliance with all applicable ORNL, Energy Systems, DOE, federal, state, and local regulations, orders, procedures, and guidelines. WAG 5 documents will be included in the readiness review to ensure that all possible avenues for personal and environmental exposures have been accounted for (e.g., site characterization summaries, WAG 5 RI implementation plans, comprehensive work plans, and WAG 5 ES&H plans). The readiness review encompasses all operational divisions including health and safety.

The RI/FS Project is subject to the ORNL Readiness Review and Documentation Program. Readiness review will be conducted by Energy Systems.

5. PROJECT ES&H PROCEDURES

RI/FS ES&H activities at WAG 5 will be conducted in accordance with project procedures that will be issued to Energy Systems after BNI Team approval. These project procedures are maintained by the ES&H Manager, the FHSS, and the FSS Manager. Where appropriate, manufacturers' instructions for equipment operation, calibration, and maintenance will be used in lieu of specific project procedures.

Each project procedure will be reviewed internally at least annually for continuing applicability and adequacy. The review will include an evaluation for compliance with applicable ES&H regulations, standards, and guidelines and Bechtel policy and procedures. Procedures that require changes to be compliant with federal or site requirements will be revised and reissued, and copies will be sent to Energy Systems. Table 5.1 lists applicable project procedures.

Programmatic assessments of the various ES&H programs will be performed at least quarterly to ensure proper use of the procedures.

Table 5.1. ES&H project procedures

Project procedure number	Procedure title
1201	Environmental, Safety, and Health Management Oversight Program
1202	Site Access Requirements
1205	Medical Surveillance
1210	ES&H Training
1220	Initial Site Survey
1230	Personal Protective Equipment
1235	Hazardous Work Permits
1240	Emergency Response
1240.1	Unusual Occurrence Reporting
1245	Personnel Decontamination
1250	Equipment Decontamination and Release for Unrestricted Use
1255	Work Area and Environmental Monitoring
1260	Hazardous Materials Transportation
1260.1	Determination of Hazardous Materials Classification
1260.2	Packaging of Hazardous Materials for Transport
1260.3	Transport Vehicle Requirements
1260.4	Transport Vehicle Operator Requirements
1260.5	Transportation Safety Requirements
1260.6	Surveying, Marking, and Placarding of Transport Vehicles and Containers
1260.9	Shipping Papers
1265	ES&H Recordkeeping
1270	Industrial Hygiene Practices

Table 5.1 (continued)

Project procedure number	Procedure title
1270.1	Air Surveillance of Radiological and Chemical Contaminants
1271	Inspection, Maintenance, Use, and Testing of the Mobile Decontamination Trailer-1 (MDT-1) Breathing Air System
1275	Industrial Safety Practices
1275.1	Electrical Equipment and Systems
1275.2	Control of Hazardous Energy Source (Lockout/Tagout)
1275.3	Excavation and Trenching
1275.4	Ladders
1275.5	Scaffolds
1275.6	Cranes, Heavy Equipment, and Motor Vehicles
1275.7	Welding and Cutting
1275.8	Confined Space Entry and Work
1275.9	Housekeeping/Sanitation
1275.10	Hand and Portable Power Tools
1275.11	Fire Prevention and Protection
1275.12	OSHA/Bechtel/DOE Recordkeeping
1280	Health Physics Practices
1280.1	Methodology for Performing Radiological Contamination Surveys
1280.2	Dosimetry Services
1280.3	External Radiation Dosimetry
1280.4	Internal Radiation Dosimetry
1280.5	Radiological Dose Rate Measurements
1280.6	Use of Pocket Meters
1280.7	Posting and Labeling
1280.8	Control Point Operations

Table 5.1 (continued)

Project procedure number	Procedure title
1280.9	Radiation Source Control
1280.10	Development and Use of Control Charts for Radiation Scalers
1280.11	Determination of Tritium and Carbon-14 Activity in Urine Using Packard Tri-Carb Liquid Scintillation Counting Systems
1280.12	Determination of Transferable Tritium and Carbon-14 Activity on Surfaces Using Packard Tri-Carb Liquid Scintillation Counting Systems
1285	Calibration and Maintenance of ES&H Instruments

6. PERSONAL PROTECTIVE EQUIPMENT

6.1 SELECTION OF PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment for a particular job will be selected by the FHSS or ES&H Manager based on an evaluation of the hazards anticipated or previously detected at a work site. The equipment selected will provide protection from contamination by chemical or radiological materials that are known or suspected to be present and exhibiting any potential for worker exposure. Respiratory protection (discussed in Sect. 7) may be required.

Requirements for PPE will be specified in an HWP based on a preliminary, on-site survey for any level of PPE protection, as defined below. When conditions occur that are not covered by existing plans and procedures, the FHSS will halt work and inform the ES&H Manager, who will then coordinate proposed solutions with ORNL management through the ORNL ES&HC Contractor Interface Manager. This may include changing PPE requirements in the HWP. (Changed PPE requirements in an HWP will be documented in the HWP.) Numerical designations of levels of PPE are reversed from OSHA designations to more closely correspond to Energy Systems designations.

6.2 LEVELS OF PERSONAL PROTECTIVE EQUIPMENT

The levels of PPE shown in Table 6.1 will be used as a starting point for ensemble creation; however, each ensemble will be tailored to the specific situation to provide the appropriate level of protection.

6.2.1 Level 1 PPE

Level 1 PPE will be used when the hazard analysis indicates that field investigations will be conducted in areas known or thought to be free of significant contamination. Use of Level 1 PPE may continue if field measurements or monitoring data confirm the following conditions.

- Airborne contaminants are less than 10 percent of the applicable limiting value (DAC, PEL, TLV, REL).
- The absorbed dose rate is less than 25 μGy/h (2.5 mrad/h) generally taken at waist level (approximately 1 m).
- Radioactive materials contamination is maintained at levels less than 0.3 Bq/100 cm^2 (20 dpm/100 cm^2) for removable alpha contamination; 5 Bq/100 cm^2 (300 dpm/100 cm^2) for total alpha contamination; 3.3 Bq/100 cm^2 (200 dpm/100 cm^2) for removable beta-gamma contamination [except for iodine-125, iodine-129, and actinium-227, for which the

guide is 0.3 Bq/100 cm^2 (20 dpm/100 cm^2)]; and 16.7 Bq.5/100 cm^2 (1000 dpm/100 cm^2) for total beta-gamma contamination.

6.2.2 Level 2 PPE

Level 2 PPE will be used initially when the hazards analysis indicates that hazardous materials are present, but in quantities that do not present a potential for significant exposures to airborne or skin contaminants. Continued use of Level 2 PPE will be based on field measurements or monitoring data that confirm the following conditions.

- Airborne contaminants are greater than or equal to 10 percent, but less than 50 percent, of the applicable limiting value. If more than one contaminant is identified, the unity rule* will be used to assign the appropriate limiting value.

- The absorbed dose rate is greater than or equal to 25 μGy/h (2.5 mrad/h), thus requiring the use of pocket dosimeters. Elevated dose rates and contamination levels may not always be coincidental. Therefore, it may be necessary to evaluate absorbed dose rate PPE requirements as a separate issue (see footnote b, Table 6.1).

- Radioactive materials contamination is maintained at levels less than 8.3 Bq/100 cm^2 (500 dpm/100 cm^2) for removable alpha contamination; 41.7 Bq/100 cm^2 (2500 dpm/100 cm^2) for removable beta-gamma contamination [except for iodine-125, iodine-129, and actinium-227, for which the guide is 8.3 Bq/100 cm^2 (500 dpm/100 cm^2)]; and 2,100 Bq/100 cm^2 (1.25×10^5 dpm/100 cm^2) for total beta-gamma contamination [except for iodine-125, iodine-129, and actinium-227, for which the guide is 41.7 Bq/100 cm^2 (2500 dpm/100 cm^2)].

- PPE for protection against skin irritants may be highly specific to the chemical constituents(s) comprising the irritant. Accordingly, choice of chemical-resistant PPE materials will be guided by knowledge of the chemical substances encountered (see Footnote a, Table 6.1).

The unity rule: $\frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots \frac{C_n}{T_n} < 1$

where
C_n = atmospheric concentration of contaminant n,
T_n = TLV, PEL, REL, or DAC of contaminant n.

6.2.3 Level 3 PPE

Level 3 PPE will be used initially when the hazards analysis indicates a potential for direct contact with hazardous contaminants that will not adversely affect exposed skin. Continued use of Level 3 PPE will be based on continuous field measurements or monitoring data that confirm the following conditions.

- Concentrations of individual airborne contaminants are less than 50 times the applicable limiting value. If more than one contaminant is identified, the unity rule will be used to assign the appropriate limiting value.

- The absorbed dose rate is greater than or equal to 25 μGy/h (2.5 mrad/h), thus requiring the use of pocket dosimeters. Elevated dose rates and contamination levels may not always be coincidental. Therefore, it may be necessary to evaluate absorbed dose rate PPE requirements as a separate issue (see Footnote b, Table 6.1).

- Radioactive materials contamination is maintained at levels less than 417 Bq/100 cm^2 (25,000 dpm/100 cm^2) for removable alpha contamination; 2100 Bq/100 cm^2 (1.25×10^5 dpm/100 cm^2) for total alpha contamination; 21,000 Bq/100 cm^2 (1.25×10^6 dpm/100 cm^2) for removable beta-gamma contamination [except for iodine-125, iodine-129, and actinium-227, for which the guide is 417 Bq/100 cm^2 (25,000 dpm/100 cm^2)]; and 1.04×10^5 Bq/100 cm^2 (6.25×10^6 dpm/100 cm^2) for total beta-gamma contamination [except iodine-125, iodine-129, and actinium-227, for which the guide is 2100 Bq/100 cm^2 (1.25×10^5 dpm/100 cm^2)].

- PPE for protection against skin irritants may be highly specific to the chemical constituents(s) comprising the irritant. Accordingly, choice of chemical-resistant PPE materials will be guided by knowledge of the chemical substances encountered (see Footnote a, Table 6.1).

6.2.4 Level 4 PPE

Level 4 PPE represents the same level of skin contaminant protection as Level 3. Level 4, however, will be used for concentrations of specific substances that do not represent a severe skin hazard but are immediately dangerous to life or health (IDLH); for atmospheres containing less than 19.5 percent oxygen; for concentrations in excess of the protection factors for air-purifying respirators; or in the presence of incompletely identified vapors or gases as indicated by direct-reading organic vapor detection equipment. Use of Level 4 PPE will be based on continuous field measurements or monitoring data that confirm the following conditions.

- Concentrations of individual airborne contaminants are less than 100 times the applicable limiting value. If more than one contaminant is identified, the unity rule will be used to assign the appropriate limiting value.

- The direct radiation dose rate is greater than or equal to 25 μGy/h (2.5 mrad/h), thus requiring the use of pocket dosimeters. Elevated dose rates and contamination levels may not always be coincidental. Therefore, it may be necessary to evaluate dose rate PPE requirements as a separate issue (see Footnote b, Table 6.1).

- Radioactive materials contamination is maintained at levels less than 830 Bq/100 cm^2 (50,000 dpm/100 cm^2) for removable alpha contamination; 4200 Bq/100 cm^2 (2.5×10^5 dpm/100 cm^2) for total alpha contamination; 4.167×10^4 Bq/100 cm^2 (2.5×10^6 dpm/100 cm^2) for removable beta-gamma contamination [except for iodine-125, iodine-129, and actinium-227, for which the guide is 830 Bq/100 cm^2 (50,000 dpm/100 cm^2)]; and 2.83×10^5 Bq/100 cm^2 (1.25×10^7 dpm/100 cm^2) for total beta-gamma contamination [except for iodine-125, iodine-129, and actinium-227, for which the guide is 4200 Bq/100 cm^2 (2.5×10^5 dpm/100 cm^2)].

- PPE for protection against skin irritants may be highly specific to the chemical constituents(s) comprising the irritant. Accordingly, choice of chemical-resistant PPE materials will be guided by knowledge of the chemical constituents encountered (see Footnote a, Table 6.1).

- Skin irritants are present.

6.2.5 Level 5 PPE

Level 5 PPE is reserved for emergency response operations in unknown atmospheres; work in IDLH atmospheres where specific substances represent a severe skin exposure hazard; work in extremely corrosive atmospheres; work in atmospheres containing concentrations of hazardous contaminants in excess of the protection factors for pressure-demand respirators; or work in atmospheres containing known hazardous contaminants that have not been adequately evaluated. The following guideline will be used for selection of Level 5 PPE.

- Almost any environment that will not degrade, permeate, or penetrate the PPE, or jeopardize planned radiation exposure limits, may be entered with Level 5 PPE.

The foregoing PPE requirements may be modified to provide the appropriate level of protection. Except in emergency situations, special PPE requirements will be recommended by the FHSS based on field survey information and appropriate laboratory analyses. These requirements will be approved by the ES&H Manager before they are implemented.

Table 6.1. Levels of personal protective equipment

Level	Equipment description
1	Required - Nonregulated cloth work uniform - Steel-toe and steel-shank work boots - Safety glasses - Hard hat - Disposable gloves[a] - Whole-body thermoluminescent dosimeter (TLD) badge Optional, as required - Work gloves[a] - Personal flotation device - Ear plugs or muffs - Two-way radio - Sweat bands - Flashlight or lantern
2	Required - Tyvek® coveralls with openings taped closed - Regulated area cloth work uniform - Chemical-resistant outer gloves[a] taped to Tyvek® coveralls - Chemical-resistant inner gloves[a] taped to cloth coveralls - Steel-toe and steel-shank work boots - Neoprene boots, or chemical-resistant boot covers[a] taped to Tyvek® coveralls - Hard hat - Safety glasses - Whole-body TLD badge Optional, as required - 0- to 200-mR pocket dosimeter ($0.025 \leq$ mGy/h < 1.0)[b] (or electronic equivalent) - 0- to 200-mR plus 0- to 1-R pocket dosimeter ($\geq$ 1.0 mGy/h)[b] (or electronic equivalent) - Extremity dosimeters (> 0.035 mGy/h)[b] - Personal flotation device - Ear plugs or muffs - Two-way radio - Flashlight or lantern Note: Access to areas and operations requiring Level 2 PPE will be restricted. Each such area will be barricaded so that dose rates and airborne exposure levels are < 0.025 mGy/h and < 0.1 derived air concentration (DAC/PEL/TLV/REL) guide, respectively, at its boundary.

Table 6.1 (continued)

Level	Equipment description
3	Required, inner set - Regulated cloth work uniform with openings taped closed - Steel-toe and steel-shank work boots - Chemical-resistant shoe covers[a] taped to cloth coveralls - Chemical-resistant gloves[a] taped to cloth coveralls Required, outer set - Full-facepiece, air-purifying, canister-equipped respirator[c] - Chemical-resistant coveralls or chemical splash suit[a] with openings taped closed - Chemical-resistant hood[a] taped to coveralls - Chemical-resistant gloves[a] taped to chemical resistant coveralls, or chemical splash suit - Neoprene boots, or chemical-resistant boot covers[a] taped to coveralls - Hard hat - Whole-body TLD badge - Personal air sampler - Two-way radio Optional, as required - 0- to 200-mR pocket dosimeter ($0.025 <$ mGy/h < 1.0)[b] (or electronic equivalent) - 0- to 200-mR plus 0- to 1-R pocket dosimeter (> 1.0 mGy/h)[b] (or electronic equivalent) - Extremity dosimeter (> 0.035 mGy/h)[b] - Personal flotation devices - Ear plugs or muffs - Sweat bands - Flashlight or lantern Note: Access to areas and operations requiring Level 3 PPE will be controlled. Each such area will be constructed with a two-barricade system comprised of an inner "hot line" and an outer "contamination control" line. Construction and operation of a Level 3 PPE controlled access area will ensure that the environmental dose rates and airborne exposure levels are < 0.025 mGy/h and < 0.1 DAC/PEL/TLV/REL, respectively.
4	Required, inner set - Modesty garments - Tyvek® (chemical-resistant[a] as appropriate) coveralls with openings taped closed - Chemical-resistant gloves[a] taped to coveralls - Steel-toe and steel-shank work boots - Chemical-resistant shoe covers[a] taped to coveralls

Table 6.1 (continued)

Level	Equipment description
	Required, outer set - Pressure-demand, full-facepiece self-contained breathing apparatus (SCBA), or pressure-demand, supplied-air respirator with escape SCBA provisions[c] - Chemical-resistant coveralls[a] or chemical-resistant splash suit[a] with openings taped closed - Chemical-resistant hood[a] taped to coveralls - Hard hat - Neoprene boots, or chemical-resistant boot covers[a] taped to coveralls - Chemical-resistant gloves[a] taped to coveralls - Whole-body TLD badge - Personal air sampler - Two-way radio Optional, as required - 0- to 200-mR pocket dosimeter ($0.025 <$ mGy/h < 1.0)[b] (or electronic equivalent) - 0- to 200-mR plus 0- to 1-R pocket dosimeter (> 1.0 mGy/h)[b] (or electronic equivalent) - Extremity dosimeters (> 0.035 mGy/h)[b] - Personal flotation device - Ear plugs or muffs - Sweat bands - Flashlight or lantern - Cooling garment Note: The same controlled access restrictions that apply to Level 3 PPE areas also apply to Level 4 PPE areas/operations.
5	Required, inner set - Modesty garments - Chemical-resistant Tyvek® coveralls[a] with openings taped closed - Steel-toe and steel-shank work boots - Chemical-resistant shoe covers[a] taped to coveralls - Chemical-resistant gloves[a] taped to coveralls - Two-way radio - Cooling garment Required, outer set - Airline, continuous-flow, full-facepiece or hood respirator with SCBA escape provisions,[c] or pressure-demand, full-facepiece SCBA, or pressure-demand supplied-air respirator with escape SCBA provisions, as appropriate - Full-encapsulating, chemical-resistant suit[a] with openings taped closed

Table 6.1 (continued)

Level	Equipment description

- Chemical-resistant boot covers
- Personal air sampler
- Whole-body TLD badge
- Knife

Optional, as required

- 0- to 200-mR pocket dosimeter (0.025 < mGy/h < 1.0)[b] (or electronic equivalent)
- 0- to 200-mR plus 0- to 1-R pocket dosimeter (> 1.0 mGy/h)[b] (or electronic equivalent)
- Extremity dosimeters (> 0.035 mGy/h)[b]
- Flashlight or lantern
- Hard hat

Note: If Level 5 PPE work is anticipated, reasonable efforts will be made to use engineering controls that will mitigate the hazard(s) to requirements of Level 4 PPE or less. If such engineering controls are not feasible, a risk assessment will be performed before work begins. The risk assessment will demonstrate that environmental dose rates and airborne exposure levels can be controlled to < 0.025 mGy/h and < 0.1 DAC/PEL/TLV/REL, respectively, or the task may not be performed at the primary location.

[a]Clean or new chemical-resistant gloves should always be used when handling samples. The most appropriate chemical-protective clothing will be chosen by the FHSS or Industrial Hygienist based on historical information and field measurements. Where data are inadequate, conservative assumptions will be used to ensure that clothing resists permeation, degradation, and penetration by chemicals.

[b]Radiation dosimetry will be issued in direct relation to field measured absorbed dose rates, as indicated. If field conditions change significantly from those shown on the HWP, that HWP will be terminated, PPE requirements reevaluated, and a new HWP initiated. Existing HWPs can be changed with the approval of the FHSS or the ES&H Manager.

[c]The decision to use respiratory protection for airborne concentrations in excess of the appropriate DAC or TLV may be based on field evaluations with a field radiation detector, Photovac-TIP, or equivalent instrument for hazardous chemical organic vapors; decisions should always be confirmed with laboratory analyses.

7. RESPIRATORY PROTECTION PROGRAM

Respiratory protection program procedures require that when engineering controls cannot maintain airborne contaminants at acceptable levels, appropriate respiratory protective devices will be used by affected persons. An effective respiratory protection program is essential to this project and will be implemented when necessary during WAG 5 field activities. HWPs will be issued to document the respiratory protection requirements for field personnel to minimize exposures to hazardous materials.

The respiratory protection program will:

- establish respiratory protection requirements, including selection of devices to be used for each work situation as required by hazard potentials (see Sect. 3);

- verify that personnel who use protective devices meet medical requirements for such use, that the fit of the assigned device is acceptable, that personnel are adequately trained in the use of the devices, and that they use the devices as specified on the job;

- verify that air supplies meet applicable requirements (such air supplies may include plant air, dedicated air supply systems, and air tanks); and

- provide for appropriate records of

  - respirator requirements for work situations,
  - medical status of individuals,
  - respirator fitting results,
  - training of employees and supervisors,
  - specification of respiratory protective requirements, for example, on HWPs,
  - actual use of respirators on jobs requiring them,
  - emergency procedures, training, and device selection,
  - respirator inspection, cleaning, and maintenance activities,
  - results of bioassay program, and
  - tests and inspections of air supplies.

These elements of the program will be carried out in accordance with PP 1230, "Personal Protective Equipment," which complies with applicable regulatory requirements.

7.1 REGULATORY REQUIREMENTS

The most conservative requirements of DOE Order 5480.11 and OSHA regulations 29 CFR Pt. 1910.134 and 29 CFR Pt. 1910.120 will be met. The American National Standards Institute (ANSI) standard "Practices for Respiratory Protection," ANSI Z88.2-1980, is

incorporated in the preceding documents by reference and serves as the basic guide for such programs.

7.2 RESPONSIBILITIES AND AUTHORITIES

Acting under the overall guidance of ORNL management and the ORNL ES&HC Contractor Interface Manager, the ES&H Manager has responsibility and authority for administration of the respiratory protection program. In this capacity, the ES&H Manager may designate the FHSS as responsible for making decisions regarding the need for any type of respiratory protective equipment.

7.3 SELECTION OF RESPIRATORS

Only respirators approved by NIOSH, the Mine Safety and Health Administration (MSHA), or the Nuclear Regulatory Commission (NRC) and those respirators that have been tested and certified (verified by test certification numbers) will be used. All component and replacement parts must also have NIOSH, MSHA, or NRC approval. In addition, respirators are approved as a system. Cartridges, canisters, filters, air lines, and regulators cannot be interchanged among equipment, even among equipment of a single manufacturer, unless specifically approved by NIOSH, MSHA, or NRC.

Selection of approved makes and types of respirators will be based on mutual BNI and ORNL agreement and on the rationale provided in Sect. 6.

7.4 TRAINING

Training relative to the respiratory protection program will be included in a 48-h hazardous waste operations training course, including the following:

- instruction in the nature of the hazard, whether acute, chronic, or both, and an accurate appraisal of what may happen if the respirator is not used;
- explanation of why engineering or administrative controls may not be feasible, including explanation of efforts being made to reduce or eliminate the need for respirators;
- discussion of why a certain type of respirator is used for a particular purpose;
- discussion of the respirator's capabilities and limitations;
- discussion of proper inspection and maintenance of the respirator;

- instruction, training, and actual use of the respirator and close, frequent supervision to ensure that it is being used properly; and
- classroom and field training in recognizing and coping with emergencies.

Instruction in the actual application of the respirator under field conditions will include:

- opportunities to handle the respirators;
- proper fitting, including demonstrations and practice in determining fit, donning, wearing, adjusting, and removing the respirator;
- testing the facepiece for face seal;
- a period for familiarization with wear in normal air; and
- wearing the respirator in a test atmosphere.

ES&H personnel will receive comprehensive training concerning respirators and respiratory protection practices. This training will include, but not necessarily be limited to, the following:

- basic respiratory protection practices;
- selection and use of respirators to protect employees against hazards to which they may be exposed;
- nature and extent of the respiratory hazard(s) to which employees may be exposed;
- structure and operation of the respiratory protection program, including ES&H responsibility to facilitate functioning of the program, maintenance and issuance of respirators, control of use, and evaluation of program effectiveness; and
- legal requirements pertinent to the use of respirators.

7.5 FITTING

Employees will be fit-tested annually (and must be kept up to date) by an ORNL-approved service for each type of respirator that may be worn to ensure proper seal of the respirator facepiece. Documentation of fit test results will be retained by the ES&H Manager as part of the fit-testing procedure. Each employee will be evaluated to see that facial features do not interfere with proper sealing. Employees with corrective lenses will be provided with specially designed respirator glasses (inserts) that do not interfere with

respirator seal. Employees with facial hair that interferes with the respirator seal will neither be fit tested nor allowed to enter areas where respiratory protection is required. Employees will be required to be clean shaven at all respirator-sealing surface contact points (before fit-testing or before occupational use), or they will not be allowed in areas that require respiratory protection. If the fit test is not performed within 60 days after the physical exam, the physical must be performed again.

Tests to be used in respirator fitting are described in Sects. 7.5.1 and 7.5.2.

7.5.1 Quantitative Test

This test involves exposing the respirator wearer to a challenge atmosphere. The concentration of particles is measured both inside and outside the respirator, and this ratio represents the protection factor afforded by the respirator.

Personnel required to use respiratory protective devices will be quantitatively tested. A separate test is required for each type of device to be worn by an individual.

7.5.2 Field Tests

Field tests consisting of the following will be performed before entry into any area requiring respiratory protection:

- Test 1—Positive Pressure Test. This test is conducted by closing off the exhalation valve and exhaling gently into the facepiece. The fit is considered satisfactory if slight positive pressure can be built up inside the facepiece without any evidence of outward leakage.

- Test 2—Negative Pressure Test. This test consists of closing off the inlets of the canister, cartridge(s), or filter(s), inhaling gently so the facepiece collapses slightly, and holding the breath for 10 seconds. If the facepiece remains slightly collapsed and no inward leakage is detected, an adequate fit has probably been obtained. This test can be used only on respirators with tightly fitting facepieces and is only a gross determination of fit.

7.6 INSPECTION, CLEANING, MAINTENANCE, AND STORAGE

7.6.1 Inspection Procedures

The OSHA standard states that respirator inspection will include the following:

- checking straps and rubber seals for signs of deterioration;
- checking tightness of the connections;

- checking the facepiece for cleanliness and secure attachment;
- inspecting valves to see that they are seated properly, are flexible, and have no noticeable deterioration;
- inspecting connecting tubes for holes or deterioration;
- checking canisters, filters, or cartridges for damage; and
- checking all flexible components for wear and deterioration.

In addition, the standard states that the regulator and warning devices on an SCBA will be checked for proper function.

ORNL will inspect and maintain the air purifying respirators used on the project. The air-supplied respirators will be inspected routinely by field personnel, and repairs will be performed by certified personnel.

7.6.2 Defects Found During Field Inspections

Defects found during field inspections will cause a respirator to be removed from service until it can be repaired. All air purifying respirators will be repaired by Energy Systems, and all SCBAs will be sent to the manufacturer for major repair (e.g., regulator adjustment). Under no circumstances will a defective device be allowed to remain in the field.

7.6.3 Inspection During Cleaning

ORNL provides inspection and cleaning of ORNL-supplied respirators. Because cleaning usually involves some disassembly, it presents an opportunity for thorough examination of each respirator.

7.6.4 Cleaning and Disinfecting

As a minimum, ORNL-supplied respirators will be cleaned and disinfected by ORNL after use. Any BNI-supplied respirators will be collected, cleaned, and disinfected in accordance with PP 1230, "Respirator Maintenance, Cleaning, Decontamination, and Storage." Respirators used during training exercises in the field will be sanitized in the field. If needed, ORNL's cleaning services may be used. Emergency-use respirators will be cleaned and disinfected after each use.

7.7 MEDICAL ASPECTS

Employees who are required to wear a respirator must be examined annually by a physician to determine medical fitness for tasks requiring respirators. An employee will not be assigned to a task that requires a respirator unless it has been determined that the employee is physically capable of performing the work while using the respirator. A release statement, signed by the physician, is kept on file in the ES&H Manager's office area.

During respirator fitting, any distress exhibited by an individual will be reported; reexamination by a physician may be required to determine whether the employee can safely continue to use the equipment. In addition, any evidence that an employee is having difficulty using any respiratory protective device will be reported to the ES&H Manager. That individual will then be reassessed by a physician.

7.8 PROGRAM EVALUATION

Periodic surveillance of work areas that require use of respirators and an evaluation of the program for effectiveness are important aspects of the respiratory protection program.

7.8.1 Surveillance of the Work Area

Many variables affect the need to use respirators. To determine the necessity for respiratory protection or the need for additional protection, appropriate surveillance of work conditions and of the degree of employee exposure or stress is provided by Health and Safety Specialists as determined by the FHSS or ES&H Manager. Program changes will be implemented as needed.

The results of work area sampling and exposure measurement determine the selection and use of respiratory protection equipment. The respiratory protection program will be modified as needed based on these exposure measurements.

Used respirators are monitored to determine the quantity of radioactive material on the interior of the facepiece. (Positive survey results will require bioassay sampling and analysis for the radioactive material that the individual was probably exposed to.) The respirator is placed in a bag, the bag is tagged as containing radioactive material, and the bag is taken to the ORNL laundry for cleaning and inspection.

7.8.2 Evaluation of Effectiveness

Frequent evaluation of respirator practices will determine whether appropriate respirators are being used and whether they are being used properly. Examination of respirators in use and in storage will indicate how well the equipment is being maintained.

Improper use or maintenance of respirators will not be tolerated. Intentional abuse of respirators is cause for dismissal from the project.

Users will be consulted periodically about their acceptance of respirators, including discomfort, unacceptable resistance to breathing, and fatigue. Users will also be consulted concerning their confidence in the respirator's effectiveness and the degree to which the respirator interferes with vision and communication, restricts movement, and interferes with job performance.

The results of periodic inspections of respirator use, consultation with wearers, measurements of airborne levels of contamination in work areas, bioassays, and medical surveillance of wearers will be reviewed and analyzed to determine the effectiveness of the respirator program. Any evidence of excessive exposure to hazards will be investigated to determine why adequate protection was not provided, and action will be taken to remedy the problem.

8. SITE AND CONTAMINATION CONTROL

WAG 5 activities will be performed in a manner that controls site access and minimizes the potential for spread of contamination. Site control measures include the WAG 5 boundary fence and the establishment of CAAs at individual work locations in accordance with the provisions of PP 1235, "Hazardous Work Permits." ORNL Security provides 24-hour armed intrusion protection and patrol for WAG 5. Project personnel will be required to have an ORNL-approved Melton Valley Access "slash badge." A physical examination, external dosimetry, bioassay, and either the 24- or 40-hour hazardous waste operations training are required to obtain a slash badge. Visitors will be allowed in WAG 5 under the direct supervision of an individual authorized to enter only after the facility manager has been notified.

At each major activity work location, a site map will be provided. The site map will be marked by the FHSS or designee to indicate the shortest evacuation route from the individual work site to a predesignated assembly area and the location of the nearest medical assistance, which is ORNL Medical, located in Building 4500 North.

8.1 WORK AREA CONTROL

Work within each CAA at WAG 5 will be controlled by PP 1235, "Hazardous Work Permits." The HWP system provides authorization for named employees to do a particular job involving exposure to radiation or radioactive contamination, hazardous chemicals, physical hazards, or other potentially dangerous work situations. The HWP system incorporates appropriate approvals for named personnel to enter areas under specified requirements. Daily entry and exit times for those personnel are recorded. If time-exposure operations are involved, appropriate time and exposure data are also recorded. The minimum work crew for operations within a CAA will be two individuals. Additional information on CAAs and the HWP system is given in Sect. 12 of this plan. Project procedures have been established to govern the establishment, entry, work activities, and monitoring of CAAs. These procedures are listed in Table 5.1.

Work areas will be controlled via the HWP system as described in PP 1235. HWPs will be used to control employee exposure to hazards and to control each work task where the evaluated potential for such exposure warrants. This system contains elements necessary to provide direction on the establishment of CAAs, including site maps, designated work zones, use of a "buddy system," site communications (e.g., emergency alerting, work practices, and procedures), and identification of the nearest medical assistance.

8.2 CONTAMINATION CONTROL

For operations, it will be necessary to apply existing project procedures and protocols to control the spread of contaminants (radioactive, chemical, and biological) to prevent or minimize exposure to the environment, the public, and project personnel. General methods to be used are as follows.

- Contaminant protection training for worker understanding of contaminant hazards and work practices is required to prevent the spread of contaminants. See PP 1210, "ES&H Training."

- Various contamination control measures will be initiated when CAAs are necessary. Exits from CAAs will be monitored by portable instruments to minimize the potential for spreading contaminants. Engineering and administrative controls will be used, when applicable, to minimize personal and environmental exposures to site-generated contaminants.

- An HWP system controls access to areas where contaminants are known to exist and specifies protective equipment for work in those areas. See PPs 1235, "Hazardous Work Permits"; and 1280.7, "Posting and Labeling."

- Contaminant surveys identify areas containing materials requiring control, establish the boundaries of CAAs, and provide input for HWPs. See PPs 1220, "Initial Site Survey"; 1255, "Work Area and Environmental Monitoring"; and 1280.1, "Methodology for Performing Radiological Contamination Surveys."

- Anticontamination clothing will be used in areas with accessible surface contamination, and respiratory protection equipment will be used in areas with known airborne contaminants. See PP 1230, "Personal Protective Equipment."

- Air sampling for radiological and organic compounds will establish the level of respiratory protection required and provide input for HWPs. At a measured concentration of 1 ppm in the breathing zone, respiratory protection and PPE will be implemented. See PPs 1255, "Work Area and Environmental Monitoring"; and 1270.1, "Air Surveillance of Radiological and Chemical Contaminants."

- Monitoring and decontamination of personnel and equipment (e.g., tools and vehicles) leaving CAAs will prevent the spread of contamination. See PPs 1245, "Personnel Decontamination"; 1250, "Equipment Decontamination and Release for Unrestricted Use"; and 1280.8, "Control Point Operations."

- Tasks will be reviewed and analyzed to make sure that they are, or will be, performed with minimal spread of contamination.

Personnel monitoring for radioactive contamination will be required when exiting a CAA and at other times designated by the FHSS. This activity will be conducted in accordance with Sect. 4.2 of PP 1280.8, "Control Point Operations." Outer anticontamination clothing will be surveyed and disposed of in accordance with PP 1402, "Waste Handling." Work clothing will be placed in appropriate containers for cleaning by ORNL's laundry. Respiratory protection equipment will be surveyed to segregate those items that exhibit radioactivity. Contaminated respirators will be properly packaged and labeled.

Work area and personnel monitoring will be conducted in accordance with PPs 1280 through 1280.9, "Health Physics Practices"; 1270, "Industrial Hygiene Practices"; and 1270.1, "Air Surveillance of Radiological and Chemical Contaminants." These procedures specify the types of monitoring to be performed, instrumentation to be used and its maintenance and calibration, and techniques to be used in sampling and analysis. This is further discussed in Sect. 13 of this plan.

9. PERSONNEL DECONTAMINATION

9.1 INTRODUCTION

All personnel and equipment (including tools and vehicles) exiting a contaminated zone will be monitored to verify that personnel and equipment are free of significant contamination and that contamination is not carried beyond the contamination zone. Personnel monitoring will be performed in accordance with PPs 1245, "Personnel Decontamination"; 1280.1, "Methodology for Performing Radiological Contamination Surveys"; and 1280.8, "Control Point Monitoring."

When monitoring indicates that an employee has become contaminated with chemicals, biological agents, or radioactive materials, decontamination efforts will be initiated immediately, and the employee's immediate supervisor will notify the FHSS, who will record the details of the incident, determine whether any injury is involved, and notify the ES&H Manager. All contamination incidents will immediately be reported by the ES&H Manager to ORNL management through the Laboratory Shift Supervisor (LSS) and the ORNL ES&HC Contractor Interface Manager to ensure that prompt procedural notifications and appropriate emergency response actions take place.

9.2 FACILITIES

The ES&H Manager will designate the FHSS to verify that facilities provided for decontamination of BNI personnel are maintained in acceptable condition and that supplies of decontaminating agents and other materials are kept available. Personnel decontamination facilities (located at the FOF) will be equipped with showers, supplies of clean work clothing, decontamination agents, and a decontamination area where ES&H personnel can assist in decontaminating individuals. Provisions will be made to retain all wash solutions and materials for appropriate disposal and to maintain separation between clean and contaminated areas and materials. Provisions will be included at the CAA boundary for decontaminating the exterior surfaces of fully encapsulating suits before personnel remove them.

9.3 DECONTAMINATION TECHNIQUES

The affected employee will remove all contaminated clothing and equipment. If radioactive contamination is involved, Health and Safety Specialists will monitor the employee and will notify the FHSS if designated action levels have been exceeded.

The employee will wash thoroughly with soap and water and may use a soft-bristled brush for cleaning the hands and fingernails. Care will be taken to avoid irritating or abrading the skin. If there is evidence, including radiation-monitoring results, that cleaning

is not complete, the washing may be repeated. When the ES&H Manager believes it is warranted (e.g., contamination of the eye, contamination abraded into the skin), any further decontamination efforts will be carried out under the direction of a physician.

9.4 RELEASE LIMITS

The following radioactive contamination guidelines for skin and hands, used by ORNL, will be used throughout the RI/FS Project.

	Transferable (smear)		Direct readings[a]	
Item	Alpha	Beta-gamma	Alpha	Beta-gamma
General body	Nondetectable[b]		2.5 (150)	16.67 (1000)[c]
Hands	Nondetectable[b]		5.0 (300)	16.67 (1000)[c]

Source: ORNL Health Physics Procedure RP-2.5, "Radioactive Contamination Control."

[a]Units are Bq/100 cm^2 (dpm/100 cm^2).

[b]Removable skin contamination should be nondetectable. Detection limit is related to the instrumentation used.

[c]Higher limit may be used if the identity of the contaminant is known.

9.5 EMERGENCY DECONTAMINATION

In the event of personnel contamination with highly caustic, strongly acidic, or high-level radioactive materials (>0.01 mGy/h), emergency shower facilities at the FOF will be used for first-level decontamination. These facilities will be adequate to treat a minimum of two contaminated individuals at one time, and use of these facilities will be in accordance with PP 1245, "Personnel Decontamination." Appropriate Energy Systems medical and radiation safety personnel will be relied on to assist as needed.

Arrangements will be made to coordinate actions with ORNL and the Radiation Emergency Assistance Center/Training Site (REAC/TS) at the Methodist Medical Center (Oak Ridge Hospital) to deal with injured employees who suffer concurrent contamination with hazardous chemicals or radioactivity in accordance with PP 1240, "Emergency Response."

10. EQUIPMENT DECONTAMINATION

10.1 RESPONSIBILITIES AND AUTHORITIES

The FHSS is responsible for ensuring that tools and equipment (including vehicles) are surveyed before they are removed from CAAs in accordance with PP 1280.1, "Methodology for Performing Radiological Contamination Surveys," and PP 1250, "Equipment Decontamination and Release for Unrestricted Use." The Field Activities Coordinator (FAC) is responsible for ensuring that tools and equipment determined to be contaminated in excess of applicable limits are decontaminated to acceptable levels prior to release for unrestricted use.

10.2 FACILITIES

Prior to release from the CAA, tools and equipment determined to be contaminated with removable radioactive and detectable chemical materials in excess of applicable limits are manually decontaminated at the field location. Field decontamination efforts are conducted in accordance with PP 1250, "Equipment Decontamination and Release for Unrestricted Use," to prevent contamination from being spread to uncontaminated areas, facilities, or personnel.

Tools and equipment that cannot be field-decontaminated to levels below applicable release limits are appropriately packaged, removed from the CAA, and decontaminated in the BNI mobile decontamination trailer. The mobile facility is self-contained and uses recycle and cleanup technology to minimize generation of waste.

Reusable contaminated PPE is collected and packaged in contamination-free containers and taken to the contaminated clothing and respirator wash facilities at ORNL. The facilities have integral recycle and cleanup capabilities to minimize the volume of waste generated. Chemical decontamination is performed for all items that are to be reused for additional field sampling. This decontamination is accomplished at the BNI decontamination trailer(s) or in the field, as described above.

10.3 DECONTAMINATION CLEARANCE LIMITS

The radioactive materials contamination limits and guides for release for unrestricted use are shown in Tables 10.1 through 10.3. The limits shown in Table 10.1 may be used if the nuclide(s) have been identified. For unidentified nuclides, the more restrictive limits shown in Table 10.2 must be used. Table 10.3 addresses limits for free release of equipment, shoes, and clothing. Tools and equipment given an unconditional release from CAAs must always be accompanied by ORNL Form UCN-14 ("Green Tag"), as specified in PP 1250.

Chemical decontamination is performed in accordance with project procedures based on procedures accepted by the Environmental Protection Agency (EPA) and PP 1250. Random sampling and analysis of final rinse solutions may be performed to check the effectiveness of the decontamination procedures.

10.4 DISPOSAL OF CONTAMINATED FLUIDS AND MATERIALS

Fluids and materials resulting from decontamination processes are contained, sampled, and analyzed for contaminants. Those materials determined to be contaminated in excess of appropriate limits are packaged in ORNL-approved containers and disposed of in accordance with the ORNL RI/FS Waste Management Plan and appropriate project procedures.

Table 10.1. Surface radioactivity guides

Nuclide[a]	Removable[b, d]	Total[b, c] (Fixed plus removable)
^{nat}U, ^{235}U, ^{238}U, and associated decay products	1000 dpm α/100 cm^2 [b]	5000 dpm α/100 cm^2
Transuranics, ^{226}Ra, ^{228}Ra, ^{230}Th, ^{228}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I	20 dpm/100 cm^2 [b]	300 dpm/100 cm^2
^{nat}Th, ^{232}Th, ^{90}Sr, ^{223}Ra, ^{224}Ra, ^{232}U, ^{126}I, ^{131}I, ^{133}I	200 dpm/100 cm^2 [b]	1000 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except ^{90}Sr and others noted above[e]	1000 dpm ß-γ/100 cm^2 [b]	5000 dpm ß-γ/100 cm^2

Source: DOE Order 5480.11, *Radiation Protection for Occupational Workers*.

[a]Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive materials as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c]The levels may be averaged over one square meter, provided the maximum surface activity in any area of 100 cm^2 is less than three times the guide values. For purposes of averaging, any square meter of surface will be considered to be above the activity guide, G, if: (1) from measurements of a representative number of sections it is determined that $1/n\ [{}_nS_i \geq G]$, where S_i is the dpm/100 cm^2 determined from measurement of section i; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100-cm^2 area exceeds 3 G.

[d]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. (Note: The use of dry material may not be appropriate for tritium.) When removable contamination on objects of a surface less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and ^{226}Ra, ^{228}Ra, ^{227}Ac, ^{228}Th, ^{230}Th, and ^{231}Pa alpha emitters, it is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

[e]This category of radionuclides includes mixed fission products, including the ^{90}Sr present in them. It does not apply to ^{90}Sr that has been separated from the other fission products or mixtures in which the ^{90}Sr has been enriched.

Table 10.2. Recommended maximum[a] contamination guide for items given radiation or contamination clearance

Direct survey		Transferable (smear)	
Alpha	Beta-gamma	Alpha	Beta-gamma
(Bq/100 cm^2)	(Bq/100 cm^2)	(Bq/100 cm^2)	(Bq/100 cm^2)
[dpm/100 cm^2]		[dpm/100 cm^2]	
5.0	17	0.33	3.3[b]
[300]	[1000]	[20]	[200]

Source: ORNL Health Physics Procedure RP-2.5, "Radioactive Contamination Control."

[a]No 100-cm^2 area to average greater than this value.
[b]Except ^{125}I, ^{129}I, and ^{227}Ac, for which the guide is 0.33 Bq/100 cm^2 (20 dpm/100 cm^2).

Table 10.3. Contamination guides[a]

	Direct survey		Transferable (smear)	
	Alpha ($Bq/100\ cm^2$)	Beta-gamma ($Bq/100\ cm^2$)	Alpha ($Bq/100\ cm^2$)	Beta-gamma ($Bq/100\ cm^2$)
	[$dpm/100\ cm^2$]		[$dpm/100\ cm^2$]	
Areas, work surfaces, tools, equipment	5.0 [300]	16.7 [1000]	0.3 [20]	3.3 [200]
Skin (general body)	2.5 [150]	16.7 [1000]	0.3[c] [20]	3.3[c] [200]
Skin (hands)	5.0 [300]	16.7 [1000]	0.3[c] [20]	3.3[c] [200]
Shoes (personal)	5.0 [300]	16.7 [1000]	0.3 [20]	3.3 [200]
Clothing (personal and company)	5.0 [300]	16.7 [1000]	Not applicable	
Clothing, C-zone area	16.7 [1000]	250 [15,000]	Not applicable	

Source: ORNL Health Physics Procedure RP-2.5, "Radioactive Contamination Control."

[a]The guides for alpha are based on the limit for transuranics, and the beta-gamma guides are based on the limit for ^{90}Sr. In those cases where specific nuclides are known, these values may be adjusted by radiation protection personnel in accordance with established internal procedures.

[b]These levels may be averaged over 1 m^2 provided the maximum surface activity in any area of 100 cm^2 is less than 3 times the guide values.

[c]Removable skin contamination should be nondetectable. These values represent the lower limit of detection for smear counting systems in the field. The sensitivity of standard frisking techniques is such that only the direct-reading limits can be readily detected.

11. PERSONNEL TRAINING

11.1 INITIAL TRAINING

Initial Energy Systems general employee training is conducted for all personnel badged for site entry. The training programs are presented at levels suitable for the various types of project personnel (e.g., management, sampling team members, and health and safety specialists). The training will introduce BNI Team personnel to key ORNL ES&H personnel, identify potential on-site hazards, and cover PPE, work practices, emergency preparedness, hazard communications, and site operational procedures. The BNI Team provides training for first responders; emergency response is primarily coordinated through the ORNL LSS.

In accordance with OSHA requirements of 29 CFR Pt. 1910.120, all employees assigned to work in hazardous waste areas must receive a minimum of 40 hours of training off site prior to job assignment and, at the time of job assignment, 3 days of actual field experience under the direct supervision of a trained and experienced supervisor. Supervisory personnel receive this same training, plus an additional eight hours of specialized training on managing hazardous waste operations. Documentation of current training records is retained in the ES&H Manager's office area. On a monthly basis, a report from the ES&H training records data base identifies personnel who are nearing retraining, and dates are scheduled; this ensures that all site personnel who require training are trained and the records are up to date.

Basic OSHA training for all employees will include the following, in accordance with PP 1210, "ES&H Training":

- names of personnel and alternates responsible for site safety and health;
- safety, health, and other hazards present on the site;
- use of PPE (including respiratory protection);
- work practices by which the employee can minimize risks from hazards;
- safe use of engineering controls and equipment on the site;
- medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazards;
- site control measures;
- decontamination procedures;
- legal background for waste disposal activities,
- emergency responses;
- confined-space entry procedures; and
- use of respiratory protective devices, including actual practice in using applicable devices.

On-site management and supervisors directly responsible for operations in waste areas will receive eight additional hours of instruction in the following:

- site standard operating procedures,
- HWP applications,
- spill control techniques, and
- structure and operation of the PPE program.

11.2 WAG 5-SPECIFIC TRAINING

Employees will be trained to the requirements of this ES&H Plan for WAG 5, the project ES&H Plan, and project procedures before being assigned to work in the specific areas. A WAG 5 hazard evaluation (Sect. 3) is given to notify project personnel of nonroutine or unusual hazards that may be encountered in the field. On-site training will be required before the start of work in accordance with PP 1210, "ES&H Training." This will be done over a 3-day period under the direction of a supervisor who is knowledgeable of hazardous waste activities. Operating personnel will review and visit all applicable areas where they will work. All workers will be instructed in all health and safety procedures applicable to their work area, and in PP 1275, "Industrial Safety Practices," and companion procedures 1275.1 through 1275.12.

Health and safety specialists will receive on-site instruction in all project ES&H procedures applicable to task operations, and each will receive specific instruction in PPs 1270, "Industrial Hygiene Practices," 1270.1, "Air Surveillance of Chemical and Radiological Contaminants," and 1280, "Health Physics Practices," and its companion procedures 1280.1 through 1280.10.

11.3 REFRESHER TRAINING

Employees and supervisors will receive an 8-hour annual refresher course covering the materials of the initial indoctrination and other pertinent topics. As part of this refresher, the bulleted items in DOE Order 5480.11 for general employee training are presented.

11.4 WEEKLY "TOOL-BOX" TRAINING

To maintain a high level of safety awareness on the part of employees and supervisors, each supervisor will hold weekly meetings to highlight specific safety concerns. On occasion such meetings may be replaced by more formal safety meetings, sometimes held in conjunction with other work groups.

11.5 VISITOR POLICY

Visitors are given abbreviated training in accordance with Sect. 4.1 of PP 1210, "ES&H Training," consisting of the following topics:

- site-specific hazards,
- conduct within work areas, and
- emergency response actions.

At all times, visitors must be escorted by an individual who has completed the 40-hour hazardous waste operations training. Visitors who have not completed this training or applicable 24-hour training are not allowed inside CAAs.

12. HAZARDOUS WORK PERMITS

The HWP system provides authorization for named employees to do particular tasks within WAG 5 involving exposure to radiation or radioactive contamination, hazardous chemicals, physical hazards, or other potentially dangerous work situations. The HWP system incorporates appropriate approvals for named personnel to enter areas under specified requirements. The entry and exit times for those personnel are recorded. If timed-exposure operations are involved, appropriate time and exposure data are also recorded. The HWP program is conducted in accordance with PP 1235, "Hazardous Work Permits."

12.1 CONDITIONS REQUIRING AN HWP

An HWP will be required before beginning work for which any of the following conditions are anticipated or possible:

- when an individual may receive a radiation dose equivalent in excess of 0.2 mSv (20 mrem) to the total body or 2 mSv (200 mrem) to the extremities during the work shift;
- when an individual may be exposed to a radiation dose equivalent rate greater than 1 mSv/h (100 mrem/h);
- when the airborne concentration of radioactive material is greater than 10 percent of the respective DAC;
- when the airborne concentrations of hazardous chemical substances are in excess of 10 percent of the TLV (PEL, REL);
- when a CAA is required to control the spread of known contamination and to protect observers, the public, and the environment;
- when intrusive characterization efforts may encounter radioactive or hazardous chemical contaminants of unknown types or concentrations; and
- when work may be conducted in oxygen-deficient atmospheres, high-noise environments, or other such dangerous environments.

12.2 HWP INITIATION

Any project personnel familiar with work scheduled to be performed may initiate an HWP. After the initiator enters his name, description of work, work location, and names of involved employees, the HWP form is routed and completed as follows.

- The FHSS specifies appropriate radiation and contamination data and applicable working time limits. If hazards other than radiation or radioactive contamination are involved, the FHSS will specify industrial hygiene and safety conditions at the work location on the HWP form based on industrial hygiene survey results. If necessary, special protective equipment or safety measures will be incorporated on the HWP form.

- The FSS Manager reviews the HWP form to verify that all appropriate elements of the permit have been completed.

- A copy of the approved form is returned to the originator and another is available at the work site. A copy of the approved form is also retained in an "active" file by the FHSS.

12.3 POSTING REQUIREMENTS

Any CAA designated in an HWP must be protected by an appropriate barricade or flagging. Entry into the CAA requires the approval of the FHSS or designee, who verifies that all individuals involved have properly completed the appropriate log-in or log-out records, are outfitted with appropriate PPE, and understand the potential exposure hazards while in the CAA.

12.4 CONTAMINATION CONTROL

If the spread of chemical or radioactive contamination is possible, appropriate PPE will be determined and PPE disposal bins and step-off pads will be established at the perimeter of the area. PP 1280.8, "Control Point Operations," specifies protocols for establishing CAAs to control the spread of radioactive contamination.

12.5 TERMINATION OF HWPs

HWPs remain active until the work is completed, any preset time limits expire, or actual field conditions differ from those stated in the HWP. If personnel exposure conditions or work practices differ significantly from those stated, the HWP will be terminated, conditions reevaluated, and a new HWP issued. Terminated HWPs are closed out and become part of the project record.

12.6 RECORD RETENTION

Upon completion of work, the supervisor in charge will sign the HWP and forward it to the ES&H Manager for retention.

13. MEDICAL SURVEILLANCE

The RI/FS Project Medical Surveillance Program will conform to DOE Order 5480.10, OSHA 29 CFR Pt. 1960, and OSHA 29 CFR Pt. 1910.120. Employees to be included in the Medical Surveillance Program include (1) employees who are, or may be, exposed to hazardous substances or health hazards above the permissible exposure limit or published exposure level for more than 30 days per year; (2) employees working in activities that fall under the scope of 29 CFR Pt. 1910.120 who wear a respirator for 30 or more days a year as required by 29 CFR Pt. 1910.134; and (3) employees who are injured due to overexposure from an emergency incident or who show symptoms of illness that may have resulted from exposure to hazardous substances in the course of their work. Periodic physical examinations will be offered to each employee, with the frequency of examinations related to the age of the employee and potential for exposure. The extent of these reevaluations will be determined by the consulting physician. In addition, a health status review will be made for all terminating employees.

Supplemental health assessments are required whenever there is an actual or suspected exposure to chemical contaminants in excess of applicable limits or when site personnel experience any symptoms of exposure. BNI Team industrial hygienists, health physicists, and safety personnel will cooperate closely with consulting physicians to supply pertinent information concerning toxic materials involved, to assist in evaluating incidents of suspected exposure, and to optimize the maintenance of a healthful work environment.

Complete and specific details of the Medical Surveillance Program are contained in PP 1205, "Medical Surveillance."

14. BIOASSAY PROGRAM

The RI/FS Project field characterization efforts will include intrusive investigations of areas of unknown, but highly probable, contamination potential. Given the uncertainties associated with this type of field work, the project internal exposure monitoring program is based on the assumption that personnel will be exposed to significant quantities of radioactive or hazardous chemical contaminants. Accordingly, the internal dosimetry program will be conducted in accordance with the provisions of PP 1280.4, "Internal Radiation Dosimetry." These provisions are outlined in the following paragraphs. (Monitoring and control of internal contamination by hazardous chemical contaminants are described in Sect. 13.

14.1 BASELINE BIOASSAYS

Individuals who are assigned to field activities or who have reason to visit or inspect field activities are assigned one of the four job function categories shown in Table 14.1. All such individuals (except Category IV) must submit urine samples and submit to whole-body counting (WBC) and lung counting prior to participation in field activities. The baseline urine samples are analyzed for the solubility Class D and Class W compounds that could reasonably be expected to be encountered at ORNL. WBCs are analyzed for the gamma-emitting radionuclides that could reasonably be expected to be encountered at ORNL.

Table 14.1. Job function categories

I.	Individuals spending more than 20 percent of their time in CAAs where uncontained radioactive material is likely to be present.
II.	Individuals spending 5–20 percent of their time in CAAs where uncontained radioactive material is likely to be present.
III.	Individuals spending less than 5 percent (but more than 0 percent) of their time in CAAs where uncontained radioactive material is likely to be present.
IV.	Any individual not included in the above categories and who will not enter CAAs.

Results of the baseline bioassay analyses are evaluated by the project Health Physicist for evidence of previous exposure. Individuals exhibiting evidence of previous internal contamination will not be permitted to enter CAAs until an evaluation of the previous exposure indicates that additional, planned radiation exposure will not result in doses in excess of applicable regulatory limits. This evaluation may include additional, rigorous sampling and counting to establish the physical and temporal parameters necessary for adequate assessment of the committed effective dose equivalent.

14.2 ROUTINE BIOASSAY PROGRAM

The routine bioassay program is used as a measure of the effectiveness of the respiratory protection and contamination control programs. Therefore, bioassay frequency will be a function of potential exposure to airborne radioactive materials and will be based on the sampling intervals shown in Table 14.2.

Evidence of inadequate respiratory protection will be cause for an investigation of the responsible field operation(s). The ES&H Manager is responsible for investigating and identifying probable causes of the respiratory protection program failure and for recommending corrective actions.

14.3 DIAGNOSTIC BIOASSAYS

In accordance with the provisions of PP 1280.4, "Internal Radiation Dosimetry," diagnostic bioassays are used to quantify internal depositions that could result in an annual effective dose equivalent of 1 mSv (100 mrem) or an annual organ or tissue dose equivalent of 50 mSv (5 rem). The need for diagnostic bioassays is determined based on the routine action levels specified in PP 1280.4.

Diagnostic bioassays involve removing the exposed individual from further internal and external exposure potentials and performing those bioassays necessary to establish the physical and temporal parameters essential for estimating the committed effective dose equivalent. The individual may return to planned exposure work if it has been determined that any such planned exposure will not result in a dose in excess of regulatory limits.

14.4 TERMINATION BIOASSAYS

All individuals participating in the bioassay program are required to submit excreta samples and submit to WBCs and lung counts prior to termination from the project. Results of the termination bioassay analyses are reviewed by the project Health Physicist. Individuals may be recalled for diagnostic bioassays if they exhibit unexpectedly high results that indicate a potential for exposure in excess of regulatory limits.

14.5 BNI-ENERGY SYSTEMS INTERFACE

Energy Systems will provide all bioassay analytical services for the RI/FS Project. Consequently, routine and nonroutine bioassay requirements (e.g., overexposure assessments) will be closely coordinated with Energy Systems. The ES&H Manager is responsible for coordinating bioassay requirements with the ORNL ES&HC Contractor Interface Manager and will notify the ORNL ES&HC Contractor Interface Manager as early as possible regarding individuals to be included in the bioassay program and their assigned job function categories. In turn, Energy Systems will provide the ES&H Manager with copies of all analytical bioassay results for each member of the BNI Team included in the program.

Table 14.2. Guide for routine sampling for those who work with radioactive material

Radioactive material	Routine sampling		
	Job function[a] Category I	Job function[a] Category II	Job function[a] Category III
^{241}Pu and alpha emitters other than Class D and W uranium	Urine each 3 months, lung count each 12 months	Urine each 6 months, lung count each 12 months	Urine each 12 months, lung count each 12 months
^{90}Sr and Class D and W uranium	Urine each 6 months	Urine each 12 months	Urine each 12 months
^{3}H	Urine twice each week	Urine twice each month	Urine each 6 months
^{131}I	Thyroid scan monthly	Thyroid scan each 3 months	Thyroid scan each 6 months
^{60}Co and ^{137}Cs	WBC each 6 months	WBC each 12 months	WBC each 12 months
All others	Consult with Energy Systems ES&H Coordinator	Consult with Energy Systems ES&H Coordinator	Consult with Energy Systems ES&H Coordinator

[a]Category defined in Table 14.1. Category IV does not require routine bioassay.

15. EXTERNAL RADIATION DOSIMETRY PROGRAM

15.1 THERMOLUMINESCENT DOSIMETRY PROGRAM

Energy Systems will provide TLD services to the BNI Team members assigned to the RI/FS Project. Energy Systems is responsible for evaluation of dosimeter response and for maintaining permanent records. Following each dosimeter exchange, Energy Systems will provide the ES&H Manager with a copy of dosimetry results for BNI Team members.

The ES&H Manager is responsible for evaluating exposure potentials and assigning BNI Team members to the TLD program. He is also responsible for evaluating exposure data to verify that exposures are maintained at ALARA levels and for ensuring that exposure data are transmitted to the appropriate BNI Team members. Access to data will be limited to those individuals that have a need to know.

15.2 SELF-READING DOSIMETER PROGRAM

SRDs (pocket ionization chambers or electronic equivalent) are used to administratively control accrual of penetrating exposure. Field measurements are used to administratively control accrual of nonpenetrating skin exposure.

These field-received dose estimates will be recorded as a function of HWP number (providing location and work category) from SRDs for each individual (providing job function category), thereby establishing a data base for ALARA evaluations. Field dose estimating protocols are instituted when the absorbed dose rates (measured in air) to the whole body, skin, forearms, and hands and feet exceed 25 μGy/h (2.5 mrad/h), 0.1 mGy/h (10 mrad/h), 0.2 mGy/h (20 mrad/h), and 0.35 mGy/h (35 mrad/h), respectively.

15.3 RADIATION DOSE CONTROL PROGRAM

When the field-received dose estimate data indicate that an individual has accrued 1 mSv (100 mrem) over a one-week period, the individual is not allowed to enter CAAs until the TLD badge is processed. The individual may be allowed to reenter CAAs only after project Health Physics review. (ORNL's Environmental and Health Protection Division will also be contacted.) The TLD badge data are used to update the individual's dose history (quarter, year, or life, as appropriate) and to correct the dose estimate data for ALARA evaluation purposes. The received dose estimates are then "zeroed," and the estimating protocol is reinstated. Table 15.1 shows the ORNL administrative limits that will be used on this project to ensure that personal exposure will remain below the DOE limits.

Table 15.1. Dose limits

Type of exposure	Condition	Administrative limit [mSv (rem)]	DOE limit [mSv (rem)]
Whole body	Annual effective dose equivalent	20 (2)	50 (5)
Skin of the whole body	Annual dose equivalent	150 (15)	500 (50)
Extremity	Annual dose equivalent	150 (15)	500 (50)
Organ or tissue	Annual dose equivalent	150 (15)	500 (50)
Lens of eye	Annual dose equivalent	50 (5)	150 (15)
Unborn child (entire gestation period)	Annual dose equivalent	5 (0.5)	5 (0.5)

Source: DOE Order 5480.11, "Radiation Protection for Occupational Workers," and ORNL Health Physics Manual Procedure RP-3.1, "Radiation Protection Standards."

16. PERSONNEL AIR MONITORING

The purpose of the personnel air monitoring program is to measure approximate concentrations of chemical and radioactive contaminants in the air breathed by RI/FS Project personnel. The RI/FS Project respiratory protection program will be designed to meet OSHA and DOE requirements, and the protection factors specified for various protective devices will be considered when evaluating the actual air concentrations entering the lungs of monitored employees.

Whenever practicable, lapel-type samplers will be used in accordance with PP 1270.1, "Air Surveillance of Radiological and Chemical Contaminants," for monitoring work activities because they provide a reasonable approximation to a true breathing zone sample. Where higher flow rates of air than can be pulled with a lapel sampler are required, various configurations of ac-powered air pumps will be used in accordance with PP 1270.1. These air pumps will be positioned to provide the closest possible approximations to the true breathing zone.

Records of personnel exposures to concentrations of airborne contaminants will be used:

- to establish that employees are not exposed to airborne contaminants above DACs, PELs, RELs, or TLVs,
- to determine whether the respirators specified are the most appropriate types for the work,
- to provide records of contaminants to which individual personnel have been exposed and estimates of exposure levels, and
- to determine whether specific ALARA actions may be appropriate.

17. ALARA PROGRAM

This section provides guidance regarding how the ALARA philosophy is to be applied to the ORNL RI/FS Project at WAG 5. ALARA is to be used by management (e.g., ES&H and support services) and the workforce at all times to minimize exposures to chemicals and radioactive materials. ALARA is to be stressed to project personnel to increase their awareness of how to use ALARA in day-to-day activities. This guidance may be in the form of tool-box safety meetings, procedural and mock-up training, dosimetry reports and consultation, and HWPs.

The basic ALARA philosophy for ORNL RI/FS Project activities is simply to "limit personnel and environment chemical and radiation exposures to the lowest levels commensurate with sound economic and social considerations." This basic statement presupposes that no exposure should occur without a positive net benefit, considering technological, economic, and societal factors. Implicit in the ALARA philosophy is the assumption that any exposure, however small, carries with it some detriment or probability of detriment (i.e., risk), which should be balanced by an offsetting benefit. This philosophy for exposures to radiation and radioactive materials is based on the linear, nonthreshold hypothesis, which is based on the assumption that detriment from radiation is directly proportional to the dose incurred and that no threshold or dose exists below which there is no detriment. Indeed, this is the heart of the ALARA philosophy, and it implies that all individuals, including management and field personnel, should not stop looking for ways to minimize exposures for a given output of work, as long as the cost of the potential detrimental effect exceeds the net benefit.

A primary principle of on-the-job safety is that safety is everyone's responsibility. This principle applies also to ALARA. Day-to-day operational ALARA responsibilities are borne by all; others have additional and special responsibilities. Management is responsible for establishing staff to provide the technical support and assistance necessary to achieve ALARA goals, and line management adopts technical, administrative, and supervisory methods applicable to the operations under their control. Each individual worker then implements ALARA principles and procedures. In addition, as in other safety-related programs, individual workers often make significant contributions.

17.1 POLICY STATEMENT

It has been and continues to be the policy of BNI RI/FS management to maintain personnel exposures to radiation, radioactive materials, and other hazardous materials at ALARA levels. ALARA is to be used in procedure development, work habits, facility and operation design, etc. to minimize both internal and external exposure. The philosophy applies to personnel exposed occupationally in CAAs in the field and to persons exposed in uncontrolled areas due to environmental releases.

17.2 WORKPLACE ALARA EFFORTS

Judicious application of basic time, distance, physical control, and PPE principles will be used to limit exposures to ALARA levels. To verify that established control is adequate, workplace monitoring for radioactive materials and chemicals detectable by field instruments will be conducted in direct proportion to expected or observed levels of exposure. Activities that result in unexpectedly high potential exposures will be terminated until provisions are made that allow work to proceed in acceptable ALARA fashion.

HWPs are used during field activities in lieu of approved operating procedures. The HWP is required when there is a potential for either internal or external exposure to chemicals or radioactive materials. The FHSS notes the safety requirements on the permit; these specified requirements are used by workers to minimize potential exposures.

An electronic personal dosimeter (if available) is worn by each individual who is assigned to an HWP. A whole-body penetrating dose equivalent action level is assigned to each individual before entering a CAA; an individual whose action level has been exceeded cannot be assigned an electronic dosimeter. If the action level is exceeded during field operations, an audible alarm will sound and the individual will exit the area. This data base-controlled external dosimetry system is updated daily at badge exchange and maintains a record of individual daily and accumulated exposures.

17.3 ALARA PROGRAM ASSESSMENT

Personnel exposure data are maintained in the BNI RI/FS data base (refer to the Data Base Management Plan for additional information). External and internal exposures of record are comprised of TLD badge and bioassay data, respectively. Field dose calculation, direct-reading pocket meter, and event-based lapel air sampling data are used to maintain estimates of personnel exposures to both radioactive materials and hazardous chemicals. These estimates are correlated with job-specific activities (work location and work category) and individual-specific activities (job function) (see Sect. 14).

Periodic reviews of personnel exposure estimates are conducted to identify unfavorable trends and unexpectedly high potential exposures, as compared with the task hazards analysis (see Sect. 3). Activities (as functions of work location, work categories, and job functions) identified as resulting in chronically unfavorable trends will be investigated, and recommendations will be made for additional administrative or physical controls, as appropriate.

All unfavorable trends and unexpectedly high potential exposures must be reported to appropriate project management by the ES&H Manager, who will also make recommendations for corrective action.

18. PERIMETER MONITORING

To verify that personnel, facilities, and environs in areas adjoining work locations are not subject to chemical or radioactive exposure, perimeter monitoring around these activities will be carried out by BNI on a routine basis. The perimeter (CAA) is the boundary of the work area defined by the applicable HWP.

18.1 AIR MONITORING

When an HWP is initiated in response to existing or potential airborne contamination, perimeter air sampling must be carried out during the course of the work. Because the areas defined by HWPs generally will be relatively small, air samplers may be located in specific downwind and upwind directions to be determined when the work begins. At these locations, sampling will monitor for airborne radioactive contamination and for hazardous chemicals thought to be present.

If hazardous chemical or radioactive contamination in excess of applicable guidelines is indicated, the ORNL RI/FS Project Manager and the ORNL ES&HC Contractor Interface Manager will be notified. The area will be evacuated, and the level of PPE required to complete the task will be upgraded, if applicable. Under the guidance of ORNL's Environmental and Health Protection Division, appropriate investigations will then be carried out as quickly as possible by RI/FS personnel to identify the cause, evaluate possible exposures to persons in adjacent work areas, initiate any necessary bioassay or medical evaluations, and assess environmental impacts.

18.2 SURFACE WATER MONITORING

To the greatest extent practical, physical and administrative controls will be used to minimize the potential for the spread of contamination via surface water runoff. If a potential exists for the spread of contamination as a result of surface water runoff, efforts will be made to sample and analyze water from primary runoff sources that could be affected by such contamination. If contamination exceeding the guidelines for water discharge from the site is found, ORNL's Environmental and Health Protection Division will oversee an investigation to identify and correct the cause, evaluate possible exposure to persons in adjacent work areas and off site, and assess environmental impacts. Remedial action will be initiated by BNI to decontaminate affected areas.

18.3 RADIATION ABSORBED DOSE RATE MONITORING

Daily absorbed dose rate surveys will be made of each CAA perimeter when occupied. Operations resulting in absorbed dose rates in excess of 25 μGy/h (2.5 mrad/h) beyond the CAA boundary will be halted, the ORNL RI/FS Project Manager and ORNL ES&HC

Contractor Interface Manager will be notified, and the perimeter boundary will be extended, if practical. Following notification of the ORNL ES&HC Contractor Interface Manager, immediate actions will be taken by the FHSS to mitigate such conditions. Action may include expanding the CAA perimeter, shielding, removing the source, or any combination of the foregoing, depending on the magnitude of the perimeter exposure rate(s). Work will not be allowed to continue until physical or administrative controls are instituted to ensure that perimeter absorbed dose rates are controlled to 30 μGy/h (3 mrad/h) or less.

19. EMERGENCY ACTION PLAN

19.1 GENERAL EMERGENCY ACTION PROCEDURES

PP 1240, "Emergency Response," specifies personnel responsibilities and actions to be taken in emergency situations. The general emergency action plan requires that the person discovering an emergency take immediate action to notify other employees and supervisors. The ORNL ES&HC Contractor Interface Manager and LSS will also be notified immediately. The LSS will control and supervise the emergency response, involving Energy Systems ES&H personnel (e.g., Radiation Protection, Environmental Control) as appropriate.

Although the ORNL organization will respond to these situations, RI/FS personnel will be responsible for first response and lending support as required. The FHSS will verify that emergency notification information is available at each work area.

19.2 SITE IDENTIFICATION

Each location where RI/FS work is being conducted at WAG 5 will be accurately identified and designated on an appropriate map or in relation to a readily identifiable structure. This designation will be available at the work site and at the FOF. RI/FS personnel working in the area will be responsible for knowing this designation so that requests for assistance can be made promptly and clearly. Methods for notifying other personnel (e.g., telephone numbers, radio call numbers) will also be posted as appropriate.

19.3 PROCEDURES

All procedures will be reviewed and approved by BNI Team management before they are implemented. Approved procedures will be submitted to the Environmental Restoration Division for Energy Systems distribution. The following additional factors addressed in PP 1240 may also be contained in other detailed emergency procedures that may be developed:

- credible potential emergencies (e.g., preemergency planning, emergency recognition and prevention procedures, safety distances and places of refuge, and emergency treatment and first aid);
- authorities, responsibilities, and actions to be taken by site personnel;
- all situations under which the LSS will be notified for assistance;
- lines of communication and criteria for notifying RI/FS Project and ORNL personnel of emergency situations;

- resources available from off-site sources (requests for off-site assistance to be initiated by the LSS);

- provisions for radiation monitoring of injured employees, with highest priorities being given to first aid and response to the injuries (i.e., emergency medical treatment and first aid);

- requirements for PPE, emergency, and communications equipment;

- notification to employees of emergency situations outside their immediate area of activity (e.g., notifications received via the National Warning System);

- evacuation of personnel, including details concerning
  - routes,
  - situations requiring evacuation,
  - plant emergency signals,
  - means for notifying affected personnel,
  - transportation for evacuees,
  - accountability of personnel, and
  - procedures;

- reentry planning;

- critique of response and follow-up;

- decontamination; and

- site security and control.

20. RECORDS

In addition to the personnel dosimetry records maintained by Energy Systems, BNI will maintain its own set of records. As appropriate, electronically retained records will be maintained on the BNI VAX computer system and will be designed to facilitate effective employee exposure management and timely ALARA evaluations. (Survey and instrumentation records are retained in the BNI Project Document Control Center.)

20.1 INDIVIDUAL MASTER RECORDS

A master record for each individual will contain at least the following information:

- personal identification number (IDN),
- full name,
- date of birth,
- sex,
- date of most recent medical evaluation,
- medical status code,
- training type IDN,
- training date,
- life-to-date whole-body dose [Note: whole-body dose will include contributions from internal emitters (committed effective dose equivalents)],
- quarter-to-date whole-body dose,
- year-to-date whole-body dose,
- quarter-to-date skin dose,
- year-to-date skin dose,
- quarter-to-date extremity dose,
- year-to-date extremity dose,
- annual (for current calendar year) committed effective dose to or concentration of contaminant in:
  - organ A,
  - organ B, and
  - organ Z, and
- job function category.

20.2 DOSIMETRY RECORDS

This data base will contain the external radiation exposure of record (i.e., TLD badge data). The following minimum information will be retained:

- personal IDN,
- penetrating radiation dose, and
- nonpenetrating skin radiation dose.

20.3 EXTERNAL DOSE ESTIMATES

This secondary data base will be used to supplement the dosimetry records and master records data bases. The following minimum information will be retained:

- personal IDN,
- HWP IDN,
- date and time of area entry,
- date and time of area exit,
- net time spent in area,
- pocket dosimeter or instrument IDN, and
- estimated exposure.

20.4 INTERNAL DOSE ESTIMATES

Internal dose estimates will be calculated from bioassay and whole-body count data. The following minimum information will be retained:

- personal IDN,
- bioassay medium,
- date of collection or measurement,
- date of analysis,
- concentration or activity of contaminants, and
- laboratory or report IDN.

20.5 EXPOSURE TO AIRBORNE CONTAMINANTS

This secondary data base will be used for administrative control of exposures to airborne concentrations of radioactive and nonradioactive hazardous chemical contaminants. The following minimum information will be retained:

- personal IDN,
- HWP IDN,
- date of measurement,
- sampler IDN,
- individual's assigned protection factor (PF),
- concentration of contaminants,
- time of exposure,
- potential (unprotected) exposure (PE),
- actual (protected) exposure (AE) (Note: AE = PE/PF), and
- concentration worksheet IDN.

20.6 ALARA ACTIVITY RECORDS

This secondary data base will be used to support any other data base or report requiring work location, work category, job function, exposure, or temporal data.

20.7 SUPPLEMENTAL DATA BASES

Supplemental data bases will be required to provide complete record sets and to support the foregoing data bases. The required data sets are

- HWP information file,
- respirator use file,
- medical history file, and
- training history file.

Though all records will be maintained by Energy Systems, hard copies of supporting primary records (e.g., TLD and bioassay reports, NRC 4 forms, air sample worksheets, calibration certificates, training tests, and course outlines) will also be retained by BNI. All records will be maintained until completion of the project, at which time a copy of all records will be provided to Energy Systems.

21. ANALYTICAL SAMPLE PACKAGING AND SHIPMENT

Samples of waste, soil, sediment, biota, and water collected for analytical purposes at WAG 5 will be packaged and transported in accordance with DOT regulations, EPA regulations, and Energy Systems protocols, as defined in PP 1260, "Hazardous Materials Transportation."

21.1 REGULATORY REQUIREMENTS

The regulatory requirements applicable to transportation of samples to and from the laboratory contained in 49 CFR Pt. 171 et seq. will be strictly complied with. Specific exemptions for transport of chemical samples are defined in 40 CFR Pt. 261.4(d). Samples meeting the levels of exempt, limited quantity, or low specific activity will be packaged in strong, tight containers.

21.2 RESPONSIBILITIES

The ES&H Manager is responsible for developing sample packaging and transportation procedures; developing, testing, or procuring DOT containers as appropriate; and ensuring compliance with regulatory requirements. Because ORNL has ultimate responsibility for compliance with regulations, Energy Systems will exercise oversight authority to verify compliance.

The FSS Manager is responsible for the characterization of samples and proper labeling in accordance with approved procedures. The Transportation Officer is responsible for verifying that samples are appropriately packed, that sample containers are properly labeled, that accurate sample identification data are entered into the appropriate data base, and that samples are delivered to their shipping destination. BNI will be responsible for shipping and for maintaining records for samples on behalf of and in the name of Energy Systems and DOE.

21.3 SAMPLE SCREENING TECHNIQUES

Sample screening for chemical contaminants may include historical data as well as the results of field monitoring for toxic and explosive atmospheres. Radiological screening consists of a review of field monitoring data, direct exposure rate measurements of each sample, gross alpha/beta counting, and gamma spectroscopy analysis, as necessary, in a field laboratory. These screening techniques are described in CSL procedures and in PP 1260.1, "Determination of Hazardous Materials Classification."

21.4 PACKAGING AND LABELING

Samples will be packaged for shipment in containers appropriate to the hazard class they represent and in accordance with requirements of 49 CFR. For samples transported by the BNI Team, an exclusive-use vehicle will be used.

22. HAZARD COMMUNICATION PROGRAM

The Hazard Communication Program informs RI/FS Project employees of the hazardous chemicals used in the conduct of operations. Within this program is a basic overview of the types of hazardous chemicals, their storage or use locations, the location of information concerning these chemicals, and the location of written programs and procedures associated with employee protection.

Regardless of the plans, procedures, documents, and programs, each employee is responsible for the safe use of chemicals. Each employee is also responsible for knowing what chemicals are used to perform a job and for obtaining available pertinent information.

Each employee engaged in work associated with the RI/FS Project will be provided with written information regarding this Hazard Communication Program. Employees of subcontractors to the Bechtel Team will also be provided with this information and a copy of the most recent hazardous materials list and any changes thereto within the period of performance of the contract. On request, subcontractor-designated safety representatives will be provided copies of all material safety data sheets (MSDSs) applicable to the hazardous materials list.

Subsections 22.1 through 22.9 describe the requirements, procedures, training, and information applicable to the RI/FS Project with regard to hazardous substances.

22.1 WARNING LABELS

Warning labels are applied to containers of chemicals. The warning label system used for chemicals is a nonstandardized system; the labels vary in appearance and content, but they contain at least the following information:

- identity of the hazardous agent or material;
- appropriate hazard warnings; and
- name and address of manufacturer, importer, or other responsible party.

Any employee who uses or handles chemicals must read these labels. If the employee does not understand the label, the chemical or agent *is not to be used*. The individual's immediate supervisor will be contacted to determine the necessary requirements.

Temporary or secondary containers will bear the identity of the chemicals and appropriate hazard warnings. All drums containing hazardous chemicals will be marked with the NFPA diamond. This label gives information at a glance regarding flammability, reactivity, and degree of health hazard for the chemical inside the container.

The FHSS will be notified immediately if labels become defaced or damaged. The chemicals in the container are not to be used until the label has been restored.

22.2 HAZARDOUS MATERIALS LIST

A list of hazardous chemicals currently in use on this project is maintained at the FOF at ORNL, Building 6565A. These documents are available for employee viewing or copying at the FOF. Should a chemical be discovered that is not on this list, it is to be reported to the FHSS immediately.

The potential hazardous chemicals located at the ORNL site within the immediate site work area are evaluated and listed in Appendix C, and a copy of this document is available at the FOF.

22.3 MATERIAL SAFETY DATA SHEETS

An MSDS is available for each hazardous agent or chemical used. As materials are procured or purchased for project use, MSDSs for these chemicals are obtained prior to acceptance, storage, or use. Old or outdated MSDSs are discarded as new safety and health data are obtained. MSDSs are discarded when the chemical they represent is no longer used or stored at the FOF.

These documents are available at the FOF for employee use. Upon written request, employees may receive personal copies of the MSDSs for hazardous materials in their work areas.

22.4 HAZARDS OF NONROUTINE TASKS

The purpose of this project is to locate, characterize, and evaluate environmental and public health hazards and impacts. Therefore, field work is intensely monitored for chemical, radiological, and physical hazards. The tasks with the highest potential for encountering a hazardous material are attended full-time by a qualified Health and Safety Specialist.

Before initiation of a nonroutine task, the FHSS will conduct a briefing, appropriately documented as described in PP 1265, "ES&H Recordkeeping," on the hazards associated with the task and protective measures to be used. Additionally, the weekly tool-box safety meeting may be used as a vehicle for the distribution of hazards data.

While engaged in field work as part of the RI/FS Project, employees may encounter hazards that are not related to their work. These hazards are evaluated and listed in each task HSP available to employees at the FOF.

22.5 EMPLOYEE INFORMATION AND TRAINING

The following general operations at ORNL involve hazardous materials:

- drilling—fuels, lubricants, alcohols;
- sample handling and analysis—acids, sodium hydroxide solution, organic solvents, radioactive materials;
- decontamination—detergents, alcohols, nitric acid;
- health and safety instrument calibration—methane, isobutylene, radioactive materials, chlorinated solvents, carbon monoxide, hydrogen sulfide; and
- housekeeping—ammonia, ethylene diamine tetra acetic acid, disinfectants, detergents.

22.6 STORAGE LOCATIONS FOR HAZARDOUS MATERIALS

Hazardous materials are stored in appropriate and compatible containers either at the point of use or at designated issue points. Points of storage for hazardous materials are as follows:

Location	Material	Custodian
Building 6556A	Commercial and consumer cleaning supplies	FSS Manager
Storage trailer 1	Petroleum fuels in safety cans, isopropanol, lubricating oils, chlorine bleach, detergent powders, adhesives	FSS Manager
Storage trailer 2	Lead bricks, stannous chloride smoke tubes, lubricating oils, residual gasoline in generators	FSS Manager/FHSS
Container prep	Nitric acid, sodium hydroxide, hydrochloric acid	Lab Supervisor or Instrumentation Specialist
ES&H instrument trailer	Hydrogen compressed gas, isobutylene, carbon monoxide, hydrogen sulfide, compressed air, methane, radioactive materials sources, trichlorethylene	FHSS
Satellite accumulation area (controlled access area)	Up to 55 gal of hazardous wastes or up to 1 quart of acutely hazardous waste	FHSS

Location	Material	Custodian
Special techniques lab (restricted area)	Biohazardous materials, carcinogenic dyes, liquid scintillation fluors, acids, bases, chromotographic standards, radioactive materials, methyl alcohol, phenols, hydrogen compressed gas, helium compressed gas	Lab Supervisor or ES&H Manager
Counting lab (restricted area)	P-10 compressed gas, nitrogen refrigerated liquid, radioactive materials	Lab Supervisor
Sample prep lab (restricted area)	Acids, bases, volatile organic standards, scintillation fluors, organic solvents, detergents, radioactive materials	Lab Supervisor
Decontamination trailer SWSA 6 (restricted area)	Isopropanol, detergents, lubricating oils, radioactive materials	Decon Supervisor

Restricted areas require the custodian's authorization for entry and may or may not require HWP sign-in. CAAs require HWP sign-in and authorization by the FHSS. Hazardous materials may be temporarily located at points of use other than those listed above. This listing is a general guide to where hazardous materials may be routinely found in use or in storage.

22.7 TRAINING

All employees engaged in field work are required to be trained as described in PP 1210, "ES&H Training." No employee will be allowed to enter a hazardous materials area or to work with a hazardous material without completion of the following training:

- initial site entry training—48 h,
- Energy Systems general employee training—4 h,
- initial RI/FS site briefing—not less than 2 h, and
- annual refresher training (if applicable)—8 h.

Each employee is provided with a training manual containing a detailed description of the RI/FS ES&H organization, the Hazard Communication Program, and MSDSs and how to use them. Further information on employee training is contained in PP 1210, "ES&H Training." As required by PP 1210, each employee will receive approximately 16 hours of training in the use of PPE.

The initial RI/FS site briefing will inform employees of the specific hazards associated with the use of hazardous materials in job performance and the specific potential hazards resulting from their job task at WAG 5.

Weekly tool-box safety meetings will be used as a vehicle for communication of hazards information to the employees.

Before allowing employees to use a hazardous chemical for the first time, the supervisor is responsible for providing training on the proper handling, use, disposal, and protective measures associated with that particular chemical or agent. The FHSS is responsible for providing necessary training and for documenting that training has been provided per PP 1210, "ES&H Training," and PP 1265, "ES&H Recordkeeping." Employees who may not be familiar with the protective measures necessary to handle hazardous chemicals are responsible for seeking appropriate training from their supervisor or the FHSS. Hazard communication conducted through training will be documented per PPs 1210 and 1265.

22.8 ADDITIONAL EMPLOYEE PROTECTION TRAINING

On the RI/FS Project, the FHSS or his designee will conduct weekly safety meetings, at which hazardous material data will be disseminated to field personnel in a discussion format. The FHSS, ES&H Manager, or FSS Manager may require additional training of individual employees engaged in nonroutine tasks or those required to use nonroutine PPE. This training will be on an individual basis and will be tailored to the hazards and PPE required to safely conduct the task. Training sessions and safety meetings will be documented per PPs 1210 and 1265.

22.9 EMPLOYEE PROTECTION MEASURES

Each use of hazardous material (as defined in 29 CFR) such that the employee could be exposed at or near the federally defined PEL or TLV, as defined by the ACGIH, requires an HWP. In areas where radioactive materials are handled, where employees could be exposed to 10 percent of the DAC, or where absorbed dose rate levels could exceed 2.5 mrad/h, an HWP will also be required. As part of the process of issuing an HWP, protective measures, monitoring requirements, and work methods are set by ES&H to minimize employee exposure. Project procedures associated with this process are contained in the PP 1200 series and are available to employees at the FHSS's office or at the ES&H Manager's office.

23. CHEMICAL HYGIENE PLAN

23.1 SCOPE AND APPLICATION

In accordance with 29 CFR Pt. 1910.1450, the chemical hygiene plan outlines the methods that the BNI Team will use to limit hazardous chemical exposure of workers in the CSL to ALARA levels. This plan is applicable to all activities conducted within the CSL complex where exposure to hazardous chemicals is a possibility.

This plan will be provided to all laboratory workers and posted conspicuously in all laboratory buildings and spaces. Appendix D provides general safety principles for laboratory practice.

23.2 INITIAL AND PERIODIC MONITORING OF LABORATORIES AND WORKERS

23.2.1 Monitoring of Laboratory Spaces

Laboratories will be monitored by the ES&H Department in accordance with project procedures:

- PP 1255, "Work Area and Environmental Monitoring";
- PP 1270, "Industrial Hygiene Practice";
- PP 1270.1, "Air Surveillance of Radiological and Chemical Contaminants";
- PP 1280, "Health Physics Practices"; and
- PP 1280.1, "Methodology for Performing Radiological Contamination Surveys."

The work environment will be initially monitored upon the establishment of new work areas or techniques or the introduction of new hazardous chemicals. Continuous radiological air monitoring has been established in laboratory spaces designated for preparation of samples for radiological procedures. At least monthly, the ES&H Department will conduct radiological and chemical surveys of each laboratory and hazardous chemical storage area. In addition, the ES&H Department will conduct spot surveys and both area and personnel air monitoring upon the initiation of new laboratory procedures or the introduction of new laboratory reagents.

23.2.2 Monitoring of Laboratory Workers

Laboratory workers will be classified as Level 1 Access in accordance with PP 1202, "Site Access Requirements." They will be participants in the medical surveillance and bioassay programs as set out in PP 1205, "Medical Surveillance," and PP 1280.4, "Internal Radiation Dosimetry." External exposure to ionizing radiation will be monitored in accordance with PP 1280.3, "External Radiation Dosimetry," and PP 1280.6, "Use of Self-Reading Dosimeters."

Personnel exposure to hazardous chemicals will be assessed quarterly, as indicated in Sect. 23.2.1. Methods of assessment will be in accordance with PP 1270.1, "Air Surveillance of Radiological and Chemical Contaminants."

23.3 TERMINATION OF MONITORING

Monitoring of laboratory spaces and laboratory workers for a particular hazardous chemical may be suspended or terminated when

- use of hazardous chemicals is terminated, and
- sampling results demonstrate statistically that at the 95 percent confidence interval, exposures are less than 10 percent of the applicable limit for the hazardous chemical or that the exposure did not exceed the action level.

These provisions do not apply to monitoring for radioactive materials.

23.4 EMPLOYEE NOTIFICATION OF MONITORING RESULTS

The results of monitoring and surveys conducted in laboratory spaces will be posted conspicuously in each space no later than 15 days from the date of data availability.

Employees may have access to the results of personnel monitoring results in accordance with PP 1265, "ES&H Recordkeeping."

23.5 STANDARD OPERATING PROCEDURES

All methods, protocols, techniques, and tests conducted in the CSL will be controlled by project procedures or nationally recognized analytical procedures (EPA, NIOSH, etc.). Methods, protocols, techniques, and tests not addressed by written and approved laboratory procedure or using reagents or chemicals other than those specified by procedure are unauthorized. No unauthorized work will be conducted in the CSL.

Project procedures controlling laboratory work will be reviewed by the ES&H Department for safety and health considerations. The ES&H Manager will concur on all laboratory procedures.

Appendix D contains the general principles for laboratory work safety as they apply to the CSL. While hazardous chemicals or hazardous materials are present in the laboratory spaces, these areas will be designated CAAs and will be controlled in accordance with PP 1235, "Hazardous Work Permits." Where so designated, the HWP will delineate health and safety requirements beyond the general principles of laboratory work safety.

23.6 ENGINEERED CONTROLS FOR LIMITING EXPOSURES

23.6.1 Fixed Facilities

23.6.1.1 Close Support Laboratory: Sample preparation laboratory (Bldg. 6556G)

- Potential hazards:

  - ionizing radiation (external exposure);
  - internal radionuclide deposition via inhalation, ingestion, and absorption;
  - inhalation of volatile organic compounds from contaminated compounds;
  - skin absorption of volatile, semivolatile, and nonvolatile organic compounds from contaminated samples;
  - vapors, mists, and fumes resulting from the use of nitric acid, hydrochloric acid, sulfuric acid, sodium hydroxide, sodium thiosulfate, and zinc acetate; and
  - vapors from preparation and storage of standards and reagents used to make gas chromatograph (GC) standards including toluene, benzene, xylene, trichlorethylene, and trichlorethane.

- Engineered controls:

  - Engineered controls for minimization of inhalation hazards are in place and functioning. Two operational fume hoods are located in the facility, each with a minimum of 125 linear feet per minute (lfm) face velocity with the sash opening set at 14 in. The total volume of air drawn by both hoods results in >10 total air exchanges per hour. Existing laboratory standard operating procedures (SOPs) require that all sample handling and chemical or physical preparation activities be conducted in a hood.

  - Flammable material storage cabinets are to be used to contain flammable and volatile hazardous chemicals. These cabinets will be grounded to prevent a static electrical ignition source. The laboratory will be a no-smoking area because the cabinets are vented to the lab work area. The cabinet vents to the ambient atmosphere inside the lab because of the significant negative pressure differential between the outside and the lab. Inorganic chemicals are stored in tightly closed containers in floor-level cabinets. Acids are stored separately in an acid-resistant storage cabinet.

  - Fixed-position alpha particle and beta/gamma particulate monitors are installed near the solids preparation hood. Alarm points for these monitors are to be set at 1 DAC (averaged over an 8-h period) for plutonium-239 and strontium-90. Alarm conditions require evacuation of the facility and special monitoring for reentry.

23.6.1.2 Close Support Laboratory: Special techniques laboratory (Bldg. 6556F)

- Potential hazards:

  - ionizing radiation (external exposure);

- internal radionuclide deposition via inhalation, ingestion, injection, and absorption;
- inhalation of volatile organic compounds from contaminated samples;
- skin absorption of volatile, semivolatile, and nonvolatile organic compounds from contaminated samples;
- inhalation of volatile organic compounds from liquid scintillation counting reagents;
- inhalation or injection of pathogenic bacteria and viruses from contaminated samples; and
- vapors from standards and reagents used to make GC standards, including toluene, benzene, xylene, trichlorethylene, and trichlorethane.

- Engineered controls:

  - Engineered controls for the abatement of inhalation hazards are in place and functioning. Two operational fume hoods are located in the facility each with a minimum of 125 lfm face velocity. The total volume of air drawn by both hoods results in > 10 total air exchanges per hour. Existing laboratory SOPs require that all sample handling and work with reagents or standards be conducted in a hood.

  - Storage of flammable and volatile hazardous chemicals in quantities greater than needed for immediate use is prohibited. A laminar-flow, high-efficiency, particulate-air-filtered cabinet is used to isolate workers from samples and media during microbiological work. The cabinet is certified by the manufacturer for National Institutes of Health Level P2 isolation.

23.6.1.3 Close Support Laboratory: Radiological counting laboratory (Bldg. 6556H)

- Potential hazards:

  - ionizing radiation (external exposure), and
  - internal radionuclide deposition via inhalation, ingestion, and absorption.

- Engineered controls:

  - Two fume hoods, not currently in use, are located in the facility and have been converted to isolated work space. Laboratory SOPs require that samples be delivered for counting in prepared and fixed form to this laboratory.

  - Storage of flammable and volatile hazardous chemicals in quantities greater than needed for instrument maintenance use is prohibited. Fixed-position alpha particle and beta/gamma particulate monitors are not installed in the general work area because of the fixed nature of the materials counted.

23.6.2 Verification of Engineered Controls Function

The ES&H Department will conduct weekly inspections of each fume hood for operability and will make monthly measurements of face velocity on each hood to verify sash-position markings and filter condition. Hoods failing to maintain required sash velocity will be

removed from service until repairs are made and testing demonstrates the hoods to be adequate.

23.6.3 Verification of Installed Safety Equipment

Safety equipment in each laboratory consists of A-B-C type fire extinguishers, safety shower/eye wash combinations, and first aid kits. The locations of safety shower/eye wash stations will be identified by signs consistent with those in use at ORNL. Barricades, signs, labels, and other equipment will be installed as hazards are identified.

The ES&H Department will test safety shower/eye wash combinations weekly and record the test on the form attached to each unit.

Fire extinguishers will be inspected monthly by the ES&H Department and serviced annually by the ORNL Fire Department.

First aid kits will be inspected at least monthly by the ES&H Department.

23.7 LABORATORY WORKER INFORMATION AND TRAINING

23.7.1 General Training Requirements

Laboratory workers will be trained as Level 1 Access personnel and will receive 40 hours of basic health and safety training. Three days of on-the-job training will be conducted under the supervision of the Laboratory Supervisor. These workers will also be trained by the Laboratory Supervisor in the specific requirements of each technique or method to be used.

Laboratory workers will be trained initially and at annual intervals regarding the project's Hazard Communication Program.

23.7.2 Job-Specific Chemical Agent and Technique Training

As techniques and hazardous chemical usage change in the laboratory facility, the Laboratory Supervisor and the FHSS will provide additional training as needed and appropriate. This training will include (but not be limited to)

- PELs, RELs, and TLVs for chemicals in the work area;
- signs and symptoms associated with exposure to chemicals in the work area;
- location and availability of known reference material regarding the safe handling, storage, and disposal of hazardous chemicals found in the laboratory, including MSDSs;
- physical and health hazards associated with chemicals in the work area;

- methods and observations that may be used to detect the presence or release of a hazardous chemical; and

- worker protective measures, including protective devices and emergency measures to be used in the event of a release of hazardous chemicals in the work area.

Training will be documented as specified in PP 1210, "ES&H Training."

23.7.3 Information Available to Workers

Laboratory workers will have access to MSDSs via the project's Hazard Communication Program. If needed and upon written request, the ES&H Department will provide MSDSs and additional data concerning specific chemicals that may be handled in the CSL.

23.8 MEDICAL SURVEILLANCE

All laboratory workers will participate in the project's medical surveillance program. The details of this program are contained in PP 1205, "Medical Surveillance."

23.9 PERSONAL PROTECTIVE EQUIPMENT

PPE for each laboratory operation will be specified by the HWP controlling individual laboratory spaces. All laboratory workers will be required to use at least PPE Level 1, as discussed in PP 1230, "Personal Protective Equipment."

23.10 INDIVIDUAL RESPONSIBILITIES

23.10.1 Program Manager

The RI/FS Program Manager is responsible for overall implementation of the project's plans and procedures. The Program Manager provides continuous support to the project's chemical hygiene plan.

23.10.2 Environmental, Safety, and Health Manager

The RI/FS ES&H Manager is responsible for implementation of the health and safety aspects of this plan. The ES&H Manager is responsible for work area and worker exposure monitoring, engineered controls evaluations and approvals, laboratory procedure review and concurrence, and industrial hygiene and health physics services to the laboratories. The ES&H Manager functions as the Chemical Hygiene Officer for the project. The ES&H Manager may delegate tasks associated with chemical hygiene to members of the ES&H professional staff and may seek guidance and assistance from the Bechtel corporate safety and health organization as necessary.

23.10.3 Analytical Services Manager

The Analytical Services Manager is responsible for developing and implementing laboratory operating procedures, specifying laboratory equipment and materials, and ensuring compliance by the laboratory staff with all applicable project ES&H procedures and the provisions of this plan.

23.10.4 Field Services and Support Manager

The FSS Manager is responsible for providing maintenance and facility resources to the CSL complex in support of this plan.

23.10.5 Close Support Laboratory Supervisor

The CSL Supervisor is responsible for the daily implementation of this plan within the CSL complex. The CSL Supervisor is responsible for training the individuals under his charge in safe laboratory techniques and ensuring compliance in the laboratory with the provisions of HWPs and this plan.

23.10.6 Field Health and Safety Supervisor

The FHSS is responsible for day-to-day on-site ES&H support to the CSL complex. In that capacity the FHSS is responsible for ES&H training on applicable plans, procedures, and regulations; work area and worker monitoring; issuance of HWPs associated with laboratory work; and coordination with the CSL Supervisor on ES&H matters associated with laboratory operations. The FHSS will designate a Health and Safety Specialist who is familiar with and able to respond to the potential hazards of field activities when the FHSS is off site. (The project Health Physicist or Industrial Hygienist will possess command authority.)

23.10.7 Laboratory Workers

Laboratory workers are responsible for the safe conduct of laboratory operations, including strict adherence to laboratory procedures and HWP provisions. Laboratory workers are responsible for maintaining housekeeping in their respective laboratory spaces. They are also responsible for being knowledgeable about the hazardous chemicals and agents used in job performance and for obtaining information related to their safe use.

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APPENDIX A

INVENTORIES OF RADIONUCLIDE CONSTITUENTS IN WAG 5 SOLID WASTE MANAGEMENT UNITS

INVENTORIES OF RADIONUCLIDE CONSTITUENTS IN WAG 5 SOLID WASTE MANAGEMENT UNITS

Solid waste management unit	Waste form	Major contaminants	Inventory(Ci)	Volume (L)[a]
5.1a (Leak site-OHF observation well)	Soil	^{90}Sr	0.72	Unknown
5.1b (Leak site-OHF grout release)	Soil	^{90}Sr, ^{137}Cs, ^{60}Co, ^{106}Ru	Unknown	Unknown
5.1c (ILLW/LLW transfer line)	Soil	Unknown	Unknown	Unknown
	Groundwater	Unknown	Unknown	Unknown
5.2 (OHF impoundment)	Surface water	^{90}Sr, ^{137}Cs, ^{60}Co, ^{134}Cs	0.071	245,000
	Sediment	^{90}Sr, ^{137}Cs, ^{60}Co, ^{134}Cs	150	55,000
	Soil	^{90}Sr, ^{137}Cs, ^{60}Co, ^{134}Cs	11.7	Unknown
5.3 (OHF surface facilities)				
Waste pits	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, ^{239}Pu ^{238}Pu, ^{241}Am, ^{244}Cm	0.1	20,000
	Grout	^{90}Sr, ^{137}Cs, ^{60}Co, ^{239}Pu ^{238}Pu, ^{241}Am, ^{244}Cm	Unknown	62[b]
5.4 (NHF surface facilities)				
Emergency waste storage tank	Liquid	Unknown	Unknown	Unknown
	Sludge	Unknown	Unknown	Unknown
Pilot sluicing tank	Liquid	Unknown	Unknown	Unknown
	Sludge	Unknown	Unknown	Unknown
5.5a (Tank T1)	Liquid;sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	1,000	32,710;4,200
5.5b (Tank T2)	Liquid;sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	1,000	33,280;4,200
5.5c (Tank T3)	Liquid;sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	1,000	2,200;4,900
5.5d (Tank T4)	Liquid;sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	1,000	31,060;4,900
5.5e (Tank T9)	Liquid;sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	600	5,670;2,200

Appendix A (continued)

Solid waste management unit	Waste form	Major contaminants	Inventory(Ci)	Volume (L)[a]
5.6 (Process Waste Sludge Basin)	Surface water	Unknown	Unknown	Unknown
	Sediment	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	20-30	824[b]
	Soil	Unknown	Unknown	Unknown
5.7 (SWSA 5 South)	Containerized waste	^{90}Sr, ^{137}Cs, ^{60}Co, ^{244}Cm, ^{238}Pu, ^{106}Ru, ^{3}H	210,000	2,450[b]
	Noncontainerized waste	Unknown	Unknown	Unknown
	Groundwater	^{90}Sr, ^{3}H	Unknown	Unknown
	Soil	Unknown	Unknown	Unknown
5.8a (Tank W-24)	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	3,641	149,140
	Sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	2,686	13,630
5.8b (Tank W-25)	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	445	115,070
	Sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	23,357	55,270
5.8c (Tank W-26)	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	1,335	130,600
5.8d (Tank W-27)	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	1,028	134,380
	Sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	4,205	28,390
5.8e (Tank W-28)	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	1,298	139,690
	Sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	141	4,160
5.8f (Tank W-29)	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	325	122,640
	Sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	804	13,630
5.8g (Tank W-30)	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	188	145,360
	Sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	733	13,630
5.8h (Tank W-31)	Liquid	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	Unknown	110,530
	Sludge	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	15,914	37,100

Solid waste management unit	Waste form	Major contaminants	Inventory(Ci)	Volume (L)[a]
5.9 (Tank 7860A)	Liquid	Unknown	0.02	17,030
5.10 (TRU waste storage area)				
-Buildings 7823, 7826 and 7834	Drummed	TRU	Unknown	526[b]
-Building 7823	Boxed	TRU	Unknown	97[b]
-Building 7855 and RH-TRU retrievable storage area	Casked	TRU	Unknown	1,281[b]
-Building 7827 and 7829 and wells T-1 through T-8	Capsuled	TRU	Unknown	Unknown
-Trenches T-11, T-14, T-16, and T-17	Bulk	TRU	Unknown	Unknown
-Trench T-8	Unknown	Unknown	Unknown	Unknown
-Building 7820	Equipment	Unknown	Unknown	Unknown
-Building 7824	Equipment	Unknown	Unknown	Unknown
-Building 7831 (computer fac.)	Equipment	Unknown	Unknown	
5.11 (septic tank)	Unknown	Unknown	Unknown	Unknown
5.12 (NHF septic tank)	Unknown	Unknown	Unknown	Unknown
5.13 (OHF septic tank)	Unknown	Unknown	Unknown	Unknown

Source: ORNL (1987); Francis and Hyder (1987); Francis and Sealand (1987); Stansfield and Francis (1986); Grizzard (1986); PEER and MCI (1987); PEER and EDGe (1987); Williams (1987); Van Cleve (1988).

[a]Volume: 1 L = 0.26 gal.
[b]This volume is reported in m^3 (1 m^3 = 35.31 ft^3).

APPENDIX B

RADIOLOGICAL SURFACE CONTAMINANTS AND LEVELS FOR WAG 5 SOLID WASTE MANAGEMENT UNITS

RADIOLOGICAL SURFACE CONTAMINANTS AND LEVELS FOR WAG 5 SOLID WASTE MANAGEMENT UNITS

		Level		
		Direct	Smearable (per 100 cm^2)	
SWMU[a]	Major contaminants	(mrad/h)	(dpm)	(mrad/h)
5.3 (OHF surface facilities)				
Building 7852	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	0–4000	0–102	0.85–35[a]
Building 7853	Unknown	Unknown	Unknown	Unknown
Pump house	^{90}Sr, ^{137}Cs, ^{60}Co, TRU	0–8000	<20	0.5–16[a]
Waste pits	^{90}Sr, ^{137}Cs, ^{60}Co, ^{238}Pu	10–40	Unknown	Unknown
T-5 water tank	Unknown	Unknown	Unknown	Unknown
Pump house	Unknown	Unknown	Unknown	Unknown
5.4 (NHF surface facilities)				
Building 7860	^{90}Sr, ^{137}Cs, ^{60}Co,TRU	5-2000	Unknown	Unknown
Building 7863	Unknown	Unknown	Unknown	Unknown
5.10 (TRU waste storage area)				
Building 7820	Unknown	Unknown	Unknown	Unknown
Building 7823	Unknown	Unknown	Unknown	Unknown
Building 7824 (WEAF)	Unknown	Unknown	Unknown	Unknown
Building 7826	Unknown	Unknown	Unknown	Unknown
Building 7827	Unknown	Unknown	Unknown	Unknown
Building 7829	Unknown	Unknown	Unknown	Unknown

Appendix B (continued)

SWMU[a]	Major contaminants	Level		
		Direct	Smearable (per 100 cm^2)	
		(mrad/h)	(dpm)	(mrad/h)
Building 7831	Unknown	Unknown	Unknown	Unknown
Building 7834	Unknown	Unknown	Unknown	Unknown
Building 7855	Unknown	Unknown	Unknown	Unknown

Source: Huang et al. (1984).

[a]See Huang et al. (1984) for locations and individual readings per building and/or structure.

APPENDIX C

CHEMICAL CONTAMINANTS, INVENTORIES, FORMS, AND VOLUMES FOR WAG 5 SOLID WASTE MANAGEMENT UNITS

CHEMICAL CONTAMINANTS, INVENTORIES, FORMS, AND VOLUMES FOR WAG 5 SOLID WASTE MANAGEMENT UNITS

SWMU	Waste form	TCL contaminants	Inventory (kg)[a]	Volume (L)[b]
5.2 (OHF Impoundment)	Surface water	Sb	< 74	245,000
		As	< 1	
		Ba	132	
		Be	1	245,000
		Cd	< 1	
		Ca	6,444	
		Cr	5	
		Co	< 5	
		Cu	< 5	
		Fe	2,266	
		Pb	< 1	
		Mg	2,203	
		Mn	49	
		Hg	< 1	
		Ni	< 15	
		K	1,593	
		Se	4	
		Ag	< 17	
		Na	< 123	
		V	< 7	
		Zn	33	
		Phenols	< 0.1	
		Endrin	< 0.1	
		Methoxychlor	< 0.1	
		Toxaphene	< 0.5	
		PCBs	< 0.1	
	Sediments	Sb	< 4	55,000
		As	< 2	

SWMU	Waste form	TCL contaminants	Inventory (kg)[a]	Volume (L)[b]
5.2 (OHF Impoundment) (cont'd)	Sediments (cont'd)	Ba	6	
		Cd	<0.1	
		Cr	7	
		Co	0.4	
		Cu	3	
		Fe	403	
		Pb	<3	
		Mn	7	
		Ni	3	
		Se	<5	
		Ag	<1	
		V	2	
		Zn	3	
		PCBs	0.5	
5.5a (Tank T1)	Liquid	Unknown	Unknown	32,710
	Sludge	Unknown	Unknown	4,200
5.5b (Tank T2)	Liquid	Unknown	Unknown	33,280
	Sludge	Unknown	Unknown	4,200
5.5c (Tank T3)	Liquid	Unknown	Unknown	2,200
	Sludge	Unknown	Unknown	2,900
5.5d (Tank T4)	Liquid	Unknown	Unknown	31,060
	Sludge	Unknown	Unknown	4,900
5.5e Tank T9	Liquid	Unknown	Unknown	5,670
5.6 (Process Waste Sludge Basin)	Surface water	Unknown	Unknown	Unknown
	Sediments	Unknown	Unknown	Unknown
	Soil	Unknown	Unknown	Unknown
5.7 (SWSA 5)	Groundwater	Unknown	Unknown	824
	Soil	Unknown	Unknown	
5.8a (Tank W-24)[c]	Liquid	Na	Major	149,140
		K	>1%	
		Ca	597	

Appendix C (continued)

SWMU	Waste form	TCL contaminants	Inventory (kg)[a]	Volume (L)[b]
5.8a (Tank W-24)[c] (cont'd)	Liquid (cont'd)	Al	1,044	
		Fe	447	
		Ba	895	
		Mg	149	
		Zn	45	
		Mn	7	
		Cr	7	
		Ni	7	
		Pb	30	
		Cu	6	
		V	0.4	
		Co	0.7	
	Sludge	Na	Major	13,630
		K	123	
		Ca	1%	
		Al	27	
		Fe	41	
		Ba	1	
		Mg	10	
		Zn	0.4	
		Mn	1	
		Cr	1	
		Ni	3	
		Pb	1	
		Cu	0.4	
		V	0.1	
		Co	0.01	
5.8b (Tank W-25)[c]	Liquid	Na	Major	115,070
		K	1,036	

Appendix C (continued)

SWMU	Waste form	TCL contaminants	Inventory (kg)[a]	Volume (L)[b]
5.8b (Tank W-25)[c] (cont'd)	Liquid (cont'd)	Ca	230	
		Al	81	
		Fe	115	
		Ba	6	
		Mg	69	
		Zn	6	
		Mn	6	
		Cr	6	
		Ni	58	
		Pb	6	
		Cu	2	
		V	1	
		Co	1	
	Sludge	Na	Major	55,270
		K	497	
		Ca	111	
		Al	33	
		Fe	55	
		Ba	3	
		Mg	55	
		Zn	6	
		Mn	6	
		Cr	3	
		Ni	28	
		Pb	6	
		Cu	2	
		V	0.6	
		Co	0.6	
		Pb	0.3	
		Cu	<0.1	

Appendix C (continued)

SWMU	Waste form	TCL contaminants	Inventory (kg)[a]	Volume (L)[b]
5.8b (Tank W-25)[c] (cont'd)	Sludge (cont'd)	V	<0.1	
		Co	0.03	
5.8c (Tank W-26)[c]	Liquid	Na	Major	130,600
		K	Major	
		Ca	Major	
		Al	78	
		Fe	26	
		Ba	26	
		Mg	131	
		Zn	4	
		Mn	1	
		Cr	3	
		Ni	3	
		Pb	1	
		Cu	<0.4	
		V	1	
		Co	0.1	
	Sludge	Na	Major	28,390
		K	170	
		Ca	Major	
		Al	57	
		Fe	28	
		Ba	2	
		Mg	28	
		Zn	1	
		Mn	1	
		Cr	3	
		Ni	3	
5.8d (Tank W-27)[c]	Liquid	Na	Major	134,380
		K	672	

SWMU	Waste form	TCL contaminants	Inventory (kg)[a]	Volume (L)[b]
5.8d (Tank W-27)[c] (cont'd)	Liquid (cont'd)	Ca	403	
		Al	108	
		Fe	40	
		Ba	13	
		Mg	134	
		Zn	13	
		Mn	3	
		Cr	5	
		Ni	4	
		Pb	1	
		Cu	<1	
		V	0.7	
		Co	<0.4	
	Sludge	Na	Major	28,390
		K	142	
		Ca	114	
		Al	9	
		Fe	11	
		Ba	3	
		Mg	28	
		Zn	0.9	
		Mn	0.9	
		Cr	0.9	
		Ni	0.9	
		Pb	0.6	
		Cu	<0.3	
		V	0.3	
		Co	<0.1	
5.8e (Tank W-28)[c]	Liquid	Na	Major	139,690
		K	1,257	

SWMU	Waste form	TCL contaminants	Inventory (kg)[a]	Volume (L)[b]
5.8e (Tank W-28)[c] (cont'd)	Liquid (cont'd)	Ca	1,118	
		Al	28	
		Fe	42	
		Ba	4	
		Mg	279	
		Zn	14	
		Mn	4	
		Cr	3	
		Ni	14	
		Pb	< 1	
		Cu	3	
		V	0.7	
		Co	1	
	Sludge	Na	Major	4,160
		K	21	
		Ca	21	
		Al	0.8	
		Fe	1	
		Ba	0.1	
		Mg	8	
		Zn	0.2	
		Mn	0.1	
		Cr	0.8	
		Ni	0.2	
		Pb	0.1	
		Cu	0.01	
		V	0.02	
5.8f (Tank W-29)	Liquid	Unknown	Unknown	122,640
	Sludge	Unknown	Unknown	13,630

SWMU	Waste form	TCL contaminants	Inventory (kg)[a]	Volume (L)[b]
5.8g (Tank W-30)	Liquid	Unknown	Unknown	145,360
	Sludge	Unknown	Unknown	13,630
5.8h (Tank W-31)	Liquid	Unknown	Unknown	110,530
	Sludge	Unknown	Unknown	37,100
5.9 (Tank 7860A)	Liquid	PCBs	Unknown	17,030

Source: Stansfield and Francis (1986); PEER and MCI (1987); Francis and Sealand (1987).
[a]Inventory: 1 kg = 2.20 lb.
[b]Volume is reported in liters unless otherwise noted (1 L = 0.26 gal).
[c]The inventory reported for the liquid phase represents the greatest concentration from three samples taken from the top, middle, and bottom layers of the liquid phase.

APPENDIX D

GENERAL SAFETY PRINCIPLES FOR LABORATORY PRACTICE

GENERAL SAFETY PRINCIPLES FOR LABORATORY PRACTICE

The following constitute the general safety rules for operations conducted in the CSL complex. Additional provisions, restrictions, or requirements can be found in the HWP controlling area operations and the individual laboratory procedures. These principles are in addition to other established safety work rules currently in force.

Avoidance of "Routine" Exposures

- Eating, drinking, and use of tobacco or cosmetics are not permitted in any laboratory space. Food, cosmetics, and beverages will not be stored in laboratory spaces.

- Spills of chemicals or sample materials are to be reported to the FHSS immediately. Upon notification, the FHSS will contact the ES&H Manager and the ORNL Laboratory Shift Supervisor. In the event of a spill of hazardous chemicals or radioactive materials, the laboratory is to be evacuated and ES&H notified. If possible, the spill should be stopped and contained.

- Chemicals are not to be smelled or tasted. Any apparatus that discharges toxic vapors or gases is to be operated in a fume hood or vented to a hood sash.

- Pipetting or starting a siphon will not be performed by mouth.

- Fume hoods (where installed) are to be operated whenever the laboratory spaces are occupied or when they are used to store uncontained hazardous materials.

- Continuous air monitors (where installed) are to be operated whenever radioactive materials are present in the laboratory spaces.

Selection of Chemicals and Methods

- Procedures will be developed so that chemicals of lowest hazard are used where practical.

- Laboratory procedures, equipment, and instruments will be selected, procured, or developed so that hazardous chemical discharge and safety hazards are minimized.

Equipment and Glassware

- Damaged glassware and equipment are not to be used.

- Evacuated glassware (such as dewar flasks) is to be handled with care. Dewars not equipped with fragmentation protection (armor) are not to be used in the CSL.

- All used glassware is to be considered contaminated with hazardous agents until decontaminated.

- Under no circumstances will laboratory glassware be used for the preparation or consumption of foodstuffs or beverages.

Personal Protective Equipment

- Level 1 PPE is to be used by all workers in the laboratory complex. Use of basic eye protection is required at all times. Use of safety shoes is mandatory.

- Appropriate gloves are to be used whenever chemicals or samples are being handled. Gloves will be inspected and tested before each use.

- Contact lenses are forbidden in laboratory spaces.

- Additional PPE specified in the controlling HWP is mandatory.

Housekeeping

- Work areas are to be kept clean and uncluttered. Work areas are to be clean and orderly at the completion of each day's operation.

- All chemicals and apparatus are to be clearly and properly labeled.

Unattended Operations

- Only automatic or computer-supervised systems that are fail-safe will be permitted to operate unattended.

Use of Fume Hoods

- Fume-hood use is mandatory at any time that work is conducted with unknown materials or when working with chemicals with a PEL or TLV of 50 ppm or less.

- Fume-hood use is mandatory for any operation that might release toxic vapors, fumes, mists, dusts, or gases.

- Ready stocks of hazardous chemicals will be kept in fume hoods or in specified cabinets.

- When not in use, hoods will be on and sashes closed while the laboratory space is occupied.

Waste Materials and Waste Management

- No waste material containing toxic materials, explosive or reactive materials, or concentrated acids or bases will be discharged into the laboratory drains. These materials are to be collected separately and handled in accordance with PP 1401, "Waste Categorization," and PP 1402, "Waste Handling."

- Spills, accidents, and emergencies will be responded to in accordance with PP 1406.

- All spills will be reported to the ORNL Emergency Response Center.

ATTACHMENT A

QUALITY ASSURANCE ASSESSMENT (QAA 05-001)

ORNL RI/FS
JOB 19118

QUALITY ASSURANCE ACTION PLAN WORKSHEET

QAAP NO: QAAP-05-002

REVISIONS NO. 0

ACTIVITIES AND ACTIONS PLANS:

DESCRIPTION	ACTION		COMPLETION	
	Responsibility	Date	Signature	Date
Before commencing work on the WAG 5 RI, ORNL personnel assigned to the operation of drill rigs at WAG 5 will read, understand, and sign Attachment 1, "Required Work Practices For Operation of Drill Rigs Near High-Voltage Lines."	FAC	1/92		

FOLLOW-UP AND CLOSE-OUT:

DESCRIPTION	Verification	
	Signature	Date
Verify that all ORNL RI/FS personnel assigned to the operation of drill rigs during the WAG 5 RI have read, understood, and signed Attachment 1 to this QAAP.	FSSM WAG 5 Manager	

REQUIRED WORK PRACTICES FOR OPERATION OF DRILL RIGS NEAR HIGH-VOLTAGE LINES

1. The drill rig mast will be lowered to its traveling position before it is moved.

2. Before positioning the drill rig at a location adjacent to high-voltage lines, the driller will be responsible for placing temporary markers on the ground to represent the closest distance the drill rig can approach the high-voltage lines without violating the minimum clearances specified in PP 1275.6 during rig setup.

3. Before positioning the drill rig adjacent to a high-voltage line, the driller will designate a member of the sampling team to direct the driver of the drill rig from the ground to ensure that the drill rig is properly positioned.'

4. When the drill rig is positioned uphill of a high-voltage power line, the member of the sampling team designated by the driller to direct the driver will block at least two wheels before the driver leaves the cab.

QUALITY ASSURANCE ACTION PLAN

ORNL RI/FS PROJECT
JOB 19118

SITE IDENTIFICATION ORNL Waste Area Grouping 5 QAAP NO. 05-002

SUMMARY DESCRIPTION:

Drill rigs will be employed during the WAG 5 RI. Because WAG 5 is traversed by high-voltage power lines, there is the potential for grounding of these lines through the drill rig if contact between the two occurs.

QAA 05-002, Item C4 (operation of drill rigs close to high-voltage lines) required preparation of a QAAP to specify responsibilities and mandatory work practices to ensure that minimum clearances, as specified in project procedure (PP) 1275.6, are maintained.

REV	ORIGINATOR	WAG MGR	ENG. SUPRV.	TECH. INTERG.	FSS MGR.	DEPUTY PROG. MGR.	ES&H MGR.	QA/QC MGR.	PROG. MGR.	DATE
0	A. K. Brill	AKB	CSD	CRJ	VBA	GKL	CW			12/5/91

SIGNATURE PAGE

I have read and understand the required work practices stated on Page 1 of this attachment, and have had my questions answered satisfactorily.

Employee Name	SSN#	Company	Signature

ATTACHMENT D

QUALITY ASSURANCE ACTION PLAN (QAAP-05-002)

REQUIRED WORK PRACTICE FOR SUBSURFACE OPERATIONS IN ARES WHERE UNDERGROUND UTILITIES AND WASTE LINES MAY BE PRESENT

1. Before set up of a drill rig, auger rig, or excavating equipment, the following will be verified by the sample team leader:

   - The location to be penetrated is marked with a survey stake or marker.
   - The appropriate Bechtel/Energy Systems Excavation Penetration Permit (EPP) is present at the location of the operation and is appropriately signed by all required functions.
   - The HWP is appropriate and acknowledges that drilling or excavating is to be conducted in an area of known or suspected underground utilities or waste lines.

2. Before the initiation of drilling, augering, or excavating the worker will:

   - Verify the location of the drill, auger, or excavating equipment over the location as marked. No in-field offset or deviation will be permitted without the written permission of the WAG 5 Project Manager, FHSS, and FSSM with concurrence from Energy Systems via a revised EPP.
   - Verify the stability of the equipment to be used (e.g., drill rig or auger). Positioning is to be such that should underground pressurized lines (steam, water, radioactive waste, electrical, etc.) be encountered, damage to the equipment and danger to the crew are minimized and possible secondary hazards are not created.

Before the initiation of operations the Field Health and Safety Specialist will:

   - Review the HWP and EPP.
   - Inspect the setup to minimize hazards in the event that an unidentified line is penetrated.
   - Notify the FHSS before drilling/excavating.

4. While drilling, augering, or sampling, personnel will:

   - Conduct drilling, augering, or excavating at a safe speed so that a hard buried objects may be detected by the equipment prior to penetration of the object.
   - Observe the behavior and "feel" of the equipment at all times.
   - Stop drilling/excavating as soon as an unusual indication is observed.
   - Notify the Field Health and Safety Specialist when a buried obstruction is encountered or suspected.

5. While drilling, augering, or excavating, the Field Health and Safety Specialist will:

   - Monitor for radiological or chemical indicators of penetration into waste lines.
   - Notify the FHSS should line penetration be suspected or where pending penetration is imminent.

6. While drilling, augering, or excavating in an area where the presence of an underground interference is likely (e.g., over underground storage task), the Sample Team Leader will:

   - Instruct the sample crew to drill, auger, or excavate in 6-inch or other increments as specified by FHSS

- Upon the completion of each increment, have the Field Health and Safety Specialist survey the penetration using a radiation detection instrument and/or a metal detector (as appropriate) capable of detecting the suspect interference.
- Notify the FHSS should surveys indicate the presence of an interference in close proximity to the penetration.

7. While drilling, augering, or excavating, the Sample Team Leader will:

   - Monitor cuttings, sampling quality, etc. for indication of nearing buried utilities (bedding materials, concrete, metal, etc.)
   - Notify the Field Health and Safety Specialist should indications of penetration or pending penetration be evident.

8. In the event of penetration of an unidentified line or utility, the sampling team will:

   - Evacuate the Controlled Access Area (CAA) to a predesignated assembly area.

9. In the event of penetration of an unidentified line or utility, the Field Health Safety Specialist will:

   - Notify the FHSS and FSSM immediately.
   - Assess the situation within the limits of available instrumentation and the level of training.
   - Secure the area until Energy Systems and RI/FS responders arrive.

QUALITY ASSURANCE ASSESSMENT

ORNL RI/FS PROJECT
JOB 19118

SITE IDENTIFICATION ORNL Waste Area Grouping 5 QAA NO. 05-001

SUMMARY DESCRIPTION:

QAA-05-001 covers general WAG 5 RI activities not specific to individual sampling programs. General activities covered are classified as ES&H, Sampling, Waste Management, and Other.

RI/FS activities pertaining to a specific sampling program are covered in QAA-05-002.

ASSESSMENT RECOMMENDATIONS [See Attachment(s)]

yes no

x — A Quality Assurance Action Plan (QAAP) is required. If yes, by: Prior to WAG 5 field activity (see RI/FS action item tracking list)

— x A Revised QAAP is required. If yes, by: _____

REV	ORIGINATOR	WAG MGR	ENG. SUPRV.	TECH. INTERG.	FSS MGR.	DEPUTY PROGRAM MGR.	ES&H MGR.	QA/QC MGR.	PROG. MGR.	DATE
0	A. K. Brill	AKB	CAD	CAJ	WBK	for L			RK	12/5/91

QAA WORKSHEET CODES

WAG/QAA NO.: 05-001

CONSEQ - CONSEQUENCES OF FAILURE

I - Insignificant
S - Significant
U - Unknown
VS - Very Significant

PROBAB - PROBABILITY OF FAILURE

L - Low
H - High
U - Unknown

RISK

A - Acceptable
U - Unacceptable

ACTION

N - None
Q - QAAP Required

QAA WORKSHEET

WAG/QAA NO.: 05-001

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
A.	ENVIRONMENT, SAFETY, AND HEALTH (ES&H)					
A1.	Inadequate ES&H training of personnel can result in: • Exposure of personnel and the environment to radiological or chemically hazardous contaminants. • Physical injury to personnel. • Missed milestones and cost increases.	S	L	Supervisory personnel will complete the Health and Environmental Training Program 8 hr supervisor course per 29 CFR 1910.120 [Project Procedure (PP) 1210]. All onsite personnel will complete training in accordance with OSHA 29 CFR 1910.120, and site-specific training as directed by PP 1210. Weekly safety meetings will enhance awareness and, as a result, establish safe work habits.	A	N
A2.	Instrument failure or failure to calibrate ES&H instruments used for assessing contaminant levels, heat stress, and other ES&H parameters may result in: • Exposure of personnel and the environment to radiological or chemically hazardous contaminants. • Physical injury to personnel. • Samples being improperly assessed and classified during screening. • Wastes being improperly categorized for waste management.	S	L	Field equipment will be calibrated periodically, in conformance with PP 1285. Sources used to check and calibrate instruments will be traceable per PP 1280.9 (radiological) and PP 1285 (chemical). Health and safety and field QC personnel will routinely monitor for current calibration stickers (PP 1285). Source/response checks will be conducted on all instrumentation prior to use and at the conclusion of daily work per PP 1285.	A	N
A3.	Failure to survey field sampling equipment for radiological or chemical contamination before use may result in: • Exposure of personnel and the environmental to radiological or chemically hazardous contaminants. • Cross-contamination of samples. • Spread of contamination.	S	L	Field sampling equipment (i.e., drill rigs, split-spoon) will not be brought onto the site unless it has been green-tagged for release for unrestricted use (PP 1250), or it is surveyed for contamination prior to first use onsite. Prior to and following each use in the field, sampling equipment will be decontaminated and surveyed in accordance with Environmental Surveillance Procedure (ESP)-900.	A	N
A4.	Failure of communications equipment may result in: • Slowed or inadequate response to injury, spill, or other emergency. • Delay of progress and increase in costs.	S	L	Sampling teams, the Field Health and Safety Supervisor, and the Field Activities Coordinator (FAC) will be equipped with radios. Radios will be turned on during working hours and will be kept within hearing distance of the sampling team. Personnel assigned radios will verify that the assigned radio is functioning properly daily prior to use. Telephone communications will be available at the Field Office Facility for calling offsite.	A	N

QAA WORKSHEET

WAG/QAA NO.: 05-001 PAGE 4 OF 11

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
A5.	Engineered safeguards are often used to isolate the workers and the environment from the hazardous substances (e.g., glove boxes, shielding, exhaust systems). Misapplication or improper construction of these safeguards could cause: • Exposure of personnel and the environment to radiological or chemically hazardous contaminants. • Spread of contamination. • Project delay and increased costs.	S	L	BNI team personnel will monitor construction of contamination control devices and approve their applicability for the intended use via hazardous work permit (PP 1235). ES&H Specialist will prescribe appropriate protective equipment (PP 1230) for each job. Field QC personnel will perform QC surveillance inspections of engineered safeguards (if required) in accordance with PP 1302.	A	N
A6.	Failure to maintain access control to contaminated and hazardous work areas can result in: • Contamination and injury of unauthorized personnel. • Spread of contamination.	S	L	Hazardous work areas will be barricaded, posted, and monitored to exclude entry of nonauthorized personnel (PP 1280.7 and PP 1280.0). Field QC personnel will monitor work sites and verify that safeguards are in place (PP 1302).	A	N
A7.	Adverse weather conditions such as extreme heat or cold, high winds, or unusual precipitation may result in: • Heat stress/stroke or hypothermia. • Blowing dust and debris. • Schedule delays and increased costs. • Damage to facilities.	S	L	Weather conditions will be monitored by onsite ES&H personnel. If conditions are determined to be unsafe (e.g., lightning storm), field work will be delayed. Otherwise, personnel will be monitored and, if necessary, will have limited work durations based on task difficulty, temperature, and protective clothing requirements for the job. PP 1230, PP 1270, and PP 1275 address these safety precautions.	A	N
A8.	Unmarked excavations, obstructions, and open holes may result in: • Damage to vehicles. • Injury to personnel. • Schedule delays and increased costs.	S	L	Hazards in the work areas will be identified and marked during the initial site survey (PP 1220). Significant site hazards will be discussed during routine site safety meetings (PP 1210).	A	N

QAA WORKSHEET

WAG/QAA NO.: 05-001

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
A9.	Maximum allowable exposure levels for work areas and exclusion zones are set to satisfy safety criteria (i.e., acceptable exposure values) and they consider the effectiveness of the specified personnel protective devices (e.g., respirator protection factor). Exposure to chemical contamination in excess of the maximum allowable can cause: • Worker exposure to chemically hazardous substances • Acute and long-term worker health effects. • Spread of chemical contamination to the environment. • Delay of project and increased costs. • Community relations impact.	S	U	Chemical exposure in excess of maximums set for the work area zone can be caused by intrusion into highly contaminated materials. While the coordinates of the LLLW tanks and pipeline trenches are delineated on ORNL design drawings, an undefined probability exists for intrusion into an unidentified waste line or zone of contamination at a leak site. Therefore, the risk of intrusion will be unknown. Continuous ES&H monitoring will be conducted during invasive sampling activities. If chemical concentrations in excess of the allowable limits are encountered, the level of PPE and/or engineered safeguards will be upgraded per the WAG 5 ES&H Plan and PP 1235. QAAP 05-001 has been prepared to address steps to minimize the potential for intrusion into known underground utilities, waste lines, tanks, etc.	U	Q

ORNL RI/FS

JOB 19118

QUALITY ASSURANCE ACTION PLAN WORKSHEET

QAAP NO: 05-001

REVISION NO. 0

ACTIVITIES AND ACTIONS PLANS:

DESCRIPTION	ACTION		COMPLETION	
	Responsibility	Date	Signature	Date
1. Prior to commencing work on the WAG 5 RI, personnel assigned to perform drilling, augering, or excavating at WAG 5 will read, understand, and sign Attachment 1, "Required Work Practice for Subsurface Operations in Areas Where Underground Utilities and Waste Lines May Be Present."	FAC	1/92		
2. Prior to initiating drilling, augering, or excavating in WAG 5, penetration sites will be located by civil survey. Coordinates and depth of penetration anticipated will be compared with the ORNL atlas to determine the relationship to known underground utilities.	FAC WAG 5 Manager FHS Supervisor	As reqd.		
3. Where underground utilities are present or suspected within 10 ft of the proposed penetration location: • Verify the location identification on the applicable penetration permit. • Identify the utility involved. • Notify the Energy System's RI/FS Coordinator of the penetration location and the proximity to the utility. • Coordinate appropriate hazardous work permit (HWP) provisions to act as a contingency.	FAC FHSS	As reqd.		

FOLLOW-UP AND CLOSE-OUT:

DESCRIPTION	Verification	
	Signature	Date
Verify that all ORNL RI/FS personnel assigned to drilling, augering, or excavating operations during the WAG 5 RI have read, understood, and signed Attachment 1 to this QAAP.	FSS Manager WAG 5 Manager	

ORNL RI/FS
JOB 19118

QUALITY ASSURANCE ACTION PLAN WORKSHEET

QAAP NO: 05-001

REVISION NO. 0

ACTIVITIES AND ACTIONS PLANS:

DESCRIPTION	ACTION		COMPLETION	
	Responsibility	Date	Signature	Date
4. Where underground utilities are known to exist in an area to be excavated and the underground utilities represent a potential hazard to the workers, prior to commencing drilling, augering, or excavating operations, the utilities will be tagged out of operation. The tag-out will be performed by both the RI team and Energy Systems.	FHSS FAC	As Reqd.		
5. Should evidence of proximity to an underground utility or abandoned line develop during drilling, augering, or excavation (bedding material, chemical or radiological indications, leakage, currents, etc.) penetration activities will cease and the FAC, FHSS, and Energy Systems RI/FS Coordinator will be informed.	Sample Team Leader FAC FHSS ES&H Manager WAG 5 Manager	As reqd.		

FOLLOW-UP AND CLOSE-OUT:

DESCRIPTION	Verification	
	Signature	Date
Verify that all ORNL RI/FS personnel assigned to drilling, augering, or excavating operations during the WAG 5 RI have read, understood, and signed Attachment 1 to this QAAP.	FSS Manager WAG 5 Manager	

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QUALITY ASSURANCE ACTION PLAN

ORNL RI/FS PROJECT
JOB 19118

SITE IDENTIFICATION ORNL Waste Area Grouping 5 QAAP NO. 05-001

SUMMARY DESCRIPTION:

Drill rigs will be employed during the WAG 5 RI. Because some of the WAG 5 areas are traversed by underground utilities and process and waste transfer lines, there is a potential for intrusion into utilities, radioactively contaminated and/or chemically contaminated wastes, or process fluids.

QAA-05-001, Items A9 and A10 and QAA 05-002, Item A1, require the preparation of a QAAP to specify responsibilities and mandate work practice to reduce the potential for penetration of known or unknown underground utilities, etc.

REV	ORIGINATOR	WAG MGR	ENG. SUPRV.	TECH. INTERG.	FSS MGR.	DEPUTY PROG. MGR.	ES&H MGR.	QA/QC MGR.	PROG. MGR.	DATE
0	A. K. Brill	AKB	CSD	CRJ	WBA					12/5/91

QAA WORKSHEET

WAG/QAA NO.:05-002

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS — COMMENTS)	RISK	ACTION
E.	SURFACE WATER				A	N
E1.	Short-term impacts on surface water quality can result from construction and operations activities such as placement of fill adjacent to drainageways associated with flume and seep station installation, and potential spills from construction equipment. If data collected reflect short-term conditions, a distorted characterization of surface water quality may result. This can lead to inappropriate decisions regarding required corrective actions.	S	L	In the period preceding and during sampling, ORNL RI/FS personnel will monitor ongoing WAG 5 potential operations and construction activities and identify conditions that may lead to short-term water quality impacts. If feasible, an attempt would be made to mitigate potential impacts. Regardless, the situation will be recorded in the filed logbook so that it is brought to the attention of project staff. Sampling will be performed in accordance with ESP-301-1, ESP-301-5, and the field work guide for this activity. QC personnel will perform surveillance inspections in conformance with PP 1302.		
E2.	Drought conditions during period scheduled for surface water sampling and measurements may result in no flow and hence in delay of this aspect of the project.	I	L	ORNL RI/FS Management recognizes this possibility and will monitor rainfall and design flexibility into the field operations schedule to accommodate weather/hydrologic conditions.	A	N
F	SURFACE GEOPHYSICAL SURVEYS					
F1.	Failure to perform the surface geophysical surveys adequately can result in: • Erroneous data associate with depth to bedrock, pipe location, and trench boundaries. • Failure to meet data quality objectives.	S	L	The geophysical surveys will be performed in accordance with PP 1649 and the field work guide for this activity. In addition, QC personnel will perform surveillance inspections in conformance with PP 1302.	A	N
G.	RADIATION WALKOVER SURVEY					
G1.	Failure to perform the radiation walkover survey adequately can result in: • Erroneous location of radiological surface soil contamination. • Failure to meet data quality objectives.	S	L	The radiation walkover survey will be performed in accordance with the subcontract objectives as described in the WAG 5 Field Sampling Plan, Sect. A2.2.	A	N

ATTACHMENT C

QUALITY ASSURANCE ACTION PLAN (QAAP-05-001)

QAA WORKSHEET

WAG/QAA NO.:05-002

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS — COMMENTS)	RISK	ACTION
C.	SOIL SAMPLING					
C1.	Failure to contain or control drilling fluids and cuttings can result in: • Uncontrolled exposure of personnel to radiological and hazardous chemical contaminants. • Spread of contaminant in the environment. • Project delays and increased costs. • Public relations impact.	S	L	Drilling and the associated management of cuttings and drilling fluids will be performed as specified in ESP-303-3 and ESP-303-4. Specific measures include placement of membrane liners under the drill rig and use of lined pits or tanks for containment. A containment box will be employed when using an air rotary rig. The Waste Generation Officer has responsibility for management of wastes in accordance with Project Procedures (PP) 1401, 1402, and 1403. Field QC personnel will perform surveillance inspections to verify compliance with the appropriate procedures.	A	N
C2.	Inadequate stability or improper operation of drill rig can result in: • Death or injury to personnel. • Damage to equipment. • Project delay and increased costs. • Public relations impact.	S	L	Only experienced drillers and well-maintained equipment will be used during the WAG 5 RI. Stabilizers will be employed with rigs. Jacking of the rig will be minimized to maintain a low center of gravity. Excessive load will not be applied to drill stem (which could destabilize the rig).	A	N
C3.	Encountering significant artesian pressures while drilling can result in: • Contact of personnel with contaminated water. • Spread of contamination • Project delay and increased costs. • Injury to personnel.	S	L	Existing data from wells with Melton Valley indicate that significant artesian pressures exist only at depth (>300 ft). Drilling during the RI will be less than 200 ft.	A	N

QAA WORKSHEET

WAG/QAA NO.:05-002 PAGE 6 OF 7

C4.	Setting or driving the drill rig too close to overhead high voltage lines in WAG 5 can result in: • Injury or death to personnel. • Disruption of routine ORNL activities. • Fire. • Significant delay of project. • Public relations impact.	S	U	PP 1275.6 specifies minimum clearances between high-voltage line and operating equipment, and drill rig operators will be trained accordingly. However, power lines cross the middle of the site and boreholes are located on both sides (requiring crossing under) and in some instances are close to power lines. A QAAP has been prepared to specify responsibilities and work procedures to ensure compliance with PP 1275 (QAAP 05-002).	U	Q
D.	SEDIMENT SAMPLING					
D1.	Short-term impacts on sediment quality and quantity can result from ongoing construction and operations activities such as placement of fill adjacent to drainageways, excavation and fills associated with flume installation, and potential spills from construction equipment. If data collected reflect short-term conditions only and are erroneously interpreted as representing long-term conditions, inappropriate decisions regarding required corrective actions may be made.	S	L	The potential for short-term impacts on sediment quality due to flume and seep stations installation is recognized in the FSP by placing sediment sampling sites upstream from construction operations. Sediment samples will be collected (ESP-304-1, ESP-304-2) after completion of construction activities. Other potential RI/FS personnel will monitor ongoing operations and construction activities and identify conditions that may lead to short-term impacts to water quality before and during collection of grab samples. If feasible, an attempt will be made to mitigate these impacts. Regardless, the situation will be recorded in the field logbook so that it is brought to the attention of project staff.	A	N

QAA WORKSHEET

WAG/QAA NO.:05-002 PAGE 3 OF 7

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS — COMMENTS)	RISK	ACTION
A	CIVIL SURVEY					
A1.	An inconsistency between the field and map coordinate systems or a field error in locating sampling stations can result in misplacement of sampling location, failure to achieve data quality objectives, and project delay. Accidental penetration of active underground utilities or waste lines can result in: • Death or injury to workers from accidental penetration of electrical or steam lines. • Contamination of the environment from chemical and radiological materials. • Interruption of ORNL activities. • Adverse community relations. • Increased costs and delays.	S	U	The WAG 5 Manager will check that coordinate systems used for mapping sampling locations are correct prior to initiation of civil survey activities. Sampling locations staked by surveyors will be visually checked prior to initiation of sampling per PP 1620. Field QC personnel will perform surveillance inspections in conformance with PP 1302. QAAP 05-001 addresses this risk and provides additional safeguards that will be used to verify drilling locations.	U	Q
A2.	An inconsistency in the elevations of benchmarks used for determining the top-of-casing elevations on new versus existing groundwater wells can result in an erroneous characterization of the groundwater flow regime and hence in failure to achieve data quality objectives.	S	L	The WAG 5 RI Plan specifies that elevations of existing wells be shot from the same bench marks as the new wells.	A	N
B.	GROUNDWATER					
B1.	Incorrect well construction can result in: • Inaccurate data (failure to meet data quality objectives) • Loss of well, requiring replacement. • Project delays and increased costs.	S	L	Well installation will be performed in accordance with ORNL's Environmental Surveillance Procedures (ESP) 600. All work will be continuously monitored by an experienced geologist and will be reviewed by the WAG Manager or designee as specified in the field work guide. Field QC personnel will provide surveillance inspections (PP 1302) to verify that project procedures are being implemented.	A	N

QAA WORKSHEET

WAG/QAA NO.: 05-002

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS — COMMENTS)	RISK	ACTION
B2.	Inadequate or erroneous documentation of well construction can result in: • Errors in interpretation of data. • Project delays and increases costs. • Failure to meet data quality objectives.	S	L	An experienced geologist will continuously monitor well construction and will be assigned responsibility for documenting construction. A well construction form/checklist will be employed to standardize and ensure complete documentation per PP 1501. The WAG Manager or designee will review documentation per PP 1501 and 1631. QC personnel will perform surveillance inspections in conformance with PP 1302.	A	N
B3.	Failure to properly develop groundwater wells can result in: • Nonrepresentative water levels. • Failure to meet data quality objectives. • Identification of inappropriate corrective measures.	S	L	An experienced geologist will continuously monitor well development. Well development will be performed as specified in ESP-600. Appropriate data will be documented per PP 1501. The WAG Manager or designee will review the effectiveness of the development techniques utilized and modify the techniques as appropriate. QC personnel will perform surveillance inspections in conformance with PP 1302.	A	N
B4.	Failure to purge wells adequately prior to sampling can result in: • Nonrepresentative water quality samples. • Failure to meet data quality objectives. • Identification of inappropriate corrective measures.	S	L	Purging of wells will be performed as specified in ESP-302-2. An experienced geologist will continuously monitor well purging. Specific purging techniques and volumes of water required to be purged will be specified in the field work guide.	A	N
B5.	Failure to adequately evaluate existing wells can result: • Erroneous characterization of groundwater flow regime. • Failure to meet data quality objectives.	S	L	Evaluation of existing wells will be done in accordance with the field work guide which contains a data collection form. QC personnel will perform surveillance inspections in conformance with PP 1302.	A	N

QUALITY ASSURANCE ASSESSMENT

ORNL RI/FS PROJECT
JOB 19118

SITE IDENTIFICATION ORNL Waste Area Grouping 5 QAA NO. 05-002

SUMMARY DESCRIPTION:

QAA-05-002 covers WAG 5 RI activities specific to individual sampling programs. General RI activities not specific to an individual sampling program are covered in QAA-05-001.

ASSESSMENT RECOMMENDATIONS [See Attachment(s)]

yes no

X __ A Quality Assurance Action Plan (QAAP) is required. If yes, by: Prior to WAG 5 field activity.

__ X A Revised QAAP is required. If yes, by: _____

REV	ORIGINATOR	WAG MGR	ENG. SUPRV.	TECH. INTERG.	FSS MGR.	DEPUTY PROGRAM MGR.	ES&H MGR.	QA/QC MGR.	PROG. MGR.	DATE
0	A. K. Brill	AKB								12/5/94

QAA WORKSHEET

WAG/QAA NO.:05-002

QAA WORKSHEET CODES

CONSEQ - CONSEQUENCES OF FAILURE

I - Insignificant
S - Significant
U - Unknown
VS - Very Significant

PROBAB - PROBABILITY OF FAILURE

L - Low
H - High
U - Unknown

RISK

A - Acceptable
U - Unacceptable

ACTION

N - None
Q - QAAP Required

ATTACHMENT B

QUALITY ASSURANCE ASSESSMENT (QAA 05-002)

QAA WORKSHEET

WAG/QAA NO.: 05-001

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
B3.	Improper sample collection, handling, and labeling can result in: • Uncontrolled exposure of personnel and the environment to radiological or chemically hazardous contaminants. • Loss of sample accountability. • Failure to meet data quality objectives. • Missed milestones and cost increases.	S	L	Sampling personnel will successfully complete on-the-job training while engaging in field activities as specified in PP 1210 and the WAG 5 ES&H Plan. Training will cover sampling methodologies to be employed during the WAG 5 RI as described in applicable Energy Systems ESPs and in applicable PPs 1600, "Field Operations." Sample chain of custody will be maintained (PP 1603), and field QC personnel will monitor sampling activities for conformance to project standards (PP 1302). Field work guides will specify sample collection, handling, and labeling for each sampling activity (PP 1132).	A	N
B4.	Dilution of highly radioactive samples may be necessary to have chemical analyses performed at a commercial laboratory. If dilution results in the reduction of contaminant concentrations to levels near or below detection limits, data quality objectives will not be met.	I	NA	The analytical laboratory at ORNL is capable of handling and analyzing for chemical constituents in samples containing radioactivity up to 50 R/h without dilution. Prior to initiating sampling activities in areas of potentially high level of radioactivity, arrangements will be made with ORNL or an alternative laboratory to perform analyses for samples exceeding commercial laboratory limits.	A	N
B5.	Improper decontamination of sampling equipment can result in: • Uncontrolled exposure of personnel and the environment to radiological or chemically hazardous contaminants. • Cross-contamination of samples. • Failure to achieve data quality objectives.	S	L	Sampling equipment will be decontaminated prior to each use (ESP 900 and ESP 901). Field QC personnel will periodically monitor field decontamination to verify compliance with applicable procedures (PP 1302). Equipment rinseates will be collected at the rates specified in Sect. B9.1 of the WAG 5 Quality Assurance Project Plan and PP 1303 to assess the adequacy of the decontamination procedures.	A	N

QAA WORKSHEET

WAG/QAA NO.: 05-001

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
C.	WASTE MANAGEMENT					
C1.	Inadequate training of waste management personnel and other field personnel can result in: • Inappropriate segregation, categorization, handling, transportation, and storage of wastes. • Uncontrolled worker and environmental exposure to radiological or chemically hazardous contaminants. • Community relations impacts.	S	L	Project employees who, by job function assignment, are responsible for the segregation, field characterization, packaging, labeling, manifesting, transporting, and/or storing waste materials will successfully complete waste management training as described in PP 1404.	A	N
C2.	Improper waste categorization can result in: • Uncontrolled worker and environmental exposure to radiological or chemically hazardous contaminants. • Violation of the ORNL NPDES Permit, resulting in regulatory enforcement actions.	S	L	RI project solid wastes will be categorized in accordance with the ORNL RI/FS Waste Management Plan and with PP 1401, "Waste Categorization for Solid Waste." All containers will be clearly labeled. Field screening will be performed on all wastes. Screening will include contact beta-gamma, and alpha measurements, wipe tests, air monitoring for volatile organics, and pH measurements (for liquid wastes). The Waste Generation Officer (WGO) is the responsible onsite officer for ensuring that waste materials are properly categorized. Field QC personnel will monitor waste management activities to verify compliance with procedures. The WAG 5 Internal Environmental Assessment prepared by Energy Systems will be completed prior to initiating work in WAG 5.	A	N

QAA WORKSHEET

WAG/QAA NO.: 05-001

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
A10.	Maximum allowable exposures from radioactive contaminants are established to prevent workers from exceeding regulatory and administrative limits. Encountering radioactivity in excess of the maximum allowable exposure levels can cause: • Worker doses above acceptable limits. • Spread of radioactivity to the environment. • Missed milestones and cost increases. • Community relations impact.	S	U	Exposure to radioactivity in excess of administrative limits can be caused by intrusion directly into wastes. The design drawing coordinates of the LLLW tanks and pipeline trenches are known; therefore, the probability of intruding into wastes is low. However, contaminant migration may have contaminated environmental media to high levels in some locations and this contributes to the probability of encountering radioactivity in excess of allowable levels. Continuous ES&H monitoring will be conducted during invasive sampling activities as described in the WAG 5 ES&H Plan. If radiation in excess of allowable limits is detected, the level of PPE will be upgraded, exposure times may be limited, and/or engineered safeguards will be employed per PP 1235. If wastes are encountered, the borehole will be abandoned and a new location selected. Emergency response (PP 1240) are issued, and workers will receive appropriate training. QAAP 05-001 addresses these concerns.	U	Q
A11.	Failure to follow appropriate safety procedures when working in an open excavation may result in physical injury to personnel.	S	L	ES&H field personnel will ensure that all OSHA requirements are followed, including shoring, providing barriers around excavations, and restricting entry into confined spaces per PP 1275.3.	A	N
A12.	Heavy rains in open and contaminated excavations could result in: • Collection of contaminated liquids. • Uncontrolled release of contaminated liquids to the environment.	S	L	Excavation activities will be minimized and performed in dry weather, or provisions will be made for collecting and processing contaminated liquids. Minor infiltration will be collected and stored in approved containers pending sampling, analysis, and appropriate disposition.	A	N

QAA WORKSHEET

WAG/QAA NO.: 05-001

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
A13.	Personnel and equipment may come in contact with an electrified fence used for deer control on Melton Branch. This may result in: • Shock/injury to personnel	I	NA	The electrified fence will be identified in the HWP covering any task in this area.	A	N
A14.	Access to the elevated well risers located in Melton Branch may result in: • Physical injury to personnel • Schedule delays	S	L	Access to elevated well risers will be performed in accordance with safety requirements in 29 CFR 1910.	A	N
B.	Sampling					
B1.	Inadequate sampling training of personnel may result in: • Failure to meet data quality objectives. • Inadequate documentation. • Cross-contamination of samples. • Uncontrolled exposure of personnel and the environment to radiological or chemically hazardous contaminants. • Physical injury to personnel. • Missed milestones and cost increases.	S	L	Sampling personnel will successfully complete on-the-job training while engaging in field activities as specified in PP 1210 and the WAG 5 ES&H Plan. Training will cover sampling methodologies employed during the WAG 5 RI as described in applicable Energy Systems ESPs and in applicable PP 1600, "Field Operations" as identified in the WAG 5 Remedial Investigation Field Sampling Plan. In addition, field work guides will be prepared for each sampling activity (PP 1132).	A	N
B2.	Inadequate maintenance of equipment required for sampling may lead to equipment failure, which in turn can result in: • Physical injury to personnel. • Loss of samples. • Exposure of personnel and the environment to radiological or chemically hazardous contaminants. • Delays and increased costs.	S	L	Sampling teams will be responsible for inspecting sampling equipment before and after each use and for notifying the FAC of maintenance required. Field work guides will specify inspection.	A	N

QAA WORKSHEET

WAG/QAA NO.: 05-001

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
C3.	Improper waste handling, transportation, and storage can result in: • Uncontrolled worker and environmental exposure to radiological or chemically hazardous contaminants. • Inadequate containment or spills. • Inadequate or erroneous records; loss of wastes. • Violation of the ORNL NPDES Permit, resulting in regulatory enforcement actions. • Impact on routing ORNL operations.	S	L	Project employees responsible for waste management will successfully complete waste management training as described in PP 1404. Training will cover proper waste handling, transportation, and storage as described in PP 1402 and PP 1403. The field WGO and Waste Transportation Officer will be responsible for ensuring that proper procedures are employed. QC personnel will conduct QC surveillance inspections of waste management activities to verify compliance with procedures (PP 1302).	A	N
D.	OTHER GENERAL					
D1.	Unanticipated ORNL operations activities can result in project delays and increased costs.	S	L	The ORNL RI/FS WAG 5 Manager and FSSM will communicate regularly with ORNL operations personnel concerning routine ORNL plant operations so that scheduling may be adjusted to minimize mutual disruption. This is achieved by discussing upcoming field activities at the weekly interface meeting between RI Team and ORNL personnel.	A	N
D2.	Failure to obtain proper excavation/penetration permits (EPPs) to perform WAG 5 RI activities bypasses normal notification channels and can cause disruption of ORNL operations and services. It also reduces job safety because verification checks on the safety of proposed sampling locations may not be performed.	S	L	The WAG 5 ES&H Plan will require compliance with ORNL EPP requirements. If EPP have not been obtained, work will not be permitted to progress.	A	N

QAA WORKSHEET

WAG/QAA NO.: 05-001 PAGE 11 OF 11

ITEM	PROBLEM DESCRIPTION (FAILURE MODE AND EFFECT)	CONSEQ.	PROBAB.	RISK ASSESSMENT/POSSIBLE CAUSES (RATIONALE STATEMENTS—COMMENTS)	RISK	ACTION
D3.	Failure to maintain the WAG 5 database as the field data is collected can result in: • Loss of data. • Failure to meet data quality objectives. • Use of unverified data. • Project delays and increased costs.	S	L	Data will be recorded in a logbooks (PP 1631) and/or serialized collection forms daily as the information is collected. This information will be entered into the database as specified in PPs 1501, 1501.1, and 1501.6.	A	N

013422

SIGNATURE PAGE

I have read and understand the required work practices stated on Page 1 of this attachment, and have had my questions answered satisfactorily.

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