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ENVIRONMENTAL RESTORATION PROJECT
MANUAL FOR SITE HEALTH AND SAFETY ACTIVITIES

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1.0

Introduction

1.0 INTRODUCTION

1.1 PURPOSE AND APPLICABILITY

This manual is based on current Los Alamos National Laboratory (LANL) policies, procedures, and practices as they apply to Environmental Restoration Project (Project) health and safety activities. It is intended to provide the user with a clear understanding of the manner in which LANL expects health and safety to be effectively managed by both LANL employees and its subcontractors during the performance of Project work. The manual contains general information, mandatory requirements (as indicated by the words "shall" and "must"), and nonmandatory guidance (as indicated by the words "should" and "may").

While written specifically for those responsible for site health and safety activities, this manual will likely prove to be useful to other Project personnel wishing to understand how the health and safety function is managed within the Project.

Any questions concerning interpretation of the contents of this document are to be referred to the Environmental Restoration Project Health and Safety Support Team [ER/HS Team (ESH-1/ESH-5), MS K494, 665-7221/667-5722] for resolution.

1.2 SCOPE

The information contained in this manual is intended for use at all Project sites, including those involved in decommissioning (D&D) work. Sites include those on LANL property, as well as those located off LANL property, where Department of Energy (DOE) work is performed in support of the LANL Environmental Restoration Project.

2.0
Definition

2.0 DEFINITIONS

AP: Administrative Procedure. An AP is a document that describes methods to perform and implement administrative requirements that are identified in the Environmental Restoration (ER) Quality Program Plan (QPP) and/or ER Program Management Plan (PMP).

AR: Administrative Requirements. An AR defines LANL policies and procedures, and includes associated responsibilities of personnel.

Competent Person: One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

ESH-1: Health Physics Operations Group. The group within the ES&H Division responsible for radiological monitoring.

ESH-2: Occupational Medicine Group. The group within the ES&H Division responsible for medical monitoring programs.

ESH-4: Health Physics Measurements Group. The group within ES&H Division responsible for maintenance and calibration of radiation/contamination survey instrumentation.

ESH-5: Industrial Hygiene and Safety Group. The group within the ES&H Division responsible for industrial hygiene and safety activities.

ESH-12: Policy and Program Analysis Group. The group within the ES&H Division that evaluates, investigates, and documents worker's personal radiation doses, and develops policies and procedures for LANL's ES&H Division.

ESH-13: Training Group. The group with the ES&H Division responsible for the coordination and delivery of ES&H training.

ER/HS Support Team: Consists of dedicated health and safety professionals assigned to ER and Decommissioning activities. The team is multi-disciplinary and include industrial hygiene, occupational safety and health physics personnel.

FPL: Field Project Leader. The FPL is responsible for all ER activities at the PRS groupings (formerly operable units, or OUs) over which she or he has control.

FTL: Field Team Leader. The FTL directs the day-to-day work activities at the site.

HASP: Health and Safety Plan. The HASP establishes generic health and safety information and requirements applicable to environmental restoration and decommissioning field operations project wide.

HPT: Health Protection Technician (formerly Health Physics Technician). An individual who has been approved to perform limited functions that would otherwise be done by a LANL RCT. Completion of the LANL RCT Certification Program is required for approval as a LANL RCT.

HSPL: Health and Safety Project Leader. The HSPL is the Environmental Restoration (ER) Project Leader for health and safety. The HSPL manages the ER/HS Support Team.

JCI: Johnson Controls Incorporated. LANL's support services subcontractor.

LANL Employee: An employee of the University of California, the prime DOE contractor at LANL.

Non-LANL Employee or Subcontractor: Everyone except employees of the University of California.

PRS: Potential release site. A site where a release of a hazardous substance or waste is known or suspected to have occurred.

Radiation Screening Personnel: A field team member authorized to perform radiological screening at a given ER site.

RCRA: The Resource Conservation and Recovery Act of 1976, as amended. Regulations issued under RCRA generally specify how hazardous wastes are to be investigated and remediated.

RCT: Radiological Control Technician. An RCT is an individual who has successfully completed the LANL RCT Certification Program.

RFI: RCRA Facility Investigation. An RFI is part of the RCRA corrective action process and involves waste site and environmental setting characterization to define the nature and extent of contamination.

RWP: Radiological Work Permit. One of the permits likely required to perform work at a Project site when elevated radiological contamination is present.

SSHASP: Site-Specific Health and Safety Plan. A document that supplements the HASP by providing additional health and safety information and requirements indicated by the operations and conditions of individual environmental restoration or decommissioning project sites.

SSO: Site Safety Officer. The SSO assists site management in the implementation of health and safety requirements, and serves as the primary site contact for health and safety matters.

TA: Technical Area. TAs are LANL geographic areas in which groups of buildings are located. The groups of buildings within a TA often support a common function or activity.

3.0

Roles, Responsibilities & Authority

3.0 ROLES, RESPONSIBILITIES, AND AUTHORITY

The responsibilities and authorities included in this section have been established by LANL to clarify expectations associated with the various safety and health-related Project support roles. Also included are health and safety-related functions associated with Project management roles.

3.1 FIELD PROJECT LEADER

The Field Project Leader (FPL) is a member of LANL's staff and reports to the Environmental Restoration (ER) Project Manager. The FPL is the project manager as defined by DOE Order 5480.9A, Construction Project Safety and Health Management. The FPL is the line manager for her/his field unit and may direct one or more Field Team Managers (FTM) and/or Field Team Leaders (FTL).

The FPL is responsible for ensuring that provisions of the Health and Safety Plan (HASP), Site-Specific Health and Safety Plan (SSHASP), and other applicable health and safety requirements are observed for field operations under her/his management. In addition, specific health and safety responsibilities of the FPL (or her/his designee) include:

- managing health and safety activities of her/his field unit;
- serving as the final authority for resolving health and safety issues concerning her/his field unit;
- ensuring that the necessary SSHASPs for her/his field unit are developed and that the comments of the Field Unit Health and Safety Representative and any other appropriate plan reviewers have been incorporated;
- ensuring that personnel performing ER work at her/his field unit are qualified in accordance with applicable health and safety requirements;
- ensuring that onsite personnel abide by applicable health and safety programs, procedures, plans, and applicable regulations;
- having the authority to ban personnel who do not abide by applicable health and safety requirements from performing field operations;
- ensuring that required inspections are conducted; and
- ensuring that appropriate field project health and safety records are submitted to the LANL Records Processing Facility.

3.2 FIELD TEAM MANAGER/DECOMMISSIONING PROJECT LEADER

FTM is the title applicable to ER site investigation and cleanup activities, whereas Decommissioning Project Leader (DPL) is the title applicable to decommissioning projects. The FTM/DPL, who may be either a LANL staff member or subcontractor, reports to the FPL and is the line manager of one or more field teams. This person is the construction manager as defined by DOE Order 5480.9A. Specific health and safety responsibilities of the FTM/DPL (or her/his designee) include:

- coordinating with the FPL to ensure that provisions of the HASP, SSHASP, and other applicable health and safety requirements are implemented for assigned field operations;
- ensuring that the site history has been adequately researched, and information regarding all known hazards and all anticipated tasks have been adequately incorporated into the SSHASP;
- coordinating with the FPL to ensure that: each concerned party has reviewed the SSHASP for accuracy and adequacy; review comments are resolved; and that the SSHASP is signed before any field activities begin;

- ensuring that all known tasks and personnel have been identified sufficiently in the SSHASP;
- coordinating with the FPL and the Field Unit Health and Safety Representative to select qualified health and safety and health physics personnel;
- coordinating with the FPL to ensure that necessary permits have been obtained before starting field operations;
- coordinating with the FPL to ensure that necessary health and safety records are produced and kept in accordance with the SSHASP;
- coordinating with the FPL to ensure that only field team members and support personnel qualified in accordance with applicable HS requirements are used to perform ER Project work; and
- coordinating with the FPL to provide necessary health and safety records to the FPL at the close of the project.

3.3 FIELD TEAM LEADER/JOB SUPERINTENDENT

FTL is the title applicable to ER site investigation and cleanup activities, whereas Job Superintendent (JS) is the title applicable to decommissioning activities. The FTL or JS, who may be either a LANL staff member or a subcontractor, reports to the FTM or DPL. (In some cases, the FTL/JS reports directly to the FPL. In this instance, responsibilities of the FTM/DPL should be delegated to the FTL/JS by and at the discretion of the FPL.) The FTL/JS is the line manager for her/his field team. She/he oversees the work of one or more supervisors assigned to the field teams, the field team members, and the SSO. The FTL/JS (or her/his designee) is responsible for

- coordinating with the FTM/DPL and/or FPL to ensure that provisions of the HASP, SSHASP, and other applicable health and safety requirements are implemented for assigned field operations;
- coordinating with the FTM/DPL and/or FPL to ensure that only field team members and support personnel qualified in accordance with applicable health and safety requirements are allowed to perform field operations;
- coordinating with the FTM/DPL and/or FPL to ensure that field team members attend health and safety briefings and daily health and safety tailgate meetings before beginning field operations;
- coordinating with the FTM/DPL and/or FPL to ensure that site control measures and hazard prevention and mitigation controls are appropriately implemented;
- ensuring that a log of field activities is maintained, especially noting site personnel and visitors who enter and exit the site;
- notifying appropriate parties when action levels are reached and when personnel exposures exceed occupational exposure levels;
- coordinating with the FTM or DPL, and/or FPL to ensure that the necessary preventative planning and employee training for emergency situations has occurred before beginning field operations;
- coordinating with the SSO to ensure that all affected site workers are informed of any condition that has been reported to the FTL/JS and/or SSO that poses a clear and imminent danger to the environment or to the health and safety of site personnel, visitors, or the public; taking action to diminish the immediate threat of harm, once it has been concluded that conditions or practices exist that pose a threat to the environment or personnel; authorizing resumption of activity only when it has been determined that the hazard/hazards has/have been sufficiently abated and there is no further threat of harm; and notifying the FPL and Field Unit Health and Safety Representative of any stop work activity;
- arranging for immediate notification of LANL emergency response personnel to take control of the scene in the event of an incident or emergency, and/or arranging for immediate notification of appropriate authorities; and
- coordinating with the FTM/DPL to ensure that modifications to the SSHASP have been prepared and approved before initiating any operational changes.

3.4 OTHER ONSITE SUPERVISORY PERSONNEL

For field teams involving multiple employers, each employer's onsite supervisory representative is responsible for ensuring that provisions of the HASP, SSHASP, and other applicable health and safety requirements are observed by her/his employees during field operations. These supervisors are responsible for coordinating with the FTL/JS and SSO or, as necessary, the FTM/DPL or the FPL, to resolve health and safety matters that affect her/his site personnel and/or operations.

3.5 SITE SAFETY OFFICER

The Site Safety Officer (SSO) assists the FTL/JS to see that provisions of the HASP, SSHASP, and other applicable health and safety requirements are observed in the field. The SSO serves as the primary contact in the field for health and safety matters. The SSO may perform other duties on the field team, provided that these duties do not compromise performance of her/his SSO duties. The specific responsibilities of the SSO include:

- assisting in the development of the SSHASP;
- verifying that onsite personnel have current certification of the applicable training and medical surveillance requirements of the HASP and SSHASP;
- assisting the FTL/JS in effectively implementing the HASP and SSHASP in accordance with applicable federal, state, and local health and safety regulatory requirements;
- notifying the FTL/JS of any onsite personnel who are not abiding by applicable HS requirements and of potential or actual hazardous situations needing to be rectified in accordance with applicable health and safety requirements;
- notifying the FTM/DPL and, subsequently, the Field Unit Health and Safety Representative when elements of the HASP and SSHASP are not being met, and when health and safety hazards are not being sufficiently minimized or mitigated;
- watching for changes in site operations and conditions that warrant hazard mitigation and/or modifications to the SSHASP;
- coordinating with the FTL/JS to ensure that all affected site workers are informed of any condition that has been reported to the FTL/JS and/or SSO that poses a clear and imminent danger to the environment or to the health and safety of site personnel, visitors, or the public; and taking action to diminish the immediate threat of harm, once it has been concluded that conditions or practices exist that pose a threat to the environment or personnel;
- ensuring that copies of the HASP, SSHASP, and any modification forms are current, and that these documents are readily accessible onsite and as needed for ER work occurring elsewhere;
- assessing the necessity and arranging for monitoring of employee exposures to health and safety hazards and conveying results and known implications of the results to the FTL/JS;
- notifying the FTL/JS, the Field Unit Health and Safety Representative, and affected employees and their supervisors of results of employee exposure monitoring;
- monitoring levels and effectiveness of personal protective equipment (PPE) and verifying proper storage and maintenance of equipment;
- performing and documenting inspection of site operations, as required by the HASP and SSHASP; and
- maintaining health and safety-related project records, including a daily log of health and safety-related matters concerning site operations, and providing these records to the FTM/DPL as necessary before close-out of the project.

3.6 HEALTH PHYSICS PERSONNEL

Project health physics personnel include ESH-1 personnel and field team personnel. Health physics field team personnel include radiological screening personnel (RSP), health protection technicians (formerly known as health physics technicians) (HPT), and radiological control technicians (RCT). These field team members are the primary source of information and guidance for radiation protection. They shall ensure compliance with the radiological requirements of the SSHASP and shall conduct monitoring per the radiological surveillance authorization agreement (RSAA) issued by ESH-1 [see ER Project Standard Operating Procedure Addendum ESH-1-01-03, Radiological Surveillance Authorization Agreement available from the ESH-1 ER/D&D Team Leader (667-7137)] and per terms of the SSHASP. If non-ESH-1 personnel perform these roles (including LANL personnel), ESH-1 must preapprove personnel and issue a RSAA before any work is performed.

3.6.1 Radiological Screening Personnel

RSPs are responsible for providing health physics monitoring support for the field team. Each RSP is responsible for performing health physics monitoring support in accordance with her/his RSAA. Specific responsibilities include:

- performing and documenting radiological surveys;
- performing conditional equipment release surveys;
- performing daily instrument response checks;
- ensuring that all radiation monitoring equipment is in good working order;
- ensuring that all radiological postings are maintained;
- immediately notifying ESH-1 when a worker has been contaminated above action levels;
- providing ESH-1 personnel who oversee the Project with a daily verbal summary of site radiological conditions and copies of all radiological survey documentation; and
- notifying ESH-1 when action levels defined in the SSHASP have been reached.

3.6.2 Health Protection Technician

In addition to the responsibilities of the RSP, the HPT is responsible for:

- preparing, ensuring compliance with, and closing out radiological work permits (RWP);
- stopping activity and revising the site RWP when the radiological controls required do not provide adequate worker protection or contamination control; and
- providing guidance on radiological decontamination of personnel and equipment.

3.6.3 Radiological Control Technician

In addition to the responsibilities of the RSP and HPT, the RCT is responsible for:

- stopping or mitigating the effect of an activity, if she/he suspects that the initiation or continued performance of the activity will result in a violation of radiological control standards or result in imminent danger or unacceptable risk; and
- performing "unconditional release" surveys for equipment.

3.6.4 ESH-1 Personnel

An ESH-1 health physicist (ER/D&D Team Leader) will be designated to provide radiological control support to the Project and to conduct oversight duties. She/he will provide technical and project management support to the Project. As a member of the ESH-1 staff, she/he will have

access to all ESH-1 Group resources and will have a dual responsibility to both the Project and the LANL-wide Radiation Protection Program. As such, the ESH-1 health physicist will ensure that all Project site radiological controls are implemented in accordance with 10 CFR 834, 10 CFR 835, DOE Orders, the SSHASP, the RWP (if generated), ESH-1 procedures, and the LANL Radiological Control Manual. The ESH-1 health physicist is responsible for the following:

- assisting in Project baseline planning;
- reviewing and approving SSHASPs;
- coordinating ESH-1, ESH-4, and ESH-12 health physics support and consultation;
- providing guidance on obtaining necessary permits (i.e., RWP);
- providing field support through advance planning and scheduling;
- maintaining notification and reporting requirements as specified in DOE Order 5000.3B, *Occurrence Reporting and Processing of Operations Information*;
- providing direct support to site health physics personnel, when requested to do so;
- performing audits to ensure that the radiological control program is in compliance with all applicable requirements;
- developing Project-specific guidance, as necessary; and
- providing support to the Field Unit Health and Safety Representatives, as necessary.

The Field Unit Health and Safety Representative, in cooperation with the ESH-1 health physicist, will arrange for participation of additional ESH-1 personnel to support field operations. In cases requiring immediate involvement by ESH-1 personnel, the FTL/JS (or her/his designee) may request ESH-1 involvement directly. Such participation may include visits to the site, the frequency of which will depend upon the specific operations and radiological conditions occurring at the site. The responsibilities of the ESH-1 personnel may include:

- performing reviews to ensure that the site radiological control program is in compliance with LANL requirements, including the LANL Radiological Control Manual;
- ensuring that survey methods and equipment are appropriate for the type of radiological contamination expected and for current site conditions;
- providing direct support to field health physics personnel, when requested to do so;
- ensuring that radiological controls are implemented in accordance with the RWP (if generated), the SSHASP, LANL's Radiological Control Manual, and any other applicable LANL requirements;
- ensuring that radiological surveys are performed and documented in accordance with required procedures;
- performing radiological surveys before the start and at the completion of field activities;
- providing guidance for radiological decontamination of equipment and personnel;
- taking the actions indicated in the SSHASP upon notification that the stated action levels have been reached;
- reviewing RWPs for the field site;
- determining and, in select cases, providing appropriate radiological postings; and
- meeting notification and reporting requirements as specified in DOE Order 5000.3B.

The above responsibilities may be performed by designated contract personnel, provided ESH-1 has approved the subcontractor's radiological safety program. This program must be submitted for LANL's approval during the pre-bid qualification or contract negotiation period.

3.7 FIELD UNIT HEALTH AND SAFETY REPRESENTATIVE

The Field Unit Health and Safety Representative may be either a LANL employee or a LANL subcontractor. (Subcontractors do not set or have direct involvement in setting LANL policy.)

- performing reviews to ensure that the site radiological control program is in compliance with LANL requirements, including the LANL Radiological Control Manual;
- ensuring that survey methods and equipment are appropriate for the type of radiological contamination expected and for current site conditions;
- providing direct support to field health physics personnel, when requested to do so;
- ensuring that radiological controls are implemented in accordance with the RWP (if generated), the SSHASP, LANL's Radiological Control Manual, and any other applicable LANL requirements;
- ensuring that radiological surveys are performed and documented in accordance with required procedures;
- performing radiological surveys before the start and at the completion of field activities;
- providing guidance for radiological decontamination of equipment and personnel;
- taking the actions indicated in the SSHASP upon notification that the stated action levels have been reached;
- reviewing RWPs for the field site;
- determining and, in select cases, providing appropriate radiological postings; and
- meeting notification and reporting requirements as specified in DOE Order 5000.3B.

The above responsibilities may be performed by designated contract personnel, provided ESH-1 has approved the subcontractor's radiological safety program. This program must be submitted for LANL's approval during the pre-bid qualification or contract negotiation period.

3.8 FIELD UNIT HEALTH AND SAFETY REPRESENTATIVE

The Field Unit Health and Safety Representative may be either a LANL employee or a LANL subcontractor. (Subcontractors do not set or have direct involvement in setting LANL policy.) Field Unit Health and Safety Representatives are assigned to one or more FPLs as technical advisors. The Field Unit Health and Safety Representative is responsible for providing support to the FPL to coordinate and oversee health and safety for her/his field unit. Specific health and safety responsibilities of the Field Unit Health and Safety Representative include:

- coordinating permits (e.g., confined space, excavation, spark/flame) and special work procedures (e.g., lockout/tagout);
- obtaining updates on the ES&H ID (formerly known as the ES&H Questionnaire);
- managing the SSHASP development, review, and approval process;
- serving as the primary point of contact for internal and external ES&H appraisers and auditors;
- serving as the primary interface between the field unit and the LANL ESH Division;
- conducting site visits for field unit operational self-assessments;
- approving and, as necessary, coordinating SSHASP modification forms;
- participating in ES&H resource planning;
- attending regularly scheduled FPL meetings;
- coordinating completion of the health and safety portion of the Operational Readiness Review checklist;
- informing analytical laboratories of expected industrial hygiene sample types and volumes, and turnaround time needed;
- maintaining a working knowledge of available ESH-13 training courses and content so that appropriate selections are made;
- ensuring that SSHASPs for his/her field unit(s) are reviewed by appropriate ESH groups;
- verifying that field operations associated with his/her field unit(s) are conducted in accordance with applicable HS programs, plans, and regulatory requirements;

- understanding ESH-13 training registration policies and procedures so as to be an information resource to the FPL's field teams; and
- interfacing with the LANL health physics organization, as necessary.

The Field Unit Health and Safety Representative may also be responsible for implementing/participating in the LANL Project Oversight Program.

3.9 FIELD TEAM MEMBERS

Field team members are responsible for performing their work in a safe and healthful manner. They also are responsible for abiding by requirements of the HASP, SSHASP, and other applicable health and safety requirements, and for fulfilling and maintaining their individual training and medical surveillance requirements. If there is concern that implementation of work orders or health and safety requirements would unreasonably compromise the safety or health of an individual or the environment, such a concern should be brought to the attention of an immediate supervisor, the SSO, or the FTL/JS. If a health and safety concern is not adequately resolved at this level, the matter should be elevated by bringing it to the attention of the FTM/DPL or Field Unit Health and Safety Representative, and subsequently and if necessary, the FPL. If adequate resolution still has not been achieved, field team members are encouraged to call LANL's ESH hotline (665-5010) or to contact the Los Alamos DOE Area Office (667-5105), where a complaint form (DOE F 5480.4) may be filed. DOE has a policy that employees who report a health and safety problem are protected from reprisal.

Any individual observing an operation that presents a clear and imminent danger to the environment and/or to the health and safety of site personnel, visitors, or the public has the authority to immediately notify the individuals involved and the SSO and/or FTL/JS.

4.0

SSO Qualifications + Approval

4.0 SITE SAFETY OFFICER QUALIFICATIONS AND APPROVAL

The site safety officer (SSO) is a critical Project team member and must have the safety and health knowledge necessary to perform her/his functions. It is the responsibility of the SSO's employer to ensure that the SSO is fully qualified to carry out these functions. Specifically, if the SSO is a LANL employee (or LANL contract labor employee), approval shall be secured from the ER/HS Support Team. Project subcontractors are responsible for approving the qualifications of SSOs provided by their own organization or by their sub-tier contractor organizations.

The ER/HS Support Team maintains a central list of Project SSOs. The names and qualifications of subcontractor-approved SSOs must be submitted to the ER/HS Support Team (MS K494, 665-7221/667-5722) for recordkeeping purposes, not for approval or acceptance. (Providing a qualified SSO for a project will be an evaluation criterion in subcontractor performance evaluations.) Qualifications for an SSO not already on the central list shall be documented on the SSO Qualifications Review Form (Appendix A) and submitted to the ER/HS Support Team at least two weeks prior to the start of a field project. Qualification updates may be submitted, as necessary, to reflect pertinent changes in an individual's qualifications.

SSOs shall be categorized into one of three qualification levels:

- HAZWOPER LEVEL 1 SSO
- HAZWOPER LEVEL 2 SSO
- HAZWOPER LEVEL 3 SSO

The following guidelines are provided to assist the reviewer in determining the proper SSO qualification category:

HAZWOPER LEVEL 1

This is the lowest level of SSO. A Level 1 SSO is appropriate for sites where hazards (chemical, physical, biological, and radiological) are anticipated to be minimal. [As a rule-of-thumb, hazards on the site will likely require Level D personal protective equipment (PPE).]

The Level 1 SSO should meet the following criteria:

- High school education.
- Ability to recognize hazards, and to implement and ensure project activities are performed in accordance with the Health and Safety Plan (HASP), the Site-Specific Health and Safety Plan (SSHASP), and applicable health and safety regulations.
- Project work experience in hazardous waste operations or other operations requiring health and/or safety activity/oversight.

HAZWOPER LEVEL 2

This level of SSO and must possess the ability to effectively support a project with a higher level of hazard complexity. [As a rule-of-thumb, hazards on the site may require: the use of air-purifying respirators (Level C PPE); an understanding of exposure monitoring strategy development; implementation of engineering controls; and/or an understanding of machine exposures associated with such heavy equipment as drill rigs and excavation equipment.]

The Level 2 SSO should be Level 1 qualified and should meet the following criteria:

- Associate degree or higher in industrial hygiene, health physics, industrial safety, or other related science or engineering degree. NOTE: Work experience may be substituted for formal education if type and amount of experience is appropriate to project requirements.

- Proficient in the use of monitoring instruments required for project activity.

- Health and safety experience (one year minimum suggested) in hazardous waste operations, or similar operations, including implementation of safety and health plans/programs.

HAZWOPER LEVEL 3 SSO

This level of SSO must possess the ability to effectively support a project with the highest level of hazard complexity. (As a rule-of-thumb, hazards on the site may have the potential for significant injury or illness resulting in irreversible harm and/or may require the use of Level A or B PPE.)

The Level 3 SSO should be Level 2 qualified and should meet the following criteria:

- Certified, or have the ability to become certified, in industrial hygiene, health physics, safety and/or a related field. NOTE: Work experience may be satisfactory if type and amount of experience is appropriate to project requirements.

- Proficient in the use of monitoring instruments required for project activity.

- Health and safety experience (two year minimum suggested) in hazardous waste operations, or similar operations, including implementation of safety and health plans/programs. Experience with projects requiring level A and/or B PPE is highly desirable.

NOTE: If designated to provide first aid and/or CPR, the SSO may receive an occupational exposure to blood or other potentially infectious material(s). If so designated, the employer of the SSO shall ensure that the requirements of affected employees contained in 29 CFR 1910.1030, Bloodborne Pathogens, are met. (These requirements are included in Section 4 of the HASP.)

5.0
Hazard Assessment

5.0 HAZARD ASSESSMENT

5.1 TASK HAZARD ANALYSES

The Department of Energy (DOE) [DOE Order 5480.9A and *Health and Safety Plan (HASP) Guidelines*] and the Occupational Safety and Health Administration (OSHA) (29 CFR 1926.65) require that a hazard analysis be prepared for each task described in the field project scope of work. The task hazard analysis is to be included in the Site-Specific Health and Safety Plan (SSHASP). It shall identify the likely radiological, safety, chemical, and physical hazards and the affected personnel so that a determination can be made of the corresponding administrative and engineering controls, site control measures, exposure monitoring and response plans, PPE, decontamination, emergency/incident response, training, and medical surveillance requirements to be implemented to minimize or mitigate the anticipated site hazards.

Note 1: Biological hazards, a significant concern to all field sites, is addressed in the Health and Safety Plan (HASP), as opposed to the task hazard analysis portion of the SSHASP. Additionally, select physical hazards that have been identified as common to all field sites are included in the HASP.

Note 2: The SSHASP is intended to meet the DOE Order 5480.9A requirements for a Preliminary Hazard Analysis.

Within the task hazard analysis, each anticipated hazard shall be assessed to determine the associated probability of occurrence and the severity of injury/illness expected to result. Hazard assessment is the process of evaluating the hazards associated with the task activities.

Evaluation of hazards should occur

- during pre-operational planning of Project field work;
- immediately after initiation of and during performance of tasks with potential hazards;
- prior to changes in tasks and/or operations;
- as required by changing site conditions; and
- continually, as appropriate.

Not all contaminants at a particular site or chemical products used during field operations pose an occupational health threat. The determination of which substances would be expected to pose such a threat is made by the process of hazard assessment. The following criteria should be considered in assessing hazardous substances:

- type, nature, form, quantity, and concentration;
- location;
- conditions under which exposure may occur; and
- hazardous substance's inherent hazards.

5.2 HAZARD ASSESSMENT RATING

A variety of methods are available to code (i.e., interpret and document) the results of a hazard assessment. The specific method selected is at the discretion of the task hazard analysis preparer and/or her/his project supervisor. It should be clearly stated in the SSHASP which method is being used for coding the task hazard analysis.

A common task hazard analysis coding method used on the Project is the Hazard Assessment Rating System. Under this qualitative system, the probability for mishap and the hazard severity potential are individually evaluated, and a hazard assessment rating is assigned according to the following chart:

Hazard Severity	Mishap Probability			
	Likely to Occur	Probably will Occur	Possibly could Occur	Unlikely to Occur
Catastrophic (i.e., death or life-threatening injury/illness from a single encounter)	Severe	Severe	Serious	Minor
Major (i.e., significant injury/illness resulting in irreversible harm)	Severe	Serious	Moderate	Minor
Minor (i.e., injury or illness resulting in reversible harm — not likely to threaten mobility, vision)	Serious	Moderate	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

Hazards assessed as imminent, serious, or moderate are considered to pose an occupational health threat. Hazards assessed as minor due to a mishap probability determination of "possibly could occur" coupled with a hazard severity rating of "minor" are also considered to pose an occupational health threat.

The following sources may be consulted when conducting and coding hazard assessments:

- *Guidelines for Hazard Evaluation Procedure, Second Ed., with Worked Examples*, American Institute of Chemical Engineers, 1992.
- *Laboratory Integration and Prioritization System* (Lawrence Livermore National Laboratory, Sandia National Laboratories, and Los Alamos National Laboratory).
- Office of Energy Research, ES&H Risked-Based Model.
- *DOE Standard - Preparation Guide for U.S. Department of Energy Non-reactor Nuclear Facility Safety Analysis Reports.*
- Draft DOE 5483.XX, *Occupational Safety and Health Program for DOE Operations*, with respect to the Risk Assessment Code Methodology, November 12, 1993.

6.0

Site Organization & Activities

6.0 SITE ORGANIZATION AND ACTIVITIES

6.1 HEALTH AND SAFETY PLAN

The HASP has been developed by LANL as a mandatory document for Project use. It has been designed to comply with federal, state, and DOE requirements. The HASP includes generic health and safety information and requirements applicable to all Project sites. This document shall be accompanied by a second document, the SSHASP, for all field projects (i.e., projects involving investigations or cleanup of potential release sites or groups of potential release sites, and decommissioning projects). (See Section 6.2.)

The LANL Group or subcontractor preparing for field work is provided a copy of the HASP by the Project's ER/HS Support Team. Subcontractors may also receive a copy of the HASP as part of their contract with LANL.

[NOTE: Health and safety plans approved prior to the release of the LANL HASP (March 1995) maybe valid if content of plan is current.]

6.2 SITE-SPECIFIC HEALTH AND SAFETY PLAN

Before beginning field work, a SSHASP shall be prepared. This document describes the health and safety precautions required for field work. The SSHASP supplements the HASP by providing health and safety information and requirements appropriate for the individual field project's operations and conditions.

The LANL Group or subcontractor preparing the SSHASP is provided a model plan (informally referred to as the Model SSHASP and more accurately referred to as the LANL ER Project Model Site-Specific Health and Safety Plan) by the Project's ER/HS Support Team. Subcontractors may also receive a copy of the Model SSHASP as part of the contract with LANL. Use of the Model SSHASP is encouraged. [NOTE: Health and safety plans approved prior to LANL's release of the Model SSHASP (March 1995) maybe valid if content of plan is current.]

NOTE: Plan preparers are encouraged to work cooperatively with the Field Unit Health and Safety Representative during SSHASP development.

Once completed, the LANL group or subcontractor should submit two copies of the SSHASP to the ER/HS Support Team in one of two ways:

- delivering the copies of the SSHASP to the ER/HS Support Team secretary (TA-59-119, MS K494, 665-7221) or
- providing the copies of the SSHASP directly to the Field Unit Health and Safety Representative assigned to the project for which the SSHASP has been developed.

The purpose of providing two copies is to ensure that both the Field Unit Health and Safety Representative and the ESH-1 (health physics) ER/D&D Team Leader each receive a copy for review and approval. If the second option (above) is taken, the Field Unit Health and Safety Representative will ensure that the second copy of the SSHASP is provided to the ESH-1 ER/D&D Team Leader, and that the ER/HS Support Team secretary is notified that it has been formally submitted.

Upon notification of SSHASP submission, the ER/HS Support Team secretary assigns the plan a unique number, if such a number has not been assigned prior to submission. (Note: The ER/HS Support Team prefers that the unique number be assigned at the time of plan submission.) Receipt of the plan, assignment of the unique number, and the deadline for completion of the review process (approximately two weeks from time of submission) are tracked in a database. Once the Field Unit Health and Safety Representative and the ESH-1 ER/D&D Team Leader complete the review, the plan preparer is contacted by the ER/HS Support Team secretary for comment resolution/finalization of the plan. A copy of the comments is retained by the ER/HS Support Team secretary.

Once all approval signatures have been obtained, the preparer/field project representative shall provide a copy of the signed SSHASP cover page to the ER/HS Support Team secretary (either directly or through the Field Unit Health and Safety Representative).

Note: Modifications to an approved SSHASP may be needed upon occasion. Refer to Section 1.3 of the HASP, Updating and Numbering Health and Safety Documents, for further instruction.

6.3 SITE LAYOUT

Many Project sites include a support zone (SZ), a contamination reduction zone (CRZ), and an exclusion zone (EZ). The EZ boundary may also represent the radiological control boundary. The SSHASP should include the planned layout of the site. Due to anticipated variability in site conditions (e.g., wind direction) this is often not done. If the SSHASP does identify the locations of zones and the locations change, a SSHASP modification form should be completed. If the SSHASP does not include the locations of zones, this information should be documented in the SSO's logbook and reviewed with field team members during the daily tailgate meeting. NOTE: If a Project site is located in an area where casual entry onto the site of personnel outside of the Project is possible, site control measures (e.g., barricades, boundary tape) should be taken.

The EZ is a controlled access area. All persons entering and exiting this zone must sign in and out. The sign in/out log may be part of the SSO's logbook, the FTL's logbook, on a separate form, or by another means deemed suitable by site management. Whichever method is selected, the following information should be included:

- Site identification (e.g., TA, SSHASP No., project title)
- Date
- Task No. (or description)
- Worker name
- Time in and out
- PPE worn

To avoid lengthy descriptions of protective attire in the log, it is suggested that a PPE ensemble be given a code number (e.g., Level D1, Level D2, etc.). Once a description of the ensemble has been documented along with its corresponding code number, completion of the log will be easier.

Prior to mobilization to the site, a pre-job radiological survey should be conducted. An area with potential radioactive contamination is to be designated as a Controlled Area (as described in Laboratory Standard LS-107-02.0, "Radiological Posting").

When an EZ is defined and radioactive contaminants are suspected, Controlled Area signs should be posted at the EZ - CRZ boundary. (Contact ESH-1 for specific guidance on proper and acceptable signage.) Personnel exiting a controlled area are required to perform a hand and foot frisk, using appropriate instrumentation as determined by the RCT/HPT/RSP performing radiological surveillance.

Prior to demobilization, a post-job radiological survey should be conducted. Signs posted to delineate controlled areas are to remain in place.

NOTE: Additional required postings (e.g., confined space) should be referenced in the SSHASP.

6.4 SITE EQUIPMENT

Before beginning site activities, the SSO should verify that all necessary safety equipment, including monitoring/surveying instruments, fire extinguisher, PPE, first aid and other safety supplies, and communications equipment, is available and ready for use.

6.5 WORK PERMITS/PROCEDURES

Selected activities performed on a field project may require the generation of a task-specific procedure or special work permit. Procedures and permits typically generated for Project work include:

- Lockout/tagout procedures
- Confined space permits
- Excavation permits
- Spark/Flame-producing work permits
- Radiation work permits

Any questions regarding acquisition or development of permits or procedures may be directed to the ER/HS Support Team.

Also, should direct contact with a LANL organization be desired, the LANL phone information number is 667-5061.

Lockout/Tagout Procedures

LANL has developed Laboratory Procedure LP106-01.2, Lockout/Tagout for Control of Hazardous Energy Sources for Personnel Safety (Red Lock Procedure), to provide the direction necessary for controlling exposure to hazardous energy during the service, maintenance, or repair of machines and equipment. LANL employees and LANL contract labor employees shall adhere to this Laboratory Procedure.

Subcontractors performing work requiring lockout/tagout should follow their own company lockout/tagout procedures, providing that the subcontractor's lockout/tagout program has received LANL approval. Note: When LANL workers are involved in the lockout/tagout task, LANL's Red Lock Procedure will be used.

Confined Space Permits

LANL has developed Administrative Requirement AR 8-1, Confined Spaces, to provide the direction necessary for initiating an entry into a confined space. LANL employees and LANL contract labor employees shall adhere to this AR.

Subcontractors performing work involving confined space entry should follow their own company confined space permit program, providing that the subcontractor's confined space entry program has received LANL approval. Note: When LANL workers are involved in the confined space entry, AR 8-1 will be used.

Excavation Permits

If you are working on DOE property and penetrating the ground surface by more than 12 inches, you need an excavation permit -- unless one of the following exemptions apply:

- you are working on a paved road, gravel road, dirt road, or jeep trail;
- you are installing signposts;
- you are performing surveying activities, including staking (stakes must be left in the ground);
- you are performing general environmental sampling;
- you are repairing lawn sprinklers; or
- you are preparing or maintaining existing firing sites.

To obtain an excavation permit, contact the Johnson Controls Inc. (JCI) Utilities Support Section (665-1449). Allow six weeks from time of application to receipt of an approved excavation permit.

The following information will be required:

- A request form (which the Utilities Support Section can provide).
- A detailed description of the work to be performed. (Note: the more complete the description, the faster the request can be processed.)
- A map denoting the area(s) where the work is done.
- A list of contractor organizations performing work on the field project.

The Utilities Support Section will schedule a walkdown of the area to identify locations of all utility pipes/lines, and will initiate the LANL review and approval process. The Utilities Support Section will issue an excavation permit upon receipt of all LANL Group approvals.

For additional details on excavation permits, refer to LANL AR 12-1.

Spark/Flame-Producing Work Permits

A spark/flame-producing work permit is required for any welding, cutting, brazing, grinding, or similar activity that might produce a spark, flame, or ignition source. Specific requirements for LANL spark/flame-producing work permits are in AR 8-4, Welding, Cutting, and Other Spark/Flame-Producing Operations. (Note: Activities such as completing a weld repair on a drill rig would require a permit.)

Permits are available through BUS-4 (7-8673). To place an order, call BUS-4 customer service and request form #ST2319, 3-part NCR. (The forms need to be ordered by LANL employees or contract labor employees so that the order can be tied to a program and cost code.) Subcontractors using the LANL spark/flame-producing work permit system may obtain the permits through the Field Unit Health and Safety Representative or the FPL (or her/his designee).

Permits require the approval of a representative from ESH-5 and FSS-DO, LANL's Facilities, Security, and Safeguards Division Office. Conditions indicating the need for additional reviews and approvals include:

- presence of radiological hazards (requires ESH-1 approval)
- presence of explosive hazards (requires ESH-5 Safety and Risk Assessment representative approval)
- fire protection systems will be taken out of service and/or radioactive material filter plenums are involved (requires FSS-FP, Fire Protection Group, approval)

Note: If work is performed within 35 feet of a building, the Building Manager responsible for the building (or equivalent responsible person) shall be included in the permit review and approval process.

Radiation Work Permits

ESH-1 is responsible for implementing the radiological work permit (RWP) program in accordance with Laboratory Procedure LP107-02.0, Handling Radiological Work Permits. ESH-1 responsibilities include determining when an RWP is required, based on the scope/type of work being performed, the radiological conditions at the job site, and the requirements listed in the LANL Radiological Control (RadCon) Manual. The RWP defines what radiological control measures are required for the subject work activity.

ESH-1 will not require an RWP for all ER field activities. For most sites, an approved SSHASP meeting the requirements of articles 321-323 of the LANL RadCon Manual will suffice -- until a specific radiological action level specified in the SSHASP is exceeded. An RWP will then be required. It is the responsibility of the on-site health physics personnel to suspend site work and call ESH-1 to initiate an RWP once this action level has been exceeded. An RWP may also be required based on a determination made during review of the SSHASP, and will be based on the criteria noted in the paragraph above.

Subcontractor RCTs with the proper RSAA can prepare the RWP (using LP107-02.0), but the RWP must then be reviewed and approved by an ESH-1 RCT supervisor. For additional guidance, contact the ESH-1 ER/D&D Team Leader (667-7137).

Subcontractors performing radiological work may follow their own radiological work permit program, providing that this program has received LANL approval.

6.6 STAFFING OF SAFETY POSITIONS

There are several safety positions that are key to field work performed under the Project: SSOs, industrial hygiene technicians, and health protection (also known as health physics) personnel.

An SSO should be on site at all times when intrusive work at a hazardous waste site is being performed. It is suggested that the SSO be selected well before field activities are to begin. This will allow time for the SSO to become well acquainted with the site and its hazards. For these same reasons, it is also suggested that the SSO participate in the SSHASP preparation process. Qualifications for an SSO are included in Section 4.

SSOs are provided by a variety of sources: the ER/HS Support Team (when field operations are performed entirely by LANL personnel); the ER subcontractor managing the field operation; LANL's support services subcontractor; or another subcontractor. ER subcontractors are expected to staff the SSO position without drawing upon the resources of the ER/HS Support Team.

The industrial hygiene technician is a designated field team member who is capable of monitoring worker exposures to hazardous substances. This position is not required for all field projects, but may prove to be a useful addition if the demands of the field project on the SSO are too great -- e.g., exposure monitoring required in the EZ at the same time the SSO is needed in the SZ to maintain site control. The industrial hygiene technician may also be in training to become an SSO.

The various health protection personnel roles and responsibilities are contained in Section 3.6 of this document. If non-ESH-1 personnel (including LANL personnel) perform any of these roles, ESH-1 must pre-approve the personnel and issue a radiological surveillance authorization agreement (RSAA) (see ER Project Standard Operating Procedure Addendum ESH-1-01-03, Radiological Surveillance Authorization Agreement at rear of Section 3).

The level of the health protection person (i.e., RSP versus HPT versus RCT) required to support the field project is dependent upon the degree of radiological hazard at the project. The scope of activity permitted for the various health protection positions and the action levels at which the higher health protection positions may be required are determined by ESH-1. Standard language contained in Section 6 of the Model SSHASP identifies the minimum staffing coverage required by ESH-1 for actual site conditions. For further guidance, contact the ESH-1 ER/D&D Team Leader (667-7137).

6.7 STOP WORK ACTIVITY AND ORDERS

6.7.1 Stop Work Activity

Workers will stop work on any LANL activity they are performing that poses a clear and imminent danger to the environment or the safety and health of workers. Work activity may be stopped by:

- a worker performing the activity
- a supervisor responsible for the activity
- an ES&H discipline expert, including the SSO, the Field Unit Health and Safety Representative, DOE personnel, and ES&H auditors and assessors.

If a worker observes an activity that needs to be stopped, she/he must notify the SSO or FTL/JS. The SSO or FTL/JS shall, in turn, verbally notify supervisors and workers on the site of suspected dangerous conditions or practices. Once it has been concluded that conditions or practices exist that pose a threat to the safety or health of personnel or the environment, the FTL/JS or other onsite supervisor or manager shall take action to diminish the immediate threat of harm. Operations shall be discontinued while efforts are taken to eliminate the danger. Authorization to begin the activity /again shall be given by the FTL/JS only when it has been determined that hazards have been sufficiently abated and there is no further threat of harm. The FTL/JS is responsible for notifying the FPL and Field Unit Health and Safety Representative of a stop work activity. Note: A single activity may be stopped without stopping an entire field operation.

6.7.2 Stop Work Order

An individual observing an activity that presents a clear and imminent danger to the environment or to the health and safety of personnel has the authority to initiate a stop work **activity**, as described in Section 6.7.1. A formal ("contractual") stop work **order**, an action that results in the cessation of the entire operation, can only be issued by a LANL Contract Administer. Experts from ESH Division may provide recommendations regarding the need to issue a stop work order by notifying the Field Unit Health and Safety Representative or the FPL, who, in turn, will contact the Contract Administrator to arrange for review of the matter. The stop work order will then be conducted in accordance with established LANL procedures.

7.0
Training

7.0 TRAINING

A properly trained field team is vital to the success of a field project. Section 10 of the HASP provides both a summary of the general health, safety, environment, and transportation training requirements for field operations and a summary of the training provided by ESH-13, the LANL ES&H Training Group. Section 10 of a completed SSHASP details the specific requirements for an individual field project.

LANL employees and contract labor employees are eligible to take LANL courses offered by ESH-13. Subcontractors are eligible to take the following LANL courses without special authorization:

- General Employee Training (GET)
- Radiological Worker I
- Radiological Worker II
- Waste Documentation Forms

Subcontractors are responsible for all other training courses. At the discretion of the FPL, however, subcontractor personnel may attend any course offered by ESH-13. Written authorization from the FPL to ESH-13 (including worker name, course number, and cost and program code) is required for these situations. A subcontractor's employees will be allowed to register for classes only if a written authorization has been received by ESH-13. Any questions regarding this procedure should be referred to the ESH-13 Team Leader for the Records and Procedures Team (665-8251, MS J596, Fax 665-4859). Note: Individuals participating in ESH-13-sponsored training shall meet course prerequisites established by ESH-13. A common example of a prerequisite is the submission to ESH-13 of documentation of 40-hour/24-hour initial HAZWOPER training before attendance is permitted at ESH-13-sponsored HAZWOPER refresher training.

To register for ESH-13 training classes, contact 667-0059.

LANL offers additional training courses, necessary for select Project activities, that are coordinated by organizations outside of ESH-13. The following information is provided to assist in registering for these courses:

- High Explosives (HE) Awareness Training - Contact DX-16 at 667-4574 or 667-8353.
- HE Spot Test Kit Training - Contact DX-16 at 667-8239.
- Hazardous Materials Packaging and Transportation (HMPT) Training - Contact BUS-6 at 667-1038. Note: HMPT training conducted by non-LANL organizations is acceptable if it meets with BUS-6's approval.

8.0
Medical Surveillance

8.0 MEDICAL SURVEILLANCE

The criteria for Project workers who are to be included in a medical surveillance program are provided in Section 11 of the HASP. A medical surveillance program includes a baseline medical evaluations, annual examinations thereafter, and exit examinations. Note: A worker may decline to participate in an exit physical. If this should occur, she/he must then sign an exit physical examination waiver. An example of an exit physical examination waiver form is included at the rear of this manual as Appendix B. Use of this specific form is not required.

LANL employees and support services subcontractor employees shall participate in LANL's medical monitoring program. To arrange for participation in this program, the FPL/DPL (or designee) should contact ESH-2, the Occupational Medicine Group (667-7890). ESH-2 should be contacted no less than four weeks before field work is to begin to allow sufficient time for the examination to be scheduled, results to be evaluated, and follow-up tests (if necessary) to be done. If a worker is expected to wear respiratory protection, an additional two weeks lead time should be allowed. (This is necessary because the worker will also have to be respirator trained and fit tested, and training and fit testing do not occur until ESH-2 has approved the worker's medical examination results.)

All subcontractors, including those that provide contract labor employees, shall maintain their own medical monitoring program. (Note: Exceptions to this policy may be made on a case-by-case basis, at the discretion of LANL.) Evidence of each Project worker's participation in such a program (e.g., certificate of medical evaluation, as described in Section 11 and Appendix E of the HASP) shall be provided to the Medical Records Department of ESH-2 (MS D421) before the worker begins field work and following each annual medical evaluation. ESH-2 will not approve/disapprove each worker's medical evaluation or coordinate additional or supplementary tests. The subcontractor will be responsible for ensuring that its medical services provider conducts high quality, comprehensive medical evaluations. The medical services provider's determination of a worker's medical fitness for duty will be particularly critical. It is important to add that quality and comprehensiveness of medical examinations will be a criterion during the subcontractor's performance evaluation.

Injuries and Illnesses

All injuries/illness that occur during normal business hours and do not require hospital emergency care should be referred to ESH-2 -- whether the injury/illness involves LANL employees, contract labor employees, support services subcontractors, or ER subcontractors.

Plutonium Wound Counting

A plutonium wound count is required if a wound occurs in a work area (including the EZ, CRZ, and SZ) where plutonium (or another alpha-emitting transuranic) is a suspect contaminant and if:

- alpha contamination is found in the vicinity of the wound;
- alpha contamination is found on the object which caused the wound;
- the object which caused the wound cannot be monitored, but is suspected, for any reason, of being plutonium contaminated; and
- the worker or her/his supervisor specifically requests a plutonium wound count.

Both ESH-2 and the Los Alamos Medical Center decontamination facility (662-2455) are capable of performing plutonium wound counting.

9.0
Dosimetry and Bioassays

9.0 DOSIMETRY AND BIOASSAYS

9.1 DOSIMETRY

To demonstrate compliance with radiation safety standards, external dosimetry monitoring is required for all workers (LANL employees, LANL contract labor employees, and subcontractors) who are likely to exceed 2% of the annual whole body effective dose equivalent limit of 5 rem. Therefore, if there is potential to receive 100 mrem per year, participation in the external dosimetry monitoring program is required. Although it is unlikely that personnel conducting sampling activities at ER sites will receive 100 mrem, LANL has decided that thermoluminescent dosimeter badges (TLDs) shall be required for personnel at ER sites.

For LANL and subcontractor organizations directly covered by the LANL radiation safety program, TLDs are issued by ESH-4 to personnel conducting sampling activities at ER sites, after review of the Employee Health Physics Checklist (ES&H form #1538) by ESH-12. For subcontractor organizations covered by a LANL-approved radiation safety program that specifically addresses dosimetry, TLDs are issued according to the subcontractor's approved procedures.

9.2 BIOASSAY

Baseline and periodic bioassay, including *in vivo* (e.g., whole body count) and/or *in vitro (e.g., urinalysis)*, may be required for ER personnel depending on such factors as the work area and job duties. For LANL and subcontractor organizations directly covered by the LANL radiation safety program, the dosimetry services team of ESH-12 in conjunction with the ESH-1 ER/D&D Team Leader determine whether or not ER field team personnel participation in the bioassay program is required.

The following procedure is to be followed to ensure compliance with Project bioassay requirements:

- All new Project employees, both laboratory and subcontract personnel, shall complete a HP Checklist to document prior exposure and shall attend a Health Physics Checklist Orientation. (NOTE: This also includes returnees that worked at other facilities this year where they may have received occupational exposure. All exposure received during the current year must be obtained to demonstrate compliance with 10 CFR 835.202.) Baseline *in vivo* and *in vitro* bioassay requirements shall be determined at this time based on any previous (non-LANL) exposure potential.

- If it uncertain that a field team member has an HP Checklist on file with ESH-12, submit the individual's name and Z # to the ESH-1 ER/D&D Team Leader.

- After the review of the SSHASP, ESH-1 and ESH-12 shall indicate in Section 6.2, Table 6-2, what the dosimetry requirements are for each task.

- If it is indicated that site-specific bioassay requirements are not required, it is not necessary to fill out a new HP Checklist.

- If it is indicated that bioassay are required for a task and the individual will be working on that task, fill out a re-evaluation HP Checklist and attach Table 6-2 to the checklist. This will need to be done for all sites having additional bioassay requirements in Table 6-2.

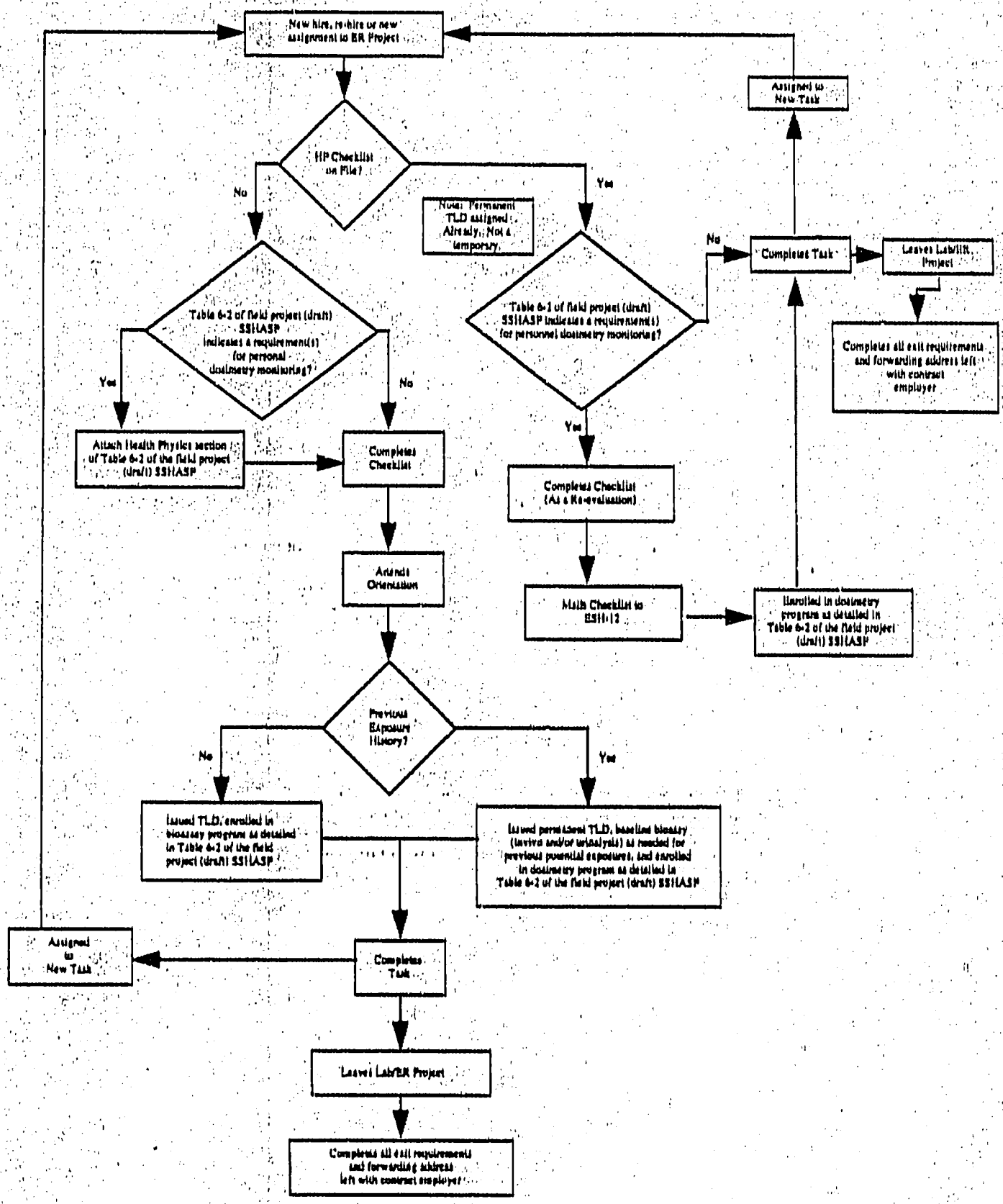
- Submit all re-evaluation checklists to ESH-12 HP Checklist Office @ MS K483. If the HP Checklist is for a re-evaluation, attendance at the orientation is not required and only the checklist need be mailed to the HP Checklist Office.

- To avoid delays, submit the HP Checklist as far in advance (at least two weeks if possible) to the start of field work.

For subcontractor organizations covered by a LANL-approved radiation safety program that specifically addresses bioassay, *in vivo* and *in vitro* monitoring will be performed according to the subcontractor's approved procedures.

Whether such biological monitoring requirements are based on a LANL or subcontractor radiation safety program, if the scope of work or potential radiological hazards change, a reevaluation of the bioassay requirements should be performed.

The process flows as follows:



10.0
Personal Protective Equipment

10.0 PERSONAL PROTECTIVE EQUIPMENT

A procedure addressing PPE has been developed and is located at the end of this section. The procedure describes the recommended levels of PPE for potentially hazardous activities that may be performed under the Project. It also covers the proper use of PPE, its limitations, and training requirements associated with its use.

Radiological Protective Clothing

ESH-1 will require no alternate or supplementary clothing until a specified radiological action level is exceeded. When this level is exceeded, a full set of protective clothing will be required. For radiological purposes, a full set of protective clothing consists of

- Anti-C coveralls (cloth or Tyvek);
- Gloves; and
- Yellow rubber booties.

General requirements for radiological protective clothing are covered in the ESH-1 Procedure ESH-1-08-01, "Radiological Protective Clothing Standard," and the addendum to that procedure for ER work [available from the ESH-1 ER/D&D Team Leader (667-7137)].

Respiratory Protection

The PPE procedure (located at the end of this section) addresses conditions necessitating the use of respiratory protection. LANL employees, contract labor workers, and support services subcontractor personnel requiring the use of respiratory protection shall participate in LANL's respirator protection program. Project subcontractors (other than the support services subcontractor) are expected to implement and maintain their own respiratory protection program -- one that has been developed in accordance with specific criteria that have been provided by LANL. Once this program has been developed, subcontractor workers requiring the use of respiratory protection shall participate in the subcontractor's program and use respiratory equipment supplied by the subcontractor.

LANL employees and contract labor employees supporting the Project and wishing to participate in the LANL respiratory protection program, and who have received approval from their supervisor, should contact the ER/HS Support Team secretary (TA-59-119, MS K494, 665-7221). The secretary will send the requester a Form 1465, Request for Respiratory Protection Evaluation and Medical Approval for Personal Protective Equipment. The top half of the form is to be completed and returned to the secretary. When proper approvals are secured, the requester will be contacted for a respirator fitting. After the first fit test, LANL employees will be contacted periodically (typically once a year, although asbestos and lead workers require a refit every six months) by the respiratory protection section of ESH-5 to complete an updated Form 1465 and to schedule a refit. A copy of the completed Form 1465 should be forwarded to the ER/HS secretary to ensure that respiratory protection program participation records for Project personnel remain current.

Support services subcontractor personnel supporting the Project and wishing to participate in the LANL respiratory protection program should contact their department superintendent to initiate the program admission process. The support services subcontractor arranges for worker participation in the medical surveillance program and completion of Form 1465, and coordinates the respirator fit test with the respiratory protection section of ESH-5.

A limited period of time (which will be formally communicated to the Project subcontractors) will be permitted for the subcontractor to develop/implement a respiratory program that meets LANL criteria. During this limited period, subcontractor personnel will be allowed to participate in the LANL respiratory protection program. To initiate/continue participation in this program, a formal request (e.g., letter, memorandum) should be submitted to the ER/HS secretary (TA-59-119, MS K494, 665-7221) containing the following information:

- Purpose of request (e.g., request for use of full-face air purifying respirator)
- Employee name;
- Employee Z-number (or social security number, if employee does not have a Z-number); and
- Company name and phone number.

The secretary will then send the requester a Form 1465. The top half of the form is to be completed and returned to the secretary. Proper approvals on Form 1465 will be secured, and ESH-2, the Occupational Medicine Group, will be contacted to verify that the worker has received medical approval for respirator use and hazardous waste operations. (The subcontractor is expected to provide ESH-2 with medical surveillance documentation authorizing each of their hazardous waste operations workers for such work.) The subject worker will then be contacted for a respirator fitting. Questions regarding the status of a request for respirator program participation should be directed to the ER/HS secretary.

Note: Typically, a subcontractor who is already in the LANL respirator program will not be contacted by ESH-5 for the periodic refit. It is the responsibility of the subcontractor to initiate a formal request (to the ER/HS secretary) for continued participation in the LANL respiratory protection program.

The subcontractor should submit a request for LANL's respiratory protection program participation at least eight weeks prior to the need for respirator use.

11.0
Sampling + Exposure Monitoring

11.0 SAMPLING AND EXPOSURE MONITORING

Sampling and exposure monitoring is performed in order to evaluate the hazardous conditions posed by chemical substances, radiological substances, and physical conditions. Sampling and exposure monitoring at Project sites generally falls into two categories: health physics (or radiological) monitoring and industrial hygiene sampling and/or monitoring. Most field projects will involve both categories.

To promote greater consistency within the Project, sampling and exposure monitoring procedures and methods have been developed. These procedures and methods include, as appropriate, procedures and forms for use, calibration, and maintenance of commonly used equipment and instruments.

To access the procedures that have been developed for radiological monitoring instruments, contact the ESH-1 ER/D&D Team Leader (667-7137). Field projects choosing to use alternate procedures may do so, providing that the procedures have been LANL-approved.

Methods for industrial hygiene sampling and monitoring are located at the end of this section and address the following:

- Photoionization Detector
- Flame Ionization Detector
- Combustible Gas Indicator
- Colorimetric Detector Tube
- Mercury Vapor Analyzer
- Real Time Aerosol Monitor (RAM)
- Noise Dosimeters and Sound Level Meter
- Personal Air Sampling Apparatus

To support the gathering of information necessary for select sampling and monitoring activities, a method addressing meteorological stations has also been developed, and is included at the end of this section.

Field projects choosing to use alternate methods for industrial hygiene sampling and monitoring may do so. However, such methods must be included in the SSHASP (or accompanied by a SSHASP modification form) for LANL review and approval.

11.1 HEALTH PHYSICS SAMPLING AND MONITORING

To assure radiological controls are being maintained, surveys using direct-reading instruments are to be conducted periodically in radiologically controlled areas and/or the exclusion zone (EZ), contamination reduction zone (CRZ), and support zone (SZ). Additional monitoring (e.g., air sampling, dose rate determinations) may also be required. Such monitoring will be indicated on a Radiation Work Permit (RWP) that has been generated for the work activity. It is also valuable to have a survey of the proposed work site done before any intrusive work is started (i.e., pre-job survey).

To conduct surveys, health physics personnel shall use radiological instruments calibrated and maintained by ESH-4; or by an alternate means approved by ESH-4. Subcontractors shall abide by this requirement, unless the subcontractor's radiological safety program, which includes identification of instruments and corresponding procedures, has been appropriately submitted to and approved by LANL (e.g., during pre-bid qualification process, contract negotiation period, SSHASP approval process).

If radiological action levels set by the SSHASP and/or ESH-1 are exceeded, health physics personnel shall specify any additional contamination control and monitoring requirements in an RWP. Factors such as suspected radiological contaminants, dispersibility, dust generation, wind conditions, weather, and the potential for resuspension of radioactive particulates will be considered in this determination. If air sampling is required, grab sampling will be the most probable sampling method (e.g., using high volume samplers). In some cases, however, continuous air monitors (CAM) may be used. Air samples taken to determine worker exposure to airborne radioactive particulates must be evaluated by the Health Physics Analytical Laboratory (HPAL), unless a written variance is obtained from ESH-4. NOTE: Use of the HPAL/obtaining a variance is not required if a subcontractor has a LANL-approved radiological safety program that includes an alternate sample analysis approach.

ESH-1 and ESH-12, with the cooperation of the employee, the employee's supervisor, and/or the Field Unit Health and Safety Representative, determines dosimetry and biological monitoring requirements for each individual, based on the field project an individual will be working at. Unless otherwise specified in a LANL-approved radiological safety program, the Employee Health Physics Checklist is the document used for recording the field project conditions to which the individual will likely be exposed. Should site conditions (e.g., identification of previously unknown isotopes) or project scope of work change, the Employee Health Physics Checklist should be revised and routed to ESH-12 for redetermination of appropriate worker dosimetry and biological monitoring requirements.

11.2 INDUSTRIAL HYGIENE SAMPLING AND MONITORING

Industrial hygiene exposure sampling and monitoring includes measurements of metals, solvents, noise, and other chemical and physical agents. Industrial hygiene measurements may be taken at a single point in time (e.g., using direct-reading instruments) or over a specific time period (i.e., integrated sampling). A measurement may also be taken as an area sample (i.e., to determine exposure within a given area) or as a personal sample (i.e., to determine exposure to a specific individual).

11.2.1 Direct Monitoring

Direct monitoring is used at Project sites to provide a real-time indication of contaminant concentrations. Although they provide instantaneous results, direct-reading instruments often lack specificity for the substance of interest. Most often, direct-reading instrument indications are compared to action levels specified in the SSHASP. Results of direct monitoring provide an indication of the need for integrated sampling.

As noted earlier, several standard methods (located at the end of this section) have been developed to guide direct-reading monitoring activities. Included in these methods are standard forms which may be used to record monitoring results. While the use of these specific methods and the associated forms is not required, LANL expects and good industrial hygiene practice dictates the use of methods and records that provide equivalent information.

Direct-reading measurement of sound levels may be required at Project sites, particularly when site activities include the use of heavy equipment (e.g., drill rigs). Measurements may be taken with the use of sound level meters. Such meters may be used as follows:

- To identify an operation requiring engineering controls to reduce excessive noise.
- To identify areas where hearing conservation measures may be needed.
- To evaluate the effectiveness of engineering controls employed to reduce sound levels.
- To determine areas where and personnel for whom noise dosimetry (i.e., integrated personal sampling) is needed.

It is important to note that, under the Project, LANL has adopted a dual approach and standard for sound level monitoring and action levels, respectively. Operations involving non-LANL employees may be monitored by both LANL and non-LANL health and safety personnel. However, should operations requiring sound level monitoring include LANL personnel, the Field Unit Health and Safety Representative must be contacted for further guidance. The reason for this is because non-LANL personnel follow the OSHA regulation for occupational noise exposure, 29 CFR 1910.95, whereas LANL personnel follow a more restrictive noise standard, Air Force Regulation 161-35.

11.2.2 Integrated Sampling

Integrated industrial hygiene sampling involves collection of samples or measurements over a specific time period (e.g., throughout a work shift). Although it is designed to be specific for the substance of concern, integrated sampling often involves delays due to the need for laboratory analysis of the samples. The sampling method selected (e.g., NIOSH, OSHA) must be documented in the SSHASP or on the SSHASP modification form.

Integrated sampling may need to be done when:

- Direct-reading instruments are insufficient to fully assess exposure.
- Direct-reading instrument measurements in the worker's breathing/hearing zone are above action levels.
- Documentation of the adequacy of respiratory protection is needed.
- Documented compliance with regulatory requirements of substance-specific standards (see note below) is needed.
- Visible evidence of suspected airborne contamination is observed.

Note: Chemical substances that require specific monitoring under OSHA regulations include, but are not limited to:

- asbestos (1910.1001, 1926.1101)
- lead (1910.1025, 1926.62)
- vinyl chloride (1910.1017, 1926.1117)
- inorganic arsenic (1910.1018, 1926.1118)
- cadmium (1910.1027, 1926.63)
- benzene (1910.1028, 1926.1128)
- formaldehyde (1910.1048, 1926.1148)

OSHA regulations require baseline monitoring for lead and arsenic. Furthermore, OSHA requires initial monitoring for many other compounds **unless** it can be documented why the Permissible Exposure Limit would not be expected to be exceeded.

Also, beryllium is a Department of Energy (DOE) regulated substance that may require integrated sampling. [LANL Administrative Requirement (AR) 6-7, Beryllium, provides additional information on work involving beryllium.]

Some sampling requires a bulk sample and specialized equipment. For example, respirable silica sampling involves submitting a bulk sample of the dust or soil being sampled along with the respirable dust sample. (The samples are collected using NIOSH method #7500.) The Field Unit Health and Safety Representative may be a useful resource when special or complex sampling protocols are required.

For a more complete listing of OSHA-regulated toxic and hazardous substances, refer to Subpart Z of 29 CFR 1910. Also, refer to LANL AR 6-1, "Chemicals," and LANL AR 6-3, "Use of Chemical Carcinogens." If any of these substances have been identified as a possible hazard requiring monitoring, refer to the OSHA regulations for instructions.

As previously noted, standard methods for personal air sampling and noise dosimetry (located at the end of this section) have been developed to guide integrated monitoring activities. Included in these methods are standard forms, which may be used to record monitoring results. While the use of these specific methods and the associated forms is not required, LANL expects and good industrial hygiene practice dictates the use of methods and records that provide equivalent information.

To reiterate, under the Project, LANL has adopted a dual approach for sound level monitoring. Operations involving non-LANL employees may be monitored by both LANL and non-LANL health and safety personnel. However, should operations require noise dosimetry and include LANL personnel, the Field Unit Health and Safety Representative must be contacted for further guidance. The reason for this is because non-LANL personnel follow the Occupational Safety and Health Administration (OSHA) regulation for occupational noise exposure, 29 CFR 1910.95, whereas LANL personnel follow a more restrictive noise standard, Air Force Regulation 161-35.

11.3 ANALYSIS OF SAMPLES

Analyses for collected radiological samples shall be performed by LANL's HPAL, a mobile extension of the HPAL, or as indicated in a subcontractor's LANL-approved radiological safety program. Analyses for collected chemical samples shall be performed by American Industrial Hygiene Association (AIHA) accredited laboratories.

On occasion, a sample collected for industrial hygiene monitoring purposes may be taken at a potentially radiologically contaminated site. To ensure that radiologically contaminated samples are handled appropriately and are not unintentionally shipped offsite, the following approach must be taken:

- If sampling in an area where radiological monitoring instrumentation indicates that the action levels for airborne radioactivity have not been reached, and field screening instruments for alpha and beta/gamma indicate that the exteriors of the sampling apparatus are also below action levels, the samples may be shipped offsite.
- If sampling in an airborne radioactivity area, take dual samples. At the close of the sampling period, open one of the samples and screen it for the presence of radiological constituents. If it is below action levels, the unbreached sample may be shipped offsite.
- In the event the exterior and/or interior of a sample is identified as being above radiological action levels, contact the Field Unit Health and Safety Representative for further guidance.

11.4 WORKER EXPOSURE REPORTING

Exposure monitoring results (including both direct and integrated results) indicating worker exposure above OSHA Permissible Exposure Limits (PEL) shall be communicated to each worker for whom the monitoring and/or sampling activity was conducted. Monitoring and sampling results below this threshold should be communicated to each worker for whom the monitoring and/or sampling activity was conducted, although such notification is not required. As monitoring and/or sampling is typically conducted for select individuals as an indicator of potential maximum exposure to a group of workers (i.e., representative/worst case sampling), the results should also be communicated to other affected workers. The important information to convey is the results of the monitoring/sampling activity and the resulting action plan (if appropriate); information indicating the identity of the individual(s) monitored/sampled should remain confidential.

Measurements taken with direct-reading instruments shall be recorded, and the original records maintained onsite for worker review. Sample direct-reading measurement recordkeeping forms for

industrial hygiene equipment are included in the standard operating methods for direct-reading instruments located at the end of this section. (Note: Use of these specific methods is not required. Alternate methods may be used if included in an approved SSHASP or with an approved SSHASP modification form.) Forms for documenting radiation monitoring results may be obtained from the ESH-1 ER/D&D Team Leader (667-7137).

Integrated sampling measurements shall be recorded, and the original records maintained onsite, with the field project files. Sample forms for use in recording sampling results and communicating these results to workers are included in the personal air sampling method (also optional) located at the end of this section. Information indicating the identity of the individual sampled should be retained in a manner that preserves confidentiality.

In addition to retaining records in the project file and notifying affected workers, results of monitoring shall be handled as follows:

- Communicate results verbally to the Field Unit Health and Safety Representative, if direct-reading instrument industrial hygiene action levels are exceeded.
- Communicate results verbally to ESH-1, if direct-reading instrument radiological action levels are exceeded.
- Provide a copy of all integrated industrial hygiene sampling results to the Field Unit Health and Safety Representative (for LANL recordkeeping purposes).
- Provide a copy of all integrated radiological sampling results to ESH-1 (for LANL radiological recordkeeping purposes).
- Provide a copy of sampling results to the worker's employer whenever personal exposure monitoring is performed.
- Provide verbal and written communication to field team management as directed by the FPL (or designee).

11.5 SETTING ACTION LEVELS

Setting action levels is an art as well as a science. These determinations draw upon professional knowledge and creativity to identify the point beyond which environmental exposures or stresses may be harmful to workers.

Health physics action levels for the Project have been set by LANL and are pre-printed in Section 6 of the LANL ER Project Model Site-Specific Health and Safety Plan (SSHASP).

Industrial hygiene action levels are set during the SSHASP preparation process and as needed during field activity. The following sources of information may be useful in determining appropriate industrial hygiene action levels:

- The ACGIH Threshold Limit Value (TLV) list is commonly used to identify the upper limit of safe exposure for a particular substance or physical agent. This list is reviewed and updated annually by a committee of experts, and then republished by the ACGIH.

- OSHA PELs are legal exposure control limits. As considerable time has passed since adoption of many of these limits, more recent data may indicate a need for reduced action levels.

- NIOSH Pocket Guide to Chemical Hazards is a source of general industrial hygiene information. It includes chemicals or substance groupings (e.g., cyanides, fluorides) that are found in the work environment and that have existing OSHA regulations. This document is updated periodically to reflect new data regarding toxicity of various substances and any changes in exposure standards or recommendations.

- American Industrial Hygiene Association (AIHA) Hygiene Guides have been published for more than 150 materials. Each guide contains a summary of toxicological information, including a maximum acceptable concentration (which is usually identical to TLV for the year of publication).

11.6 DETERMINING EXPOSURE MONITORING STRATEGIES

A single exposure monitoring strategy cannot be established for all situations. Several factors must be taken into consideration:

Collection Techniques -- Samples taken for the purpose of measuring worker exposure normally should be obtained using personal methods (i.e., the sampling device is attached to the worker) or breathing zone methods (i.e., the sampling device is held in the worker's breathing zone, a sphere approximately two feet in diameter surrounding the head). If samples are taken as general area samples and are to be used for determining worker exposure (e.g., sound level surveys), time and motion must be tracked.

Sampling Location -- If the purpose of the sampling is to define a potential hazard, samples should be taken in the vicinity of the source. If, instead, the purpose is to evaluate a worker's exposure, samples should be taken as near as practical to the worker's breathing zone.

Whom to Sample -- Samples are usually obtained for the most highly exposed worker. In general, the most logical and the simplest means of identifying the most highly exposed worker is to observe and select the individual who is closest to the source of the hazardous air contaminant being generated. Air movement patterns should be noted to ensure that the individual closest to the source is, in fact, the most highly exposed.

When to Sample -- Sampling should be performed in accordance with the SSHASP. Consideration should be given to sampling when operations change, and at different times of the day and under varying weather conditions -- to ensure that monitoring is representative of overall field site conditions.

How Long to Sample -- For personal air sampling, refer to the specific method used and instrument manuals for determining appropriate sampling durations. The volume of air sampled and duration of sampling is based on the sensitivity of the analytical procedure or direct-reading instrument, the estimated air concentration, and the OSHA standard or the TLV for the particular contaminant. The duration of sampling typically correlates to a complete activity cycle. The evaluation of a worker's daily time-weighted average (TWA) exposure is best accomplished by having the individual work a full shift with a personal sampler. Note: The OSHA standards require that a full-shift, eight-hour sample be obtained for an eight-hour TWA exposure limit comparison, or a short-term sample can be obtained when the Permissible Exposure Limit has a ceiling value or peak concentration limit.

How Many Samples to Take -- There is no set rule to determine the number of samples that are necessary to evaluate a worker's exposure; the number of samples depends on the purpose of the sampling. For data reliability purposes, a statistically-based sampling approach should be considered. If assistance is needed, the Field Unit Health and Safety Representative is a resource in determining appropriate sample quantities.

The following is a suggested general monitoring approach where significant exposures to contaminants are not initially anticipated:

1. Use direct-reading instruments to monitor at the operational source point where the highest level(s) of gases, vapors, or particulates would be expected to be generated (e.g., at the point where potentially contaminated soils are disturbed). (It is important to remember that

such instruments respond in the presence of many different contaminants; they do not indicate which one.) Use of data logging equipment (to identify peaks) is encouraged.

2. If the instrument indicates the presence of gases, vapors, or particulates, monitor in the worker's breathing zone. If multiple readings are taken and levels differ, record all levels but use the highest level for comparison with the SSHASP-specified action levels.

3. If the direct-reading instrument indicates the presence of contaminants above action levels, allow the area to vent (naturally or by mechanical means) and/or explore alternate engineering controls (e.g., dampening soils to control dust generation). Conduct additional direct-reading monitoring to verify the efficacy of the engineering controls.

4. If action levels continue to be above specified levels <u>and</u> the potential contaminant of concern is capable of being monitored with colorimetric tubes, employ the use of such a direct-reading device. Note 1: The tube used must be selected specifically for the contaminant of concern. Note 2: When determining the contaminant to be monitored, select the most restrictive of the contaminants that may be leading to the elevated instrument readings.

5. If colorimetric tube monitoring results do not indicate the presence of the contaminant, the action level may be increased to the action level of the next most restrictive potential contaminant. If the new action level is reached, repeat step 4, as appropriate.

6. If colorimetric tube analysis reveals unacceptable levels or if colorimetric tubes are not available for monitoring the specific contaminant of concern, upgrade the level of personal protective equipment (e.g., respiratory protection for inhalation exposure, protective clothing for dermal exposure). Initiate personal air sampling to ensure that concentrations of contaminants are not so excessive that they would overwhelm the ability of the respiratory protective equipment to reduce worker exposure to below the action level.

11.7 HEAT STRESS

Heat stress is a significant health concern for field project workers during warmer periods of the year. The SSHASP calls for reference to a procedure for controlling this exposure. While there is currently no universally accepted heat stress management approach within the health and safety community, the following method incorporates a multi-faceted approach that is consistent with much of the available research on and philosophy of heat stress control. LANL organizations and subcontractors may use alternate methods, if these methods provide adequate exposure control.

A. PURPOSE

To establish minimum requirements to protect workers exposed to hot environments.

B. DEFINITIONS

(1) **Acclimatized.** Workers who have developed physiological adaptation to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures without stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat; and much of its benefit may be lost if exposure to hot environments is discontinued for a week.

(2) **Chemical protective clothing** is defined as, but not limited to, clothing which is constructed of relatively impermeable materials with the intent to act as a barrier to physical contact of the worker with potentially hazardous materials in the workplace. Such materials include: Tyvek™ coveralls (all types), CPF™ Series coveralls, and polyvinylchloride (PVC) coveralls and rain suits.

(3) **Unacclimatized.** Workers who have not been exposed to hot work conditions for one week or more, or who have become heat-intolerant due to illness, or other reason.

C. GENERAL REQUIREMENTS

Heat stress (hyperthermia) is a common hazard to workers on projects involving exposure to hazardous substances, most particularly when impermeable protective clothing is used. This problem can occur at ambient temperatures below what is normally considered "hot weather." The body normally sheds excess heat primarily through radiation (capillaries in the skin dilate, transferring heat from the body core to the surface), and evaporation of sweat. Thermodynamically, evaporation is much more effective than radiation. Heat stress results when the body's regulating mechanisms are inadequate to dispose of internally generated, and externally supplied heat.

Heat is normally generated internally through metabolic processes, and the quantity of heat generated corresponds to the level of muscle activity. External heat sources include radiant bodies (the Sun, furnaces, fires, etc.), and convection (temperature difference between the skin and ambient air). External heat gain can occur through conduction from hot surfaces, but this is normally not significant since such contact will be avoided. (It could be a very important factor if immersed in water, however.)

The overall heat balance of a human can be written as an equation:

$$H = M \pm R \pm C - E$$

where:

H = body heat burden
M = metabolic heat gain
R = radiant or infrared heat load
C = convective heat load
E = evaporative heat loss.

The "normal" person maintains a core body temperature of 37°C ± 1°C, (98.5°F ± 1.8°F). Core body temperatures should not exceed 38°C (100.4°F) as a result of the total heat burden. Heat stroke occurs when the core temperature is greater than 40°C, and death is probable at core temperatures ≥42°C.

Working outdoors in hot, sunny weather places the worker under increased heat load from M, R, and C. If the heat loss from E, is less than the sum of M, R, and C, the total body heat balance will increase. Unfortunately, the use impermeable protective clothing can reduce the heat loss from E to near zero.

D. IMPLEMENTATION

(1) Recommended Controls

(a) Note that the guidelines discussed in this section are only intended to be used as a means for initial establishment of a work-rest regimen. It will be the responsibility of the Site Safety Officer (SSO) to evaluate the conditions at a specific site and make final determinations of the work-rest regimen.

(b) Heat stress is difficult to control in environmental work. Most work takes place outdoors, and, in much of the country, during the spring and summer months. There are three factors that impact on control of heat stress: worker acclimatization, replacement of fluid lost through sweating, and reducing work schedules.

(i) Acclimatization is the process by which the body adapts to higher environmental temperatures, and is very significant in preventing heat related illnesses. Acclimatization is a gradual adaptation requiring seven to ten days to complete. In an acclimatized worker, the heart rate is lower, the resting body temperature is lower, sweating begins more rapidly, and the sweat is more dilute (less salt loss). Acclimatization is temporary, and much of the benefit can be lost if the worker is not exposed to heat stress for a week or so. Lack of acclimatization is the reason heat-related illnesses are more common, and more severe in the early summer.

(ii) Replacement of lost fluids is critical for all workers, whether acclimated or not. Intake of fluid needs to be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating. Two 8 oz. glasses of water should be taken **prior** to beginning work, then up to 32 oz per hour during the work shift; fluid replacement at frequent intervals is more effective. The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration, and may increase loss of water. If commercial electrolyte drinks (Gatorade, Squincher, etc.) are used, the drink should be diluted one-third to one-half with water, or 8 oz of water should be taken with each 8 oz of electrolyte. Additional salt is usually not needed; and **salt tablets should never be taken.** Replacement fluids should be cool, but not cold.

(iii) A reduced work schedule lowers the contribution of the metabolic heat gain by periodically reducing the level of activity. Breaks should be taken in a cool, shaded location, and any impermeable clothing should be removed. Dry clothing or towels should be available to minimize chills when taking breaks, but paperwork, and other similar light tasks may be performed.

(iv) Other controls include working at night or during the cooler parts of the day (6 a.m. - 10 a.m., 3 p.m. - 7 p.m.), erecting a shade over the work area, and use of cooling garments. The last option is expensive and logistically difficult to implement.

(c) Work Schedules

(i) Work schedules providing periodic rest periods need to be implemented when workers are exposed to heat stress. Schedules may be developed based on instrumental measurements of the environment (temperature, radiant heat, humidity, and wind speed) with the resulting measurement compared to published guidelines (NIOSH REL, ACGIH TLV, for Heat Stress). When using this method, allowance needs to be made for the use of impermeable protective clothing.

(ii) Alternate methods of establishing a work schedule are based on measuring physiological indices (heart rate, or oral temperature), which correlate to the core body temperature. Oral temperature does not correlate well to increasing core temperature (during heat exhaustion, it may be normal or even depressed due to extreme peripheral vasodilation), and is subject to effects from drinking replacement fluids.

(iii) Measures of heart rate (pulse) appear to correlate well with heat-related stress, and can be used to estimate the impact of heat stress on individuals with differing levels of fitness (i.e., individuals with a pulse of 150/minute are experiencing about the same level of stress, even though the work output required to reach this rate will be quite higher for a fit person). The heart rate also incorporates the combined effects of environmental heat, muscle activity, and elevated body temperature, making it a useful, and easily measured variable. The procedure for controlling heat stress via establishment of work schedules based on the measurement of heart rate is presented below.

(d) The SSO should determine the potential for heat stress based on planned activities, and weather forecasts.

If the potential for heat stress exists:

(i) All site workers should be informed of the potential for heat stress during the tailgate safety meeting.

(ii) The SSO should determine if any EZ workers are at particular risk for heat stress due to illness, etc.

(iii) The SSO should assure that sufficient quantities of potable water, and electrolyte drinks are available in the decon area; and that a shaded rest area is available at, or immediately outside the decon area.

(iv) All EZ workers and relief workers should drink 16 oz. of water prior to beginning work; and at least 16 oz. during each rest period.

(v) The initial work period and monitoring frequency is set according the table in Attachment A.

(vi) Within the first minute of each rest period, each worker's heart rate (pulse) should be measured, and compared to the following:

Initial heart rate: $\leq$110 beats/minute (28 beats/15 sec).

(vii) Each worker's heart rate will be measured again three minutes later, and compared to the following:

- Recovery heart rate: $\leq$80 beats/minute (20 beats/15 sec).

(viii) If both heart rate criteria are met, the subsequent work period may be increased by one third, <u>provided the temperature remains constant.</u>

(ix) If the initial heart rate is > than 110 beats per minute, or the recovery rate is not less than 80 beats per minute, the subsequent work shift is decreased by one third.

(e) Additional Means of Prevention

(i) Cooling devices such as vortex tubes or cooling vests can be worn beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

(ii) All breaks are to be taken in a cool, shaded rest area.

(iii) Workers should open or remove chemical protective garments during rest periods.

(iv) Workers should not be assigned other tasks, except paperwork during rest periods.

(v) All workers should be informed of the importance of adequate rest and proper diet in the prevention of heat stress.

(vi) Workers should be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.

(2) **Training:** Those personnel potentially exposed to heat stress should receive the following training. Training provided as a part of this procedure should be documented.

(a) Workers should be trained on:

(i) Sources of heat stress, influence of protective clothing, and importance of acclimatization.

(ii) How the body handles heat.

(iii) Heat related illnesses.

(iv) Preventative/Corrective measures.

(v) First Aid procedures for heat stress.

(b) SSOs and supervisory personnel should be trained on measurement methods and calculations of heat stress indices, and establishing work schedules.

E. EXHIBITS/ATTACHMENTS

The following worker Physiological Monitoring Record as shown in Attachment B is used for documenting activities associated with this procedure.

ATTACHMENT A

Frequency of Measurement		
AMBIENT TEMPERATURE (°F)	NORMAL WORK CLOTHING[1]	IMPERMEABLE WORK CLOTHING
70°-80°	N/A	90 MIN
80°-85°	120 MIN	60 MIN
85°-90°	90 MIN	30 MIN
>90°	60 MIN	15 MIN

[1]Normal work clothing is cotton coveralls, or other cotton clothing with long sleeves and pants.

Note: Individuals with pre-existing medical conditions or restrictions contraindicating exposure to elevated environmental heat are precluded from assignments that involve exposure to high temperatures.

Note: Healthy individuals will vary significantly in their tolerance to heat, and heat tolerance can be affected by minor illnesses (cold, flu) and by prescription, and over-the-counter medications.

Note: The heart rate measure is only a part of the overall situation to be considered; other objective, and subjective symptoms of heat stress, such as: extreme fatigue, nausea, disorientation, lightheadedness, and breathlessness need to be fully considered when evaluating the adequacy of control measures.

Note: The heart rate measure will provide guidance that can be significantly different for each member of a field team based on their acclimatization, physical fitness, and heat-tolerance. If it is critical that all team members use the same work/break schedule, the schedule that accommodates the least heat-tolerant member will be observed.

ATTACHMENT B
Employee Physiological Monitoring Record for Heat Stress

Name:		Date:	
SS#/Z#:		Project Name:	
Project Location:			
Completed By:			
Pre-Work Baseline		After 5th Work Period	
Ambient Air Temperature		Ambient Air Temperature	
Heart Rate		Initial Heart Rate	
		Recovery Heart Rate	
After 1st Work Period		After 6th Work Period	
Ambient Air Temperature		Ambient Air Temperature	
Initial Heart Rate		Initial Heart Rate	
Recovery Heart Rate		Recovery Heart Rate	
After 2nd Work Period		After 7th Work Period	
Ambient Air Temperature		Ambient Air Temperature	
Initial Heart Rate		Initial Heart Rate	
Recovery Heart Rate		Recovery Heart Rate	
After 3rd Work Period		After 8th Work Period	
Ambient Air Temperature		Ambient Air Temperature	
Initial Heart Rate		Initial Heart Rate	
Recovery Heart Rate		Recovery Heart Rate	
After 4th Work Period		After 9th Work Period	
Ambient Air Temperature		Ambient Air Temperature	
Initial Heart Rate		Initial Heart Rate	
Recovery Heart Rate		Recovery Heart Rate	

11.8 COLD STRESS

Cold stress is a significant health hazard for field project workers during colder periods of the year. The SSHASP calls for reference to a procedure for controlling this exposure. The following method is provided as an approach to controlling cold stress. LANL organizations and subcontractors may use alternate methods, if these methods provide adequate exposure control.

A. PURPOSE

To establish minimum requirements to protect workers exposed to cold environments.

B. DEFINITIONS

Not applicable.

C. GENERAL REQUIREMENTS

(1) Most cold-related worker fatalities have resulted from failure to escape low environmental air temperatures, or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is a fall in the deep core temperature of the body.

(2) Hypothermia occurs when a person's body loses heat faster than it can be produced. The body's "normal" deep body temperature is 99.6° Fahrenheit. If body temperature drops to 95° Fahrenheit, uncontrollable shivers occur. If cooling continues, these other symptoms may occur.

- Vague, slow, slurred speech
- Forgetfulness, memory lapses
- Inability to use hands
- Frequent stumbling
- Drowsiness
- Exhaustion, collapse
- Unconsciousness
- Death

(3) Hypothermia can occur at temperatures above freezing. Cold, wet, windy conditions make prime hypothermia weather.

(4) Hypothermia impairs your judgement. You may not be able to make good decisions about your situation.

(5) Frostbite is the freezing of some part of the body. Fingers, toes, and even whole arms and legs can be lost as a result of frostbite.

(6) Pain in the hands and feet is felt only when temperature of the tissue is changing very rapidly. There may be <u>no pain</u> with gradual freezing.

(7) Loss of the sensations of touch, pressure, and pain may occur without awareness of any numbness or other sensation. Therefore, it is important to test these sensations often and to wear clothing that is loose and does not restrict the flow of the blood to the limbs.

(8) Exposed parts of the body should be inspected routinely. This is done best by a partner. Just before freezing, the skin - especially the face with its many blood vessels - becomes bright red. Then small patches of white appear, as freezing actually occurs.

(9) The skin also becomes less elastic. This is best noted in the finger pads, which remain pitted when touched or squeezed. Any further cooling will surely result in frostbite.

(10) Serious freezing is most common in the feet because of less awareness of them, poor circulation and sensation, and inadequate foot gear. Hands are next in order of serious injury. Exposed head parts are less likely to become frostbitten than feet because they are conditioned to exposure and have a better blood supply.

(11) Next to the extent of freezing, inadequate or improper treatment of a frozen part is the most common cause of serious loss of tissue. If you suspect you or a co-worker has experienced frostbite, seek medical attention immediately.

D. IMPLEMENTATION

(1) Workers should wear warm clothing, such as mittens, heavy socks, etc., when the air temperature is below 40-45° Fahrenheit (F). Chemical protective clothing, if required by the project, may be used to partially protect the worker from the cold.

(2) When the air temperature is below 30-40°F (depending upon worker comfort), clothing for warmth, in addition to chemical protective clothing where necessary, should be provided. This will include insulated suits, such as whole-body thermal underwear; wool socks or polypropylene socks to keep moisture off the feet if there is a potential of work activity which would cause sweating; insulated gloves [when air temperatures are extremely low (less than 5-10°F), gloves with reflective surfaces, which reflect body heat back to the hand, should be used]; boots; and insulated head cover, such as knit caps (ski caps).

(3) At air temperature **below 35°F**, the following work practices need to be followed:

(a) If the clothing of a worker might become wet on a job site, the outer layer of the clothing needs to be impermeable to water.

(b) If a worker's underclothing (socks, mittens, etc.) becomes wet in any way, the worker needs to change into dry clothing immediately. If the clothing becomes wet from sweating, the worker may finish the task which is causing the sweating before changing into dry clothing.

(c) Workers need to be provided a warm area (65°F or above) to change from work clothing into street clothing.

(d) Workers need to be provided a warm break area (65°F or above).

(e) If appropriate, space heaters may be provided in the work area to warm the hands, feet, etc. Necessary fire and electrical safety practices should be observed when using space heaters. Space heaters should be shut off when the site is not occupied.

(f) Hot liquids, such as soups, warm, sweet drinks, etc. should be provided in the break area. The intake of caffeinated beverages should be limited because of the attendant diuretic and circulatory effects.

(g) The buddy system should be practiced at all times. Any worker observed with severe shivering should leave the cold area immediately.

(h) Workers should layer their clothing, i.e., wear thinner, lighter clothing next to the body with heavier clothing layered outside the inner clothing.

(i) Avoid overdressing when going into warm areas or when performing activities which are strenuous. This could lead to a heat stress problem.

(j) Auxiliary heated versions of handwear, footwear, etc., can be used in lieu of mittens, insulated socks, etc. if extremely cold conditions exist, and if compatible with hazards in the work area.

(k) Workers handling volatile liquids (gasoline, hexane, alcohol, etc.) should take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

(l) Work should be arranged in such a way that sitting still or standing for long periods is minimized.

(4) All workers who may work in cold areas should be trained in the following subjects:

- Proper first aid treatment
- Proper clothing practices
- Proper eating and drinking habits
- Recognition of impending adverse health effects
- Safe work practices

(5) Clothing for warmth, which is worn under chemical protective clothing in contaminated areas, can be laundered in normal fashion, without the wash water being collected as contaminated water so long as the chemical protective clothing is worn properly, and remains intact.

(6) If there is a rip or tear in the chemical protective clothing in a contaminated area, the clothing for warmth needs to be handled as potentially contaminated, and the water in which it was washed needs to be collected as potentially contaminated water. More rigorous steps may be required if materials handled are extremely toxic (dioxin, etc.).

12.0
Equipment Management

12.0 EQUIPMENT MANAGEMENT

As used in this section, the term "equipment" refers to industrial hygiene, safety, and radiation exposure monitoring instruments. Examples include:

- Flame Ionization Detectors
- Photoionization Detectors
- Combustible Gas Indicators/Oxygen Meters (CGI/O_2)
- Real-Time Aerosol Monitors
- Mercury Vapor Analyzers
- Colorimetric Indicator (Detector) Tubes and Pumps
- Sound Level Meters
- Heat Stress Monitors
- Radiation Survey Instruments

12.1 INVENTORY OF EQUIPMENT

To ensure proper Project equipment management, a current list of all organizational (i.e., LANL or subcontractor) equipment should be maintained. The following information should be included in this inventory list:

- Organization Name (and alphanumeric code, if applicable)
- Type of Instrument
- Instrument Manufacturer
- Serial Number/Property Number (for identification purposes)
- Required Frequency of Factory Maintenance/Calibration (per manufacturer's instructions)
- Last Date of Factory Maintenance/Calibration

12.2 CALIBRATION AND MAINTENANCE

Equipment calibration and maintenance requirements for the various pieces of equipment used to support the Project vary considerably. It is imperative that the manufacturer's instruction manual be reviewed to ensure a proper understanding of the specific calibration and maintenance requirements associated with each type and model of equipment. Furthermore, in the special case of radiation survey instruments, calibration must be performed in accordance with American National Standards Institute (ANSI) N323-1978, Radiation Protection Instrumentation Test and Calibration.

12.3 EQUIPMENT MANAGER

One person should be designated to be responsible for the equipment management system within each organization. This person should ensure that:

- the equipment inventory is current and accurate
- equipment is maintained/calibrated in accordance with manufacturer's recommendations (and, in the special case of radiation survey instruments, ANSI N323)

The name and organization of the equipment manager should be communicated to the ER/HS Support Team.

12.4 RECORDS

The location and retention times for equipment factory maintenance and calibration records are to be determined by the organization managing the equipment used to support the Project. As a minimum performance objective, the records should be retained such that they are readily available to equipment users (e.g., inside the instrument case, in the equipment manager's central records file, and/or in the field project file), and provide a history of service work such that a user would feel secure that the equipment will perform with a high degree of reliability.

Records of field calibrations of equipment (more accurately referred to as "response checks") shall be maintained in field project files.

13.0

Decontamination

13.0 DECONTAMINATION

As stated in Section 8 of the HASP, decontamination involves the physical removal of contaminants from personnel and equipment and/or the chemical conversion of the contaminants into innocuous substances.

Decontamination at Project sites involves the removal and/or chemical conversion of

- Nonradioactive hazardous materials;
- Radiological materials; and
- Mixed waste (i.e., nonradioactive hazardous waste and radiological materials).

The type of PPE and procedures required for decontamination activities will vary with the site conditions. Refer to Section 8 of the HASP (and its various subsections) for a discussion of the following:

- General requirements applicable to personnel and equipment decontamination;
- Guidelines for determining appropriate decontamination strategies;
- Special precautions for protecting environmental monitoring equipment from contamination;
- Disposal versus reuse of PPE; and
- Special procedures for decontamination of radiologically contaminated PPE and environmental monitoring equipment.

Section 9 of the HASP should be reviewed for directions on dealing with decontamination of personnel in emergency situations. (In general, life-saving care takes precedence over decontamination activities, providing that the worker has not been contaminated with an extremely toxic or corrosive material that could cause severe injury or loss of life.)

As an added note, the equipment necessary for decontamination needs to be available on site and arranged for use prior to EZ entry. The site needs to have the ability to conduct decontamination should workers or equipment come in contact with a nonradioactive hazardous material, radioactive material, or mixed waste.

Release Authority

As stated in Section 8 of the HASP, the SSO and health physics personnel shall monitor decontamination activities to determine their effectiveness. The SSO usually determines the effectiveness of decontamination for nonradiological contaminants while health physics personnel determine decontamination effectiveness for radiological contaminants.

Removal of equipment/items from a [radiologically] Controlled Area designated for contamination control purposes requires monitoring for radioactive contamination. The general procedures and requirements are located in the ESH-1 Procedure ESH-1-07-01, Releasing Equipment and Items. Equipment release requirements will depend upon the destination of the equipment/item, the suspected radionuclides, and whether or not, while working at the site, radioactive material has been detected with portable instruments. Health physics personnel shall document the release process in accordance with Laboratory Procedure LP107-04.0, Documenting Equipment and Item Removal. Note: Subcontractors shall abide by this requirement unless the subcontractor has a LANL-approved radiological safety program that addresses equipment/item release.

For unrestricted release to the public (free release), smear and direct surveys shall be required. Smear and direct surveys shall be conducted in accordance with the ESH-1 Procedure ESH-1-02-02, Surveying for Alpha and/or Beta/Gamma Contamination, and ESH-1-07-01. Note: Subcontractors shall abide by this requirement unless the subcontractor has a LANL-approved radiological safety program that addresses unrestricted release of equipment/items to the public.

14.0
Site
Inspections

14.0 SITE INSPECTIONS

Site inspections are crucial to ensuring the health and safety of Project workers. Furthermore, such inspections of the work site are mandated by the Department of Energy (DOE) in DOE Order 5480.9A, Construction Project Safety and Health Management. Note: Construction is defined by the DOE to include construction, demolition, and excavation activities conducted as part of environmental restoration or remediation efforts.

As described in Section 12 of the HASP, the responsibility for inspections and the associated minimum required frequency of inspections per DOE Order 5480.9A are as follows:

- The construction subcontractor (i.e., prime subcontractor or, where a prime subcontractor is not involved, the subcontractor performing the work) must conduct daily inspections of the work site to identify hazards and instances of noncompliance with field project health and safety requirements (e.g., HASP and SSHASP).

- The FTM/DPL must conduct work site health and safety inspections on at least a weekly basis.

- The FPL must conduct inspections of all construction projects exceeding $500,000 on at least a monthly basis during periods of active construction. For projects below this dollar threshold, the FPL must develop and implement an inspection schedule that ensures a representative sample of ongoing construction projects is inspected on at least a monthly basis. The objective of these inspections is to assess the effectiveness of the FTM/DPL in supervising the subcontractor's safety and health performance.

Additionally, Section 12 of a completed SSHASP details types of inspections required for a given field project, along with the regulatory driver for the inspection and the team member expected to complete the inspection. **No specific checklist or format is mandated for these inspections.** The means by which the inspections are documented is discretionary. It must be kept in mind, however, that the quality of inspections will be an evaluation criterion in the subcontractor performance evaluations.

Examples of select inspection checklists are provided on the following pages to assist in inspection documentation. Again, use of these specific checklists is not required.

The example checklists address the following inspection activities:

- Daily Safety Inspection Checklist - used to document routine safety inspections.

- Chemical Protective Clothing Inspection Checklist - used to document inspections of newly received and existing stock of PPE.

- Fall Protection/Rescue Equipment Checklist - used when fall protection or rescue equipment such as harnesses, lanyards, and lifelines are used at the field site.

- Daily Drill Rig Inspection Checklist - used to document daily rig inspections.

As an added note, inclusion of field team members in the inspection activity who are not directly responsible for completion of the inspection is encouraged. The purpose of this is to raise the level of safety consciousness and commitment throughout the field team.

DAILY SAFETY INSPECTION CHECKLIST

TA ___ SSHASP No. _____ Date __/__/__

Project Title _____

SITE CONTROL

___ Site map posted on site
___ Site work zones identified and posted
___ Use of a buddy system, if appropriate
___ Site communication
___ Is the site secure from unauthorized entry?

ENGINEERING CONTROL, WORK PRACTICES, AND PPE

___ Site hazards posted
___ PPE properly selected
___ Is there adequate PPE on site?
___ Employees properly fitted for PPE
___ Do employees know how to don and doff PPE?
___ PPE properly used
___ PPE maintenance and storage
___ Decontamination and personal hygiene procedures followed

SANITATION

___ Toilet facilities available
___ Hand and face washing available
___ Potable water provided and labeled safe for drinking
___ Non-potable water labeled not safe for drinking or washing

MONITORING

___ Air monitoring conducted
___ Results of previous monitoring maintained on site
___ Direct reading instrumentation on site and ready for use.

ILLUMINATION

___ Is additional lighting provided when needed?

EMERGENCY RESPONSE

___ Site security and control
___ Evacuation routes and procedures posted
___ Emergency medical treatment and first aid procedures posted

Completed by _____ _____
(Print Name) (Title) (Signature)

CHEMICAL PROTECTIVE CLOTHING INSPECTION CHECKLIST

TA___ SSHASP No. _____ Date __/__/__

Project Title _____

___ Determine if the PPE has expired (if applicable)

Visually inspect the inside and outside of the material for:

___ Imperfect seams
___ Non-uniform coatings
___ Tears
___ Malfunctioning closures
___ Punctures
___ Worn areas or abrasion
___ Missing parts
___ Damaged parts
___ Etched or scratched lenses
___ Pinholes around fingers of gloves

Flex the material and check the inside and outside for:

___ Cracks
___ Shelf deterioration
___ Non-uniform flexibility

Check for degradation by looking and feeling for:

___ Discoloration
___ Swelling
___ Stiffness

Check stock quantity of PPE:

___ Gloves
___ Suits
___ Boots/booties

Completed by _____ _____
(Print Name) (Title) (Signature)

FALL PROTECTION/RESCUE EQUIPMENT CHECKLIST

TA___ SSHASP No. _____ Date __/__/__

Project Title _____

Instructions for use: The manufacturer's inspection procedures and recommendations should always be consulted and used when performing inspections of fall protection equipment. The following checklist may be used as an additional guide when performing inspections of this type of equipment. This checklist may be used for both daily and periodic inspections.

1.0 Safety Harness

Requirement	Yes	No
Does the harness material show any visible defects such as:		
- fraying or tearing?	___	___
- stretching?	___	___
- mildew or mold?	___	___
- broken or pulled stitches?	___	___
Does the hardware (rings, snaplinks, etc.) show any sign of wear or deterioration?	___	___
- cracks?	___	___
- sharp edges?	___	___
- deformation?	___	___
- corrosion?	___	___
- chemical attack?	___	___
- excessive wear?	___	___
Is each belt rivet secure and intact?	___	___
Are the product information and warning labels firmly attached to the harness?	___	___

2.0 Lifelines

Requirement	Yes	No
Do the lifelines show any visible defect or damage such as:		
- fraying?	___	___
- kinking?	___	___
- knotting?	___	___
- unspliceing?	___	___
- mold or mildew?	___	___
- elongation?	___	___
- chemical attack?	___	___
- excessive soiling?	___	___
- evidence of abrasion?	___	___
- excessive wear?	___	___
Are the product information and warning labels firmly attached to the lifeline:	___	___
Are labels legible?	___	___
If wire rope is used, is there evidence of the following: (Note that wire ropes require at least monthly inspections)		
- broken wires exceeding three wires in one strand or six wires in one rope lay?	___	___
- distortion of rope structure such as would result from crushing or kinking?	___	___
- heat damage?	___	___
- rope deterioration from corrosion?	___	___
- a broken wire within 18 inches (460.8 mm) of the end attachments?	___	___
- noticeable rusting and pitting?	___	___
- core failure (a lengthening of rope lay, protrusion of the rope core and a reduction in rope diameter suggests core failure?)	___	___
- more than one valley break (broken wire)?	___	___
- outer wire wear exceeds one-third of the original outer wire diameter?	___	___

3.0 Mechanical Lifting Equipment (Tripod with Winch)

Requirement	Yes	No
Are any part visibly defective or worn as evidenced by:		
- rust or corrosion?	___	___
- cracks?	___	___
- deformation?	___	___
- excessive wear?	___	___
Are attachments to lifelines secured to mechanical devices as per manufacturer's instructions?	___	___
Are there any missing parts?	___	___
Do movable parts operate as specified?	___	___
Are all required labels in place and legible?	___	___

4.0 Self Contained Breathing Apparatus (SCBA) and Supplied Air Respirators

Note: SCBAs for emergency use require monthly inspections, as well as inspections before and after each use:

Requirement	Yes	No
Are SCBA air cylinders fully charged according to manufacturer's specifications?	___	___
Do the regulator and warning devices function properly (see manufacturer's instructions)?	___	___
Are all connections tight and secure?	___	___
Are all valves, connecting hoses, headbands in place?	___	___
Are all parts visibly free from deterioration?	___	___
- face piece?	___	___
- valves?	___	___
- headbands?	___	___
- hoses?	___	___
Are elastomer parts still pliable and free from deterioration?	___	___
For compressors which supply air:		
- Is the compressor constructed so that contaminated air does not enter the system?	___	___
- If required, are in-line air purifying sorbants and filters in place?	___	___
- Is there a receiver of sufficient capacity to enable the wearer to escape during a failure?	___	___
- are the alarms for indicating compressor failure or overheating in place and working?	___	___
Are breathing air cylinders appropriately marked? (example: "Air, Compressed for Breathing Purposes.")	___	___

Completed by _____ _____
(Print Name) (Title) (Signature)

DAILY DRILL RIG INSPECTION CHECKLIST

TA ___ SSHASP No. _____ Date ___/___/___

Project Title _____

		COMMENTS
CAB		
___	Fire Extinguisher (20 ABC)	_____
___	F/E Inspected and Charged	_____
___	Lights	_____
___	Mirrors	_____
___	Gauges all functional	_____
___	Seat & belts in working order	_____
___	Cab kept neat & clean	_____
___	Window glass free of cracks	_____
ENGINE		
___	Engine operation	_____
___	Lubrication done regularly	_____
___	No fluids leaking from rig	_____
DRIVE TRAIN		
___	Tires in good condition	_____
___	No loose lug nuts	_____
___	Brakes in working order	_____
___	Back-up alarm functional	_____
CONTROLS		
___	All emergency switches working	_____
___	Pressure gauges functioning	_____
___	Safety relief working	_____
___	Weight indicator working (req'd)	_____
___	All hoses in good condition	_____
___	All drill controls working	_____

DRILLING EQUIPMENT

___	Tools in working order	_____
___	Jacks in working order	_____
___	Solid footing for rig and jacks	_____
___	All equipment guards in place	_____
___	Guards on sheaves to prevent line displacement	_____
___	Ropes in good condition (no cuts, worn spots, burns, etc.)	_____
___	Cables in good condition	_____
___	Hooks all have safety latches	_____
___	Augers in good condition	_____
___	Auger pins in good condition	_____
___	Cat head smooth & free of grooves	_____
___	Anti-fouling devices installed on all manual cat head	_____
___	Crown block bolted/welded to mast	_____
___	Mast has manufacturer and load capacity on it	_____
___	Bolts and nuts tight	_____
___	Locking device on mast pivot points	_____
___	Guy lines in place	_____

Completed by _____ _____
(Print Name) (Title) (Signature)

15.0
Site
Emergencies/Incidents

15.0 SITE EMERGENCIES/INCIDENTS

Refer to Section 9 of the HASP for a description of the general aspects of the emergency/incident action plan required for all Project field operations. Note that Section 9 of the SSHASP is expected to supplement this plan by providing plan details, including the equipment and supplies necessary for proper execution of the plan.

The following subjects are addressed in the HASP:

- Posting requirements;
- Emergency alerting and site evacuation procedures;
- Procedures for onsite responders;
- Emergency medical treatment and first aid/cardiopulmonary resuscitation (CPR); and
- Decontamination of personnel under emergency conditions.

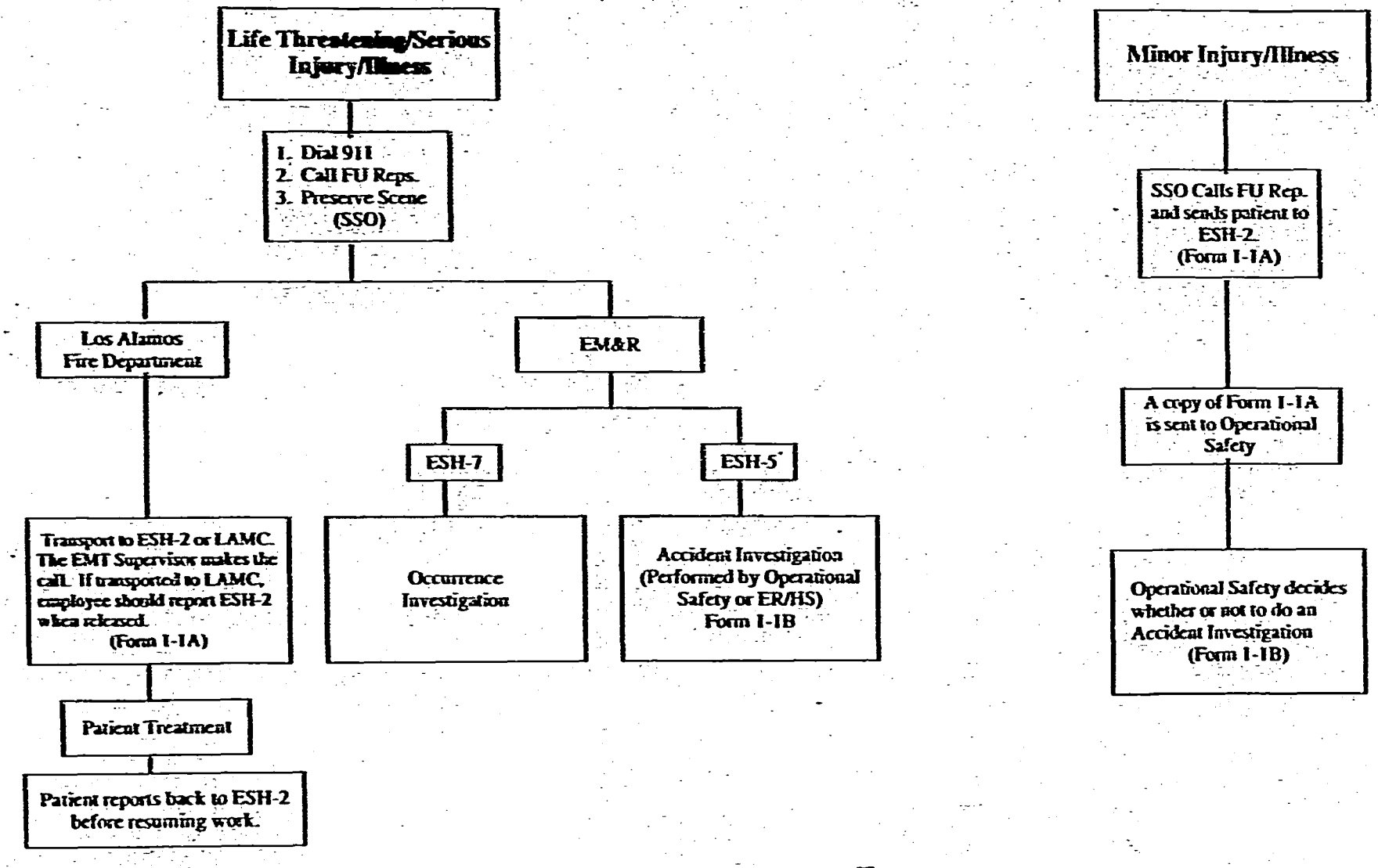
Proper notification and reporting procedures for incidents and occurrences have been established by LANL and are applicable to Project activities. Minimum criteria for notification/reporting are referenced in PRD-120-01.0, Occurrence Investigation and Reporting Program. Examples of situations that would meet the criteria and, therefore, necessitate initiation of notification/reporting include (but are by no means limited to):

- unexpected discovery of radioactive or hazardous material contamination due to DOE operations;
- any vehicle damage >$500;
- any occupational injury or illness, or any near miss that could have resulted in an occupational injury or illness;
- any occupational exposure to blood or body fluids, as defined by 29 CFR 1910.1030, Bloodborne Pathogens;
- any fire on a site; and
- any property damage or estimated loss of >$1,000.

If the situation meets the minimum criteria, notify the LANL project leader (e.g., a LANL FTM, an LANL DPL, the FPL). This individual will, in turn, notify the Occurrence Investigation Group (ESH-7) at 665-0033. Also, notify the Field Unit Health and Safety Representative of any incident or occurrence involving health and safety.

It is important to add that subcontractors have injury/illness reporting requirements beyond those included in the notification and reporting document referenced above. Subcontractors shall also notify their LANL Contract Administrator within 24 hours of any personal injury resulting in lost workdays and/or any loss or damage to Government property. This information is to be submitted on Form DOE F 5484.X, U.S. Department of Energy Individual Accident/Incident Report. Assistance in completing this form may be obtained from the Field Unit Health and Safety Representative.

EMERGENCIES/INCIDENTS



16.0
Site
Recordkeeping

16.0 SITE RECORDKEEPING

Records management is an important element of Project work. The ER/HS Support Team can provide assistance in designing and managing site recordkeeping systems.

16.1 REQUIRED SITE RECORDS

The following safety and health records shall be maintained at a Project site:

- Logbook of daily health and safety-related events
- Material Safety Data Sheet (MSDS) for each chemical brought onto site
- HASP and SSHASP, and any SSHASP modification forms generated
- Exposure monitoring records
- Health and safety inspection records
- Work permits (e.g., radiological work, confined spaces, excavations, spark/flame-producing operations) and special work procedures (e.g., lockout/tagout procedures)
- Tailgate safety meeting records
- Visitor log, if not otherwise recorded in daily logbook
- Accident/incident investigation reports

16.2 OPTIONAL SITE RECORDS

The following safety and health records shall be maintained, although their physical retention at the site is optional:

- Worker training records
- Worker medical surveillance (physician) approval records
- Monitoring instrument manuals

The following materials may be useful references at or near the site:

- RFI Work Plan
- This manual
- OSHA General Industry standards (29 CFR 1910)
- OSHA Construction Industry standards (29 CFR 1926)
- ACGIH TLV booklet
- NIOSH Pocket Guide to Chemical Hazards
- U.S. Department of Transportation Emergency Response Guidebook

16.3 DATA COLLECTION AND REPORTING

All Project health and safety activities should be recorded. These records are to be provided to site management (e.g., FTL, FPL) and will become part of the official site work record. The Project expects that these records will be retained indefinitely by the LANL records management facility. Additional copies of selected records shall be provided to the ER/HS Support Team

- as may be required by specific policy or procedure (e.g., personal air monitoring results); and/or
- on a request basis.

In general, the specific format for records (e.g., inspection reports supervisory accident investigations) is based on the professional discretion and judgement of the LANL organization/subcontractor responsible for records generation. However, it is expected that the format will be developed to document all pertinent information, and the record itself will be fully completed.

The following requirements apply to records generation:

- Make text and data entries in ink (not pencil). Field sketches may be made in pencil initially, and then inked at a later time;
- Record entries in sufficient detail so that another similarly qualified individual could repeat the work described and achieve comparable results;
- Void all blank portions of standard forms with a diagonal line. If using the expression "N/A" or "NA," clearly specify whether it means not available or not applicable;
- Correct entries by crossing out the incorrect entry with a single line, so that the original entry is readable, and entering in the correct information; and
- If a correction is made at a later date, initial and date the correction.

17.0
Nuclear Criticality

17.0 NUCLEAR CRITICALITY

Criticality safety involves planning and conducting operations with fissile material in such a manner that a nuclear excursion (i.e., a steady, self-sustaining fission chain reaction) does not occur -- both during normal operation and for any foreseen abnormal operating or accident situation which is considered credible and may reasonably be designed against. Fissile material is defined as material that contains nuclides capable of undergoing fission by interaction with slow neutrons, such that the thermal neutron production cross section exceeds the thermal neutron absorption cross section. For the purpose of LANL operations, fissile materials are plutonium, uranium-233, and uranium enriched in the 235 isotope.

Factors influencing criticality include, but are not limited to, the following:

- Mass - Before a criticality accident can occur, a certain amount of fissile material must be present. The minimum amount of fissile material necessary to cause a criticality is called the minimum critical mass, and is defined as 500 grams for U-233 and Pu-239 and 800 grams for U-235.

- Density - This parameter is a measure of the spacing between atoms in metals and powders. When used to describe fissile material, it means how tightly the fissile atoms are packed together. For typical ER operations, separation of fissile atoms by dirt would be expected to result in a fissile atom density at least a million fold less than their density would be in pure metal or oxides. There are no criticality concerns for such large dilutions due to the absorption of neutrons by dirt.

- Shape - This is a very important consideration in nuclear criticality safety. In order to maintain safety margins, it is necessary to have a shape that will allow neutrons to escape or leak out. The "leakiest" shapes will have a large surface area for a given volume -- e.g., a slab has more surface area per unit volume than a sphere. For expected ER operations, the volume and shape are such that subcriticality is not being maintained by either of these parameters. The very low fissile density is the controlling parameter in maintaining the soil highly subcritical.

- Volume - Particularly for solutions and loose powders, which could accidentally become flooded, container volumes less than six liters are often used as an aid to criticality control.

- Concentration - Similar to density, concentration is often used to describe how much fissile material is present in a volume of solution

- Enrichment - This term refers to the percentage of fissile atoms in a given amount of material.

Criticality is listed in the ES&H ID (formerly known as the ES&H Questionnaire) as a safety issue that needs to be considered when preparing for field operations under the Project. LANL AR 4-1, Nuclear Criticality Safety, states that operations involving significant quantities of fissile materials may pose the risk of accidental nuclear criticality. Therefore, for operations where the quantities of fissile materials are close to the significant quantities of 500 grams for U-233, 500 grams for Pu-239, or 800 grams for U-235, and for operations where the quantities of fissile materials are unknown, contact ESH-6, LANL's Nuclear Criticality Safety Group, for criticality safety guidance. The Group Office phone number is 667-4789.

18.0

Oversight Program

18.0 OVERSIGHT PROGRAM

18.1 PURPOSE

This portion of the manual describes the health and safety oversight program for the Project.

LANL has adopted the following approach to Project health and safety management and oversight:

> LANL will provide the Project with health and safety requirements to be met.
>
> The HASP and the SSHASP are the primary documents for defining LANL Project requirements. These documents require that Project activities be conducted without unnecessary risk of personal injury, damage to property, or insult to the environment. As stated throughout this manual, Project personnel, particularly support organizations (i.e., subcontractors), are encouraged to develop and use their own programs and procedures (e.g., inspections, approval of SSOs, training, exposure monitoring) to meet these requirements in a performance-based manner.
>
> LANL will evaluate the Project's field operations to determine how well they are meeting health and safety requirements.
>
> LANL will evaluate and document the Project operations' ability to safeguard the Project's personnel, property, and environment. The oversight program is designed to address this organizational responsibility. The information may then be used to determine performance award fees for subcontractors.

18.2 SCOPE

The scope of the oversight program is to provide health and safety oversight to Project activities and personnel. Organizations subject to the oversight program include, but are not limited to:

- the prime ER subcontractors and their lower-tier subcontractors; and
- subcontractors supporting the Project that are under direct contract to LANL.

18.3 ROLES AND RESPONSIBILITIES

The Laboratory Director has ultimate authority and responsibility for oversight of the environmental, safety, and health (ES&H) activities at LANL. Through Director's Policy No. 103 (ES&H), LANL ensures maintenance of a safe and healthful workplace that does not adversely affect the environment or the public, and ensures LANL compliance with all applicable ES&H regulations. Project subcontractors that are subject to LANL health and safety oversight will be responsible for and provide to LANL documentation that will enable LANL reviewers to determine if the subcontractors are in compliance with health and safety requirements. Additionally, subcontractors shall be fully cooperative with LANL representatives during oversight activities.

The LANL oversight criteria will be made available to Project subcontractors prior to a formal health and safety evaluation.

18.4 OVERSIGHT ASSESSMENT PLAN

The oversight program has two components, and culminates in a health and safety performance evaluation (see Figure 1).

Figure 1. Schematic of ER Project Health & Safety Oversight

Component One

PROGRAMMATIC REVIEW/APPROVAL

HEALTH & SAFETY PROGRAMS

SSHASP PREP & REVIEW

INCLUDES SUPPLEMENTAL PROCEDURES

Component Two

FIELD VERIFICATION

COMPLIANCE INSPECTIONS & REVIEWS:

HASP

SSHASP

H&S Programs

18.4.1 Programmatic Reviews (Component One)

The first component focuses on review of all applicable H&S programs and the preparation, review and approval of the Site-specific Health and Safety Plan.

Prior to conducting any field work and within thirty (30) days of the contract being let all applicable H&S Programs shall be submitted for approval. (The employer's OSHA 200 Log from the previous year shall also be submitted at this time.) The contract administrator will, within 5 working days, submit the program and OSHA Log, along with the contract statement of work, to the ER/HS Team for ESH Division review and approval. [See attached Subcontractor Health & Safety Program Review and Approval form - Appendix C].

- the contract statement of work is provided to the ER/HS Team to ensure that appropriate program elements are included in the subcontractor's health and safety documents and
- the OSHA Log is submitted for the purpose of determining if the subcontractor is complying with recordkeeping requirements.

ESH Division comments will be coordinated by ESH-5 (i.e., Field Unit Health and Safety Representative) and will be communicated directly to the subcontractor's health and safety representative. Final approval will be communicated by the designated Field Unit Health and Safety Representative to the contract administrator who, in turn, will notify the subcontractor.

Also, prior to conducting any field work the ER Project SSHASP (including any procedures that have been developed to supplement the SSHASP) shall be submitted to the Field Unit H&S Representative. The SSHASP will be evaluated by the Field Unit Health and Safety Representative on the basis of timeliness of delivery and quality of completion. Note: The degree to which the plan must be modified to satisfy the reviewers (with special emphasis on plan re-submissions) will also be a criterion in the evaluation.

18.4.2 Field Verification (Component Two)

The second component focuses on field verification of health and safety activities. This component has two aspects: routine reviews of field operations and the Field Project Oversight Review.

The routine field operations review will be based upon observations of field operations by the Field Unit Health and Safety Representative (or designee), and will include a determination of the appropriateness of the developed SSHASP for work in progress. Routine observations of deficiencies resulting from reviews of field activities will be documented by the Field Unit Health and Safety Representative and communicated to appropriate site representatives and to LANL project management. [Deficiencies identified as a result of field observations will be noted on the Environmental Restoration/Decommissioning Project Field Surveillance Report (Appendix D).]

The Field Project Oversight Review is a structured field health and safety evaluation. This oversight review program is managed by the ER/HS Team Health and Safety Project Leader (HSPL).

ER Project Health and Safety Team Leaders (ESH-1 and ER/HS) select the oversight team, which may be composed of subject matter experts representing specific groups within ESH Division [e.g., ESH-1 (Health Physics Operations), ESH-2 (Occupational Medicine), ESH-4 (Health Physics Measurements), ESH-5 (Industrial Hygiene and Safety), ESH-6 (Nuclear Criticality), ESH-12 (Policy and Program Analysis), and ESH-13 (Training)] and, possibly, the contract administrator. The oversight team leader will be appointed by the HSPL.

The specific frequency for Field Project Oversight Reviews will be established by the HSPL on a case-by-case basis. The frequency depends on the number of field project work hours and site history. The frequency may increase or decrease based on subcontractor health & safety performance.

The HASP, SSHASP, and any referenced health and safety programs (e.g., Administrative Requirements, Laboratory Procedures, the previously approved subcontractor health and safety program) provide the basis for the oversight evaluation. A menu of oversight criteria will be developed from these documents. This menu will be provided to the Project subcontractor under review in advance of the formal performance evaluation. Also in advance of the evaluation, the oversight team will select specific criteria (appropriate to field operation) from the master menu to create a list of discrete points for the actual evaluation. This list will remain confidential within the oversight team.

Examples of specific points that may be reviewed during the Field Project Oversight Reviews include (but are by no means limited to):

- Have all project personnel reviewed the HASP and SSHASP?
- Have assessments of industrial hygiene exposures been performed adequately?
- Has proper authorization been secured for radiological personnel (RSP, HPT, RCT)?
- Has monitoring equipment (e.g., radiation and industrial hygiene) been properly calibrated?
- Have personnel received medical authorization for their assigned tasks and is the authorization current?
- Are decontamination activities effective?
- Has appropriate training been provided for project personnel?
- Is there an onsite copy of HASP, SSHASP, and, as appropriate, completed SSHASP modification forms and task hazard analysis forms?
- Is the fire extinguisher inspected monthly?
- Is the drill rig inspected daily and do equipment conditions reflect notations in the completed inspection forms?
- Are ladders provided for workers entering excavations greater than 4' in depth so as to require no more than 25' of lateral travel?
- Are material safety data sheets available for chemicals brought on site and are workers familiar with their content?
- Is personal protective equipment worn and worn properly?

Note 1: In the course of the evaluation, the team may elect to review in detail decisions and documents that the field team has used to substantiate compliance with the evaluation review points -- e.g., field team member medical records, SSO qualification determinations, and HAZWOPER training documentation.

Note 2: Deficiencies from other recent health and safety evaluations (e.g., those performed by AA-2 and the DOE) may be referenced in the report generated as a result of the Field Project Oversight Review.

Note 3: The deficiencies documented on the Environmental Restoration/Decommissioning Project Field Surveillance Report may be included in the report generated as a result of the Field Project Oversight Review.

A record of the Field Project Oversight Review will be maintained by the Field Unit Health and Safety Representative for later use in the subcontractor safety performance evaluation. This evaluation may factor into the Project's subcontractor award fee program.

Observed deficiencies contained in the Field Project Oversight Review record will be classified as described below. The subcontractor shall have the right to request reconsideration of deficiency classification.

Health and Safety Deficiency Classification

The following are categories of safety and health deficiencies. They are based on deficiency classifications used by OSHA.

Willful -- Where evidence shows that the employer knowingly and with intent endangered a worker or workers by exposing the worker(s) to a serious or unsafe condition or practice that could cause death or serious injury; or that the employer had knowledge of the unsafe condition or practice and took no reasonable effort to eliminate the condition or practice.

Imminent Danger -- Any unsafe or hazardous condition or practice such that a danger exists which could reasonably be expected to cause or result in death or serious harm immediately or before the imminence of such danger can be eliminated through the normal process of citation or warning. Imminent danger conditions or practices may result in an immediate Stop Work or Stop Activity Action (see Section 6.7).

Serious -- In order for a deficiency to be classified as serious in severity there must be a substantial probability that death or serious physical harm could result from conditions which exist, or from one or more practices, means, methods, operations, or processes that have been adopted or are in use.

Other than Serious -- Where a deficiency would result in a hazardous condition that could, in turn, result in an accident or injury that would probably not lead to death or serious physical harm, but could have a direct and immediate relationship to the safety and health of employees.

De minimis -- Violations of standards which have no direct or immediate relationship to safety and health (e.g., lack of toilet partitions).

Repeat/Failure to Correct -- A violation that has been cited previously for the same or substantially similar condition or for a failure to correct a deficiency within the a specified time period.

The ultimate goal, of course, for the oversight program is to ensure that Project operations are being conducted in a manner designed to protect the workers, property, and the environment.

19.0
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ER-HSM-02

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

PERSONAL PROTECTIVE EQUIPMENT

ER-HSM-02

ER-HSM-02

PERSONAL PROTECTION EQUIPMENT METHOD

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PERSONAL PROTECTIVE EQUIPMENT

1.0 PURPOSE

This method was written to meet requirements of the OSHA personal protective equipment (PPE) standards (29 CFR 1910 Subpart I and 29 CFR 1926 Subpart E) and the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard (29 CFR 1926.65[g][5]). ESH-5 developed this method to promote greater consistency among the various Los Alamos National Laboratory (LANL) Environmental Restoration (ER) Project subcontractors and field teams.

2.0 SCOPE

2.1 Applicability

This method applies to all LANL ER Project field operations. It provides requirements and guidance for selection, donning and doffing, use, decontamination, inspection, maintenance, and storage of PPE and awareness of equipment limitations. This information is applicable to the development of site-specific health and safety plans (SSHASPs) for ER Project field operations. This method does not apply to the use of PPE for protection against radiological hazards; refer to Section 5.1 below.

In some cases, LANL has chosen to invoke OSHA, DOE, and LANL requirements which ordinarily may not apply to ER field operations (e.g., OSHA general industry standards in 29 CFR 1910). These choices were made on a case-by-case basis to maintain consistency with LANL's goal of minimizing the threat and occurrence of hazards to health, property, and the environment to as low as reasonably achievable (ALARA), and to clarify LANL's expectations with regard to interpretable requirements of the multiple standards governing ER work.

2.2 Written PPE Program

Employers of employees who wear PPE to perform HAZWOPER work are required to maintain a written PPE program in accordance with requirements of 29 CFR 1926.65(g)(5) and 29 CFR 1910.132. Refer also to Section 4.2.2 of the LANL ER Project Health and Safety Plan (HASP) for further details concerning written health and safety program requirements.

2.3 Training

OSHA requires (29 CFR 1910.132(f)) that the employer provide training to each employee who is required to use PPE to know at least the following:

- When PPE is necessary.
- What PPE is necessary.
- How to properly don, doff, adjust, and wear PPE.
- Limitations of the PPE.
- Proper care, maintenance, useful life, and disposal of the PPE.

Furthermore, OSHA requires that the employer's written PPE program required for HAZWOPER work address employee training for proper selection, donning and doffing, use, decontamination, inspection, maintenance, and storage of PPE and awareness of equipment limitations (29 CFR 1926.65[g][5]).

Each affected employee must demonstrate an understanding of the training and the ability to use the PPE properly before being allowed to perform work requiring use of the PPE. When the

employer has reason to believe that an affected employee who has been previously trained does not have the necessary understanding and skill, the employer is required to retrain the employee. This includes situations where changes in the workplace or the types of PPE to be used render previous training obsolete. Certification of training is addressed in Section 8.0.

2.4 Medical Surveillance

The use of PPE can cause an extraordinary burden on the employee which may create stress on the body's ability to function in a healthy manner. LANL has interpreted the various OSHA requirements pertaining to medical surveillance and has established employee medical surveillance requirements for ER Project participation described in Section 11 of the HASP. Site-specific requirements are to be indicated in the SSHASP for the field operation. Certification of training is addressed in Section 8.0.

2.5 Responsibilities

The SSO, with approval of the Field Unit Health and Safety Representative and a subcontractor representative of each employer having employees affected by the SSHASP, is responsible for developing the SSHASP. This responsibility includes assessing the site- and operation-specific hazards posed by the field work and determining the appropriate PPE to be used by field team members. The roles and additional responsibilities of the SSO are defined in Section 3.2.3.1 of the HASP, and the roles and responsibilities of the subcontractor representatives and the Field Unit Health and Safety Representatives are defined in Sections 3.3.1 and 3.3.2 of the HASP, respectively. Refer also to Section 8.0 for responsibilities concerning documentation of employee training and medical fitness with regard to PPE.

3.0 DEFINITIONS

Defined within subsection of first occurrence.

4.0 BACKGROUND AND/OR CAUTIONS

According to the DOE (Section 11.5, *Handbook for Occupational Safety and Health During DOE Hazardous Waste Activities*, Second Working Draft, October 1994), PPE is acceptable as an exposure control method only

- when engineering controls are not feasible or do not totally eliminate the hazard;
- while engineering controls are being developed;
- when safe work practices do not provide sufficient additional protection; or
- during emergencies when engineering controls may not be feasible.

According to OSHA (29 CFR 1910.132(d)), the employer is required to assess the workplace to determine if hazards are present, or likely to be present, which necessitate the use of PPE. If such hazards are present, or likely to be present, the employer is required to select and to have each affected employee use the type(s) of PPE sufficient to protect the affected employee(s) from the hazards identified in the hazard assessment. The employer is also required to communicate selection decisions to each affected employee and to select PPE that properly fits the affected employee(s). The employer must verify that the required workplace hazard assessment has been performed through a written certification that identifies the workplace has been evaluated; refer to Section 8.0.

5.0 EQUIPMENT

Refer to Section 6.0; PPE identified and described according to selection subheading.

6.0 PROCEDURES

6.1 Selection and Limitations

The types of PPE that are required or recommended for use during performance of ER field operations are discussed alphabetically in this section by the following subheadings:

- Electrical Protection
- Ensembles (Levels D, C, B, A)
- Eye and Face Protection
- Fall Protection
- Foot Protection
- Hand Protection
- Hearing Protection
- Radiological Protection
- Respiratory Protection
- Welding Protection
- Working in Traffic
- Working Over or Near Water

For the most part, PPE limitations are device and manufacturer specific. Although some general PPE limitations are discussed in this section, the manufacturer's equipment-specific limitations must be taken into account prior to using any PPE item. In deciding whether disposable PPE should be selected for use, consider the feasibility of decontaminating the PPE sufficiently; refer to Section 8 of the HASP.

Electrical Protection

Where the use of electrical protective equipment is required (DOE - Section E of the Construction Safety Reference Guide, DOE/ID 10447, September 1993; DOE - Electrical Safety Guidelines, DOE/ID 10600, September 1993; and OSHA - 29 CFR 1926 Subparts K and V), select and use only protective equipment that complies with OSHA requirements (29 CFR 1910.137). Such protective equipment may include hand, head, body, and/or foot protection.

Ensembles (Levels D, C, B, A)

Specific levels of PPE (primarily protective clothing and respiratory protective equipment) are typically divided into the four categories described in Table 1 - Levels D, C, B, and A - according to the degree of protection afforded and the differing selection criteria (29 CFR 1926.65 Appendix B). PPE accessories (e.g., head, foot, eye, and face protection, fall protection, and electrical protection) may be added to any of these PPE ensembles depending upon the hazard(s) associated with the task(s) to be performed.

Select and use protective materials on the basis of an evaluation of the hazards and potential hazards identified, conditions present (including hazardous substances and situations, and temperature extremes), duration of use, and performance characteristics of the protective material relative to the task(s) to be performed. Common protective clothing materials used for ER field operations include: cotton, nonwoven polypropylene fabrics which may be breathable or nonbreathable (e.g., standard Tyvek® or Kleenguard General Protection), splash protective fabrics (e.g., Tyvek® QC or Kleenguard Liquid Protection), and chemical-resistant fabrics (e.g. Tyvek®/Saranex® 23-P). Common protective materials for gloves and foot coverings used during ER field operations include: cotton, latex (natural rubber), nitrile, neoprene, and polyvinylchloride (PVC). Several publications are available, including manufacturer-specific references, for deciding the appropriate protective material for use during specific applications.

TABLE 1 - PPE ENSEMBLES

Level	Selection Criteria	OSHA Suggested Ensemble
D	Worn when respiratory protection is not necessary. Typically includes use of street clothing or protective clothing (e.g., cotton or "breathable" coveralls) for working in environments where the atmosphere contains no known or suspected airborne chemical or radiological contaminants, oxygen concentrations are between 19.5% and 23%, and conditions are not immediately dangerous to life or health (IDLH).	• Coveralls* (chemical-resistant*) • Gloves* (chemical-resistant*) • Shoes/Boots*: steel-toe/shank (chemical-resistant*) • Boots (outer) or Boot Covers*: chemical-resistant* • Hard hat* • Safety glasses
C	Worn when the type(s) and concentration(s) of airborne substances are known and the criteria for using air-purifying respirators (APRs) are met, including, though not limited to: environments where oxygen concentrations are between 19.5% and 23%, the airborne contaminants are known and the concentrations are estimated to be within the limits of protection afforded by the APR, and when conditions are not IDLH. Paraphrasing OSHA, 29 CFR 1926.65(c)(5)(ii) says that if a self-contained breathing apparatus (SCBA) is not used, and if (Level C) respiratory protection is warranted by the potential hazards identified during the preliminary site evaluation, an escape SCBA of at least 5 minutes duration shall be carried by employee(s) during initial site entry.	• Full-face or half-mask air-purifying respirator (APR) • Escape SCBA* (See "Selection Criteria") • Hooded chemical-resistant clothing* • Coveralls* (chemical-resistant*) • Gloves: outer and inner - chemical-resistant* • Boots*: chemical-resistant*, steel-toe/shank • Hard hat*
B	Should be used when: • Type and concentration of substances have been identified and require a high level of respiratory protection but not air-tight skin protection, • Atmosphere contains less than 19.5% oxygen, or • Presence of incompletely identified vapors or gases is indicated by direct-reading instruments, but vapors/gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the skin Furthermore, OSHA states that: "If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site, an ensemble providing protection equivalent to Level B PPE shall be provided as minimum protection, and direct reading instruments shall be used as appropriate for identifying IDLH conditions." (29 CFR 1926.65(c)(5)(iii))	• Positive pressure, full facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA • Coveralls* • Gloves: outer and inner - chemical-resistant* • Boots*: chemical-resistant*, steel-toe/shank • Boot covers*: disposable, chemical-resistant* • Hard hat*
A	Worn when highest level of respiratory, skin, and eye protection is necessary (e.g., when potential exists for skin contact with substances with a high degree of skin hazard; potential for splash, immersion, or exposure to unexpected vapors, gases, fumes, or dusts that are harmful to or readily absorbed by the skin; potential for high levels of radiological contamination).	• Positive pressure, full facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA • Totally-encapsulating chemical-protective suit • Coveralls* • Long Underwear* • Gloves: outer and inner - chemical-resistant • Boots: chemical-resistant, steel-toe/shank • Hard hat* (under suit)

* Optional - per SSHASP requirements. Note that any of Levels D, C, or B may include use of chemical-resistant protective clothing to protect against contact with wet contaminated surfaces, equipment, or materials that can saturate cloth.

Eye and Face Protection

OSHA requires personnel to use appropriate eye and face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acid or caustic liquids, chemical gases or vapors, or potentially injurious light radiation (29 CFR 1926.133). Protective eye and face devices include: safety glasses (with sideshields), cover goggles (Type 2 or Type 3), chemical goggles, burning goggles, and face shields (with plastic or glass lens). Descriptions of these PPE items are provided in Table E-1 of 29 CFR 1926.102 and in Section A of the DOE Construction Safety Reference Guide (DOE/ID 10447, September 1993).

Select eye and face PPE that complies with ANSI Z87.1-1989, "American National Standard Practice for Occupational and Educational Eye and Face Protection." An individual's lens prescription, if any, must be incorporated into the protective eyewear in a manner that does not compromise the integrity or protective ability of the PPE. Eye and face protection must be distinctly marked to identify the manufacturer, and personnel must be informed of any product-specific limitations indicated by the manufacturer. Table 2 lists OSHA recommendations that should be considered when selecting eye and face protection (29 CFR 1910.95 Appendix B). For protection against light radiation, use filter lenses of the appropriate shade (Table 3).

TABLE 2 - EYE AND FACE PROTECTION SELECTION CHART

Source	Hazard Assessment	Protection
Impact	Flying fragments, objects, large chips, particles, sand, dirt, etc.	Glasses with sideshields or goggles; for severe exposure use faceshield*
Heat	Hot sparks, splash from molten metals High temperature	Same as above Screen or reflective faceshield*
Chemicals	Splash Irritating mists	Goggles; for severe exposure use faceshield* Special purpose goggles
Dust	Nuisance dust	Goggles
Light and/or radiation:		
Welding: electric arc	Optical radiation	Welding helmet or faceshield*
Welding: gas	Optical radiation	Welding goggles or faceshield*
Cutting, torch brazing/soldering	Optical radiation	Glasses or welding faceshield*
Glare	Poor vision	Glasses with UV-protective shaded or special-purpose lenses

* Faceshields and welding helmets or faceshields should only be used over primary eye protection (glasses or goggles); typical shades of lenses to be used are indicated in Table 3.

Fall Protection

Several regulatory standards have requirements for use of fall protection equipment (Table 4). Although Table 4 makes reference to a broad array of fall protection standards and requirements, for the purposes of this procedure, guidance for selection of, and the limitations of, fall protection equipment is limited to devices that are worn by or attached to the employee (i.e., fall arrest equipment and emergency and rescue equipment). Thus, fall prevention equipment such as guard rails are not included in this procedure. Fall arrest equipment is discussed below by the following categories: nets, personal lifeline systems, and climbing protection systems.

Personnel nets are typically used where many workers are employed such as in large and/or long-term construction projects, or where large areas are exposed at heights of 25-feet or more. Nets are to be selected, positioned, and tested once in place in accordance with OSHA requirements (29 CFR 1926.105).

TABLE 3 - FILTER LENSES FOR PROTECTION AGAINST RADIANT ENERGY

Operation	Electrode Size 1/32 in.	Arc Current	Minimum* Protective Shade
Shielded Metal Arc Welding	Less than 3	Less than 60	7
	3-5	60-160	8
	5-8	160-250	10
	More than 8	250-550	11
Gas Metal Arc Welding and Flux Cored Arc Welding		Less than 60	7
		60-160	10
		160-250	10
		250-500	10
Gas Tungsten Arc Welding		Less than 50	8
		50-150	8
		150-500	10
Air Carbon Arc Cutting	(Light)	Less than 500	10
	(Heavy)	500-1000	11
Plasma Arc Welding		Less than 20	6
		20-100	8
		100-400	10
		400-800	11
Plasma Arc Cutting	(Light)**	Less than 300	8
	(Medium)**	300-400	9
	(Heavy)**	400-800	10
Torch Brazing			3
Torch Soldering			2
Carbon Arc Welding			14
Operation	**Plate Thickness (inches)**	**Plate Thickness (mm)**	**Minimum* Protective Shade**
Gas Welding: Light	Under 1/8	Under 3.2	4
Medium	1/8 to 1/2	3.2 to 12.7	5
Heavy	Over 1/2	Over 12.7	6
Oxygen Cutting: Light	Under 1	Under 25	3
Medium	1 to 6	25 to 150	4
Heavy	Over 6	Over 150	5

* Rule of thumb: Start with shade that is too dark to see the weld zone. Then go to a lighter shade that gives sufficient view of the weld zone without going below the minimum protective shade. In oxyfuel gas welding or cutting when the torch produces a high yellow light, use a filter that absorbs he yellow or sodium line in the visible light of the spectrum.

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.

TABLE 4 - FALL PROTECTION, RESCUE, AND ESCAPE STANDARDS			
Operation/Equipment	**OSHA Standard**	**Operation/Equipment**	**OSHA Standard**
Anchorage Strength	29 CFR 1926.104(b)	Safety Belts, Lanyard, Lifelines (cont'd)	
Confined Spaces	29 CFR 1910.146	Crawling Boards or Chicken Ladders	29 CFR 1926.451(v)(2)
Crane Safety	29 CFR 1926.550(a)(13), (c)(2), (g)	Concrete/ Masonry Construction	29 CFR 1926.701(e)(2)
Emergency Egress	29 CFR 1910.38(a)	Cranes	29 CFR 1926.550(c)(2)
Fall Protection - General	29 CFR 1926 Subpart M	Power Transmission/Distribution	29 CFR 1926.951(b) 29 CFR 1926.959
Floor and Wall Openings	29 CFR 1926.500	Silos, Hoppers, Tanks, Bins	29 CFR 1926.250(b)(2)
Ladder Safety	29 CFR 1926.450(a)(5) 29 CFR 1926.1053	Telecommunications	29 CFR 1910.268(g)(1)
Telecommunication Power Transmission	29 CFR 1926.959	Tunnels and Shafts	29 CFR 1926.800(h)(3)(v)
Personal Protective Equipment	29 CFR 1926.28(a) 29 CFR 1926.95	Type-T Powered Platforms	29 CFR 1910.66(d)(8)
Rescue		Welding, Cutting, Brazing	29 CFR 1910.252(e)(1)(i) 29 CFR 1910.252(e)(4)(iv)
Confined Spaces	29 CFR 1926.21(b), (c)	Safety Nets	29 CFR 1926.105 29 CFR 1926.750(b)(1)(ii)
Excavation	29 CFR 1926.651(i), (g)	Scaffolds	29 CFR 1926.451
Trenching	29 CFR 1296.652(f)	Float or Ship	29 CFR 1926.451(w)(6)
Ventilation in Tanks	29 CFR 1910.94(d)(11)(v)	Needle Beam	29 CFR 1926.451(p)(9)
Welding in Confined Spaces	29 CFR 1910.252(e)(4)(iv)	Window Jack	29 CFR 1926.451(t)(3)
Working Over Water	29 CFR 1926.106(c)	Pump Jack	29 CFR 1926.451(y)(11)
Roof Lifelines	29 CFR 1926.451(u)(3) 29 CFR 1926.500(g)	Roofing Brackets	29 CFR 1926.451(u)(3)
Safety Belts, Lanyard, Lifelines - Fall Protection Requirements	29 CFR 1926.104 29 CFR 1926.107(b)(1), (c)	Suspended	29 CFR 1926 Subpart L
Aerial Lifts	29 CFR 1926.556(b)(2)(iv)	Swinging	29 CFR 1926.451(i)(8)
Bell Bottom Pier	29 CFR 1926.652(f)	Single Point	29 CFR 1926.451(k)
Boatswain's Chair	29 CFR 1926.451(l)(4)	Stairs and Ladders	29 CFR 1926.501 29 CFR 1926.1050-1053

Personal lifeline systems, discussed below in greater detail, are comprised of a body support system, a connecting line device or system, and an anchorage system. These systems are designed to arrest a fall and help absorb the shock, yet to provide flexibility for freedom of movement by the worker. Select and use safety belts, lifelines, and lanyards in accordance with OSHA requirements (29 CFR 1926.104) and the following guidance and requirements:

- The term "safety belts" is a generic term representing many types of belts and harnesses which is often used in lieu of the preferred term "body support". Since leather tends to dry out and crack, nylon and polyester webbings have become common body belt materials. The American Society of Safety Engineers (ASSE) does not recognize the use of belts in its publication, "American National Standard - Safety Requirements for Personal Fall Arrest Systems" (ANSI Z359.1-1992). Parachute-type harnesses are preferable to belts because they offer more comfort and support after a fall occurs, and because fitting is more reliable. A chest harness should be used only for restraint or positioning to control a fall hazard on the edge. A body harness is designed to spread shock load over the shoulders, thighs, and seat area, should be used in all fall arrest applications and is a must where free falls up to 6-feet are anticipated.

- A connecting line system may consist of only a lifeline or lanyard and hardware connectors (e.g., bolts, shackles, D-rings, snap hooks, and metal links), or may also include a mechanical grabbing device that locks the rope or cable to prevent travel.

  - A lanyard is a short, flexible rope or strap webbing connecting a worker's body support system to either an anchorage point or to a grabbing device on the lifeline. OSHA requires that a lanyard be at least 1/2-inch diameter nylon rope or equivalent. A lanyard is designed to permit freedom of movement on the job and to absorb the shock of a free fall up to 6-feet. As little slack as possible is vital to limit the free fall distance to which the worker is exposed.

  - A horizontal lifeline is an anchoring cable designed to be rigged between two fixed anchorage points on the same level. This may serve as a mobile fixture point for the attachment of lanyards or lifelines. Pre-fabricated engineered systems are available to meet requirements of various applications.

  - A "dropline" is a vertical line that extends from the independent anchorage point and to which a lanyard or body support device is attached using a grabbing device. The dropline should be at least 5/8-inch diameter polyester twisted rope, or 1/3-inch to 3/8-inch diameter steel cable with a minimum breaking strength of 5,400 pounds.

- The anchorage point is the position on an independent structure to which the fall arrest device or lanyard is securely attached. The anchorage point must be able to sustain a 5,400 pound minimum static load strength; although, where free falls of 2-feet or less are anticipated, a strength of 3,000 pounds per worker is sufficient (29 CFR 1926.502).

Climbing protection systems are distinguished from most lifeline systems by their inelasticity and ability to withstand outdoor exposure. Protection of workers climbing poles and ladders, or on rigs, towers, bridges, antennas, etc., can be accomplished with taut cables or rigid rails running centrally or alongside the vertical structure to be climbed. The worker's body support system is attached to the cable or rail by means of a climbing protection device which is designed to move freely but locks the instant a fall is sensed. Climbing protection systems shall be selected and used based upon the applicable requirements of OSHA regulations and/or standard industrial practices (i.e., 29 CFR 1926.1053 and ANSI A14.3-1992).

Emergency and rescue equipment consists of controlled descent and retrieval systems. Descent devices are systems designed to lower one or more persons by either a variable or an automatic constant speed method. Descent devices may be manual or automatic. Manual devices require constant user control to regulate the speed of descent. Automatic devices are controlled with a maximum lowering speed inherent to the device. A typical automatic controlled descent system

incorporates a pulley mechanism equipped with a centrifugal brake. Harnesses and mechanical retrieval devices must be used by personnel working in confined spaces at depths greater than 5-feet (29 CFR 1910.146). When working in manholes and tanks deeper than 10-feet, fall protection must be used in addition to a retrieval system. Manual winch systems may be adequate to lift victims from 50-feet maximum depth within 3-minutes. Beyond 50-feet, powered systems are highly recommended to provide a speedy ascent. All manual and powered winches should have manufacturer approval for use as a personnel lifting device and a mechanical advantage of 4:1 minimally, and preferably 5:1 or 7:1.

Foot Protection

Protective footwear must be worn when personnel are working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where their feet may be exposed to electrical hazards (29 CFR 1926.136). Select and use only protective footwear that complies with ANSI Z41-1991, "American National Standard for Personal Protection - Protective Footwear" if purchased after July 5, 1994, and with ANSI Z41.1-1967 if purchased before this date. Metatarsal guards should be used when working near operations that may be very hazardous to the feet (e.g., where heavy objects may be subject to falling or rolling such as during some demolition operations). Further descriptive information is provided in Section 2 of the Construction Safety Reference Guide (DOE/ID 10447, September 1993).

Rubber and/or chemical-resistant footwear may be necessary when work is performed outdoors in wet weather or during operations involving exposure to ground contamination. Disposable footwear may be necessary to protect from substantial or toxic contamination of footwear. Select and use protective footwear on the basis of an evaluation of the hazards and potential hazards identified, conditions present, duration of use, and performance characteristics of the foot protection relative to the task(s) to be performed. Refer to the "Ensembles" subsection for further guidance. Several publications are available, including manufacturer-specific references, for deciding the appropriate protective footwear for use during specific applications. Non-conductive and static-resistant protective footwear are available to meet electrical safety requirements discussed above.

Hand Protection

OSHA requires employers to select, and require employees to use, appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, and harmful temperature extremes (29 CFR 1926.138). Select and use hand protection (gloves) on the basis of an evaluation of the hazards and potential hazards identified, conditions present, duration of use, and performance characteristics of the hand protection relative to the task(s) to be performed. Refer to the "Ensembles" subsection for further guidance. Several publications are available, including manufacturer-specific references, for deciding the appropriate glove material for use during specific applications.

Head Protection

Personnel are required (29 CFR 1910.135) to wear head protection (hard hats) when working in areas where there is a potential for head injury due to falling objects (e.g., when working within a radius equivalent to the height of a drill rig mast while the mast is raised or equivalent to the length of a backhoe arm while the backhoe is in use). Select and use only head protection that complies with ANSI Z89.1-1986, "American National Standard for Personal Protection - Protective Headwear for Industrial Workers Requirements." Protective headwear designed to reduce electrical shock hazard must be worn by affected personnel when working near exposed electrical conductors that could contact the head.

Hearing Protection

OSHA requires employers to provide hearing protectors to employees who are exposed to an 8-hour time-weighted average (TWA) of 85 decibels or greater (29 CFR 1910.95(i)), and to ensure that employees who are exposed to noise levels listed in Table 5 wear hearing protectors that attenuate their exposure at least to an 8-hour TWA of 85 decibels. The employer also must maintain a hearing conservation program, including employee training and proper fit and use of hearing protectors (HASP Section 4.2.2.7).

Employees are to be given the opportunity to select their hearing protectors from a variety of suitable protectors which are to be provided by the employer at no cost to the employee. The EPA requires that manufacturers label their hearing protectors indicating the noise reduction rating (NRR) of the protector (40 CFR Part 211, Subpart B). The NRR is an indication of the effectivaness of the protector in terms of decibels of noise attenuation. Refer to Section 6.3 of the ER Project Health and Safety Method - Noise Exposure Monitoring Method (ER-HSM-1G) for equations to be used for calculating the exposure of the person wearing the protectors. If noise exposure consists mainly of frequencies below 500-herz (Hz), the calculation should be made using the C-weighted noise level.

Select and use only hearing protectors that attenuate noise exposure at least to an 8-hour TWA of 85 decibels. Earmuffs and semiaural devices typically have a NRR between 15 and 30. Foam, premolded, and custom molded earplugs (some of which are disposable) typically provide a NRR between 10 and 30. In some exposure situations, both earplugs and earmuffs should be selected and used to achieve sufficient noise attenuation.

TABLE 5 - NOISE EXPOSURES REQUIRING USE OF HEARING PROTECTORS

Duration (hours per day)	Sound Level (dBA slow response)	Duration (hours per day)	Sound Level (dBA slow response)
8	≥ 85 *	1.5	> 102
6	> 92	1	> 105
4	> 95	0.5	> 110
3	> 97	≤ 0.25	> 115
2	> 100		

* The OSHA standard indicates 90 dBA with the caveat that employees who have not yet had a baseline audiogram or who have experienced a standard threshold shift in their hearing ability must have hearing protection when exposed to noise ≥ 85 dBA 8-hour TWA. Therefore, ESH-5 has decided that it is easier to monitor this requirement if all personnel are required to use hearing protection when exposed to noise ≥ 85 dBA 8-hour TWA.

Radiological Protection

Refer to LANL procedure, "Radiological Protective Clothing Standard" (ESH-1-06-01) for PPE requirements pertaining to protection against radiological hazards.

Respiratory Protection

Refer to Section 7.1 of the HASP.

Welding Protection

Workers may need special protection from molten metal and slag, hot sparks, and high temperature exposure during overhead or other heavy welding operations, and from respiratory hazards associated with toxic vapors and fumes produced during the welding operation. Select and use PPE for welding operations in accordance with applicable OSHA requirements (29 CFR

1926.353). Leather or flame-proof aprons, leggings, chaps, capes or arm protection may be necessary to prevent weld-flash burns. Eye and face protection is addressed above.

Working in Traffic

According to OSHA (29 CFR 1926.201(a)(4)), flagmen are to be provided with and wear a red or orange warning garment while flagging traffic. Warning garments worn at night are to be made of reflectorized material(s).

Working Over or Near Water

Where danger of drowning exists, personnel are to be equipped with and wear a protective flotation device (PFD) (29 CFR 1926.106). Select and use only PFDs (life jackets or buoyant vests) that are U.S. Coast Guard-approved. There are five types of PFDs that differ depending upon the design and application of the device.

- Type I: Sleeveless jacket that surrounds the body, designed to turn a person (even someone unconscious) from a face downward position in the water to a vertical or slightly backward position. These devices have at least 20 pounds of buoyancy and are the most effective type of PFD in rough waters or when immersion could be for a considerable time. Recommended for use when working far from shore and for nonswimmers.

- Type II: A vest that can turn a conscious or unconscious person from a face downward to an upright or slightly backward position, but the turning action is not as pronounced as that of the Type I device. These devices have a buoyancy of 15.5 pounds and are most appropriate for boating and marine operations close to shore.

- Type III: These devices are designed for conscious persons to place themselves in a vertical or slightly backward position, afterward this PFD will maintain that position. These devices are made of water-resistant materials and have at least 15.5 pounds of buoyancy. Recommended for use where other workers are nearby and there is a probability of quick rescue.

- Type IV: This class includes buoyant cushions and rings designed to be thrown to someone in the water and to be grasped and held, not worn, by the victim. These devices have at least 16.5 pounds of buoyancy and are recommended only for temporary emergency use (i.e., to be thrown to someone who has accidentally fallen into the water).

- Type V: These are devices that have received approval for specified, restricted uses.

6.2 Donning/Doffing

PPE items should be donned (put on), worn, and doffed (taken off) according to the manufacturer's instructions. Once donned, PPE should be adjusted to fit well and comfortably (e.g., not too tight or restrictive). General procedures for donning and doffing protective clothing are described in this section.

Donning

1. Inspect the clothing and other equipment items before donning. (Refer to Section 6.5.)
2. If required, don inner foot coverings and tape the ankles where the pant legs meet the foot coverings. (Duct tape should be used for sites having chemical or mixed waste hazards.)
3. If required, don inner gloves.
4. Standing or sitting, step into the legs of the coveralls, then gather the coveralls around the waist.
5. Place arms through the sleeves of the coveralls. Zip the coveralls, and if directed by the SSO or SSHASP requirements, tape the wrists where the sleeves meet the gloves. (Duct tape should be used for sites having chemical or mixed waste hazards.)
6. If required, don foot coverings or outer boots.

7. If required, don outer gloves.
8. If respiratory protection is required, don the respirator according to the procedures provided in the employer's Respiratory Protection Program. Adjust respirator to fit and perform respirator fit-checks (inhalation and exhalation). Repeat adjustment and fit-checks until respirator fits properly.
9. If ear plugs are required, don the protectors in a manner that does not disrupt the face seal of the respirator (if any).
10. If coveralls are fitted with a hood, carefully place hood over head in a manner that does not disrupt the face seal of the respirator (if any).
11. If ear muffs are required, don the protectors in a manner that does not disrupt the face seal of the respirator (if any).
12. Adjust hard hat or headpiece to fit head, and if required, fit the hard hat with a faceshield. Don hard hat (in a manner that does not disrupt the face seal of the respirator, if any).
13. Have another field team member or the SSO visually check that PPE is donned satisfactorily.

Doffing

PPE items should be scrubbed and/or doffed according to the decontamination sequence indicated in the SSHASP. General procedures for doffing PPE are described in this section. At the appropriate decon station perform each of the following steps as applicable.

1. Remove hard hat and decontaminate, as necessary.
2. Decontaminate, as necessary, and remove outer foot covers or boots.
3. Decontaminate, as necessary, and remove outer gloves.
4. Remove ear muffs, if worn, and decontaminate as necessary. Store in clean, nonhazardous location.
5. Carefully peal hood off of head while turning it inside out.
6. Remove and dispose of ear plugs, if worn.
7. Remove and dispose of tape from wrists and ankles, if any.
8. Unzip coveralls and peal them off - by turning them inside out while pealing them off from the neck down to the feet.
9. Remove inner foot coverings, if any.
10. Loosen straps of respirator facepiece, if any, and remove facepiece (according to employer's Respiratory Protection Program procedures). Be careful not to touch or to spread contamination into the inner surface of the respirator facepiece.
11. Remove inner gloves, if any, by turning them inside out while pealing them off.

6.3 Use

Only use PPE in accordance with the manufacturer's instructions and with applicable approvals or certifications (e.g., NIOSH approvals of respiratory protective components). Furthermore, PPE should only be selected and used in accordance with applicable regulatory requirements and standard industrial practices; refer to Section 6.1. General guidance for use of PPE are described in this section.

- While using PPE, report any perceived difficulties or malfunctions to the SSO or FTL. Possible difficulties or malfunctions involving PPE use may include
  - discomfort,
  - fatigue, rapid pulse, shortness of breath, nausea, or chest pain,
  - interference with vision or communication,
  - unsafe or undesired restriction of motion,
  - degradation of protective materials or equipment,
  - skin irritation,
  - unusual residues on the PPE, and
  - detection of odor(s) within the respirator facepiece

- Alert the SSO if a situation arises that may be reason to upgrade or downgrade the use of PPE. Reasons to upgrade PPE include

  - known or suspected presence of dermal hazards,
  - occurrence or likely occurrence of toxic gas, fume, or vapor emission,
  - change in the task to be performed that increases the potential for contact with hazardous substance(s) or moving parts, or
  - personal discomfort or dissatisfaction with PPE in use.

  Reasons to downgrade PPE include

  - new information indicating that the situation is less hazardous than previously determined,
  - hazard assessment and monitoring data indicate low or no exposure levels,
  - change in site conditions or operations that decreases the threat of hazard, or
  - change in the work task that reduces contact with hazardous substances or moving parts.

6.4 Decontamination

Decontaminate PPE in accordance with the HASP, the SSHASP for the field work, and any other supplemental site-specific procedures (e.g., operating procedures for use of Level B PPE and employer's health and safety program procedures).

6.5 Inspection, Maintenance, and Storage

Inspect, maintain, and store PPE in accordance with the manufacturer's instructions and in accordance with applicable regulatory requirements and standard industrial practices; refer to Section 6.1 for regulatory references. General guidance for inspection, maintenance, and storage of PPE items are described in this section and in Table 6. PPE should be

- inspected by the user before use, and in some cases after use or after cleaning, to verify that the integrity of the protective material and/or device is not compromised; any defective materials or components should be repaired or replaced by a qualified person (as defined in the HASP Section 3.2.3.5),

- cleaned and disinfected, or properly disposed, as frequently as necessary to ensure that the user is properly protected, and

- stored in a clean and sanitary location in a manner that prevents damage and cross-contamination during storage.

7.0 REFERENCES

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- American National Standards Institute (ANSI). *American National Standard for Personal Protection - Protective Footwear*. ANSI Z41-1991 and ANSI Z41-1967. New York: American National Standards Institute, Inc., 1991 and 1967.

- American National Standards Institute (ANSI). *American National Standard for Personal Protection - Protective Headwear for Industrial Workers Requirements*. ANSI Z89.1-1986. New York: American National Standards Institute, Inc., 1986.

- American National Standards Institute (ANSI). *American National Standard for Ladders - Fixed - Safety Requirements*. ANSI A14.3-1992. Des Plaines, IL: American Society of Safety Engineers (ASSE), 1992.

TABLE 6 - PPE INSPECTION CHECKLISTS - GUIDANCE*		
PPE	**Before/After Use**	**Periodically During Work Task**
Clothing	• Determine that clothing material is correct for specified task in accordance with the SSHASP; if not, do not use • Visually inspect for signs of poor integrity indicating poor protection: - imperfect seams - non-uniform coatings - tears - malfunctioning closures (zippers) • Hold up to light and check for undesirable pinholes • Flex PPE and observe for signs of poor protective quality, such as: - cracks - other signs of deterioration • If PPE has been used previously, inspect inside and out for signs of wear or chemical attack, such as: - stretched and thereby weakened material - discoloration - swelling - stiffness If any evidence is observed that the protective quality of the PPE is compromised, do not use.	• Check for evidence of wear or chemical attack (refer to "Before/After Use") • Check for closure (zipper) or seam failure • Check for punctures or tears If any evidence is observed that the protective quality of the PPE has become compromised, appropriately decontaminate and/or dispose of PPE and don acceptable PPE.
Gloves	• Pressurize glove by blowing into it and rolling gauntlet toward fingers or inflate and hold under water while observing for bubbles. In either case, no air should escape. If air does escape, discard gloves and try another pair.	• Periodically check gloves for signs of poor integrity: puncture, tearing, or chemical attack. If any evidence is observed that the protective quality of the PPE has become compromised, appropriately decontaminate and/or dispose of PPE and don acceptable PPE.
Fully-Encapsulating Suit	• Check that pressure relief valves are functioning properly • Inspect the fitting of wrists, ankles, and neck • Check faceshield if so equipped for undesirable: cracks, crazing, or fogginess	• Periodically have buddy visually check that protective quality of suit has not been compromised. If any evidence is observed that the protective quality of the PPE has become compromised, appropriately decontaminate and/or dispose of PPE and don acceptable PPE.
Respiratory Protection	Refer to employer's written Respiratory Protection Program	

* Source: *Handbook for Occupational Safety and Health During DOE Hazardous Waste Activities* (second working draft). U.S. Department of Energy (DOE), Washington, DC, October 1994

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8.0 RECORDS

For LANL ER field operations, the hazard assessment is to be achieved through development of the SSHASP in accordance with requirements of the HASP. Include the corresponding PPE specifications, if any, in the SSHASP in accordance with the recommendations and requirements of this section. Subcontractor representatives and the Field Unit Health and Safety Representative, among others, are required to approve and/or concur with the SSHASP per Sections 1.2 and 1.3 of the HASP.

OSHA requires that the employer verify that each affected employee has received and understood the required training (Section 2.3) through a written certification that contains the name of each trained employee, the date(s) of training, and which identifies the subject of the certification (29 CFR 1910.132[f][4]). OSHA requires that an accurate record of medical surveillance be retained by the employer. Per Sections 10 and 11 of the ER Project HASP, the SSO is to verify that field team members have current certification(s) of required training and medical surveillance, including hearing conservation, prior to the FTL or JS tasking the field team member with performing an ER field duty.

9.0 ATTACHMENTS

None.

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

DIRECT-READING MONITORING METHOD USING COLORIMETRIC DETECTOR TUBES

ER-HSM-1A

ER-HSM-1A

DIRECT-READING MONITORING METHOD USING COLORIMETRIC DETECTOR TUBES

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1.0 PURPOSE

To provide a method for:

- Further characterizing and identifying airborne contaminants that have been detected using non-chemical specific direct-reading instruments (e.g., PID, and FID); and,
- Obtaining real time rough quantification of airborne contaminants.

2.0 SCOPE

2.1 Applicability

This method applies to all personnel performing direct-reading monitoring using colorimetric tubes during ER Project field operations.

2.2 Training

Personnel conducting colorimetric tube monitoring shall:

- Have a thorough knowledge of the use and maintenance of the colorimetric tubes and supporting equipment (e.g., pump) used;
- Be trained to conduct monitoring per this method;
- Be trained to conduct leak testing; and
- Be informed of the necessary monitoring data to be obtained and recorded.

3.0 DEFINITIONS

- **Accuracy:** The agreement between the true value and a reading or observation made from an instrument.
- **Action Level:** An administrative control level at or above which specific actions are required. Refer to the Site Specific Health and Safety Plan (SSHASP) for action levels.
- **American Conference of Governmental Industrial Hygienists (ACGIH):** A professional society that establishes exposure limits, referred to as threshold limit values (TLVs), and guidance for limiting occupational exposure to toxic substances and hazardous physical agents. Each year the ACGIH revises TLVs as appropriate.
- **Breathing Zone:** A sphere approximately two feet in diameter surrounding the head.
- **Calibration:** The act of checking, adjusting, and systematically standardizing the graduation of a quantitative measuring instrument.
- **Ceiling Limit:** Contaminant air concentration that should not be exceeded during any part of the workday. The ceiling concentration is usually expressed as a 15-minute time weighted average (TWA) exposure not to be exceeded at any time during the workday.
- **Concentration:** The amount of a given substance in a stated unit of measurement (concentration = mass/volume).

- **Direct-Reading/Real Time Instruments:** Instruments that provide instantaneous (or near instantaneous) measurements of particular parameters of interest (e.g., airborne contaminants).

- **Engineering Controls:** A means of controlling personnel exposure by modifying the work environment. Refer to the SSHASP for engineering controls.

- **Reagent:** The substance inside the colorimetric tube that chemically reacts with the gas being analyzed and changes color to indicate the concentration of that gas in the air.

- **Short-Term Exposure Limit (STEL):** Maximum concentration to which workers may be exposed for a short period of time (15 minutes) on only four separate occasions throughout the workday with at least 1 hour between exposures without respiratory protective equipment.

- **Threshold Limit Value (TLV):** The ACGIH time weighted average for airborne toxic materials that are used as guidelines in the control of health hazards. They represent concentrations to which nearly all workers may be exposed 8 hours per day over extended periods of time without adverse effects.

4.0 BACKGROUND AND/OR CAUTIONS

4.1 Applicable Standards

Air monitoring using colorimetric tubes is conducted per this method, manufacturer's instructions and is generally recognized industrial hygiene practices.

4.2 Limitations/Interferences

- Colorimetric tubes have an accuracy of ± 35% at 1/2 the exposure limit and ± 25% at 1 to 5 times the exposure limit.

- The pump and pump/tube connection are subject to leaking.

- Requires prior knowledge of gases/vapors in order to select the appropriate detector tube.

- Temperature and humidity may affect readings.

- Cold colorimetric tubes should not be used. They should be kept at room temperature or in a shirt pocket for 1 hour before using.

- Error in reading the color change endpoint (often indistinct) is a major source of inaccuracy. Tubes that turn the wrong color, have granules in the color - stained area that are not stained, or stain at an angle or irregular shape should be suspect.

- Improper pump operation may result in inaccurate air volume being drawn through the tube.

- Injuries could result from broken or flying glass when the tube ends are broken off. Use a scoring device to reduce the potential for these injuries.

- Detector tubes of a given brand are to be used only with a pump of the same brand. The tubes are calibrated specifically for the same brand of pump and may give erroneous results if used with a pump of another brand.

- Lack of specificity is a limitation of many detector tubes. Many indicators are not highly selective and can cross-react with other compounds. Manufacturer's instructions describe the effects of interfering contaminants.

- Another important consideration is sampling time. Detector tubes give only an instantaneous interpretation of environmental hazards. This may be beneficial in potentially dangerous situations or when ceiling limit exposure determinations are sufficient. When long-term assessment of occupational exposures are necessary, short-term detector tube measurements may not reflect time-weighted average levels of the hazardous substances present.

- Detector tubes normally have a shelf-life at 25° C of 1 to 2 years. Refrigeration during storage lengthens the shelf-life. Outdated detector tubes (i.e., beyond the printed expiration date) should never be used.

5.0 EQUIPMENT

5.1 Colorimetric Tubes

The colorimetric tube is an hermetically sealed glass tube that contains solid granular material such as silica gel, alumina, or pumice. This material has been impregnated with an agent that reacts to produce a color change when air containing a specific contaminant or group of contaminants is drawn through the tube. The intensity or length of color change is proportional to the contaminant concentration.

Two major brands of colorimetric tubes are generally used, Draeger and Sensidyne. Several hundred different detector tubes are available; therefore, the user must consult the specific instructions provided with each tube.

General types of colorimetric tubes include:

- Direct-Reading Scale: As the gas passes through the tube, the reagent becomes discolored. The longer the stain, the greater the concentration. The concentration is read directly from the scale on the tube. Most colorimetric tubes fall into this category.

- Color Comparison Tubes: The color to which the reagent changes indicates the concentration. The color in the indicating layer is compared to a standard reference layer in the tube.

- Ampule Tubes: When two chemical reagents in the tube are reactive with each other, they are separated by an ampule.

- Passive Dosimeter Tubes: These tubes require no pumps and are a form of direct-reading tubes. Repetitive measurements can be taken with the same tube for periods as short as 15 minutes (STEL samples) or as long as 24 hours.

- Special Tubes and Tube Sets: Both Draeger and Sensidyne make special application tubes and tube sets. These tubes often use additional attachments and equipment. Examples include the Draeger Oxygen 5% B Indicating Tube Set and the Sensidyne Compressed Breathing Air Analysis Kits.

5.2 Pumps

Pumps are used in conjunction with colorimetric tube to draw a known quantity of air through the tube.

Commonly used pumps are the Draeger tube pump, which operates by squeezing a bellows-like baffle and the Sensidyne tube pump, which is piston operated. In addition, Draeger and MSA manufacture automatic pumps. Some takes can be used with a low flow "personal type" pump set at a calibrated flow rate and read in a predetermined time lapse.

5.3 Equipment Maintenance

All colorimetric tubes and associated pumps shall be maintained in accordance with manufacturer's specifications and instructions.

6.0 PROCEDURES

6.1 Scheduling and Frequency

Direct-reading monitoring using colorimetric tubes shall be conducted:

- As required by the SSHASP;
- When further characterization/identification of airborne contaminants is warranted (e.g. due to unanticipated site conditions, and when measurements from non-chemical specific direct-reading instruments exceed an action level); and,
- For obtaining real time preliminary rough estimates of airborne contaminant concentration.
- Frequency of colorimetric tube monitoring shall adhere to the following specifications:
- As necessary to characterize employee exposure to gases and vapors, and to determine whether levels meet or exceed action levels specified in the SSHASP;
- Whenever there is a change in an operation or controls that may expose employees to gases or vapors at or exceeding an action level;
- Whenever respirator protection is required and/or may be considered inadequate due to a rise in overall gas or vapor level(s).
- Whenever engineering controls are required and/or may be considered inadequate due to a rise in overall gas or vapor level(s).

6.2 Monitoring Location(s)

Monitor at the operational source point where the highest level(s) of gases or vapors would be expected to be generated (e.g., at the point where potentially contaminated soils or water are disturbed). If the colorimetric tube indicates the presence of a contaminant, monitor for gas and vapor level(s) in the employee's breathing zone. If multiple breathing zone readings are taken and levels differ, record all levels. The highest level shall be used for comparison with action levels specified in the SSHASP.

6.3 Instrument Calibration and Use

It is critical that the colorimetric tube manufacturer's manual be reviewed prior to use. Colorimetric tubes and the associated pump shall be calibrated and used accordingly.

6.3.1 Leak Test

Each day prior to use, perform a pump leakage test by inserting an unopened detector tube into the pump and attempt to draw in 100 ml of air. After a few minutes, check for pump leakage by examining pump compression for bellows-type pumps or a return to resting position for piston-type pumps. Automatic pumps should be tested according to the manufacturer's instructions.

Record that the leakage test was made on the Direct-Reading Air Monitoring Form (Attachment A).

6.3.2 Calibration Test

Calibrate the colorimetric tube pump at least once every three months for proper volume measurement using a primary standard (e.g. a soap-bubble meter, and electronic bubble flow meter). Refer to the manufacturer's information for proper use of the primary standard.

Generally, the calibration test involves the following steps:

1. Connect the pump directly to the bubble meter with a detector tube in-line. Use a detector tube and pump from the same manufacturer.

2. Wet the inside of the primary standard with soap solution and calibrate as follows:

   - For piston-type pumps, pull the pump handle all the way out (full pump stroke) and note where the soap bubble stops;

   - For bellows-type pumps, fully compress the bellows; and,

   - For automatic pumps, program the pump to take a full pump stroke.

3. For each type of pump, the bubble should stop between the 95 cc and 105 cc marks. Allow 4 minutes for the pump to draw the full amount of air. This time interval varies with the type of detector tube being used in-line with the calibration setup.

4. Check the volume for 50 cc (1/2 pump stroke) and 25 cc (1/4 pump stroke) if pertinent. A ±5% error is permissible. If error is greater than ±5%, send the pump to the manufacturer for repair and recalibration.

5. It may be necessary to clean or replace the rubber bung or tube holder if a large number of tubes have been taken with the pump.

6. Record the results of the calibration test in the health and safety logbook.

Colorimetric tubes are specific for individual compounds, or groups of compounds, and require specific sampling techniques. Manufacturer's information details the required volume, proper tube preparation, insertion of the tube into the pump, and the applicability and limitations of the individual tubes.

Generally, direct-reading monitoring using colorimetric tubes will involve the following steps:

Check that the action level, specified in the SSHASP, for the gas or vapor being analyzed is within the limits of the tube selected. Also check that the ambient temperature and relative humidity are within the limits of the tube selected and that the tube has not exceeded its shelf life.

Break off the tips of the tube, with the scoring device, and insert it into the tube holder with the arrow on the tube pointing towards the pump. (NOTE: Use a short piece of tubing at the end of the open end of the tube to avoid cuts.)

Obtain measurements by positioning the tube as close as possible to the monitoring area (close to a worker's breathing zone), without interfering with the employee's job duties, and complete the appropriate number of strokes. The manufacturer's instructions in the tube box must be consulted for this information.

When drawing air through the tube using a bellows-like baffle, allow the pump chain to become taut, then wait about 5 seconds before proceeding to the next pump stroke. When using a piston operated pump, pull the piston out (without forcing it) to the notch which matches the required air volume and allow the piston to retract and draw the air through the tube. Hold the specified time before releasing or reading. (NOTE: Make sure the bellows are closed completely before releasing.)

Compare the color change of the tube with the colors in the manufacturer's instruction. When reading the stain end point, the indicated concentration is the furthest shade of coloration. Do not "average" peaks and valleys of jagged color edges. Err on the side of safety.

Measurements in Los Alamos should be corrected for barometric by multiplying the actual measurement by 1.3 (i.e., 30" Hg/23" Hg) to provide concentration estimates which can be compared to a PEL or TLV. Temperature corrections could be made but usually the magnitude of the change is very small.

Record measurements on the Direct-Reading Air Monitoring Form (Attachment A). Note in the comments section if the reading has been corrected for pressure and/or temperature.

Compare readings with action levels as specified in SSHASP. If measured levels exceed the action level, notify the Field Unit ESH Representative.

Convey the air monitoring results to personnel working on site, and keep a copy of the results on site available for review by affected individuals and site management.

7.0 REFERENCES

7.1 Required Documents

- *Site-Specific Health and Safety Plan (SSHASP)*
- *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (current edition published annually)
- *Manufacturer's Literature*

7.2 Bibliography

- American Conference of Governmental Industrial Hygienists (ACGIH): *1994-95 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.* ACGIH, Cincinnati, OH (1994).
- _____: *OSHA Technical Manual.* Government Printing Office, Washington, DC (1993).
- Barbara A. Plog, Ed. *Fundamentals of Industrial Hygiene,* 3rd ed. National Safety Council, (1988).
- *U.S. Environmental Protection Agency. Air Monitoring for Hazardous Materials. Environmental Response Training Program.*

8.0 RECORDS

8.1 Recordkeeping

- Record calibration test results in the health and safety logbook as described in Section 6.3.2. and note performance of leak test on the Direct-Reading Air Monitoring Form (Attachment A). Describe any deviations from this approach, if any, and associated rationale(s).
- Gas and vapor monitoring results shall be recorded on the Direct-Reading Air Monitoring Form (Attachment A). Describe any deviations from this method, if any, and associated rationale(s).
- In accordance with LANL-ER-AP-02.1.R1, "Procedure for LANL ER Records Management," verify completeness and accuracy of entries and sign and date each page.
- A copy of the results shall be kept on site available for review by affected personnel and management.

9.0 ATTACHMENTS

Attachment A: Direct-Reading Air Monitoring Form

DIRECT-READING AIR MONITORING FORM

SSHASP No. _____ Mod. No. _____ SSHASP Title: _____ TA(s): _____

Instrument Data

Instrument:	Mfr./Model:	Serial No.:	Factory Calibration Date Completed: Date Due:	Leak Test: Pass ☐ N/A ☐ Not Pass ☐

Gas Type	Mfr.	Part/Lot No.	Conc.	Date	Time	Comments

Additional Comments:

Date: _____

Monitoring Data

Page ____ of ____

Time	Location	Reading (units)	Task Monitored	Admin./Eng Control(s)	PPE	Temp.	Humidity (%)	Atm. Press. (mm Hg)	Rain	Snow	Wind	Comments
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	

Additional Comments:

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

DIRECT-READING MONITORING METHOD USING COMBUSTIBLE GAS INDICATORS (CGIs)

ER-HSM-1B

ER-HSM-1B

DIRECT READING MONITORING METHOD

COMBUSTIBLE GAS INDICATORS (CGIs)

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1.0 PURPOSE

The purpose of this method is to describe the characteristics, proper use, limitations, and calibration procedures for Combustible Gas Indicators (CGIs).

2.0 SCOPE

2.1 Applicability

This method applies to all personnel performing direct-reading monitoring using a CGI during ER Project field operations.

2.2 Training

Personnel conducting monitoring shall:

- Have a thorough knowledge of instrumentation calibration, use, and maintenance;
- Be trained to conduct monitoring per this method; and
- Be informed of the necessary monitoring data to be obtained and recorded.

3.0 DEFINITIONS

- **Accuracy:** The agreement between the true value and a reading or observation made from an instrument.
- **Action Level:** An administrative control level at or above which specific actions are required. Refer to the Site Specific Health and Safety Plan (SSHASP) for action levels.
- **American Conference of Governmental Industrial Hygienists (ACGIH):** A professional society that establishes exposure limits, referred to as threshold limit values (TLVs), and guidance for limiting occupational exposure to toxic substances and hazardous physical agents. Each year the ACGIH revises TLVs as appropriate.
- **Calibration:** The act of checking, adjusting, and systematically standardizing the graduation of a quantitative measuring instrument.
- **Direct-Reading/Real Time Instruments:** Instruments that provide instantaneous (or near instantaneous) results of particular parameters of interest (e.g., airborne contaminants). Generally, direct-reading/real time instruments only provide results for a moment in time, unless they can integrate the data (e.g., they are equipped with data logging capabilities).
- **Engineering Controls:** A means of controlling personnel exposures by modifying the work environment. Refer to the SSHASP for engineering controls.
- **Flammable:** Any solid, liquid, or gas that ignites easily and burns rapidly. A vapor or gas is flammable when its concentration in air is above its lower explosive limit (LEL) or below its upper explosive limit (UEL). Between these values lie the gas or vapor's flammable range.
- **Fume:** Air dispersed particulates ranging from 0.01 to 1.0 microns that are produced by combustion, condensation, and various chemical reactions.

- **Gas:** A state of matter in which the material has a very low density and viscosity, can expand and contract in response to a change in pressure or temperature, can easily diffuse into other substances, and readily and uniformly distributes itself throughout any container.

- **Lower Explosive Limit (LEL):** The smallest concentration of gas or vapor in air by volume that can be ignited and cause an explosion or fire. This may also be referred to as Lower Flammability Limit (LFL). LEL is expressed in percent of gas or vapor in air by volume.

- **Mist:** Particles of various sizes suspended in air. Considered to be liquid condensed on submicroscopic particles of dusts or gases.

- **Precision:** The ability to repeat results of an instrument or test under the same conditions.

- **Threshold Limit Values (TLVs):** The ACGIH occupational exposure limits. These values are published annually in the most current version of the *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

- **Upper Explosive Limit (UEL):** The gas concentration in air by volume at or above which there is insufficient oxygen available to support combustion making an explosion unlikely. This may also be referred to as Upper Flammability Limit (UFL). UEL is expressed in percent of gas or vapor in air by volume.

- **Vapor:** The gaseous form of substances that are normally in the liquid or solid state.

4.0 BACKGROUND AND/OR CAUTIONS

4.1 Applicable Standards

Air monitoring using CGIs is conducted per this method, manufacturer's instructions, and generally recognized industrial hygiene practices.

4.2 Limitations/Interferences

- Combustible gas measurement instruments do not generally indicate if a given atmosphere contains hazardous or toxic compounds.

- Several compounds such as, silicon-containing compounds, sulfuric acid, and nitric acid may poison the detection filament.

- If the detector has a platinum filament, its sensitivity may be reduced by exposure to gases like leaded gasoline vapors (tetraethyl lead), sulfur compounds (mercaptans and hydrogen sulfide), and sulfide compounds. (See manufacturers recommendations.)

- Unusually high concentrations of sulfur dioxide, fluorine, chlorine, bromine, iodine, and oxides of nitrogen cause measurement interference. (See manufacturers recommendations.)

- If known organic species are present, maximum accuracy requires a recalibration for each gas.

- CGIs will not detect the presence of explosive or combustible mists or sprays such as lubrication oil and grain or coal dust.

- Most CGIs are not designed for use in oxygen deficient (<19.5%) or oxygen enriched (>25%) atmospheres.

- Relative humidity must range between 10% and 90% for reliable readings.

5.0 EQUIPMENT

5.1 Combustible Gas Indicators (CGIs)

CGIs (also known as explosimeters) indicate the concentration of a flammable vapor or gas in air as a percentage of the lower explosive limit (LEL). CGIs typically operate by drawing a sample over a filament that combusts the flammable gas or vapor. The filament, which is heated or coated with a catalyst (usually platinum), is part of a balanced resistor circuit called a Wheatstone Bridge. When gases or vapors are burned on the filament, its resistance changes. These changes in the electrical current are registered as "percent LEL" on the instrument's meter.

Several manufacturers (e.g., MSA and Gastech) make CGIs. Although the instruments differ somewhat in design and operating features, their operation is based on the fact that a measurable amount of heat is released when a flammable gas or vapor is burned. Some CGIs (e.g. Gastech Four Gas Portable Monitor and the MSA Passport 4-in-1) are capable of monitoring for oxygen and toxic gases (e.g. carbon monoxide and hydrogen sulfide) as well as combustible gases and vapors. Most CGIs come equipped with audible and/or visual alarms to alert the user of unsafe gas levels, low battery or equipment failure.

In general, CGIs respond in the following manner:

- The meter indicates 0.5 LEL (50%). This means that 50% of the concentration of combustible gas needed to reach an unstable combustible situation is present. If the LEL of the gas is 5% in air, then the instrument indicates the presence of a 2.5% mixture in the atmosphere being tested.

- The meter needle stays above 1.0 LEL (100%). This means that the concentration of combustible gas is greater than the LEL and less than the UEL. Therefore, the concentration is immediately combustible and explosive.

- The meter needle rises above the 1.0 (100%) mark and then returns to zero. This response indicates that the ambient atmosphere has a combustible gas concentration greater than the UEL and an overabundance of the gas or vapor has displaced or consumed the oxygen. Although this atmospheric environment is not explosive, it could quickly become so if normal, oxygenated air is introduced to the environment or gas concentrations decrease.

The operator should be familiar with the LEL concentrations for specific gases to effectively use instruments that provide data only in ppm and not as percentages of the LEL.

5.2 Calibration Kit

Use only the calibration kit compatible with the CGI being used (i.e., one specified by the manufacturer) according to the manufacturer's instructions.

5.3 Batteries and Battery Charger

Use only the battery type and battery charger specified by the manufacturer for the instrument being used. Discharge and/or charge batteries according to the manufacturer's instructions. If a low battery is indicated during sampling, turn the analyzer off and recharge the instrument in a non-hazardous area.

5.4 Instrument Maintenance

Maintain all CGI equipment in accordance with manufacturer's specifications and instructions.

If the meter ceases to respond in the expected manner, refer to the manufacturer's operations manual for troubleshooting and corrective actions.

When the work activity being monitored is completed, or at the end of the day, carefully clean the outside of the CGI with a damp disposable towel to remove any visible dirt.

6.0 PROCEDURES

6.1 Scheduling and Frequency

Conduct monitoring of gases and vapors using a CGI to determine whether action levels specified in the SSHASP have been reached.

This monitoring should be conducted under normal operating conditions without altering operation.

The frequency of monitoring adheres to the following specifications:

- During field operation that may expose workers to gases or vapors as identified in the SSHASP.
- Whenever there is a change in an operation or controls that may expose employees to gases or vapors at or exceeding an action level.
- Whenever engineering controls are required and/or may be considered inadequate due to a rise in overall gas or vapor level(s).

6.2 Monitoring Location(s)

CGIs are used for initial entry on hazardous waste sites and for entering or operating machinery in any confined space where combustible gases or vapors denser than air may have accumulated. CGIs have also been used to monitor combustible gas or vapor levels during the installation of monitoring wells, around landfills, and during the excavation of buried drums and tanks where the accumulation of methane gas is of primary concern.

Monitor at the operational source point or area where the highest level(s) of gases or vapors would be expected to be generated (e.g., at the point where potentially contaminated soils or water are disturbed).

6.3 Calibration and Use

It is critical that the CGI operations manual be reviewed prior to use. Refer to the manufacturer's operations manual for step-by-step guidance on start-up, calibration, troubleshooting, shutdown, handling and maintenance.

Record instrument, model, serial number, and all calibration information on the Combustible Gas Indicator Monitoring Data Form (Attachment A).

Allow the CGI to warm up (about five minutes) so the battery will heat up the filament.

To test the instrument, follow the start-up procedure in the manufacturer's manual to verify normal functioning. (To establish a zero background reading, test the CGI in an area known to be free of combustible gases and vapors). Next, calibrate the instrument with the calibration gas, typically methane, according the manufacturer's manual and record the information on the Combustible Gas Indicator Monitoring Data Form (Attachment A).

Obtain measurements and record data on the Combustible Gas Indicator Monitoring Data Form (Attachment A).

Compare readings with action levels specified in SSHASP. If measured levels exceed an action level, notify the Field Unit ESH Representative.

Convey the air monitoring results to personnel working on site and keep a copy of the results on site available for review by affected individuals and site management.

7.0 REFERENCES

7.1 Required Documents

- *Site-Specific Health and Safety Plan (SSHASP)*
- *Instrument Operation Manual*

Note: If CGIs are used to monitor for toxic gases and vapors,

- *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (current edition published annually).

7.2 Bibliography

- Barbara A. Plog, Ed. *Fundamentals of Industrial Hygiene*, 3rd ed. National Safety Council, (1988).
- *U.S. Environmental Protection Agency. Air Monitoring for Hazardous Materials. Environmental Response Training Program.*

8.0 RECORDS

- Gas and vapor monitoring results, and instrument calibration data shall be recorded on the Combustible Gas Indicator Monitoring Data Form (Attachment A). Describe any deviations from this method, if any, and associated rationale(s).
- In accordance with LANL-ER-AP-02.1.R1, "Procedure for LANL ER Records Management", verify completeness and accuracy of entries and sign and date each page.
- A copy of the results must be kept on site, available for review by affected personnel and site management.

9.0 ATTACHMENTS

Attachment A: Combustible Gas Indicator Monitoring Data Form

CGI MONITORING DATA FORM

SSHASP No. _____ Mod. No. _____ SSHASP Title: _____ TA(s): _____

Calibration Data

Instrument:		Mfr./Model:		Serial No.:		Factory Calibration Date Completed:	Date Due:
Calibration	**Date**	**Time**	**Battery Check**	**Temp.**	**% LEL**	**% Oxygen**	**Other (ppm) Specify:** _____
Pre				____ °F ____ °C	Calib. Gas Mfr. _____ Lot/Serial No. _____ Conc. _____ in _____ gas Alarm Check Upper _____ Lower _____ Instr. Reading _____	Calib. Gas Mfr. _____ Lot/Serial No. _____ Conc. _____ in _____ gas Alarm Check Upper _____ Lower _____ Instr. Reading _____	Calib. Gas Mfr. _____ Lot/Serial No. _____ Conc. _____ in _____ gas Alarm Check Upper _____ Lower _____ Instr. Reading _____
Other				____ °F ____ °C	Calib. Gas Mfr. _____ Lot/Serial No. _____ Conc. _____ in _____ gas Alarm Check Upper _____ Lower _____ Instr. Reading _____	Calib. Gas Mfr. _____ Lot/Serial No. _____ Conc. _____ in _____ gas Alarm Check Upper _____ Lower _____ Instr. Reading _____	Calib. Gas Mfr. _____ Lot/Serial No. _____ Conc. _____ in _____ gas Alarm Check Upper _____ Lower _____ Instr. Reading _____

Additional Comments:

Date: _____

CGI Monitoring Data

Page ____ of ____

Time	Location	% LEL Reading	% Oxygen Reading	Other (PPM) Specify: _____ Reading	Task Monitored	Admin./Eng Control(s)	PPE	Temp.	Humidity (%)	Atm. Press. (mm Hg)	Rain	Snow	Wind
								___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW
								___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW
								___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW
								___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW
								___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW
								___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW
								___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW

Additional Comments:

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

DIRECT-READING MONITORING METHOD USING GCs, PIDs and FIDs

ER-HSM-1C

ER-HSM-1C

DIRECT-READING MONITORING METHOD

USING

GCs, PIDs AND FIDs

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1.0 PURPOSE

The purpose of this method is to describe the characteristics, proper use, limitations, and calibration procedures for the following direct-reading (real time) air monitoring instruments:

- Photoionization Detector (PID)
- Flame Ionization Detector (FID)
- Gas Chromatograph (GC) with PID/FID

2.0 SCOPE

2.1 Applicability

This method applies to all personnel performing direct-reading monitoring, using the instrumentation referenced in section 1.0, during ER Project field operations.

2.2 Training

Personnel conducting monitoring shall:

- Have a thorough knowledge of instrumentation calibration, use, and maintenance;
- Be trained to conduct monitoring per this method; and,
- Be informed of the necessary monitoring data to be obtained and recorded.

3.0 DEFINITIONS

- **Accuracy:** The agreement between the true value and a reading or observation made from an instrument.
- **Action Level:** An administrative control level at or above which specific actions are required. Refer to the Site Specific Health and Safety Plan (SSHASP) for action levels.
- **American Conference of Governmental Industrial Hygienists (ACGIH):** A professional society that establishes exposure limits, referred to as threshold limit values (TLVs), and guidance for limiting occupational exposure to toxic substances and hazardous physical agents. Each year the ACGIH revises TLVs as appropriate.
- **Breathing Zone:** A sphere approximately two feet in diameter surrounding the head.
- **Calibration:** The act of checking, adjusting, and systematically standardizing the graduation of a quantitative measuring instrument.
- **Concentration:** The amount of a given substance in a stated unit of measurement (concentration = mass/volume).
- **Direct-Reading/Real Time Instruments:** Instruments that provide instantaneous (or near instantaneous) measurements of particular parameters of interest (e.g., airborne contaminants). Generally, direct reading/real time instruments only provide results for a moment in time, unless they can integrate the data (e.g., they are equipped with data logging capabilities).

- **Engineering Control:** A means of controlling personnel exposures by modifying the work environment. Refer to the Site Specific Health and Safety Plan (SSHASP) for engineering controls.
- **Fume:** Air dispersed particulates ranging from 0.01 to 1.0 microns that are produced by combustion, condensation, and various chemical reactions.
- **Gas:** A state of matter in which the material has a very low density and viscosity, can expand and contract in response to a change in pressure or temperature, easily diffuses into other substances, and readily and uniformly distributes itself throughout any container.
- **Intrinsically Safe:** Incapable of releasing sufficient electrical energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture.
- **Ionization Potential (IP):** The amount of energy required to remove the outermost electron from the molecule. It is specific for compounds or atomic species. The IP is expressed as electron volts (eV).
- **Precision:** The ability to repeat results of an instrument or test under the same conditions.
- **Relative Humidity:** The ratio of the quantity of water vapor present in the air to the quantity that would saturate it at any specific temperature.
- **Threshold Limit Values (TLVs):** The ACGIH occupational exposure limits. These values are published annually in the most current version of the *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*
- **Vapor:** The gaseous form of substances that are normally in the liquid or solid state.

4.0 BACKGROUND AND/OR CAUTIONS

4.1 Applicable Standards

Air monitoring using the instruments referenced in section 1.0 shall be conducted per this method, manufacturer's instructions and per generally recognized industrial hygiene practices.

4.2 Limitations/Interferences

4.2.1 Photoionization Detector (PID):

- The PID light source emits photons with energy levels not high enough to ionize the major components of air (O_2, N_2, CO, CO_2, and H_2O).
- The PID emits ultraviolet rays which could cause eye damage if the user stares into the probe for a prolonged period of time.
- The PID is a <u>nonspecific</u> total vapor detector. It cannot be used to identify unknown substances; it can only roughly quantify them.
- The PID does not respond to certain low molecular weight hydrocarbons, such as methane and ethane. In addition, the PID does not detect a compound if the lamp has a lower energy than the compound's ionization potential.
- Certain models of PID instruments are not intrinsically safe. The HNU PI-101 and HW-101 are not designed for use in potentially flammable or combustible atmospheres. Therefore, these models should be used in conjunction with a Combustible Gas Indicator. The ISPI-101 is intrinsically safe, however.

- Electrical power lines, power transformers, and radio transmissions may cause interference with the instrument and thus cause measurement errors.

- High winds and high humidity may affect measurement readings. The PID may become unusable under foggy or humid conditions. An indication of this is the needle dropping below 0, or a slow constant climb on the read-out dial.

- The lamp window must be periodically cleaned to ensure proper ionization of compounds.

- The PID measures concentrations from about 1-2000 ppm, although the response is not linear over this entire range. For example, if calibrated to benzene, the response is linear from about 0-600 units above background. This means the PID reads a true concentration of benzene only between 0 and 600 ppm. Greater concentrations are detected at a lower level than the true value.

- Atmospheres with concentrations of vapors and gases above the detection limits of the instrument can cause inconsistent instrument behavior.

- Some instruments are not to be exposed to precipitation. (Refer to manufacturer's literature.)

- In cold weather, the battery life is significantly reduced (almost by half at 32°F and below).

4.2.2 Flame Ionization Detector (FID):

- FIDs do not respond to inorganics.

- The FID is a nonspecific total vapor detector. It cannot be used to identify unknown substances; it can only roughly quantify them.

- FIDs should not be used at a temperature less than 40° F because gases will condense on the pump and the column, providing false readings.

- The FID does not respond to nongaseous organic compounds like some pesticides, polynuclear aromatic hydrocarbons (PNAs), and polychlorinated biphenyls (PCBs).

- Mixtures of specific contaminants and their quantities cannot easily be identified because the instrument measures an integrated response relative to the calibration gas used.

- A relative humidity in excess of 95% may cause inaccurate responses.

- Most portable FIDs rely on the sample gas to supply the combustion air to the detector flame, so they are designed to operate in ambient atmospheres with oxygen concentrations at approximately 21%. This design precludes the sampling of process vents, poorly ventilated or sealed containers, or any sample gas hydrocarbon concentration sufficient to reduce the available oxygen or saturate the detector. Optional equipment is available that supplies oxygen from a compressed gas bottle or introduces sample gas through a dilution system with a known dilution factor.

- Concentrations beyond the greatest scale factor of the instrument or in excess of 30% of the lower explosive limit (LEL) of the sample component require system modification. If system modifications are required, consult the manufacturer's operations manual.

- The FID ionization source (e.g., hydrogen flame) does not emit high enough energy to ionize the major components of air (O_2, N_2, CO, CO_2, and H_2O).

4.2.3 Gas Chromatograph (GC):

- Do not expose GCs to precipitation or high humidity.
- GCs are best utilized in stable, temperature-controlled environments.
- Combustion fumes can contaminate the columns.
- Readings can only be reported relative to the calibration standard used.
- High alkane concentrations may interfere with the resolution and detector response of early-eluting chlorinated alkenes, and aromatic compounds.
- Target compounds are identified by their retention time (RT). If a non-target compound has the same RT, it can be misidentified as a target compound.
- GCs are not designed to accept an injected water sample. Injection of water into the instrument will damage the column, cause gross contamination, and necessitate thorough overhaul.
- The boiling point of any known compound must not be so high as to preclude elution through an ambient air temperature column.
- If there are significant changes in ambient temperature (greater than 10°F) when the instrument is moved from place to place, the column will require time to stabilize thermally. At higher sensitivities, a non-thermally stabilized column will manifest itself as baseline drift.
- The instrument requires up to an hour to warm up at the start of the sampling day, and more time to stabilize when the septum or carrier gas supply is changed.
- The instrument must always be connected to a carrier gas supply of ultra pure air and a continuous stream of gas must be passed through the column to maintain peak condition and minimize delay when ready to use.
- Reconditioning of the column should be performed every 3 months, after heavy use, or when a new column is to be installed. This process involves running ultra-high purity helium or nitrogen through the column, overnight, at a temperature of 100°C (212°F), at a maximum flow rate of 100 cubic centimeters (cc) per minute. (See manufacturer's instructions for specific directions.)

5.0 EQUIPMENT

5.1 Photoionization Detector (PID)

5.1.1 Detector

The PID is used to detect the presence of total organic airborne contaminants. The instrument's principle means of detection is photoionization using an ultraviolet lamp as the ionization source. The theory of operation is that when a photon of ultraviolet energy strikes a chemical compound, it ionizes the molecule if the energy is equal to or greater than the ionization Potential (IP) of the compound. Since ions are capable of conducting an electrical current, the current produced is then measured and corresponding concentration is displayed on the instrument meter in parts per million (ppm). Some PIDs (e.g., the Photovac 10S, and the Hnu Model 311GC) have Gas Chromatograph (GC) capabilities. Refer to section 5.3 for a description of GC.

Common PIDs used in field investigation are: Hnu 101, Hnu HW, Hnu DL, and The Photo Tip. Typically, the instrument consists of two parts:

- A probe which houses the UV lamp, pump (or fan), ionization chamber, and,
- A readout unit consisting of the amplifier and electrical circuits, display meter, and battery.

5.1.2 Calibration Kit

Use only the calibration kit compatible with the PID being used (i.e., one specified by the manufacturer) according to the manufacturer's instructions.

5.1.3 Lamps

Ultraviolet lamps with various ionization potentials are available for the PID. The typical lamps are 9.5 eV, 10.2 eV, and 11.7 eV. The IP of the lamp must be equal to or greater than the IP of the compound being investigated. For example, if the chemical being investigated has a IP of 10.9 eV, then the 11.7 eV lamp needs to be used to detect that component.

5.1.4 Batteries and Battery Charger

Use only the battery type and battery charger specified by the manufacturer for the instrument being used. Discharge and/or charge batteries according to the manufacturer's instructions.

Most PIDs are equipped with a Nickel/Cadmium (NiCd) battery which requires a "charge-use" cycle to be established. When feasible, allow the battery to completely discharge before recharging so as to maximize battery life. Follow the manufacturer's instructions on battery use, care, and charging.

If the instrument uses a lead acid gel battery, it should remain on charge at all times when not in use. The Hnu and Photo tip both have lead acid gel batteries. **Note:** To charge the battery on the HNU 101, the probe must be connected to the readout assembly.

If a low battery is indicated during sampling, turn the analyzer off and recharge the instrument in a non-hazardous area.

5.1.5 Instrument Maintenance

Maintain all PID equipment in accordance with manufacturer's specifications and instructions.

During periods of operation, dust or foreign matter could be drawn into the probe forming deposits on the surface of the UV lamp or ion chamber. This condition is indicated by meter readings that are low, erratic, usable or non-repeatable. Cleaning should be performed on a monthly basis or whenever known contamination has occurred.

Follow manufacturer instructions on lamp cleaning. It is important to note that no liquid can be used to clean the 11.7 eV lamp or the ion chamber.

5.2 Flame Ionization Detector (FID)

5.2.1 Detector

The FID is designed to detect and measure total organic vapors/gases. The FID utilizes flame ionization for detection and measurement. In the normal survey mode, a continuous sample is drawn into the probe and transmitted to the detector chamber. The sample stream is metered and passed through particle filters before reaching the detector chamber. The sample is then exposed to a hydrogen flame which ionizes the vapors. The resulting signal is then translated on

the meter for a direct-reading concentration as total organic vapors. Some FIDs (e.g., the Foxboro 128) have Gas Chromatograph (GC) capabilities. Refer to section 5.3 for a description of GC.

The most commonly used FID is the Foxboro Organic Vapor Analyzer (OVA). Two types of OVAs are available: the OVA 128 which reads linearly and has the detection range from 0.1 - 1000 ppm and the OVA 108 which reads using a log scale and has a detection range from 0.1 - 10,000 ppm.

FID's typically consist of a sampling pump, battery pack, support electronics, flame ionization detector, hydrogen gas cylinder, and an instrument probe.

Most FIDs are rated as a Class I, Division 2 instrument. This means it can be used in areas where hazardous atmospheres exist, but due to a leak or breakage, the atmosphere may become flammable/explosive. This also means the instrument is not intrinsically safe and the battery should only be charged in non-flammable atmospheres.

5.2.2 Calibration Kit

Use only the calibration kit compatible with the FID being used (i.e., one specified by the manufacturer) according to the manufacturer's instructions.

5.2.3 Batteries and Battery Charger

Use only the battery type and battery charger specified by the manufacturer for the instrument being used. Discharge and/or charge batteries according to the manufacturer's instructions. Most FID's use a lead acid gel battery, so it should remain on charge at all times when not in use. Follow the manufacturer's instructions on battery use and care. See section 5.1.4 if a NiCd battery is used.

If a low battery is indicated during sampling, turn the analyzer off and recharge the battery in a non-hazardous area.

5.2.4 Instrument Maintenance

All FID equipment shall be maintained in accordance with manufacturer's specifications and instructions.

During periods of operation, dust or foreign matter could be drawn into the probe forming deposits on the pump or probe filters. This condition may be indicated by a reduced flow rate or the inability to ignite the instrument. This condition could lead to low meter readings or, erratic, unusable and non-reproducible results. For these reasons, cleaning should be performed on a monthly basis or whenever known contamination has occurred. Manufacturer's cleaning instructions should be followed.

5.3 Gas Chromatograph (GC)

5.3.1 Detector

There are a variety of detectors available for GC's. This method only addresses GC's using PIDs and FIDs. These two detectors are discussed in sections 5.1.1 and 5.1.2 respectively.

When PIDs and FIDs are used in the gas chromatography (GC) mode, the air sample is injected into a column packed with an inert solid. The components to be separated are carried through the column and different components of the sample migrate through the column at different rates. The components then leave the column and are measured by the detector. In this fashion, individual components of the ambient air may be analyzed. The GC is not temperature controlled and will not provide the accurate results which a laboratory GC can provide. Essentially, the GC is good for separating out methane and non-methane fractions.

5.3.2 Carrier Gas

A high pressure gas cylinder serves as the source of the carrier gas. The carrier gas should be:

- Inert to avoid interaction with the sample or solvent
- Able to provide a minimum of gaseous diffusion
- Readily available and of high purity
- Inexpensive
- Suitable for the detector used

Commonly used gases are helium, nitrogen, and hydrogen.

Portable GCs have internal cylinders that usually have an 8 to 10 hour gas supply. Many of these also have connections for external cylinders to provide longer duration analysis.

Consult with the manufacturer for the carrier gas used for your instrument.

5.3.3 Flow Control

Since compounds elute (come out) at a characteristic time ("retention time") based on a given temperature and a constant flow rate, carrier gas flow control and column temperature are important. A flow controller is necessary to maintain a constant flow rate.

5.3.4 Sample Injection System

Samples are introduced into the column as a single sharp plug. The sample injection system allows introduction of the sample rapidly and in a reproducible manner. Samples can be manually injected by a syringe, which allows the operator to control the sample volume. Some GCs have a built-in sample loop that injects a known and consistent volume by manual operation or automatic programming. Sample volume is important in that the quantitative evaluation of a chromatogram is affected by the sample volume. Also, some columns are limited by the size of sample that can be injected into them.

5.3.5 Column

The column is a tube made of stainless steel, glass, aluminum or Teflon. *Packed columns* contain a solid adsorbent (gas-solid chromatography) or an inert solid support coated with liquid stationary phase (gas-liquid chromatography). *Capillary columns* consist of a liquid stationary phase coated to the inside wall of a thin tube. Gas-liquid chromatography columns and capillary columns are the more common types for the portable GCs.

Tube sizes range from 0.5 mm to 6 mm outside diameter and from 20 centimeters to 50 meters in length. Capillary columns are usually longer than packed columns. Portable GC columns are typically 4 meters in length. Columns can be coiled to fit inside portable units.

Capillary columns give better resolution than packed columns. However, they require smaller injection volumes than packed columns and thus need sample inlets and detectors that can handle small volumes.

5.3.6 Temperature Control

Column temperature affects the retention time of a chemical. A constant temperature is desired to ensure comparison of sample standards. Temperature control can be:

- *ambient* temperature: The column temperature is the same as ambient air. As ambient temperature changes, the retention times change. Consequently, frequent calibration checks are needed. Ambient temperature limits use to volatile compounds. The time to run a sample is longer and thus limits number of samples that can be run per day.

- *isothermal* temperature control: The column temperature is maintained at a constant temperature by an oven. Retention times are much more stable. Temperatures can be adjusted to reduce analysis time or expand the range of compounds that can be analyzed. Retention times are halved for every 30°C increase in temperature. Isothermal temperature control consumes more electricity than ambient.

- *temperature programming*: Column temperature is slowly increased under very controlled conditions. This allows simultaneous analysis of compounds with a wide range of boiling points. A lower temperature is used for the volatile components. The temperature is raised to elute the less volatile compounds. More electrical power is needed for this operation.

Temperature control can also be used on the injector and the detector. Heating the injector prevents condensation of the sample (if a vapor) or can ensure vaporization of a liquid sample. The detector may need to be heated to prevent chemical condensation.

5.3.7 Recorder

The recorder is located in the detector and its function is to record signal production and signal strength. A plot of signal versus time is called a chromatogram. The chromatogram is used for qualitative and quantitative analysis of the sample. Integrators and microprocessors can be used to electronically evaluate the chromatogram.

5.3.8 Calibration Kit

Use only the calibration kit compatible with the GC being used (i.e., one specified by the manufacturer) according to the manufacturer's instructions.

5.3.9 Batteries and Battery Charger

Use only the battery type and charger specified by the manufacturer for the instrument being used. Discharge and/or charge batteries according to the manufacturer's instructions.

5.3.10 Instrument Maintenance

All GC equipment shall be maintained in accordance with manufacturer's specifications and instructions.

6.0 PROCEDURES

6.1 Direct-Reading Monitoring Using PIDs, FIDs, and GCs

6.1.1 Scheduling and Frequency

Conduct monitoring of gases and vapors to determine whether action levels have been reached as specified in the SSHASP.

This monitoring should be conducted under normal operating conditions without altering operation or interfering with the employee's job duties.

The frequency of monitoring adheres to the following specifications:

- During field operations that may expose workers to gases or vapors as identified in the SSHASP.
- Whenever there is a change in an operation or controls that may expose employees to gases or vapors at or exceeding an action level.
- Whenever engineering controls are required and/or may be considered inadequate due to a rise in overall gas or vapor level(s).
- Whenever respiratory protection is required and/or may be considered inadequate due to a rise in overall gas or vapor level(s).

6.1.2 Monitoring Location(s)

Monitor gas and vapor level(s) at an upwind location from the operation to determine background levels.

Monitor around the operation when interferences are suspected (e.g., drill rig or pressure washer exhaust.)

Monitor at the operational source point where the highest level(s) of gases or vapors would be expected to be generated (e.g., at the point where potentially contaminated soils are disturbed). If the instrument indicates the presence of gases or vapors, monitor in the employee's breathing zone. If multiple breathing zone readings are taken and levels differ, all levels shall be recorded. The highest level shall be used for comparison with action levels specified in the SSHASP.

6.2 Calibration and Use

6.2.1 PID

It is critical that the PID operations manual be reviewed prior to use. PIDs shall be calibrated and used in accordance with manufacturer's recommendations.

At a minimum, calibrate the PID prior to each use and document the calibration data on the Direct-Reading Air Monitoring Form (Attachment A).

Allow the temperature of the PID to equilibrate to its surrounding. This should take about five minutes. *Before instrument calibration, the battery must be checked by turning on the function switch.* The battery should indicated full charge in order to assure at least 8 hours of service. The instrument must be "electronically" zeroed prior to use. This should be done in the STANDBY mode so that background is not zeroed out. For an Hnu, turn the zero adjust knob until the meter needle is at zero. When the instrument is in the STANDBY mode all the electronics are on, but the UV light source is off. This means the instrument is not ionizing any gases or vapors. This position is used to conserve power and extend battery life.

The typical PID has a detection range of 0.2 - 2,000 ppm. Make sure you know what range the instrument is set on. For example, the Hnu has three operating ranges: 0-2,000 ppm; 0-200 ppm; and 0-20 ppm. It is best to start on the 0-2,000 ppm range and then switch to the more sensitive ranges. Once the instrument is operational, the UV lamp will present a glow. Hold the instrument probe so that the extension is at the point where the measurements are to be taken.

If additional tubing is added to the probe, allow additional time for the instrument to respond (**Note:** The Hnu 101 uses a fan, not a pump, to pull the sample across the UV light source; therefore, an additional sampling line cannot be added to the probe.) While taking measurements, the readout unit should be kept stationary (set it down, if possible) to get an accurate reading. Care must be taken not to suck up debris or water into the instrument through

the probe. A good practice is to never place the probe in a position where you can not see the intake (e.g., do not stick it in drums or other containers suspected of containing liquids).

Upon completion of use, turn the function switch to OFF. The instrument should be placed on charge in a non-hazardous area.

The relative response of the instrument to a compound must be considered for proper interpretation of the data. In general, the PID is more sensitive to complex compounds and less sensitive to simpler ones. The instrument's sensitivity and response is dependent on the lamp and list calibration. Refer to the manufacturer's operations manual for the relative responses for the particular instrument used.

Obtain measurements and record data on the Direct-Reading Air Monitoring Form (Attachment A).

Compare readings with action levels as specified in SSHASP. If measured levels exceed the action level, notify the Field Unit ESH Representative.

Convey the air monitoring results to personnel working on site and keep a copy of the results on site available for review by affected individuals and site management.

Additional considerations in PID use are as follows:

- A simple instrument check can be performed in the field by passing an organic point source, such as a magic marker, in front of the probe.
- Routinely verify battery charge in the field.

6.2.2 FID

It is critical that the FID operations manual be reviewed prior to use. FIDs shall be calibrated and used in accordance with manufacturer's recommendations.

At a minimum, calibrate the FID prior to each use and the calibration data shall be documented on the Direct-Reading Air Monitoring Form (Attachment A).

Allow the temperature of the FID to equilibrate to its surrounding. This should take about five minutes. Prior to calibration the battery should be fully charged.

FIDs will respond to most organic vapors as they form positively charged ions when burned in a hydrogen flame. The magnitude of the response is a function of the detector sensitivity and the ionization properties of the particular compound, as well as its concentration. As a result, the response must be compared with the response generated by a known concentration of a standard gas. The sample concentration is then reported as the parts per million (ppm) equivalent of the standard gas. Most FIDs are calibrated with methane; however, almost any gaseous hydrocarbon that produces a response can be used. Many models also have built-in calibration circuits to ensure that the electronic response remains constant in all ranges. Refer to the manufacturer's operations manual for the relative sensitivities for the particular instrument used.

Obtain measurements by positioning the intake assembly close to the monitoring area, because the low sampling rate allows for only very localized readings. Conduct the FID survey at a slow to moderate rate of speed and slowly sweep the intake assembly (the probe) from side to side. Record data on the Direct-Reading Air Monitoring Form (Attachment A).

Compare readings with action levels as specified in SSHASP. If measured levels exceed the action level, notify the Field Unit ESH Representative.

Convey the air monitoring results to personnel working on site and keep a copy of the results on site available for review by affected individuals and site management.

Additional considerations in FID use are as follows:

- A simple instrument check can be performed in the field by passing an organic point source, such as a magic marker, in front of the probe.
- Routinely verify battery charge in the field.

6.2.3 GC

It is critical that the GC operations manual be reviewed prior to use. GCs shall be calibrated and used in accordance with manufacturer's recommendations.

This method addresses GCs in combination with PID or FID. Refer to the applicable section above for details regarding the detector selected.

GCs can be used for obtaining both qualitative and quantitative analyses of compounds. Qualitative analysis can be done by comparing the retention times of the compounds in an unknown sample with the retention times of known compounds in a standard analyzed under identical conditions. Quantitative analysis is done by comparing the peak size of the sample compound with the peak size of a known amount of the compound (the standard).

The capability and ease of obtaining qualitative and quantitative analyses is dependent on the type of GC used. Some Gcs (e.g., the Photovac 10S and the HNU 311) have microprocessors that aid in compound identification and quantitation. Other GCs (e.g., the OVA-128GC) do not supply an integrator and therefore require the user to develop standards for comparison. Refer to the operations manual for instruction on using the GC for qualitative and/or quantitative analyses.

Obtain measurements and record data on the Direct-Reading Air Monitoring Form (Attachment A). In the comments section specify "GC analysis" and in the Meter Reading/Indication column state the specific reading obtained for each compound. In addition, any associated printouts and/or calculations shall be attached to the Direct-Reading Air Monitoring Form.

Compare readings with action levels as specified in SSHASP. If measured levels exceed the action level, notify the Field Unit ESH Representative.

Convey the air monitoring results to personnel working on site and keep a copy of the results on site available for review by affected individuals and site management.

7.0 REFERENCES

7.1 Required Documents

- *Site-Specific Health and Safety Plan (SSHASP)*
- *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (current edition published annually)
- *Instrument Operation Manuals*

7.2 Bibliography

- *U.S. Environmental Protection Agency, Air Monitoring for Hazardous Materials, Environmental Response Training Program.*

8.0 RECORDS

- Gas and vapor monitoring results, and instrument calibration data shall be recorded on the Direct-Reading Air Monitoring Form (Attachment A). Describe any deviations from this method, if any, and associated rationale(s).
- In accordance with LANL-ER-AP-02.1.R1, "Procedure for LANL ER Records Management," verify completeness and accuracy of entries and sign and date each page.
- A copy of the results shall be kept on site available for review by affected personnel and site management.

9.0 ATTACHMENTS

Attachment A: Direct-Reading Air Monitoring Form

Attachment B: Comparison of the Flame Ionization Detector (FID) and Photoionization Detector (PID)

COMPARISON OF THE FLAME IONIZATION DETECTOR (FID) AND PHOTOIONIZATION DETECTOR (PID)

	FID	PID
Response	Responds to many organic gases and vapors, especially low molecular weight hydrocarbons.	Responds to many organic and some inorganic gases and vapors, especially heavy hydrocarbons.
Application	In survey mode, detects total concentrations of gases and vapors. In GC mode, identifies and measures specific compounds.	In survey mode, detects total concentrations of gases and vapors. Some identification of compounds possible if GC column and standards are used.
Limitations	Does not respond to organic gases and vapors with a higher ionization potential than the flame detector. No temperature control.	Does not respond to methane or inorganic aliphatic chlorinated solvents. Does not respond properly in presence of water vapor (high humidity). Does not detect a compound if probe (lamp) has a lower energy than compound's ionization potential. Does not respond well in severe temperatures.
Calibration gas	Methane and others	Benzene (1,3-butadiene) and others
Ease of operation	Requires experience to interpret correctly.	Fairly easy to use and interpret. More difficult in the GC mode.
Detection limits	0.1 ppm (methane)	0.1 ppm (benzene), depends on lamp voltage
Response limits	2-3 seconds (survey mode)	3 second for 90% of total concentration
Maintenance	Periodically clean and inspect particle filters, valve rings, and burner chamber. Check calibration and pumping system for leaks. Recharge battery after each use.	Clean UV lamp frequently. Check calibration regularly. Recharge battery after each use.
Useful range	0-1,000 ppm	0-2,000 ppm
Service life	8 hr; 3 hr with strip chart recorder	10 hr; 5 hr with strip chart recorder

DIRECT-READING AIR MONITORING FORM

SSHASP No. _____ Mod. No. _____ SSHASP Title: _____ TA(s): _____

Instrument Data

Instrument:	Mfr./Model:	Serial No.:	Factory Calibration Date Completed:	Date Due:

Gas Type	Mfr.	Part/Lot No.	Conc.	Instr. Response (Incl. Units)	Date	Time	Temp.	Humidity (%)	Atm. Press. (mm Hg)	Rain	Snow	Wind	Comments
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	

Additional Comments:

Date: _____

Monitoring Data

Page ____ of ____

Time	Location	Reading (units)	Task Monitored	Admin./Eng Control(s)	PPE	Temp.	Humidity (%)	Atm. Press. (mm Hg)	Rain	Snow	Wind	Comments
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	

Additional Comments:

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

DIRECT-READING MONITORING METHOD USING MERCURY VAPOR ANALYZERS (MVAs)

ER-HSM-1D

ER-HSM-1D

DIRECT-READING MONITORING METHOD USING MERCURY VAPOR ANALYZERS (MVAs)

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1.0 PURPOSE

The purpose of this method is to describe the characteristics, proper use, limitations, and calibration procedures for Mercury Vapor Analyzers (MVAs).

2.0 SCOPE

2.1 Applicability

This method applies to all personnel performing direct-reading monitoring using MVAs during ER Project field operations.

2.2 Training

Personnel conducting monitoring shall:

- Have a thorough knowledge of instrumentation calibration, use, and maintenance;
- Be trained to conduct monitoring per this method; and,
- Be informed of the necessary monitoring data to be obtained and recorded.

3.0 DEFINITIONS

- **Accuracy:** The agreement between the true value and a reading or observation made from an instrument.
- **Action Level:** An administrative control level at or above which specific actions are required. Refer to the Site Specific Health and Safety Plan (SSHASP) for action levels.
- **Absorption:** The penetration of a substance into the body of another.
- **Adsorption:** The condensation of gases, liquids, or dissolved substances onto the surface of solids.
- **American Conference of Governmental Industrial Hygienists (ACGIH):** A professional society that establishes exposure limits, referred to as threshold limit values (TLVs), and guidance for limiting occupational exposure to toxic substances and hazardous physical agents. Each year the ACGIH revises TLVs as appropriate.
- **Breathing Zone:** A sphere approximately two feet in diameter surrounding the head.
- **Calibration:** The act of checking, adjusting, and systematically standardizing the graduation of a quantitative measuring instrument.
- **Direct-Reading/Real Time Instruments:** Instruments that provide instantaneous (or near instantaneous) measurements of particular parameters of interest (e.g., airborne contaminants). Generally, direct reading/real time instruments only provide results for a moment in time, unless they can integrate the data (e.g., they are equipped with data logging capabilities).
- **Engineering Control:** A means of controlling personnel exposures by modifying the work environment. Refer to the SSHASP for engineering controls.

- **Gas:** A state of matter in which the material has a very low density and viscosity, can expand and contract in response to a change in pressure or temperature, easily diffuses into other substances, and readily and uniformly distributes itself throughout any container.
- **Vapor:** The gaseous form of substances that are normally in the liquid or solid state.

4.0 BACKGROUND AND/OR CAUTIONS

4.1 Applicable Standards

Air monitoring using MVAs shall be conducted per this method, manufacturer's instructions and per generally recognized industrial hygiene practices.

4.2 Limitations/Interferences

There are various limitations and interferences depending on the operating principle (e.g., ultraviolet (UV) and visible light photometry, aerosol formation and detection, and conductivity analysis) of the MVA used. Personnel using MVAs must consult the manufacturer's operation manual for specific limitations/interferences associated with the instrument selected. Typical limitations/interferences are listed below.

4.2.1 Ultraviolet (UV) and Visible Light Photometers:

- Organic vapors may interfere with measurement accuracy
- Not intrinsically safe

4.2.2 Aerosol Formation and Detection Systems:

- Not intrinsically safe

4.2.3 Conductivity Analyzers:

- Require yearly factory calibration
- Have short (5 hour) battery life
- Require AC power source for heat cleaning cycle
- Once the film heat cycle is initiated (See Section 6.2.3), **DO NOT** interrupt the cycle
- Very sensitive to moisture and humidity
- Intended for vapor use only. **DO NOT** allow the probe or the instrument's intake to come in contact with liquids, dusts, or other foreign materials.

5.0 EQUIPMENT

5.1 Mercury Vapor Analyzers (MVAs)

5.1.1 Ultraviolet (UV) and Visible Light Photometers:

Several manufacturers (e.g., Bacharach, Inc., Beckman Instruments, Inc., and Sunshine Scientific Instruments) make portable MVAs that operate on the principle of UV light absorption by mercury vapor. Some MVAs (e.g., J-W Model MV-2 Mercury Vapor Sniffer and the Beckman Model K-238

Mercury Vapor Meter) are specifically intended for detection of mercury vapors while others (e.g., the Sunshine Scientific Instruments Instantaneous Vapor Detector) are used for the detection of mercury vapors as well as other vapors.

5.1.2 Aerosol Formation and Detection Systems:

Environmental/One Corporation manufactures the Condensation Nuclei Monitor Model RICH 100, which measures trace concentrations of gases and vapors such as mercury, sulfur dioxide, and ammonia. This portable MVA uses the nucleogenic technique, which involves the selective creation of submicrometer particles from gas molecules. The particles created are proportional in number to the gas concentration and are counted in the instrument.

5.1.3 Conductivity Analyzers:

These MVAs are the type most commonly used in the Environmental Restoration Project. Arizona Instrument Corporation manufactures several Jerome MVAs (e.g., Model 411 and Model 431). The portable instruments' principle of operation is that a thin gold film, in the presence of mercury vapor, will undergo an increase in electrical resistance proportional to the mass of mercury in the sample. The gold film is selective in its adsorption of elemental mercury. As mercury adsorbs on the sensor, the percentage of saturation is indicated on the meter.

5.2 Batteries and Battery Charger

Use only the battery type and battery charger specified by the manufacturer for the instrument being used. Discharge and/or charge batteries according to the manufacturer's instructions.

If a low battery is indicated during sampling, turn the monitor off and recharge batteries in a non-hazardous area.

5.3 Instrument Maintenance

Maintain MVAs in accordance with manufacturer's specifications and instructions.

6.0 PROCEDURES

6.1 Scheduling and Frequency

Conduct direct-reading monitoring using MVAs to determine whether action levels have been reached, as specified in the SSHASP.

This monitoring should be conducted under normal operating conditions without altering operation.

The frequency of monitoring must adhere to the following specifications:

- During field operation that may expose workers to mercury vapors as identified in the SSHASP.
- Whenever there is a change in an operation or controls that may expose employees to mercury vapors at or exceeding an action level.
- Whenever engineering controls are required and/or may be considered inadequate due to a rise in overall mercury vapors.

6.2 Monitoring Location(s)

Monitor at the operational source point where the highest level(s) of mercury vapors would be expected to be generated (e.g., at the point where potentially contaminated soils are disturbed). If the MVA indicates

the presence of mercury vapors, monitor in the employee's breathing zone. If multiple breathing zone readings are taken and levels differ, record all levels. Use the highest level for comparison with action levels specified in the SSHASP.

6.3 Calibration and Use

It is critical that the MVA operations manual be reviewed prior to use. Calibrate and use MVAs in accordance with manufacturer's recommendations.

The MVAs typically used on Environmental Restoration Projects are calibrated at the factory and must be recalibrated by the manufacturer at least annually.

Record initial weather conditions, personal protective equipment (PPE) level, and task being monitored on the *Direct-Reading Air Monitoring Form (Attachment A)*.

Obtain mercury vapor measurements and record data on the Direct-Reading Air Monitoring Form (Attachment A).

Compare readings with action levels specified in SSHASP. *If measured levels exceed the action level,* notify the Field Unit ESH Representative.

Record changes in field conditions (e.g., weather, PPE changes, deviations from normal operations, or other special considerations) in the health and safety logbook.

Convey the air monitoring results to personnel working on site and keep a copy of the results on site available for review by affected individuals and site management.

7.0 REFERENCES

7.1 Required Documents

- *Site-Specific Health and Safety Plan (SSHASP)*
- *Instrument Operation Manual*

7.2 Bibliography

- Barbara A. Plog, Ed. *Fundamentals of Industrial Hygiene*, 3rd ed. National Safety Council, (1988).
- American Conference of Governmental Industrial Hygienists (ACGIH), *Air Sampling Instruments For Evaluation of Atmospheric Contaminants, 7th ed. (1989).*
- _____: *OSHA Technical Manual.* Government Printing Office, Washington, DC (1993).

8.0 RECORDS

- Record MVA results on the Direct-Reading Air Monitoring Form (Attachment A). Describe any deviations from this method, if any, and associated rationale(s).
- Record changes in field conditions, as specified in section 6.3, in the health and safety logbook.

- In accordance with LANL-ER-AP-02.1.R1, "Procedure for LANL ER Records Management," verify completeness and accuracy of entries and sign and date each page.
- A copy of the results shall be kept on site available for review by affected personnel and site management.

9.0 ATTACHMENTS

Attachment A: Direct-Reading Air Monitoring Form

DIRECT-READING AIR MONITORING FORM

SSHASP No. _____ Mod. No. _____ SSHASP Title: _____ TA(s): _____

Instrument Data

Instrument:	Mfr./Model:	Serial No.:	Factory Calibration Date Completed:	Date Due:

Gas Type	Mfr.	Part/Lot No.	Conc.	Instr. Response (Incl. Units)	Date	Time	Temp.	Humidity (%)	Atm. Press. (mm Hg)	Rain	Snow	Wind	Comments
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	

Additional Comments:

Date: _____

Monitoring Data

Page ____ of ____

Time	Location	Reading (units)	Task Monitored	Admin./Eng Control(s)	PPE	Temp.	Humidity (%)	Atm. Press. (mm Hg)	Rain	Snow	Wind	Comments
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	

Additional Comments:

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

DIRECT-READING MONITORING METHOD USING REAL TIME AEROSOL MONITORS (RAMs)

ER-HSM-1E

ER-HSM-1E

DIRECT-READING MONITORING METHOD USING REAL TIME AEROSOL MONITORS (RAMs)

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1.0 PURPOSE

The purpose of this method is to describe the characteristics, proper use, limitations, and calibration procedures for Real Time Aerosol Monitors (RAMs).

2.0 SCOPE

2.1 Applicability

This method applies to all personnel performing direct-reading monitoring using RAMs during ER Project field operations.

2.2 Training

Personnel conducting monitoring shall:

- Have a thorough knowledge of instrumentation calibration, use, and maintenance;
- Be trained to conduct monitoring per this method; and
- Be informed of the necessary monitoring data to be obtained and recorded.

3.0 DEFINITIONS

- **Accuracy:** The agreement between the true value and a reading or observation made from an instrument.
- **Action Level:** An administrative control level at or above which specific actions are required. Refer to the Site Specific Health and Safety Plan (SSHASP) for action levels.
- **Aerosols:** Liquid droplets or solid particles dispersed in air, that are of fine enough particle size (0.01 to 100 micrometers) to remain so dispersed for a period of time.
- **American Conference of Governmental Industrial Hygienists (ACGIH):** A professional society that establishes exposure limits, referred to as threshold limit values (TLVs), and guidance for limiting occupational exposure to toxic substances and hazardous physical agents. Each year the ACGIH revises TLVs as appropriate.
- **Breathing Zone:** A sphere approximately two feet in diameter surrounding the head.
- **Calibration:** The act of checking, adjusting, and systematically standardizing the graduation of a quantitative measuring instrument.
- **Direct-Reading/Real Time Instruments.** Instruments that provide instantaneous (or near instantaneous) measurements of particular parameters of interest (e.g., airborne contaminants). Generally, direct-reading/real time instruments only provide results for a moment in time, unless they can integrate the data (e.g., they are equipped with data logging capabilities).
- **Engineering Control:** A means of controlling personnel exposures by modifying the work environment. Refer to the SSHASP for engineering controls.
- **Fog:** Fine particles of water suspended in air.

- **Fume:** Air dispersed particulates ranging from 0.01 to 1.0 microns that are produced by combustion, condensation, and various chemical reactions.

- **Gas:** A state of matter in which the material has a very low density and viscosity, can expand and contract in response to a change in pressure or temperature, easily diffuses into other substances, and readily and uniformly distributes itself throughout any container.

- **Mist:** Particles of various sizes suspended in air. Considered to be liquid condensed on submicroscopic particles of dusts or gases.

- **Smoke:** An air suspension (aerosol) of particles, originating from combustion or sublimation.

- **Threshold Limit Values (TLVs):** The ACGIH occupational exposure limits. These values are published annually in the most current version of the *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

- **TLV-TWA:** The Threshold Limit Value-Time Weighted Average. The time weighted average concentration for normal 8 hour workday and a 40 hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

- **Vapor:** The gaseous form of substances that are normally in the liquid or solid state.

4.0 BACKGROUND AND/OR CAUTIONS

4.1 Applicable Standards

Air monitoring using RAMs shall be conducted per this method and per generally recognized industrial hygiene practices.

4.2 Limitations/Interferences

- RAMs provide only qualitative measurements of aerosol concentrations. For that reason, they can be used to provide only an indication of total particulate concentration unless samples of the medium of interest (like soil) are taken before the work begins and quantitatively analyzed for content.

- RAMs do not provide information about the hazardous or toxic nature of airborne particulates.

- Over time, RAM performance may be affected by the slow buildup of dust in the sensor. Therefore, RAMs must be serviced and cleaned regularly.

- RAMs respond preferentially to a physical particle size of 0.1 to 10 microns. Some fumes may contain particles smaller than this.

- The RAM measures the physical particle size as opposed to the aerodynamic size. The particle's aerodynamic size affects the degree of transportability and respirability.

5.0 EQUIPMENT

5.1 Real-time Aerosol Monitors (RAMs)

Airborne particulate contaminants can present a significant threat to the health and safety of workers. RAMs are used to determine the relative concentrations of airborne particulates that may cause a respiratory hazard. These instruments can determine concentrations of airborne particulates in dust, fumes, smoke, and fog. The real time data obtained from these instruments are used to establish the level of protection for the health and safety of workers and assist in the establishment of possible control

measures. The RAM has particular application in monitoring ambient air for toxic aerosols or toxic elements associated or transported by aerosols.

Most RAMs read in units of mg/m^3. In order to quantify the results, apply the appropriate guidelines, and establish action levels, it is necessary to have some knowledge of the sample composition and to determine what percent of the total dust seen is respirable. In some cases, it may be necessary to perform continuous air monitoring in conjunction with the RAM measurements to help identify contaminant characteristics. In terms of dust content, it can be assumed that 100% of the dust produced is silica if drilling through sandstone. In areas where the dust produced is from other sources, quantitative analysis must be performed to determine the exact content of the dust-producing media. The analysis should include the silica content, type of silicates (crystalline, amorphous, coal dust, and others), and a general background analysis of the soil. The results of the soil analyses are then used to establish guidelines for action levels during work activities that are based on the applicable TLVs.

Several manufacturers (e.g., MIE and Met One, Inc.) make RAMs. Although the instruments differ somewhat in design, their operating principle is based on the generation of an electrical pulse by a photocell, which detects the light scattered by a particulate. The number of electronic pulses is related to the number of particles counted in the gaseous medium. The scattering sensing parameters have been designed for preferential response to the range of particle size from 0.1 to 10 microns. Some RAMs (e.g., MIE Miniram PDM-1) are portable and intended for personal sampling.

5.2 Batteries and Battery Charger

Use only the battery type and battery charger specified by the manufacturer for the instrument being used. Discharge and/or charge batteries according to the manufacturer's instructions.

If a low battery is indicated during sampling, turn the monitor off and recharge batteries in a non-hazardous area.

5.3 Instrument Maintenance

RAMs shall be maintained in accordance with manufacturer's specifications and instructions.

If the meter ceases to respond in the expected manner, refer to the manufacturer's operator's manual for a discussion of possible causes and corrective actions. If recalibration appears advisable, consult the manual for factory locations and shipping instructions.

6.0 PROCEDURES

6.1 Scheduling and Frequency

Direct-reading monitoring using RAMs shall be conducted to determine whether action levels have been reached as specified in the SSHASP.

Conduct this monitoring under normal operating conditions without altering operation.

The frequency of monitoring adheres to the following specifications:

- During field operation that may expose workers to airborne particulates as identified in the SSHASP.
- Whenever there is a change in an operation or controls that may expose employees to airborne particulates at or exceeding an action level.
- Whenever engineering controls are required and/or may be considered inadequate due to a rise in overall airborne particulates.

6.2 Monitoring Location(s)

Monitor at the operational source point where the highest level(s) of airborne particulates would be expected to be generated (e.g., at the point where potentially contaminated soils are disturbed). If the RAM indicates the presence of airborne particulates, monitor in the employee's breathing zone. If multiple breathing zone readings are taken and levels differ, all levels shall be recorded. The highest level shall be used for comparison with action levels specified in the SSHASP.

6.3 Calibration and Use

It is critical that the RAM operations manual be reviewed prior to use for step-by-step guidance on start-up, troubleshooting, shut-down, handling, and maintenance.

The RAM is typically calibrated at the factory, against a filter gravimetric reference, and recalibrated by the manufacturer at least annually.

To test the instrument, follow the start-up procedure in the manufacturer's manual to verify that the instrument functions normally. The instrument must be set to zero in an atmosphere known to be free of airborne particulates.

To take a measurement, position the instrument near the operational source point or in the workers' breathing zone to obtain readings. For the MINIRAM, a specific brand of compact, personal size RAM, aerosol concentrations are displayed every 10 seconds in units of mg/m^3. These readings are stored and integrated to provide time-weighted averages that can be compared to the operable TLV-TWA for the site.

> Example: Analysis of the soil at a drilling site shows a mica content of 75%. Assuming that 50% of the dust is respirable, a RAM reading of 10 mg/m^3 would result in 3.75 mg/m^3 of mica being inhaled by the workers in that area (0.50 x 10 x 0.75 = 3.75). The TLV time-weighted average (TWA) for mica of 3.0 mg/m^3 may have been exceeded. (For this example, it would then be appropriate to perform personal sampling.)

Record initial weather conditions, personal protective equipment (PPE) level, and work being monitored on the Real-Time Aerosol Field Monitoring Data Form (Attachment A).

Obtain airborne particulates measurements and record data on the Real-Time Aerosol Field Monitoring Data Form (Attachment A).

Compare readings with action levels specified in SSHASP. If measured levels exceed the action level, notify the Field Unit ESH Representative.

Record change in field conditions (e.g., weather, PPE changes, deviations from normal operations, or other special considerations) in the health and safety logbook.

Convey the air monitoring results to personnel working on site and keep a copy of the results on site available for review by affected individuals and site management.

When the work activity being monitored is completed, or at the end of the day, carefully wipe the outside of the RAM with a damp disposable towel to remove any visible dirt. When the sensor chamber needs cleaning, carefully follow the instructions in the manufacturer's operations manual. Return the RAM to a secure area and charge the battery.

7.0 REFERENCES

7.1 Required Documents

- *Site-Specific Health and Safety Plan (SSHASP)*

- *Instrument Operation Manual*
- *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (current edition published annually).

7.2 Bibliography

- Barbara A. Plog, Ed. *Fundamentals of Industrial Hygiene*, 3rd ed. National Safety Council, (1988).
- American Conference of Governmental Industrial Hygienists (ACGIH), *Air Sampling Instruments For Evaluation of Atmospheric Contaminants, 7th ed. (1989)*.

8.0 RECORDS

- Record RAM results on the Real Time Aerosol Field Monitoring Data Form (Attachment A). Describe any deviations from this method, if any, and associated rationale(s).
- Record changes in field conditions, as specified in section 6.3, in the health and safety logbook.
- In accordance with LANL-ER-AP-02.1.R1, "Procedure for LANL ER Records Management," verify completeness and accuracy of entries and sign and date each page.
- Keep a copy of the results on site available for review by affected personnel and site management.

9.0 ATTACHMENTS

Attachment A: Real Time Aerosol Field Monitoring Data Form

REAL TIME AEROSOL FIELD MONITORING DATA FORM

SSHASP No. _____ Mod. No. _____ SSHASP Title: _____ TA(s): _____

Instrument Data

Instrument:	Mfr./Model:	Serial No.:	Factory Calibration Completed:	Date Due:

Gas Type	Mfr.	Part/Lot No.	Conc.	Instr. Response (Incl. Units)	Date	Time	Temp.	Hum-idity (%)	Atm. Press. (mm Hg)	Rain	Snow	Wind	Comments
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
							___°F ___°C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	

Additional Comments:

Date: _____

Monitoring Data

Page ___ of ___

Time	Location	Reading (units)	Task Monitored	Admin./Eng Control(s)	PPE	Temp.	Humidity (%)	Atm. Press. (mm Hg)	Rain	Snow	Wind	Comments
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	
						___ °F ___ °C			☐ Yes ☐ No	☐ Yes ☐ No	_____ mph ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW	

Additional Comments:

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

METEOROLOGICAL (MET) STATION METHOD

ER-HSM-1F

ER-HSM-1F

METEOROLOGICAL (MET) STATION METHOD

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1.0 PURPOSE

The purpose of this procedure is to describe the setup and operation of the meteorological (MET) station. This equipment is used for the determination of various weather data including: temperature, wind direction, wind speed, relative humidity, and barometric pressure. This information applies to most air sampling events as well as many other sampling activities.

2.0 SCOPE

2.1 Applicability

This procedure applies to the use of meteorological (MET) stations during ER Project field operations.

2.2 Training

No formal training is required, however personnel using a MET station shall be acquainted with its capabilities and operations.

3.0 DEFINITIONS

- **Barometric (Atmospheric) Pressure:** The pressure exerted in all directions by the atmosphere as measured by a barometer. At sea level, mean atmospheric pressure is 29.92 inches Hg, or 407 inches w.g.

- **Direct-Reading/Real Time Instruments:** Instruments that provide instantaneous measurements (or near instantaneous) for the airborne concentration of particular parameters of interest (e.g., relative humidity). Generally, direct reading/real time instruments only provide results for a moment in time, unless they can integrate the data (e.g., they are equipped with data logging capabilities).

- **Relative Humidity:** The ratio of the quantity of water vapor present in the air to the quantity that would saturate it at any specific temperature.

- **Topography:** Configuration of a surface, including its relief and the position of its natural and man-made features.

4.0 BACKGROUND AND/OR CAUTIONS

Meteorological information is an integral part of any air monitoring program. Data concerning wind speed and direction, temperature, barometric pressure, and relative humidity, singularly or in combination, are needed for selecting air sampling locations, calculating air dispersion, calibrating instruments, and determining population at risk of exposure from airborne contaminants.

A MET station is used whenever sampling events or sampling activities require meteorological information for data reliability, and when other reliable sources of similar data (e.g. National Weather Service) are not available.

There are no chemical interferences for this instrument. However, potential sources of problems might include topography of the site and conditions surrounding the area. The topography could be a problem in that the actual area of concern may be inaccessible (hidden in a valley or crevice) to the MET station. In addition, conditions surrounding the area, including buildings and large structures, can affect the weather data taken on-site by making unnatural weather patterns. The MET station should be not setup in close proximity to large steel structures or scrap piles.

The equipment design allows for operation in severe weather; however, extreme conditions may affect setup and breakdown of the equipment. If ice should form on the unit, make efforts to melt the ice and dry off the equipment before packing it in its case. If the equipment is damp or wet, dry it before packing. Also, extreme cold can make joints and knobs on the equipment stiff and very difficult to move. Efforts should be made to warm the unit before breakdown. Never force the knobs and joints; they break easily under these conditions. See operations manual for additional information and cautions.

5.0 EQUIPMENT

A MET station is a direct-reading/real time instrument that is generally comprised of sensors, stand, power source, and carrying case. Consult manufacturer's information for specific components and replacement parts.

Several companies (e.g., Davis Instruments, RainWise and Campbell Scientific, Inc.) make portable MET stations. These stations measure a wide range of meteorological data in virtually any remote location through the use of separate sensors. Several MET stations (e.g., The Weather Monitor II and the WeatherNet Weather Station) monitor for additional meteorological information such as wind chill and rainfall, and allows for processing and storage of data on computers.

5.1 Instrument Maintenance

Maintain all MET station equipment in accordance with manufacturer's specifications and instructions.

6.0 PROCEDURES

6.1 Scheduling and Frequency

Setup and start the MET station prior to the initiation of air sampling, instrument calibration or any other activity that requires meteorological information for data reliability. The MET station should continue to run throughout the duration of these activities.

Retrieve the data from the MET station at the beginning of the work shift and as often as necessary thereafter to determine changing meteorological conditions.

6.2 Monitoring Location(s)

Conduct monitoring at the work site. Refer to section 4.0 for MET station placement limitations.

6.3 Instrument Calibration and Use

It is critical that the MET station operations manual be reviewed prior to use. Calibrate and use MET stations in accordance with manufacturer's recommendations.

Please note that some MET station manufacturers require that the instrument be calibrated only by the manufacturer.

Make periodic checks with local weather services to determine accuracy of readings.

7.0 REFERENCES

7.1 Required Documents

- *Instrument Operation Manual*

7.2 Bibliography

- *U.S. Environmental Protection Agency. Standard Operating Safety Guides. June 1992. Publication Number 9285.1-03.*

8.0 RECORDS

Document readings obtained from the MET station in the health and safety logbook and, as appropriate on the forms (i.e. Direct-Reading Air Monitoring Form, Personal Air Sampling Field Data Sheet) generated during area and personal air monitoring.

9.0 ATTACHMENTS

None

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

NOISE EXPOSURE MONITORING METHOD

ER-HSM-1G

ER-HSM-1G

NOISE EXPOSURE MONITORING METHOD

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1.0 PURPOSE

- To evaluate noise levels to which personnel may be exposed during performance of Environmental Restoration (ER) Project field activities.
- To identify the need for engineering controls to reduce noise levels.
- To identify work areas where the use of hearing protection is required.
- To comply with requirements of applicable DOE requirements and regulations (e.g., the OSHA Noise Standard - Section 95, Part 1910 of Title 29, *Code of Federal Regulations* [29CFR 1910.95] and DOE Orders 5480.10 and 5480.4).

2.0 SCOPE

2.1 Applicability

This procedure applies to noise exposure monitoring conducted during ER Project field operations.

2.2 Training

2.2.1 Monitoring Technicians

Personnel conducting noise monitoring shall:

- Have a thorough knowledge of noise instrumentation calibration, use, and maintenance;
- Be trained to conduct monitoring per this method; and,
- Be informed of the necessary monitoring data to be obtained and recorded, and the procedure for appropriately completing the Sound Level Survey Form, and the Noise Dosimetry Sample Field Form (Attachments A and B).

2.2.2 Field Personnel

Personnel identified as exposed, or potentially exposed to noise levels at or above the action level (defined in Section 3.0), shall be enrolled in a hearing conservation program according to *29 CFR 1910.95* and as described under Section 4.1. ER Project personnel shall have documented evidence of current participation in their employer's hearing conservation program (defined in Section 3.0) whenever they are potentially or actually exposed occupationally to noise levels at or above the action level.

3.0 DEFINITIONS

- **Accuracy:** The agreement between the true value and a reading or observation made from an instrument.
- **Action Level:** An administrative control level at or above which specific actions are required (i.e., noise monitoring is required when noise levels are suspected of being at or above 85 decibels measured on the A-weighted scale [85 dBA]; and, at or above 85 dBA, employees are required to participate in their employer's hearing protection program).
- **Calibration:** The act of checking, adjusting, and systematically standardizing the graduation of a quantitative measuring instrument.

- **Crest Factor:** Characterizes the ability of a sound measuring instrument to measure accurately transient or impulse sound levels. The crest factor should be less than the crest factor capability of the measuring instrument. The arithmetic difference between the peak sound pressure level and the root-mean-square (RMS) sound pressure level for a given noise measurement situation is expressed by the following equation:

  Crest Factor = (Peak Sound Pressure) - (RMS Sound Pressure Level)

- **dBA:** A unit of measure expressing sound level measurements (in decibels) taken using the A-weighted scale of the noise monitoring instrument. The A scale was designed to approximate the response of the human ear at low sound pressure levels to discriminate between low frequency ranges as the human ear does.

- **dBC:** A unit of measure expressing sound level measurements (in decibels) taken using the C-weighted scale of the noise monitoring instrument. The C scale was designed to approximate the response of the human ear at high sound pressure levels; however, this scale also responds to low frequencies and thus may result in higher readings than the A-weighted scale. Measurements using the C-weighted scale are used to evaluate peak noise levels and the effectiveness of hearing protection devices.

- **Decibel (dB):** A unit of measure expressing the amount of sound level.

- **Dose:** When the sound level is constant over the entire work shift, the noise dose, D, in percent, is given by: $D = 100\ C/T$; where C is the total length of the work day in hours, and T is the reference duration of the sound level measurement. When the work shift noise exposure is composed of two or more periods of noise at different levels, the total noise dose over the work day is given by: $D = 100\ (C_1/T_1 + C_2/T_2 + \ldots + C_n/T_n)$; where C_x indicates the total time of exposure at a specific noise level, and T_x indicates the reference duration for that level given in Table 1 of Section 4.1 or Table G-16a of *29 CFR 1910.95*.

- **Engineering Control:** A means of controlling personnel exposure to noise by modifying the noise source to reduce the level of noise in the work environment.

- **Exchange Rate:** Trade-off between the A-weighted sound level decibels and the duration of exposure in hours. The OSHA exchange rate is 5 dB. The U.S. Departments of Defense and Energy use a 4 dB exchange rate, while the U.S. Environmental Protection Agency (EPA) and most foreign governments use a 3 dB exchange rate. For ER Project field operations use the OSHA exchange rate of 5 dB.

- **Hearing Conservation Program:** A written program in accordance with *29 CFR 1910.95(c)* that is implemented whenever employees are potentially or actually exposed to occupational noise levels at or exceeding the action level of 85 dBA. The employer's program addresses the following:

  - Training of employees concerning the hazards of excessive noise exposure, occupational exposure limits, and the topics listed below. Training shall be conducted at least annually for employees with the potential for exposure to noise at or above the action level;

  - Means and methods for monitoring and reducing noise exposure (e.g., administrative and engineering controls);

  - Means for posting work areas where the occurrence of excessive noise levels necessitates the use of hearing protection;

  - Selection, fitting, use, care, and determination of effectiveness of hearing protection; and,

- Audiometric (hearing) testing is performed at least annually by a health professional under the supervision of a qualified physician specializing in occupational medicine, and at no cost to the employee.

- **Hertz:** A unit of measure of frequency expressed as cycles per second.

- **Microphone:** An electroacoustic transducer that responds to sound waves and delivers relatively equivalent electric waves to a measuring device.

- **Noise:** Any unwanted sound.

- **Noise Dosimeter:** An instrument worn by an employee that records the noise dose to which the employee is exposed during a specific time period (usually an entire work day).

- **Noise Reduction Rating (NRR):** The manufacturer's rating of the noise reduction in decibels provided by a hearing protector device.

- **Precision:** The ability to repeat results of an instrument or test under the same conditions.

- **Sound Level:** Ten times the common logarithm of the ratio of the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals; units are decibels.

- **Sound Level Meter (SLM):** An instrument for the measurement of the sound level at a given moment.

- **Standard Threshold Shift:** A change in hearing threshold relative to baseline audiogram of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear.

- **Threshold Level:** The A-weighted sound level at which a noise dosimeter is set to begin integrating the noise as a measurable dose. 80 dBA for ER Project field operations. OSHA uses 80 dBA or 90 dBA. Typically, an 80 dBA threshold dosimeter yields a noise dose greater than or equal to the dose measured with a 90 dBA threshold dosimeter when used simultaneously to measure the same noise exposure.

4.0 BACKGROUND AND/OR CAUTIONS

4.1 Applicable Regulatory and Agency Requirements

Monitoring of noise exposure is conducted per this method and in accordance with the following DOE and OSHA requirements as further clarified below.

- *29 CFR 1910.95*

- DOE Orders 5480.10 and 5480.4

Monitoring of noise exposure is conducted whenever occupational noise exposures at or above 85 dBA are suspected. (As a guideline, whenever voices must be raised by individuals communicating to each other from a distance of less than or equal to 3-feet apart.)

Work areas where noise levels meet or exceed the TLVs listed in Table 1 are identified and posted as requiring the use of hearing protection by employees working in the area. ER Employees working in such areas shall be required to use the hearing protection specified in Tables 4-4.1 and 4-4.2 of the *Site-Specific Health and Safety Plan (SSHASP)* or in an approved *SSHASP modification form.*

Noise measuring instruments are set to use the A-weighted scale with slow meter response, except for peak level measurements using the C-weighted scale.

When the daily noise exposure involves two or more periods of noise exposure of different levels, the combined effect is considered rather than each individual effect. Per OSHA guidance, if the sum of the fractions in the following formula exceeds unity (1), then the mixed exposure shall be considered to exceed the Permissible Exposure Level (PEL).

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots + \frac{C_n}{T_n}$$

where C_X = total duration of exposure at a specific noise level measured at time T_X

With SLMs, this formula should be used for sounds with steady levels of at least 3 seconds. For sounds with steady that do not meet this condition, use a dosimeter or an integrating SLM. The PEL is exceeded when the dose is more than 100% measured with a dosimeter set with a 5dB exchange rate and an 8-hour criteria level of 90 dBA. When using an integrating SLM, the PEL is exceeded when the average sound level exceeds a value listed in Table 1.

TABLE 1

PERMISSIBLE EXPOSURE LEVELS (PELs) FOR NOISE

The duration of exposure shall not exceed the limits specified below. These PELs apply to total duration of exposure per working day regardless of whether the employee is exposed to one continuous exposure or a number of short-term exposures.

Duration per Day (Hours)	Sound Level (dBA) slow response
8	90
6	92
4	95
3	97
3	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions:

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots + \frac{C_n}{T_n}$$

exceeds unity, then, the mixed exposure should be considered to exceed the limit value. Cn indicates the total time of exposure at a specified noise level, and Tn indicates the total time of exposure permitted at that level.

Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

4.2 Limitations/Interferences

- **Atmospheric Pressure:** When checking an acoustical calibrator, always apply the corrections for atmospheric pressure designated in the manufacturer's instruction manual. Generally, if the altitude where the measurement is being made is less than 10,000 feet above sea level, the correction is negligible and need not be considered further. If the measurement is made at an altitude higher than 10,000 feet above sea level or if the site is pressurized above ambient pressure, refer to *29 CFR 1910.95* for the equation to correct the instrument reading.

- **Crest Factor:** When measuring impulse noise with a dosimeter, determine the crest factor for the noise to be measured (as defined in Section 3.0). The noise crest factor should be less than the crest factor capability of the measuring instrument. The peak sound pressure level and the average sound pressure level can be determined by using an impulse-precision, SLM. If there is difficulty or uncertainty about determining the crest factor, refer to the manufacturer's instructions manual.

- **Dust or Wind:** Dust or wind blowing across a microphone produces turbulence noise that may cause positive error in the measurement. Cover the microphone with a wind screen for all out-door measurements and whenever there is significant air movement or dust inside a building.

- **Humidity:** Noise instruments should perform accurately as long as moisture does not condense on the microphone diaphragm.

- **Magnetic Fields:** Certain operations (e.g., heat sealers, induction furnaces, generators, transformers, electromagnets, arc welding, and radio transmitting devices) generate electromagnetic fields that may cause erratic readings by inducing current in the electronic circuitry of sound measuring instruments. If sound measuring instruments must be used near such operations, attempt to determine whether the magnetic field is negligible or interfering, and follow the manufacturer's instructions for situations where magnetic fields are of concern.

- **Microphone Placement:** For SLMs and noise dosimeters equipped with omnidirectional microphones, the effects of microphone placement and orientation on instrument readings are negligible in a typical reverberant (resonant) environment. To minimize body shielding effects on microphones and where the measurement site is non-reverberant and/or the noise is highly directional, refer to the manufacturer's instruction manual to determine proper placement of the microphone.

- **Temperature:** Sound measuring equipment should perform within the manufacturer's design specifications for ambient temperatures, generally ranging between -20°F and 140°F (-7°C to 66°C). If the temperature at the measurement site is outside this range, refer to the manufacturer's instructions to determine if the instrument is capable of performing properly at the site. Sound measuring equipment should not be stored in automobiles during temperature extremes. Warm-up drift, moisture condensation, and weakened batteries may result which would adversely affect instrument performance.

5.0 EQUIPMENT

5.1 Acoustical Calibrators

Use only the acoustical calibrator compatible with the SLM or noise dosimeter being used (i.e., one specified by the manufacturer of the SLM or noise dosimeter) according to the manufacturer's instructions.

5.2 Batteries

Use only the battery type specified by the manufacturer for the instrument being used. Discharge and/or charge batteries according to the manufacturer's instructions. Note that certain battery types build up a memory that may significantly reduce the battery life; such batteries must be discharged prior to charging.

5.3 Maintenance and Use

Maintain all noise measurement equipment and use according to the manufacturer's specifications and instructions.

5.4 Noise Dosimeters

A noise dosimeter shall be used to measure the noise dose to which an employee is exposed. Only equipment conforming as a minimum to the requirements of the *American National Standards Institute Specification for Personal Noise Dosimeters (ANSI S1.25-1991)* shall be used to perform noise dosimetry. Noise dosimeters shall have a 5 dB exchange rate, 80 dBA threshold level, and be set to use the A-weighted scale with slow meter response. For example, the AMETEK Mark-1, 2, or 3 Audio Dosimeters, or equivalent, are lightweight dosimeters and offer many features, including options to integrate noise levels throughout the work day into a daily dose, be set to monitor against different noise standards, or download results from the instrument to a computer.

5.5 Sound Level Meters (SLMs)

An SLM shall be used to:

- Measure the noise level to identify an operation requiring engineering controls to reduce excessive noise and/or an area where hearing protection is required;
- Determine areas where noise dosimetry is necessary, and/or to evaluate effectiveness of noise dosimetry evaluation; and,
- Determine the effectiveness of engineering controls to reduce excessive noise levels.

Only equipment conforming as a minimum to the requirements of the *American National Standards Institute Specification for Sound Level Meters, (ANSI S1.4-1983)* Type S2A shall be used to perform noise monitoring. SLMs shall be set to use the A-weighted scale with slow meter response unless otherwise specified in this method (e.g., for determining compliance with the impulse noise provision of *29 CFR 1910.95(b)(1)* or *29 CFR 1926.52(e)*, use unweighted peak mode setting). For example, the Quest Model 215 SLM, or equivalent SLM, is a hand held general purpose SLM suitable for a wide range of applications including monitoring continuous or impulse noise.

6.0 PROCEDURES

6.1 Noise Monitoring Using SLM

6.1.1 Scheduling and Frequency

- Monitoring of noise exposure shall be conducted whenever occupational noise exposures at or above 85 dBA are suspected.
- Perform noise monitoring while the noisy operation is in progress, under normal operating conditions without altering operation.
- Try not to interfere with the employee's job duties.
- The frequency of noise monitoring adheres to the following specifications:
  - ⇒ As necessary to characterize employee exposure to excessive noise and to determine whether noise levels meet or exceed an action level specified in this method or the *SSHASP*.
  - ⇒ Whenever there is a change in an operation or controls that may expose employees to noise levels at or exceeding an action level.
  - ⇒ Whenever hearing protection is required and/or may be considered inadequate due to a rise in overall noise level(s).

6.1.2 Monitoring Location(s)

- Monitor noise level(s) at a distance of one to five feet for direct measurement of a noise source.
- Monitor source noise level(s) at a distance of 10 to 20 feet for measurement of noise levels in environments where reverberation and reflection effects may be expected.
- Monitor noise level(s) in the employee's hearing zone (a sphere with a two foot diameter surrounding the head). When noise levels differ at each of an employee's ears, both levels shall be recorded and the higher level shall be used for determining appropriate controls and/or use of hearing protection.
- Do not stand between the instrument and the noise source when taking measurements.

6.1.3 Instrument Calibration and Use

- Review Section 4.2 (Limitations/Interferences) prior to calibrating and using SLM.
- Set SLMs to use the A-weighted scale with slow meter response; however, when determining compliance with the impulse noise provision of *29 CFR 1910.95(b)(1)* or *29 CFR 1926.52(e)* use unweighted peak mode setting.
- Calibrate SLMs according to the manufacturer's instructions before and after each day of use, and whenever environmental conditions change significantly in relation to temperature and relative humidity.
- Obtain noise level measurements and record data on the Sound Level Survey Form (Attachment A).
- Post-calibrate the SLM and record the calibration on the Sound Level Survey Form (Attachment A).
- Assess the need for noise dosimetry.
- Convey the noise monitoring results to personnel working on site and keep a copy of the results on site available for review by affected individuals. If measured noise levels exceed an action level, provide a copy of the results to the employee, the employee's supervisor, and to the Field Unit ESH Representative.

6.2 Noise Dosimetry

6.2.1 Scheduling and Frequency

- Conduct noise dosimetry:
  - ⇒ Whenever occupational noise exposures at or above 85 dBA have been measured using an SLM,
  - ⇒ Whenever there is a change in an operation or controls that may expose employees to noise levels at or exceeding 85 dBA, and,
  - ⇒ Whenever hearing protection is required and/or may be considered inadequate due to a rise in overall noise level(s), to determine sufficiency of hearing protection.

6.2.2 Monitoring Location

- Unless specified otherwise by the instrument manufacturer:
  - ⇒ Clip or tape the dosimeter to the employee's clothing in a shirt pocket or at the waist,
  - ⇒ Clip or tape the microphone to the employee's clothing in the proximity of the collar area,
  - ⇒ Orient the microphone vertically so that the opening is toward the employee's ear, and,
  - ⇒ Position and secure with duct tape any excess microphone cable along the chest, under the employee's arm, and across the back, if necessary, to avoid getting it snagged and to avoid inconvenience to the wearer.

6.2.3 Instrument Calibration and Use

- Review Section 4.2 (Limitations/Interferences) prior to calibrating and using noise dosimeters.
- Set dosimeters to use the A-weighted scale with slow meter response and a threshold level of 80 dBA and exchange rate of 5 dB and criterion level of 90 dBA.
- Calibrate dosimeters according to the manufacturer's instructions before and after each day of use, and whenever environmental conditions change significantly in relation to temperature and relative humidity.
- Inform employees being monitored that the dosimeter should not interfere with work performance, and emphasize that the employee should perform work routinely.
- Explain the purpose of the dosimeter to all employees working in the area being monitored and that it is not a speech recording device.
- Instruct the employee being monitored not to tamper with the dosimeter and microphone, not to remove the dosimeter unless absolutely necessary, and not to cover the microphone (e.g., with an outer garment).
- Inform the employee when and where the dosimeter will be removed.
- Set the noise dosimeter and microphone on the employee to be monitored according to Section 6.2.2.
- Check the dosimeter periodically during use to ensure that the microphone remains oriented properly.
- Obtain noise dosimetry measurements for the entirety of each work shift during the work day.
- Record exposure data on the Noise Dosimetry Sample Field Form (Attachment B).
- Post-calibrate the dosimeter and record the calibration on the Noise Dosimetry Sample Field Form (Attachment B).
- Assess the need for implementation or modification of controls and/or the required use of hearing protection. Refer also to Section 6.3.
- Convey the noise dosimetry results to each employee monitored, keep a copy of the results on site available for review by affected individuals, provide a copy of the results to the employee's supervisor, and if requested, provide a copy of the results to the employee. If

measured noise levels exceed an action level, provide a copy of the results to the Field Unit ESH Representative.

6.3 Hearing Protection Attenuation Evaluation

According to Appendix B of *29 CFR 1910.95*, hearing protection attenuation must be sufficient to reduce employee exposure to a time-weighted average (TWA) of 85 dB for employees who have experienced a standard threshold shift (defined in Section 3.0). The ER Project has adopted this provision across the board for all employees performing ER Project field operations.

Employers shall select one of the four methods provided below to estimate the adequacy of hearing protector attenuation. In these equations, "NRR" refers to the Noise Reduction Rating specified by the manufacturer of the hearing protector device. For dual protection (e.g., ear plugs and muffs worn simultaneously), add 5 dB to the NRR of the higher rated protector.

1. **Using SLM With A-Weighting Scale:**

   Estimated $TWA_{(dBA)}$ Under Hearing Protector = Employee's $TWA_{(dBA)}$ - (NRR - 7 dB)

2. **Using Dosimeter With A-Weighting Scale:**

   Convert Employee's dose to $TWA_{(dBA)}$, using the following equation, or Table A-1 in Appendix A to *29 CFR 1910.95*:

   8-hour TWA = $16.61 \log_{10}(D/100) + 90$; where D = accumulated dose in percent exposure

   Then plug this TWA value into equation (1) to calculate the estimated TWA under the hearing protector.

3. **Using SLM With C-Weighting Scale:**

   Estimated $TWA_{(dBA)}$ Under Hearing Protector = Employee's $TWA_{(dBC)}$ - NRR

4. **Using Dosimeter With C-Weighting Scale:**

   Convert employee's C-weighted dose to $TWA_{(dBC)}$ using equation (2); plug this value into equation (3).

7.0 REFERENCES

7.1 Required Documents

- *American National Standards Institute Specification for Personal Noise Dosimeters (ANSI S1.25-1991)*
- *American National Standards Institute Specification for Sound Level Meters, (ANSI S1.4-1983)*
- *Occupational Noise Exposure Standard (29 CFR 1910.95)*
- *Site-Specific Health and Safety Plan (SSHASP)*

7.2 Bibliography

- American National Standards Institute: *American National Standards Institute Specification for Personal Noise Dosimeters (ANSI S1.25-1991)*. ANSI, New York (1991).

- American National Standards Institute: *American National Standards Institute Specification for Sound Level Meters, (ANSI S1.4-1983)*. ANSI, New York (1983).
- United States Department of Energy: _____, DOE Order No. 5484.10, Government Printing Office, Washington, DC (_____).
- United States Department of Labor, Occupational Safety and Health Administration: *Occupational Noise Exposure Standard (29 CFR 1910.95)*. Government Printing Office, Washington, DC (current edition published annually).
- _____: *OSHA Technical Manual*. Government Printing Office, Washington, DC (1993).

8.0 RECORDS

8.1 Recordkeeping

- Record noise exposure monitoring, dosimetry, and instrument calibration data on the Sound Level Survey Form, and/or the Noise Dosimetry Sample Field Form (Attachments A and B). Describe any deviations from this method, if any, and associated rationale(s).
- Complete the Sound Level Survey Form, and the Noise Dosimetry Sample Field Form by filling in all applicable information in the spaces provided on the forms.
- In accordance with LANL-ER-AP-02.1.R1, "Procedure for LANL ER Records Management", verify completeness and accuracy of entries and sign and date each page.
- A copy of the results shall be:
  - ⇒ Kept on site available for review by affected personnel,
  - ⇒ Provided to the employee and the employee's supervisor
  - ⇒ Provided to the Field Unit ESH Representative if measured noise levels exceed an action level.

9.0 ATTACHMENTS

Attachment A: Sound Level Survey Form

Attachment B: Noise Dosimetry Sample Field Form

Attachment A

SOUND LEVEL SURVEY FORM

TA(s)/SWMU(s): _____ SSHASP#: _____ SSHASP Title: _____

Change Order #: _____ Task Being Monitored: _____

Sound Level Meter: _____ Serial #: _____

Calibrator: _____ Serial #: _____

Calibration: Initial _____ Final _____

Drawing of equipment or work layout
Reference Numbers refer to the Test Number above

Attachment A

SOUND LEVEL SURVEY FORM

Test No.	Description Location/Equipment	Distance	dB(A)	Hearing Protection Required Y	N	Comments

Attachment B

NOISE DOSIMETRY SAMPLE FIELD FORM

TA(s)/SWMU(s): _____ SSHASP#: _____ SSHASP Title: _____

SSHASP Modification #: _____ Task Being Monitored: _____

Sample I.D.: Date: _____

Sample I.D.#: _____

Name, Person Sampled: _____ Z#/SS#: _____

Job: _____ Work Location: _____

Dosimeter-Model: _____ Serial #: _____ Dosimeter Threshold: _____ dB(A)

Calibration: Initial _____ Final _____

Calibrator: _____ Serial #: _____ Battery Check: _____

Dosimeter Information-Time On: _____ Time Off: _____ Run Time: _____

Avg: _____ Dose %: _____ Max: _____ Over Time Limit Value: _____

Over 115 dB(A)? Yes ____ No ____

Workplace Conditions:

Operations: Normal _____ Abnormal _____ Explain _____

Hearing Protection - Type: _____ % of Time Worn: _____

Weather Conditions:

Approximate Temperature: _____ °F

Sky: Precipitation _____ Cloudy _____ Partly Cloudy _____ Clear _____

Wind: Calm _____ Light _____ Medium _____ High _____

Work Description/Comments: _____

Scheduled Hours per Shift: _____

Monitored By: _____

Attachment B

NOISE DOSIMETRY SAMPLE FIELD FORM

IDENTIFICATION

Location: _____

Prepared By: _____

Date Prepared: _____

GENERAL INFORMATION

Calibrator: _____

Exposure Limit: _____ **Scheduled Hours Per Shift** _____

OSHA-PEL _____

Date	Name or Area	Job Description		Hearing Protection		Dosimeter			Run Time Hr:Min:Sec	Over Limit Min:Sec	Max Level	% Dose	Avg dB(A)	Full Shift % Dose
Sample #	Soc Sec #	Classification	Location	Type	% Use	Model	Serial #	Thr						

ENVIRONMENTAL RESTORATION PROJECT

HEALTH AND SAFETY METHOD

PERSONAL SAMPLING METHOD

ER-HSM-1H

ER-HSM-1H

PERSONAL SAMPLING METHOD

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1.0 PURPOSE

Personal sampling may be used to determine air concentrations for one or a number of individuals by sampling their breathing zone for durations representative of whole workshifts. If workers whose exposures are determined in this way are truly representative of those in their job classifications, this type of sampling yields excellent estimates. The purpose of this method is to provide general guidance for the collection of personal samples.

2.0 SCOPE

2.1 Applicability

This method applies to all personnel performing personal monitoring during ER Project field operations.

2.2 Training

Personnel conducting personal air monitoring shall:

- Have a thorough knowledge of calibration, use, and maintenance of personal sampling equipment as well as the proper analytical procedures as prescribed by NIOSH, OSHA, ANSI, or ACGIH,
- Be trained to conduct monitoring per this method; and,
- Be informed of the necessary monitoring data to be obtained and recorded.

Personnel being monitored shall:

- Be informed of the purpose of the sampling, when and where the equipment will be removed, and the importance of not removing or tampering with the sampling equipment.
- Be informed of the results of the sampling.

3.0 DEFINITIONS

- **Accuracy:** The agreement between the true value and a reading or observation made from an instrument.
- **Action Level:** An administrative control level at or above which specific actions are required. Refer to the Site Specific Health and Safety Plan (SSHASP) for action levels.
- **American Conference of Governmental Industrial Hygienists (ACGIH):** A professional society that establishes exposure limits, referred to as threshold limit values (TLVs), and guidance for limiting occupational exposure to toxic substances and hazardous physical agents. Each year the ACGIH revises TLVs as appropriate.
- **Analyte:** The constituent to be qualitatively or quantitatively identified that poses the exposure concern.
- **Asbestos:** A commercial term applied to a family of magnesium - silicate minerals in fibrous form. They have electrical and thermal insulating properties and can be woven into fabrics. These mineral forms have been used extensively in the construction industry, and for other uses such as brake and clutch linings.

- **Bubble Tube:** A device with a calibrated volume, such as a graduated cylinder, through which a bubble is moved by way of the suction produced by an air sampling pump. A flow rate calculation may be made when a timer is used to measure the time that it takes the bubble to traverse the known volume.

- **Calibration:** The act of checking, adjusting, and systematically standardizing the graduation of a quantitative measuring instrument.

- **Cassette:** The filter holder used when sampling for particulates.

- **Contaminant:** An undesirable substance or constituent in an unwanted location.

- **Cyclone:** An air sampling system accessory that is used for sampling respirable particulates. A cyclone "swirls" the incoming air stream, and through centrifugal action causes the larger non-respirable particles (>10 microns) to drop out. The respirable particles then travel with the air stream and are captured on the filter cassette. The non-respirable particles accumulate in the bottom of the cyclone and are usually discarded.

- **Dust:** Solid particulate matter suspended in air by mechanical means such as handling, crushing, grinding, abrading or blasting. Dusts can be an inhalation, fire and/or explosion hazard.

- **Engineering Controls:** A means of controlling personnel exposure by modifying the work environment. Refer to the SSHASP for engineering controls.

- **Flow Rate:** The volume of air or water that flows within a given time period.

- **Fume:** Minute, solid particles (less than one micron in diameter), dispersed in air from the heating of a solid. This heating is often accompanied by a chemical reaction where the particles react with oxygen to form an oxide. An example is metal fume produced during welding or torch cutting operations.

- **Gas:** A formless fluid that occupies the space of its enclosure. Gases change to a liquid or solid state with increased pressure and decreased temperature. Gases have low densities and viscosities, and can greatly expand or contract.

- **Gilibrator:** A primary standard airflow calibrator that uses a microprocessor and a bubble tube to provide a high accuracy, instantaneous air flow reading in milliliters/minute.

- **Heavy Metals:** Metallic elements with high molecular weights, such as iron, lead, arsenic, cadmium, vanadium, and uranium.

- **Integrated Air Sampling:** In integrated air sampling, a known volume of air is passed through a collection medium to remove the contaminant from the sampled airstream.

- **Mists:** Suspended liquid droplets formed by condensation from the gaseous to the liquid state or by mechanically breaking up a liquid into a dispersed form by splashing, foaming or atomizing.

- **NIOSH:** National Institute for Occupational Safety & Health. Source for criteria documents and technical guidance.

- **Precision:** The ability to repeat results of an instrument or test under the same conditions.

- **Primary Standard:** A primary standard is a type of air sampling pump calibration method involving generally direct measurements of volume on the basis of the physical dimensions of an enclosed space.

- **Respirable:** The respirable portion of total particulate collected. Respirable particulates are usually those having an aerodynamic diameter of 10 microns or less in size.

- **Rotometer:** Rotometers provide an indication of flow rate. There are two types of rotometers, precision and pump. Precision rotometers stand alone and are calibrated against a primary standard. Pump rotometers are commonly attached to high flow pumps and provide crude indications of flow rates.

- **Sample Pump:** The pumps used to pull a predetermined volume of air through an air filter at a specific rate.

- **Threshold Limit Value (TLV):** Threshold Limit Values refer to airborne concentrations of substances, and it is believed represent conditions under which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

- **Vapors:** The gaseous state of a material suspended in air that would be a liquid under ordinary conditions.

4.0 BACKGROUND AND/OR CAUTIONS

4.1 Applicable Standards

- Personal air monitoring is conducted per this method, as prescribed by NIOSH, OSHA, ANSI, or ACGIH, and per generally recognized industrial hygiene practices.

- There are various recognized sampling methods for the collection of integrated air samples. These methods vary dependent upon contaminant collected and sample analysis. Always check to see if there are specific NIOSH or OSHA sampling methods for the contaminants being investigated before proceeding. This information can often be obtained through the laboratory used for sample analysis, by consulting NIOSH and OSHA manuals, and the SSHASP.

- When two or more contaminants are present, which act upon the same organ, the combined effect shall be considered rather than the individual effect of each. Per ACGIH guidance, if the sum of the fractions in the following formula exceeds unity (1), then the mixed exposure shall be considered to exceed the Threshold Limit Value (TLV).

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots + \frac{C_n}{T_n}$$

Where C_X = observed atmospheric concentration and T_X represents the corresponding threshold limit.

Exceptions to the above rule may be made when there is a good reason to believe that the chief effects of the contaminants are independent, not additive.

4.2 Limitations/Interferences

It is beyond the scope of this method to describe the many and varied limitations and interferences associated with the wide array of methods and equipment required to perform personal air monitoring. It is therefore critical for the person performing the sampling to review analytical methodology and instrument literature for *specific* limitations and interferences.

5.0 EQUIPMENT

The entire array of equipment used to perform personal air sampling is contained in the air sampling train. Generally included in an air sampling train is an air sampling pump, flow rate meter, and collection media.

5.1 Air Sampling Pump

A critical component of the air sampling system is the air sampling pump. The proper selection and calibration of that pump is a critical element of the sampling process. A pump must be selected, based on the desired sampling flow-rate, ease of servicing and calibration, and suitability in a hazardous environment, among other factors. The primary determinant is the desired flow-rate. Personal, battery-powered air-sampling pumps can be classified into the following categories:

- Low-flow pumps (approximately 0.5-500 mL/min) - examples are the Gillian GilAir and the MSA Escort.
- High-flow pumps (approximately 500-4,500 mL/min) - an example is the Gillian Model HFS 513A.
- Dual range pumps (approximately 0.5-4,500 mL/min) - an example is the MSA Gemini Twin-Port Sampler.

5.2 Flow Rate Meters

Maintaining a constant pump flow-rate is critical in determining the sample volume based on elapsed time. Sample volume is one of the determining factors in the formula for concentrations.

$$\text{Concentration} = \frac{\text{mass}}{\text{volume}}$$

Pump flow rates are determined by calibrating the pump with a primary standard (e.g., an electronic bubble flow meter such as, the Gilibrator by Gillian Instrument Corporation) or with a precision rotometer (e.g., Dwyer rotometers by Dwyer Instruments, Inc.) which must be calibrated against a primary standard at regular intervals.

5.3 Collection Media

The physical form of the contaminant determines the type of medium that the sample is collected on. Thus, there is one set of media for gases and vapors and another grouping for particulates.

Gases and vapors are collected using liquid media samplers, solid-sorbent tubes, and passive monitors.

Particulates are collected using filters, electronic precipitators, cascade impactors, impingers, and elutriators.

5.4 Equipment Maintenance

Maintain all equipment used for collecting personal air samples in accordance with manufacturer's specifications and instructions.

6.0 PROCEDURES

6.1 Scheduling and Frequency

Conduct personal air sampling to determine whether action levels specified in the SSHASP have been reached.

This monitoring should be conducted under normal operating conditions without altering operation or interfering with the employee's job duties.

The frequency of sampling adheres to the following specifications:

- Conduct sampling during field operation that may expose workers to potential airborne contaminants as identified in the SSHASP;
- Whenever there is a change in an operation or controls that may expose employees to contaminants at or exceeding an action level;
- Whenever engineering controls are required and/or may be considered inadequate due to a rise in overall contaminant level(s); or,
- Whenever respiratory protection is required and/or may be considered inadequate due to a rise in overall contaminant level(s).

6.2 Sampling Location(s)

Personal samples shall be collected in the breathing zone of high risk workers (i.e., those who are closest to the source of contaminant generation). This is based on the probability that significant exposure varies directly with distance from the source. If workers closest to the source are not significantly exposed, then other workers, presumably, are not significantly exposed and may not need to be monitored.

When levels differ at each of an employee's breathing zone, all levels shall be recorded and the highest level shall be used for comparison with action levels specified in the SSHASP.

6.3 Equipment Calibration and Use

6.3.1 Equipment Calibration

Calibrate the air sampling pump before and after each day of sampling using a primary standard (e.g. electronic bubble flow meter, bubble tube, or precision rotometer). Conduct calibration with the entire sampling train in place. Refer to the manufacturer's information for proper use of the calibration equipment.

Obtain and record calibration data in the field health and safety logbook. At a minimum, entries are to include:

- Name of person performing calibration.
- Date and time of calibration.
- Type, manufacturer, model and serial number of pump and calibrator.
- Location of calibration activity, and temperature and barometric pressure at the time of calibration.
- Results of before and after sample calibrations.

If the before and after flow rates are not within 10% of each other, then the data is considered to be suspect. Use the lower flow rate in data analysis as a safety factor when the data is suspect.

Periodic calibration checks can be performed using precision rotometers. Rotometer readings are to be documented on the Personal Air Sampling Field Data Sheet (Attachment A).

6.3.2 Equipment Use

The sampling method used must meet the procedures outlined in the NIOSH Analytical Methods or OSHA Technical Manual. The specific method to be used for a given analyte will be specified in the SSHASP. The general steps to follow in air sampling are:

- Place the sampling equipment on the employee so that it does not interfere with work performance.
- Mark sample media with uniquely identifiable sample number.
- Attach the collection device (filter cassette, charcoal tube, etc.) to the shirt collar or as close as practical to the nose and mouth of the employee, i.e., in a hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches. Position the excess tubing so as not to interfere with the work of the employee. Tape should be used to keep sample tubing from becoming entangled. Note: Where multiple pumps and/or sampling media are used, ensure the correct placement of sampling media and sampling train configuration.
- Turn on the pump and record the starting time (using military time) on the Personal Air Sampling Field Data Sheet (Attachment A).
- Observe the pump operation for a short time for a short time after starting to make sure it is operating correctly.
- Record the information required on the Personal Air Sampling Field Data Sheet (Attachment A).
- Check the pump status every one to two hours. More frequent checks may be necessary with heavy filter loading. This is because the flow rate will decrease if the filter or tube becomes overloaded (blocked), and some types of samples cannot be analyzed if the filter is overloaded (e.g., total dust). Ensure that the sampler is still assembled properly and that the hose has not become pinched or detached from the cassette or the pump. For filters, observe for symmetrical deposition, fingerprints, or large particles, etc.
- Periodically monitor the employee throughout the work day to ensure that the sample integrity is maintained and cyclical activities and work practices are identified.
- Take detailed notes in health and safety logbook concerning visible airborne contaminants, work practices, potential interferences, and other conditions to assist in determining appropriate engineering controls. Take photographs of site activities and engineering controls, as appropriate.
- Prepare field blank(s) during the sample period for each type of media used. Prepare at least one blank per day per media type. The field blank should be exposed/opened in the sampling area when possible. For any given analysis, one field blank will suffice for up to 20 samples collected, except for asbestos, which requires a minimum of two field blanks. The blanks may include opened but unused charcoal tubes, or cassettes.
- Before turning off the pump, record the elapsed time and the ending time (using military time) on the Personal Air Monitoring Field Data Sheet (Attachment A).
- Remove the collection device from the pump and close the inlet and outlet openings (using sample tube caps or cassette plugs).
- Calculate the air sample volume and the corrected air sample volume. The corrected air sample volume is the sample volume corrected to normal temperature and pressure (298.15

K and 760 mm Hg). If the pumps are calibrated near their use location, it is not necessary to correct sample volumes for temperatures and pressures (altitude).

- Compare sample results with action levels as specified in SSHASP. If measured levels exceed the action level, notify the Field Unit ESH Representative.

- Record personal air monitoring results on the Personal Monitoring Results Employee Notification Form (Attachment B) or equivalent form.

7.0 REFERENCES

7.1 Required Documents

- *Site-Specific Health and Safety Plan (SSHASP)*

- *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (current edition published annually)

- *Manufacturer's instrument operation manuals*

7.2 Bibliography

- American Conference of Governmental Industrial Hygienists (ACGIH): *1994-95 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.* ACGIH, Cincinnati, OH (1994).

- _____: *OSHA Technical Manual.* Government Printing Office, Washington, DC (1993).

- Barbara A. Plog, Ed. *Fundamentals of Industrial Hygiene,* 3rd ed. National Safety Council, (1988).

8.0 RECORDS

- Record personal air monitoring calibration data in the health and safety logbook as described in Section 6.3.1. Describe any deviations from this approach, if any, and associated rationale(s).

- Record personal air monitoring field data on the Personal Air Sampling Field Data Sheet (Attachment A).

- Record results of personal air monitoring on the Personal Monitoring Results Employee Notification Form (Attachment B). Describe any deviations from this approach, if any, and associated rationale(s).

- In accordance with LANL-ER-AP-02.1.R1, "Procedure for LANL ER Records Management", verify completeness and accuracy of entries and sign and date each page.

- A copy of the results shall be provided to the employee, his/her employer, and to the Field Unit ESH Representative.

9.0 ATTACHMENTS

Attachment A: Personal Air Sampling Field Data Sheet

Attachment B: Personal Monitoring Results Employee Notification Form

Personal Air Sampling Worksheet
ER Project

1. Location (TAs, SWMUs)		2. Sampling Date	
3. SSHASP No.	4. Modification No.	5. SSHASP Title	

6. Exposure Information (a = No. people performing same task, b = No. hrs. per day, c = No. days per week / No. years)	a. Number	b. Duration	c. Frequency

7. Employee(s): (Name, Title, Z # or SSN, Employer Name/Telephone #)

8. Job Description (Task, Work Location(s), Administrative and Engineering Controls, PPE, Weather Conditions)

Cont'd

Sampling Data

9. Pump ID (Mfr/Model/Serial #)						
10. Sample Type/Media						
11. Filter/Tube Mfr./Lot #						
12. Pre-Calibration Date						
Flow Rate Cl/min Ccc/min						
13. Employee Z No.						
14. Sampling Time On						
Off						
On						
Off						
15. Total Time (minutes)						
16. Noted Pump Checks/ Adjustments (if any)						
17. Post-Calibration Date						
Flow Rate Cl/min Ccc/min						
18. Avg. Flow Rate Cl/min Ccc/min						
19. Sample Volume (liters)						
20. Net Smpl Wt. (mg)						
21. Sample ID No.						
22. Lab Sample No.						

23. Analysis Instructions (Indicate analytes and analytical method # (e.g., NIOSH, OSHA, or EPA) and whether TWA, Ceiling, etc. calculation necessary)

[redacted]						

24. Person Performing Sampling (Name/Title/Employer/Signature/Date)	25. Shipping Date

26. Interferences / IH Comments to Lab	27. Supporting Samples	28. Chain of Custody	Initials Yes	Initials No	Date
	a. Blanks:	a. Seals Intact?		/	
		b. Rec'd in Lab		/	
		c. Rec'd by Anal.		/	
	b. Bulks:	d. Anal. Completed		/	
		e. Calc. Checked		/	
		f. Supr. OK'd		/	

PERSONAL MONITORING RESULTS
EMPLOYEE NOTIFICATION

Employee Name: _____ (ZI or SSN): _____

Employer Name: _____ Telephone: _____

Date of Monitoring: _____ Date Results Received: _____

In accordance with LANL ER Project HASP Requirement (Section 13) and OSHA regulations, you are notified of the following personal monitoring results:

Sample No.	Date	Substance	Level	Standard*	Std. Exceeded?

*Standard means the OSHA permissible exposure limit (PEL), or in the case where there is no PEL for the substance, the applicable published occupational exposure limit (e.g., ACGIH or NIOSH)

Calculations:

Actions taken to control levels:

_____ None required

_____ Process controls

_____ Ventilation controls

_____ Other administrative or engineering controls (specify):

_____ Respiratory protection

_____ Hearing protection

Employee Acknowledgment

This is to certify that I have read this notification and that it has been explained to me.

_____ Employee signature

_____ Date

APPENDIX A

SSO QUALIFICATION REVIEW FORM

SSO QUALIFICATION REVIEW FORM

Sec. I Name of individual needing qualification: _____

Supervisor: _____ Employer: _____

Phone #: _____ Fax #: _____

Sec. II Educational Experience/Equivalent

Institution	From	To	Degree	Major

Work/Applicable Experience

Employer	Job Title	From	To	Credited Experience

Sec. III SSO Qualification Experience (Check all that apply)

SUBJECT	SPECIFIC ACTIVITY	Yes	No	Date
HAZWOPER Training:	40 hour			
	8 hour refresher			
	8 hour supervisor			
	RAD Worker (I or II)			
	First Aid/CPR			
SSO Experience:	HAZWOPER Activity	Yes	No	How Often
Intrusive	-Drilling			
	-Excavation			
	-Heavy Equipment			
	-Other:			
Non-intrusive	-Geophysical			
	-Water Samples			
	-Surface Scrapes			
	-Other:			
Performing Hazards Analysis:	Chemical Agents examples:			
	Biological Agents examples:			
	Physical Agents examples:			
Administrative Experience	Writing Health and Safety Plans			
	Leading Safety Meetings			

		Yes	No	How Often
Air Sampling Experience:	Particulates			
	VOC's			
	Semi-VOC's			
	Metals			
	Other:			
PPE Selection and Use Experience:	Level A			
	Level B			
	Level C			
	Level D			

Air Monitoring Equipment Experience: (Check all that apply)	Calibration	Field Use	Trouble shooting	Maintenance and Repair
PID				
OVA				
CGI				
Colorimetric Tubes				
Mini-RAM				
IH Pumps				
Respirable Samplers				
Miran				
Other:				
Other:				
Other:				

I have reviewed the qualifications for the above individual and verify to the best of my knowledge that this individual meets level _____ SSO qualifications.
(1, 2, or 3)

_____ Employer Signature _____ Date

_____ Printed Name/Title

_____ ESH-5 Review

July 14, 1995

APPENDIX B

EXIT PHYSICAL EXAMINATION WAIVER FORM

EXIT PHYSICAL EXAMINATION WAIVER

I have been informed of the availability of an exit physical examination. This examination is offered free of cost as a component of the Medical Surveillance Program in which I have participated during my employment.

I choose not to participate in the exit physical examination.

_____
(Name Printed)

_____
(Signature)

_____
(Date)

_____
(Z-Number/Social Security Number)

_____
(Company Name)

APPENDIX C

SUBCONTRACTOR HEALTH & SAFETY PROGRAM REVIEW & APPROVAL

Los Alamos National Laboratory

ENVIRONMENTAL RESTORATION PROJECT

SUBCONTRACTOR HEALTH & SAFETY PROGRAM REVIEW & APPROVAL

The technical evaluators from ESH Division should review the safety program elements below and indicate with a check mark if approved (A) or rejected (R). Program elements listed that are not applicable to the scope of work will be checked as not applicable (NA). If a program element is rejected, a written summary of concerns/recommendations will be attached to this page.

Subcontractor: _____ Point of Contact/Phone: _____

Program	Evaluator			Initials	Date
1. Hazardous Waste Operations (NA _____)					
	ESH-5 _____	A ___	R ___	_____	_____
2. Respiratory Protection (NA _____)					
	ESH-5 _____	A ___	R ___	_____	_____
3. Medical Monitoring (NA _____)					
	ESH-2 _____	A ___	R ___	_____	_____
4. Hazard Communication (NA _____)					
	ESH-5 _____	A ___	R ___	_____	_____
5. Employee Orientation & Training (NA _____)					
	ESH-5 or 12 _____	A ___	R ___	_____	_____
6. Confined Spaces (NA _____)					
	ESH-5 _____	A ___	R ___	_____	_____
7. Hearing Conservation (NA _____)					
	ESH-5 _____	A ___	R ___	_____	_____
8. Fall Protection (NA _____)					
	ESH-5 _____	A ___	R ___	_____	_____
9. Excavation and Trenching (NA _____)					
	ESH-5 _____	A ___	R ___	_____	_____
10. Health Physics Programs (NA _____)					
	ESH-1 (Pat LaFrate) _____	A ___	R ___	_____	_____

11. Asbestos Program (NA _____)

ESH-5 _____ A ___ R ___ _____ _____

12. Spark/Flame-producing Operations (NA _____)

ESH-5 _____ A ___ R ___ _____ _____

13. Lockout/Tagout (NA _____)

ESH-5 _____ A ___ R ___ _____ _____

14. Accident Investigation and Injury/Illness Reporting and Recordkeeping (NA _____)

ESH-5 _____ A ___ R ___ _____ _____

15. Lead Program (NA _____)

ESH-5 _____ A ___ R ___ _____ _____

16. Other: _____

Evaluator: _____ A ___ R ___ _____ _____

Additional Comments: _____

_____

_____

_____

_____

_____

_____

OSHA 200 Log Previous Year Submitted: Yes _____ No _____

Comments: _____

_____

_____

SUMMARY EVALUATION (ER Project Field Health & Safety Representative)

A ___ R ___ Name _____ Date _____

APPENDIX D

Environmental Restoration Project
FIELD SURVEILLANCE REPORT

Environmental Restoration Project
FIELD SURVEILLANCE REPORT

Page ____ of ____

Field Unit _____ SSHASP # _____ Inspection No. _____

Date _____

SSO is required to be on site during the walkthrough. SSO or designee present during walkthrough Yes ____ No. ____

Name of SSO _____

Routine surveillance of site activities resulted in the following observations:

PART I *(To be completed on-site)*

Field Unit # ___ Field Project Leader/Decommissioning Project Leader _____

Project Title _____

TA/Location _____ Subcontractor _____

Observations:

#_____ _____

_____

#_____ _____

_____

#_____ _____

_____

Recommended Actions:

#_____ _____

_____

#_____ _____

_____

#_____ _____

_____

Health & Safety Representative (Print)_____(Signature)_____

Notifications			Via		
FPL/DPL	Phone	Date	FAX	Mail	In person
FTL	Phone	Date	FAX	Mail	In person
Other	Phone	Date	FAX	Mail	In person

PART II *(Specify dates for completion of actions)*

ER Project Representative/SSO:

Response/Actions taken:

Signatures:

FPL/DPL Date

SSO Date

RETURN TO M/S K494

PART III

Data Entry

Closure Date: Initials

Entered Date: Initials