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**REVISION / REVIEW LOG****SECTION 1 – INTRODUCTION**

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**SIGN-OFF RECORD**

The Environment, Safety, Health and Assurance Program Manual has been reviewed and approved as documented below:

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**1.0 INTRODUCTION****1.1 DIRECTOR'S STATEMENT*****Ames Laboratory Integrated Safety Management System******Policy Statement***

*(Policy 10200.010, Revision 2)*

*The Ames Laboratory has a firm commitment to the safety and health of each Laboratory employee and associate. The Laboratory is equally committed to preventing accidental loss of resources and assets, and protecting the general public and the environment, through the prevention of pollution, damage to the environment, or property loss. It is our goal to eliminate foreseeable hazards, and maintain a safe and healthful workplace through continuous improvement. Compliance with applicable Laboratory Contract requirements, DOE Orders and regulatory standards is a prerequisite for conducting Ames Laboratory business, and is the responsibility of every Laboratory worker.*

*The Laboratory has incorporated the principles of Integrated Safety Management (ISM) and the practices of an Environmental Management System (EMS) into an Integrated Safety Management System (ISMS). Our Integrated Safety Management System provides mechanisms to ensure that we incorporate safety and environmental management into all aspects of our work, from planning to completion.*

*Every Laboratory worker must comply with the Laboratory's ES&H requirements. Each level of line management has the responsibility to consider the impacts of its activities on every other level, on the environment and the workplace, and to support the continuous improvement of our safety and environmental practices. A team effort is necessary to achieve a safe, productive and excellent research laboratory.*

*Alexander H. King, Director  
The Ames Laboratory*

## 1.2 ENVIRONMENT, SAFETY, HEALTH & ASSURANCE PROGRAM MANUAL

The Environment, Safety, Health & Assurance (ESH&A) Program Manual incorporates the requirements of environmental, safety and health standards referenced in the Ames Laboratory contract with the requirements for quality assurance and training. The ESH&A Program Manual serves as the Laboratory's "Safety Manual". Major topical divisions of this manual are referred to as Sections. This manual is divided into ten sections.

**1.0 INTRODUCTION:** The Introduction includes a statement by the director, the organizational design of the manual, an explanation of Integrated Safety Management System (ISMS) and Worker Safety and Health Program, a description of the Laboratory's safety coordinator and representative program, an overview of the Safety Review Committee and readiness reviews, and information regarding the reporting of events.

**2.0 QUALITY ASSURANCE:** The Quality Assurance Program establishes an effective management system by ensuring that senior management provides planning, organization, direction, control, and support to achieve DOE objectives and minimize environment, safety, and health risks and impacts. Systems are continually reviewed and enhanced in the areas of management, training, quality improvement, documents & records, work processes, design, procurement, inspection & acceptance testing, and assessments.

**3.0 TRAINING PROGRAM:** The Training Program provides employees with the training necessary for the safe and productive completion of their work responsibilities. A primary emphasis is placed on the fulfillment of Environment, Safety, and Health (ES&H) training requirements. The Training Program focuses on the following core activities: needs assessment; institutional training courses (General Employee Training; Visitor Training; Emergency Awareness Training, etc); job (activity) specific training; course development; training record keeping; training coordination and performance reporting.

**4.0 INDUSTRIAL HYGIENE (IH) PROGRAM:** The Industrial Hygiene section describes the components of the Laboratory's Industrial Hygiene Program, including hazard communication, chemical hygiene, respiratory protection, bloodborne pathogens, non-ionizing radiation including lasers, asbestos, lead and ergonomics.

**5.0 INDUSTRIAL/GENERAL SAFETY PROGRAM:** The Industrial/General Safety Program section includes regulatory requirements for both industrial and general applications relating to specific activities such as walking and working surfaces, personal protective equipment, machine guarding, scaffolding, confined space entry, lockout/tagout, etc. These requirements are primarily derived from 29 CFR 1910 (General Industry) and 29 CFR 1926 (Construction Standards).

**6.0 ENVIRONMENTAL PROTECTION PROGRAM:** This program encompasses the general overriding environmental protection requirements that apply at Ames Laboratory. It refers to specific policies and procedures for protecting all environmental media.

**7.0 RADIOLOGICAL PROTECTION PROGRAM:** The Radiological Protection Program is designed to promote the safe use, handling, storage, receipt, shipping, transferring, and disposal of radioactive materials, and the safe use of analytical X-ray systems. The program is based on standards which have been developed for the safe use of ionizing radiation.

**8.0 FIRE PROTECTION PROGRAM:** The Fire Protection Program provides an overview of fire safety concerns and procedures to be used at the Laboratory. Hot work (torches, etc.), flammable chemical storage, and employee response to fire situations are discussed.

**9.0 EMERGENCY PREPAREDNESS AND SITE SECURITY:** The Emergency Preparedness and Site Security Program provide descriptions of employee responses to emergency situations, severe weather, fire alarms, and security incidents.

**10.0 ASSESSMENT PROGRAM:** The Assessment Program describes the Laboratory's efforts to identify and correct deficiencies through a broad scope program. Elements include employee observations, manager observations and independent walk-throughs.

Where necessary, the major topical divisions are organized into sub-sections. Sub-sections are organized under the following general headings.

**x.x. "SUB-SECTION HEADING"**

**APPLICABILITY STATEMENT**

A brief statement designed to assist the user in determining the applicability of the sub-section to assigned work responsibilities.

**x.x.1 REFERENCES**

A listing of standards and local documents applicable to the topic.

**x.x.2 BACKGROUND**

A statement addressing the scope, historical practices, and/or source of the requirements related to the topic of the subsection.

**x.x.3 PROGRAM INFORMATION**

Information regarding the requirements related to the sub-topic area.

**x.x.4 TRAINING**

A list of relevant training courses.

**x.x.5 PERFORMANCE CHECKLISTS**

Brief statements of specific responsibilities for various levels of line management and safety coordinators and representatives.

### **1.3 INTEGRATED SAFETY MANAGEMENT SYSTEM (ISMS) AND WORKER SAFETY AND HEALTH PROGRAM**

*Applicability Statement:* This section applies to all employees. This section also applies to the Environment, Safety, Health & Assurance (ESH&A) office, which is charged with administering the Laboratory's Integrated Safety Management System and the Worker Safety and Health Program.

#### **1.3.1 REFERENCES**

Ames Laboratory Contract No DE-AC02-07CH11358  
Ames Laboratory Contract, Clause I.103, DEAR 970.5223-1 *Integration of Environment, Safety and Health into Work Planning and Execution (DEC 2000)*  
DOE P 450.4, Safety Management System Policy  
DOE P 450.7, Department of Energy Environment, Safety and Health (ES&H) Goals  
10 CFR Part 851 Worker Safety and Health Program  
Policy 10200.010 Integrated Safety Management Policy  
Plan 10200.016 Integrated Safety Management System (ISMS) and Worker Safety and Health Program Description  
Manual 10200.002 ESH&A Program Manual, Section 2 – Quality Assurance Program

#### **1.3.2 BACKGROUND**

The Laboratory's Integrated Safety Management System is required by Clause I.103 of the Ames Laboratory Contract (DEAR 970.5223-1 *Integration of Environment, Safety and Health into Work Planning and Execution (DEC 2000)*). The Laboratory's safety programs, policies, procedures, and practices are the mechanisms through which the Laboratory's Integrated Safety Management System is implemented. These mechanisms ensure that safety considerations are integrated into all aspects of the Laboratory's work, from planning to completion.

Ames Laboratory is required to prepare a written worker safety and health program by 10 CFR Part 851 *Worker Safety and Health Program*. The program must describe how the requirements of the rule are integrated with other related site-specific worker protection activities and with their Integrated Safety Management System (ISMS). Ames Laboratory has implemented an effective ISM System which is also integrated with the requirements of the rule. The Laboratory performed a compliance analysis of the requirements of the rule versus the Laboratory's existing processes. Identified gaps have been addressed and the essential program elements are documented.

#### **1.3.3 PROGRAM INFORMATION**

##### **1.3.3.1 ISMS OBJECTIVE AND DOCUMENTATION**

Ames Laboratory integrates safety into management and work practices at all levels so that its mission is accomplished while protecting workers, the public, and the environment. This objective is fulfilled through a system of programs, policies, procedures and practices based on the guiding principles of Integrated Safety Management (ISM) and the Laboratory's Quality Assurance Program as detailed in Section 2 of this Manual and in Plan 10200.026 Quality Assurance Program Plan. The ISM guiding principles are: line management responsibility for safety, clear roles and responsibilities, competence commensurate with responsibilities, balanced priorities, identification of safety standards and requirements, hazard controls tailored to work being performed, and operations authorization. Ames Laboratory work activities that can potentially affect workers, the public or the environment are defined, analyzed, developed, performed and reviewed according to the Laboratory's ES&H programs and practices. These work activities are subject to the core functions of Integrated Safety Management with

the degree of rigor appropriate to address the type of work activity and hazards involved. The ISM core functions are: (1) define the scope of work, (2) analyze the hazards, (3) develop and implement hazard controls, (4) perform work within controls, and (5) provide feedback and continuous improvement.

Ames Laboratory has developed the *Integrated Safety Management System (ISMS) and Worker Safety and Health Program Description* (Plan 10200.016) to document its alignment with DOE's Policy 450.4 *Safety Management System Policy*, Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, and 10 CFR 851, *Worker Safety and Health Program*. The Laboratory's programs, policies, procedures, and practices are the mechanisms through which the ISM core functions are implemented. These mechanisms assure compliance with standards described in the Ames Laboratory contract. The Laboratory's programs, policies, procedures and practices also define responsibilities and provide implementation guidance according to and sufficient with the hazards associated with the work activity being performed.

### **1.3.3.2 EMPLOYEE INVOLVEMENT**

Ames Laboratory and Iowa State University recognize that a successful Environment, Safety, and Health (ES&H) program is only possible when every employee in the organization is fully empowered to be a participant. The Laboratory's Integrated Management System is founded on the fundamental principles that line management is directly responsible for the protection of the public, the workers, and the environment, and safety and protection of the environment are fully integrated into research and support activities. These principles are critical to Ames Laboratory achieving its mission as a DOE national laboratory. Participation in the ES&H Program is not only encouraged but required as part of employees' job responsibilities.. Employee responsibilities include being mindful of work conditions that may impact safety, assisting each other in preventing unsafe acts or behaviors, and reporting unsafe work conditions to their supervisor or the Environment, Safety, Health and Assurance (ESH&A) office. Information regarding employee responsibilities related to specific ES&H subject areas is detailed in the ESH&A Program Manual (Manual 10200.002), and employees are responsible for reading and understanding pertinent sections of the program manual. Employees' participation in safety activities, such as reading safety and operational documents, attending training, and conducting workplace observations is a fundamental part of their job responsibilities, and it is the policy of Ames Laboratory that all employees shall be allowed to conduct such activities on official time.

### **1.3.3.3 ROLES AND RESPONSIBILITIES**

The following comments detail the roles, responsibilities, and expectations of Ames Laboratory in support of effective and efficient fulfillment of the *Ames Laboratory Integrated Safety Management System Policy Statement* (Policy 10200.010).

Laboratory Director and Deputy Director: The Laboratory director is ultimately responsible for assurance that a safe and healthful workplace is provided for employees, to protect the environment and the public, to minimize or eliminate hazards to government property, and to comply with applicable ES&H regulations. The director has delegated ES&H responsibilities to the line organization through program directors and department managers and, in turn, to group / section leaders. The director also has assigned staff, policy, and advisory functions related to ES&H to the Environment, Safety, Health and Assurance (ESH&A) office.

Program Directors / Department Managers: Program directors / department managers have responsibility for assuring the implementation of program / department ES&H processes under their authority. Program directors / department managers shall assure that group / section leaders implement, maintain, and document appropriate ES&H program activities within each group. Program directors / department

managers are responsible for appointing a safety coordinator, who serves as a liaison between the program and ESH&A and also serves as a resource for ES&H information to departmental personnel.

Group / Section Leaders: Group / section leaders function as first line managers responsible for day-to-day operational oversight of safety in their areas. Group / section leaders are responsible for implementing the programs described in the *ESH&A Program Manual* (Manual 10200.002) by:

- Identifying which requirements apply to their activities within the "applicability statements,"
- Understanding and implementing the "program information,"
- Completing the appropriate "training," and
- Completing the tasks listed in the "performance checklist."

Group leaders receive additional awareness of their roles and responsibilities via training courses. Group / section leaders ensure that all employees are properly trained in accordance with the provisions of each subject area and have supporting training documentation that is retained for five years after employment. Group / section leaders may designate a safety representative to assist with ES&H program implementation.

Employees: Employees are responsible for:

1. Following established standard operating procedures (SOPs) when performing their work;
2. Completing group / activity-specific training with the supervisor or designee prior to conducting any work at Ames Laboratory;
3. Asking questions about SOPs until they understand them; and
4. Reporting unsafe work conditions to their supervisor or ESH&A, as appropriate.

Information regarding employee responsibilities for specific ES&H subject areas are detailed in the *ESH&A Program Manual*, and employees are responsible for reading and understanding pertinent sections of the program manual. Employees are also responsible for ensuring the safety of visitors to the Laboratory. Whenever possible, visitors should be excluded from areas of potential hazard. Visitation discussions should be held in offices or conference rooms.

Line Management: Line management is defined as any management level within the Laboratory, including program directors, department managers, group / section leaders and supervisors that are responsible and accountable for directing and conducting work. Integrated Safety Management performance expectations for line management are defined as follows.

#### Define the Scope of Work

- Identify new or significantly modified activities during the planning of work associated with unified field budget call, preliminary proposal process, and service order requisitions (SORs).
- Utilize position descriptions, Hazard Inventory forms (HIs), Training Needs Questionnaires (TNQs), or other documentation to define significant safety roles, responsibilities and expectations for new and significantly modified job assignments.

#### Analyze the Hazards

- Identify hazards associated with new or significantly modified activities via the Readiness Review process and review these hazards with safety coordinators and representatives, and ESH&A in accordance with the requirements developed by the Safety Review Committee (SRC).
- Develop and maintain the skills necessary to analyze hazards associated with work tasks through participation in related safety training.

- Utilize HIs and TNQs or other documentation to analyze the safety hazards related to roles, responsibilities and expectations for new and significantly modified job assignments.

#### Develop and Implement Hazard Controls

- Develop and implement hazard controls to assure work is performed safely and is consistent with the Ames Laboratory safety policies, procedures, and requirements, including controls required as part of readiness review or identified deficiencies.
- Assure workers have received appropriate safety and awareness training before performing work.
- Utilize supervisory relationships, such as mentoring, and/or develop job / activity specific requirements to assist employees with control of hazards.

#### Perform Work Within Controls

- Utilize the Readiness Review process and the Service Order Requisition (SOR) process to document line management's approval of activities.
- Perform work within the controls developed during activity reviews, written procedures and group / department requirements.
- Use employee training profiles (ETPs) to assure appropriate training has been completed for the performance of work within controls.

#### Feedback and Continuous Improvement

- Promote worker identification and prompt correction of safety deficiencies.
- Develop, promote, and participate in program / department walk-throughs.
- Promote an open and effective environment for expression and resolution of employee safety concerns.
- Cooperate with independent and external walk-throughs and assessments.
- Review employee safety performance and discuss safety expectations during annual performance reviews.
- Report accident, incidents, and injuries, and cooperate with related investigations.
- Promote the distribution of safety related lessons learned.
- Support the Laboratory's contract performance measures.

### 1.3.4 TRAINING

Specific training for Integrated Safety Management is provided via the following institutional training course:

<b>INTEGRATED SAFETY MANAGEMENT</b>		<b>AL-143</b>
<i>Intended Audience:</i>	<i>Mandatory for all employees</i>	
<i>Course Format:</i>	<i>Provided as a component of General Employee Training</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>No retrain</i>	

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES</b>		<b>AL-001</b>
<i>Intended Audience:</i>	<i>Mandatory for all employees</i>	
<i>Course Format:</i>	<i>Classroom instruction, reviews administrative policies, general safety, emergencies, industrial hygiene program, environmental protection program, and radiation safety</i> <i>Estimated Completion time: 1.5 hours</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's annual retrain mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders</i>	

<b>AMES LABORATORY GROUP LEADER TRAINING</b>		<b>AL-198</b>
<i>Intended Audience:</i>	<i>Mandatory for Ames Laboratory Group Leaders</i>	
<i>Course Format:</i>	<i>Web-based training. Estimated completion time: 0.5 hours</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>No retrain</i>	

### 1.3.5 PERFORMANCE CHECKLIST

**Supervisors / Group / Section Leaders / Department Managers / Program Directors** shall:

- Promote and comply with the principles and functions of the Laboratory's Integrated Safety Management Program.

**Safety Coordinators and Representatives** shall:

- Promote the principles and functions of the Laboratory's Integrated Safety Management Program.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Administer the Laboratory's Integrated Safety Management System and maintain related processes and appropriate documentation.

## 1.4 SAFETY COORDINATORS AND REPRESENTATIVES

**Applicability Statement:** *This section applies to all group leaders / department managers and to employees designated as safety coordinators or representatives; it also applies to the Environment, Safety, Health & Assurance (ESH&A) office which administers the safety coordinator and representative program.*

### 1.4.1 REFERENCES

Plan 10200.009, Safety Coordinator and Representative Program

### 1.4.2 BACKGROUND

The purpose of the safety coordinator and representative program is to provide an additional network (other than group leaders / department managers) by which relevant ES&H information is disseminated to Ames Laboratory employees. Safety coordinators and representatives serve as liaisons between employees and supervisory personnel and frequently interact with the ESH&A office on safety issues. Coordinators and representatives provide program directors / department managers or group / section leaders information on the status of safety conditions in the program or group. Coordinators and representatives receive regular information on safety issues such as lessons learned information, requests for information on chemical usage and requests for assistance with remediation of safety discrepancies.

### 1.4.3 PROGRAM INFORMATION

The basic elements of the program are safety coordinators (designated by program directors or department managers) and representatives (designated by group leaders or department managers), training, and roles and responsibilities. Detailed programmatic information can be found in the document "Safety Coordinator and Representative Program" (Plan 10200.009).

### 1.4.4 TRAINING

Specific training for safety coordinators and representatives is provided via the following institutional training courses:

<b>HAZARD IDENTIFICATION</b>		<b>AL-130</b>
<b>Intended Audience:</b>	<i>Mandatory for safety coordinators and representatives; strongly recommended for group leaders / department managers or other personnel wishing to increase hazard identification skills.</i>	
<b>Course Format:</b>	<i>Computer-based training. Estimated completion time: 1.5 hours.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>No retrain.</i>	

<b>SAFETY COORDINATOR &amp; REPRESENTATIVE ORIENTATION</b>		<b>AL-031</b>
<b>Intended Audience:</b>	<i>Mandatory for safety coordinators and Representatives.</i>	
<b>Course Format:</b>	<i>Computer-based training, Estimated completion time: 1.0 hour.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>No retrain.</i>	

<b>MACHINE SAFEGUARDING</b>		<b>AL-131</b>
<b>Intended Audience:</b>	<i>Mandatory for safety coordinators and</i>	

	<i>representatives, and all employees who perform service and/or maintenance of equipment utilizing hazardous energy (belts/pulleys, moving, rotating shafts, gears, chains, nip points, etc).</i>
<b>Course Format:</b>	<i>Classroom training, Estimated completion time: 1.0 hour.</i>
<b>Associated Retrain Period &amp; Format:</b>	<i>5-year retrain.</i>

Group/activity-specific training shall be given to each employee designated a safety coordinator or representative that details specific roles and responsibilities. This training shall be documented by the group leader / department manager and the records maintained for a period of 5 years.

#### 1.4.5 PERFORMANCE CHECKLISTS

##### **Program Director/Department Manager shall:**

- Appoint a safety coordinator for the program.
- Notify ESH&A in writing of the person appointed to be the safety coordinator (also when changes are made).
- Assure that the group safety coordinator has a clear understanding of roles and responsibilities and has attended required training.
- Request information from the safety coordinator on the status of safety activities in the group.

##### **Group / Section Leaders shall:**

- Appoint a safety representative for the group.
- Notify ESH&A in writing of the person appointed to be the safety representative (also when changes are made).
- Assure that the group safety representative has a clear understanding of roles and responsibilities and has attended required training.
- Request information from the safety representative on the status of safety activities in the group.

##### **Safety Coordinators and Representatives shall:**

- Attend Ames Laboratory "Hazard Identification (AL-130)" training, "Safety Coordinator & Representative Orientation (AL-031)" training, and "Machine Safeguarding (AL-131)" training.
- Attend other training as indicated by supervisory personnel and ESH&A.
- Serve as a liaison between group members and supervisory personnel and / or the ESH&A office.
- Provide information on the status of safety activities to program directors / department managers or group / section leaders.

##### **Environment, Safety, Health & Assurance (ESH&A) shall:**

- Administer the safety coordinator and representative program by maintaining policies and procedures, conducting meetings, maintaining databases, and disseminating relevant ES&H information.

## 1.5 SAFETY REVIEW COMMITTEE AND READINESS REVIEWS

*Applicability Statement:* This section applies to all groups leaders / department managers and to all activities of Ames Laboratory. This section also applies to the Environment, Safety, Health & Assurance (ESH&A) office which is charged with administering readiness reviews.

### 1.5.1 REFERENCES

ALARA Committee Charter  
Electrical Safety Committee (ESC) Charter  
Fire Safety Committee Charter  
Laser Safety Committee Charter  
Safety Review Committee (SRC) Charter  
10 CFR 835, Occupational Radiation Protection  
Form 10200.003, Activity ES&H Hazard Identification Checklist  
Form 10200.004, Readiness Review Activity Approval Form  
Plan 10202.004, Radiological Protection Program (RPP)  
Procedure 10200.010, Readiness Review Procedure

### 1.5.2 BACKGROUND

The Safety Review Committee was established by the Ames Laboratory director in 1992. It serves in an advisory capacity to the director, recommending policy and procedures related to safety issues and the readiness review of research and operational activities. The specific responsibilities of the SRC include:

- to appoint and oversee sub-committees for the study of safety issues,
- to prepare and seek approval of policies and procedures for the review of activities, and
- to facilitate the timely and orderly review of activities.

The membership of the SRC includes three representatives of the research division and one representative each from Engineering Services, Facility Services and Environment, Safety, Health and Assurance.

### 1.5.3 PROGRAM INFORMATION

Ames Laboratory management has identified the space, activities, and personnel for which programs / departments have management responsibilities. Programs / departments, in turn, have assigned responsibilities to group / section leaders. The group / section leaders closely monitor and manage the day-to-day performance of activities and therefore are best suited to identify and manage the hazards associated with the activities for which they are responsible.

### 1.5.3.1 READINESS REVIEWS

#### Identification of Activities

Group / section leaders shall identify activities for which they have management responsibilities and clearly assign authorities, responsibilities, and accountabilities to other members of the group/section. An activity is one or several action(s), process(es), and/or equipment, coordinated to perform a task. Actions are the manner, method, or act of performing a task.

Additional information relating to the identification of activities is included in the procedure for Readiness Review (Procedure 10200.010).

#### Activity Hazard Identification and Categorization

Ames Laboratory activities are classified as laboratory / industrial type and office type. Examples of laboratory / industrial type activities include: experimental research, applied research, production, maintenance, fabrication, construction, hazardous waste handling, and warehouse shipping and receiving activities. Examples of office type activities include: theoretical research, computational, design, and administrative activities.

The identification of ES&H hazards associated with activities is accomplished by utilizing a checklist of potential environmental, safety, and health concerns, the Activity ES&H Hazard Identification Checklist (Form 10200.003). The identification of hazards should be undertaken without consideration of the administrative and physical controls used to mitigate hazards. A description of the identified hazards and the administrative and physical controls associated with the management of the concerns shall be documented. All activities are categorized into one of three ES&H hazard levels. The three levels are defined as:

##### **ES&H Hazard Level I:**

Hazard Level I activities have hazards similar to those encountered and/or accepted by the general public in an office environment. These hazards involve limited risk to (1) the health or safety of workers or the public, (2) the environment, or (3) the facilities or mission of the Laboratory. These hazards have minimal scope and magnitude.

##### **ES&H Hazard Level II:**

Hazard Level II activities have hazards similar to those encountered in a typical industrial / laboratory environment. These activities involve hazards whose scope may involve significant risk (1) to the health and safety of workers involved in the activity or those working within the same room in which the activity is being performed, (2) of short-term localized environmental impacts, or (3) of minimal and localized damage to facilities or negative impacts on the performance of program or Laboratory functions.

##### **ES&H Hazard Level III:**

Hazard Level III activities have hazards that involve a larger scope than impacts upon a single work site or laboratory area. These activities involve hazards whose scope may involve (1) significant risk to the health or safety of the public or on-site personnel who are not involved in the activity, (2) significant risk of widespread or lasting environmental effects, or (3) significant risk of damaging facilities or impeding the mission of the Laboratory.

## **Readiness Review**

All laboratory / industrial type activities shall undergo a readiness reviews and be approved: (1) before acquisition, fabrication, or testing; and, (2) before operation. Approvals and reviews shall be documented by the Activity ESH&H Readiness Review Approval Form (Form 10200.004), in accordance with the procedure for Readiness Review (Procedure 10200.010). All laboratory / industrial type activities shall be approved by the group / section leader, the program director / department manager, and the ESH&A Office. Hazard Level II and Hazard Level III activities require additional approval by the Safety Review Committee (SRC).

Activities which undergo a modification will also be subject to a readiness review if the modification significantly alters the hazards associated with the activity or if the risk associated with a particular hazard is increased. Activities in which the hazards have changed may be identified by reviewing the Activity ESH&A Hazard Identification Checklist (Form 10200.003). An example where the risk associated with a hazard has increased is the scale-up of an activity where larger quantities or a different class of hazardous chemical are to be used. Office-type activities are not required to undergo readiness reviews in addition to reviews by the group / section leader. Additional [readiness review formation](#) is available on the Ames Laboratory webpage.

All activities are reviewed five (5) years after the last approval date. The readiness review procedure is used for these 5-year reviews, as well.

### **1.5.3.2 SAFETY REVIEW COMMITTEE (SRC) SUBCOMMITTEES**

#### **Electrical Safety Committee (ESC)**

The Laboratory director established the Electrical Safety Committee (ESC) in 1993. The ESC reports to the Safety Review Committee (SRC) and to the Ames Laboratory director through the SRC. The ESC establishes policies and procedures related to electrical safety issues in research and operational activities, and develops and maintains the Laboratory's Electrical Safety Program and the Ames Laboratory Electrical Safety Manual. The ESC is the authority having jurisdiction (AHJ) for the interpretation and the implementation of the National Electric Code (ANSI/NFPA70); Occupational Safety and Health Act (OSHA 29 CFR 1910, Subpart S, and 29 CFR 1926, Subpart K); and/or other applicable federal, state, and local codes/standards. The ESC includes a chairperson and five voting members appointed by the Ames Laboratory director: one representative of SRC; two representatives of the research division; two representatives of the Technical and Administrative Services Division (TASD); one representative from Environment, Safety, Health and Assurance (ESH&A); and two nonvoting ex officio members, and one technical advisor from Engineering Services.

#### **Fire Safety Committee (FSC)**

The Ames Laboratory director established the Fire Safety Committee (FSC), as a standing subcommittee of the Safety Review Committee in 1999. The committee is comprised of a technical specialist from each of the following organizations: Environment, Safety, Health & Assurance (ESH&A); Facilities Services (FS); and Engineering Services (ES). The committee is the local authority having jurisdiction (AHJ) for fire safety issues. The FSC utilizes applicable standards, such as: the requirements of the pertinent US Department of Energy directives, Occupational Safety and Health Administration regulations, National Fire Protection Association standards, American National Standards Institute standards, and other applicable state / local codes. The FSC is established to develop, document and implement the Ames Laboratory Fire Safety Program. The committee is charged with advising the managers of ESH&A, FS, and ES regarding fire safety systems, requirements and actions, as well as the SRC and the director.

### As Low As Reasonably Achievable (ALARA)

ALARA is an acronym which means as low as reasonably achievable, and refers to keeping doses from ionizing radiation as low as reasonably achievable. The ALARA committee serves as the governing body for all aspects of ionizing radiation protection within the Laboratory and reports to the Safety Review Committee (SRC). The ALARA committee is charged with oversight of all activities involving ionizing radiation to ensure that any radiation doses from the use of these sources at Ames Laboratory are maintained ALARA. The ALARA committee ensures that all possession, use and disposition of sources of ionizing radiation by Ames Laboratory personnel complies with the requirements of 10 CFR 835, Occupational Radiation Protection and the Ames Laboratory Radiological Protection Program (RPP) (Plan 10202.004), and that all concomitant radiation exposures are maintained ALARA. The ALARA committee is composed of individuals who represent the various uses of ionizing radiation within Ames Laboratory and are knowledgeable and experienced in the safe use of ionizing radiation sources, as well as individuals representing administrative and service functions. Representatives of Occupational Medicine and of Ames Laboratory management are required to serve on the committee. The Radiation Safety Officer is an ex officio member of the committee.

### Laser Safety Committee (LSC)

The Ames Laboratory Laser Safety Committee was established in 2005. The specific responsibilities of the LSC include advising the SRC on adequacy of laser safety policies and procedures, and advising ESH&A on programmatic aspects of laser safety at Ames Laboratory with an emphasis on a sound assessment process. Membership of the LSC includes: three representatives from the research division, and one representative each from ISU Environmental Health & Safety (EH&S) and Environment, Safety, Health and Assurance (ESH&A). The ESH&A Industrial Hygienist serves as the chairperson of the LSC.

## 1.5.4 TRAINING

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES AL-001</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all employees.</i>
<b><i>Course Format:</i></b>	<i>Classroom instruction, reviews administrative policies, general safety, emergencies, industrial hygiene program, environmental protection program, and radiation safety. Estimated Completion time: 1.5 hours</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's annual retrain mailing, which covers, fire safety, cyber security, physical security, informational updates and policy reminders.</i>

## 1.5.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- Identify activities and associated hazards and submit activities for readiness review.
- Comply with the recommendations of readiness review.

**Safety Coordinators and Representatives** shall:

- Review ES&H Hazard Identification checklists.

**Program Directors / Department Managers shall:**

- Promote readiness review with group / section leaders.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- Administer the readiness review processes and maintain appropriate documentation and database information.

## 1.6 REPORTING OF EVENTS

**Applicability Statement:** *This section applies to all employees. This section also applies to the Environment, Safety, Health & Assurance (ESH&A) office, which is charged with administering the Laboratory's investigation and reporting efforts.*

### 1.6.1 REFERENCES

DOE Manual 231.1-1A, Environment, Safety and Health Reporting Manual  
DOE Manual 470.4-1, Safeguards and Security Program Planning and Management  
Plan 10200.020, Ames Laboratory Lessons Learned Implementation Plan  
Plan 40000.001, Event Reporting Plan  
Procedure 10200.038, Accidents, Incidents & Employee Safety Concerns: Classification & Investigation  
Procedure 10200.039, Corrective Action Plan Development  
Procedure 10200.041, Trend Analysis of ES&H Concerns

### 1.6.2 BACKGROUND

Effective response to environmental, safety and health events requires timely notification of the appropriate organizations. Ames Laboratory has numerous reporting responsibilities related to environmental, safety and health events. These requirements include: Occurrence Reporting and Processing of Operations Information, as per DOE M 231.1-2; reporting of radiological incidents (Price-Anderson Act Amendments reporting); reporting of injuries and illnesses to the Computerized Accident/Incident Reporting System (CAIRS) as required by DOE Manual 231.1-1A, Environment, Safety and Health Reporting; and reporting of incidents of security concern as per DOE Manual 470.4-1, Safeguards and Security Program Planning and Management.

### 1.6.3 PROGRAM INFORMATION

#### **Event Notification of Ames Laboratory Personnel**

Timely notification of events shall be given to supervisors, group / section leaders, Occupational Medicine and the Environment, Safety, Health and Assurance office. Employees are required to notify supervisors and group / section leaders of all work related injuries and illnesses. Injuries and illnesses requiring first aid or treatment from a trained medical provider shall be reported to Occupational Medicine. All other events require notification of supervisors, group / section leaders and the Environment, Safety, Health and Assurance office. In addition, security related events shall be reported to the appropriate safeguards and security personnel. The Plant Protection Section (PPS) is available for notification at all hours by calling 4-3483.

**Emergency events shall be reported by calling 911.**

Group / section leaders shall ensure timely notification of Occupational Medicine, the Environment, Safety, Health and Assurance office and the appropriate safeguards and security personnel.

**Near Misses**

Experience in both the Department of Energy (DOE) and in industry show that accidents that claim a life or result in serious personal injury or environmental damage are often preceded by precursor or near miss events. Simply stated, a near miss is when an otherwise reportable event, such as an injury or release, was avoided by only a single barrier or when all of the conditions necessary to cause an event existed (i.e., when all barriers were compromised). The capture and dissemination of information from near miss events should provide a better chance of avoiding serious injuries, fatalities, or environmental impacts from future events.

**Investigation of Events**

Incident and accident information is developed according to the requirements of the procedure, Accidents, Incidents & Employee Safety Concerns: Classification & Investigation (Procedure 10200.038).

**Corrective Action Development and Tracking**

Corrective actions are developed and assigned as needed according to the results of the event investigation. The ESH&A office is responsible for the tracking and closeout of safety related corrective actions. Significant institutional issues derived from Type A and B investigations, from DOE program initiatives and from DOE surveillance activities are addressed by corrective action plans developed according to the requirements of Corrective Action Plan Development (Procedure 10200.039).

**Lessons Learned**

Lessons learned from internal and external events are distributed by the ESH&A office according to the elements of the Lessons Learned Implementation Plan (Plan 10200.020).

**Trend Analysis**

Information from investigations of events will be incorporated by the ESH&A office into the annual trend analysis according to Procedure 10200.041, Trend Analysis of ES&H Concerns.

**Reporting**

Reporting is achieved according to the Event Reporting Plan (Plan 40000.001).

**1.6.4 TRAINING**

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES AL-001</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all employees.</i>
<b><i>Course Format:</i></b>	<i>Classroom instruction, reviews administrative policies, general safety, emergencies, industrial hygiene program, environmental protection program, and radiation safety. Estimated Completion time: 1.5 hours</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's annual retrain mailing, which covers, fire safety, cyber security, physical security, informational updates and policy reminders.</i>

## 1.6 PERFORMANCE CHECKLISTS

### **Employees shall:**

- Report all incidents, accidents, injuries and abnormal events in a timely fashion.
- Cooperate with all investigative and corrective efforts related to incidents, accidents, injuries and abnormal events.

### **Supervisors / Group / Section Leaders / Department Managers / Program Directors shall:**

- Ensure that all incidents, accidents, injuries and abnormal events are reported in a timely fashion.
- Cooperate with all investigative and corrective efforts related to incidents, accidents, injuries and abnormal events.

### **Safety Coordinators and Representatives shall:**

- Support investigative efforts related to accidents, injuries, illnesses, near misses and abnormal events.

### **Environment, Safety, Health & Assurance (ESH&A) shall:**

- Administer the Laboratory's efforts for reporting and investigation of incidents, accidents, injuries, and abnormal events, and maintain related processes and appropriate documentation.

*Comments and questions regarding this section may be directed to the person listed below:*

Tom Wessels, ESH&A  
G40 TASF  
294-4965

*NOTE: This Section's Sign-Off Record is maintained in the ESH&A Office.*

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**REVISION / REVIEW LOG****SECTION 2 – QUALITY ASSURANCE PROGRAM**

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0	05/01/00	Kate Sordelet	All	Original Issue
1	02/13/06	Kate Sordelet	See Revision Description	G:\Document Control\Revision Descriptions\ Manual 10200.002 Section 2 revdesc.doc
2	06/01/11	Tom Wessels	See Revision Description	G:\Document Control\Revision Descriptions\ Manual 10200.002 Section 2 revdesc.doc

**SIGN-OFF RECORD**

The Environment, Safety, Health and Assurance Program Manual has been reviewed and approved as documented below:

<b>Reviewed by:</b>	_____	Date:	_____
	Amy J. Harris-Tehan, ESH&A, Document Control Coordinator		
<b>Approved by:</b>	_____	Date:	_____
	Tom E. Wessels, ESH&A Program Manager		
<b>Approved by:</b>	_____	Date:	_____
	Mark L. Murphy, Chief Operations Officer		
<b>Approved by:</b>	_____	Date:	_____
	Debra L. Covey, Associate Director for Sponsored Research Administration		
<b>Approved by:</b>	_____	Date:	_____
	Duane D. Johnson, Chief Research Officer		
<b>Approved by:</b>	_____	Date:	_____
	Bruce N. Harmon, Deputy Director		
<b>Approved by:</b>	_____	Date:	_____
	Alexander H. King, Laboratory Director		

*Note: Original Sign-off Record with signatures is on file with ESH&A.*

## 2.0 QUALITY ASSURANCE

### ***Applicability Statement:***

*The Ames Laboratory Quality Assurance Program applies to all employees.*

The Ames Laboratory [Quality Assurance Program Plan](#) (QAP) provides an overview of the Laboratory program to address the requirements contained in 10 CFR 830 Subpart A, Quality Assurance. The quality assurance criterion from 10 CFR 830 Subpart A and DOE Order 414.1C (an Ames Laboratory contract directive) are the same. Additional guidance for the Laboratory's quality assurance activities is derived from DOE Guide 414.1-2A and ANSI/ASQ Z 1.13-1999, when necessary and applicable. The quality assurance criteria are listed below, and links to specific sections of the QAP and other Laboratory web addresses and applicable sections of this ESH&A Program Manual are included as references.

### **2.1 Criterion 1—Program.**

- (1) Establish an organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing work.*
- (2) Establish management processes, including planning, scheduling, and providing resources for work.*

#### **REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 1  
[The Ames Laboratory webpage](#)

### **2.2 Criterion 2—Personnel Training and Qualification.**

- (1) Train and qualify personnel to be capable of performing assigned work.*
- (2) Provide continuing training to personnel to maintain job proficiency.*

#### **REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 2  
***Refer to Section 3 of this manual for a detailed review of the Laboratory's Training Program.***

### **2.3 Criterion 3—Quality Improvement.**

- (1) Establish and implement processes to detect and prevent quality problems.*
- (2) Identify, control and correct items, services, and processes that do not meet established requirements.*
- (3) Identify the causes of problems, and include prevention of recurrence as a part of corrective action planning.*
- (4) Review item characteristics, process implementation, and other quality-related information to identify items, services, and processes needing improvement.*

#### **REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 3

**2.4 Criterion 4—Documents and Records.**

- (1) Prepare, review, approve, issue, use, and revise documents to prescribe processes, specify requirements, or establish design.*
- (2) Specify, prepare, review, approve, and maintain records.*

**REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 4

**2.5 Criterion 5—Work Processes.**

- (1) Perform work consistent with technical standards, administrative controls, and hazard controls adopted to meet regulatory or contract requirements using approved instructions, procedures, etc.*
- (2) Identify and control items to ensure proper use.*
- (3) Maintain items to prevent damage, loss, or deterioration.*
- (4) Calibrate and maintain equipment used for process monitoring or data collection.*

**REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 5  
Procedure 10200.010, Readiness Review Procedure

**2.6 Criterion 6—Design.**

- (1) Design items and processes using sound engineering/scientific principles and appropriate standards.*
- (2) Incorporate applicable requirements and design bases in design work and design changes.*
- (3) Identify and control design interfaces.*
- (4) Verify/validate the adequacy of design products using individuals or groups other than those who performed the work.*
- (5) Verify/validate work before approval and implementation of the design.*

**REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 6

**2.7 Criterion 7—Procurement.**

- (1) Procure items and services that meet established requirements and perform as specified.*
- (2) Evaluate and select prospective suppliers on the basis of specified criteria.*
- (3) Establish and implement processes to ensure that approved suppliers continue to provide acceptable items and services.*

**REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 7

**2.8 Criterion 8—Inspection and Acceptance Testing.**

- (1) *Inspect and test specified items, services, and processes using established acceptance and performance criteria.*
- (2) *Calibrate and maintain equipment used for inspections and tests.*

**REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 8

**2.9 Criterion 9—Management Assessment.**

*Ensure that managers assess their management processes and identify and correct problems that hinder the organization from achieving its objectives.*

**REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 9  
The Laboratory's Assessment Program is discussed in Section 10 of this manual.

**2.10 Criterion 10—Independent Assessment.**

- (1) *Plan and conduct independent assessments to measure item and service quality, to measure the adequacy of work performance and to promote improvement.*
- (2) *Establish sufficient authority and freedom from line management for independent assessment teams.*
- (3) *Ensure that persons conducting independent assessments are technically qualified and knowledgeable in the areas to be assessed.*

**REFERENCES**

The Ames Laboratory Quality Assurance Program Plan (QAP) Criterion 10  
The Laboratory's Assessment Program is discussed in Section 10 of this manual.

*Comments and questions regarding this section may be directed to the person listed below:*

Amy Tehan, ESH&A  
151 TASF  
294-1376

*NOTE: This Section's Sign-off Record is maintained in the Training & Records Management Office, 151 TASF.*

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## REVISION / REVIEW LOG

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## SIGN-OFF RECORD

The Environment, Safety Health and Assurance Program Manual has been reviewed and approved as documented below:

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Tom E. Wessels, Manager, Environment, Safety, Health & Assurance

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Mark L. Murphy, Chief Operations Officer

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Debra L. Covey, Sponsored Research Administration Associate Director

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Dr. Duane Johnson, Chief Research Officer

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Dr. Bruce N. Harmon, Deputy Director

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Dr. Alexander H. King, Laboratory Director

*Note: Original Sign-off Record with signatures is on file with ESH&A.*

### 3.0 TRAINING PROGRAM

#### ***Applicability Statement:***

*The Training section applies to all employees. Program development resides with the Training Program with implementation assistance from subject matter experts, Human Resources, Occupational Medicine, program/department managers, group/section leaders, supervisors, safety coordinators, and safety representatives.*

### 3.1 BACKGROUND

ESH&A coordinates the Laboratory's Training Program, which provides employees with the training necessary for the safe and productive completion of their work responsibilities. A primary emphasis is placed on the fulfillment of Environment, Safety, and Health (ES&H) training requirements.

The heart of the Training Program is the Needs Assessment Process, which identifies training requirements for Laboratory employees. Subject matter experts (SMEs) provide training from various disciplines around the Laboratory. The SMEs in conjunction with the Training Coordinator prepare sound lesson plans to address identified needs. Course evaluations are also obtained to continually improve upon training sessions.

Furthermore, the program utilizes a web-based training management system (Cyber Train) to track employee training participation in relation to mandatory job requirements, and to deliver training in various formats. Employees have access to view their own training records and those of any employees they supervise. The Training Program focuses on the following core activities: needs assessment, institutional training courses, course development, job (activity) specific training, training record keeping (electronic and/or file copies), training coordination and performance reporting.

### 3.2 PROGRAM INFORMATION

#### 3.2.1 NEEDS ASSESSMENT PROGRAM

The Needs Assessment Program is a joint effort between Occupational Medicine and ESH&A. The Needs Assessment Program provides a mechanism to identify hazards and training needs. The identification of hazards is accomplished using the Hazard Inventory Packet. Employee training needs are determined by the Hazard Inventory Packet as well as by the completion of a Training Needs Questionnaire (TNQ). The information collected during the Needs Assessment Process aids the supervisor in planning for training events and triggers certain medical actions and related ESH&A room monitoring events.

##### **3.2.1.1. HI/TNQ Templates for Manager (Supervisor) Groups**

Each supervisor is given a Hazard Inventory (HI) and a Training Needs Questionnaire (TNQ) to complete for his/her group. The completed HIs/TNQs will serve as hazard and training needs "templates" for each group and will trigger training requirements automatically in Cyber Train. Supervisors are informed that these templates must be all-inclusive. If one employee in a group works with X-rays and the rest do not, the X-ray hazard must be indicated on the HI (which will trigger X-ray training courses). The employees in that group who do not work with X-rays must go through the opt-out procedure within Cyber Train to have the training removed from their

profiles. The opt-out procedure requires supervisor and/or subject matter expert approval depending on the training.

On a quarterly basis, supervisors receive an automated report from Cyber Train detailing any outstanding training for their employees as well as training completion statistics for their groups. They are also required to review Hazard Inventory/Training Needs Questionnaire templates on an annual basis and make any necessary changes. In addition, when a question is modified or added to the Training Needs Questionnaire (or when a hazard is modified or added to the Hazard Inventory), the question or hazard is sent to all supervisors within 30 days. Responses are added to the group templates.

#### **3.2.1.2. HI/TNQ for Groups that Opt Out of Template Option**

For employees in groups whose supervisors have chosen not to utilize the template option, the Hazard Inventory/Training Needs Questionnaire is automatically added to new employees' training requirements. Answers to the HI and TNQ will be used to assign training in Cyber Train. Supervisors of these employees are also required to review their employees' training profiles on an annual basis. When a question is modified or added to the Training Needs Questionnaire (or when a hazard is modified or added to the Hazard Inventory), the question or hazard is sent to all managers within 30 days. Responses are entered to employee requirements by the Training Office.

#### **3.2.1.3. Additional Organization Level Training Requirements**

In addition to the HI/TNQ Needs Assessment Process that assigns training to the "Manager" organization level, training is assigned by other organization levels on Cyber Train as a result of vigorous ongoing tracking and analysis by the Training Office and subject matter experts. Training is assigned to job codes (titles) and to the following organization levels:

- Divisions (Research, Admin, Associates)
- Special Assignment Positions (SAPs)

### **3.2.2 INSTITUTIONAL TRAINING COURSES**

Institutional training courses are formally coordinated and tracked by the Laboratory's Training Office. Many of the institutional training courses are required before employees can begin working on certain activities or in certain environments. It is the responsibility of employees and their supervisors to ensure that training requirements are fulfilled before beginning or continuing such work.

As stated above, institutional courses are determined by an employee's assigned activities; however, each employee's training profile will automatically list the following core courses: General Employee Training (AL-001), Sexual Harassment Awareness Training (AL-053), Cyber Security Training (AL-082), Fire Safety Brochure (AL-089), Integrated Safety Management (AL-143), Security Immersion Training (AL-147), Counterintelligence Training (AL-164), Environmental Management Awareness Training (AL-182), Electrical Awareness Training (AL-190) and Foreign Visits and Assignments Training (AL-194). Listed below is a description of three of the Laboratory's key training courses.

**3.3.2.1 General Employee Training (GET)**

GET (AL-001) is a mandatory training course for all new Ames Laboratory employees, including full time staff, graduate students, post doctorates, undergraduate students, and designated Ames Laboratory facility users (associates, etc.). GET provides new employees with an understanding of the Laboratory's organizational structure, policies and procedures, general safety policies and several other ES&H aspects. GET is also designed to include training that satisfies the requirements for the following institutional courses:

- Sexual Harassment Awareness Training (AL-053)
- Foreign Visits & Assignments Training (AL-194)
- Security Immersion Training (AL-147)
- Environmental Management Awareness (AL-182)
- Fire Safety Brochure (AL-089)
- Cyber Security Training (AL-082)
- Integrated Safety Management (AL-143)
- Counterintelligence Training (AL-164)
- Electrical Awareness Training (AL-190)

Employees are strongly encouraged to complete GET within the first two weeks of their employment. The Environment, Safety, Health & Assurance Office offers a classroom session of GET every other week as well as an online version that can be accessed by all Ames Laboratory employees. Employees' completion of GET is documented either automatically by Cyber Train (for online completions) or manually by Training Office staff. Further institutional training is provided based upon each employee's work activities. In addition, the employee's program/department and/or group/section shall provide job (activity) specific training.

**3.3.2.2 Emergency Awareness Training**

The Emergency Awareness Training course [AL-002] is mandatory for all Ames Laboratory employees who work in Ames Lab owned or rented space. It shall be the responsibility of the program/department's safety coordinator or designee to ensure that a new employee is brought through this training within two weeks of their hire. The training shall be directed according to the Emergency Awareness Training Form (Form 10200.001) and shall cover such items as: the Ames Laboratory Safety Manual, emergency evacuation procedures, communication systems, incident reporting procedures, and the location of fire pulls, eye wash stations, fire extinguisher, emergency showers, and first aid kits. The completion of this training course shall be documented on Cyber Train.

**3.3.2.3 Visitor Training**

The Ames Laboratory considers "visitors" to be persons who come to the Laboratory for ten working days or fewer. All visitors shall receive some form of visitor training based upon their activities. A Visitor Safety Guide (Guide 10200.001) shall be distributed to each visitor. Anyone who visits the Lab for more than ten working days must check with ESH&A to determine training requirements.

**3.2.3 COURSE DEVELOPMENT**

Institutional courses shall be presented by subject matter experts (SMEs) utilizing formal training lesson plans. These lesson plans shall be developed in accordance with the procedure for Training Course Development (Procedure 10200.002). This procedure directs the development of the training course, including the delineation of the requirement(s) for the training, the preparation of the lesson plan, and the incorporation of review statements by a training review group. The training review will be conducted by individuals with the

appropriate technical background and will identify course deficiencies before general release to the intended audience.

During the course development process, training trigger(s) and priority are determined using the Laboratory's Needs Assessment Program. A training can be triggered by organization levels or job codes in Cyber Train, or by the Hazard Inventory Packet or Training Needs Questionnaire. Courses can be either mandatory, suggested or elective. Institutional courses have various formats that include classroom instruction, examination, online, or computer based training (CBT). Training courses are continually reviewed by incorporating feedback from trainees, updated regulations, and reviews of other agencies' training materials.

#### **3.2.4 JOB (ACTIVITY) SPECIFIC TRAINING**

Job specific training is the responsibility of each employee's group/section leader and is designed to address the training aspects that relate to the employee's specific work location. This would include a review of the group's/section's policies and procedures along with hands-on training for specialized equipment. Because job specific training consists of training on individual activities, it is not necessary that instruction be given formal lesson plans; however, the group/section leader must maintain accurate operator aids, procedures, or manufacturer equipment manuals. Furthermore, they must maintain a sign-off record that indicates which employees have been trained on the specialized activity.

#### **3.2.5 TRAINING RECORDS**

Training records are maintained both electronically and manually. Cyber Train is utilized to electronically track training records, and to continually review and identify employees who are in need of initial training or retraining. Cyber Train provides detailed information on all institutional training courses, e.g., course description, length, instructor, status, etc. In addition to the electronic training records, hard copy attendance records are maintained in employee training files. Class rosters are also maintained by date to accommodate different search modes.

#### **3.2.6 TRAINING COORDINATION AND PERFORMANCE REPORTING**

The Laboratory's Training Coordinator performs training coordination and performance reporting. Training coordination centers around analyzing reports, planning training schedules, coordinating classes, modifying databases and providing training notifications for employees. Other activities include distributing retrain materials and the annual retrain packet. Coordination efforts are also needed to assist SMEs in the development and/or modification of training courses. Also, statistics are maintained on key mandatory training events for submission with the Laboratory's Self-Assessment Report.

#### **3.2.7. TRAINING**

A core set of institutional training courses/activities have been established for all Laboratory employees. The training courses identified below are automatically indicated on each employee's Employee Training Profile.

<b>GENERAL EMPLOYEE TRAINING</b>		<b>#AL- 001</b>
<b>Intended Audience:</b>	<i>All Ames Laboratory Employees</i>	
<b>Course Format:</b>	<i>Classroom instruction, CBT, online, reviews administrative policies, general safety, emergencies, ESH&amp;A programs. Estimated completion time: 1.5 hours</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's annual retrain mailing, which covers fire safety, cyber security, physical security, informational updates and policy reminders.</i>	

<b>SEXUAL HARRASSMENT AWARENESS TRAINING</b>		<b>#AL-053</b>
<b>Intended Audience:</b>	<i>Suggested for all employees</i>	
<b>Course Format:</b>	<i>Provided as a segment of GET. Additional information available through ISU.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>No associated retrain requirement</i>	

<b>CYBER SECURITY AWARENESS TRAINING</b>		<b>#AL-082</b>
<b>Intended Audience:</b>	<i>All Ames Laboratory Employees</i>	
<b>Course Format:</b>	<i>Provided as a segment of GET. Estimated completion time: 15 minutes.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>Annual retrain requirement. Guide mailed to all employees as a part of the annual retrain packet.</i>	

<b>FIRE SAFETY BROCHURE</b>		<b>#AL-089</b>
<b>Intended Audience:</b>	<i>All Ames Laboratory Employees</i>	
<b>Course Format:</b>	<i>Provided as a segment of GET. Estimated completion time: 15 minutes.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>Annual retrain requirement. Fire Safety Brochure mailed to all employees as a part of the annual retrain packet.</i>	

<b>INTEGRATED SAFETY MANAGEMENT TRAINING</b>		<b>#AL-143</b>
<b>Intended Audience:</b>	<i>All Ames Laboratory Employees</i>	
<b>Course Format:</b>	<i>Provided as a segment of GET. Estimated Completion time: 30 minutes.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>No associated retrain requirement.</i>	

<b>SECURITY IMMERSION TRAINING</b>		<b>#AL-147</b>
<i>Intended Audience:</i>	<i>All Ames Laboratory Employees</i>	
<i>Course Format:</i>	<i>Provided as a segment of GET. As of 5/2000 all existing employees were provided training via classroom or CBT on the Ames Lab website. Estimated Completion time: 1 1/2 hours.</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>No associated retrain requirement.</i>	

<b>COUNTERINTELLIGENCE TRAINING</b>		<b>#AL-164</b>
<i>Intended Audience:</i>	<i>All Ames Laboratory Employees</i>	
<i>Course Format:</i>	<i>Provided as a segment of GET. As of 12/2001 all existing employees were provided training via a training mailer. Estimated Completion time: 15 minutes.</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>Annual retrain requirement provided as a mailer to all employees in December.</i>	

<b>ENVIRONMENTAL AWARENESS TRAINING</b>		<b>#AL-182</b>
<i>Intended Audience:</i>	<i>All Ames Laboratory employees</i>	
<i>Course Format:</i>	<i>Provided as a segment of GET. As of 12/21/2004 all existing employees were provided training via a training mailer and CBT on the Ames Lab web site. Estimated Completion time: 1/2 hours.</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>No associated retrain requirement.</i>	

<b>ELECTRICAL SAFETY AWARENESS TRAINING</b>		<b>#AL-190</b>
<i>Intended Audience:</i>	<i>All Ames Laboratory employees</i>	
<i>Course Format:</i>	<i>Provided as a segment of GET. As of 9/7/2005 all existing employees were provided training via a training mailer with a guide. Estimated Completion time: 1/2 hours.</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>No associated retrain requirement.</i>	

<b>FOREIGN VISITS AND ASSIGNMENTS AWARENESS TRAINING</b>		<b>AL-194</b>
<i>Intended Audience:</i>	<i>All Ames Laboratory employees</i>	
<i>Course Format:</i>	<i>Provided as a segment of GET. As of 9/23/2005 all existing employees were provided training via a training mailer with a guide. Estimated Completion time: 1/2 hours.</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>No associated retrain requirement.</i>	

**3.2.8. PERFORMANCE CHECKLIST****All Employees – Shall:**

- ❑ Attend General Employee Training and all other mandatory training courses that are identified on their profiles.
- ❑ Attend retraining in accordance with each course's prescribed retrain date.
- ❑ Review the Laboratory's annual retrain packet that is distributed in August.
- ❑ Respond to monthly training announcements by registering for class with the Training Office.
- ❑ Go through Human Resource's formal checkout process, which automatically updates the Cyber Train database.

**Subject Matter Experts – Shall:**

- ❑ Review DOE Requirements and other regulations for associated training requirements.
- ❑ Develop and modify training lesson plans for their technical specialty.
- ❑ Present training courses that rely on their technical expertise and track employee compliance with these courses.
- ❑ Provide target audience for each course under their purview with regulatory and informational updates when necessary in between training sessions.

**Human Resources – Shall:**

- ❑ Register each person for General Employee Training when they are going through the Laboratory's check-in process.
- ❑ Update the Human Resource database, which in turn updates Cyber Train records accordingly, e.g., new hires, terminations, etc.

**Occupational Medicine – Shall:**

- ❑ Input Hazard Inventory information into the OMSCREENS database, which triggers medical actions and ESH&A room monitoring.
- ❑ Generate automated HI letters for any employees who have not completed these forms.
- ❑ Verify that laser workers have had a baseline eye exam and handle billing with off-site vendor.
- ❑ Provide Ames Laboratory employees with physicals per requirements.

**Group/Section Leaders & Supervisors – Shall:**

- ❑ Complete HI/TNQs either as group templates or individually for each employee in their groups.
- ❑ Ensure that their employees have attended General Employee Training.
- ❑ Verify that their employees have received Emergency Awareness Training (if necessary) by the program/ department's safety coordinator or designee.
- ❑ Review their employees' training requirements and ensure that training is being completed as necessary.
- ❑ Complete required training for supervised activities as required by governmental regulation and identified through the readiness review process by the activity supervisor and ESH&A representative.
- ❑ Ensure that their employees review the materials that are distributed in the Laboratory's annual retrain packet.

- ❑ Identify all job activities that each employee will be performing and provide the appropriate job (activity) specific training to ensure that they can perform all work activities in a safe manner.
- ❑ Prepare and retain job (activity) specific training sign-off records to demonstrate completion of each training activity.
- ❑ Ensure that visitors to their area are properly trained and follow Laboratory policies and procedures.
- ❑ Ensure that employees go through Human Resource's checkout process.

**Program Directors/Department Managers – Shall:**

- ❑ Oversee the completion of HI/TNQs for each of their group/section leaders, either as a template or individually. Also ensure that each group/section leader completes HI/TNQs for their groups.
- ❑ Ensure that their group/section leaders have attended General Employee Training.
- ❑ Verify that their group/section leaders have received Emergency Awareness Training (if necessary) by the program/department's safety coordinator or designee.
- ❑ Review their group/section leaders' training requirements and ensure that training is being completed as necessary.
- ❑ Review training statistics reports for mandatory training courses to ensure compliance.
- ❑ Ensure that their group/section leaders review the materials that are distributed in the Laboratory's annual retrain packet.
- ❑ Identify all job activities that each group/section leader will be performing and provide the appropriate job (activity) specific training to ensure that they can perform all work activities in a safe manner.
- ❑ Prepare and retain job (activity) specific training sign-off records to demonstrate the completion of each training activity.
- ❑ Ensure group/section leaders go through Human Resource's checkout process.

**Safety Coordinators /Representatives – Shall:**

- ❑ Conduct Emergency Awareness Training (EAT) for individuals in their program/department.
- ❑ Review training information for employees in their program/department to ensure compliance with General Employee Training, EAT, and courses with mandatory status or associated retrain dates.
- ❑ Provide job (activity) specific training as requested by their program/department.
- ❑ Provide safety meetings for the program/department's employees as necessary.
- ❑ Attend safety coordinator/safety representative meetings hosted by ESH&A.

**Training Coordinator – Shall:**

- ❑ Coordinate the completion of HI/TNQ templates, or individual forms as required.
- ❑ Coordinate all institutional course offerings and special session training. This includes the monthly schedule, training reminders, registrations, examinations, reminders, room and equipment set-up, etc.
- ❑ Track all institutional training records and statistics.
- ❑ Distribute annual retrain packets.
- ❑ Coordinate with subject matter experts on the development of and modifications to training lesson plans.

- ❑ Distribute various retrain quizzes and study guides as required.
- ❑ Modify Cyber Train and needs assessment components as necessary.
- ❑ Update training forms, procedures, policies, etc. as required.

### 3.3 REFERENCES

Needs Assessment Process (Procedure 10200.029).

[Visitor Guide](#) (Guide 10200.001)

[Emergency Awareness Training Form](#) (Form 10200.001)

[Hazard Inventory Packet](#) (Packet 10200.002)

Training Course Development (Procedure 10200.002)

[Training Needs Questionnaire](#) (Form 10200.109)

*Comments and questions regarding this section may be directed to the person listed below:*

Jim Withers, ESH&A  
G40 TASF  
294-2153

*NOTE: This Section's approval record is maintained in the Training & Records Management office, 151 TASF.*

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## REVISION / REVIEW LOG

### SECTION 4 – INDUSTRIAL HYGIENE PROGRAM

<u>Review Number:</u>	<u>Effective Date:</u>	<u>Contact Person:</u>	<u>Pages Affected:</u>	<u>Description of Revision:</u>
0	10/11/99	Jim Withers	All	Original Issue
1	2/13/06	Jim Withers	See Revision Description	G:ESHA/Document Control/Revision Descriptions/ESH&A Manual/Manual 10200.002 Section 4 revdesc.doc
2	1/8/07	Jim Withers	See Revision Description	G:ESHA/Document Control/Revision Descriptions/ESH&A Manual/Manual 10200.002 Section 4 revdesc.doc
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## SIGN-OFF RECORD

The Environment, Safety Health and Assurance Program Manual has been reviewed and approved as documented below:

### Record Sign-Off

**Reviewed by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
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*Note: Original approval record with signatures is on file with Training & Records Management.*

## **4.0 INDUSTRIAL HYGIENE PROGRAM**

### **4.1 HAZARD COMMUNICATION (RIGHT TO KNOW) PROGRAM**

*Applicability Statement: This section applies ONLY to those Groups/Departments whose employees use hazardous chemicals in a non-laboratory environment (hazardous chemical use in research laboratories is specifically covered by Section 4.2, Chemical Hygiene Program).*

*This section also applies to the Environment, Safety, Health & Assurance (ESH&A) office which is charged with ensuring compliance with specific sections of the Iowa Chemical Risks Right To Know Law.*

#### **4.1.1 REFERENCES**

29 CFR 1910.1200, Hazard Communication  
347 IAC Iowa Chemical Risks Right To Know (Chapters 110, 120, 130, and 140)  
Iowa State University Worker Right-To-Know Program

#### **4.1.2 BACKGROUND**

The purpose of the Hazard Communication regulation is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets (MSDSs) and employee training. The key components of the Laboratory's Hazard Communication Program are an integral component of the Chemical Hygiene Program described in Section 4.2.

#### **4.1.3 PROGRAM INFORMATION**

Ames Laboratory follows the requirements listed in ISU's Worker Right To Know Manual. Information on ISU's program can be found at:

<http://www.ehs.iastate.edu/publications/manuals/wrtk.pdf>

The basic elements of the Laboratory's program are: Worker or Employee Right to Know, Community Right to Know and Emergency Right to Know.

#### 4.1.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>CHEMICAL HAZARD COMMUNICATION</b>		<b>AL-137</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with hazardous chemicals.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction with Material Safety Data Sheet exercise. Estimated completion time: 2.0 hours</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>5 year retrain. Classroom or Computer-Based Training instruction.</i>	

<b>HAZARD COMMUNICATION FOR EMPLOYEES THAT DON'T USE CHEMICALS</b>		<b>AL-150</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all AL personnel who don't work with hazardous chemicals.</i>	
<b><i>Module Format:</i></b>	<i>Administered during General Employee Training via a handout. Estimated completion time: 10 minutes</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No retrain. Course administered during General Employee Training.</i>	

Group or activity-specific training shall be given to each employee prior to work that includes a discussion of chemical hazards, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. Verification of group or activity-specific shall be conducted during the Readiness Review of activities involving the use of chemicals.

#### 4.1.5 PERFORMANCE CHECKLISTS

**Group Leader / Department Manager** shall:

- ❑ Assure that all activities have been identified, reviewed and approved by the Laboratory's Safety Review Committee via Readiness Review.
- ❑ Attend Ames Laboratory "Chemical Hazard Communication" (AL-137) training. Group Leaders receive Hazard Communication training through another course (Chemical Hygiene Training for Group Leaders) but need not attend Chemical Hazard Communication.
- ❑ Assure Hazard Inventory / Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- ❑ Conduct group or activity-specific hazard communication training for each employee prior to work that includes a discussion of chemical hazards, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. Verification of this training shall be conducted during Readiness Review.
- ❑ Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.

- ❑ Assure that Material Safety Data Sheets (MSDSs) for all hazardous chemicals are present and accessible.
- ❑ Submit chemical inventories to ESH&A annually.
- ❑ Assure that chemical container labeling is complete and in accordance with guidelines given in the ISU Worker Right-To-Know Manual.

**Employees shall:**

- ❑ Attend Ames Laboratory “Chemical Hazard Communication”, (AL-137) training.
- ❑ Attend Ames Laboratory and / or ISU chemical safety training as indicated by Employee Training Profile.
- ❑ Receive activity / experiment-specific training prior to working with hazardous chemicals including a discussion of hazard awareness and emergency procedures.
- ❑ Perform work in accordance with group Standard Operating Procedures (SOPs).

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- ❑ Maintain access to MSDS information and make it available to Laboratory staff during normal business hours and emergency response personnel upon request.
- ❑ Assure NFPA 704 signage is present and accurate for all hazardous chemical storage areas.
- ❑ Conduct training modules and provide consultations on request that assist Laboratory personnel in the implementation of a group-specific Hazard Communication Program.
- ❑ Assure that Ames Laboratory is in compliance with the provisions of Chapters 130 (Community Right To Know) and 140 (Iowa Public Safety/Emergency Response Right To Know) of the Iowa Chemical Risks Right To Know law.

## 4.2 CHEMICAL HYGIENE PROGRAM

**Applicability Statement:** *This section applies to groups/departments whose employees use hazardous chemicals in a laboratory environment. Employees who use hazardous chemicals in a non-laboratory environment should refer to the Hazard Communication (Right to Know) Program discussed in Section 4.1.*

### 4.2.1 REFERENCES

29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories  
Iowa State University Laboratory Safety Manual

### 4.2.2 BACKGROUND

Use of a wide variety of hazardous chemicals is critical to fulfillment of the Laboratory's research mission. Many of the Laboratory's research programs use hazardous chemicals. The Laboratory has nearly 20,000 chemicals in its inventory. The hazards associated with chemical use are significant and demand an effective management program. This section describes the mechanisms by which worker and environmental protection from deleterious effects of hazardous chemicals is assured.

### 4.2.3 PROGRAM INFORMATION

Ames Laboratory follows the requirements listed in ISU's Laboratory Safety Manual. The Manual is a written program that sets forth the policies, procedures, and practices, both for employees who work with hazardous chemicals and for those whose responsibilities include the supervision of such work. The Manual can be found at:

<http://www.ehs.iastate.edu/publications/manuals/labsm.pdf>

### 4.2.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>CHEMICAL HYGIENE TRAINING FOR GROUP LEADERS AL-127</b>	
<b>Intended Audience:</b>	<i>Mandatory for group leaders who supervise personnel who work with hazardous chemicals in a research laboratory.</i>
<b>Module Format:</b>	<i>Computer-Based Instruction. Estimated completion time: 2.0 hours</i>
<b>Associated Retrain Period &amp; Format:</b>	<i>No retrain.</i>

<b>CHEMICAL HAZARD COMMUNICATION</b>		<b>AL-137</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with hazardous chemicals.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction with Material Safety Data Sheet exercise. Estimated completion time: 2.0 hours</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>5 year retrain. Classroom or Computer-Based Training instruction.</i>	

Group / activity-specific training on chemical hygiene policies and procedures shall be given to each employee prior to work that includes a discussion of chemical hazards, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. Verification of training shall be conducted during Readiness Review.

#### **4.2.5 PERFORMANCE CHECKLISTS**

##### **Group Leaders / Department Managers shall:**

- ❑ Assure that all research activities have been identified, reviewed and approved by the Laboratory's Safety Review Committee via Readiness Review.
- ❑ Attend "Chemical Hygiene Training for Ames Laboratory Group Leaders", (AL-127) training (NOTE: Hazard Communication training is also presented in this module.)
- ❑ Assure that Hazard Inventory / Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- ❑ Conduct group or activity-specific chemical hygiene training for each employee prior to work that includes a discussion of chemical hazards, hazard mitigation, location of MSDSs or other safety information, emergency response measures and any other procedural information. Verification of this training will be conducted during Readiness Review.
- ❑ Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.

##### **Employees shall:**

- ❑ Attend "Chemical Hazard Communication", (AL-137) training.
- ❑ Attend Ames Laboratory and/or ISU chemical safety training courses as identified on a n Employee Training Profile.
- ❑ Receive group / activity-specific chemical hygiene training prior to work that includes a discussion of chemical hazards and their mitigation.
- ❑ Perform work in accordance with group Standard Operating Procedures (SOPs).

##### **Environment, Safety, Health & Assurance (ESH&A) shall:**

- ❑ Assist employees with hazard determinations including the performance of monitoring, procedure reviews, hazard control recommendations, etc.
- ❑ Conduct training modules and provide consultations, upon request, that assist Laboratory personnel in the implementation of a group-specific Chemical Hygiene Program.

### 4.3 COMPRESSED / LIQUIFIED GASES

**Applicability Statement:** *This section applies to Ames Laboratory employees who handle, store or use compressed / liquefied gases.*

#### 4.3.1 REFERENCES

ISU Document: *Cylinder Safety Guidelines*

#### 4.3.2 BACKGROUND

Compressed and liquefied gases are routinely used in laboratory and various other operations at ISU and have the potential for creating hazardous working environments. An effective chemical management program includes the safe use of compressed and liquefied gases. Because of the diversity of gases used at Ames Laboratory and the associated acute hazards, the topic is addressed separate from the Chemical Hygiene Program section.

#### 4.3.3 PROGRAM INFORMATION

Ames Laboratory's policies and procedures for the safe handling of compressed and liquefied gases are discussed in the document "Cylinder Safety Guidelines". This document is applicable to all handling of gases at Iowa State University. The basic principles of an effective management program for compressed and liquefied gases are: hazard classification, employee training, proper set-up and operation of systems as dictated by Standard Operating Procedures (SOPs), control of hazards through engineering controls /administrative controls / personnel protective equipment and emergency procedures.

Detailed programmatic information is provided via the training module listed in Section 4.3.4.

#### 4.3.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>CYLINDER SAFETY</b>		<b>AL-022</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with compressed gas cylinders.</i>	
<b><i>Module Format:</i></b>	<i>Computer-based instruction with quiz. Estimated completion time: 1 hour.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No retrain.</i>	

Group / activity-specific training on compressed gas usage shall be given to each employee prior to work that includes a discussion of specific hazards, hazard mitigation, equipment operation, location of MSDSs and other safety information, emergency response measures and any other procedural information. Verification of group-specific training is conducted during Readiness Reviews.

#### 4.3.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- ❑ Assure that all activities that involve use of compressed/liquefied gases are identified, reviewed and approved via the Readiness Review procedure.
- ❑ Attend Cylinder Safety (AL-022) training.
- ❑ Assure that Hazard Inventory / Job Task Analyses packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- ❑ Conduct and document group or activity-specific training prior to work that includes a discussion of compressed and liquefied gas usage, associated hazards and their mitigation, location of MSDSs or other safety information, emergency response measures and any other procedural information.
- ❑ Assure that group or activity-specific Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.

**Employee** shall:

- ❑ Attend Cylinder Safety (AL-022) training.
- ❑ Receive group / activity specific training on the safe use of compressed and liquefied gases prior to work.
- ❑ Perform work in accordance with group Standard Operating Procedures (SOPs).

**Environment, Safety, Health & Assurance** shall:

- ❑ Provide technical assistance to Ames Laboratory employees on the safe use of gases via workplace consultations and training sessions.

## **4.4 EXPOSURE ASSESSMENTS / MEDICAL SURVEILLANCE**

*Applicability Statement: This section applies to all Ames Laboratory employees.*

### **4.4.1 REFERENCES**

Iowa State University document: *Occupational Medicine Program*

### **4.4.2 BACKGROUND**

The accurate characterization of employee exposures to chemical, physical, biological and ergonomic exposures is a fundamental component of the Industrial Hygiene Program. Accurate characterization is critical to the successful reduction or elimination of potentially harmful agents.

Medical surveillance is a vital component of any employee health and safety program and is closely linked to data gleaned from exposure assessments. Medical surveillance is one indicator that existing control measures are adequate. Occupational Medicine also prevents injury and illness by identifying potential problems and dealing with them before they have deleterious health impacts.

### **4.4.3 PROGRAM INFORMATION**

The Occupational Medicine Program provides comprehensive occupational health services to Ames Laboratory employees and is described in detail in ISU's "Occupational Medicine Manual". The main mission of the Occupational Medicine Program is compliance with applicable Federal, State and local law with emphasis on prevention, early recognition, and treatment of occupationally related illness and injury.

All Ames Laboratory employees and / or their supervisors are required to complete a Hazard Inventory prior to their employment. Supervisory personnel are required to keep these documents complete and current for each employee throughout their tenure at Ames Laboratory. Successful completion of these documents assures that the employee's hazards and activities will be reviewed as a part of the Industrial Hygiene and Occupational Medicine Programs.

### **4.4.4 TRAINING**

There is no specific training module associated with this sub-section. All employees are introduced to the Hazard Inventory in "General Employee Training", (AL-001) which is discussed in Section 3 (Training) of this manual.

#### 4.4.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- ❑ Assure that all activities are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- ❑ Assure that Hazard Inventory for all personnel are complete and current.
- ❑ Review employee Hazard Inventories on an annual basis and / or whenever activities change and update if necessary.
- ❑ Assure that employees receive required medical examinations per notification by Occupational Medicine.
- ❑ Assure that employees report to Occupational Medicine with work-related injuries.

**Employees** shall:

- ❑ Complete Hazard Inventory and Training Needs Questionnaires (TNQs) in collaboration with supervisor at time of initial employment and whenever job functions and associated hazards change.
- ❑ Receive mandatory medical examinations as notified by Occupational Medicine.
- ❑ Report to Occupational Medicine with work-related injuries and / or illnesses.

**Occupational Medicine** shall:

- ❑ Conduct mandatory medical surveillance examinations.
- ❑ Assure that employees receive medical surveillance examinations.
- ❑ Identify potential or actual health effects resulting from work site exposures.
- ❑ Communicate information regarding workplace health hazards to management, workers, and those responsible for mitigating work site hazards.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- ❑ Review site survey information and perform monitoring, as indicated, to characterize worker exposures.
- ❑ Report exposure monitoring results to employees and Occupational Medicine as indicated.

## **4.5 ERGONOMICS**

***Applicability Statement:** This section applies to groups/departments whose activities involve repetitive motions that may lead to cumulative trauma disorders. Examples include frequent use of computer keyboards and frequent lifting.*

### **4.5.1 REFERENCES**

ISU document: "Introduction to Ergonomics"

### **4.5.2 BACKGROUND**

Working Americans spend about 2000 hours a year in the workplace. Not surprisingly, all of these hours can take a toll on an employee's eyes, back, hands and neck. Poorly designed working environments can result in momentary pain or long-term injury and lead to reduced efficiency and production, loss of income, increased medical claims and permanent disability

Ergonomics is the art and science of designing the workplace to fit the worker. The primary goal of an ergonomics program is the prevention of musculoskeletal injuries caused by poor lifting techniques and/or repetitive motions associated with job tasks.

Occupational Medicine and Ames Laboratory's Environment, Safety, Health & Assurance (ESH&A) are available to assist employees in the resolution of any potential ergonomic problems. The following is provided as guidance information on ergonomics.

### **4.5.3 PROGRAM INFORMATION**

Ames Laboratory follows the procedures described in the ISU document "Introduction to Ergonomics" (appended to the end of this section). All employees should be familiar with the basic information in this document. It's especially important that employees know the signs and symptoms associated with ergonomic injuries including musculoskeletal disorders or MSDs and how to get assistance from Occupational Medicine and safety personnel. Using ergonomically friendly equipment such as keyboard trays and chairs is another important part of minimizing the risk of ergonomic injuries. Education and awareness through training is critical and employees are encouraged to take advantage of the numerous courses on ergonomics that are offered on campus.

### **4.5.4 TRAINING**

As stated previously, ISU EH&S offers a variety of training opportunities that are detailed in the attached document. Ames Laboratory also offers the following module:

<b>SPRAINS &amp; STRAINS PREVENTION TRAINING</b>		<b>AL-183</b>
<b><i>Intended Audience:</i></b>	<i>Provides employees with information on sprains and strains, contributing factors, body postures, engineering controls and safe lifting practices. This course is <u>required</u> for all employees who lift, push/pull objects that weigh more than 40 pounds or who frequently lift, push/pull objects that weigh 20-40 pounds.</i>	
<b><i>Module Format:</i></b>	<i>Computer-based instruction. Estimated completion time: 0.5 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No retrain.</i>	

#### 4.5.5 PERFORMANCE CHECKLISTS

**Group Leader / Department Manager** shall:

- Assess group activities for repetitive motions including use of computers and materials handling (lifting, etc.).
- Assure that all activities including those with repetitive motions and lifting are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- Assure that Hazard Inventory / Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- Encourage group members to attend ergonomic training courses as listed on the ISU and / or Ames Laboratory training schedules.
- Review ergonomic training course offerings as listed on the ISU and / or Ames Laboratory training schedules and attend, as appropriate.
- Request ergonomic consultations from Occupational Medicine and Industrial Hygiene personnel, as needed.

**Employee** shall:

- Be aware of ergonomic hazards in the work environment and signs/symptoms of ergonomic stress.
- Attend applicable ISU and AL courses on ergonomics as indicated by activities and supervisor.
- Notify supervisor of any ergonomic issues in the work environment.
- Request ergonomic consultations from Occupational Medicine and Industrial Hygiene personnel as appropriate.

**Environment, Safety, Health & Assurance** shall:

- Assess ergonomic issues identified via Readiness Review or employee notification.
- Provide ergonomic consultations to employees upon request, in conjunction with Occupational Medicine personnel.
- Assist supervisors and employees with resolving ergonomic issues in the work environment.

IOWA STATE UNIVERSITY

# Introduction to Ergonomics

Department of Environmental Health and Safety  
2809 Daley Drive Ames, IA 50011-3660  
(515) 294-5359 [www.ehs.iastate.edu](http://www.ehs.iastate.edu)

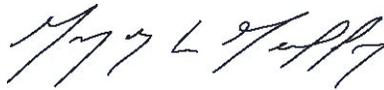
**Iowa State University  
Safety Policy**

It is the policy of Iowa State University to provide and ensure a safe and healthful environment for employees, students and the general public.

Each person in a supervisory or management capacity is responsible for the provision and maintenance of safe working conditions in his or her respective area, and for proper adherence to all authorized and applicable environmental, health and safety policies, rules and regulations.

Each employee and student is responsible for complying with environmental, health and safety rules and for using any safety equipment that is provided or required. Each failure to comply with applicable rules, as well as environmental releases, safety hazards and accidents, shall be reported to supervisory personnel and, if necessary, referred to the proper environmental, health or safety authority.

It is the intent of this policy to promote environmental stewardship and prevent accidents and injuries to the Iowa State University community.



July 2001

Dr. Gregory L. Geoffroy  
President  
Iowa State University

## What is Ergonomics?

Ergonomics is the science of fitting jobs to the people who work in them so that a balance is created between work demands and worker capabilities. The goal of an ergonomics program is to achieve a balance between work and the workers that will optimize productivity and, at the same time, preserve the health and safety of the workforce.



## Examples of ergonomic injuries/illnesses

The most common types of ergonomic injuries and illnesses are musculoskeletal disorders (MSDs). MSDs are injuries/illnesses that affect muscles, nerves, tendons, ligaments, joints or spinal discs. Employees may suffer ergonomic injuries/illnesses when major portions of their jobs include reaching, bending over, lifting heavy objects, using continuous force, working with vibrating equipment and/or performing repetitive motions.

MSD injuries/illnesses come under many different names depending on the part of the body affected. If you suffer an ergonomic injury/illness, your doctor may diagnose one of the following common MSDs:

- Carpal tunnel syndrome
- Carpet layer's knee
- De Quervain's disease
- Epicondylitis
- Hand-arm vibration syndrome
- Herniated spinal disc
- Low back pain
- Raynaud's phenomenon
- Rotator cuff syndrome
- Sciatica
- Tendinitis
- Tension neck syndrome
- Trigger finger



## What are the signs and symptoms of an MSD?

Employees suffering from MSDs may experience lessened strength for gripping, decreased range of motion, loss of muscle function and inability to do everyday tasks. Common symptoms include:

- Back or neck pain
- Burning sensation
- Fingers or toes turning white
- Pain, tingling or numbness in hands or feet
- Pain in wrists, shoulders, forearms or knees



- Painful joints
- Shooting or stabbing pains in arms or legs
- Stiffness
- Swelling or inflammation

### What causes MSDs?

As is the case with many medical conditions, exact causes of MSDs are not always known. Both non-occupational and occupational factors can contribute to the development of MSDs. Work-related MSDs may be caused or exacerbated by exposure to the following risk factors:

**Contact stress:** Pressing the body against a hard or sharp edge can result in placing too much pressure on nerves, tendons and blood vessels. For example, using the palm of your hand as a hammer or resting your arms against sharp countertop or desk edges can increase your risk of suffering an MSD.



**Awkward postures:** Posture is the position your body is in and affects muscle groups that are involved in physical activity. Awkward postures include repeated or prolonged reaching, twisting, bending, kneeling, squatting, working overhead with your hands or arms or holding fixed positions.



### Forceful exertions:

Force is the amount of physical effort required to perform a task (such as heavy lifting) or maintain control of equipment or tools. The amount of force depends on the type of grip, the weight of an object, body posture, the type of activity and the duration of the task.

**Repetition:** Doing the same motions over and over again places stress on muscles and tendons. The severity of risk depends on how often the action is repeated, the speed of the movement, the number of muscles involved and the required force.

**Vibration:** Operating vibrating tools over extended periods of time may lead to nerve damage. Examples of vibrating tools include sanders, grinders, chippers, routers, drills and saws.

### Does Iowa State have an ergonomics program?

Yes. As part of a comprehensive health and safety program, the Department of Environmental Health and Safety (EH&S) offers Iowa State University personnel a variety of ergonomic resources. Employees can choose from ergonomic workstation evaluations, classroom training or online resource information. If you would like to learn more about a particular topic, please see our online ergonomics page at [www.ehs.iastate.edu/oh/ergo.htm](http://www.ehs.iastate.edu/oh/ergo.htm). Online information includes ergonomic services available to the Iowa State University community, e-books for training on various ergonomically related topics and information on ergonomic risk factors. Additional links provide information on lifting, computer use concerns, stretching and workstation ergonomic checklists.

### Worksite evaluations

EH&S offers ergonomic worksite evaluations. The purpose of an ergonomic evaluation is to identify occupational injury risk factors and make appropriate recommendations based on

current guidelines. To request a worksite evaluation:

1. Inform your supervisor about your concerns and that you would like to schedule an ergonomic worksite evaluation with EH&S.
2. Call EH&S at 294-5359 to schedule an ergonomic worksite evaluation. Either the employee or supervisor can schedule an ergonomic worksite evaluation, but EH&S encourages the participation of both parties in the evaluation process.

### **What ergonomic features should I look for in office furniture?**

#### **Desks and writing surfaces**

Just like one pair of shoes will not fit everyone in your department, desks, chairs and writing surfaces may not fit everyone who works at them. Most of the furniture purchased at Iowa State University should have height adjustment that allows the furniture to fit the user. Office furniture should be made of durable materials, have rounded edges and be adjustable for comfortable typing and writing. Through worksite evaluations, EH&S can make recommendations for correct work surface heights related to writing and typing.

#### **Chairs**

Since chairs must accommodate a person's individual characteristics, one is not restricted to a specific manufacturer, but should purchase a quality ergonomic chair. Desirable ergonomic features to consider when choosing a new desk chair include backrests and chair heights that are adjustable, seat pan angle adjustments and adjustable armrests. Other important chair features are discussed in EH&S's e-book entitled "Features to Consider When Purchasing a Chair."



If you are considering buying a new chair, you should work with FP&M interior designers to select the chair that best meets your needs and to determine colors that will work with your office finishes. Central Stores stocks several styles of chairs for immediate purchase. In addition, FP&M's Architectural and Engineering Design Services has samples of several of the more popular styles. Contact Design Services (294-1710) to try them out. Finally, you may visit Storey Kenworthy/ASI Office Solutions in Ames to see samples of the Allsteel chairs, or visit the furniture dealers in Des Moines to see other manufacturer's chairs.

#### **Ergonomic accessory installation and furniture alterations**

To schedule ergonomic accessory installation (such as keyboard tray placement) or workstation furniture adjustment or relocation, contact Central Stores at 294-8484. If your office area will be relocated or needs to be redesigned, submit a Request for Services to FP&M at [www.fpm.iastate.edu/forms/servicerequest/](http://www.fpm.iastate.edu/forms/servicerequest/) and request that one of their designers assist with the redesign. Design Services can evaluate your work areas and develop an efficient layout for office furniture.



Where can I get information and training on ergonomics?

#### **Classroom training**

An ergonomics training course entitled "Office Ergonomics" is available through EH&S. This course focuses on the prevention of repetitive motion injury, as well as proper workstation

configurations and adjustment. Information on low back pain and computer-related eyestrain is also presented. If you would like to sign up for the classroom training course or arrange for on-site ergonomics training for campus personnel, please contact EH&S Training at 294-5359.

### **Ergonomics electronic books or “e-books”**

E-books are online training guides designed to offer easily accessible and timely information. EH&S e-books can be accessed at [www.ehs.iastate.edu/training/ebooks.htm](http://www.ehs.iastate.edu/training/ebooks.htm). Current titles include:

Alternative Keyboards and Pointing Devices  
Computer Workstation Ergonomics Checklist  
Eliminating Computer Eyestrain  
Features to Consider When Purchasing a Chair  
Introduction to Ergonomics  
Low Back Pain  
Manual Materials Handling  
Sitting Down on the Job: Ergonomics Tips  
Stretching at Work

### **Where do I go if I have an ergonomic medical concern?**

All employees seeking treatment for work-related injuries or illnesses, including ergonomic medical concerns, should first notify their departmental supervisors.

Supervisors must deliver completed “First Report of Injury” forms to the Office of Risk Management at 1350 Beardshear Hall within 24 hours of reporting the incident. Reports may be faxed to 294-1621 to the attention of the Claims Administrator.



### **Medical care - Ames area employees**

McFarland Clinic Occupational HealthWorks is the workers compensation provider for Ames area Iowa State University employees. Occupational HealthWorks provides treatment and consultation for occupationally related accidents, illnesses and injuries. The clinic is located at 1215 Duff Avenue, and office hours are 8:00 a.m. to 5:00 p.m., Monday through Friday. Supervisors should call 239-4496 to schedule appointments for medical care. Access is available on the north and east sides, including handicap accessibility. Free parking is available to the north and east, with limited spaces available on the west side of the building.

### **Medical care – Employees working outside the Ames area**

A list of approved workers compensation medical providers outside the Ames area is available by calling the Office of Risk Management at 294-7711.

### **Is there an OSHA regulation for ergonomics?**

Not currently. A final standard was published on November 13, 2000, that was to go into effect on January 16, 2001. This standard was overturned by Congress under the Congressional Review Act in March 2001, and subsequently repealed with the signature of President George W. Bush shortly thereafter. However, ergonomic hazards must still be addressed in the workplace. Under Section 5(a)(1) of the Occupational Safety and Health Act, OSHA requires that Iowa State University furnish to each employee a place of employment free from recognized hazards that are causing or are likely to cause death or serious physical harm to its employees.

## 4.6 RESPIRATORY PROTECTION

**Applicability Statement:** *This section applies to employees who use respiratory protection in the workplace. Respiratory protection includes conventional rubber/silicon masks as well as single use disposable dust masks.*

### 4.6.1 REFERENCES

29 CFR 1910.134, Respiratory Protection  
ISU Respiratory Protection Program Manual

### 4.6.2 BACKGROUND

Hazards can be effectively controlled through engineering, administrative and / or personal protective equipment controls. Engineering controls contain hazards at the source and are considered the most effective. Administrative controls include standard operating procedures and, when followed, effectively reduce or eliminate hazards. The last form of control is personal protective equipment and includes gloves, hard hats, steel-toed shoes and respirators.

### 4.6.3 PROGRAM INFORMATION

Ames Laboratory follows the requirements listed in the ISU document “Respiratory Protection Program”. Respirator users are identified by the Occupational Medicine database or by employees contacting ESH&A. Hazard evaluations are conducted to evaluate the need for any type of respiratory protection including the use of disposable dust masks. Fit-testing and training are conducted initially and annually thereafter.

Detailed programmatic information is discussed via the training module listed in Section 4.6.4.

### 4.6.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>RESPIRATOR FIT-TESTING &amp; TRAINING</b>		<b>AL-011</b>
<b>Intended Audience:</b>	<i>Mandatory for employees who use any type of tight-fitting respirators.</i>	
<b>Module Format:</b>	<i>Laboratory instruction with quiz. Estimated completion time: 30 minutes.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>Annual retrain. Written information and quiz.</i>	
<b>DUST MASK TRAINING</b>		<b>AL-211</b>
<b>Intended Audience:</b>	<i>Mandatory for employees who use a disposable dust mask.</i>	
<b>Module Format:</b>	<i>Personal instruction provided by ESH&amp;A personnel. Estimated completion time: 15 min.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>No retrain; OSHA information reviewed.</i>	

#### 4.6.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- ❑ Assure all activities are identified, reviewed and approved via the Readiness Review procedure.
- ❑ Attend respirator fit-testing and training prior to using any tight-fitting respirator including disposable dust masks.
- ❑ Assure Hazard Inventory / Job Task Analysis packets and Training Needs Questionnaires (TNQs) are complete and current for each employee.

**Employees** shall:

- ❑ Attend respirator fit-testing and training prior to using any tight-fitting respirator including disposable dust masks.
- ❑ Notify ESH&A of any usage of single-use, disposable dust masks.
- ❑ Perform work in accordance with group Standard Operating Procedures (SOPs).

**Environment, Safety, Health & Assurance** shall:

- ❑ Administer the ISU Respiratory Protection Program that includes conducting training, notifying employees of the need for refresher training, recordkeeping, etc.
- ❑ Provide exposure evaluations, upon request, that will assist employees in determining the need for respiratory protection.

**Occupational Medicine** shall:

- ❑ Administer medical surveillance to respirator users, as required.

## 4.7 BIOHAZARDOUS MATERIALS

**Applicability Statement:** *This section applies to groups/departments whose employees work with or may be exposed to biohazardous materials as part of their job responsibilities.*

### 4.7.1 REFERENCES

ISU Biosafety Manual

### 4.7.2 BACKGROUND

Research with biohazardous materials is increasing at Ames Laboratory. The ISU Biosafety Manual defines biohazardous materials as follows:

“Biohazardous materials are those materials of biological origin that could potentially cause harm to humans, domestic or wild animals, or plants. Examples include recombinant DNA; transgenic animals or plants; human, animal or plant pathogens; biological toxins (such as tetanus toxin); human blood and certain human body fluids; and human or primate cell cultures.”

Included in this definition are bloodborne pathogens as defined by OSHA’s Bloodborne Pathogen regulation. Traditionally, occupational exposures to potentially infectious materials has been the biohazardous material of primary concern at Ames Laboratory. A bloodborne pathogen is defined as any pathogenic microorganism present in human blood that can cause disease in humans. These pathogens include the Human Immunodeficiency Virus (HIV) or AIDS virus, Hepatitis B virus (HBV) and other bloodborne infectious agents. The information in this section describes the mechanisms by which biohazardous materials are evaluated and controlled.

### 4.7.3 PROGRAM INFORMATION

Ames Laboratory follows the requirements listed in ISU’s Biosafety Manual. The Manual along with the information in this section constitute the Laboratory’s written program. Additional programmatic information is provided via the modules listed in section 4.7.4.

The three areas of concern when using biohazardous materials are as follows:

**Licensing:** Does the Group Leader have a signed agreement with the vendor of the material that states the details of their use and disposition?

**Safety:** Are the materials pathogenic to humans, animals or plants? Is so, has the project received Institutional Biosafety Committee approval? Have employees received Biohazardous Materials and Bloodborne Pathogen training, as appropriate?

**Confidentiality:** Are there any unique identifiers associated with the samples? If so, has the project received Institutional Review Board approval?

The primary mechanism by which work with biohazardous materials is evaluated is Readiness Review (described in Section 1). Group Leaders should consult with ESH&A on the requirements for work with biohazardous materials early in the planning of research and prior to any research being conducted as many biohazardous materials have strict regulatory requirements for shipment, use and disposition.

#### 4.7.4 TRAINING

The following institutional training modules provide detailed information to the student on biohazardous materials:

<b>BIOHAZARDOUS MATERIALS: AN INTRODUCTION</b>		<b>AL 202</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with or supervise work with biohazardous materials as defined previously as a part of their job.</i>	
<b><i>Module Format:</i></b>	<i>Web-based training. Estimated completion time: 1.0 hour.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No retrain.</i>	

<b>BLOODBORNE PATHOGEN EXPOSURE CONTROL PLAN TRAINING</b>		<b>AL035</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with or supervise employees who work with potentially infectious materials as a part of their job.</i>	
<b><i>Module Format:</i></b>	<i>Classroom or web-based instruction. Estimated completion time: 1.5 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Annual retrain.</i>	

In addition to the institutional modules above, group / activity-specific training shall be given to each employee prior to work that includes a discussion of hazards associated with biohazardous materials in use, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. Verification of group-specific training shall be conducted during Readiness Reviews.

#### 4.7.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- ❑ Maintain an inventory of all biohazardous materials (see definition above).
- ❑ Assure that all research activities involving biohazardous materials are identified, reviewed and approved via the Readiness Review procedure. This approval will include verification of all ISU committee approvals including the Institutional Biosafety Committee and Institutional Review Board.
- ❑ Complete the “Biohazardous Materials: An Introduction” course and, if appropriate the “Bloodborne Pathogen Exposure Control Plan Training” course.
- ❑ Assure Hazard Inventory / Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current and reflect work with biohazardous materials.

- ❑ Conduct and document group or activity-specific training prior to work that includes a discussion of the hazards of biohazardous materials, hazard mitigation, location of MSDSs or other safety information, emergency response measures and any other procedural information.
- ❑ Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.
- ❑ Consult Environment, Safety, Health and Assurance with any questions related to biohazardous materials.

**Employees shall:**

- ❑ Attend “Biohazardous Materials: An Introduction” and “Bloodborne Pathogen Exposure Control Plan Training” as appropriate.
- ❑ Receive group or activity-specific training prior to work that includes a discussion of the hazards associated with the potentially infectious materials being used.
- ❑ Perform work in accordance with group Standard Operating Procedures (SOPs).

**Environment, Safety, Health & Assurance shall:**

- ❑ Maintain a facility-wide inventory of biohazardous materials and submit an annual report to the Ames Site Office.
- ❑ Facilitate completion of Readiness Review and any applicable ISU committee approvals.
- ❑ Assist employees with hazard determinations including the performance of monitoring, procedure reviews, hazard control recommendations, etc.
- ❑ Conduct training module and provide consultations, upon request, that assist Laboratory personnel in the implementation of requirements of this section.

## 4.8 ASBESTOS

**Applicability Statement:** *This section applies to groups/department whose employees remediate asbestos as certified asbestos abatement workers.*

### 4.8.1 REFERENCES

29 CFR 1910.1001, Asbestos  
ISU Asbestos Management Program Manual

### 4.8.2 BACKGROUND

Health effects from asbestos exposure include asbestosis and mesothelioma. Asbestos-containing materials are prevalent throughout Ames Laboratory buildings and periodically require removal or encapsulation. This section of the Program Manual describes how to implement the program that ensures all affected employees are protected from occupational exposure to asbestos.

### 4.8.3 PROGRAM INFORMATION

The purpose of the Asbestos Management Program is to assure the safe handling of asbestos during treatment, removal and disposal. The program consists of comprehensive safe operating practices (which includes guidelines for all scales of asbestos projects).

### 4.8.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>SUPERVISOR / WORKER TRAINING</b>		<b>AL-159</b>
<b>Intended Audience:</b>	<i>This is required for supervisors and workers who conduct asbestos abatement work.</i>	
<b>Module Format:</b>	<i>Classroom Instruction. Estimated completion time: 4.0 days. Course conducted by off-site vendor.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>Annual retrain; 8-hour refresher.</i>	

<b>ASBESTOS AWARENESS TRAINING</b>		<b>AL-125</b>
<b>Intended Audience:</b>	<i>This is required for all employees who may potentially encounter asbestos in the course of their normal duties but do not handle it directly.</i>	
<b>Module Format:</b>	<i>Classroom instruction. Estimated completion time: 1.0 day.</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>Annual retrain.</i>	

#### 4.8.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- ❑ Assure that all activities are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- ❑ Assure that Hazard Inventory / Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- ❑ Attend initial "Supervisor/Worker Training" and receive annual refresher training.
- ❑ Assure that employees are performing work in accordance with policies and procedures that mitigate hazards associated with asbestos.

**Employees** shall:

- ❑ Attend initial "Supervisor/Worker Training" and receive annual refresher training.
- ❑ Perform work in accordance with group Standard Operating Procedures (SOPs).

**Environment, Safety, Health & Assurance** shall:

- ❑ Provide consultations, upon request, to determine potential for asbestos exposure.
- ❑ Collaborate with Facilities Services on work activities, bulk samples, training, waste disposal, state notifications and other programmatic elements.

**Facilities Services** shall:

- ❑ Perform asbestos remediation work in accordance with established policies and procedures.

## 4.9 LEAD

**Applicability Statement:** *This section applies to groups/departments whose activities involve the use, maintenance, and disturbance of lead-containing materials. At Ames Laboratory this primarily applies to Facilities Services. Lead use in a research activity is covered by the Chemical Hygiene Program section.*

### 4.9.1 REFERENCES

29 CFR 1910.1025, Lead

### 4.9.2 BACKGROUND

Health effects from lead exposure continue to be a concern in the workplace and in the home. Since the ban on lead in gasoline, lead levels detected in areas near roadway have decreased dramatically; however, lead based paint used in buildings and housing prior to 1980 continue to serve as significant sources of exposure.

### 4.9.3 PROGRAM INFORMATION

The Laboratory follows the policies and procedures detailed in the ISU document “Guidelines for Working with Lead-Containing Materials”. The information in this document applies to the use, maintenance and/or disturbance of lead-containing materials at ISU. The purpose of the document is to assure that lead and lead-containing materials are properly maintained and handled.

*Laboratory use* of lead is covered in the Chemical Hygiene Program, Section 4.2.

Detailed programmatic information is provided via the training modules listed in Section 4.9.4.

### 4.9.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

LEAD AWARENESS TRAINING	ISU INH06
<b>Intended Audience:</b>	<i>Employees and their supervisors who may sand, scrape, abrade or otherwise disturb lead containing building materials during construction, renovation or maintenance activities.</i>
<b>Module Format:</b>	<i>Classroom instruction. Estimated completion time: 2.0 hours.</i>
<b>Associated Retrain Period &amp; Format:</b>	<i>No retrain.</i>

#### 4.9.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- ❑ Assure that all activities are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- ❑ Attend ISU "Lead Awareness Training", (INH06).
- ❑ Assure that Hazard Inventory / Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- ❑ Assure that all work conducted by employees is done in accordance with the provisions of the ISU document "Guidelines for Working with Lead-Containing Materials".

**Employees** shall:

- ❑ Attend ISU "Lead Awareness Training", (INH06).
- ❑ Conduct work in accordance with the provisions of the ISU document "Guidelines for Working with Lead-Containing Materials".

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- ❑ Assist employees with hazard determinations including the performance of monitoring, procedure reviews, hazard control recommendations, etc.
- ❑ Provide consultations, upon request, that assist Laboratory personnel in the implementation of a group-specific program that assures the safe handling and use of lead and lead-containing materials.

## 4.10 LABORATORY CHEMICAL HOOD TESTING PROGRAM

*Applicability Statement: This section applies to groups/departments whose activities involve the testing and maintenance of chemical hoods. At Ames Laboratory this primarily applies to Environment, Safety, Health & Assurance and Facilities Services.*

### 4.10.1 REFERENCES

29 CFR 1910.1450, Occupational Exposures to Hazardous Chemicals in Laboratories  
ISU Laboratory Hood Manual (<http://www.ehs.iastate.edu/publications/manuals/labhood.pdf>)

### 4.10.2 BACKGROUND

Laboratory chemical hoods are the primary engineering control utilized at Ames Laboratory for chemical safety. When properly used, chemical hoods are effective in reducing or eliminating worker exposures to chemical vapors produced as a result of work with hazardous chemicals. Regular testing and certification of chemical hoods is essential to ensuring adequate performance. This section describes the protocol for annual testing of chemical hoods at Ames Laboratory.

### 4.10.3 PROGRAM INFORMATION

The Environment, Safety, Health & Assurance office tests chemical hoods on an annual basis. In general, performance criteria include a face velocity of 100 feet per minute at a sash height of 18 inches. Industrial Hygiene personnel evaluate current usage of the chemical hood and make a determination of the adequacy of the face velocity rating. ESH&A personnel consult with Facilities Services when face velocity adjustments are necessary.

### 4.10.4 TRAINING

There is no specific institutional training module associated with hood usage. Chemical hoods and their proper operation are discussed in the Chemical Hazard Communication (AL-137) training course.

### 4.10.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- Assure that all activities are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- Assure chemical hoods are used correctly and in accordance with the guidelines in the ISU Laboratory Hood Manual.
- Report chemical hood performance deficiencies to ESH&A for correction.

**Employees** shall:

- Use chemical hoods in accordance with guidelines in the ISU Laboratory Hood Manual.
- Report chemical hood performance deficiencies to supervisor.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- ❑ Test chemical hood face velocities on an annual basis and request any modifications from Facilities Services.
- ❑ Provide consultations, upon request, to Laboratory personnel on the use of chemical hoods.

**Facilities Services shall:**

- ❑ Modify chemical hoods as requested by ESH&A.

## 4.11 LASERS

*Applicability Statement: This section applies to Groups/Departments that use lasers.*

### 4.11.1 REFERENCES

Iowa State University *Laser Safety Manual*

### 4.11.2 BACKGROUND

Use of laser systems is an important part of research conducted at Ames Laboratory. The hazards associated with lasers are significant and demand an effective management program. This section describes the basic elements of the Laboratory's Laser Safety Program.

### 4.11.3 PROGRAM INFORMATION

Ames Laboratory follows the requirements listed in Iowa State University's *Laser Safety Manual*. This document can be viewed at:

<http://www.ehs.iastate.edu/publications/manuals/laser.pdf>

The basic elements of the ISU document are: Responsibilities, Basic Laser Characteristics, Classes of Lasers, Beam Hazards, Associated Hazards, Laser Safety Practices, Requirements for Laser Operations, Personal Protective Equipment, Warning Labels & Signs, Laser Safety Standard Operating Procedures, Laser Safety Training, Medical Surveillance & Exposure Incidents. The following is an abbreviated summary of each of these elements. All users of Class 3B & 4 lasers at Ames Laboratory are required to review the information in this Section of the ESH&A Program Manual and the ISU Laser Safety Manual.

#### 4.11.3.1 Responsibilities

**Environment, Safety, Health & Assurance (ESH&A)** is responsible for maintaining an inventory of all Class 3B & 4 lasers, reviewing procedures, providing technical assistance, verifying training records and facilitating the completion of training. The Laboratory's Laser Safety Officer (LSO) is Jim Withers; Deputy LSO's are Mike McGuigan and Shawn Nelson.

**Occupational Medicine** is responsible for providing laser safety eye exams to all users of Class 3b & 4 lasers.

**Engineering Services** is responsible for installing and performing annual maintenance checks on door interlock systems.

**Laser user** is responsible for meeting all applicable requirements including training and medical surveillance before operating a Class 3b or 4 laser and following safe work practices when working with lasers including the use of appropriate PPE.

**Laser System Supervisor** is responsible for ensuring that all laser systems are set up and operated in a mode that ensures the lowest potential for exposure; Group Leaders also shall ensure that all laser users are authorized, trained and medically-approved to use lasers and that an approved Standard Operating Procedure (SOP) is being followed that includes the use of appropriate Personal Protective Equipment (PPE). Work practices are regularly observed and any deficiencies corrected.

#### **4.11.3.2 Basic Laser Characteristics**

A complete discussion of the characteristics of lasers is given in the video as well as in the ISU Laser Safety Manual.

In general, lasers produce radiant energy that is deposited in the form of heat. The principle target organs of concern are the eyes and skin. The degree of hazard for laser radiation is dependent on the wavelength, the intensity or power and the duration of exposure. The principal goal of the Laser Safety Program is to minimize to the lowest extent possible the potential for exposure to laser beams either via direct exposure or reflection.

#### **4.11.3.2 Classes of Lasers**

A complete description of laser classes is given in the video and in the ISU Laser Safety Manual. A brief summary is as follows:

Class 1 & 1M Laser: low power, completely enclosed, exempt from any control measures.

Class 2 & 2M Laser: power <1 milliwatt, blink reflex of human eye is usually adequate control, training and medical surveillance not required.

Class 3R Laser: power levels of 1-5 milliwatts, significant hazards when viewed through optical instruments, training and medical surveillance not required.

Class 3B Laser – power levels of 5-500 milliwatts, hazardous upon direct viewing or diffuse/specular reflection, training and medical surveillance required.

Class 4 Laser – power levels >500 milliwatts, hazardous upon direct viewing or diffuse/specular reflection, potential for fire hazards, training and medical surveillance required. Door interlock systems required at Ames Laboratory.

#### **4.11.3.3 Beam Hazards**

The nature of laser beam damage is dependent on the wavelength of light, energy of the beam, divergence and exposure duration. The primary organ of concern is the eye with heating of the tissue being a principle adverse effect. The retina is the part of the eye of particular concern as this tissue does not regenerate.

#### **4.11.3.4 Associated Hazards**

There are additional hazards associated with lasers. Electrical hazards are a concern due the high-voltages required to power lasers. Chemicals such as dyes are sometimes used with laser and can be toxic. Collateral radiation can be given off as a “by-product” of the primary laser and

can include forms of ionizing radiation. A fire hazard can be created by any combustible material that is exposed to high beam irradiance for more than a few seconds. Explosion hazards exist with high-pressure lamps, filament lamps and capacitors.

#### **4.11.3.5 Laser Safety Practices**

The requirements for safe operation of a laser are stated in the ISU Laser Safety Manual. Some highlights are as follows:

Common work area safety practices include: isolating the laser from uninformed or curious bystanders, setting up the laser operation above or below normal eye level, enclosing the beam when practical, reducing the potential for reflections and covering windows to hallways. Laser use safety practices include: avoiding direct beam observations, keeping unauthorized personnel out of laser labs and the use of appropriate Personal Protective Equipment (PPE).

All Class 3B and 4 laser systems shall be reviewed and approved by the LSO or Deputy LSO via completion of a Laser Hazard Assessment or LHA. The LHA is formal review that documents a complete hazard assessment that assures that exposure potentials have been minimized to the greatest extent.

#### **4.11.3.6 Engineering Controls**

When setting up a laser system, utmost consideration shall be given to minimizing the potential for accidental exposures. This is best accomplished via a hierarchy of controls starting with engineering controls followed by administrative and personal protective equipment controls. Priority should be given to enclosure of the laser beam to fullest amount practicable.

Remote interlock systems (most typically door interlocks) must be in place for all Class 4 systems. Remote interlock systems provide additional protection against incidental eye exposures to individuals entering the laser controlled area. Deviations from this policy are strongly discouraged and shall only be allowed after review and approval by the LSO.

Laser control areas shall be designated for use of Class 3b and 4 systems (in most applications, the laser control area is the entire lab). As stated previously, all beams shall be enclosed to the fullest extent and remote interlock systems shall be required for Class 4 systems. Control areas must be appropriately signed and designated for authorized personnel only.

#### **4.11.3.7 Personal Protective Equipment**

Laser protective eyewear is a fundamental part of a group-specific laser safety program. The LHA process is used to calculate and confirm the appropriate necessary Optical Density (OD) rating for eyewear based on the parameters of usage. Goggles must be stored properly and maintained in good condition. Occasionally, protective clothing such as gloves and forearm covers might be required to avoid damage to the skin.

#### 4.11.3.8 Warning Labels and Signs

Lasers and laser systems require appropriate signage. The verbiage on signage is specific to the class of laser. ANSI Z136.1 requirements will be followed for all laser signage.

#### 4.11.3.9 Laser Safety Standard Operating Procedures (SOPs)

A written SOP is required for laser Class 3b and 4 laser operations. SOPs are a sequential list of actions taken during a particular activity and typically include a discussion of potential hazards and associated control measures such as the use of beam enclosures and laser safety eyewear. The level of detail in a SOP is commensurate with the level of hazard. For example, the SOP for a Class 4 laser operated in an open beam configuration will be more detailed than the SOP for a totally enclosed or Class 1 laser system.

Since most laser exposure events occur during alignments, the SOP will include specific information on how alignments are done and both the laser user and the system supervisor shall assure that training on conducting alignments is complete and the potential hazard associated with this activity has been reduced to the lowest possible extent.

There is no prescriptive format for a laser system SOP. Ames Laboratory has a standardized SOP template that is available for use with a laser system. Once prepared, SOPs can be used to document training of laser users. It is imperative that SOPs be periodically review for adequacy and updated as necessary (e.g. addition of new lasers, new users, etc.). SOPs shall be readily available in the laser lab and reviewed by ESH&A during annual laser system reviews.

#### 4.11.3.10 Training

All Class 3b and 4 laser operators are required to take the Ames Laboratory laser safety training module. Additionally, 3-year refresher training is required for all Class 3b & 4 laser users. Laser system-specific training is also required and shall be conducted by the Laser System Supervisor or an authorized designee. Documentation related to group-specific training shall be available in the laser laboratory.

#### 4.11.3.11 Medical Surveillance & Exposure Incidents

Baseline eye exams are required for all Class 3b & 4 laser users. Eye exams are conducted at the Occupational Medicine department in G11 TASF and consist of several visual acuity tests. There is no charge for the exam. Additional medical exams may be indicated if an ocular abnormality is detected or in the event of an exposure. Employees are required to report all laser exposure events.

### 4.12 TRAINING

<b>LASER SAFETY TRAINING</b>		<b>AL-070</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers who work with Class 3b and 4 lasers.</i>	
<b><i>Module Format:</i></b>	<i>Module consists of a video; computer based training. The participant shall also complete a</i>	

	<i>base line eye exam. Estimated completion time: 1.5 hours.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>3 year retrain via a Web-based course.</i>

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of laser hazards and hazards associated with the laser, such as laser dyes, electrical hazards, chemical concerns, etc. In addition, the group or activity training shall review emergency response measures and any other procedural information.

#### **4.11.5 PERFORMANCE CHECKLISTS**

##### **Laser System Supervisor shall:**

- Assure that all research activities are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- Assure that all Class 3B & 4 laser systems have been reviewed and approved via completion of a Laser Hazard Assessment.
- Attend Ames Laboratory "Laser Safety" training, (AL-070) if working with Class 3b and 4 lasers and receive baseline and exit eye exams.
- Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- Assure that all laser users have completed both institutional and group-specific training prior to work.
- Conduct periodic observations of work to ensure that safe work practices are being conducted.
- Assure that group Standard Operating Procedures (SOPs) are current and address all laser operations including any specific activities such as performing alignments that may involve a higher risk of exposure; supervisors shall assure that work is performed within established guidelines.
- Assure that laser laboratory is set up in accordance with the ISU Laser Safety Manual.

##### **Employees shall:**

- Attend Ames Laboratory "Laser Safety" training, (AL-070) if working with Class 3b and 4 lasers and receive baseline and exit eye exams.
- Receive activity or experiment-specific training prior to working with lasers.
- Perform work in accordance with group Standard Operating Procedures (SOPs) including the use of appropriate PPE.
- Report any discrepancies or any off-normal events to the Group Leader for correction.

##### **Environment, Safety, Health and Assurance (ESH&A) shall:**

- Perform Laser Hazard Assessments initially and review on an annual basis. LHAs may also be done if significant changes are made in the set up of a laser system.
- Advise Laboratory personnel on the safe use of lasers and assist with group-specific implementation.

##### **Occupational Medicine shall:**

- Facilitate the completion of laser eye exams for Laboratory personnel.

## 4.12 RADIO FREQUENCY (RF) RADIATION-GENERATING DEVICES

**Applicability Statement:** *This section applies to Groups/Departments that use RF radiation-generating devices.*

### 4.12.1 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH) Handbook “Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices”

ANSI/IEEE Standard C95.1 Safe Levels With Respect to Human Exposure to RF Radiation, 3kHz to 300 GHz

### 4.12.2 BACKGROUND

Use of devices that generate RF radiation is an important part of several of the Laboratory’s research programs. The hazards associated with RF radiation are potentially significant and demand an effective management program. This section describes the health physics protection mechanisms designed to ensure worker protection from RF radiation.

### 4.12.3 PROGRAM INFORMATION

Ames Laboratory follows the requirements listed in American Conference of Governmental Industrial Hygienists (ACGIH) Handbook entitled “Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices” and ANSI/IEEE Standard C95.1, “Safe Levels With Respect to Human Exposure to RF Radiation, 3kHz to 300 GHz.” These documents, along with the information contained in this section of the Ames Laboratory ESH&A Program Manual and the training information presented below constitute the Laboratory’s written program. The basic elements of the Laboratory’s program are: ESH&A surveys of RF systems, Readiness Review procedures and the group-specific safety training for laser users.

#### 4.12.3.1 EMFs and RFR

Electromagnetic energy exists in a variety of forms: television and radio waves, heat lamp radiation, microwaves, light from the sun and other sources, and electrical currents passing through wires. Electromagnetic energy occurs in two forms. When current passes through electrical wires, electromagnetic energy is created as fields around the wires. These fields, called electromagnetic fields (EMFs), have both an electric and magnetic component. Electromagnetic energy can also move from one point to another by waves propagated through space, such as visible light and radio waves. As defined by the Institute of Electrical and Electronics Engineers (IEEE), radiofrequency radiation (RFR) are waves moving through space which lie in the frequency range of 3 kHz to 300 GHz. (Figure 4.12-1 below)

Frequency Range (Hz)	Wavelength Range	Type of Radiation
10E20-10E24	10E-12 - 10E-16 m	Gamma-rays
10E17 - 10E20	1 nm - 1 pm	x-rays
10E15 - 10E17	400 - 1 nm	Ultraviolet light
4.3 - 7.5x10E14	700-400 nm	visible light
10E12 - 10E14	2.5 um - 700 nm	Infrared light
10E8 - 10E12	1 mm - 2.5 um	Microwaves
10E0 - 10E8	10e8 - 1 m	radio waves

Figure 4.12-1 – The Electromagnetic Spectrum

Health effects caused by the magnetic field portion of EMFs have been a subject of intense debate. Beginning in 1979, researchers began to suggest a link between EMFs and leukemia. Some feel that continuing research since 1979 has confirmed the correlation between EMFs and leukemia. However, the National Academy of Science report of October 31, 1996, "Possible Health Effects of Exposure to Residential Electric and Magnetic Fields," "concluded that no conclusive evidence exists which shows that EMFs play a role in the development of cancer."

#### **4.12.3.2 Characteristics of Radio Frequency Radiation**

Transmitted electromagnetic waves travel at the speed of light. RFR radiates outward from its transmission source in energy packets that combine the characteristics of waves and particles. Once generated, these waves of energy travel from their transmitter through space, where they are reflected from, refracted around, or absorbed by, their intended receivers or by any object in its path. The absorbed energy is the source of health-related concerns.

Based on the characteristics of the wave and the material that absorbs it, the absorbed energy might affect the absorbing material in a number of ways. The absorbed energy could cause a resonating electrical effect in some conducting materials, as occurs in receiving antennas in radio and TV systems. It could be re-emitted as electromagnetic energy such as fluorescence in visible or ultraviolet light. As higher energy forms it could interact with chemical bonds in complex molecules resulting in changes to the nature of the molecule. This interaction is the basis for sunburns caused by ultraviolet light, and "radiation" burns caused by gamma ray irradiation. Some electromagnetic waves, like X-rays and certain forms of gamma radiation, may pass completely through some materials without being absorbed. (Each of these types of electromagnetic waves are in frequency ranges much higher than RFR.) Most commonly, electromagnetic energy is simply absorbed by materials and converted into heat energy. ESH&A will measure RFR levels and determine if they exceed the TLVs. If they do, shielding in the form of some type of wire mesh, around the RFR source has been found to be very effective in reducing the RFR emission rate. Care must be taken not to allow the mesh to come in contact with surfaces that would be effected by heat energy, since the mesh absorbs the RFR, which is converted to heat in the mesh.

Electromagnetic waves can be characterized by three attributes - frequency, amplitude and intensity. Frequency is the rate at which electromagnetic waves are generated or pass a fixed point. Frequency determines wavelength, with longer waves having lower frequency and shorter waves a higher frequency. Frequency is measured in cycles per second units, called hertz (Hz) (60 Hz = 60 cycles/second).

Amplitude is a relative measure of a wave's energy level. Waves at the same frequency with higher amplitude deliver more energy. Waves with the same amplitude at higher frequencies carry more energy. Two waves with the same frequency can have different amplitudes based upon how much energy is put into each wave's production.

Intensity, or power density, is the rate at which energy is transmitted through a given area (measured in milliwatts per square centimeter - mW/cm<sup>2</sup>). Intensity is therefore a measure of a wave's total energy after traveling a given distance from its source. A wave radiating away from its source has its energy spread more thinly the farther it travels. As a radio wave radiates outward, its energy is dispersed over an ever-increasing area resulting in an inverse-square

principle. Every time the distance from an emitting source is doubled, the area covered increases by a factor of four and the power density decreases by a factor of four. A wave registering a certain power level when measured at a distance of fifty feet from the antenna would then register one-fourth that power level at one hundred feet and one-sixteenth at two hundred feet. Radio waves can also diminish in intensity as they are absorbed or scattered by air, fog or objects.

An electromagnetic wave's basic properties may be manipulated to encode information within the wave. This process is called modulation. The amplitude of the wave may be varied as in AM radio, or the frequency of the wave may be varied as in FM radio. The frequency or amplitude of the continuous wave is changed in proportion to an imposed signal. The imposed signal is the information such as a radio, TV, or radar signal. RFR is generally of lower frequencies and lower energy levels than many other types of artificially generated electromagnetic energy.

Refer to the previous chart of the electronic spectrum provided as Figure 4.12-1. Specific ranges and segregation of frequencies for RFR are identified below.

RFR, in general 3 kHz to 300 GHz

AM Radio 550 - 1600 kHz

FM Radio, TV channels 2-13 30 - 300 MHz

UHF Television 470 - 806 MHz

Commercial Paging 35, 43, 152, 158, 454, 931 MHz

Cellular Telephone 824-849 MHz, 869-894 MHz

Specialized Mobile Radio (SMR) "800 MHz" (806-821/851-866 MHz)

"900 MHz" (896-901/935-941 MHz)

Personal Communication Services (PCS) 901-941, 1850-1990 MHz

### 4.12.3.3 Ionizing and Non-ionizing Radiation

Radiation is characterized by its effect upon absorption as either ionizing or non-ionizing radiation. Ionizing means that there is sufficient energy to change the chemical structure of the absorbing matter by removing one or more electrons, creating an electrically charged particle (ion). Non-ionizing means that there is not enough energy in the radiation to create ions. Instead, the energy is absorbed only as heat. Because of its low energy, RFR is non-ionizing radiation.

With their high frequencies and energies, X-rays, some gamma rays and radiation from nuclear processes are ionizing radiation. When ionizing radiation interacts with living structures, it can cause chemical bonds of molecules struck by high-energy particles to be broken. If the absorbing molecules are DNA or other genetic materials, cellular metabolism can be interfered with and the cell's ability to reproduce itself can be altered. Correlations have been made between the incidence of cancer and high rates of exposure to ionizing radiation (National Research Council, 1990).

Non-ionizing RFR does not directly alter molecular structure. When RFR is absorbed, it results in an increase in molecular movement. This is sensed as heat. RFR, which is low frequency and low-energy, produces relatively low amounts of heat in biological tissue. Non-ionizing radiation is not known to damage DNA in the manner that ionizing radiation does.

A useful concept to measure the effect of non-ionizing radiation is specific absorption rate (SAR). SAR is the measurement of power absorbed by whomever or whatever is being studied. It is the power deposited in tissue by the electromagnetic wave, measured in Watts per kilogram of body mass (W/kg).

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of RF hazards and other safety information. In addition the group/activity training shall review emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager.

### 4.12.4 TRAINING

Currently, there is no institutional training module for the Radio Frequency (RF) Radiation-Generating Devices Program. However, all affected populations are required to read this program and comply with the requirements discussed in the section.

### 4.12.5 PERFORMANCE CHECKLISTS

**Group Leader / Department Manager** shall:

- Assure that all activities are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- Review the safety training section for RF in this Manual.
- Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- Conduct and document group/activity-specific training for each employee prior to work that includes a discussion of RFR, hazard mitigation, and emergency procedures.

- Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.
- Assure that equipment and room where potentially high levels of RFR will be produced are marked and labeled in accordance with the guidelines in the ACGIH Handbook.
- Assure that all activities that include use of RF radiation-generating devices receive Readiness Review.

**Employees shall:**

- Review the safety training section for RF in this Manual.
- Receive activity or experiment-specific training prior to working with radioactive materials.
- Perform work in accordance with group Standard Operating Procedures (SOPs).

## **4.13 ULTRAVIOLET (UV) LIGHT –GENERATING DEVICES**

*Applicability Statement: This section applies to Groups/Departments using devices that generate UV light.*

### **4.13.1 REFERENCES**

American Conference of Governmental Industrial Hygienists (ACGIH) Handbook entitled “Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices”  
ANSI/IEEE Standard C95.1, “Safe Levels With Respect to Human Exposure to UV Radiation”

### **4.13.2 BACKGROUND**

Use of devices that generate UV light is an important part of several of the Laboratory’s research programs. The hazards associated with UV light are significant and demand an effective management program. This section describes the health physics protection mechanisms designed to ensure worker protection from UV light.

### **4.13.3 PROGRAM INFORMATION**

Ames Laboratory follows the requirements listed in American Conference of Governmental Industrial Hygienists (ACGIH) Handbook entitled “Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices” and ANSI/IEEE Standard C95.1, “Safe Levels With Respect to Human Exposure to UV Radiation.” These documents, along with the information contained in this section of the Ames Laboratory Program Manual and the training module constitute the Laboratory’s written program.

#### **4.13.3.1 What is Ultraviolet Radiation?**

Ultraviolet radiation is the portion of the invisible light spectrum between approximately 100 and 400 nanometers (nm). The primary source of UV is the sun, but artificial sources include welder's flash, sunlamps or tanning parlors, high-intensity mercury vapor lamps used for night sports, special lamps used in infant care units, xenon arc lamps, and lasers.

Ultraviolet is composed of three segments, designated as A, B, and C. UV-C (below 280 nm) is filtered by the earth's ozone layer and does not reach earth. Because it never reaches us, UVC currently does not pose a threat. There is much evidence, however, that exposure to both UV-A and UV-B can have adverse short-term and long-term effects on your eyes and visual health.

#### **4.13.3.2 Possible Effects of UV**

The most common short-term effects of UV exposure are termed "snow blindness" and "welder's flash." Both of these conditions result from corneal exposure to excessive amounts of UV radiation over a short amount time. This is like a sunburn of the eye. The exposure can come from a welding arc or from long hours spent in snowy altitudes or the beach without proper eye protection. Symptoms include red eyes, a gritty or foreign sandy sensation, extreme light sensitivity, and tearing. Though painful, these symptoms are usually temporary and rarely cause

permanent damage. Long-term effects of UV radiation, on the other hand, are usually gradual and painless. Vision impairment can result from premature cataract formation due to the cumulative effects of UV exposure. It has been reported that 10 percent of cataract operations are necessitated by this type of UV exposure.

Long-term exposure to UV radiation has also been implicated in age-related macular degeneration. This condition affects 10 percent of the U.S. population over the age of 52, and increases to 33 percent in people over age 75. Age-related macular degeneration is the leading cause of vision loss in older Americans.

#### **4.13.3.3 Recommendations for Protection**

Here are some helpful tips from the American Optometric Association that can be used when selecting sunglasses.

Sunglasses should:

- block 99-100 percent of both UV-A and UV-B radiation;
- screen out 75 to 90 percent of visible light; and
- are perfectly matched in color and absorption, and are free of distortion and imperfections.

You should also wear clothing to cover areas of the body possibly exposed to UVR.

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of UV hazards and other safety information. In addition the group/activity training shall review emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager.

#### **4.13.4 TRAINING**

Currently, there is no institutional training module for UV Radiation-Generating Devices. However, it is imperative that supervisory personnel are aware of all sources of UV exposures and potential for adverse health affects and inform all personnel as to how to protect themselves. At a minimum, both supervisory personnel and research group members with potential to interact with sources of UV shall be required to read this program and comply with the safety requirements discussed in the section.

#### **4.13.5 PERFORMANCE CHECKLISTS**

**Group Leader / Department Manager** shall:

- Assure that all activities are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- Review the UV training information in this Manual.
- Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- Conduct and document group/activity-specific training for each employee prior to work that includes a discussion of UVR, hazard mitigation, and emergency procedures.

- Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.
- Assure that equipment emitting potentially hazardous levels of UVR and laboratories are properly marked and labeled in accordance with guidelines given in the ACGIH.
- Assure that all activities that include work with UV radiation-generating devices receive Readiness Review.

**Employees shall:**

- Review the UV training information in this Manual.
- Receive activity/experiment-specific training prior to work with UV radiation-generating devices.
- Perform work in accordance with group Standard Operating Procedures (SOPs).

## 4.14 MAGNET SYTEMS

**Applicability Statement:** *This section applies to groups/departments that conduct research using magnet systems.*

### 4.14.1 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH) TLV booklet entitled “Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices”. Specifically, the section entitled “Non-Ionizing Radiation and Fields (pp. 152-156) addresses acceptable magnetic and electric field exposure levels for these systems.

### 4.14.2 BACKGROUND

Use of magnet systems is an important part of research conducted at Ames Laboratory. The hazards associated with high-powered magnets are significant and demand an effective management program. This section describes the designed to minimize employee exposures and therefore ensure worker protection from electric and magnetic fields.

### 4.14.3 PROGRAM INFORMATION

#### 4.14.3.1 Exposure Limits

The ACGIH TLV values and associated text are as follows:

##### 4.14.3.1.1 Static Magnetic Fields

These TLVs refer to static magnetic field flux densities to which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. These values should be used as guides in the control of exposure to static magnetic fields and should not be regarded as fine lines between safe and dangerous levels.

Routine occupational exposures should not exceed 60 millitesla (mT), equivalent to 600 gauss (G), whole body or 600 mT (6,000 G) to the limbs on a daily, TWA basis [1 tesla (T) = 10,000 G]. Recommended ceiling values are 2 T for the whole body and 5 T for the limbs. Safety hazards may exist from the mechanical forces exerted by the magnetic field upon ferromagnetic tools and medical implants. Cardiac pacemaker and similar medical electronic devices wearers should not be exposed to field levels exceeding 0.5 mT (5 G). Adverse effects may also be produced at higher flux densities resulting from forces upon other implanted devices such as suture staples, aneurism clips, prostheses, etc. These TLVs are summarized in Table 1.

**TABLE 1. TLVs for Static Magnetic Fields**

	8-hour TWA	Ceiling
Whole body	60 mT	2 T
Limbs	600 mT	5 T
Medical electronic device wearers	—	0.5 mT

#### 4.14.3.1.2 Sub-Radiofrequency (30 kHz and below) and Magnetic Fields

These TLVs refer to the amplitude of the magnetic flux density (B) of sub-radiofrequency (sub-RF) magnetic fields in the frequency range of 30 kilohertz (kHz) and below to which it is believed that nearly all workers may be exposed repeatedly without adverse health effects. The magnetic field strengths in these TLVs are root-mean-square (rms) values. These values should be used as guides in the control of exposure to sub-radiofrequency magnetic fields and should not be regarded as fine lines between safe and dangerous levels.

Occupational exposures in the extremely-lowfrequency (ELF) range from 1 to 300 hertz (Hz) should not exceed the ceiling value given by the equation:

$$B_{\text{TLV}} = 60 / f$$

where: f = the frequency in Hz,  $B_{\text{TLV}}$  = the magnetic flux density in millitesla (mT).

For frequencies in the range of 300 Hz to 30 kHz (which includes the voice frequency [VF] band from 300 Hz to 3 kHz and the very-low-frequency [VLF] band from 3 to 30 kHz), occupational exposures should not exceed the ceiling value of 0.2 mT.

These ceiling values for frequencies of 300 Hz to 30 kHz are intended for both partial-body and whole-body exposures. For frequencies below 300 Hz, the TLV for exposure of the extremities can be increased by a factor of 10 for the hands and feet and by a factor of 5 for the arms and legs.

The magnetic flux density of 60 mT/f at 60 Hz corresponds to a maximum permissible flux density of 1 mT. At 30 kHz, the TLV is 0.2 mT, which corresponds to a magnetic field intensity of 160 A/m.

Contact currents from touching ungrounded objects that have acquired an induced electrical charge in a strong sub-RF magnetic field should not exceed the following point contact levels to avoid startle responses or severe electrical shocks:

- A. 1.0 milliampere (mA) at frequencies from 1 Hz to 2.5 kHz.
- B.  $0.4f$  mA at frequencies from 2.5 to 30 kHz, where f is the frequency expressed in kHz.

#### 4.14.3.1.3 Sub-Radiofrequency (30 kHz and below) and Static Electric Fields

These TLVs refer to the maximum unprotected workplace field strengths of sub-radiofrequency electric fields (30 kHz and below) and static electric fields that represent conditions under which it is believed that nearly all workers may be exposed repeatedly without adverse health effects. The electric field intensities in these TLVs are root-mean-square (rms) values. The values should be used as guides in the control of exposure and, due to individual susceptibility, should not be regarded as a fine line between safe and dangerous levels. The electric field strengths stated in these TLVs refer to the field levels present in air, away from the surfaces of conductors (where spark discharges and contact currents may pose significant hazards).

Occupational exposures should not exceed a field strength of 25 kilovolts per meter (kV/m) from 0 hertz (Hz) (direct current [DC]) to 100 Hz. For frequencies in the range of 100 to 4 kilohertz (kHz), the ceiling value is given by:

$$E_{TLV} = 2.5 \times 10^6 / f$$

where:  $f$  = the frequency in Hz; ETLV = the electric field strength in volts per meter (V/m).

A value of 625 V/m is the ceiling value for frequencies from 4 to 30 kHz. These ceiling values 0 to 30 kHz are intended for both partial-body and whole-body exposures.

**Notes:**

1. These TLVs are based on limiting currents on the body surface and induced internal currents to levels below those that are believed to produce adverse health effects. Certain biological effects have been demonstrated in laboratory studies at electric field strengths below those permitted in the TLV; however, there is no convincing evidence at the present time that occupational exposure to these field levels leads to adverse health effects.

Modifications of the TLVs will be made if warranted by new information. At this time, there is insufficient information on human responses and possible health effects of electric fields in the frequency range of 0 to 30 kHz to permit the establishment of a TLV for time-weighted average exposures.

2. Field strengths greater than approximately 5 to 7 kV/m can produce a wide range of safety hazards such as startle reactions associated with spark discharges and contact currents from ungrounded conductors within the field. In addition, safety hazards associated with combustion, ignition of flammable materials, and electro-explosive devices may exist when a high-intensity electric field is present. Care should be taken to eliminate underground objects, to ground such objects, or to use insulated gloves when ungrounded objects must be handled. Prudence dictates the use of protective devices (e.g., suits, gloves, and insulation) in all fields exceeding 15 kV/m.
3. For workers with cardiac pacemakers, the TLV may not protect against electromagnetic interference with pacemaker function. Some models of cardiac pacemakers have been shown to be susceptible to interference by power frequency (50/60 Hz) electric fields as low as 2 kV/m. It is recommended that, lacking specific information on electromagnetic interference from the manufacturer, the exposure of pacemaker and medical electronic device wearers should be maintained at or below 1 kV/m.

#### **4.14.3.2 Signage & Other Types of Notifications**

As stated previously, certain segments of the population (e.g. people with pacemakers) may be susceptible to 5 Gauss fields. To address that potential hazard, employee notification is

paramount. There are many methods of notification including signage, barricades, floor markings. Examples are given below:



Picture 1. Sample magnetic field warning sign on laboratory door denoting 5 Gauss line.



Picture 2. Sample magnetic field warning sign on unit denoting 5 Gauss line.



Picture 3. Warning sign on stanchions and floor markings denoting 5 and 10 Gauss lines.

It shall be the Group Leaders responsibility to determine the best means of employee notification in their respective research areas. Door signage is considered to the minimum form of employee notification. ESH&A can provide assistance in determining the most effective means of employee notifications and can custom make signage upon request.

#### 4.14.3.3 Training

Currently, there is no institutional training module for the operation of magnets or magnet systems. Group or activity-specific training shall be given to each employee prior to work that includes a discussion of magnetic fields and other pertinent safety information. Verification of group or activity-specific training is conducted during Readiness Review.

#### 4.14.5 PERFORMANCE CHECKLISTS

**Group Leader / Department Manager** shall:

- Assure that all activities are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- Review the safety training presented in this Manual on magnets.
- Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- Conduct and document group/activity-specific training for each employee prior to work that includes a discussion of magnets with potential hazards and controls.
- Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.
- Assure that equipment and laboratories are properly labeled so occupants are notified of 5 Gauss fields.

**Employees** shall:

- Review the safety information on magnets contained in this section of the Manual.
- Receive group/activity-specific training prior to working with magnet systems.
- Perform work in accordance with group Standard Operating Procedures (SOPs).

**Environment, Safety, Health and Assurance** shall:

- Provide consultations upon request on issues related to management of potential hazards associated with magnet systems including signage and other forms of employee notifications.

## 4.15 NANOMATERIALS

**Applicability Statement:** *This section applies to groups/departments that use unbound nanoscale materials (particles with diameters less than 100 nanometers).*

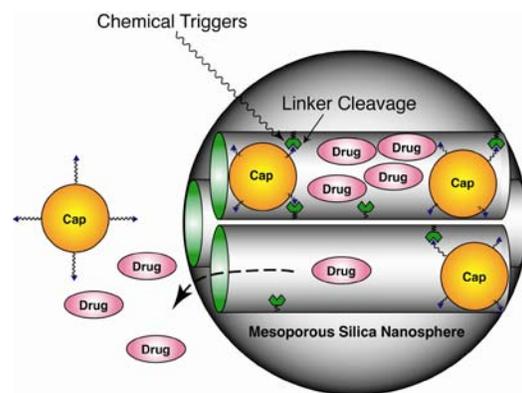
### 4.15.1 REFERENCES

Department of Energy Nanoscale Science Research Centers - Approach to Nanomaterial ES&H - Revision 3a – May 2008

DOE Order 456.1 – The Safe Handling of Unbound Engineered Nanoparticles

### 4.15.2 BACKGROUND

Ames Laboratory has limited activities involving unbound nanomaterials. Potential hazards associated with unbound nanomaterials work are addressed through the Laboratory's Integrated Safety Management System (ISMS) and specifically the Readiness Review process. Readiness Review provides the identification and evaluation of potential hazards and establishes effective control mechanisms to ensure protection of the employee and the environment. To date, hazards associated with projects involving unbound nanomaterials have been determined to be amenable to conventional controls such as ventilation and use of personal protective equipment. The Laboratory recognizes that nanotechnology is an emerging field and that many of the associated ES&H concerns related to work with these materials are still being investigated. Ames Laboratory safety professionals monitor professional sources of information to identify new control strategies associated with nanomaterials research.



The DOE Notice 456.1 – The Safe Handling of Unbound Engineered Nanoparticles delineates the expectations in the following areas:

- 1) Nanotechnology Policies and Procedures
- 2) Training
- 3) Exposure Assessment
- 4) Medical Surveillance
- 5) Controls
- 6) Posting and Labeling
- 7) Transportation
- 8) Waste Management

In addition, Ames Laboratory utilizes the Department of Energy Nanoscale Science Research Centers *Approach to Nanomaterial ES&H(Revision 3a – June 2008)* document as a resource for evaluating health and safety risks associated with use of unbound nanoscale materials.

### 4.15.3 PROGRAM INFORMATION

#### 4.15.3.1 Nanomaterial Hazard Assessment

All work with unbound nanoscale materials will undergo a Nanomaterials Hazard Assessment (Form 10200.187). The assessment is the mechanism by which data is collected and an analysis of the hazards, exposure potential and controls. Specifically, the assessment includes a review of specific usages, Material Safety Data Sheets, Standard Operating Procedures, toxicity, routes of exposure and controls in place (e.g. ventilation, Personal Protective Equipment). Documentation generated as a result of this assessment is maintained in the Readiness Review file for that particular research activity. Readiness Review records are maintained by ESH&A.

#### 4.15.3.2 Readiness Review

Nanoscale work is identified via Readiness Review (Procedure 10200.006). Specifically, the physical hazard of nanomaterials is addressed on the ES&H Hazard Identification Checklist by the following statements:

Section A – Chemical & Biological Concerns: A14 Nanoscale materials.

For each identified hazard, the Activity Supervisor develops associated Hazard Management Statements that explain what controls are in place to minimize exposure potential. Standard Operating Procedures (SOPs) are also reviewed for adequacy along with a check of training records.

#### 4.15.3.3 Training

Laboratory personnel identify work with nanomaterials via completion of a Training Needs Questionnaire (TNQ). The TNQ question on nanomaterials work is as follows:

“Do you work with nanoscale materials (particles with diameters less than 100 nanometers)?”  
If answered “yes”, the employee’s training profile is updated and reflects the need for completion of the Lab’s nanomaterials safety module entitled “Nanotechnology Awareness (AL-208)”. This course is computer-based, takes 30 minutes to complete and requires an 80% or higher score on a Learning Assessment Tool. Subjects covered in the training module include:

- Introduction to Nanomaterials
- Definitions
- Overview of inhalation, dermal, ingestion routes of exposure
- Safety precautions including engineering controls, respiratory protection
- Work practices including spill clean up
- Waste management
- Transportation
- Training
- Medical surveillance
- Lab postings and labeling
- Points of contact

New health and safety information related to nanoscale materials is emerging on a regular basis. By necessity, training will need to be assessed for adequacy on a regular basis. Any new or refresher information will be provided all employees who have completed the module via e-mail updates within an approximate timeframe of 90 days of receipt.

#### **4.15.3.4 Medical Surveillance**

The Hazard Inventory form is completed by all Ames Laboratory employees. "A"-listed hazards are located on the first page of the form and are those agents that have special requirements such as medical surveillance. Hazard "A265" denotes use of nanoscale materials. Laboratory employees with exposure potential to nanoscale materials will be offered a baseline medical exam at Occupational Medicine (G11 TASF). The baseline exam will consist of a general physical, general blood work, pulmonary function test and chest x-ray. Other tests such as a chest x-ray will be recommended at the discretion of the Occupational Medicine physician. Recall frequency will also be determined by the physician.

#### **4.15.3.5 Exposure Monitoring**

There are currently no accepted methods for exposure monitoring of nanoscale materials. IH personnel will continue to monitor progress on the development of monitoring equipment through professional sources of information including ISU EH&S personnel.

#### **4.15.3.6 Exposure Controls**

Engineering controls such as a ventilated enclosure or chemical hood will be evaluated for all work with dispersible (able to be inhaled) nanoparticles. If engineering controls are deemed not feasible, respiratory protection will be implemented with the employee being placed on the Respiratory Protection Program which includes fit-testing and training. Other personal protective equipment that will be recommended as standard issue for work with nanoparticles includes a lab coat and latex gloves with extensions.

#### **4.15.3.7 Posting and Labeling**

Laboratories where work with dispersible nanoparticles occurs will have signage commensurate with the risk of exposure. An example of a sign that would be appropriate for work with dispersible particles used outside of a ventilated enclosure with occupants wearing respiratory protection would be as follows:

***“NOTICE***

*Nanoscale materials used in this lab. The health and physical hazards of these materials have not been fully evaluated. Only authorized personnel are allowed to work with nanoscale materials. Other personnel entering the lab should first verify that work with nanoscale materials is not being conducted. For more information, contact PI listed on the emergency door card or a safety office representative.”*

In other cases, updating the emergency door card may be sufficient in terms of signage. The ESH&A office should be consulted regarding appropriate laboratory signage.

#### **4.15.3.7 Transportation**

All shipments of nanoscale materials will be in accordance with Department of Transportation regulations. Innermost receptacles used for waste shipments will have a label attached that communicates an appropriate level of caution and description of contents.

#### **4.15.3.8 Waste Management**

Handling and disposal of nanoscale material-containing waste will be done in accordance with procedures described in the waste management section of this Manual.

#### **4.15.3.9 Feedback Mechanisms**

Feedback on the adequacy of the mechanisms in place for identifying, evaluating and controlling hazards associated with research involving work with nanoscale materials is ensured via a variety of mechanisms. As previously stated, Readiness Review provides a mechanism by which safe use of nanomaterials is assured. Topical appraisals and external reviews also provide feedback on program effectiveness.

### **4.15.4 PERFORMANCE CHECKLISTS**

**Group Leader / Department Manager** shall:

- Assure that all activities involving work with nanoscale materials are identified, reviewed and approved via the Laboratory's Readiness Review procedure and have undergone a Nanomaterials Hazard Assessment.
- Assure that all employees working with dispersible nanoscale materials complete Nanomaterials Awareness (AL-206) training.
- Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- Conduct and document group/activity-specific training for each employee prior to work that includes a discussion of nanoscale materials with potential hazards and controls.
- Assure group Standard Operating Procedures are current and sufficiently detailed to perform work within established guidelines and reduce exposure potentials to the lowest possible level.

**Employees** shall:

- Complete the Nanomaterials Awareness (AL-206) course.
- Receive group/activity-specific training prior to working with nanoscale materials.
- Perform work in accordance with group Standard Operating Procedures (SOPs) including use of appropriate control measures such as chemical hood and PPE.

**Environment, Safety, Health and Assurance** shall:

- Review activities involving nanoscale materials to determine exposure potential surveillance.
- Provide consultations upon request on issues related to management of potential hazards associated with nanoscale materials.

**Occupational Medicine** shall:

- Provide appropriate medical surveillance to nanoscale materials users including history, basic exam, blood work, pulmonary function test and chest x-ray.

## 4.16 BERYLLIUM

**Applicability Statement:** *This section applies to groups/departments that have potential to interact with research-derived beryllium as a result of experimental or operational activities.*

### 4.16.1 REFERENCES

10 CFR 850 Chronic Beryllium Disease Prevention Plan  
Ames Laboratory Chronic Beryllium Disease Prevention Plan

### 4.16.2 BACKGROUND

In the early 1940's, Iowa State College, now Iowa State University (ISU), participated in a classified research and development effort, known as the Manhattan Project. These efforts produced over one thousand tons of uranium from 1942 to 1945 by a metallothermic reduction process. After the war, other metals were produced in limited quantities, thorium being the next most prevalent in the production process. Beryllium, as beryllia, was used in crucibles, and produced by the reduction of beryllium fluoride.

In 1952, the AEC (Atomic Energy Commission, now DOE) Chicago Operations Office assessed occupational exposure to thorium at Ames Laboratory and conducted a brief study of several beryllium operations. The beryllium results indicated that several of the operations in Wilhelm Hall exposed technicians to concentrations exceeding the AEC maximum concentration for a single exposure by 6 to 8 times. No other surveys were made in other buildings.

Evidence of documented beryllium testing exists from episodic beryllium activities, including limited production of beryllium crucibles in the 1960's, indicate that safety practices, oversight, and monitoring were utilized, with the level of rigor and analytical accuracy available at that time. Discussions with researchers revealed that sporadic research activities with beryllium have taken place since the 1960's that included a significantly greater amount of safety oversight.

In 2005-2009, several beryllium surveys were conducted. Early surveys focused on exhaust stacks and 29 were found to have beryllium concentrations above limits established by the Department of Energy. This contamination was unexpected due to the historical understanding that beryllium work had been very limited in Spedding Hall and not of the type that would result in residual contamination. Further characterization efforts revealed isolated contamination (above DOE limits) in Metals Development and Wilhelm.

However, the exposure potential to current workers, building visitors, and the public is extremely low as the contaminated areas are not accessible to the general workforce and the public. The contaminated areas are periodically accessed by crafts people, but appropriate precautions are applied to ensure their safety, and personnel monitoring has confirmed the efficacy of the procedural controls. The Laboratory continues to assess the need for periodic sampling as beryllium characterization and remediation activities are performed and during the performance of remodeling and maintenance activities in areas of known or suspected beryllium contamination.

### **4.16.3 PROGRAM INFORMATION**

#### **4.16.3.1 Chronic Beryllium Disease Prevention Plan**

The Chronic Beryllium Disease Prevention Plan (CBDPP) stated in 10 CFR Part 850 – Chronic Beryllium Disease Prevention Program describes existing conditions at the Ames Laboratory and the procedural controls in place that ensure employee protection from exposures that may cause adverse health effects such as berylliosis and chronic beryllium disease.

#### **4.16.3.2 Readiness Review**

All activities that have potential to interact with research-derived beryllium are reviewed and approved via the Readiness Review (Procedure 10200.006).

#### **4.16.3.3 Training**

There is no institutional training specific to beryllium. Employees that perform activities that have potential to interact with research-derived beryllium receive activity-specific information that ensures exposure potentials are minimized to the lowest possible extent.

#### **4.16.3.4 Medical Surveillance**

Laboratory employees with an A213 beryllium and beryllium compounds will be sent a questionnaire requesting information on how the material is used and what controls are in place to reduce exposure. Upon completion of an exposure assessment by industrial hygiene personnel, the employee may be offered appropriate medical screening at Occupational Medicine (G11 TASF).

#### **4.16.3.5 Exposure Monitoring & Controls**

Extensive characterization and exposure monitoring has been conducted throughout the Laboratory. Results generated have been used to develop specific work controls or verify their adequacy.

### **4.16.4 PERFORMANCE CHECKLISTS**

**Group Leader / Department Manager** shall:

- Assure that all activities involving work with beryllium-containing materials are identified, reviewed and approved via the Laboratory's Readiness Review procedure.
- Assure that Hazard Inventory and Training Needs Questionnaire documents for each employee are complete and current.

- Assure group Standard Operating Procedures are current and sufficiently detailed to perform work within established guidelines and reduce exposure potentials to the lowest possible level.

**Employees shall:**

- Perform work in accordance with group Standard Operating Procedures including use of appropriate control measures such as ventilation and and PPE.

**Environment, Safety, Health and Assurance shall:**

- Provide consultations upon request on issues related to management of potential hazards associated with beryllium-containing materials/contamination.

**Occupational Medicine shall:**

- Provide appropriate medical surveillance to current workers in accordance with the Chronic Beryllium Disease Prevention Plan.

*Comments and questions regarding this section may be directed to the person listed below:*

Shawn Nelson, ESH&A  
G40 TASF  
294-2153

*NOTE: This Section's Sign-Off Record is maintained in the ESH&A Office, G40 TASF.*

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## REVISION / REVIEW LOG

### SECTION 5 – INDUSTRIAL/GENERAL SAFETY PROGRAMS

<u>Review Number:</u>	<u>Effective Date:</u>	<u>Contact Person:</u>	<u>Pages Affected:</u>	<u>Description of Revision:</u>
0	10/11/1999	Shawn Nelson	All	Original Issue
1	1/13/2006	Shawn Nelson	See Revision Description	G:\Doc&Recs\DCP\Revision Description\Manual 10200.002 Section 5 Revision 1.doc
2	12/1/2006	Shawn Nelson	See Rev. Description	G:\Doc&Recs\DCP\Revision Description\Manual 10200.002 Section 5 Revision 2.doc
3	3-15-07	Shawn Nelson	See Rev. Description	G:\Docs*Recs\DCP\Revision Description\Manual 10200.002 Section 5.12 Rev 3 (Group Lockout)
4	8-1-2010	Shawn Nelson	See Rev. Description	
5	8-1-2011	Shawn Nelson	See Rev. Description	G:\Document Control\Rev Description\ESH&A Manual\Manual 10200.002 Section 5 revdesc.doc

## SIGN-OFF RECORD

The Environment, Safety Health and Assurance Program Manual has been reviewed and approved as documented below:

### Record Sign-Off

**Reviewed by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Amy J. Tehan, ESH&A, Document Control Coordinator

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Tom E. Wessels, Manager, ESH&A

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
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**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Debra L. Covey, Associate Laboratory Director for Sponsored  
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**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Duane D. Johnson, Chief Research Officer

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Bruce N. Harmon, Deputy Director

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Alexander H. King, Laboratory Director

*Note: Original Sign-off Record with signatures is on file with ESH&A.*

## **5.0 INDUSTRIAL SAFETY PROGRAM**

### **5.1 GENERAL SAFETY**

*Applicability Statement: This section applies to all employees and contractors.*

#### **5.1.1 REFERENCES**

OSHA 1910.1 Purpose and Scope General Industry  
OSHA 1926.1 Purpose and Scope Construction Industry  
Manual 10200.003 Waste Management Program Manual  
Manual 46200.001 Electrical Safety Manual

#### **5.1.2 BACKGROUND**

Williams-Steiger Act of 1970, Section 5(a)

Each Employer shall:

- Furnish to each employee a place of employment which is free from recognized risks that are causing or are likely to cause death or serious physical harm;
- Comply with occupational safety and health standards promulgated under this Act.

Each Employee shall:

- Comply with occupational safety and health standards and all rules, regulations and orders issued pursuant to the Williams Steiger Act which are applicable.

#### **5.1.3 PROGRAM INFORMATION**

##### **5.1.3.1 Failure to follow ESH&A Policies, Procedures and Programs**

- Flagrant or willful disregard or repeated failure to follow safety rules or other acts which endanger people or property may normally result in progressive discipline.

##### **5.1.3.2 General Safety Rules**

The following are the general safety rules for all employees of Ames Laboratory:

- Employees have the right to refuse any job where adequate safety precautions have not been met. Employees must contact their immediate Supervisor/Group Leader/Manager to agree upon proper safety precautions. If employees and Supervisor/Group Leader/Manager do not agree, ESH&A must be contacted immediately.

NOTE: See Section 5.2, "Stop Work Authority", of this manual for further information and guidance.

- Report unsafe conditions or activities (NEAR-HITS) to the Supervisor, Group Leader, Manager or ESH&A.
- Perform work safely and correctly.
- Submit safety suggestions for the promotion of safety and the prevention of accidents using the Accidents, Incidents & Employee Safety and Security Concerns: Classification & Investigation (Procedure 10200.038).
- Understand, perform and comply with all written safety programs, procedures, and requirements.
- If unsure on how to perform a task or job correctly and safely, ask a more experienced co-worker, Supervisor, Group Leader, Manager, or refer to group specific SOP's.
- Practical jokes and horseplay lead to accidents and are strictly prohibited.
- Report all accidents, injuries or illnesses, no matter how minor, to your Supervisor/Group Leader/Manager or Occupational Medicine or ESH&A.
- Do not lift or push an object if it is too heavy. Ask for assistance.
- Keep work areas, clean and orderly. Return items to their proper place after use.
- Keep aisles, eyewashes, fire extinguishers, first aid kits and work places uncluttered, clear and unobstructed. Pick up debris on the floor immediately.
- Discard hazardous waste according to the Ames Laboratory Waste Management Program Manual (Manual 46400.001).
- Clean spilled oil or any liquid on the floor immediately.
- Remove or secure loose fitting or torn clothing, long hair, ties, jewelry (rings, watches, bracelets, necklaces, chains, etc.) before working around machine parts. These can lead to accidents by getting caught in moving parts. Also, clothing which is too tight can restrict movement and can be hazardous.
- Do not run.
- Follow all traffic ordinances of the university, city, and state in which you are driving.

### 5.1.3.3 Operations Rules

The following are the operational safety rules:

- Replace or repair defective tools such as:
  - Hammers with cracked handles
  - Unstable ladders
  - Mushroomed chisel heads
- Examine all equipment for safe operation before work is started. Operate all equipment with safeguards in place.
- Never use compressed air to clean clothing, your body, fellow employees or equipment.
- Know how to operate machinery before starting the job. Do not proceed until training and full understanding are attained.
- Before cleaning, repairing or adjusting machinery, disconnect and verify that power is locked out and tagged out. (Lockout/tagout training is required—see Section 5.12 of this manual for the Lockout/Tagout Program.)
- When removing chips from machines, do not use fingers to pickup chips or hand to brush chips. Use brush, gloves, towel, etc.
- Do not use tools for purposes other than intended by design.
- Do not ride on cranes or lift trucks as a passenger.

### 5.1.3.4 Fire Prevention Rules

The following are the general Fire Prevention Safety Rules (see Section 8 for complete Fire Protection information):

- Iowa State University is a smoke free campus. Smoking is not permitted anywhere in the buildings, near air-handling intakes, or at building main entrances.
- Maintain combustibles/flammables in a flammable storage cabinet or room.
- Know where emergency exits are located in the event of an emergency and maintain traffic paths which are clear and unobstructed.
- Know where the fire alarms and fire extinguishers are located.
- Call 911 in the event of a medical emergency.
- Call 4-5511 in the event of a chemical spill.
- Activate the Fire Alarm Pull Station or call 911 in the event of a fire emergency

### 5.1.3.5 General Electrical Safety Rules

The complete electrical safety rules are contained in the Ames Laboratory Electrical Safety Manual. The following are general electrical safety rules:

- No Live (energized) work over 50 volts is permitted unless written approval is granted by either the Chief Operations Officer or the Director for Science and Technology.
- Before using any electrical equipment, ensure that hands are dry and you are not standing in water.
- All electrical tools must be grounded or double insulated.
- Inspect/examine all electrical equipment, including extension cords every time used. Take damaged equipment out of service and tag it until repaired or replaced. Equipment must be inspected for:
  - Frayed, torn or split cords;
  - Strain relief (outer insulating jacket of cord has pulled from male/female attachment);
  - Cracked or broken insulation;
  - Missing ground prong, etc.
- Take electrical equipment out of service and tag if you detect any of the following danger signals:
  - Sparks or smoke;
  - Unusual heat or odors;
  - Shock or tingle while using the tool.
- Do not remove guards and do not use equipment which is missing guards. If a guard is missing, immediately notify the Supervisor, Group Leader, Manager or ESH&A.

### 5.1.3.6 Storage Safety Rules

- Overhead storage on top of office, laboratory or shop cabinets, bookcases or other flat surfaces, which are over 6 feet above a floor surface, is not permitted. This policy does not apply to areas designed to permit high rack storage such as a warehouse.
- Storage on top of cabinets, shelves or bookcases below 6 feet from a floor surface is permitted. However, it should be stable and secure. It should not compromise the physical integrity of the shelf, bookcase, or cabinet on which it is stored.
- Employees observing overhead storage that does not meet the requirements of this policy should correct the storage problem or report it to their direct supervisor or ESH&A. Exception to this policy will be considered by ESH&A on a case-by-case basis.

### 5.1.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES</b>		<b>AL-001</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all new employees</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction, reviews administrative policies, General Safety, Emergencies, Industrial Hygiene Program, Environmental Protection Program, and Radiation Safety. Estimated Completion time: 1.5 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's Annual Retrain Mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders.</i>	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of physical hazards, chemical hazards, hazard mitigation, location of MSDS's, procedural information, emergency response measures and other safety information. This training shall be documented by the Supervisor, Group Leader or Department Manager.

### 5.1.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leader / Department Manager** shall;

- Assure workers have training and competence commensurate with work responsibilities.
- Enforce the ESH&A procedures in this manual.
- Communicate and explain the need for compliance with all ESH&A Programs.

**Employees** shall:

- All employees are expected to observe and follow the established procedures in this Environment, Safety, Health and Assurance Program Manual (Manual10200.002).
- Bring all unsafe acts, practices, or conditions to their Supervisors, / Group Leaders / Department Managers attention.
- Inform Supervisor/Group Leader/Manager or ESH&A if unable to get an unsafe situation corrected.

**Environment, Safety, Health and Assurance** shall:

- Conduct training as necessary for understanding of these procedures.
- Periodically review and update regulations applicable to Ames Laboratory.
- Provide support for and help in enforcing the Environment, Safety, Health and Assurance procedures.

## 5.2 STOP WORK AUTHORITY

*Applicability Statement: This section applies to all employees and contractors.*

### 5.2.1 REFERENCES

Stop Work Authority Policy 10200.005  
Procedure 10200.010 Readiness Review  
Williams-Steiger Act of 1970, Section 5(a)

### 5.2.2 BACKGROUND

The purpose of the Stop Work Authority Policy is to provide Ames Laboratory employees with a process to prevent serious injury, impairment of health, or adverse impact to the environment. Included in this policy is a process to start up operations that have been shut down (Readiness Review Procedure 10200.010). The concept of having Stop Work Authorization for Ames Laboratory employees is recognized as a good management practice.

#### **Definition:**

##### Stop Work:

Immediate action taken by any Ames Laboratory employee, Supervisor, Group Leader, Department Manager, Program Director, Division Director, Deputy Director, Director or Environment, Safety, Health and Assurance Personnel to stop work when there is the apprehension of a serious injury, impairment of health or adverse impact to the environment. This immediate action would result from a condition or practice in the work place as judged by a reasonable and knowledgeable employee.

### 5.2.3 Stop Work Authority Policy (10200.005)

All Ames Laboratory employees have authority to stop work to prevent serious injury, impairment of health or adverse impact to the environment. The responsibilities listed in Section 5.2.5 ensure the safety of the individual initiating the stop work, the safety of the individual(s) performing the activity, and safeguarding the research or work that is in process.

A Readiness Review (Procedure 10200.010) shall be completed as a prerequisite to the start-up of operations resulting from Stop Work actions.

## 5.2.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET)</b>		<b>AL-001</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all employees</i>	
<b><i>Module Format:</i></b>	<i>Stop Work Authority is incorporated into General Employee Training (GET) which is classroom instruction. Estimated completion time: 1.5 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's Annual Retrain Mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders.</i>	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of physical hazards, chemical hazards, hazard mitigation, location of MSDSs, emergency response measures, procedural information and other safety information,. This training shall be documented by the Group Leader / Department Manager.

## 5.2.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers** shall:

- Stop Work in all the areas for which they have been assigned responsibility.
- Ensure employees and contractors performing work at the facility adhere to the Stop Work Program.

**Employees** shall:

- Stop Work through their Supervisor / Group Leader / Department Manager for activities in their immediate work area.

**Environment, Safety, Health and Assurance Personnel, Division Directors, Deputy Director, and Laboratory Director** shall:

- Stop Work Authority for all Ames Laboratory activities and all activities performed in Ames Laboratory or rented space.

### **5.3 MEANS OF EGRESS AND WALKING & WORKING SURFACES**

*Applicability Statement: This section applies to all employees, visitors, and contractors.*

#### **5.3.1 REFERENCES**

NFPA 101 Life Safety Code  
OSHA 1910.21 Walking & Working Surfaces Definitions  
OSHA 1910.22 Walking & Working Surfaces General Requirements  
OSHA 1910.23 Guarding Floor & Wall Openings  
OSHA 1910.35 Means of Egress Definitions  
OSHA 1910.36 Means of Egress General Requirements  
OSHA 1910.37 Means of Egress

#### **5.3.2 BACKGROUND**

Every building or structure shall be so constructed, arranged, equipped, maintained, and operated as to avoid undue danger to the lives and safety of its occupants during normal operations and in the event of fire, smoke, fumes, resulting panic or other emergency.

#### **5.3.3 PROGRAM INFORMATION**

Ames Laboratory follows the requirements outlined by NFPA 101 Life Safety Code and OSHA General Industry Standards. This program sets forth standards to ensure safe walking and working surfaces and means of egress.

##### **5.3.3.1 Rules Applying to Housekeeping**

- All places of employment, passageways, storerooms, and service rooms shall be maintained in a clean, orderly, and sanitary condition.
- The floor of every workroom shall be maintained in a clean and, so far as possible, a dry condition. Where wet processes are used, drainage shall be maintained and false floors, platforms, mats, or other dry standing places should be provided where practicable.
- Every floor, work area, and passageway shall be maintained free from protruding nails, splinters, holes, or loose boards.

##### **5.3.3.2 Rules Applying to Aisles and Passageways**

- The minimum width of any aisle leading to a main passageway or hallway shall not be less than 28 inches.
- Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, through doorways and wherever turns or passage must be made. Aisles and passageways shall be maintained clear and in good repair, with no obstruction across or in aisles that could create a hazard.

### **5.3.3.3 Requirements for Floor Loading Protection**

- In every building or other structure (mezzanines), the loads approved by the building official shall be posted and securely affixed.

### **5.3.3.4 Requirements for Safe Means of Egress from Fire and Like Emergencies**

- The minimum width of any passageway or exit access shall not be less than 36 inches.
- Every building or structure shall be so constructed, arranged, equipped, maintained, and operated as to avoid undue danger to the lives and safety of its occupants from fire, smoke, fumes, or resulting panic during escape from the building or structure in case of fire or other emergency.
- In every building or structure exits shall be so arranged and maintained as to provide free and unobstructed egress from all parts of the building or structure at all times when it is occupied.
- Every exit shall be clearly visible or the route to reach it shall be conspicuously indicated in such a manner that every occupant of every building or structure will readily know the direction of escape from any point, and each path of escape, in its entirety.
- Any doorway or passageway not constituting an exit or way to reach an exit, but of such a character as to be subject to being mistaken for an exit, shall be so arranged or marked as to minimize its possible confusion. Identify doors that could be confused for an exit by used of a sign reading "Not an Exit", "To Basement," "Storeroom," "Restroom", or the like.
- In every building or structure equipped for artificial illumination, adequate and reliable illumination shall be provided for all exit facilities.

### **5.3.4 TRAINING**

Currently, there is no institutional training module for the Means of Egress and Walking and Working Surfaces Program. However, all affected populations are required to read this program and comply with the requirements discussed in this section.

### 5.3.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers** shall:

- Maintain all areas in a clean and orderly manner.
- Ensure employees and contractors performing work at the facility adhere to the Walking and Working Surfaces Program.

**Employees** shall:

- Maintain all areas in a clean and orderly manner.

**Ames Laboratory Director (or Deputy Director)** shall:

- Support ESH&A to ensure all walking and working surfaces are maintained in a clean and orderly manner.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct random and annual inspections to ensure employees are adhering to the Walking and Working Surfaces Program.
- Conduct General Employee Training and refresher training.
- Review changes to the regulatory requirements and update program as necessary.

## 5.4 VEHICLE MOUNTED ELEVATING & ROTATING WORK PLATFORMS

*Applicability Statement:* This section applies to all employees and contractors who utilize Vehicle Mounted Elevating and Rotating Work Platforms and Scissors lifts.

### 5.4.1 REFERENCES

OSHA 1910.66 Powered Platforms for Building Maintenance  
OSHA 1910.67 Vehicle Mounted Elevating and Rotating Work Platforms  
OSHA 1910.333(c)(3) Selection and Use of Work Practices (Electrical)  
OSHA 1926.450 Scaffolds  
OSHA 1926.451 General Requirements  
OSHA 1926.452 Additional requirements applicable to specific types of scaffolds.  
OSHA 1926.453 Aerial Lifts  
ANSI Standards A92.2-1969 Vehicle Mounted Elevating Rotating Work Platforms

### 5.4.2 BACKGROUND

This program includes but is not limited to the following vehicle mounted elevating devices:

- Scissors Lifts
- Extensible Boom Platforms
- Aerial Ladders
- Articulating Boom Platforms

This program does not address Powered Platforms for Building Maintenance (OSHA 1910.66) or (OSHA 1910.68). Fire fighting equipment is also not subject to this program.

Definitions:

Aerial Lifts = Scissors Lifts and Vertical Towers.

Vehicle Mounted Elevating Rotating Work Platforms = Extensible Boom Platforms and Articulating Boom Platforms.

Qualified Operator = ANSI terminology.

Competent Operator = OSHA terminology

### 5.4.3 PROGRAM INFORMATION

- Aerial lifts may be field modified provided the modification has been certified in writing by the manufacturer that it still meets the applicable ANSI Standard requirements.
- Operators shall comply with the requirements of OSHA 29 CFR 1910.333(c)(3) (Selection and Use of Work Practices) for operations near electrical hazards.

- Lifts shall be inspected each day before use (mandatory).
  - ✓ Ensure lift controls are in safe working condition (both base and platform controls).
  - ✓ Inspect welds, mechanical connections, hoses, etc. on the base, the scissors/telescope, and platform.
  - ✓ Inspect the control display to ensure they are legible (not faded, marred, missing, etc.).
- Only trained persons may operate an aerial lift.
- Contractors are not to use Ames Laboratory lifts unless authorized and trained to Ames Laboratory requirements.
- Belting off to an adjacent pole, structure or equipment while working from an aerial lift is not permitted.
- Do not sit or climb on the edge of the basket. Keep both feet on the floor of the basket at all times.
- Do not use ladders or other devices on lift platforms.
- Wear a full body harness attached to the boom or basket for vehicle mounted elevating and rotating work platforms including extensible boom platforms or articulating boom platforms. Belting off is not required for scissors lifts or vertical towers (scaffolding standard).
- Scissors lifts and vertical towers, including those with platforms that extend beyond the equipment wheelbase, do not require employees to be tied off (scaffolding standard).
- Do not exceed boom and basket load limits specified by the manufacturer.
- Ensure that outriggers are positioned on pads or a solid surface as necessary.
- Use wheel chocks when an aerial lift is used on an inclined surface.
- Do not move the truck when the boom is elevated in a working position and personnel are in the basket unless the equipment is specifically designed to do this. Articulating and extensible booms designed primarily as personnel carriers must have controls on the platform and at ground level.
- Platform controls must be within easy reach of the operator.
- Lower controls must be able to override the platform controls.
- All controls must be plainly marked as to their function.
- Do not operate the lower controls unless the person in the lift has granted permission, except in case of emergency.

- Do not alter the insulated portion of an aerial lift in any manner that might reduce its insulating value.
- Before moving an aerial lift for travel, inspect it to see that it is properly cradled and outriggers are in a stowed position.
- A man basket used on the forks of a lift truck is prohibited.

#### 5.4.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>VEHICLE MOUNTED ELEVATING &amp; ROTATING WORK PLATFORMS AL-144</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignment involves use of vehicle mounted elevating &amp; work platforms.</i>
<b><i>Module Format:</i></b>	<i>Module is a video with handbook and quiz. Estimated completion time: 1.5 hours / exam.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three-year retrain</i>

<b>Aerial Lift Safety AL-179</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignment involves use of vertical scissors lifts or telescoping vertical lifts.</i>
<b><i>Module Format:</i></b>	<i>Module is a video with handbook and quiz. Estimated completion time: 1.5 hours / exam.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three-year retrain</i>

Group / activity-specific training shall be given to each employee prior to start of work. Training will include a discussion of physical hazards, proper operation, safety requirements, hazard mitigation, emergency response measures, procedural information and other safety information. This training shall be documented by the Group Leader / Department Manager.

#### 5.4.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Powered Platform Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Ensure that employees attend any required training.
- Ensure employees and contractors performing work at the facility adhere to the Powered Platform Program.

**Employees** shall:

- Attend required Powered Platform course as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Adhere to the requirements set forth in the Powered Platform Program.

- Conduct inspection every day the equipment is used or at the beginning of each shift.

**Contractors shall:**

- Ensure their equipment meets the applicable ANSI Standards.
- Ensure their employees are qualified and trained in the safe operation of the lifts as required by the OSHA Standard.
- Comply with Ames Laboratory ESH&A requirements as applicable.

**Facilities Services shall:**

- Ensure contractors performing work at the facility adhere to the Powered Platform Program.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- Conduct random and annual inspections to ensure employees are adhering to the Powered Platform Program.
- Develop and conduct Powered Platform Program Training and refresher training.
- Review changes to the regulatory requirements and update program as necessary.

## 5.5. POWERED INDUSTRIAL VEHICLES

*Applicability Statement:* This section applies to all employees and contractors who operate Powered Industrial Vehicles such as fork lifts and powered pallet jacks.

### 5.5.1 REFERENCES

OSHA 1910.178 Powered Industrial Trucks

ANSI Standard B56.1 Powered Industrial Trucks

Appendix A Ames Laboratory Forklift Inspection Checklist (Form 46300.057)

### 5.5.2 BACKGROUND

A powered industrial vehicle means an internal combustion engine or electric motor powered vehicle used for material handling. This would include sit down forklift trucks, standup forklift trucks, and motorized hand trucks.

NOTE: Hand operated carts, lifts, etc., having no motorized force beyond that of the operator, are excluded.

### 5.5.3 PROGRAM INFORMATION

#### 5.5.3.1 General Safety Requirements

- Employees that need to operate a powered industrial vehicle must be trained.
- All operators must inspect the powered industrial vehicles before each use or beginning of each shift by completing the “Ames Laboratory Forklift Inspection Checklist”, (see Appendix A) which is attached to each Powered Industrial Vehicle. Inspection forms when completely filled out must be returned to program that own the equipment for documentation and auditing.
  - If the vehicle is in need of repair, remove it from service immediately. Do not use the vehicle until repairs are completed.
  - The vehicle must be tagged out of service by operator until repairs are completed.
  - Failure to tag out the vehicle is a serious issue and may result in disciplinary action.
- Contractors and vendors are prohibited from using Ames Laboratory powered industrial vehicles unless approved by ESH&A (for training, insurance, etc). The cost of renting equipment should be figured into the contractor’s overhead. Ames Laboratory will not assume liability for equipment or hardware damage. Contractors must demonstrate powered industrial vehicle operating competency for each driver in the event ESH&A grants approval.
- Modifications or additions to Powered Industrial Vehicles shall not be performed by Ames Laboratory without the manufacturer’s prior written approval.

- Changing and charging batteries shall be performed in areas designated for that purpose, with adequate ventilation and eye wash facilities immediately available.
- Precautions shall be taken to prevent Hot Work in battery charging areas (no open flames, welding, grinding, soldering, sparks or electric arcs, smoking).

### **5.5.3.2 Operation Rules for Powered Industrial Vehicles**

- Trucks shall not be driven up to anyone standing in front of a bench, wall or other fixed object.
- No person shall be allowed to stand or pass under the elevated portion of any truck, whether loaded or empty.
- Employees shall not ride (as passengers) anywhere on powered industrial vehicles.
- Employees shall not place arms or legs between the uprights of the mast or outside the running lines of the truck.
- When a powered industrial truck is left unattended, load-engaging (forks) means shall be fully lowered, controls shall be neutralized, power shall be shut off and brakes set. Wheels shall be blocked if the truck is parked on an incline.
- Brakes shall be set and wheel blocks or a catch mechanism must be in place to prevent movement of trucks/trailers while loading or unloading with a Powered Industrial Vehicle.
- The tractor trailer must be inspected by the operator prior to entering the trailer.
- Only industrial trucks approved in hazardous locations shall be used in such cases.
- Aisles, intersections and access to fire and emergency equipment shall be kept clear. Do not park/stage/store powered industrial vehicles in these locations.

### **5.5.3.3 Traffic Regulations to be observed by Powered Industrial Vehicles**

- A safe distance shall be maintained approximately three truck lengths between Powered Industrial Vehicles.
- The Powered Industrial Vehicle must be under control at all times.
- The driver shall slow down and sound the horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view, the driver shall travel backward with the load trailing.

- When ascending or descending grades in excess of 10 percent, loaded trucks shall be driven with the load upgrade.
- Under all travel conditions the truck shall be operated at a speed that will permit it to be brought to a stop in a safe manner.
- Stunt driving and horseplay is not permitted.
- The weight of the powered industrial vehicle must be compared with the weight load capacity of the elevator to ensure the elevator is not overloaded.
- Elevators shall be approached slowly, and then entered squarely after the elevator car is properly leveled. Once on the elevator, the control shall be neutralized, power shut off and the brakes set. Operators are not to ride with the powered industrial vehicle on the elevator.
- Motorized hand trucks must enter elevators or other confining areas with load end forward.
- Running over loose objects on the roadway/aisle surface must be avoided.
- While negotiating turns, speed shall be reduced and turning shall be in a smooth sweeping motion.
- Only loads within the rated capacity of the vehicle shall be handled.
- Immediately report damage of property to the powered industrial vehicle to Supervisor/Group Leader/Department Manager, ESH&A or Facilities Services Group.

#### **5.5.3.4 Personal Protective Equipment (PPE) Requirements**

- Steel toed safety shoes;
- Hard hats;
- Safety glasses;
- Leather gloves when handling rough/sharp materials; and
- Chemical-resistant gloves when potentially exposed to chemicals;

### 5.5.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>FORK TRUCK TRAINING</b>		<b>AL-013</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignment involves use of Powered Industrial Vehicles.</i>	
<b><i>Module Format:</i></b>	<i>It is classroom with exam and a practical factors evaluation. Estimated completion time: 2.0 hours</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three (3) year practical evaluation. Full retraining will be required if:</i> <ul style="list-style-type: none"> <li>• <i>Unsafe operation witnessed</i></li> <li>• <i>Accident or near-miss</i></li> <li>• <i>Evaluation indicates need</i></li> <li>• <i>Different type of equipment introduced</i></li> <li>• <i>Workplace condition changes</i></li> </ul>	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of equipment specific operation, physical hazards and other procedural information. This training shall be documented by the Group Leader / Department Manager.

### 5.5.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Powered Industrial Vehicles are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Ensure that employees attend required training.
- Ensure employees and contractors adhere to the Powered Industrial Vehicle Program.

**Employees** shall:

- Attend required Powered Industrial Vehicle Training as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Complete practical evaluation every 3-years.
- Fully adhere to the requirements set forth in the Powered Industrial Vehicle Program.
- Conduct Inspection every day the equipment is used or at the beginning of each shift.

**Contractors** shall:

- Ensure their equipment meets the applicable ANSI Standards.
- Ensure their employees are qualified and trained in the safe operation of the Powered Industrial Vehicles as required by the OSHA Standards.
- Comply with Ames Laboratory rules as applicable.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct random and annual inspections to ensure employees adhere to the Powered Industrial Vehicle Program.
- Develop and conduct Powered Industrial Vehicle Training and refresher training.
- Periodically review regulations requirements and update program as necessary.



### Forklift Inspection Checklist Instructions

If damage to the forklift is noted or a checklist item does not meet the criteria described below, the user should contact their supervisor to determine a corrective course of action. Do not use the forklift until all checklist items are listed as "OK" per the instructions below. Follow the instructions below for each of the Forklift Inspection Checklist Items:

1. Obvious Damage – Inspect the forklift for damage to the structural and mechanical aspects of the equipment. Look for cracks in the frame or in the lift mechanism. Any damage that jeopardizes the workability of the equipment or its ability to carry a load should be noted.
2. Tires – Inspect the tires. Are they in good condition and are the pneumatic tires inflated properly?
3. Battery Indicator – Check the battery indicator on the electric forklift to insure the batteries are properly charged.
4. Engine Fluid Levels – Check the fuel levels (propane or gas) to insure there is an adequate amount to perform the intended work. Check the engine oil to insure it is at the proper level.
5. Hydraulic System – Inspect the hydraulic system for leaks. Check the condition of the reservoir and hoses. Is the reservoir adequately filled and are there any cracks or damage to the hoses?
6. Leaks – Survey the entire forklift, and the area in which it is parked, for any other fluid leaks.
7. Forks and Carriage – Are the forks and carriage in good condition? Both the forks and carriage should be structurally intact and not bent. Test the fork locking mechanism to insure that it works properly and does not allow the fork to move on the carriage. Before any lifting, check the placement of the forks to insure they are properly positioned and locked in to place on the carriage.

Turn the forklift on to test the remainder of the checklist items:

8. Hydraulic Controls – Test the controls for manipulating the forklift. Move the forklift in all directions looking for smooth operation and listening for unusual sounds indicating worn or broken parts.
9. Warning Lights – Turn on the warning lights to insure they are working properly.
10. Horn – Test the horn to insure that it works.
11. Emergency Brake – With the emergency brake on, slowly begin moving the forklift forward and then backward to test the emergency brake. The emergency brake should not allow the forklift to move forward or backward. **Caution -- Do not engage a lot of power to move the forklift forward or backward. This may damage the emergency brake.**
12. Steering – Turn the steering wheel all the way to the left and then back all the way to the right. Does the steering perform adequately?
13. Brakes – Move the forklift forward and apply the brakes. Move the forklift backward and apply the brakes. Do the brakes perform adequately in both the forward and backward movement?
14. Backup Alarm – Move the forklift in a backward direction. Does the backup alarm make a loud sound to indicate to anyone in the proximity of the equipment that it is moving in a backward direction?

**If any of the items above are deemed unsatisfactory fill out the following form:**

Date	Checklist Item #	Description of Unsatisfactory Condition	Date Corrected	Corrected by (Employee #)

Forward completed forms to Purchasing and Property Services for forklift #Clark-TM17 and Ames Laboratory Facilities Services administrative office for the remaining forklifts. Contact each of these offices for new forms.

## 5.6 PERSONAL PROTECTIVE EQUIPMENT (PPE)

**Applicability Statement:** *This section applies to all employees, visitors and contractors who are potentially exposed to hazards of the eye, skin, feet, hands and head. Hazards encountered that can not be eliminated by engineering controls (interlocks, guards, barriers, etc.) or administrative (signs, SOP's, training), Personal Protective Equipment (safety glasses, face shields, steel toed shoes, hard hats, gloves, etc.) must be utilized.*

**Note:** *Respiratory Protection and Hearing Protection are covered specifically in the Industrial Hygiene Section of the manual.*

### 5.6.1 REFERENCES

ANSI Z41.1 Standard for Personal Protection-Protective Footwear  
ANSI Z87.1 Standard Practice for Occupational and Educational Eye and Ear Protection  
ANSI Z89.1 Standard for Personal Assurance Protection-Protective Headwear for Industrial Workers Requirements  
OSHA 1910.132 General Requirements  
OSHA 1910.133 Eye and Face Protection  
OSHA 1910.134 Respiratory Protection  
OSHA 1910.135 Head Protection  
OSHA 1910.136 Foot Protection  
OSHA 1910.137 Electrical Protective Equipment  
OSHA 1910.138 Hand and Arm Protection  
Chemical Compatibility Charts  
Form 10200.095 Personal Protective Equipment Needs Assessment  
Procedure 10200.010 Readiness Review

### 5.6.2 BACKGROUND

OSHA requires the use of Personal Protective Equipment (PPE) whenever a hazard cannot be engineered out or administratively controlled. OSHA also requires the employer to provide PPE including protective equipment for the eyes, face, head, feet, and in some instances protective clothing. Those hazards include, but are not limited to, chemical hazards, environmental hazards, radiological hazards, mechanical hazards, electrical hazards, irritants etc. Personal Protective Equipment must meet ANSI Standards for hazards identified.

Ames Laboratory is required to perform a hazard assessment and equipment selection survey. Included in this assessment, Ames Laboratory shall determine if hazards are present or are likely to be present which necessitate the use of PPE. If hazards are present, or likely to be present, Ames Laboratory shall:

1. Select and have each affected employee use the types of PPE that will protect the affected employee from the identified hazard.
2. Communicate PPE selection decisions to each affected employee.
3. Provide PPE that properly fits each employee.

### **5.6.3 PROGRAM INFORMATION**

#### **5.6.3.1 Eye Protection Requirements**

- Employees requiring eye protection shall be trained on proper use of PPE.
- Eye and face protection shall be used in any area or operation where a potential eye and/or face hazard exists.
- Protective eye and face devices shall comply with ANSI Z87.1. Eye and face PPE shall be distinctly marked to facilitate compliance.
- Contact lenses are not a form of PPE and shall not be worn in areas that have a potential for eye hazards such as when handling liquid or gaseous chemicals.
- Prescription safety glasses are provided at no cost to the employee by the research group or administrative department.
- Affected employees who wear prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design or shall wear eye protection that can be worn over the prescription lenses without disturbing the proper position of either the prescription lenses or the protective devices.
- Contractors, visitors, tours and vendors are subject to all provisions of this procedure.
- PPE for contract employees will be provided by the contract company, not Ames Laboratory.
- The Ames Laboratory escort shall be responsible for tours and visitors complying with these guidelines.
- Side shields are required on safety glasses.
- When entering areas posted with specific PPE requirements, entering those areas without the PPE is prohibited.
- When entering non-posted area where certain limited (i.e., not performed routinely) hazards operations are present, the appropriate PPE shall be worn.
- Goggles or a face shield shall be worn when transferring acids or caustics of volumes over 1 Liter (approximately 1 quart), flying particles or other eye hazards.
- Prescription lenses for full-face respirators will be provided at no cost to the employee by the research group or administrative department.

#### **5.6.3.2 Head Protection Requirements**

- Employees requiring head protection shall be trained on proper use of head protection PPE.

- Protective helmets shall comply with ANSI Z89.1.
- Protective helmets shall be worn to provide protection where there exists the threat of head injuries from impact, penetration from flying objects, or from limited electric shock and burn hazards.
- Employees, contractors, vendors and all others are subject to all provisions of this procedure. Contractor employees shall be provided head protective equipment by their contract firm or employer.
- Visitors will wear head protection in accordance with this procedure. The Ames Laboratory escort shall be responsible for the visitor complying with these requirements.

### 5.6.3.3 Foot Protection Requirements

- Employees requiring foot protection shall be trained on proper use and the limitation of foot protection PPE.
- It is mandatory that solid, non-perforated shoes be worn at all times by personnel who work in laboratories where chemical exposures are possible. Bare feet, sandals and open-toed shoes are not permitted in chemical laboratories. The need for additional foot protection such as metatarsal protection, HAZMAT boots, etc. shall be determined by the lab supervisor with assistance from the Chemical Hygiene Officer or the Industrial Safety Specialist.
- Foot protection shall be used in any area posted as required or any operation where a potential foot injury exists due to falling or rolling objects. Protective foot wear shall comply with ANSI Z41.-1991.
- Foot protection will be provided at no cost to the employee by the research group or administrative department.
- Subcontractors, Manpower, or temporary employees are subject to the requirements of this foot protection program and must assure Ames Laboratory that their employees will wear safety footwear. The subcontractor must make all of their subcontractors are aware and comply with this program.
- The requirement of safety footwear **does not pertain to visitors**, although it is required by the Ames Laboratory escort to maintain a safe distance from hazardous operations. If a safe distance can not be attained, access / exposure shall be prohibited. However, Department of Energy (DOE) employees from other locations are not considered visitors and are subject to the requirements of this program.

#### 5.6.3.4 Hand and Arm Protection Requirements

- Employees requiring hand protection shall be trained on proper use and limitations of hand and arm protection PPE.
- Hand protection shall be used in any area or operation where a potential hand hazard exists.
- Hand protection must be designed for the hazards generated.
- Contractors and vendors are subject to all provisions of this procedure. Contract employees will be provided the necessary hand protection by their contract firm or employer.
- More than one type of glove may be required based on the type of hazard(s) present.
- Employees must be able to remove the gloves in such a manner as to prevent skin contamination during removal.
- When there is a possible hazard to the forearm, extended gloves or gauntlet sleeves (forearm to wrist coverings) must be worn.
- For mixtures and formulated products (unless specific test data are available), a glove should be selected on the basis of the chemical component with the longest breakthrough time, since it is possible for solvents to carry toxic ingredients through polymeric materials.
- With respect to the selection of gloves for protection against chemical hazards, employees should contact their Supervisor/Group Leader/Manager or ESH&A.

#### 5.6.3.5 Skin Protection

Body protection must be worn to protect skin from harmful contaminants (i.e., dusts, fogs, fumes, mists, gases, smokes, sprays, vapors, or splashes), limit contamination of “street clothing,” and aid the decontamination process. Lab coats shall constitute minimum body protection when working in laboratories. Elastomeric equipment (such as acid-resistant aprons) used for chemical resistance must be used.

Another important function of lab coats is protection from fire. Although most lab coats are not designed to be flameproof, they can be quickly removed to isolate the flames. It is recommended a cotton/polyester blend be used in a research laboratory setting.

Lab coats must never be cleaned in home washing machines or general purpose [laundromats](#).

Like any other [safety equipment](#), lab coats must be worn properly in order to provide any real benefit. Every snap, button or zipper on a lab coat should be used; an open lab coat is an invitation for stray spills. Sleeves should also extend past the wrists, not rolled up for comfort or ventilation.

## 5.6.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>PERSONAL PROTECTIVE EQUIPMENT (PPE) TRAINING</b>		<b>AL-133</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignment involves use of PPE including safety glasses, face shields/goggles, foot protection, gloves, hearing protection, etc.</i>	
<b><i>Module Format:</i></b>	<i>The institutional training for PPE is either computer based training or classroom training. Both training modules contain the following information:</i> <ul style="list-style-type: none"> <li>• <i>Hazard Control Hierarchy</i></li> <li>• <i>Care and maintenance of PPE</i></li> <li>• <i>Proper fit of PPE</i></li> <li>• <i>Rules and Regulations</i></li> <li>• <i>Both require a quiz.</i></li> </ul> <i>Estimated completion time: 1.0 hours</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No Retrain, unless repeated discrepancies are observed or understanding of limitation of PPE is not retained.</i>	

Group / activity-specific PPE training shall be given to each employee prior to work. The training will include a discussion of physical hazards, chemical hazards, hazard mitigation, and, emergency response measures. This training shall be documented by the Group Leader / Department Manager.

## 5.6.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Personal Protective Equipment Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Attend PPE Training. Consult the Ames Laboratory training schedule for the next available class.
- Ensure employees and contractors performing work at the facility adhere to the PPE Program.
- Participate in Readiness Reviews to complete PPE Survey/Certification.

**Employees** shall:

- Attend required course as denoted on Employee Training Profile.
- Maintain Personal Protective Equipment in a clean and working order.
- Fully adhere to the requirements set forth in the Personal Protective Equipment Program.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct random and annual inspections to ensure employees are adhering to the Personal Protective Equipment Program.
- Develop and conduct Personal Protective Equipment Program Training.
- Survey and evaluate all Activities to determine PPE requirements based on hazards involved. See Personal Protective Equipment Needs Assessment (Form 10200.095 for certification).
- Conduct Readiness Reviews (Procedure 10200.010).

## 5.7 MACHINE GUARDING

**Applicability Statement:** *This section applies to all employees who utilize powered industrial machinery including but not limited to wood working machinery, abrasive wheel machinery, power presses, mechanical power transmission apparatus, portable machinery, metal working machinery, etc.*

### 5.7.1 REFERENCES

- OSHA 1910.212 General Requirements for All Machines
- OSHA 1910.213 Woodworking Machinery Requirements
- OSHA 1910.215 Abrasive Wheel Machinery
- OSHA 1910.216 Mills and Calendars
- OSHA 1910.217 Mechanical Power Presses
- OSHA 1910.218 Forging Machines
- OSHA 1910.219 Mechanical Power Transmission Apparatus
- OSHA 1910.242 Hand and Portable Powered Tools and Equipment
- OSHA 1910.243 Guarding of Portable Powered Equipment

### 5.7.2 BACKGROUND

The purpose of this program is to establish the minimum requirements for machine guarding to eliminate the possibility of an injury or property damage due to any moving parts of any machines if not properly guarded. Because OSHA cannot create guarding requirements for every possible machine configuration, certain general requirements have been established to ensure the safety of the operator and other employees. One or more methods of machine guarding must be provided for all machinery from hazards such as those created by point of operation, nip points, rotating parts, flying chips, sparks etc. Examples of guarding methods include:

- Barrier Guards
- Two Handed Tripping Devices
- Electronic Safety Devices
- Foot Pedals
- Presence Sensing Devices
- Light Curtains

NOTE: OSHA does not grant a grandfather clause for old equipment. All equipment must be guarded.

NOTE: Equipment specific guidelines can be obtained from ESH&A.

### 5.7.3 PROGRAM INFORMATION

The following is an index to specific machine guarding requirements:

Section	Title	Figures
5.7.3.1	General Safety Requirements For All Machinery	
5.7.3.2	Machine Controls and Equipment	
5.7.3.3	Inspection and Maintenance of Machinery	
5.7.3.4	Hand Fed Circular and Crosscut Table Saws	Appendix A1
5.7.3.5	Radial Arm Saws	Appendix A2
5.7.3.6	Band Saws	Appendix A3
5.7.3.7	Drill Presses	Appendix A4
5.7.3.8	Abrasive Wheel Machinery	Appendix A5
5.7.3.9	Portable Abrasive Wheels	
5.7.3.10	Metal Cut Off Saw	Appendix A6
5.7.3.11	Vertical Milling Machine	Appendix A7
5.7.3.12	Lathe	Appendix A8
5.7.3.13	Surface Grinder	Appendix A9
5.7.3.14	Ames Laboratory Fabricated Equipment	

#### 5.7.3.1 Requirements for All Machinery & Equipment

- One or more methods of machine guarding must be provided to protect the operator and other employees for all machinery from hazards such as those created by point of operation, nip points, rotating parts, flying chips and sparks. Examples of guarding methods are:
  - Barrier Guards;
  - Two-handed Tripping Devices;
  - Electronic Safety Devices;
  - Foot Pedals;
  - Presence Sensing Devices;
  - Light Curtains.
- The point of machine operation which exposes an employee to injury must be guarded. The guarding device must be in conformity with any appropriate standard and in the absence of applicable specific standards must be so designed and constructed as to prevent the operator from having any part of his/her body in the danger zone during the operating cycle.
- Old and new machines and equipment must meet the requirements of this section. If equipment has been purchased without the required guarding or the guarding has been removed, the equipment must be locked and tagged out of service (see Section 5.12) until the appropriate guarding is provided.

- Special handling tools for placing, removing, and manipulating material must be designed to permit easy handling of material without the operator placing a hand in the danger zone. Such tools must not be in lieu of other guarding required by this program, but can only be used to supplement protection provided.
- Revolving barrels, containers and drums must be guarded by an enclosure, which is interlocked with the drive mechanism so that the barrel, container or drum cannot revolve unless the guard enclosure is in place.
- Do not wear loose clothing around moving parts that could get caught and pulled into the equipment.
- Ensure long hair is controlled. The best way to do this is to put it in a bun or under a hat or hair net. Remember that long beards and mustaches can also become caught in machinery.
- Do not wear jewelry that could get caught in machinery.
- Vibrating machinery designed for a fixed location must be securely anchored to the floor to prevent walking or moving.
- Any employee who operates machinery must be trained in the proper operation of the machinery, be familiar with the hazards of the machinery, and use appropriate protective devices while operating the machinery.
- Malfunctioning machinery must be reported immediately to Facilities Services Group or Engineering Services Group and the machine must be locked and tagged out of service (see Section 5.12) with a sign indicating “Out of Service”, “Machine Guarding Absent”, etc. Signs may be obtained from ESH&A.
- Guards may not be removed during any operation. Guards shall prevent access to the danger area from the top, front, sides, bottom and back.
- All guards must be designed for the specific job and machine with provisions made for oiling, inspecting, adjusting and repairing of machine parts.
- All belts, pulleys, gears, sprockets, shafts, chains and moving parts must be guarded.
- When the blades of a fan are less than seven (7') feet above the floor or working level, the blades shall be guarded. The guard shall have no openings larger than one half (1/2') inch.
- Signs shall be posted on machinery to communicate hazardous conditions (Danger, Caution, Warning) per 29 CFR 1910.145 (Specifications for Accident Prevention Signs and Tags).

### **5.7.3.2 Machine Controls and Equipment**

- A mechanical or electrical power control device must be provided at the point of operation on each machine to make it possible for the operator to cut off the power from each machine

without leaving his/her position. The power controls must be located so as to make it unnecessary for him/her to reach over the hazard to make adjustments.

- Where injury to the operator might result if motors were to restart after a power failure, provisions must be made to prevent machines from automatically restarting upon restoration of power.
- For each machine operated by electric motors or stored hazardous energy, positive means must be provided for rendering such controls or devices inoperable while repairs or adjustments are being made to the machines they control (see Section 5.12 Lockout/Tagout Program in the ESH&A Program Manual).
- Servicing or performing maintenance of equipment powered by cord and plug can be disconnected by unplugging from wall outlet. The cord must be locked out if the male end is not in control of the operator at all times.
- Each operating pedal/treadle must be protected against unexpected or accidental activation/tripping.

### **5.7.3.3 Inspection and Maintenance of Machinery**

The following are the Inspection and Maintenance Requirements for Machinery:

- Immediately remove from service all dull, badly set, improperly filed or improperly tensioned saws before they begin to cause material to stick, jam, or kick back.
- Maintain all knives and cutting heads of machines sharp, properly adjusted and firmly secured.
- Keep all bearings free from loose motion and well lubricated.
- Arbors of all circular saws must be free from play (it should not be loose when pressure is applied against the arbor).
- Clean woodworking machinery after each use to ensure the effectiveness of guards and the prevention of fire hazards in switch enclosures, bearings, and motors.
- All cracked saws must be removed from service.
- Inserting wedges between saw blades and the collar to form a “Wobble Saw” is not permitted.

### **5.7.3.4 Requirements for Table Saws**

- Push sticks or push blocks must be provided at the saw or other equipment requiring such in the several sizes and types suitable for the work to be done.

- Circular hand-fed rip and crosscut table saws must be guarded by a hood which must completely enclose that portion of the saw above the table and that portion of the saw above the material being cut. The hood and mounting must be so arranged so that the hood will automatically adjust itself to the thickness of and remain in contact with the material being cut. The hood must not offer any considerable resistance to insertion of the material to saw or to passage of the material being sawed.
- The rip saw must be furnished with a spreader to prevent material from squeezing the saw blade. The spreader must be so attached that it will remain in true alignment with the saw even when blade is tilted.

NOTE: A spreader in connection with grooving, dadoing, or rabbeting is not required. On completion of such operations, the spreader must be immediately replaced.

- The rip saw must be furnished with non-kickback fingers or dogs so located as to oppose the thrust or tendency of the saw to pick up the material or to throw it back toward the operator.

See Appendix A1 for Table Saw Guarding Examples.

#### **5.7.3.5 Requirements for Radial Arms Saws**

- The upper portion of the blade must be completely enclosed including the end of the saw arbor. The sides of the lower exposed portion of the blade must be guarded to the full diameter of the blade by a device that will automatically adjust itself to the thickness of the stock and remain in contact with stock being cut to give maximum protection possible for the operation being performed.
- Radial arm saws used for ripping must be provided with non-kickback fingers or dogs located on both sides of the saw so as to oppose the thrust or tendency of the saw to pick up the material or to throw it back toward the operator.
- An adjustable stop must be provided to prevent the forward travel of the blade beyond the position necessary to complete the cut in repetitive operations.
- Installation must be in such a manner that the front end of the unit will be slightly higher than the rear, so as to cause the cutting head to return gently to the starting position or a mechanical return mechanism must be used.
- Ripping must be against the direction the saw turns.

See Appendix A2 for Radial Arm Saw Guarding Examples.

#### **5.7.3.6 Guarding Requirements for Band Saws**

- All portions of the saw blade must be enclosed or guarded except for the working portion of the blade between the bottom of the guide rolls and the table. Bandsaw wheels must be fully encased. The outside periphery of the enclosure must be solid. The front and back of the band wheels must be either enclosed by solid material or by wire mesh or perforated metal.

Such mesh or perforated metal must not be less than .037 inch (U.S. Gage No. 20) and the openings must not be greater than three-eighths inch.

- The guard must be self adjusting to raise and lower with the guide. The upper wheel guard must be made to conform to the travel of the saw on the wheel.
- Each bandsaw must be provided with a tension control device to indicate a proper tension for the standard saws used on the machine, in order to assist in the elimination of saw breakage due to improper tension.

See Appendix A3 for Band Saw Guarding Examples.

#### **5.7.3.7 Requirements for Drill Presses**

- Because a drill press is top heavy, all drill presses must be bolt anchored to the floor.
- The electrical disconnect switch must be readily available and lockable. The switch must also be readily identifiable and located on the machine.
- The work must be restrained / secured to prevent material rotation.

See Appendix A4 for Drill Press Guarding Examples.

#### **5.7.3.8 Requirements for Guarding Abrasive Wheels**

- The safety guards must cover the spindle end, nut and flange projections.
- The safety guard must be mounted to maintain proper alignment with the wheel and the strength of the fasteners must exceed the strength of the guard.
- Grinding machines must be equipped with flanges.
- Work rests must be used to support the work. The work rests must be of rigid construction and designed to be adjustable to compensate for wheel wear. Work rests must be kept adjusted closely to the wheel with a maximum opening of 1/8 inch to prevent the work from being jammed between the wheel and the rest, which may cause breakage. The work rest must be adjusted immediately when out of tolerance. Check the tolerance after each use.
- Tongue guards must be used to enclose the upper portion of the abrasive wheel. The tongue guard must be of rigid construction and designed to be adjustable to compensate for wheel wear. Tongue guards must be kept adjusted closely to the wheel with a maximum opening of 1/4 inch to prevent material/fragments from flying towards the operator. The tongue guard must be adjusted immediately when out of tolerance. Check the tolerance after each use.
- All abrasive wheels must be mounted between flanges which are not less than one-third the diameter of the wheel.

- Immediately before mounting, all wheels must be closely inspected and ring tested by the user to ensure they have not been damaged in transit, storage, or otherwise. A ring test procedure for abrasive wheels consists of lightly tapping the wheel with a nonmetallic device. An undamaged wheel will produce a clear “ring”. A cracked wheel will sound dull or “dead”. Immediately remove from service any wheel that fails the ring test. Render the wheel unusable (break) and discard in the trash.
- The spindle speed of the machine must be checked before mounting of the wheel to be certain that it does not exceed the maximum operating speed marked on the wheel.

See Appendix A5 for Abrasive Wheel Guarding Examples.

NOTE: Natural sand stone wheels and metal, wooden, cloth or paper discs having a layer of abrasive on the surface are not regulated by OSHA.

### **5.7.3.9 Requirements for Portable Abrasive Wheels**

- A safety guard must cover the spindle end nut and flange projections. The safety guard must be mounted so as to maintain proper alignment with the wheel.
- Safety guards must have a maximum exposure angle of 180 degrees (covering one half of the wheel) and the guard must be so located so as to be between the operator and the wheel during use. Adjustment of the guard must be such that pieces of an accidentally broken wheel will be deflected away from the operator.
- All wheels must be closely inspected and ring tested by the user prior to mounting on the equipment.
- The spindle speed of the machine must be checked with the rating of the wheel being used.
- All contact surfaces of wheels, blotters and flanges must be flat and free of foreign matter.
- When a bushing is used in the wheel hole, it must not exceed the width of the wheel and must not contact the flanges.

NOTE: The requirements of portable grinders do not apply to:

- wheels with a diameter of 2 inches or less;
- wheels used for internal grinding while within the work being ground; or
- cloth or paper discs having a layer of abrasive on the surface.

#### **5.7.3.10 Requirements for Metal Cut Off Saws**

- Stock fastening chuck must be functional and in use;
- Power transmission mechanism must be fully guarded;
- Check blade travel for proper direction; and
- Ensure unused portion of blade is guarded against accidental contact.

See Appendix A6 for Cut Off Saw Guarding Requirements.

#### **5.7.3.11 Requirements for Vertical Milling Machines**

- Hand-wheels must be disengaged to prevent inadvertent motion in rapid traverse;
- Power transmission system must be guarded;
- Electrical disconnect switch is readily available and lockable; and
- Electrical disconnect is properly identified and located on machine

See Appendix A7 for Vertical Milling Machine Guarding Requirements.

#### **5.7.3.12 Requirements for Lathes**

- Power transmission system must be guarded;
- Electrical disconnect switch must be readily available and lockable;
- Electrical disconnect must be properly identified and located on machine; and
- No protrusions on chuck or faceplate beyond the periphery unless guarded.

See Appendix A8 for Lathe Guarding Requirements.

#### **5.7.3.13 Requirements for Surface Grinders**

- Machine must be bolted/anchored to prevent movement (walking) from vibration;
- Spindle speed and wheel speed must match;
- Power transmission system must be guarded;
- Table shields must be in place;
- Wheel guard cover must cover at a minimum 210 degrees of wheel;
- Electrical disconnect switch must be readily available and lockable; and
- Electrical disconnect must be readily identifiable and located on machine.

See Appendix A9 for Surface Grinder Guarding Requirements.

#### **5.7.3.14 Ames Laboratory Fabricated Equipment**

Although not all equipment is mentioned in this program, all equipment which poses a hazard (which is not exempted) must be guarded including hydraulic, pneumatic, mechanical, gravitational, electrical, etc. See Section 5.7.3.1 of this program for guarding requirements for equipment internally manufactured by Ames Laboratory.

## 5.7.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>MACHINE GUARDING TRAINING</b>		<b>AL-131</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for Safety Coordinators and Representatives within the scientific areas and those employees who are exposed to injury from machinery (pinch points, belts and pulleys, chains, shafts, etc.) which has not been eliminated by the use of a guard. It is suggested for Group Leaders.</i>	
<b><i>Module Format:</i></b>	<i>Module is classroom. Module consists of slides, discussion and exam. Estimated completion time: 1.5 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Five-year retrain</i>	

Group / activity-specific machine guarding training shall be given to each employee prior to start of work. Training will include a discussion of physical hazards, safety precautions, PPE, hazard mitigation, emergency response measures, procedural information and other safety information. This training shall be documented by the Supervisor / Group Leader / Department Manager.

## 5.7.5 PERFORMANCE CHECKLISTS

**Supervisor / Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Machine Guarding Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Attend Machine Guarding Training. Consult the Ames Laboratory training schedule for the next available class.
- Ensure employees and contractors performing work at the facility adhere to the Machine Guarding Program.
- Inspect equipment on a periodic basis to ensure guards are in place and in proper working condition.

**Employees** shall:

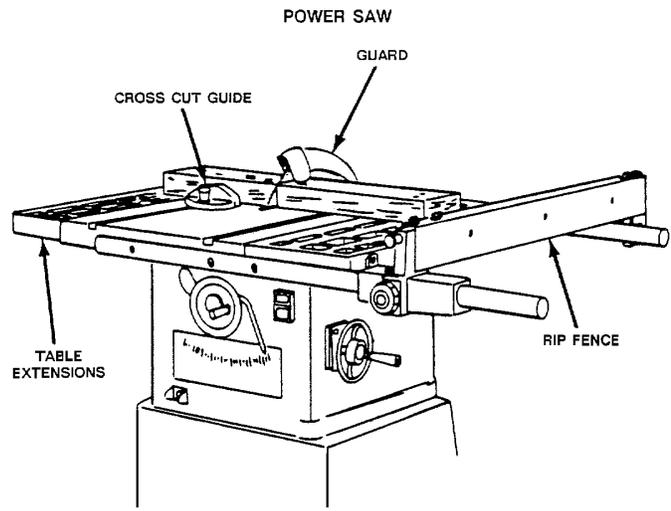
- Attend required course as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Fully adhere to the requirements set forth in the Machine Guarding Program.
- Shut down any equipment not properly guarded and promptly report to your Supervisor/Group Leader/Department Manager.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct inspections through the Annual Walk-Through Program to ensure machines are guarded properly.
- Develop and conduct Machine Guarding Training and refresher training.
- Post signs as necessary for machine guarding requirements.
- Lockout/Tagout equipment not meeting guarding requirements as necessary.

## Appendix A1

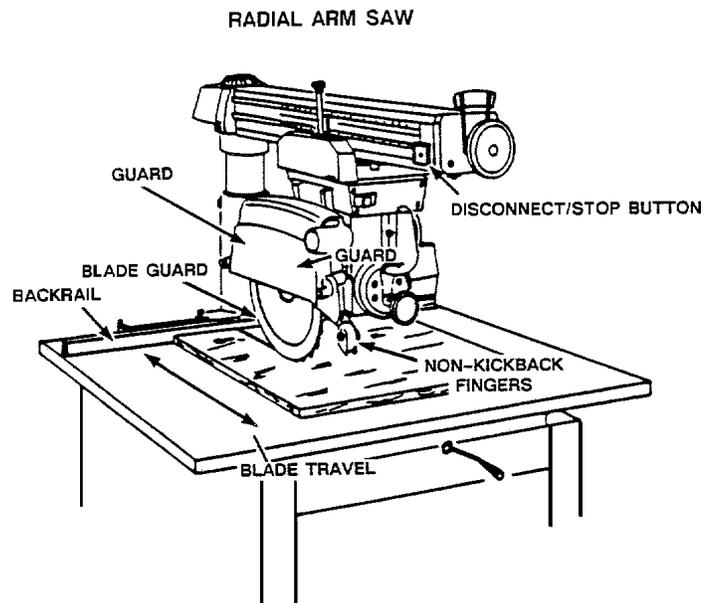
### Power Saw Guarding



- Hood Guard over Blade
- Spreader for Rip Sawing
- Anti-Kickback Devices (dogs)
- Electrical Disconnect Switch Readily Available and Lockable (Unless cord & plug connected)
- Electrical Disconnect Properly Identified and Located On Machine

## Appendix A2

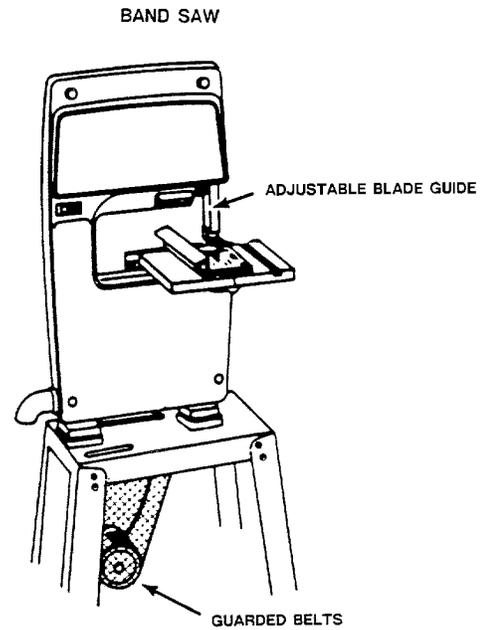
### Radial Arm Saw Guarding



- Backrail In Place to Hold Wood
- Hooded Guard to Cover Top of Blade
- Retractable Guard On Each Side of Saw Blade
- Non-Kickback Fingers for Use When Ripping
- Stop to Prevent Forward Travel Past Table Edge
- Head Returns Automatically to Rear When Released By Operator
- Electrical Disconnect Switch Readily Available and Lockable
- Electrical Disconnect Properly Identified and Located On Machine

## Appendix A3

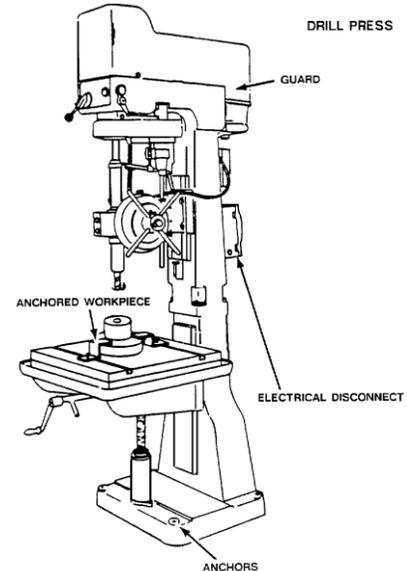
### Band Saw Guarding



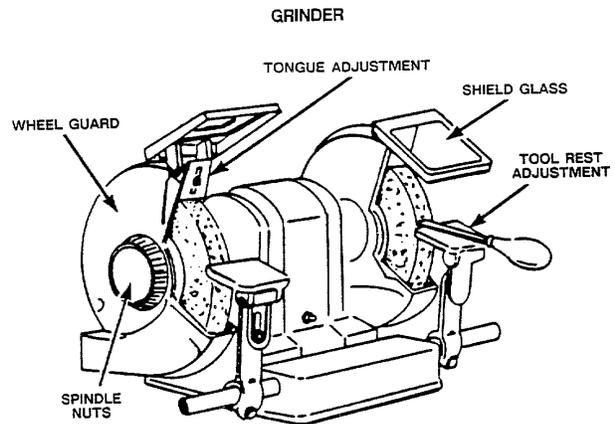
- All Belts Are To Be Guarded
- Disconnect Switch Must Be Located On Machine
- Guard Should Be Adjusted To Within 1/8" Of Stock
- Disconnect Switch Must Be Lockable and Properly Identified
- Adjustable Blade Guard To Enclose Entire Blade Except For Material Being Cut

## Appendix A4

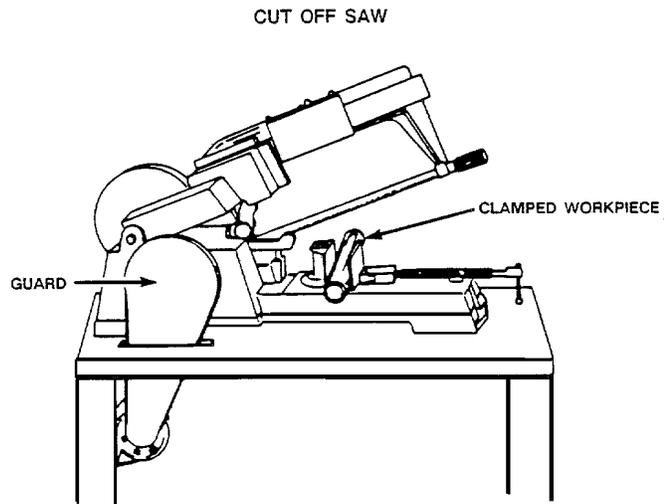
### Drill Press Guarding



- Drill Press Must Be Anchored To The Floor
- Power Transmission System Guarded
- Electrical Disconnect Switch Readily Available and Lockable
- Electrical Disconnect Readily Identifiable and Located On Machine
- The Work Must Be Restrained / Secured To Prevent Material Rotation.

**Appendix A5****Grinder Guarding**

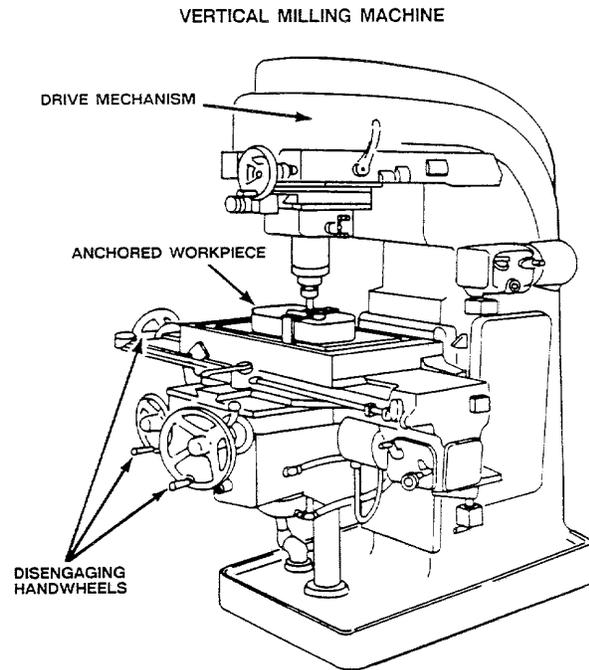
- Spindle Nuts Guarded
- Lockable Disconnect Switch
- Shield Glass To Be Clean and Free of Cracks
- Wheel Guard To Cover 210 Degrees Of Wheel
- Tongue Guard Not To Exceed 1/4 Inch Gap
- Tool Rest Adjustment Not To Exceed 1/8 Inch Gap
- Wheel Blotters To Be Used Between Wheel and Flanges
- Flanges and /or Special Nut and Flange Combinations As Designed For The Grinder Shall Be Used

**Appendix A6****Cut Off Saw Guarding**

- Stock Fastening Chuck Secure
- Power Transmission System Guarded
- Unused Portion Of Blade Guarded

## Appendix A7

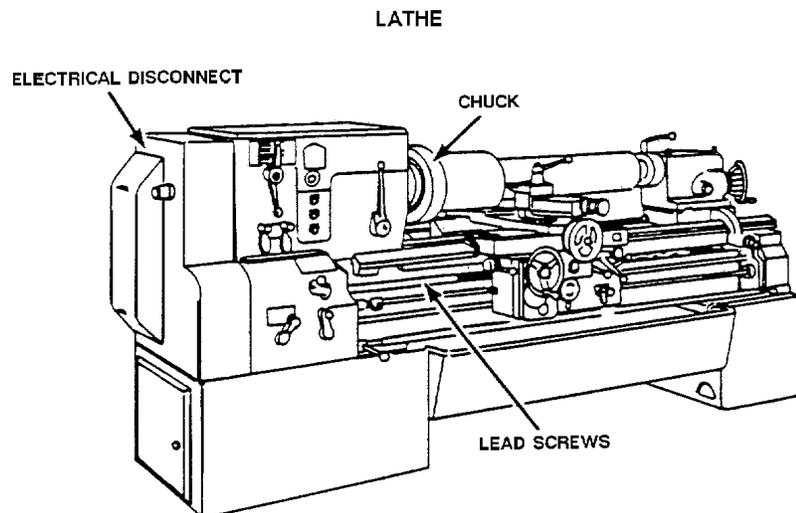
### Vertical Milling Machine



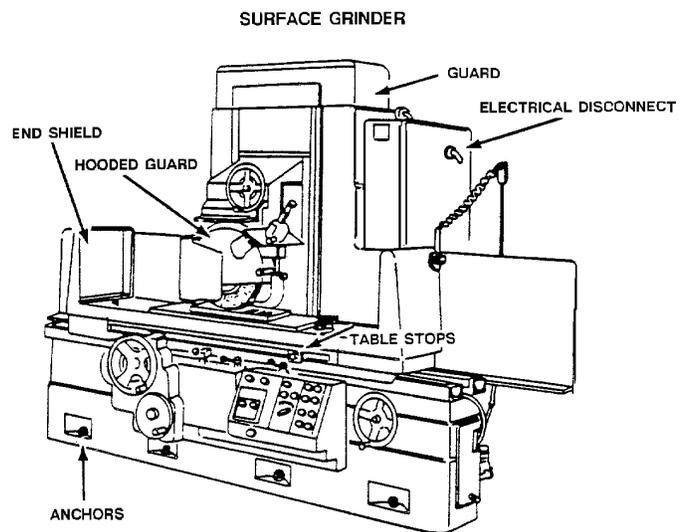
- Power Transmission System Guarded
- Electrical Disconnect Switch Readily Available and Lockable
- Electrical Disconnect Readily Identifiable and Located On Machine

## Appendix A8

### Lathe



- Power Transmission System Guarded
- Electrical Disconnect Switch Readily Available and Lockable
- Electrical Disconnect Readily Identifiable and Located On Machine
- Feed Rods And Lead Screws Within Envelope Of Machine
- No Protrusions On Chuck Or Faceplate Beyond Its Periphery Unless Guarded
- Chuck Guards and Chip Guards Required
- Remove loose clothing and jewelry that could get caught.
- Control long hair (i.e., put it in a bun, under a hat, or in a hair net).

**Appendix A9****Surface Grinder**

- Table Shields In Place
  - Match Spindle And Wheel Speeds
  - Power Transmission System Guarded
  - Wheel Guarded Covered A Minimum of 210 Degrees Of Wheel
  - Electrical Disconnect Switch Readily Available and Lockable
  - Electrical Disconnect Readily Identifiable and located On Machine
-

## 5.8 HAND AND PORTABLE POWER TOOLS

*Applicability Statement: This section applies to all employees and contractors using hand and portable powered tools.*

### 5.8.1 REFERENCES

OSHA 1910.241 Hand Held and Portable Power Tools and Other Hand Held Equipment  
OSHA 1910.242 Hand and Portable Power Tools and Equipment, General  
OSHA 1910.243 Guarding of Portable Power Tools  
OSHA 1910.244 Other Portable tools and Equipment  
Manual 46200.001 Electrical Safety Manual

### 5.8.2 BACKGROUND

The program applies to all employees and contractors who use hand and portable power hand tools and is to provide minimum requirements for the maintenance, inspection and use.

### 5.8.3 PROGRAM INFORMATION

#### 5.8.3.1 General Requirements

- Tools shall be kept in good repair, sharpened, not damaged, etc.
- Hand tools shall not be painted other than by the manufacturer.
- Approved eye protection shall be worn by all employees when:
  - work may produce flying chips or debris
  - using force cutting tools
  - working overhead
- If tools are in poor condition, unsafe or do not meet regulations, the tools must be removed from service, tagged as defective and replaced immediately. All tools, including contractors' tools are subject to inspection.
- Cracked saws shall be removed from service.
- Portable electric powered tools shall meet the requirements of Ames Laboratory Electrical Safety Manual (46200.001).

#### 5.8.3.2 Knives or Edged Tools

- **Knives and pointed or edged tools** shall:
  - be directed away from the body
  - not be carried in pockets but carried in sheaths or protective holders
  - be stored in a rack, tool box, or other safe location

- A **chisel** shall not be used as a pry or a wedge. Chisels with mushroomed heads shall be removed from service until repaired.
- **Screwdrivers:**
  - Blades and handles must be smooth, clean, and in good condition.
  - Must not be used as punches, chisels, levers or nail pullers.
  - Only insulated screwdrivers shall be used on electrical work.
  - Must not be carried in pockets.
  - When using a screwdriver, the material being worked on shall not be held in the hand.
  - Screwdrivers shall only be used for the appropriate size screw.
- A **file** shall not be:
  - used without a handle on the tang
  - cleaned by striking against a vise or other metal object
  - hammered or struck by any metal object
  - used as a pry or a wedge
  - Cracked files shall be discarded

### 5.8.3.3 Miscellaneous Hand Tools

- Cracked heads and loose or cracked handles on **hammers** shall be replaced immediately.
- Hammers with mushroomed heads or with checked or chipped faces shall not be used.
- Hammer-heads shall fit tightly and handles shall be securely wedged. Nails shall not be used in place of a wedge. Steel or cast iron hammers shall not be used on hardened pins.
- A **wrench** that is bent, cracked, battered, or has a loose or broken handle shall not be used. A piece of pipe slipped over the handle of a wrench, or other means to gain additional leverage is not permitted.
- **Wire cutting tools (dikes)** shall be held such that flying cuttings are directed towards the floor and away from the user's body.

### 5.8.3.4 Guards

- All portable, power-driven circular saws having a blade diameter greater than 2 inches shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to covering position.
- Right angle grinders shall have minimum exposure angle of 180 degrees and the guard shall be so located so as to be between the operator and the wheel during use.

- A physical barrier must be in place between an operator and passers-by for hazards generated as a result of hand tools, powered tools, and compressed air.
- Guards may not be removed during any operation. Guards shall prevent access to the danger area from the top, front, sides, bottom and back.
- If equipment has been purchased without the required guarding or the guarding has been removed, the equipment must be locked out of service (see Section 5.12), made inoperable or removed from the premises until guarding is provided.

#### **5.8.4 TRAINING**

Currently, there is no institutional training module for the Hand and Portable Power Tools. However, all affected populations are required to read this program and comply with the requirements discussed in this section.

Group / activity-specific hand and portable power tool training shall be given to each employee prior to start of work. The training will include a discussion of physical hazards, proper use of tools, hazard mitigation, emergency response measures and inspection. This training shall be documented by the supervisor.

#### **5.8.5 PERFORMANCE CHECKLISTS**

**Supervisors / Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Hand and Portable Power Tools Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Ensure employees and contractors performing work at the facility adhere to the Hand and Portable Power Tool Program.
- Ensure employees and contractors performing work at the facility adhere to the Hand and Portable Power Tools Program.

**Employees** shall:

- Attend required courses as denoted on Employee Training Profile.
- Inspect tools and equipment prior to every use.
- Fully adhere to the requirements set forth in the Personal Protective Equipment Program (see Section 5.6 of this manual).

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct inspections through the annual Walk-Through Program to ensure hand tools and portable power tools guarded properly.
- Develop and conduct Hand and Portable Power Tool Training and refresher training.
- Investigate any accidents involving hand and portable power tools.

## **5.9 COMPRESSED AIR**

*Applicability Statement: This section applies to all employees and contractors using compressed air.*

### **5.9.1 REFERENCES**

OSHA 1910.169 Air Receivers

OSHA 1910.242(b) Compressed Air Used For Cleaning

ISU EH&S Gas Cylinder Safety Guidelines

Manual 10200.002 ESH&A Program Manual, Compressed / Liquefied Gases, Section 4.3

### **5.9.2 BACKGROUND**

This program applies to all employees who use compressed air and is to provide minimum requirements for the maintenance, inspection and use of compressed air.

### **5.9.3 PROGRAM INFORMATION**

#### **5.9.3.1 Compressed Air Receiver Rules**

- Position all drains, hand-holes, and manholes on all air receivers in easily accessible locations.
- Install a drain pipe and valve at the lowest point of the air receiver to remove accumulated oil and water.

**NOTE:** The drain pipe and valve must vent internally to buildings or have a receiving vessel of sufficient size to prevent spills of accumulated oil and water to the outside.

- Open the valve and drain frequently to avoid oil and water buildup. Do not drain oil and water to the ground or any other area outside.
- Verify that filters for the removal of oil and water from the air line will function efficiently at the maximum anticipated air flow and maximum degree of contamination in the line.
- Install easy to read gauges on air receivers.
- All compressed air receivers must have one or more spring-loaded safety relief valves providing a total pressure relief that keeps pressure in the receiver from exceeding the maximum rated pressure by 10 percent.
- Do not place a valve in line between the air receiver and its safety relief valve(s). The safety relief valve must be between air receiver and the valve(s).

- Safety relief valves, indicating devices, and controlling devices must be tamper-proof and weather proof.
- All air receivers must be constructed according to the ASME Boiler and Pressure Vessel Code, Section VIII, 1968 edition or later, as long as the later edition meets or exceeds the requirements of the 1968 edition. (See Engineering Services Group for guidance).
- Air receivers may not be buried underground or located in an in-accessible area.

#### **5.9.3.2 Air Compressor Receiver Hose and Attachment Maintenance**

- Test each safety relief valve to make sure it will operate properly at pressures at least 10 percent greater than the maximum operating pressure of the machine it is installed on.
- Test all other valves to ensure proper function at maximum rated pressure.
- Inspect valve fittings and hose attachments for signs of corrosion and wear.
- Inspect air lines for cracking, bulging, or other signs of weakness and wear.
- Destroy and discard hoses that are worn, cracked, or show other signs of exposure or aging.
- Remove from service and repair/replace all attachments that do not pass inspection.

#### **5.9.3.3 Cleaning with Compressed Air**

- Compressed air shall not be used for cleaning purposes except where the pressure is reduced to less than 30 p.s.i. and then only with effective chip guarding and personal protective equipment.
- Use personal protective equipment (safety glasses, face shield, long sleeve shirt, gloves, etc.) when operating the air hose.
- Never direct air under pressure toward yourself or another person.

## 5.9.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>COMPRESSED AIR SAFETY</b>		<b>AL-161</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for Facilities Services Crafts Workers and Engineering Services Machinists</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction. Estimated completion time: 1.0 Hour</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No retrain</i>	

Group / activity-specific training on compressed gas usage shall be given to each employee prior to work that includes a discussion of specific hazards, hazard mitigation, equipment operation, location of MSDSs and other safety information, emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager and the records maintained for a period of five years.

## 5.9.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Compressed Air Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Consult the Ames Laboratory training schedule for the next available class.
- Ensure employees and contractors performing work at the facility adhere to the Compressed Air Program.

**Employees** shall:

- Attend required courses as denoted on Employee Training Profile.
- Fully adhere to the requirements set forth in the Compressed Air Program.
- Attend "Cylinder Safety Training", (AL-022) training.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct inspections through the Annual Walk-Through Program to ensure air nozzles are equipped with either chip shields or safety relief devices.
- Develop and conduct Compressed Air training and refresher training.

## **5.10 WELDING, CUTTING AND BRAZING PROGRAM**

*Applicability Statement:* This section applies to all employees and contractors using welding, cutting, brazing and other open-flame equipment.

### **5.10.1 REFERENCES**

ANSI B57.1-1965 Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections,  
which is incorporated by reference as specified in Sec. 1910.6  
ANSI Z49.1-1967 Safety in Welding and Cutting published by the American Welding Society  
ANSI Z87.1-1968 Standard Practice for Occupational and Educational Eye and Face Protection,  
which is incorporated by reference as specified in Sec. 1910.6. (b)(2)(iii)  
OSHA 1910.251 Welding, Cutting and Brazing Program  
OSHA 1910.252 General Requirements  
OSHA 1910.253 Oxygen-Fuel Gas Welding and Cutting  
OSHA 1910.254 Arc Welding and Cutting  
OSHA 1910.255 Resistance Welding  
NFPA 51 Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting and Allied  
Processes  
NFPA 51B Standard for Fire Prevention in Use of Cutting & Welding Processes  
Section 8 Fire Protection of ESH&A Program Manual  
Procedure 46200.001 Welding Program (Engineering Services Group)  
Procedure 46300.001 Welding Program (Facilities Services Group)

### **5.10.2 BACKGROUND**

The program applies to all employees who perform welding, cutting and brazing.

### **5.10.3 PROGRAM INFORMATION**

#### **5.10.3.1 Fire Prevention and Protection for Welding, Cutting and Brazing**

There are generally two types of Hot Work; Designated and Transient.

- Designated areas are where Hot Work is routinely performed. The evaluation of the protection needs shall be done during the Readiness Review evaluations. Prior to starting a new Hot Work operation, the employee must complete a Readiness Review for a designated area. Changes in fuel loading, materials used, or type of Hot Work conducted may necessitate re-opening the Review.
- Transient Hot Work is usually task driven, such as soldering plumbing pipes. It is typically done outside a designated Hot Work area, and by employees who may lack day-to-day familiarity with the hazards of the area. A Hot Work Permit is required for a transient operation. Hot Work Permit forms (Form 10200.096) may be picked up from the Plant Protection Section Office in G34 TASF. See Section 8 of the ESH&A Program Manual for specifics on Hot Work Permits.

- If the object to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guards shall be used to confine the heat, sparks, and slag, and to protect the immovable fire hazards.
- If the welding or cutting cannot be performed in a safe location or the flammable/combustible materials cannot be relocated or guarded, then welding and cutting shall not be performed.
- Wherever there are floor openings or cracks in the flooring that cannot be closed, precautions shall be taken so that no readily combustible materials on the floor below will be exposed to sparks which might drop through the floor. The same precautions shall be observed with regard to cracks or holes in walls, open doorways and open or broken windows.
- Suitable fire extinguishing equipment shall be maintained in a state of readiness for instant use. Such equipment may consist of pails of water, buckets of sand, hose or portable extinguishers depending upon the nature and quantity of the combustible material exposed.
- Fire watchers shall be required whenever welding or cutting is performed in locations where other than a minor fire might develop, or any of the following conditions exist:
  - Appreciable combustible material closer than 35 feet to the point of operation must be relocated,
  - Flame-proofed covers are used to eliminate the potential for fires, and
  - Materials are otherwise shielded with metal or guards or welding curtains.
- Fire watchers shall have fire extinguishing equipment readily available and be trained in its use. They shall be familiar with methods for sounding an alarm in the event of a fire. They shall watch for fires in all exposed areas, try to extinguish them only when obviously within the capacity of the equipment available, or otherwise sound the alarm. A fire watch should be maintained for at least a half-hour after completion of welding or cutting operations to detect and extinguish possible smoldering fires. See Section Fire Protection Program of this manual for additional information.
- Before cutting or welding is permitted, the area shall be inspected by the individual responsible for authorizing cutting and welding operations. He/she shall designate precautions to be followed in granting authorization on to proceed with the Hot Work Permit.
- Cutting or welding shall not be permitted in the following situations:
  - In areas not authorized by management.
  - In sprinklered buildings while such protection is impaired.
  - In the presence of explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air), or explosive atmospheres that may develop inside uncleaned or improperly prepared tanks or equipment which have previously contained such materials, or that may develop in areas with an accumulation of combustible dusts.
- No welding, cutting, or other hot work shall be performed on used drums, barrels, tanks or other containers until they have been cleaned so thoroughly as to make absolutely certain that there are no flammable materials present. Any substances such as greases, tars, acids, or

other materials which, when subjected to heat, might produce flammable or toxic vapors must also be removed. Any pipe lines or connections to the drum or vessel shall be disconnected or blanked.

- Personal Protective Equipment shall include:
  - Eye protection.
  - Helmets or hand shields shall be used during all arc welding or arc cutting operations.
  - Helpers or attendants shall be provided with proper eye protection.
  - Goggles or other suitable eye protection shall be used during all gas welding or oxygen cutting.
  - All filter lenses and plates shall meet the test for transmission of radiant energy prescribed in ANSI Z87.1-1968 - American National Standard Practice for Occupational and Educational Eye and Face Protection, which is incorporated by reference as specified in Sec. 1910.6. (b)(2)(iii).
  - Apron, sleeves and gloves as necessary depending on the type of welding and duration of welding to be performed.
- To eliminate the possibility of gas escaping through leaks of improperly closed valves, the torch valves shall be closed and the fuel-gas and oxygen supply to the torch positively shut off whenever the torch is not in use for a substantial period of time (i.e., over the weekend).
- Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. Use adequate ventilation. See ANSI Z49.1-1967 Safety in Welding and Cutting published by the American Welding Society. Contact ESH&A with questions pertaining to specific metals to be welded, cut or brazed.

### **5.10.3.2 Requirements for Oxygen and Fuel Gases**

- Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or the trade name of the gas. Such marking shall be by means of stenciling, stamping, or labeling, and shall not be removable.
- Compressed gas cylinders shall be equipped with connections complying with the American National Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections, ANSI B57.1-1965, which is incorporated by reference as specified in Sec. 1910.6.
- All cylinders with a water weight capacity of over 30 pounds (13.6 kg) shall be equipped with means of connecting a valve protection cap or with a collar or recess to protect the valve.
- Backflow protection shall be installed by an approved device that will prevent oxygen from flowing into the fuel gas or from fuel gas from flowing into the oxygen.
- Approved flashback protection shall be installed that will prevent flame from passing into the fuel gas cylinder.

### 5.10.3.3 General Storage of Cylinders

- Cylinders shall be kept away from radiators and other sources of heat.
- Cylinders inside of buildings shall be stored in a well-protected, well-ventilated, dry location at least 20 (6.1 m) feet from highly combustible materials such as oil or excelsior. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways.
- Assigned storage spaces shall be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering by unauthorized persons.
- Empty cylinders shall have their valves closed.
- Acetylene cylinders shall be stored valve end up.
- Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

### 5.10.3.4 Requirements for Operating Procedures

- Cylinders, cylinder valves, couplings, regulators, hose, and apparatus shall be kept free from oily or greasy substances. Oxygen cylinders or apparatus shall not be handled with oily hands or gloves. A jet of oxygen must never be permitted to strike an oily surface, greasy clothes, or enter a fuel oil or other storage tank.
- Cylinders shall not be dropped or struck or permitted to strike each other violently.
- Valve protection caps shall not be used for lifting cylinders from one vertical position to another.
- Bars shall not be used under valves or valve-protection caps to pry cylinders loose when frozen to the ground or otherwise fixed. The use of warm (not boiling) water is recommended. Valve protection caps are designed to protect cylinder valves from damage.
- Cylinder valves shall be closed before moving cylinders.
- Cylinder valves shall be closed when work is finished.
- No person, other than the gas supplier, shall attempt to mix gases in a cylinder. No one, except the owner of the cylinder or person authorized by him, shall refill a cylinder.
- Unless connected to a manifold, oxygen from a cylinder shall not be used without first attaching an oxygen regulator to the cylinder valve. Before connecting the regulator to the cylinder valve, the valve shall be opened slightly for an instant and then closed to purge dust/debris so as not to enter the manifold. Always stand to one side of the outlet when opening the cylinder valve.

### 5.10.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>Welding Safety and Hot Work</b>		<b>AL-149</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for Ames Laboratory individuals who perform electric or gas welding and cutting.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction with video. Estimated completion time: 1 Hour</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three-year retrain. Retrain module consists of Classroom and video.</i>	

### 5.10.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Welding, Cutting and Brazing Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Consult the Ames Laboratory training schedule for the next available class.
- Ensure employees and contractors performing work at the facility adhere to the Welding, Cutting and Brazing Program.

**Employees** shall:

- Attend required courses as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Fully adhere to the requirements set forth in the Personal Protective Equipment Program.
- Taking necessary precautions outlined in this program.
- Locating a Fire Watch as outlined in this program (trained in the use of a fire extinguisher).

**Fire Watch** shall:

- Check that fire extinguisher equipment is readily available (must be trained in the use of a fire extinguisher).
- Know how to sound the alarm and summon the Fire Department and the Emergency response Team.
- Watch for fires, smoke, or sparks or other conditions indicating the onset of a fire in all exposed areas and try to extinguish them.
- Be aware of capacity of fire fighting equipment, otherwise sound the alarm immediately and evacuate.
- Remain on the site of the hot work for a minimum of ½ hour after the completion of cutting, welding, etc. to detect smoldering fires.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct inspections through the annual Walk-Through Program.
- Investigate all accidents.
- Ensure program remains current with applicable federal, state and local regulations.
- Periodically review and update this program.

**Contractors shall:**

- Comply with all ESH&A Programs.
- Failure to comply with ESH&A Programs may subject the contractor and contract company to immediate discharge.

## 5.11 ELECTRICAL SAFETY & ELECTRICAL RELATED WORK PRACTICES

***Applicability Statement:** This section applies to all employees and contractors who face a risk of electrical shock that is not reduced to a safe level by the electrical installation requirements set forth in OSHA 1910.303 through 1910.308.*

### 5.11.1 REFERENCES

OSHA 1910.145 Specifications for Accident Prevention, Signs and Tags  
OSHA 1910.301 Electrical  
OSHA 1910.302 Electric Utilization Systems  
OSHA 1910.303 General Requirements  
OSHA 1910.304 Wiring Design and Protection  
OSHA 1910.305 Wiring Methods, Components and Equipment for General Use  
OSHA 1910.306 Specific Purpose Equipment and Installations  
OSHA 1910.307 Hazardous (classified) Locations  
OSHA 1910.331 Scope of Electrical Program for both Qualified and Unqualified Persons  
OSHA 1910.332 Training  
OSHA 1910.333 Selection and Use of Work Practices  
OSHA 1910.334 Use of Equipment  
OSHA 1910.335 Safeguards for Personal Protection  
Manual 46200.001 Electrical Safety Manual  
Manual 10200.002 ESH&A Program Manual, Control of Hazardous Energy (Lockout/Tagout),  
Section 5.12  
NFPA 70, National Electric Code  
NFPA 70E, Standard for Electrical Safety in the Workplace

### 5.11.2 BACKGROUND

Many standards make up the requirements to meet compliance and safety with electrical work. In an effort to outline all of those requirements, Ames Laboratory has developed an Electrical Safety Manual. The manual is distributed to a select list but it is available to all on the Ames Laboratory Web Site ([http://www.external.ameslab.gov/esh/ESH&A\\_Documents/Manuallist.html](http://www.external.ameslab.gov/esh/ESH&A_Documents/Manuallist.html)). The Electrical Safety Manual is the main reference for guidance.

Lockout / Tagout for all energy sources (electrical, pneumatic, hydraulic, gravitational, steam, etc.) is referenced in Section 5.12 Control of Hazardous Energy (Lockout / Tagout) of this Manual.

The purpose of the Electrical Safety Manual is to outline work requirements for both qualified persons (those who have training in avoiding the electrical hazards of working on or near exposed parts) and unqualified persons (those with little or no such training) working on, near or with the following installations:

- 1) premises wiring;
- 2) wiring for connection to supply;
- 3) other wiring; and
- 4) optical fiber cables.

### **5.11.3 PROGRAM INFORMATION**

#### **5.11.3.1 Definitions:**

Dangerous Voltage: 50 Volts and greater

High Voltage: 600 Volts and greater

Qualified Persons: Those persons trained and familiar with:

- The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed live parts.
- The clearance distances specified in 1910.333(c) and the corresponding voltages to which the qualified person will be exposed.

Extension Cord: Cords and plug-in strips intended for temporary use (less than 90 days).

#### **5.11.3.2 General Electrical Safety Requirements**

- No Live (energized) work over 50 volts is permitted unless written approval is granted by either the Chief Operations Officer or the Director for Science and Technology.
- Portable ladders shall have nonconductive side rails if they are used where the employee or the ladder could contact exposed energized parts. (See Section 5.15 Ladder Safety and Maintenance.)
- Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, key chains, necklaces, aprons with metal eyelets, etc.) may not be worn if exposed to energized metal parts of equipment and circuits.
- Only a qualified employee following the requirements of Paragraph 5.11.3.5 Working On or Near Energized Parts, may defeat an electrical safety interlock, and then it shall be returned to its operable condition when work is complete.
- Adapters (two prong cheaters) that interrupt the continuity of the grounding connection shall not be used.

- Ground Fault Circuit Interrupters (GFCI's) shall be used in wet and damp locations.
- Employees hands shall not be wet when plugging and unplugging flexible cords and plug connected equipment.
- Routine opening and closing of switches, circuit breakers or other devices shall mandate use of equipment specifically designed and labeled as SWD (switching device / switch rated).
- Where flammable materials are present, electrical equipment capable of igniting them shall not be used unless measures are taken to prevent hazardous conditions from developing.
- Safety signs, tags and symbols shall be used where necessary to warn employees about electrical hazards which may endanger them as required by 29 CFR 1910.145 (signs available upon request from ESH&A).
- Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas (Prohibited Approach Boundary). If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect employees.
- Live parts to which an employee may be exposed shall be de-energized before the employee works on or near them. If an employee can demonstrate that de-energizing introduces additional or increased hazards or is not feasible due to equipment design or operational limitations, work on live equipment is permitted, however other safety related work practices shall be used to protect employees who may be exposed to the electrical hazards involved and **Approval by the Chief Operations Officer or the Director for Science and Technology is REQUIRED.**

NOTE: Examples of increased or additional hazards include interruption of life support equipment, deactivation of emergency alarm systems or shut down of hazardous location ventilation equipment. The severity of increased hazard or being infeasible justifies not de-energizing equipment or machinery, not personal convenience.

- Safety Related Work Practices for working on energized electrical equipment include:
  - Being familiar with the proper use of special precautionary techniques
  - Personal Protective Equipment
  - Insulating and shielding materials
  - Insulating tools
- The use of Personal Protective Equipment **does apply** to taking voltage measurements with approved equipment.
- Live parts that operate at less than 50 volts to ground need not be de-energized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.

- The work practices that are used shall be suitable for the conditions under which the work is to be performed and for the voltage level of the exposed electrical conductors or circuit parts (NFPA 70E).

### **5.11.3.3 Personal Protective Equipment (PPE)**

- Employees working in areas where there are potential electrical hazards shall be provided with and shall use electrical protective equipment that is appropriate for the specific parts of the body to be protected (i.e., electrical gloves, electrical sleeves, electrical mats, insulated tools, etc.).
- Protective shields, protective barriers, insulating mats and materials shall be used to protect each employee from shock, burns or other electrically related injuries while that employee is working near exposed energized parts which might be accidentally contacted.
- PPE shall be maintained in a safe, reliable condition and shall be maintained or tested as required.
- If the insulating capability of protective equipment (i.e. electrical rated rubber gloves) may be subject to damage during use, the insulating material shall be protected by additional materials such as leather gloves.
- Employees shall wear protective equipment for the eyes or face wherever there is danger of injury from electric arcs or flashes or from flying objects resulting from electrical explosions.
- Employees shall use insulated tools.

### **5.11.3.4 Working On or Near Exposed De-Energized Parts**

- Conductors and parts of electrical equipment that have been de-energized but have not been locked out or tagged shall be treated as energized parts.
- Stored electrical energy which might endanger personnel shall be released. Capacitors shall be discharged and high capacitance elements shall be short circuited and grounded if the stored electrical energy might endanger employees.
- While any employee is exposed to contact with parts of fixed electrical equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked out. Locks and tags shall be placed on each disconnecting means (multiple energy source equipment) used to de-energize circuits and equipment on which work is to be performed. The lock shall be attached so as to prevent persons from operating disconnecting mean unless they resort to undue force or the use of tools which is means for immediate disciplinary action. (See Section 5.12 of the ESH&A Program Manual for Control of Hazardous Energy (Lockout/Tagout) for program details.

NOTE: Lockout/Tagout does not apply to cord and plug connected equipment and tools as long as the male end of the cord is in constant control and sight of the employee

servicing the equipment. (See Section 5.12 Control of Hazardous Energy (Lockout/Tagout) for lockout/tagout program details.)

- Safe procedures for de-energizing circuits and equipment shall be determined before circuits or equipment is de-energized.
- Verification of de-energization is necessary before any circuits or equipment can be considered and worked on as de-energized. See Section 5.12 Control of Hazardous Energy (Lockout/Tagout) for program details.
- Locks shall only be removed by the employee who applied them. If this employee is absent from the workplace, then the lock may be removed by a qualified employee authorized to perform this task provided that:
  - a. The employee who applied the lock or tag is not available at the workplace and attempts to contact the employee have failed.
  - b. The employee is made aware that the lock or tag has been removed before he or she resumes work.
  - c. It was absolutely necessary to remove the lock.
  - d. ESH&A is notified in advance that the lock is to be removed and the circumstances for removal.

#### **5.11.3.5 Working On or Near Energized Parts**

- Only qualified employees may work on electric circuits or equipment that has not been de-energized. Such employees shall be capable of working safely on energized circuits and shall be familiar with the proper use of:
  - Special Precautionary Techniques
  - Personal Protective Equipment
  - Insulating and Shielding Materials
  - Insulating Tools

**Note: Approval by the Chief Operations Officer or the Director for Science and Technology is REQUIRED.**

Detailed information on Electrical Safety and Electrical Related Safe Work Practices is conveyed via the Ames Laboratory Electrical Safety Manual.

### 5.11.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>RESEACHER ELECTRICAL SAFETY</b>		<b>AL-191</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for Ames Laboratory researchers that work with electrical equipment in a research setting.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction with quiz. Estimated completion time: 1 hour.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three-year retrain.</i>	

<b>BASIC ELECTRICAL SAFETY, &lt; 600 Volts</b>		<b>AL-019</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for Ames Laboratory individuals working on or near exposed electrical parts less than 600Volts.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction with quiz. Estimated completion time: 4 hour.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three-year retrain. Retrain module consists of Computer Based Training and exam.</i>	

<b>HIGH VOLTAGE ELECTRICAL SAFETY, &gt; 600 Volts</b>		<b>AL-020</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with 600 Volts or more as a function of their job must utilize safe work practices, special tools, test equipment to become a Qualified Electrical Workers as defined by Ames Laboratory.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction with quiz. Estimated completion time: 1.5 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three-year retrain. Retrain module consists of classroom/video and exam.</i>	

<b>SAFE EQUIPMENT WIRING</b>		<b>AL-063</b>
<b><i>Intended Audience:</i></b>	<i>For individuals performing 120 volt plug wiring, electrical equipment construction and electrical power wiring.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction with quiz. Estimated completion time: 1.5 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three-year retrain. Retrain module consists of classroom and exam.</i>	

<b>LOCKOUT TAGOUT TRAINING</b>		<b>AL-012</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignments involve activities such as servicing or maintenance of machines or equipment which may have unexpected energizing, startup, or release of stored energy (pneumatic, hydraulic, springs, gravity, etc.).</i>	
<b><i>NOTE:</i></b>	<i>Employees performing <b>ONLY</b> electrical LOTO <u>do not</u> need to attend this module if they have completed the Basic Electrical Safety Training Module (AL-019).</i>	
<b><i>Module Format:</i></b>	<i>Module is Classroom discussion with video, handouts and exam. Estimated completion time: 1.0 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Two year retrain: Retrain module consists of classroom discussion with video, handouts and exam.</i>	

### 5.11.5 PERFORMANCE CHECKLISTS

#### **Supervisors / Group Leaders /Department Managers shall:**

- Ensure that all questions pertaining to the Electrical Safety and Electrical-Related Work Practices Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Ensure outside contractors performing work at the facility adhere to the Electrical Safety and Electrical-Related Work Practices Program.
- Initiates progressive discipline when authorized employees fail to comply with the Electrical Safety and Electrical-Related Work Practices Program.
- Ensure new and present employees attend initial and refresher training.

#### **Employees shall:**

- Attend required course as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Comply with the requirements of this program.
- Inspect electrical equipment regularly.

#### **Environment, Safety, Health & Assurance (ESH&A) shall:**

- Periodically review and update the program requirements according to changes in regulations.
- Inspect electrical equipment annually during the Independent Walk-Throughs.
- Stop work for installations found to be unsafe.

#### **Engineering Services Group shall:**

- Conduct Basic Electrical Safety Training, High Voltage Electrical Safety Training and Safe Equipment Wiring Training.

#### **Contractors shall:**

- Comply with:
  - Ames Laboratory Electrical Safety Program
  - Electrical-Related Work Practices Program
  - Lockout Tagout Program

## 5.12 LOCKOUT TAGOUT PROGRAM

**Applicability Statement:** *This section applies to all employees and contractors performing servicing or maintenance activities with machines or equipment.*

### 5.12.1 REFERENCES

OSHA 1910.147 The Control of Hazardous Energy (Lockout/Tagout)  
Form 10200.099 Appendix A, Authorized Employee LOTO Annual Certification

### 5.12.2 BACKGROUND

The purpose of the Control of Hazardous Energy Program (commonly referred to as the Lockout/Tagout Program) is to prevent injuries to employees and contractors from the unexpected energizing, startup, or release of stored energy from machines, equipment or processes. The Lockout/Tagout program establishes minimum performance requirements for the control of hazards.

It is limited in scope to activities related only to controlling hazardous energy in machinery and equipment. For example, applications would include, but not limited to the service and maintenance of:

Electrical	Mechanical	Hydraulic
Pneumatic	Steam	Capacitors
Gravitational	Chemical	Etc.

### 5.12.3 PROGRAM INFORMATION

#### 5.12.3.1 Definitions:

**Affected Personnel:** An unqualified person whose job requires that they operate or use a machine or piece of equipment on which servicing or maintenance is being performed under lockout/tagout, or whose job requires them to work in an area in which such servicing or maintenance is being performed.

**Authorized Personnel:** A qualified person to whom authority and responsibility to perform a specific lockout and/or tagout assignment has been given by the employer.

**Designated Lead:** A designated lead is an authorized employee appointed by a Department Manager / Program Director who coordinates one or more LOTO activities for multiple personnel (Group Lockout) involved in servicing maintenance.

**Energized:** Connection of an energy source (mechanical, electrical, hydraulic, pneumatic, etc.) which has not been isolated.

**Energy Isolating Device:** A device that physically prevents the transmission or release of energy. This includes manually operated electrical circuit breakers, a disconnect switch, a manually

operated switch, a slide gate, a line valve, a blank, and buttons, selector switches and other control circuit-type devices.

Energy Source: Any electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy source that is capable of causing injury to personnel.

Hot Tap: A procedure used in repair, maintenance, and service activities which involves welding a piece of equipment (pipelines, vessels, or tanks) under pressure, in order to install connections. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, and steam.

Lockout Device: A device that utilizes a lock and key to hold an energy isolating device in a safe position.

Lockout / Tagout: The placement of a lock and a tag on the energy isolating device in accordance with an established procedure indicating that the energy isolating device or the equipment being controlled shall not be operated until removal of the lock and/or tag.

Servicing and Maintenance: Functions that include workplace activities such as installing, constructing, adjusting, setting up, inspecting, maintaining, or repairing machines and equipment.

### 5.12.3.2 Applications Requiring Lockout/Tagout

- This standard applies to the control of energy during servicing and/or maintenance of machines and equipment.
- The program applies to but not limited to:
  - Maintenance Activities
  - Electronic Technicians
  - Production Mechanics
  - Production Engineers
  - Service Technicians
  - All employees including scientists, graduate students and other professionals whose work exposes them to equipment which is capable of causing injury.
- Minor tool changes and adjustments, and other minor servicing activities, which take place during normal production operations, are not covered by this program provided that minor tool changes are routine, repetitive, and integral to the use of the equipment for production. (Example: *Changing tools in a milling machine or drill press.*)
- Normally exempt servicing and/or maintenance of production equipment requires Lockout/Tagout if:
  - An employee is required to remove or bypass a guard or other safety device or
  - An employee is required to place any part of his or her body into an area on a machine or piece of equipment where work is actually performed upon the material being

processed (point of operation) or where an associated danger zone exists during a machine operating cycle.

- Examples of equipment and machinery which have the potential for unexpected energization, startup or release of stored energy include but are not limited to the servicing and maintenance of:

motors	pumps	air compressors	lighting
elevators	refrigeration	compactors	machine shop equipment
boilers	pipng	valves	air conditioning equipment
fans	welders	switch gears	transformers

- The Lockout / Tagout Program does not apply to work on electrical equipment for which exposure to the hazards can be controlled by unplugging the equipment from the receptacle provided the cord end remains under the control of the person performing service or maintenance. If equipment is going to be impaired over time due to ordering parts, shift is over, etc., then the equipment should be locked and tagged to prevent someone from trying to energize the equipment unknowing that the equipment is impaired.

### 5.12.3.3 Lockout/Tagout Procedure

The following are the established procedures for application of energy control and Lockout/Tagout.

Step	Action
1.	Before proceeding with any equipment shutdown, a survey will be made to locate and identify all energy isolating devices feeding the equipment (i.e., electrical circuit breakers, shut-off valves, electrical disconnect switches, etc.).
2.	Once the survey is complete, the authorized personnel will notify all affected personnel, including the area supervisor that a shutdown of the equipment or machine will occur.
3.	Following notification, the equipment or machine (if operating) will be shut down by normal stopping procedure (i.e., depress stop button, open toggle switch, turn light switch off, etc.).
4.	Once turned off, the energy isolating device (i.e., circuit breaker, disconnect switch, valve, etc.) will be operated in such a manner that the machine or equipment will be isolated from the energy source (electrical, mechanical, hydraulic, pneumatic, chemical, thermal, etc.).
5.	The energy-isolating device is then "locked out" by applying the padlock and tag to the device. In some cases, a chain must be used (in combination with a padlock) to sufficiently "lockout" a device, (i.e., steam valve, hydraulic valve, etc.)
NOTE	If a machine or equipment can not be locked out by conventional means call ESH&A. Tagout can be used for isolated instances. For Tagout to be considered, implementation of additional safety measures shall be completed such as the removal of an isolating element, blocking of a controlling switch, opening an extra disconnecting device or the removal of a valve handle to reduce the likelihood of inadvertent energization.

<b>Step</b>	<b>Action</b>
6.	A tag will be filled out by each authorized person indicating the person's name, the date and time of the lockout.
7.	Once the energy isolating device has been locked out and tagged, all potentially hazardous sources or residual energy will be purged or dissipated (i.e., grounding, capacitors, bleeding, venting, lowering to rest position, etc.)
8.	After ensuring that no personnel are exposed, the authorized personnel will operate the normal operating controls to make certain the equipment will not restart. The operating controls <u>MUST</u> be returned to the "off" or "neutral" position after the test.
NOTE	Every person involved with the service or maintenance of the locked out equipment will place their assigned padlock to every lockout device in such manner that if all other padlocks were removed, the person would still have their padlock assuring that every source of energy is still "locked out". No personnel may affix the lockout/tagout device of another person.
9.  NOTE	<p>The following are to be performed to ensure machinery/equipment is in a zero energy state:</p> <ul style="list-style-type: none"> <li>• Remove conductive apparel.</li> <li>• Wear the appropriate personal protective equipment.</li> <li>• Perform testing using an approved category III or IV multi-meter.</li> </ul> <p>Measuring technique:</p> <ol style="list-style-type: none"> <li>1. Verify meter operates properly on a known power source within the same voltage range.</li> <li>2. Ground one terminal of meter.</li> <li>3. Connect to one phase, measure to ground, measure other phases to ground.</li> <li>4. Remove ground, measure phase to phase for all phases.</li> <li>5. If possible, use one hand at a time.</li> <li>6. When complete, verify meter operates properly on a known power source within the same voltage range.</li> <li>7. Try to start the equipment (return the controls to the neutral position when finished).</li> <li>8. Stop work if unanticipated conditions exist.</li> </ol> <ul style="list-style-type: none"> <li>• Attach a "ground stick" of sufficient size to handle any possible fault current to all three phases of stored electrical equipment.</li> <li>• Blocking shall be performed on hydraulic equipment such as presses which must be maintained in a stored hazardous potential state.</li> </ul>
10.	Apply Lockout lock and tag devices to all energy sources.
11.	Perform maintenance or servicing of the machinery or equipment.
<b>Re-Energization</b>	
1.	When the maintenance and/or service are completed, the work area is to be inspected to ensure that all affected personnel are safely positioned and/or removed. In addition, remove all nonessential items from the equipment.

Step	Action
2.	The lockout, padlock, and tag shall then be removed from the energy isolating device by the authorized personnel who applied the lockout devices.
3.	<p>When the authorized person who applied the lockout/tagout device is not available to remove it, that device may be removed provided:</p> <ol style="list-style-type: none"> <li>Verification by the supervisor, group leader or department manager that the authorized personnel who applied the device is not in the facility.</li> <li>All efforts to contact the authorized personnel to inform them that their lockout device has been removed.</li> <li>The authorized employee, if contacted and cannot return, is asked relevant questions about the status of the equipment or machinery locked out.</li> <li>The authorized employee has all relevant information about the lockout and the equipment condition before work resumes.</li> </ol>
4.	<b>Exception:</b> If the employee who applied their lockout device is not available to remove the lockout device, the device may only be removed by the supervisor, group leader or manager, in accordance with step 3 above.

#### 5.12.3.4 Group Lockout / Tagout Procedure

A Department Manager / Program Director shall appoint a Designated Lead for Group Lockout / Tagout. The Designated Lead shall coordinate the activities of all members of the group, regardless of occupation(s) / craft(s), to ensure continuity of protection.

Group lockout will be accomplished by using a multiple lockout hasp (pictured below) to secure energy control (keys). Each locking device shall have only one individualized key per lock. Subsequent workers / crafts place their locks (red) to the lockout hasp to secure that key. The Designated Person shall be responsible for the notification steps. The procedure below is primarily directed towards electrical lockout but can be applied to other energy sources. See ESH&A with any questions.

Step	Action
1.	The Designated Lead shall scope the job prior to equipment shutdown and make a survey to locate and identify all energy isolating devices feeding the building / equipment / machinery (i.e., service feeds, breakers, electrical disconnects, etc.).
2.	The Designated Lead shall ensure all individuals involved understand the Group Lockout Procedure.
3.	The Designated Lead will notify all "Affected" personnel of the pending shutdown.
4.	Following notifications, the building / equipment / machinery (if operating) will be shut down by normal stopping procedure (i.e., depressing switches, toggle switches, close valves, etc.).
5.	The energy isolating device(s) (i.e., building feeds, circuit breaker, disconnect switch, building feeds, etc.) will be operated in such a manner that the building / machinery / equipment, etc. will be isolated from all energy source(s).

6.	The Designated Lead will affix a lock (red) and tag to the isolating device.
7.	<p>The energy isolating device is now "locked out".</p> <p>The key to this isolating lock(s) will be placed inside a lockout box. A hasp (below) will be applied to the lockout box. Each person working on the job will apply their lock &amp; tag to the hasp securing the key inside. This will ensure that the last person removing their lock will have the same protection as the first.</p> 
8.	All residual energy must be purged (i.e., grounding, dissipate capacitors, etc.).
9.	<p>After ensuring that no personnel are exposed, the authorized personnel will confirm equipment is at a zero energy state:</p> <p>NOTE</p> <ul style="list-style-type: none"> <li>• Remove conductive apparel.</li> <li>• Wear the appropriate personal protective equipment.</li> <li>• Perform testing using an approved category III or IV multi-meter.</li> </ul> <p>Operate the controls of equipment / machinery to make certain the equipment will not restart. The operating controls <u>MUST</u> be returned to the "off" or "neutral" position after the test.</p> <p>Measuring voltage (electrical leads, capacitors, etc.)</p> <ol style="list-style-type: none"> <li>1. Verify meter operates properly on a known power source.</li> <li>2. Ground one terminal of meter.</li> <li>3. Connect to one phase, measure to ground, measure other phases to ground.</li> <li>4. Remove meter ground, measure phase to phase for all phases.</li> <li>5. If possible, use one hand at a time.</li> <li>6. When complete, verify meter operates properly on a known power source.</li> <li>7. Try to start the equipment (return the controls to the neutral position when finished).</li> <li>8. Stop work if unanticipated conditions exist.</li> </ol> <p>Attach a "ground" of sufficient size to handle any possible fault current to all three phases of electrical equipment.</p>
11.	Perform maintenance or servicing of equipment.
<b>Re-Energization</b>	
1.	The Designated Lead notifies all personnel of the intent to re-energized equipment.
2.	The Designated Lead confirms the switches / breakers are in the off position.
3.	The Designated Lead confirms the removal of the grounding straps.
4.	The Designated Lead confirms all personnel are clear from work area before the power is reapplied (head count).
5.	The Designated Lead gathers all personnel to Lockout Box and inquires with every individual for any concerns and addresses items as necessary.
6.	Locks are removed from the hasp by individuals who applied the locks.

NOTE	<b>Exception:</b> If the employee who applied their lockout device is not available, the device may only be removed by the supervisor / group leader.
7.	The “primary” key is removed from the lock box.
8.	The proper PPE is donned and the primary lock(s) is removed.
9.	Perform electrical re-connect.
NOTE	The proper PPE must be donned to re-energize downstream breakers / equipment.
10.	Check equipment / building for proper operation.
NOTE	<b>This is a general procedure for Group Lockout – Equipment or building specific lockout procedures must be developed to ensure effective communication and adherence to principals and procedures.</b>

### 5.12.3.5 Shift and/or Personnel Changes

If work on a piece of equipment or machinery that is locked out carries over to the next shift, the authorized personnel may remove their lockout device, provided that the next authorized personnel applies their lockout device at the same time the previous authorized personnel removes their lock device.

### 5.12.3.6 Testing of Machinery, Equipment and/or Trouble-Shooting

When machinery and/or equipment must be tested before service work is completed (i.e., checking motor rotation, checking belt alignment, electrical calibration, etc.) the following procedure shall be used:

Step	Action
1.	Clear the machine and/or equipment of nonessential items.
2.	Safely clear personnel from the machine area.
3.	Remove lockout devices from energy isolating equipment.
4.	Ensure PPE required per OSHA "Safety Related Work Practices" is utilized. (i.e., insulating gloves, mats, sleeves, safety glasses, etc.)
5.	Energize and proceed with the test.
6.	De-energize all systems and reapply lockout devices to the energy isolating devices to proceed with maintenance per Paragraph 5.12.3.3.

### 5.12.3.7 Working on Energized Equipment

- No work is to be performed on any equipment or machinery which is knowingly "hot", "live", "energized", "pressurized", etc.
- OSHA states that all energized equipment must be de-energized unless it is demonstrated that de-energization introduces an increased hazard or it is infeasible due to equipment design or operational limitations. Examples of increased hazard or being infeasible include interruption of life support equipment, deactivation of emergency alarm systems, shutdown of hazardous location ventilation equipment,

NOTE: The severity of increased hazard or being infeasible justifies not de-energizing equipment or machinery, not personal convenience.

- If an employee can demonstrate that de-energizing introduces additional or increased hazards or is not feasible due to equipment design or operational limitations, work on live equipment may be permitted, however other safety related work practices shall be used to protect employees who may be exposed to the electrical hazards involved and **Approval by the Chief Operations Officer or the Director for Science and Technology is REQUIRED.**
- **Exemption:** Testing of electrical circuits may be performed live with probes having approved insulating properties.
- If the equipment or machinery cannot be shut down for the required period of time, all work must be postponed until a proper action plan is developed. Personal Protective Equipment including electrical gloves, safety glasses, insulating mats, etc. are required when working on or near energized electrical parts.

#### 5.12.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>LOCKOUT TAGOUT TRAINING</b>		<b>AL-012</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignments involve activities such as servicing or maintenance of machines or equipment which may have unexpected energizing, startup, or release of stored energy.</i>	
<b><i>NOTE:</i></b>	<i>Employees performing <b>ONLY</b> electrical LOTO <u>do not</u> need to attend this module if they have completed the Basic Electrical Safety Training Module (AL-019).</i>	
<b><i>Module Format:</i></b>	<i>Module is Classroom discussion with video, handouts and quiz.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Two year retrain: Retrain module consists of classroom discussion with video, handouts and exam.</i>	

<b>BASIC ELECTRICAL TRAINING</b>		<b>AL-019</b>
<b><i>Intended Audience:</i></b>	<i>Lockout/Tagout for electrical work is covered in Basic Electrical Safety. It is mandatory for Ames Laboratory individuals working on or near exposed electrical parts.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction with quiz. Estimated completion time: 4 hours.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three-year retrain. Retrain module consists of Computer Based Training and exam.</i>	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of physical hazards, chemical hazards, hazard mitigation, location of MSDS's and other safety information, emergency response measures and any other procedural information. This training shall be documented by the Supervisor / Group Leader / Department Manager.

### 5.12.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers shall:**

- Ensure that all questions pertaining to the lockout/tagout program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Attend “Lockout/Tagout Training” (AL-012). Consult the Ames Laboratory training schedule for the next available class.
- Ensure outside contractors performing work at the facility adhere to the lockout/tagout program.
- Assist ESH&A with the development of machine specific lockout/tagout procedures for equipment with multiple energy sources.

**Employees shall:**

- Attend required course as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Maintain lockout/tagout equipment.
- Fully adhere to the requirements set forth in the lockout/tagout program when installing, servicing and maintaining machinery and equipment.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- Conduct periodic inspection of the energy control program at least annually to ensure that the procedures and requirements are being followed.
- Develop lockout/tagout procedures for machines with multiple energy sources (more than one source).
- Conduct lockout/tagout training and refresher training.
- Periodically review and update the Lockout/Tagout Program.
- Evaluate employees who are authorized to perform Lockout/Tagout annually.
- See Appendix A - Authorized Employee LOTO Annual Certification form to be used to document certification.

**Contractors shall:**

- Comply with the Lockout/Tagout program.

## Appendix A

## Authorized Employee LOTO Annual Certification

The purpose of this observation is to ensure this employee understands the procedures used for the control of energy associated with equipment when performing service / maintenance. The below listed employee successfully conducted the Lockout – Tagout and understands the 10 step procedure listed below:

Employee \_\_\_\_\_ Date \_\_\_\_\_

Department \_\_\_\_\_ Shift \_\_\_\_\_

Selected Equipment \_\_\_\_\_

Type of Energy (Circle all that apply): Electrical, Potential/Stored, Kinetic/in motion, Pneumatic, Hydraulic, Thermal, Chemical, other?? \_\_\_\_\_

**Does the task qualify under the exceptions of the procedure, e.g. minor adjustments; work on cord/plug connected equipment under exclusive control of employees performing the work, etc. If no, then proceed with remaining questions.**

Installing Locks and Tags

Key Elements	Yes	No	NA
1. Were affected employees notified?			
2. Was the equipment shutdown using its normal operating controls?			
3. Were all energy sources identified and isolated?			
4. Were locks and tags appropriately applied to all energy controls (each person applies personal lock and tag)??			
5. Were areas of stored and / or residual energy identified and released (i.e., volt meter)?			
6. Was the equipment tested (verified) to ensure inadvertent startup is not possible (operate the controls / use volt meter)?			
<b>NOTE:</b> Is it understood that cord and plug connected equipment that is not under the exclusive control of the “Authorized Employee”, or goes beyond the work shift, must be locked and tagged using a plug lockout device?			

Restoring from LOTO

1. Was equipment checked / verified to ensure all guards / safety devices are in place and functional?			
2. Were “Affected Employees” notified that locks and tags are being removed?			
3. Were the equipment controls checked / verified to ensure they are in neutral or off position?			
4. Were the locks and tags properly removed and equipment ready for use?			

Changes or Recommendation in Procedure: \_\_\_\_\_

Evaluator Signature \_\_\_\_\_ Date: \_\_\_\_\_

Employee Signature \_\_\_\_\_ Date: \_\_\_\_\_

### 5.13 SCAFFOLDING AND FALL PROTECTION

**Applicability Statement:** *This section applies to all employees and contractors who use scaffolding. The requirements include assembly, use, disassembly, tie offs, guarding, fall protection and OSHA guidelines of Tubular Welded Frame Scaffold and Manually Propelled Mobile Ladder Stands and Scaffolds.*

This procedure intentionally does not cover:

Masons Adjustable Multiple Point Suspension Scaffolds	Wood Pole Scaffolding
Tube and Coupler Scaffolds	Two Point Suspension Scaffolds
Stone Setters Adjustable Multiple Point Scaffolds	Horse Scaffolds
Single Point Adjustable Suspension Scaffolds	Needle Beam Scaffolds
Plasters/Decorators/Large Area Scaffolds	Boatswain's Chairs
Bricklayers Square Scaffolds	Carpenters Bracket Scaffolds
Interior Hung Scaffolds	Ladder Jack Scaffolds
Window Jack Scaffolds	Float or Ship Scaffolds

Call ESH&A for specific safety rules if the above types of scaffolds are to be used.

#### 5.13.1 REFERENCES

OSHA 29 CFR 1910.21 Definitions

OSHA 29 CFR 1910.28 Safety Requirements of Scaffolding

OSHA 29 CFR 1910.29 Manually Propelled Scaffolding

Manual 10200.002 ESH&A Program Manual, Ladder Safety, Section 5.15

#### 5.13.2 BACKGROUND

The Scaffolding and Fall Protection Program is designed to prevent employees and contractors from hazards associated with falling. Scaffolds must be furnished and erected in compliance with this program for employees and contractors engaged in work that cannot be conducted safely from the ground or from solid construction. Ladders used for such work must comply with Section 5.15 Ladder Safety in this ESH&A Program Manual.

#### 5.13.3 PROGRAM INFORMATION

##### 5.13.3.1 Definitions:

Scaffold: A temporary elevated platform used for supporting workmen and materials. Scaffolding and its components must be capable of supporting 4 times the maximum intended load.

Competent Person: One who is capable by education or experience of identifying existing and predictable hazards with scaffolding and working conditions and who has the authorization to take prompt corrective action to eliminate them.

***Toe-board:*** A barrier at the platform level erected along the exposed sides and ends of a scaffold platform to prevent falls and materials/tools from falling off onto employees below. Toeboards must be a minimum of 4 inches in height.

***Climbing Ladder:*** A ladder attached to the scaffolding structure for ascending and descending.

***Full Dimension Planking:*** Planking cut to dimension after shrinkage has occurred.

***Tag Line:*** Used to hoist materials onto scaffolds. Materials are not to be carried up the ladder onto the scaffold by the operator.

**Guardrail System:**

- Guardrails are not to be less than 2 x 4 (stock) inches or the equivalent
- Not less than 36 inches or more than 42 inches high
- A mid-rail, of 1 x 4-inch lumber or equivalent
- Toeboards are to be installed at all open sides on all scaffolds more than 6 feet above the ground or floor.

**5.13.3.2 Material Requirements Used To Erect Scaffolding**

- Scaffolds must be furnished and erected in compliance with this program for employees and contractors engaged in work that cannot be done safely from the ground or from solid construction, except that ladders used for such work must comply with Section 5.15, Ladder Safety in this ESH&A Manual.
- The footing or anchorage must be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, bricks and concrete blocks or other such materials must not be used to support scaffolds or planks.
- Scaffolds and their components must be capable of supporting without failure at least four times the maximum intended load.
- Frames and accessories for scaffolds must be maintained in good repair and every defect, unsafe condition, or noncompliance with this section must be immediately corrected before further use of the scaffold. Any broken, bent, excessively rusted, altered, or otherwise structurally damaged frames or accessories must not be used.
- Scaffold exceeding 30 feet horizontally and/or 26 feet vertically must be guyed/tied at equal intervals and securely braced against the building or structure.
- Scaffolds cannot be loaded in excess of the working load for which they are intended.
- The work level platform of scaffolds must be made of wood, aluminum or plywood planking, steel or expanded metal, for the full width of the scaffold, except for necessary openings. The work platform must be secured in place. All planking must be 2 inch (nominal) scaffold grade, minimum 1500 (stress grade) construction grade lumber or equivalent.

- All planking shall be “Scaffold Grade” as recognized by grading rules for the species of wood used. The maximum permissible spans for 2 X 9 inch or wider planks are shown in the following tables:

#### **FULL THICKNESS UNDRESSED LUMBER**

Working Load	25 lbs./sq. ft	50 lbs./sq. ft	75 lbs./sq. ft
Permissible Span	10 ft	8 ft	6 ft

#### **NOMINAL THICKNESS LUMBER**

Working Load	25 lbs./sq. ft	50 lbs./sq. ft
Permissible Span	8 ft	9 ft

- All continuous planking or platforms must be overlapped (minimum of 12 inches) or secured from movement.
- Scaffold planks must extend over their end supports not less than 6 inches and no more than 18 inches.
- Scaffolding uprights, bracing and planking must be plumb, secure and rigidly braced to prevent swaying and displacement.
- Scaffolds where people are required to work or pass under must have a screen attached between the toe-board and the top guardrail, on all open sides of scaffolding, consisting of No. 18 gauge US Standard Wire one half inch mesh or the equivalent.
- A climbing ladder or stairway must be provided for proper access and egress and must be affixed or built into the scaffold and so located that its use will not have a tendency to tip the scaffold.
- Guardrails are required at 10 feet or higher for a standard scaffolds (5' by 5' by 5') and 6 feet for a Baker Scaffolding (6' by 6' by 28 inches). The 28 inches is the minimum base dimension.
- A standard (4 inch nominal) toe-board is required on the working level.
- The minimum platform width for any work level must not be less than 20 inches.
- Scaffolds must be secured to permanent structures, through the use of anchor bolts, reveal bolts, or other equivalent means when the height of the scaffold exceeds four (4) times the minimum base dimension

NOTE: See Appendix A for proper erection of Tubular Frame Scaffolding Components.

### **5.13.3.3 General Employee Safety Rules**

- Scaffolds must not be altered or moved horizontally while they are in use or occupied.
- Periodic inspections must be made of all welded frames and accessories and any maintenance, including painting or minor repairs authorized by the manufacturer, must be made before further use.
- All scaffolds must be erected by competent and experienced personnel.
- Materials being hoisted onto and off a scaffold must have a tag line.
- Overhead protection (hard hats) must be used for workers on and under scaffolding exposed to overhead hazards.
- Scaffolds must not be used to support a crane, pulleys, hoist or block and tackle to lift or pull objects.
- Employees must not work outdoors on scaffolds during storms or high winds.
- Employees must not work on scaffolds which are covered with ice or snow, unless all ice or snow is removed and planking sanded to prevent slipping.
- Tools, materials and debris must not be allowed to accumulate in quantities to cause a hazard.

### **5.13.3.4 Safety Rules for Tubular Welded Frame Scaffolds**

- Metal tubular frame scaffolds, including accessories such as braces, brackets, trusses, screw legs, ladders, etc., must be designed to safely support four times the maximum intended load.
- Spacing of the panels or frames must be consistent with the loads imposed.
- Diagonal braces must be used to support scaffolding. For securing vertical members together laterally, cross braces must be of such length as will automatically square and align the scaffolding. All brace connections must be made secure.
- Scaffold legs shall be set on adjustable bases or plain bases placed on mud sills or other foundations adequate to support the maximum intended load.
- The frames must be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.
- Where uplift may occur, panels must be locked together vertically by pins or other equivalent suitable means.

- Where leveling of the elevated work platform is required, screw jacks must be provided in the base section of each mobile unit.
- Guardrails not less than 2x4 inch lumber or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail (1"x4" lumber) and toe-board must be installed at all open sides on all scaffolds more than 6 feet above the ground or floor. Toe boards must be a minimum of 4 inches in height.

NOTE: See Appendix A for proper erection of Tubular Frame Scaffolding Components.

### 5.13.3.5 Safety Rules for Manually Propelled Mobile Scaffolds

- Vertical members must be locked together vertically by pins to prevent uplift. Bolts or fasteners used to connect sections of scaffolding must be of adequate size at each connection to maintain the designed strength of the unit.
- The minimum platform width for any work level must not be less than 20 inches.
- The supporting structure for the work level must be rigidly braced, using adequate cross bracing or diagonal bracing with ridged platforms at each work level.
- Wheels or casters must be designed for strength and dimensions to support four times the designed working load.
- All scaffold casters must be provided with a positive wheel and/or swivel lock to prevent movement.
- The maximum work level height must not exceed four (4) times the minimum or least base dimension of any mobile scaffold. Where the basic mobile unit does not meet this requirement, outriggers must be employed to achieve this base dimension or provisions must be made to guy or brace the unit against tipping.

NOTE: See Appendix A for proper erection of Tubular Frame Scaffolding Components.

### 5.13.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>SCAFFOLDING SAFETY TRAINING</b>		<b>AL-139</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignment involves assembly or use of Tubular Welded Frame Scaffold and Manually Propelled Mobile Ladder Stands and Scaffolds</i>	
<b><i>Module Format:</i></b>	<i>Module is classroom/video training with an exam. Estimated completion time: 1.0 hour.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Every Three Years</i>	

Group / activity-specific Scaffolding Training shall be given to each employee prior to start of work. Training will include a discussion of physical hazards, hazard mitigation, inspection of scaffolding, assembly, use, dismantling, fall protection, emergency response measures, procedural information and other safety information. This training shall be documented by the Supervisor / Group Leader / Department Manager.

### **5.13.5 PERFORMANCE CHECKLISTS**

**Supervisors / Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Scaffolding Safety Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Attend Scaffolding Safety Training. Consult the Ames Laboratory training schedule for the next available class.
- Ensure outside contractors performing work at the facility adhere to the Scaffolding Safety Program.

**Employees** shall:

- Attend required course as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Inspect scaffolding every day of use or at beginning of each shift scaffolding is used.
- Remove, replace or repair scaffolding as necessary.
- Comply with the requirements of this program.
- Attend Scaffolding Safety Training.

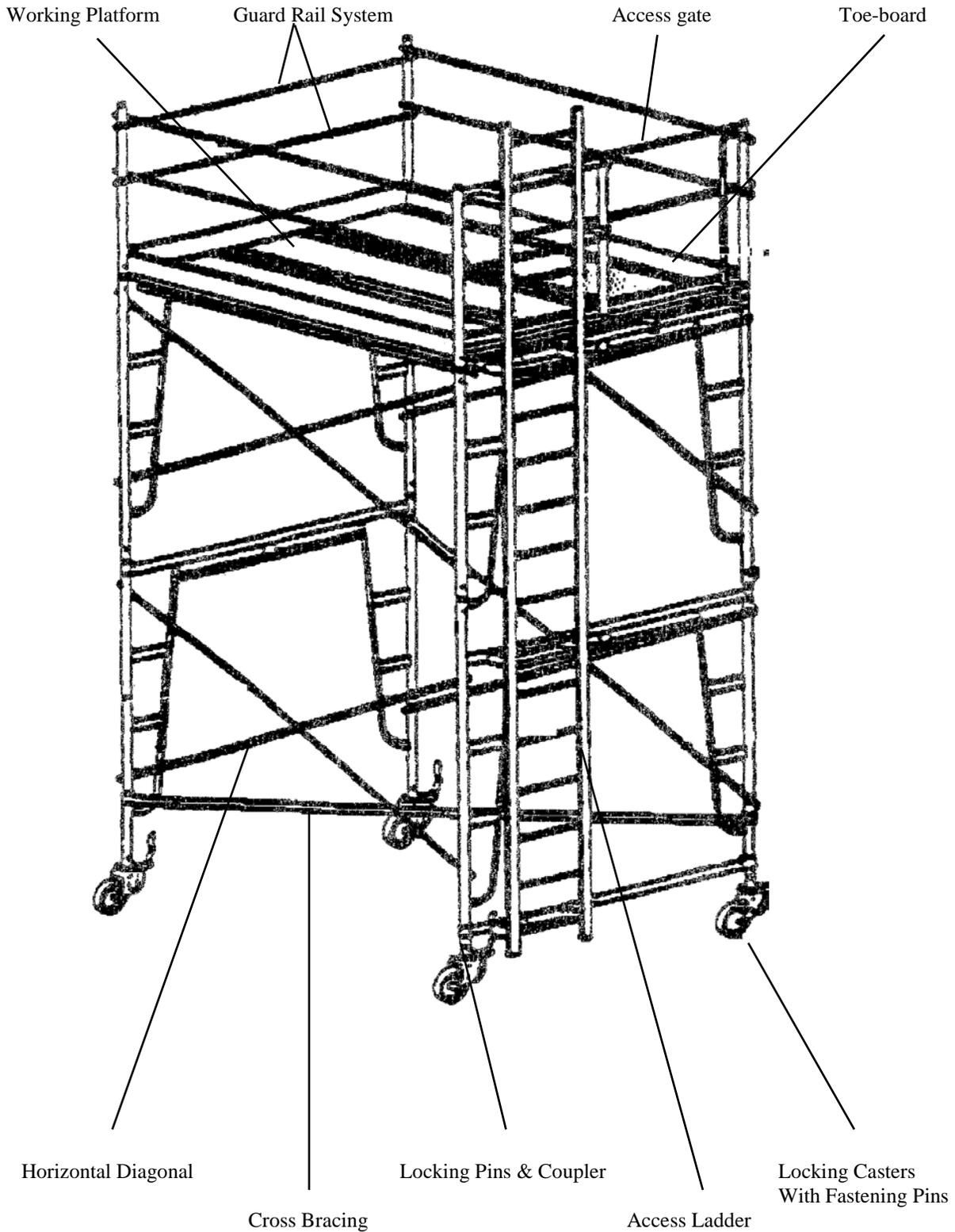
**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Periodically review and update the program requirements according to changes in regulations.
- Periodically audit the performance of scaffolding use to ensure compliance and safety.
- Conduct training.
- Inspect scaffolds.
- Shutdown work on scaffolds not approved by ESH&A.

**Contractors** shall:

- Compliance with the Ames Laboratory Scaffolding Safety Program or their equivalent program.
- Failure to comply with the Scaffolding Safety and Maintenance Program may result in suspension of work.

### Appendix A Tubular Frame Scaffolding Components



Standard Scaffolding (5 foot by 5 foot by 5 foot sections)

Baker (multi-purpose) Scaffolding  
5 foot by 5 foot by 28 inches (minimum base dimension)



## **5.14 EYE WASHES AND SAFETY SHOWERS**

*Applicability Statement: This program includes the provisions for safety showers and eyewashes in a usable and ready condition for all employees for the rendering of basic first aid from chemical or physical exposure.*

### **5.14.1 REFERENCES**

OSHA 1910.151 Medical Services and First Aid

### **5.14.2 BACKGROUND**

The purpose of this program is to outline the procedures, responsibilities and requirements for providing and maintaining Eyewashes and Safety Showers.

### **5.14.3 PROGRAM INFORMATION**

#### **5.14.3.1 Eye Washes and Safety Showers**

- Identified by readily identifiable - highly visible signs.
- Located in all areas where a corrosive, injurious or harmful material is used in a manner where potential skin or eye contact exists.
- Routed along normal walkways and situated where easily accessible.
- No greater than 100 feet from hazards such as: acids, caustics, corrosives, solvents, chemical tanks, powders, etc.
- Never blocked rendering the emergency equipment ineffective.

#### **5.14.3.2 Portable (non-plumbed) Eyewashes**

- Capable of delivering potable water to the eyes at not less than 1.5 liters per minute (0.4 gallons per minute) for fifteen (15) minutes.
- Meet all of the provisions stated in 5.14.3.1.

NOTE: Hand held plastic squeeze bottles are unacceptable for eyewashes because they do not meet the requirement to supply a minimum of 15 minutes of continuous water flow.

#### 5.14.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>EMERGENCY AWARENESS TRAINING</b>		<b>AL-002</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all new employees</i>	
<b><i>Module Format:</i></b>	<i>Employees receive Eye Wash and Safety Shower Safety information as part of the Laboratory's Emergency Awareness Training (EAT). Training is provided by the Safety Coordinator or a designee and is documented on an EAT Form. Estimated completion time: 1/2 hour</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No retrain required</i>	

Group / activity-specific General Employee Training shall be given to each employee prior to start of work. Training will include a discussion of physical hazards, chemical hazards, hazard mitigation, location of MSDS's, emergency response measures and, procedural information and other safety information. This training shall be documented by the Supervisor / Group Leader / Department Manager.

#### 5.14.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leader / Department Manager** shall:

- Assure workers have had group / activity specific training for the area.
- Review their operation to determine where eyewashes and safety showers may be required. Consult with ESH&A for guidance.
- Submit work orders to Facilities Services Group for additional safety showers and eyewashes where a deficiency exists (concurrence with ESH&A).
- Ensure employees wear appropriate eye protection, gloves, aprons, gauntlet sleeves and other protective equipment when performing a task that involves working with chemicals or in a safety glass designated area.
- Orient employees on locations and correct use of safety showers and eyewashes and the importance of maintaining clear access to eyewashes and safety showers at all times.
- Report any non-operational equipment to Facilities Services Group for immediate repair.
- Provide temporary eyewash facilities or safety showers until non-operational equipment is repaired.
- Call Occupational Medicine and request immediate medical assistance if a chemical gets into someone's eye or on their body. Immediately provide a copy of all applicable MSDSs to Occupational Medicine.

**Employees shall:**

- Wear all personal protective equipment as outlined in procedures and recommendations in Material Safety Data Sheets.
- Bring all unsafe acts, practices, or conditions to their coworker's attention.
- Report any non-operational equipment to Facilities Services and immediately tagout the non-operational equipment until it is repaired. If employees are unable to correct an unsafe situation, they must inform the next level of management and ESH&A.
- Keep safety showers accessible and clean. (This includes, but is not limited to, no dumping of chemicals or other contaminants into the drain of an eyewash or safety shower.)

**Facilities Services shall:**

- Inspect/Test eyewashes monthly (flow water to ensure proper flow and prevent foreign and sediment materials from accumulating in nozzles and supply pipes).
- Inspect/Test safety showers quarterly.
- Maintain records of inspection.
- Provide and install appropriate safety showers and eyewashes when designing or renovating areas.
- Immediately (within 24 hours) repair safety showers and eyewashes when identified as being non-operational.
- Install eyewashes (fixed or hand-held) no less than 33 inches, but no more than 45 inches, above floor or platform.

**Environment, Safety, Health and Assurance shall:**

- Periodically review and update regulations applicable to Ames Laboratory.
- Advise Facilities Services where safety showers and eyewashes should be located.

## 5.15 LADDER SAFETY PROGRAM

**Applicability Statement:** *This section applies to all employees and contractors performing activities on ladders and/or rolling stairs.*

### 5.15.1 REFERENCES

OSHA 1910.24 Fixed Stairs  
 OSHA 1910.25 Portable Wood Ladders  
 OSHA 1910.26 Portable Metal Ladders  
 OSHA 1910.27 Fixed Ladders

### 5.15.2. BACKGROUND

The purpose of the Ladder Safety Program is to prevent injuries to employees and contractors by ensuring proper maintenance, inspection and use of ladders and rolling stairs. This program does not apply to step stools or rolling stairs having one or two steps.

This program applies to but is not limited to:

Step Ladders	Extension Ladders	Fixed Ladders
Rolling Stairs	Slide Rolling Ladders	Platform Ladders

### 5.15.3 PROGRAM INFORMATION

#### 5.15.3.1 General Equipment Requirements

- The maximum length for single straight ladders is 30 feet and the maximum length for extension ladders is 60 feet.
- Straight/extension ladders shall be equipped with safety feet.
- The maximum length for step ladders shall be twenty (20') feet. Step ladders must have legs fully extended and locked in the open position before use. Do not use a step ladder as a straight ladder. Step ladders are not designed or approved for leaning against the wall, equipment, etc.
- Ladders must be of sufficient length so that work can be performed safely while standing on or below the second rung from the top. Standing on the top rung is not permitted. The top of the ladder shall not be used as a seat.
- Fixed ladders must be designed and constructed to accept a minimum concentrated live load of 200 pounds.
- This program establishes minimum maintenance, inspection and use requirements for ladders and rolling stairs. The program applies to all employees and contractors who use ladders.

- Cages are required for fixed ladders longer than twenty (20') feet and shall extend a minimum of 42 inches above the top of a landing.

### 5.15.3.2 Use Requirements

- Fiberglass or wooden ladders will be used for all work near electrical equipment. Aluminum ladders are acceptable for other applications.
- Ladders shall not be used in a horizontal position such as for platform, runways, or scaffolds.
- Ladders shall not be placed in front of a door unless the door is locked, roped off, or otherwise guarded with a sign on the door.
- Employees must face the ladder while ascending, descending, or standing on the ladder.
- Employees must have their hands free of material while climbing ladders. Hand lines and/or tool pouches will be used to raise or lower material.
- A ladder shall not be used to support more than one (1) individual at a time, unless it is specifically designed to accommodate more than one (1) person.
- When using a straight or extension ladder to climb onto a roof or platform, the top of the ladder shall extend at least three (3') feet above the roof or platform and must be tied off securely. Never climb over the top of the ladder.
- If the ladder has hooks, both hooks shall be secured over an edge before using.
- All straight ladders shall be placed as to prevent slipping or secured at the top of the ladder before starting the job. A second person shall hold the bottom of the ladder while the top is being secured.
- Straight ladders shall be placed so that the distance from the base of the ladder is approximately one-fourth (1/4) of the length of the ladder.

**Example:** A sixteen (16') foot ladder should be placed so the bottom is four (4') feet away from the wall.

- Ladders shall be returned to their assigned place of storage when the work is finished. They shall also be stored in a manner that provides ease of access and inspection. Ladders in storage shall be chained or otherwise secured against the wall.
- The bracing on back legs and the tops of step ladders shall not be used as steps unless specifically designed for that purpose.

- Any other use not outlined in this document is strictly forbidden - such as, but not limited to:
  - Ladders shall not be placed on top of boxes, barrels, or other unstable bases.
  - Ladders shall not be spliced together as braces or skids.

### **5.15.3.3 Inspection & Maintenance requirements:**

- All portable ladders shall be kept in good condition. Employees using ladders will be responsible for performing an inspection prior to use and reporting any defective ladders to their Supervisor/Manager. Defective ladders must be taken out of service immediately and destroyed if repair is not feasible.
- Ladder rungs shall be kept free of grease, oil, dirt, and other foreign materials.
- Wooden ladders shall not be painted. The wood must be free of splinters, sharp edges, and evidence of defects, decay, or other irregularities. Linseed oil may be used for preservation.
- Inspection of ladders, including step ladders, rolling steel ladders (mobile stairs), and extension ladders will be performed by users / owners before each use.
- An annual inspection of all ladders, including step ladders, rolling steel ladders/mobile stairs (having 4 or more steps) and extension ladders. The inspection is conducted by Facilities Services. After the inspection is completed, the ladders will be marked with colored tape indicating the year of inspection.
- When an employee inspects a ladder prior to use, they shall check the last inspection date on the tag. If it has been longer than one year since the last inspection, if the tag is missing or if the ladder is new, the ladder shall not be used until it is inspected and a tag is affixed. The employee must tag the ladder “Out Of Service” if the ladder is found to be defective or not inspected.
- The ladders shall be inspected:
  - for broken or missing steps / rungs, cleats and rails
  - to ensure steps and rungs are free from grease and oil
  - to ensure ladders are free of sharp edges, burr, etc.
  - for stability (shaking / swaying)

#### 5.15.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>LADDER SAFETY TRAINING</b>		<b>AL-136</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers, whose job assignments involve ladders, rolling stairs with 3 or more rungs.</i>	
<b><i>Module Format:</i></b>	<i>Module is Pamphlet with an exam to be sent to Training Office.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No Retrain, unless repeated discrepancies are observed or understanding of ladder safety is not retained.</i>	

Group / activity-specific Ladder Training shall be given to each employee prior to start of work. Training will include a discussion of proper use, inspection, storage, physical hazards and hazard mitigation. This training shall be documented by the Supervisor / Group Leader / Department Manager.

#### 5.15.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Ladder Safety Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Attend “Ladder Safety Training” (AL-136). Consult the Ames Laboratory training schedule for the Training Module.
- Ensure outside contractors performing work at the facility adhere to the Ladder Safety Program.
- Report any deficient ladders.

**Employees** shall:

- Attend required course as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Maintain and use ladders in a safe manner.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct annual inspection of non-Facilities Services Group ladders.
- Periodically review and update this procedure.
- Conduct Ladder Safety Training.

**Facilities Services Group** shall:

- Conduct annual inspections of Facilities Services Group Ladders.
- Ensure all new and present employees working with ladders attend Ladder Safety Training.
- Ensure all contractors comply with the Ladder Safety Program.

**Contractors** shall:

- Ladders brought on Ames Laboratory premises will be subject to inspection by both Facilities Services Group and ESH&A.
- Contractors are to remove ladders that are found to be defective.

## 5.16 CRANES, HOISTING, AND RIGGING PROGRAM

**Applicability Statement:** *This section applies to all employees and contractors utilizing fixed Ames Laboratory hoists and rigging equipment and rented mobile cranes (i.e., articulating cranes, crawler cranes, mobile cranes, service/mechanic trucks with hoisting device, etc.).*

*This does not apply to power shovels, excavators, backhoe (including when chains/slings are used to lift a suspended loads), vehicle mounted aerial devices (lifting personnel) and self propelled elevating work platforms, forklifts (except when using a hoist off of forks), tree trimming equipment, helicopter cranes, material handling equipment to deliver material to construction site (from truck to ground).*

### 5.16.1 REFERENCES

ANSI B30.2 Overhead and Gantry Cranes

ANSI B30.10 Slings

ANSI B30.16 Overhead Hoists

OSHA 1910.179, Subpart N, Overhead and Gantry Cranes in General Industry

OSHA 1910.184 Slings

OSHA 1926.1400 – 1442, Subpart CC, Cranes and Derricks in Construction

DOE Standard, DOE-STD-10190-2004 (for reference only). Not applicable to Ames Laboratory

### 5.16.2 BACKGROUND

The purpose of the Crane, Hoisting, and Rigging Program is to ensure safe use to personnel, ensure proper maintenance and inspection of cranes, hoists and rigging equipment.

### 5.16.3 PROGRAM INFORMATION

#### 5.16.3.1 Definitions

A/D director (Assembly/Disassembly director) means an individual who meets this subpart's requirements for an A/D director, irrespective of the person's formal job title or whether the person is non-management or management personnel.

Brake is a device used for retarding or stopping motion by friction or power means.

Bridge means that part of a crane consisting of girders, trucks, end ties, and drive mechanism which carries the trolley or trolleys.

Bridge travel means the crane movement in a direction parallel to the crane runway.

Bumper [buffer] is an energy absorbing device for reducing impact when a moving crane or trolley reaches the end of its permitted travel; or when two moving cranes or trolleys come in contact.

Clearance means the distance from any part of the crane to a point of the nearest obstruction.

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

Crane is a machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism an integral part of the machine. Cranes, whether fixed or mobile, are driven manually or by power.

Critical Lift is a load item, if damaged or upset would result in a release into the environment of radioactive or hazardous material exceeding the established permissible environmental limits. A critical lift is also a load item that is unique that if damaged would be irreplaceable or not repairable and is vital to a system, facility or project operation.

Dedicated spotter (power lines) must meet the requirements of a Signal person qualification and dedicated to the sole responsibility to watch the separation between the power line and the equipment, load line and load (including rigging and lifting accessories), and ensure through communication with the operator that the applicable minimum approach distance is not breached.

Drum is the cylindrical member around which the ropes are wound for raising or lowering the load.

Emergency Stop Switch is a manually or automatically operated electric switch to cut off electric power independently of the regular operating controls.

Exposed means capable of being contacted inadvertently. Applied to hazardous objects not adequately guarded or isolated.

Fail-safe means a provision designed to automatically stop or safely control any motion in which a malfunction occurs.

Fall zone means the area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident and the area where materials could disperse if dropped.

Floor-operated crane means a crane which is pendant, radio or nonconductive rope controlled by an operator on the floor or an independent platform.

Gantry crane means a crane similar to an overhead crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway.

Hoist is an apparatus which may be a part of a crane, exerting a force for lifting or lowering.

Hoist chain means a mechanical device for lifting and lowering loads by winding a line onto or off a drum.

Inspections

- Frequent - Daily to monthly intervals
- Periodic - 1 to 12 month intervals

Limit Switch is a switch that is operated by some part or motion of a power-driven machine or equipment to alter the electric circuit associated with the machine or equipment.

Load means the total superimposed weight on the load block or hook.

Load Block is the assembly of hook or shackle, swivel, bearing, sheaves, pins, and frame suspended by the hoisting rope.

Main hoist means the hoist mechanism provided for lifting the maximum rated load.

Ordinary Lift means any lift not designated as critical or pre-engineered.

Overhead crane means a crane with a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.

Pre-Engineered Lifts is a repetitive, production type lifting operation (typically not performed at Ames Laboratory).

Qualified Operator (DOE Definition) is one whose competence is recognized by the responsible manager and whose qualifications to perform specific inspection activities has been determined, verified and attested to in writing.

Qualified Person (OSHA) is one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

Qualified rigger is a rigger who meets the criteria for a qualified person.

Rated load means the maximum load for which a crane or individual hoist is designed and built by the manufacturer and shown on the equipment nameplate.

Rope refers to wire rope, unless otherwise specified.

Sheave is an assembly of rope and tackle arranged for hoisting and pulling.

Side pull means that portion of the hoist pull acting horizontally when the hoist lines are not operated vertically.

Span means the horizontal distance center to center of runway rails.

Stop is a device to limit travel of a trolley or crane bridge. This device normally is attached to a fixed structure and normally does not have energy absorbing ability.

Suspect / Counterfeit Items is one in which visual inspection, testing or other means indicate that it may not conform to established Government or industry accepted specifications or national consensus standards.

Trolley is the unit that travels on the bridge rails and carries the hoisting mechanism.

### **5.16.3.2 Requirements for Overhead and Gantry Cranes**

- Cranes may be modified and re-rated provided that the modification and the supporting structure are checked thoroughly for the new rated load by a qualified engineer or manufacturer.
- Cranes must be tested when new (125% of rated capacity) and re-tested any time the crane is altered, repaired (i.e., new cable).
- The rated load of the crane (crawler, truck, etc.) must be marked on the side of the crane and clearly legible from the ground.
- The rated load of the hoist (gantry, trolley, etc) must be marked on the side of the unit and clearly legible from the ground.
- A minimum clearance of 3 inches overhead and 2 inches laterally must be provided and maintained between crane and obstructions.
- Obstructions must not jeopardize passageways or walkways by movement of crane.
- Only designated employees who have received training are permitted to operate cranes.

### **5.16.3.3 Requirements for Stops, Bumpers Rail Sweeps and Guards**

- All cranes must be provided with bumpers to prevent crane operation from striking any object.
- Bumpers must be located so there is no direct shear force applied to bolts.
- Exposed moving parts such as gears, set screws, projecting keys, chains, chain sprockets and reciprocating components must be guarded. (Guards must be capable of supporting, without permanent distortion, the weight of a 200 pound person unless the guard is located where it is impossible for a person to step on it.)

### **5.16.3.4 Requirements for to Sheaves**

- Sheave grooves must be smooth and free from surface defects that could cause rope damage.

- Sheaves carrying ropes that can be momentarily unloaded must be provided with close fitting guards or other suitable devices to guide the rope back into the groove when the load is applied.
- Sheaves in the bottom block must be equipped with close fitting guards that will prevent ropes from becoming fouled when the block is lying on the ground with ropes loose.
- Pockets and flanges of sheaves used with hoist chains must be of such dimensions that the chain does not catch or bind during operation.
- All sheaves must be equipped with means for lubrication. Permanently lubricated and/or shielded bearings meet the requirement.

#### **5.16.3.5 Requirements for Ropes (Wire Rope, Synthetic Rope, etc.)**

- The crane operator must inspect ropes prior to use.
- Swaged or compressed fittings must be applied as recommended by the rope or crane manufacturer.
- Replacement rope must be the same size, grade, and construction as the original rope furnished by the crane manufacturer.
- Wire ropes must be taken out of service when any of the following conditions exists:
  - Six (6) randomly distributed broken wires in one lay or three (3) broken wires in one strand in one lay.
  - Wear of one-third of the original diameter of outside individual wires.
  - Kinking, crushed, bird caging or any other damage resulting in distortion of the rope structure.
  - More than two broken wires in one lay in sections beyond end connections or more than one broken wire at end connection.
  - Reduction from nominal diameter of more than:
    - ◇ 1/64 inch for diameter up to and including 5/16 inches
    - ◇ 1/32 inch for diameters 3/8 inch to and including 1/2 inch
    - ◇ 3/64 inch for diameters 9/16 inch to and including 3/4 inch
    - ◇ 1/16 inch for diameters 7/8 inch to 1 1/8 inches inclusive
    - ◇ 3/32 inch for diameters 1 1/4 to 1 1/2 inches inclusive
- Rope must be secured to drums as follows:
  - No less than two wraps of rope must remain on the drum when the hook is in its extreme low position.
  - Rope end must be anchored by a clasp securely attached to the drum or by a socket arrangement approved by the crane or rope manufacturer.
- The following are the requirements for Rope Clips:

- Rope clips attached with U-Bolts must have the U-Bolts on the dead or short end of the rope.
- Spacing and number of all types of clips must be in accordance with the clip manufacturer's recommendation.
- Clips must be drop forged steel in all sizes manufactured commercially.
- When the newly installed rope has been in operation for one hour, all nuts on the clip bolts must be retightened.

#### **5.16.3.6 Requirements for Slings**

- The crane operator must inspect slings prior to use.
- Each sling must be marked to show the rated capacity.
- Slings must be taken out of service when any of the following conditions exist:
  - Melting or charring of any part of the sling surface
  - Acid or caustic burns
  - Snags, punctures, tears or cuts
  - Broken or worn stitches
  - Distortion of hardware or fittings

#### **5.16.3.7 Requirements for Chains**

- The crane operator must inspect chains prior to use. Cleaning the chain may be required to inspect chains since dirt, oil, etc. may hide damage.
- Chains must be taken out of service when any of the following conditions exist:
  - Stretching (When a chain has stretched so that it is now more than three percent longer than it was new, it is unsafe and must be discarded.)
  - Binding (deformed to the extent that individual links cannot move freely)
  - Wear
  - Nicks and gouges

#### **5.16.3.8 Brakes (Holding Brakes)**

- Each hoisting unit shall be equipped with at least one self-setting brake applied directly to the motor shaft or some part of the gear train.

#### **5.16.3.9 Suspect/ Counterfeit Items**

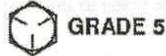
- Suspect / counterfeit items must not be used in conjunction with hoists / cranes. The DOE Headmark List is to be used as a reference for identifying suspect / counterfeit items.

DOE-STD-1090-2004

# DOE HEADMARK LIST

ANY BOLT ON THIS LIST SHOULD BE TREATED AS DEFECTIVE WITHOUT FURTHER TESTING

**ALL GRADE 5 AND GRADE 8 FASTENERS OF FOREIGN ORIGIN WHICH DO NOT BEAR ANY MANUFACTURE'S HEADMARKS:**



GRADE 5



GRADE 8

**GRADE 5 FASTENERS WITH THE FOLLOWING HEADMARKS:**

MARK	MANUFACTURER	MARK	MANUFACTURER
	J Jinn Her (TW)		KS Kosaka Kogyo (JP)

**GRADE 8 FASTENERS WITH THE FOLLOWING HEADMARKS:**

MARK	MANUFACTURER	MARK	MANUFACTURER
	A Asahi Mfg (JP)		KS Kosaka Kogyo (JP)
	E Datal (JP)		M Minamida Sleybo (JP)
	FM Fastener Co. of Japan (JP)		MS Minato Kogyo (JP)
	H Hinamoto Metal (JP)		NF Nippon Fasteners (JP)
	J Jinn Her (TW)		RT Takai Ltd (JP)
	KY Kyoel Mfg (JP)		UNY Unylite (JP)
	Intasco (CA, TW, JP, YU) (Greater than 1/2 Inch diameter)		

**GRADE 8.2 FASTENERS WITH THE FOLLOWING HEADMARKS:**

MARK	MANUFACTURER
	KS Kosaka Kogyo (JP)

**GRADE A325 FASTENERS (BENNETT DENVER TARGET ONLY) WITH THE FOLLOWING HEADMARKS:**

	MARK	MANUFACTURER
Type 1		A325KS Kosaka Kogyo (JP)
Type 2		
Type 3		



AUGUST 1992

KEY: CA - CANADA JP - JAPAN TW - TAIWAN YU - YUGOSLAVIA

GP00 0206

Figure 1-5

### **5.16.3.10 Requirements for Inspections**

#### **5.16.3.10.1 Frequent (Daily) Inspections**

To be performed by Ames Laboratory operators include:

- All functional operating mechanisms for maladjustment interfering with proper operation.
- Deterioration or leakage in lines, tanks, valves, drains, pumps, and other parts of air or hydraulic systems.
- Hoist chains including end connections for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturers recommendations.
- Hooks with deformation or cracks. Hooks with 15 percent in excess of normal throat opening or more than 10 degrees twist from the plane of the unbent hook must be discarded.
- The inspection must be documented utilizing Form 10200.119.

#### **5.16.3.10.2 Periodic (Annual) Inspections**

To be performed by trained inspector includes examination of:

- Deformed, cracked or corroded members, loose bolts or rivets
- Cracked or worn sheaves and drums
- Worn, cracked or distorted parts such as pins, bearing, shafts, gears, rollers, locking and clamping devices
- Excessive wear on brake system parts, linings, pawls and ratchets
- Reduction of rope diameter due to corrosion, wear, etc.
- Number of broken outside wires and wear on outside wires
- Corroded, cracked, bent, worn, or improperly applied end connectors
- Kinking, crushing, cutting or unstranding
- The inspection must be documented utilizing Form 10200.122

NOTE: Any auxiliary rope used must be inspected before each use for the same criteria list above.

#### **5.16.3.10.3 Inspection Tagging**

- The status of annual hoist inspection will be indicated by colored tag (e.g., with a different color from year to year printed with the year). The tags will be adhered to the hoist or posted in a conspicuous location to show inspection status.

Included on the tag is:

- Valid through:
  - Inspected by:
  - Date:
  - ID No.:
- For hoists not in use, an “Out of Service” tag will be attached to the hoist (i.e., chain, pendant, controls).
  - For equipment not passing inspection, a “Danger-Do Not Operate” tag will be attached to the hoist (i.e., chain, pendant, controls). The owner will be notified and instructed the hoist cannot be used until repaired or replaced.

#### **5.16.3.11 Requirements for Testing:**

- New or altered cranes must be tested prior to first use. Function to be tested include:
  - Raising and lowering the hook
  - Trolley travel
  - Bridge travel
  - Limit switches, locking and safety devices
- Installations will be load tested to no more than 125% of the rated load.
- It is the equipment owner’s responsibility to arrange testing/inspection service.
- The test reports must be maintained by the owner of the crane with a duplicate copy maintained by Facilities Services.
- Annually thereafter hoists will be visually inspected using Form 10200.122.

#### **5.16.3.12 Precautionary Measures for Preventive Maintenance:**

- Move the crane to a location where it will cause the least interference with other operations in the area.
- Ensure all controllers are in the off position.
- Open and lockout the main (pneumatic and/or electric) or emergency switches.
- Post a sign “Out Of Order” on the pendant.
- Do not use the crane until after adjustment and repairs have been made:
  - the crane must not be used until all guards have been reinstalled,
  - safety devices reactivated, and
  - maintenance equipment removed.
- Repairs by welding or reshaping are not permitted unless authorized by the manufacturer.

- Replace all critical parts that are cracked, broken, bent or excessively worn.

#### **5.16.3.13 Requirements for Attaching, Handling, and Moving a Load:**

- Do not load the crane beyond its rated capacity (except for test purposes).
- Ensure hoist chain or hoist rope is free from kinks or twists and not wrapped around the load.
- Attach the load to the load block hook by means of slings or other approved devices.
- Ensure slings clear all obstacles.
- Secure and balance the sling or lifting device before it is lifted more than a few inches.
- Hoist rope must not be kinked.
- Multiple part lines must not be twisted around each other.
- The hook must be brought over the load in such a manner as to prevent swinging.
- Cranes must not be used for side pulls.
- While any employee is on the load or hook, there must be no hoisting, lowering, or traveling.
- Do not carry loads over personnel.
- Test the brakes each time a load is approaching the rated load capacity.
- Test the brakes by raising the load a few inches and applying the brakes.
- Do not lower the load below the point where less than two full wraps of rope remain on the hoisting drum.
- Do not leave the controls while the load is suspended. Lower the load to the ground and disengage.

#### **5.16.3.14 Requirements for Cranes in Construction** (*articulating cranes, crawler cranes, mobile cranes, etc.*).

- There are 4 different designations of workers with the new OSHA requirements for cranes in construction (1926.1400):
  - Qualified Signal Person
  - Qualified Rigger
  - Assembly/Disassembly Director (employer delegated)
  - Qualified / Certified Crane Operator

#### **5.16.3.14.1 Qualified Signal Person**

The following are the requirements for a Qualified Signal person:

- A signal person is required when:
  - When the point of operation is not in full view of the operator.
  - The operators view is obstructed in the direction the equipment is traveling.
  - Either the operator or the person handling the load determines that a signalperson is needed.
  - The signal person must understand and know the types of signals used at worksite
  - Is competent using these signals
- The signal person is considered qualified if they:
  - Know and understand the type of signals used as the worksite.
  - Is competent in using these signals.
  - Understand the operations and limitations of the equipment, including the crane dynamics involved in swinging, raising, lowering, and stopping loads and in boom deflection from hoisting loads.
  - Passes and oral or written test and practical test.

#### **5.16.4.14.2 Qualified Rigger**

Qualified riggers are required whenever workers are within the fall zone and hooking, unhooking, or guiding a load, or doing the initial connection of a load to a component or structure.

- A qualified rigger is one who meets the criteria for a qualified person (but do not have to be certified by an accredited organization or assessed by a third party).
- Employers must determine whether a person is qualified to perform specific rigging tasks. Each qualified rigger may have different credential or experience. A qualified rigger is a person that:
  - Possesses a recognized degree, certificate, or professional standing, or
  - Has extensive knowledge, training, and experience , and
  - Can successfully demonstrate the ability to solve problems related to rigging loads

#### **5.16.4.14.3 Assembly / Disassembly (A/D) Director**

Assembly/Disassembly must comply with the manufacturer's prohibitions.

- The A /D Director must meet the criteria for both a competent person and a qualified person or must be a competent person assisted by a qualified person (Ames Lab personnel).
- For smaller units, a single individual may arrive on site. This person will be responsible for assembly / disassembly and operation of the crane. Ames Lab personnel (qualified person) may assist the A / D Director.
- The A / D Director must ensure that each member of the crew understands his or her tasks, the hazards of the tasks, and any hazardous positions or locations to avoid.
- The A / D Director must address 12 specific areas of concern:
  - ✓ Site and ground conditions

- ✓ Blocking material
- ✓ Proper location of blocking
- ✓ Verifying assist crane loads
- ✓ Boom and jib pick points
- ✓ Center of gravity
- ✓ Stability upon pin removal
- ✓ Snagging
- ✓ Struck by counterweights
- ✓ Boom hoist brake failure
- ✓ Loss of backward stability, and
- ✓ Wind speed

#### 5.16.3.14.4 Qualified / Certified Crane Operator

Operators of equipment must meet the criteria for minimum expertise described in the applicable section.

- Since Ames Laboratory does not own a mobile crane, so having a qualified / certified crane operator is not cost effective (accredited training, written and practical testing, and certification for the specific type and capacity of the crane are required).
- When cranes are rented from ISU or outside agency, they unit comes with a qualified/certified operator. Designated Ames Lab personnel are permitted to help the operator in assembly and disassembly of the crane, under their supervision.
- When a larger crane is necessary, the unit would come with its own operator, assembly/disassembly personnel, and qualified riggers. Ames Laboratory personnel may assist as directed by the operator and other personnel.

#### 5.16.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>HOISTING AND RIGGING TRAINING</b>		<b>AL-014</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignments involve use, servicing or maintenance and inspection of hoists.</i>	
<b><i>Module Format:</i></b>	<i>Module is Classroom discussion with video, handouts, and quiz. Training will cover:</i> <ul style="list-style-type: none"> <li>• <i>OSHA Guidelines</i></li> <li>• <i>Equipment</i></li> <li>• <i>Procedures</i></li> <li>• <i>Authorization</i></li> <li>• <i>Etc.</i></li> </ul> <i>Estimated completion time: 1.5 hours</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Three Year Retrain: Retrain module consists of classroom discussion, handouts, hands on use (practice lift) and exam. Estimated completion time: 1.5 hours</i>	

<b>CRANE, HOISTING, AND RIGGING TRAINING</b>		<b>AL-221</b>
<b>Intended Audience:</b>	<i>Mandatory for all workers whose job assignments involve use, servicing or maintenance and inspection of hoists.</i>	
<b>Module Format:</b>	<i>Module is Classroom discussion with video, handouts, and quiz.</i> <i>Training will cover:</i> <ul style="list-style-type: none"> <li>• OSHA Guidelines</li> <li>• Equipment</li> <li>• Procedures</li> <li>• Authorization</li> <li>• Etc.</li> </ul> <i>Estimated completion time: 1.5 hours</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>Three Year Retrain: Retrain module consists of classroom discussion, handouts, hands on use (practice lift) and exam.</i> <i>Estimated completion time: 1.5 hours</i>	

<b>HOISTING AND RIGGING INSPECTOR</b>		<b>AL-158</b>
<b>Intended Audience:</b>	<i>Mandatory for all workers whose job assignments involves annual inspection of hoists.</i>	
<b>Module Format:</b>	<i>Module is classroom discussion with video.</i> <i>Training will cover:</i> <ul style="list-style-type: none"> <li>• OSHA Guidelines</li> <li>• Equipment</li> <li>• Suspect and Counterfeit Parts</li> <li>• Procedures</li> <li>• Inspection Criteria</li> <li>• Etc.</li> </ul> <i>Estimated completion time: 1.0 hour</i>	
<b>Associated Retrain Period &amp; Format:</b>	<i>Two Year Retrain: Retrain module consists of classroom discussion, PPT, and video.</i>	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of physical hazards, chemical hazards, hazard mitigation, and any other procedural information.

### 5.16.5 PERFORMANCE CHECKLISTS

**Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Crane, Hoist and Rigging Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Ensure employees who operate cranes and hoist attend the Crane, Hoist and Rigging Program Training (AL-014). Consult the Ames Laboratory training schedule for the next available class.
- Ensure outside contractors performing work at the facility adhere to the Hoist and Rigging Program.

**Employees shall:**

- Attend required course as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Fully adhere to the requirements set forth in the Crane, Hoist and Rigging Program.
- Wear Personal Protective Equipment as necessary.
- Complete daily inspection checklist for each day the hoist(s) is used. If determined to be deficient, lock and tag the equipment out of service and notify appropriate supervisor and group leader.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- Periodically review and update the Crane, Hoist and Rigging Program.
- Conduct Crane, Hoist and Rigging Training (AL-158) and refresher training.
- Maintain Crane, Hoist and Rigging Inventory and documentation of inspections.
- Notify owners of annual inspection and administer the inspection.

**Engineering Services Group shall:**

- Conduct annual inspections of all operative hoists and cranes belonging groups other than Facilities Services.
- Be familiar and comply with this program.
- Inform contract personnel, prior to work startup of this program if their work involves a crane.

**Facilities Services Group shall:**

- Be familiar and comply with this program.
- Conduct annual inspections of all operative hoists and cranes belonging Facilities Services.
- Inform contract personnel, prior to work startup, of this program if their work involves a crane.
- Although, 2-way radios would most likely be used for communication between riggers and an operator, riggers must be familiar with basic standard hand signals per Subpart Cc of Part 1926.
- Notify ESH&A when portable cranes are brought on site.

**Contractors shall:**

- Comply with the Crane, Hoist, and Rigging Program. Failure to comply may subject the contractor to immediate discharge.



### Hoisting & Rigging Inspection Checklist Instructions

If damage to the Hoist/Crane or Rigging is noted or a checklist item does not meet the criteria described below, the user should contact their supervisor to determine a corrective course of action. Do not use the equipment until all checklist items are listed as "OK" per the instructions below. Follow the instructions below for each of the Hoists/Cranes and Rigging Inspection Checklist Items:

15. Load Hook & Blocks – Inspect the load hook for twist, expansion of throat opening and wear. Inspect the load blocks for obvious damage (cracks, wear, rust, etc.) and lubrication. Any damage that jeopardizes the workability of the equipment or its ability to carry a load should be noted.
16. Wire Rope or Chains – Inspect the wire rope for broken wires, kinking, bird-caging, chemical damage, etc. Inspect chains for worn links, stretching, chemical damage, etc.
17. Cracked or Worn Sheaves and Drums – Check for surface defects such as catches, binding, lubrication, etc.
18. Bridge Wheels and Bearings – Check wheels for damage/wear and bearings for damage and lubrication.
19. Trolley and Rails – Inspect trolley and rails for smooth operation, no damaged welds, proper connections, etc.
20. Hydraulic Hoses, Pump & Controls – Inspect hoses, pump and controls for leakage, splits/cracks in hoses and any obvious damage.
21. Tires/Wheels – For mobile hoists/cranes inspect the tires or wheels for damage and ensure they are lubricated for smooth operation.
22. Bumpers/End Stops – Inspect bumpers and end stops to ensure they are in place and firmly secured.
23. Current Inspection Sticker – Ensure the annual inspection sticker is current. If not, contact ESH&A or Engineering Services for inspection.
24. Capacity Posting – Inspect the hoist/crane to ensure the unit is posted with the maximum weight load capacity.
25. Electrical Disconnect Accessible – For electrical hoists/cranes ensure the electrical disconnect is immediately accessible.
26. Lubrication – Inspect all moving parts to ensure they move freely.
27. Rigging Equipment (Synthetic Slings, Chains and Wire Rope):
  - Inspect Synthetic Slings for melting or charring, acid or caustic burns, snags, punctures, tears or cuts, broken or worn stitches and distortion of hardware or fittings.
  - Inspect Chains for stretching, binding, wear, nicks and gouges.
  - Inspect Wire Ropes for kinking, bird caging, wear, broken wires, etc.
28. Structural – Inspect welds and frame for any obvious damage.
29. PPE (Personal Protective Equipment) – Inspect PPE including gloves, steel toed shoes and hard hats to ensure proper fit and effective protection.

**If any of the items above are deemed unsatisfactory, complete a Service Order Requisition to have Engineering Services evaluate and repair (if possible).**

Date	Checklist Item #	Description of Unsatisfactory Condition	Date Corrected	Corrected by (Employee #)

## Appendix B

**AMES LABORATORY**  
**Annual Hoist and Crane Inspection Record**

Program		Owner (equipment contact)				
Location		Cost Center # (Account #)				
Property #		ID #				
Description of Hoist, Crane, Platform Lift:						
Manufacturer of Trolley/Rail		Model #	Serial #	Capacity		
Manufacturer Hoist		Model #	Serial #	Capacity		
Control and mechanisms operate properly?				N/A	YES	NO
Hoist upper limit switch operates properly (if applicable)?						
Lines, hoses, valves, switches, etc. in good condition? (no signs of wear, damage, etc.)						
Hooks are in good condition? (no signs of stress, i.e., cracks, deformation, damage, etc.)						
Hooks are within limits (i.e., >15% excess throat opening or 10% twist)						
Hook retaining pins, welds, rivets, etc. in good operating condition?						
Hoist rope or cable in good condition? (no signs of kinking, crushing, bird caging, damage, etc.)						
Hoist chain in good condition? (no signs of nicks, gouges, distortion, wear or damage)						
Web straps in good condition? (no signs of wear, knots, cuts, tears, broken stitching or damage)						
Hoist braking system in proper operation?						
Fasteners, Crosby cable-clamps, etc in good operating condition?						
Drums, sheaves, sprockets, etc. in good operating condition? (cracked or worn)						
Other parts are in good operating condition? (worn, corroded, cracked, damaged)						
Motor in good operating condition?						
End connections are in good operating condition? (not deteriorating or damaged)						
Electrical components in good operating condition? (proper strain relief, insulation, etc.)						
Warning Labels Posted?						
Current Annual Inspection Sticker? (or tagged "Out Of Service")						
Inspect for counterfeit parts						
Equipment is maintained according to manufacturer's original production? (not altered)						
Comments (findings):						

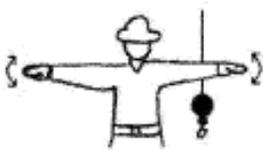
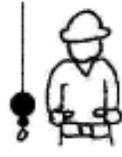
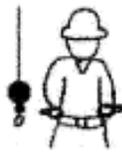
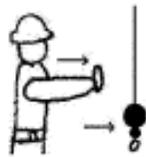
Passed Inspection?	Yes	No
If inspection did not pass, was the unit tagged out of service and user notified of issues?	Yes	No

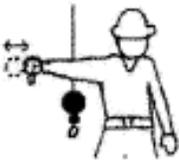
Name of Person Conducting Inspection:		
Print:	Signature:	Date:

Inspection Records Maintained at ESH&A

## Appendix C

## Subpart CC of Part 1926—Standard Hand Signals

 <p><b>STOP</b> – With arm extended horizontally to the side, palm down, arm is swung back and forth.</p>	 <p><b>EMERGENCY STOP</b> – With both arms extended horizontally to the side, palms down, arms are swung back and forth.</p>	 <p><b>HOIST</b> – With upper arm extended to the side, forearm and index finger pointing straight up, hand and finger make small circles.</p>
 <p><b>RAISE BOOM</b> – With arm extended horizontally to the side, thumb points up with other fingers closed.</p>	 <p><b>SWING</b> – With arm extended horizontally, index finger points in direction that boom is to swing.</p>	 <p><b>RETRACT TELESCOPING BOOM</b> – With hands to the front at waist level, thumbs point at each other with other fingers closed.</p>
 <p><b>RAISE THE BOOM AND LOWER THE LOAD</b> – With arm extended horizontally to the side and thumb pointing up, fingers open and close while load movement is desired.</p>	 <p><b>DOG EVERYTHING</b> – Hands held together at waist level.</p>	 <p><b>LOWER</b> – With arm and index finger pointing down, hand and finger make small circles.</p>
 <p><b>LOWER BOOM</b> – With arm extended horizontally to the side, thumb points down with other fingers closed.</p>	 <p><b>EXTEND TELESCOPING BOOM</b> – With hands to the front at waist level, thumbs point outward with other fingers closed.</p>	 <p><b>TRAVEL/TOWER TRAVEL</b> – With all fingers pointing up, arm is extended horizontally out and back to make a pushing motion in the direction of travel.</p>

 <p><b>LOWER THE BOOM AND RAISE THE LOAD</b> – With arm extended horizontally to the side and thumb pointing down, fingers open and close while load movement is desired.</p>	 <p><b>MOVE SLOWLY</b> – A hand is placed in front of the hand that is giving the action signal.</p>	 <p><b>USE AUXILIARY HOIST (whipline)</b> – With arm bent at elbow and forearm vertical, elbow is tapped with other hand. Then regular signal is used to indicate desired action.</p>
 <p><b>CRAWLER CRANE TRAVEL, BOTH TRACKS</b> – Rotate fists around each other in front of body; direction of rotation away from body indicates travel forward; rotation towards body indicates travel backward.</p>	 <p><b>USE MAIN HOIST</b> – A hand taps on top of the head. Then regular signal is given to indicate desired action.</p>	 <p><b>CRAWLER CRANE TRAVEL, ONE TRACK</b> – Indicate track to be locked by raising fist on that side. Rotate other fist in front of body in direction that other track is to travel.</p>
 <p><b>TROLLEY TRAVEL</b> – With palm up, fingers closed and thumb pointing in direction of motion, hand is jerked horizontally in direction trolley is to travel.</p>		

## 5.17 WORKING ALONE

**Applicability Statement:** *This section applies to all employees who work during non-standard hours (5 P.M. – 8 A.M., weekends and holidays) when performing activities that require only one person, but due to the hazardous nature must not be performed solo.*

### 5.17.1 REFERENCES

OSHA 1910.146 Permit Required Confined Spaces  
Manual 46400.002 ESH&A Program Manual, Confined Space Entry Program, Section 5.18  
Policy 46300.003 Facilities Services Safety Policy  
Procedure 10200.010 Readiness Review Procedure

### 5.17.2 BACKGROUND

The purpose of this program is to establish the requirements for employees to work alone during off hours. Personal enterprise, diligence, and innovative procedures are encouraged at Ames Laboratory. It is also Ames Laboratory policy to ensure that employees are not put at risk. Supervisors are charged with the responsibility of reviewing and documenting which activities require working alone procedures and approval. For this reason:

- working alone will be prohibited for hazardous tasks unless safety procedures are developed to ensure personnel safety
- all tasks shall be reviewed (see Readiness Review Procedure 10200.010) and documented
- activities that change significantly require additional review (see Readiness Review Procedure 10200.010) and documentation.

#### **Definitions:**

##### Buddy or Attendant:

A co-worker on a “one person” job where the chances of an incapacitating accident cannot be eliminated for the solitary worker.

##### Non-Standard Hours:

5 P.M. – 8 A.M., weekends and holidays

##### Hazardous Task:

A task that could result in an incapacitating accident which renders the victim incapable of self help or summoning help.

##### Working Alone:

Any employee not working within eye sight or hearing, (no room or wall separations) for more than a few moments.

### 5.17.3 PROGRAM INFORMATION

Many jobs performed at Ames Laboratory are routine and have acceptable risks. The only risk generally associated with such tasks is the risk related to workers' physical condition (such as heart failure, stroke, etc.). This program will not address such situations.

#### 5.17.3.1 Rules Applying to Working Alone

1. In the absence of supervisor approval, the following activities may not be performed alone during non standard hours:
  - Bulk dispensing, transferring, packaging or handling of chemicals (amount greater than routinely used/stored in a laboratory) such as:
    - Corrosives
    - Cryogenic materials
    - Hydrofluoric Acid
    - Pyrophoric materials
    - Radioactive materials
    - Poisonous gases
    - Waste cleanups or response to a spill or fire emergency
  - Electrical work or service on exposed electrical parts having greater than 50 volts
  - Trenching or excavation work
  - Hot work including welding, torching, brazing, etc. that must be performed without shielding, guarding or where combustibles and flammables are not further than 35 feet away. *(This does not apply to routine torch work such as that performed in laboratories for glass work or welding which is performed in the facilities shops.)*
  - Scaffolding, elevated platforms
  - Any Non - Permit Required Confined Space Entry (see Section 5.18 of this manual). At no time may someone enter a Permit Required Confined Space alone.
  - Working with or on machinery or equipment with guards missing or removed unless the equipment is locked and tagged out of service
2. Supervisors are responsible for reviewing and documenting those tasks which require two people. In those cases:
  - At least two (2) employees familiar with the hazards and the equipment shall be present in the general area where work of a hazardous nature is present so that prompt and competent assistance can be provided in the case of an emergency. ESH&A is available for consultation.
  - Employees performing tasks of a hazardous nature must be familiar with applicable emergency procedures (call 911, location of fire alarm activation pull stations, First Aid, etc).
  - Employees performing tasks of a hazardous nature must be aware of the location of the nearest phone and have access in the event of an emergency.

### 5.17.3.2 Exemptions

1. Supervisors / managers may approve work in hazardous areas under non-hazardous conditions. ESH&A may be contacted for guidance in determining when a work activity to be performed could be deemed hazardous or non-hazardous under this procedure.
2. There are circumstances that warrant some general exemptions from the rules to the Working Alone Program. The situations and groups involved include:
  - Working Alone in an office area.
  - If no hazards are present in the normally hazardous area (no bulk chemical use, etc.) which has been authorized by the Supervisor or Manager prior to the activity. Examples include but is not limited to:
    - Chemical checking the progress of an experiment or the status of mechanical equipment and conditions (pumps, temperature, etc.), laboratory checks and tests, etc.
    - Facilities Services Group may need to come in to perform non-hazardous work for resolution of some type of condition.
    - Plant Protection Personnel perform walk throughs of the Ames Laboratory Buildings for security and safety issues.

### 5.17.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES AL-001</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignments involve Hazardous Tasks outside of peak business hours.</i>
<b><i>Module Format:</i></b>	<i>Working Alone is incorporated into General Employee Training (GET) which is classroom instruction. Estimated Time of Completion: 1.5 Hours</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's Annual Retrain Mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders.</i>

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of physical hazards, chemical hazards, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. This training shall be documented by the Supervisor / Group Leader / Department Manager.

### 5.17.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leaders / Department Managers shall:**

- Ensure principles outlined in this program are applied and followed.
- Review all jobs outside of peak hours to determine which tasks need special work procedures.
- Document the tasks requiring special work procedures.
- Make employees aware of Working Alone Program.
- Make employees aware of hazards involved in a task.
- Assure the job procedures accurately reflect actual job practices.
- Respond to employee safety concerns and correct unsafe conditions that may exist.

**Employees shall:**

- Attend General Employee Training as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Perform all tasks in a safe manner.
- Review work procedures that outline the job and discuss any modification of these procedures with Supervisor/Group Leader/Manager.
- Fully adhere to the requirements set forth in the Working Alone Program.
- Utilize a second or buddy system while working in a hazardous location or working with hazards.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- Assist Supervisors/Group Leaders/Department Managers in evaluation of job tasks and designing safe work procedures.
- Periodically review and update the Working Alone Program.
- Conduct General Employee Training.

**Working Alone Attendant (Buddy) shall:**

- Provide assistance to employee working alone to ensure safety during controlled operation.
- Review work being performed to ensure familiarity of operations and hazards involved.
- Review duties of attendant including how to summon help and get worker out of danger without endangering yourself.
- Maintain audio or visual contact with employee performing activity.

## 5.18 CONFINED SPACE ENTRY PROGRAM

**Applicability Statement:** *This section applies to all employees and contractors entering confined spaces including but not limited to man holes, pressure vessels, tanks, boilers, etc.*

### 5.18.1 REFERENCES

OSHA 1910.146 Confined Space Entry  
NIOSH Recommended Criteria for Working in Confined Spaces  
Form 10200.097 Confined Space Entry Permit (Appendix C)  
Form 46300.055 Pre-Entry Checklist for Non-Permit Required Confined Spaces (Appendix D)  
Form 46400.042 Confined Space Entry Procedures – Training Statement (Appendix E)  
Procedure 46300.010 Emergency Procedures  
Plan 46300.001 Emergency Plan

### 5.18.2 BACKGROUND

The Confined Space Program is a program designed to prevent employees and contractors from encountering physical and atmospheric hazards in areas defined as confined spaces by OSHA. The program requires a survey to determine potential and actual hazards. These hazards include but are not limited to mechanical, engulfment, electrical and atmospheric (oxygen deficiency, toxic substances, flammables, etc.) After the survey is completed, the spaces are determined to be Permit Required Confined Spaces or Non Permit Required Confined Spaces. Training is required for employees and contractors who enter either.

#### **Definitions:**

Attendant means an individual trained to monitor the authorized entrants, initiate emergency activities, and perform duties assigned in the Confined Space Program.

Authorized Employee (Entrant) an individual trained and authorized to enter a confined space to perform duties assigned in the Confined Space.

#### Confined Space

- Is large enough and so configured that an employee can bodily enter and perform assigned work;
- Has limited or restricted means of entry and exit; and
- Is not designed for continuous occupancy.

Entry Permit means a written or printed document that is provided by the employer to allow and control entry into a permit space. Permits are kept in the ESH&A Office. See Appendix C for copy of Confined Space Entry Permit, Form 10200.097.

Non Permit Required Confined Space means a confined space that does not contain or have the potential to develop a hazardous atmosphere causing death or serious physical harm. A Non Permit Required Confined Space still requires a checklist; however the confined space may be entered without the use of a retrieval system and attendant provided that the space can be

maintained in a safe atmospheric condition. The checklists are kept in the ESH&A Office. See Appendix D for copy of Pre-Entry Checklist (Form 46300.055) for Non-Permit Required Confined Spaces.

*Hazardous atmosphere:*

An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL)
- Airborne combustible dust at a concentration that meets or exceeds its LFL
- Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent
- Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, which could result in employee exposure in excess of its dose or permissible exposure limit
- Any other atmospheric condition that is immediately dangerous to life or health.

NOTE: Dust concentrations may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

NOTE: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

*Hot Work Permit* A written authorization by Ames Laboratory Facilities Services Group or ESH&A or designee to perform operations including welding, grinding, cutting, burning, heating, etc.

*IDLH* means ImmEDIATELY Dangerous to Life or Health. Any condition that poses an immediate or delayed threat to life or health that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided.

*Prohibited Condition* Any condition in a permit-required space that is not allowed by the permit.

*Retrieval System* Equipment used including retrieval lines, chest or full body harness, wristlets and a lifting device (tri-pod) or anchor.

*Testing* means a process by which the hazards that may confront entrants of a confined space are identified and evaluated using a number of tools (monitoring equipment).

### 5.18.3 PROGRAM INFORMATION

#### 5.18.3.1 General Safety Rules:

- All confined spaces will be evaluated annually to ensure proper hazard identification. Also, when new hazards are identified during regular confined space entry, the matrix will be revised.
- All spaces defined as Permit-Required Confined Spaces are identified and labeled:

**“DANGER  
CONFINED SPACE  
PERMIT REQUIRED”**

See Appendix A & B for location of Permit Required Confined Spaces

NOTE: All provisions of the Confined Space Entry Procedure must be thoroughly implemented prior to authorizing and issuing a permit for entry into any space identified and labeled as a Permit Required Confined Space.

- All spaces defined as Non-Permit Required Confined Spaces are identified and labeled:

**“DANGER  
CONFINED SPACE  
AUTHORIZED PERSONNEL ONLY”**

See Appendix A & B for location of Non-Permit Required Confined Spaces.

- Spaces identified in Research Areas (due to potential for staff turn over) will be labeled:

**CONTACT ESH&A PRIOR TO ENTRY @ 4-2153**

- If hazards arise within a non-permit required confined space, each employee must exit the space immediately. The space must be re-evaluated to determine whether it must be reclassified as a permit required confined space, then requiring a Permit.
- If hazards are generated as a result of the work being performed (i.e., hot work, cleaning with solvents, asbestos removal, etc.) in a non-permit required space, it must be re-classified as a permit required confined space, then requiring a Permit.
- Control of atmospheric hazards through forced air ventilation to control atmospheric hazards does not constitute elimination of the hazard. Anytime forced air ventilation is used to control an atmospheric hazard, the space is automatically deemed a Permit Required Confined Space. If the space was a non-permit space originally and ventilation is being used for comfort (temperature control), it will remain a non-permit required space.

**5.18.3.2 Equipment Requirements:**

The following equipment is supplied by Ames Laboratory and may be required to be used for entry into confined spaces dependent on circumstances which will be dictated in the permit:

- Atmospheric Testing and Monitoring Equipment
  - 1 - TMX412 Four Gas Monitor (Oxygen, Flammable Limits, Carbon Monoxide, Hydrogen Sulfide)
  - 3 – TMX410 Four Gas Monitor (Oxygen, Flammable Limits, Carbon Monoxide, Hydrogen Sulfide)

NOTE: These units are required to be inspected and calibrated monthly. It is the responsibility of ESH&A to perform the calibration.

- Ventilating equipment needed to obtain acceptable entry conditions
- Manhole ventilation unit
- Two-way radios to be used by the attendant and entrant
- Personal Protective Equipment for hazards which could not be engineered out:
  - Safety Glasses
  - Protective Clothing
  - Gloves
  - Hard Hats
  - Air Purifying Respirators

NOTE: SCBAs (Self Contained Breathing Apparatus) will not be used to enter a space which is not safe from atmospheric hazards. The space must be ventilated through the use of forced air equipment.

- Lighting equipment needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency (flash lights);
- Barriers and shields as required to protect personnel from external hazards (Caution Tape, Traffic Cones, Chain & Stanchions);
- Equipment such as ladders, needed for safe entry and exit by authorized entrants;
- Rescue and emergency equipment including:
  - Tri-Pod with Winches
  - Harnesses
  - Lanyards
  - Wristlets
- Any other equipment deemed necessary for safe entry into and rescue from Permit Required Confined Spaces.

### 5.18.3.3 Site Preparation Procedure

Step	Action
1.	De-energize, lockout and tagout all mechanical hazards (such as agitators, motors, pumps, etc.) and electrical energy sources within or connected to the confined space per Procedure 5.12 Lockout/Tagout in the ESH&A Program Manual.
2.	Isolate the permit space from hazards such as nitrogen, steam, solvents, or other respiratory or asphyxiant hazards.
3.	Purge, inert, flush or ventilate the permit space to eliminate or control atmospheric hazards.
4.	Setup and stage pedestrian, vehicle or other barriers as necessary to protect entrants from external hazards.
NOTE	<ul style="list-style-type: none"> <li>Safeguards and Security is notified prior to entry into a permit required confined space and notified again upon exiting the space. This is a requirement on the Entry Permit (Form 10200.097).</li> <li>Radio communication is maintained with Safeguards and Security.</li> <li>Should rescue from a confined space become necessary, Safeguards and Security will notify the City of Ames Fire Department and Rescue.</li> <li>Periodic rescue drills are performed with the City of Ames Fire Department and Rescue in association with Iowa State University.</li> </ul>

### 5.18.3.4 Elements of a Confined Space Permit

The entry permit documents compliance and authorizes entry into a permit space. The entry permit must be completed prior to entry into the space. The following information is required for each permit:

Step	Action
1.	Date and time of entry
2.	Duration of entry
3.	Permit Space to be entered
4.	Permit Space Hazards (oxygen deficiency, flammable gases, mechanical hazards, electric shock, etc.)
5.	Purpose of entry
6.	Name(s) of authorized entrant
7.	Name of attendant ( <i>Not required for Non-Permit Spaces</i> )
8.	Name of entry supervisor authorizing entry
9.	The measures taken to isolate and eliminate or control the permit space hazards.
NOTE	The protective measures may include Lockout/Tagout, purging, inerting, ventilating, flushing, blanking lines, two way radios, tripod and harness, lighting, PPE, alarms, testing equipment, etc.

Step	Action
10.	List of any other permits issued, isolation measures, or other hazards eliminated to facilitate the confined space entry.
11.	Rescue and Emergency Services (Plant Protection) must be notified prior to entry into Permit Required Confined Spaces with the following information: <ul style="list-style-type: none"> <li>• Location</li> <li>• Time</li> <li>• Expected duration of the job</li> <li>• Name of Entrant</li> <li>• Name of Attendant</li> <li>• Expected hazards</li> </ul>
12.	Rescue and Emergency Services (Plant Protection) must be notified upon exiting the confined space.
NOTE	The Attendant is to call Base 2, 4-5511 or 911 to activate Plant Protection in the event of a rescue.
13.	The communication procedures used by the authorized entrants and attendants to maintain contact during the entry.
14.	The acceptable entry conditions.
15.	Provide pedestrian, vehicle or other barriers as necessary to protect entrants from external hazards.
16.	Results of initial and periodic atmospheric monitoring to verify that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry (document the instrument used and the date of last calibration).
17.	Any other information necessary to ensure employee safety during confined space entry.
18.	Print and sign the permit and return to ESH&A when complete.

### 5.18.3.5 Procedure for Entry into Permit Required Confined Spaces

Step	Action
1.	Complete Site Preparation Procedure. See Procedure 5.18.3.3 of this program.
2.	Document completion of protective measures taken on the Confined Space Permit.
3.	Monitor the atmosphere of the Confined Space before entry to ensure safety.
4.	Before entry begins, the entry Supervisor must evaluate and sign the entry permit to authorize entry.
NOTE	See Appendix C for a copy of Ames Laboratory Confined Space Entry Permit.
5.	Entry Supervisor must assess if entrant can bodily enter confined space to ensure unhindered rescue.
6.	Set the duration of the permit for the length of time required to do the job. The duration of the permit may not exceed the time required to complete the assigned task or job.
7.	The entry supervisor must <u>terminate</u> the entry and permit when: <ul style="list-style-type: none"> <li>• The operations covered by the permit have been completed; or</li> <li>• Conditions that are not allowed under the entry permit arise in or near the permit space.</li> </ul>
8.	Post the completed permit at the entry or immediate area of entry to confirm that the pre-entry preparations have been completed.
9.	After entry is complete, each permit is to be sent to ESH&A. Each permit is to be retained for at least 1 year to facilitate the review of the program. Any problems encountered during any entry must be noted on the permit.

### 5.18.3.6 Procedure for Rescue from a Permit Required Confined Spaces

Step	Action
NOTE	Ames Laboratory Employees are prohibited from entering a confined space to perform a rescue.
1.	Confined Space rescue for Ames Laboratory is to be performed only by non-entry (i.e., Tri-pod-winch-lanyard and harness, self removal from space, etc).
2.	In the event rescue is necessary in which entry is required, the Attendant must contact Plant Protection by Radio at Base 2, or call 911.
3.	Plant Protection is to contact the City of Ames Fire Department for rescue.
4.	An escort is to be established to direct the City of Ames Fire Department to the confined space location.
5.	Ames Laboratory ESH&A and FSG will provide necessary support to the FD.

**NOTE:** For non-permit required confined spaces, where there is no potential to develop a hazardous atmosphere, personnel can enter to assist an employee as long as the proper hazard assessment is done and procedures followed.

### 5.18.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>CONFINED SPACE TRAINING</b>		<b>AL-023</b>
<b><i>Intended Audience:</i></b>	<p><i>Mandatory for all workers whose job assignment involves entry into a confined space which is:</i></p> <ul style="list-style-type: none"> <li>• Large enough and so configured that an employee can bodily enter and perform assigned work</li> <li>• Has limited or restricted means of entry and exit</li> <li>• Is not designed for continuous occupancy</li> <li>• Has the potential to develop a hazardous atmosphere or condition</li> <li>• Labeled as a confined space by ESH&amp;A</li> </ul> <p>See Appendix E for copy of On Site Instruction to be completed after Computer Based Training.</p>	
<b><i>Module Format:</i></b>	<p><i>Module is Computer Based Training with a exam and Job Specific Training using “Confined Space – Entry Procedures – Training Statement”. Estimated completion time: 1.5 hours</i></p>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<p><i>Two Year Retrain</i></p>	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of physical hazards, atmospheric hazards, hazard mitigation, emergency response measures, procedural information and other safety information. This training shall be documented by the Supervisor / Group Leader / Department Manager.

### 5.18.5 PERFORMANCE CHECKLISTS

**Supervisors /Group Leaders / Department Managers** shall:

- Ensure that all questions pertaining to the Confined Space Entry Program are appropriately answered for each employee on the Training Needs Questionnaire and that all hazards are denoted on the Hazard Inventory.
- Attend Confined Space Entry Training. Consult the Ames Laboratory training schedule for the next available class.
- Ensure outside contractors performing work at the facility adhere to the Confined Space Entry Program.
- Notify ESH&A if a contractor requires entry into a confined space.
- Inform contractors coming on site of the Confined Space Program.
- Complete permits as necessary to enter confined spaces.
- Ensure employees know, understand and follow Confined Space Entry Program rules.
- Ensure protective equipment is available and in good working order.
- Monitor/supervise contract employees who have to enter a confined space to perform work duties.
- Apprise contractors of the hazards identified and experience with the confined spaces.

- Apprise contractors of precautions or procedures that Ames Laboratory has implemented for the protection of employee.
- Initiate progressive discipline when authorized employees fail to comply with the Confined Space Entry Program.
- Complete the Confined Space Entry Procedures – Training Statement. On site instruction to be completed after Computer Based Training. See Appendix E.

**Attendant shall:**

The following are the responsibilities of the employee whose duties as attendant involve ensuring the safety of the authorized entrant:

- Attend all required training.
- Evaluate hazards in the work area, chemicals, procedures, etc. including information on the mode, signs, or symptoms and consequences of the exposure hazards.
- Notify Plant Protection prior to entry into Permit Required Confined Space.
- Notify Plant Protection upon exiting the Permit Required Confined Space.
- Communicate with the Authorized Entrant to monitor entrant's status and alert entrant of the need to evacuate.
- Remain outside the permit space during entry operations until relieved by another attendant or operations are complete.
- Ensure Authorized Entrant wears Personal Protective Equipment corresponding to the hazards exposed to and listed on the permit.
- Ensure Authorized Entrant wears retrieval gear such as body harness and cable attached to Tri-Pod as required by the entry supervisor and noted on the permit.
- Avoid unsafe practices.
- Abort the entry if safety is compromised.
- Report unsafe conditions and practices of others to Supervisor/Group Leader/Manager or ESH&A and note on permit.
- Monitor the activities inside and outside the space to determine if it is safe for entrants to remain in the space.
- Order the authorized entrants to evacuate immediately under any of the following conditions:
  - A prohibited condition is detected;
  - Behavioral effects of hazardous exposure is detected;
  - A situation outside the space that could endanger the entrant;
  - The attendant cannot safely perform all the duties required.
- Summon rescue and other emergency services immediately upon determining entrant may need assistance to escape from permit space hazards.
- Take the following actions when unauthorized persons approach or enter a permit space while entry is underway:
  - Warn unauthorized persons that they are to stay away;
  - Advise unauthorized persons to exit immediately if they have entered the permit space;
  - Inform Supervisor / Group Leader or Manager and ESH&A of unauthorized persons entry.
- Perform non-entry rescues.
- Perform no duties that might interfere with attendant's primary responsibility to protect the authorized entrant.
- Monitoring multiple spaces is prohibited.
- Attend required course as denoted on Employee Training Profile. Consult the Ames Laboratory training schedule for the next available class.
- Maintain confined space entry equipment.

- Fully adhere to the requirements set forth in the lockout/tagout program when installing, servicing and maintaining machinery and equipment.

**Authorized Entrant shall:**

The following are the responsibilities of the Authorized employee(s) entering a confined space:

- Attend all required training.
- Evaluate hazards in the work area, including pneumatic, hydraulic, mechanical, procedural, and information on the mode, signs, symptoms and consequences of exposure to a hazardous atmosphere.
- Communicate with the Attendant as necessary to enable the Attendant to monitor entrant status and alert entrant of the need to evacuate.
- Wear Personal Protective Equipment corresponding to the hazards listed on the permit.
- Wear retrieval gear such as body harness and cable attached to Tri-Pod or connecting point as listed on the permit as necessary.
- Avoid unsafe practices.
- Abort entry if unsafe condition and practices compromise entrant safety.
- Report unsafe conditions and practices of others to Facilitator or ESH and note on permit.
- Know the location of fire alarms and other emergency equipment.
- Evacuate the space whenever:
  - An order to evacuate is given by the attendant;
  - Any warning signs or symptoms or exposure to a dangerous situation;
  - The entrant detects a prohibited condition.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- Conduct periodic inspection of the Confined Space Entry Program at least annually to ensure that the procedures and requirements are being followed.
- Conduct random and annual inspections to ensure authorized employees are adhering to the Confined Space Entry Program.
- Develop and conduct Confined Space Entry Program Training and refresher training.
- Survey and evaluate all confined spaces for type, function, use, design, quantity, hazards, etc.
- Calibrate monitoring equipment prior to entry into Permit Required Confined Spaces.
- Participate with ISU to perform periodic rescue drill with the City of Ames Fire Department and Rescue (designated rescue service).
- 

**Plant Protection shall:**

- Dial 911 (Department of Public Safety / City of Ames) in the event rescue is necessary.
- Establish an escort to guide emergency services to the confined space.
- Contact ESH&A and FSG to provide ancillary support to emergency services.

**Contractors shall:**

- ❑ Follow Ames Laboratory Confined Space Entry Program or have a written program that meets this program.
- ❑ Debrief with Ames Laboratory Facilities Services Group or ESH&A at the conclusion of the entry operations regarding any hazards confronted or created in permit spaces during entry operations.
- ❑ Prohibit entry into a confined space unless employees have been trained and a written program has been reviewed and approved by Facilities Services Group or ESH&A.
- ❑ Supply their own confined space entry equipment.
- ❑ Show proof of training and a copy of their own Confined Space Entry Program to enter Permit Required Confined Spaces. Ames Laboratory Training can be made available to contractors (see 5.18.4 of this program).
- ❑ Enter Non-Permit Required Confined Spaces only after being made aware of hazards and have entry approved by Facilities Services Group or if accompanied by a Facilities Services Group Employee who is trained.
- ❑ Failure to comply with the Confined Space Entry Program shall subject the contractor to immediate discharge.

NOTE: Contractors are prohibited from entering a confined space without authorization from Facilities Services Group and ESH&A.

NOTE: ESH&A reserves the right to refuse contractor entry based on contractor qualifications.

## **Appendix A**

### **Ames Laboratory External Confined Spaces**

The current map of external confined spaces is available for viewing in the ESH&A Office (G40 TASF).

## **Appendix B**

### **Ames Laboratory Confined Spaces**

The current list of all Ames Laboratory Confined Spaces is available for viewing in the ESH&A Office (G40 TASF).

**Appendix C - Section 5.18****AMES LABORATORY CONFINED SPACE ENTRY PERMIT  
Form # 10200.097**

Date:	Time:	Estimated Time of Expiration:	Actual Time of Completion:
Location and Description of Confined Space:			
Permit Space Hazards (Indicate Specific Hazards with Initials):			
<input type="checkbox"/>	Oxygen Deficiency (less than 19.5%)	<input type="checkbox"/>	Toxic Gases or Vapors (greater than PEL)
<input type="checkbox"/>	Oxygen Enrichment (greater than 23.5%)	<input type="checkbox"/>	Mechanical Hazards
<input type="checkbox"/>	Flammable Gases or Vapors (greater than 10% of LEL)	<input type="checkbox"/>	Electric Shock
<input type="checkbox"/>	Airborne Combustible Dust (meets or exceeds LEL)	<input type="checkbox"/>	Engulfment
<input type="checkbox"/>	Radiation	<input type="checkbox"/>	Other
Purpose of Entry:			
Name of Entrant(s):		Name of Attendant(s):	
Comments:			

Special Requirements:	YES	NO	Special Requirements:	YES	NO
Lockout/Tagout			Tripod/Harness		
Lines Blanked			Additional Lighting (explosion proof)		
Additional Ventilation (purge)			Protective Clothing (gloves, suit, hard hat, etc.)		
Secure the Area			Hot Work Permit		
Communications / Radio			Other		

**Entering a Permit Required Confined Space with a SCBA is Prohibited.**

Atmospheric Testing Required Every__ Hours/Min(s)	Acceptable Levels	Before Entry	Re-Entry (Time)	Re-Entry (Time)	Entry Supervisors Initials	Employee Initials
Oxygen	19.5 – 23.5%					
% Lower Explosive Limit	<10 %					
Carbon Monoxide	<20 PPM					
Hydrogen Sulfide	<5 PPM					
Other:						
Instrument Used:		Serial #:		Date of Last Calibration:		

Plant Protection Office Notified Prior To Entry	Yes
Plant Protection Office Notified Upon Completion of Confined Space Entry	Yes

The work and safety precautions authorized by this permit have been reviewed. Instructions, safety procedures and appropriate MSDS's have been received and are understood. This permit is not valid unless all appropriate items are completed.

Name of Person Conducting Testing:	
Print:	Signature:
Supervisor or ESH&A Authorizing Entry:	
Print:	Signature:
Entrant Reviewed and Approved Atmospheric Monitoring and Safety Precautions:	
Print:	Signature:

**EMERGENCY ACTIONS**

**Entrant(s):** shall immediately self evacuate if a hazard is detected or perceived or directed by Attendant.

**Attendant(s):** shall summon emergency assistance by two-way radio (BASE 2) or by telephone (911) or (4-5511).  
The attendant shall not, under any circumstances, enter the confined space to attempt a rescue.

**Post Permit At Site - Send Permit To ESH&A After Entry Is Complete**

**Appendix D**  
**PRE-ENTRY CHECKLIST FOR NON-PERMIT REQUIRED CONFINED SPACES**  
**Form # 46300.055**

NAME OF CONFINED SPACE: \_\_\_\_\_ DATE: \_\_\_\_\_

CHECKLIST COMPLETED BY: \_\_\_\_\_

**DO NOT USE THIS FORM IF SPACE IS POSTED:**

DANGER  
 CONFINED SPACE  
 PERMIT REQUIRED

IF POSTED AS ABOVE, DO NOT ENTER AND CONTACT SUPERVISOR.

**MINIMUM CONDITIONS FOR ENTRY**

If the specified conditions are met, and hazard control is verified on this checklist, then one or more persons may enter the confined space without an entry permit and an attendant (stand-by person). **If the specified conditions cannot be met and/or hazard control cannot be verified, DO NOT ENTER** the space becomes a **PERMIT REQUIRED CONFINED SPACE** and cannot be safely entered without further hazard evaluation and control. Contact immediate supervisor for assistance.

VERIFICATION OF HAZARD CONTROL				
HAZARD	METHOD/MEANS OF HAZARD CONTROL	HAZARD ELIMINATED? (Circle appropriate response then initial.)		
1. Engulfment Hazards?	Have all engulfment hazards been eliminated? (Engulfment means the surrounding and effective capture of a person by liquid or finely divided solid substance that can be aspirated to cause death by filling or plugging the respiratory system or can exert enough force on the body to cause death by strangulation, constriction, or crushing.)	N/A	YES	NO
2. Entrapment Hazards?	Have all entrapment hazards been eliminated? (Any internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.)	N/A	YES	NO
3. Hazardous Energies?	Have all hazardous energies (exposed electrical conductors and moving machinery) been secured and locked/tagged out?	N/A	YES	NO
4. Hazardous Atmosphere?	Will work being performed introduce any substances or processes which could produce a hazardous atmosphere? (Non-permit spaces, by themselves, have been determined to not have hazardous atmospheres nor the potential for developing one if left to its own devices.)	N/A	YES	NO
5. Permit Required?	If any of items 1 through 3 are "NO" OR If item 4 is "YES". <b>AN ENTRY PERMIT IS REQUIRED.</b>  <b>STOP! DO NOT ENTER SPACE. NOTIFY SUPERVISOR</b>		YES	NO

## Appendix E – Section 5.18

### CONFINED SPACE ENTRY PROCEDURES - TRAINING STATEMENT Form # 45400.042

Name: \_\_\_\_\_

Employee Number: \_\_\_\_\_

Address: \_\_\_\_\_

Phone Number: \_\_\_\_\_

**Part I. Institutional Training Verification:** *This section is to be completed by an ESH&A Staff Member who provided the training:*

The above listed employee has completed the computer based training on *Confined Space Entry Procedures*.

\_\_\_\_\_  
ESH&A Staff Member's Signature\_\_\_\_\_  
Date

**Part II. Job (Activity) Specific Training Verification:** *This section is to be completed by the supervisor who oversees the confined space work activity:*

**As an employee working in a Confined Space, I:**

- 1) clearly understand the Confined Space Entry Policy requirements as outlined in Section 5.18 of the ESH&A Program Manual (46400.002).
- 2) have been provided Job (activity) Specific Training on the Confined Space Entry Procedures for the Activities listed below. *(Please note that the supervisor is responsible for keeping the below list current.)*

Description of Confined Space Activity	Location	Is a Permit required? (Y or N)

- 3) am aware that it is my responsibility to inspect all Confined Space Equipment prior to use to guarantee that it is in good working condition.
- 4) have familiarized myself with the associated Emergency Response Plan should a rescue become necessary.
- 5) understand all entry requirements of a Permit-Required Confined Space (if applicable).

All items listed in **Part II** have been completed. Please enter the successful completion of Confined Space Training (Module AL-023) on the Ames Laboratory Training Records System (ALTRS).

\_\_\_\_\_  
Employee's Signature\_\_\_\_\_  
Date\_\_\_\_\_  
Group/Supervisor's Signature\_\_\_\_\_  
Phone Number\_\_\_\_\_  
Date

It is the responsibility of the Ames Laboratory employee and their supervisor to complete the items indicated above and to return the **original**, signed Confined Space Training Statement to Environment, Safety, Health & Assurance, **125 Spedding**, **prior** to working in a confined space.

**Note to Supervisor:** *Maintain a copy of this record in your Job (Activity) Specific Training Files.*

## 5.19 FALL PROTECTION (ELEVATED WORK – PLATFORMS AND ROOF WORK)

**Applicability Statement:** *This section applies to all employees and contractors when working at dangerous heights of 6 feet or greater (platforms, roof work, mezzanines, etc).*

### 5.19.1 REFERENCES

29 CFR 1910.23 Guarding Floor and Wall Openings and Holes  
29 CFR 1926.500-503 Fall Protection in Construction  
ANSI A12.1-67 Safety Requirements for Floor and Wall Openings, Railings & Toe Boards

### 5.19.2 BACKGROUND

The purpose of this program is to provide information and guidance on safety precautions when working at dangerous heights. This includes any work area which has a potential for a fall of six (6') feet or greater (i.e. platforms, roof work, etc.).

This procedure does not apply to:

- Employees making an inspection, investigation, or assessment of workplace conditions prior to the actual start of construction work or after all construction work has been completed.
- Ladders (refer to Section 5.15)
- Scaffolding (refer to Section 5.13)
- Vehicle Mounted Elevating and Rotating Work Platforms (refer to Section 5.4)

### 5.19.3 PROGRAM INFORMATION

#### 5.19.3.1 Definitions

**Anchorage Point:** A secure point for attachment for lifelines, lanyards, or deceleration devices.

**Body Harness:** Strap webbing body device designed to distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders, attached to a personal fall arrest system.

NOTE: Body belts **are prohibited** as a method of fall protection. A full body harness must be utilized.

**Connector:** A device which is used to couple (connect) parts of the personal fall arrest system and positioning device systems together. It may be an independent component of the system, such as a carabiner or buckle or D-ring sewn into a body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

**Controlled Access Zone (CAZ):** An area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled.

**Dangerous Equipment:** Equipment (such as pickling or galvanizing tanks, degreasing units, machinery, electrical equipment, and other units) which, as a result of form or function, may be hazardous to employees who fall onto or into such equipment.

**Dangerous Heights:** Any work area which has a potential for a fall six (6) feet or greater where guardrails, mid rails and other protection devices do not exist to prevent a fall.

**Deceleration Device:** Any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards, etc., which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on an employee during fall arrest.

**Deceleration Distance:** The vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop.

**Guardrail System:** A barrier erected to prevent employees from falling to lower levels.

**Hole:** A gap or void 2 inches or more in its least dimension, in a floor, roof, or other walking/working surface.

**Infeasible:** Is impossible to perform the construction work using a conventional fall protection system (i.e., guardrail system, safety net system, or personal fall arrest system) or that it is technologically impossible to use any one of these systems to provide fall protection.

**Lanyard:** A flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body harness to a deceleration device, lifeline, or anchorage.

**Leading Edge:** The edge of a floor, roof, or form work for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or form work sections are placed, formed, or constructed. A leading edge is considered to be an "unprotected side and edge" during periods when it is not actively and continuously under construction.

**Lifeline:** Components consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline) or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline) and serve as a means for connecting other components of a personal fall arrest system to the anchorage.

**Low-Slope Roof:** A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

**Opening:** A gap or void 30 inches or more high and 18 inches or more wide, in a wall or partition, through which employees can fall to a lower level.

*Personal Fall Arrest System:* A system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these.

NOTE: As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

*Rope Grab:* A deceleration device which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking, or both.

*Safety-Monitoring System:* A safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

*Self-Retracting Lifeline/Lanyard:* A deceleration device containing a drum-wound line which will automatically lock after the onset of a fall and arrests the fall.

*Snap-Hook:* A hook shaped connector with a self closing, self locking keeper, which remains closed and locked until unlocked and pressed open for connection or disconnection.

*Unprotected Sides and Edges:* Any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 39 inches high.

*Walking/Working Surface:* Any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, form work and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

*Warning Line System:* A barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, or safety net systems to protect employees in the area.

*Work Area:* That portion of a walking/working surface where job duties are being performed.

*Unprotected Sides and Edges:* A walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.

### 5.19.3.2 Fall Protection Requirements:

Fall protection is required for employees exposed to falls of six (6) feet or greater at unprotected sides and edges, leading edges, walking and working surfaces, wall openings, hoists areas, holes, skylights, ramps, runways, excavations and when working above dangerous equipment.

Protection must be provided with the use of guardrail systems, personal fall arresting systems, warning line systems or safety monitoring systems.

The following is an index to specific Fall Protection Requirements:

<b>Section</b>	<b>Title</b>
5.19.3.3	Guardrail Systems
5.19.3.4	Personal Fall Arrest Systems
5.19.3.5	Warning Line Systems
5.19.3.6	Safety Monitoring Systems
5.19.3.7	Hoisting Areas
5.19.3.8	Covers
5.19.3.9	Exception to the above mentioned fall protection. Written Fall Protection Plan
5.19.3.10	Inspection of Equipment

NOTE: Safety Net Systems and Position Devices Systems will not be addressed in this program. Contact ESH&A if such systems are warranted.

### 5.19.3.3 Guardrail System Requirements

- Top edge height of top rails, or equivalent guardrail system members, shall be 42 inches plus or minus 3 inches above the walking/working level. When conditions warrant, the height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria.
- Mid rails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 inches (53 cm) high.
- Mid rails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.
- Screens and mesh, when used, shall extend from the top rail to the walking/working level and along the entire opening between top rail supports.
- Intermediate members (such as balusters), when used between posts, shall be not more than 19 inches apart.

- Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds applied within 2 inches of the top edge, in any outward or downward direction, at any point along the top edge.
- When the 200 pound test load is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches above the walking/working level.
- Mid rails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding, without failure, a force of at least 150 pounds applied in any downward or outward direction at any point along the mid rail or other member.
- Guardrail systems shall be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.
- The ends of all top rails and mid rails shall not overhang the terminal posts, except where such overhang does not constitute a projection hazard.
- Top rails and mid rails shall be at least one-quarter (1/4") inch nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it shall be flagged at not more than 6-foot intervals with high-visibility material.
- When guardrail systems are used at hoisting areas, a chain, gate or removable guardrail section shall be placed across the access opening between guardrail sections when hoisting operations are not taking place.
- When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.

Manila, plastic or synthetic rope being used for top rails or mid rails shall be inspected as frequently as necessary to ensure that it continues to meet the strength requirements.

#### **5.19.3.4 Personal Fall Arresting System Requirements**

- When engineering controls are not feasible in the work area, a personal fall arrest system may be used. The fall arrest system is designed to stop a worker from free falling at a distance of six (6) feet. Personal fall arresting system components are listed below:
- D-rings and snap hooks shall have a minimum tensile strength of 5,000 pounds.
- Snap hooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snap hook.

NOTE: Effective January 1, 1998 only locking type snap hooks shall be used.

- Unless the snap hook is a locking type and designed for the following connections, snap hooks shall not be engaged:
  - directly to webbing, rope or wire rope
  - to each other
  - to a D-ring to which another snap hook or other connector is attached
  - to a horizontal lifeline, or
  - to any object which is incompatibly shaped or dimensioned in relation to the snap hook such that unintentional disengagement could occur by the connected object being able to depress the snap hook keeper and release itself.
- Horizontal lifelines shall be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system.
- Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds.
- When vertical lifelines are used, each employee shall be attached to a separate lifeline.
- Lifelines shall be protected against being cut or abraded.
- Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet or less shall be capable of sustaining a minimum tensile load of 3,000 pounds applied to the device with the lifeline or lanyard in the fully extended position.
- Self-retracting lifelines and lanyards that do not limit a free fall distance to 2 feet or less, rip-stitch lanyards, tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds.
- Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds per employee attached.
- The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.
- Personal fall arrest systems and components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.
- Personal fall arrest systems shall be inspected prior to each use for wear, damage and other deterioration, and defective components shall be removed from service.
- Personal fall arrest systems shall not be attached to guardrail systems nor shall they be attached to hoists.
- When a personal fall arrest system is used at hoist areas, it shall be rigged to allow the movement of the employee only as far as the edge of the walking/working surface.

### 5.19.3.5 Warning Line System Requirements

Warning line systems and their use shall comply with the following:

- The warning line shall be erected around all sides of the roof work area.
- When mechanical equipment is not being used, the warning line shall be erected not less than 6 feet from the roof edge.
- When mechanical equipment is being used, the warning line shall be erected not less than 6 feet from the roof edge that is parallel to the direction of mechanical equipment operation and not less than 10 feet from the roof edge that is perpendicular to the direction of mechanical equipment operation.
- Points of access, materials handling areas, storage areas, and hoisting areas shall be connected to the work area by an access path formed by two warning lines.
- When the path to a point of access is not in use, a rope, wire, chain, or other barricade, equivalent in strength and height to the warning line, shall be placed across the path at the point where the path intersects the warning line erected around the work area or the path shall be offset such that a person cannot walk directly into the work area.
- Warning lines shall consist of ropes, wires, or chains, and supporting stanchions erected as follows:
  - The rope, wire, or chain shall be flagged at not more than 6-foot intervals with high-visibility material;
  - The rope, wire, or chain shall be rigged and supported in such a way that its lowest point (including sag) is no less than 34 inches from the walking/working surface and its highest point is no more than 39 inches from the walking/working surface;
  - After being erected, with the rope, wire, or chain attached, stanchions shall be capable of resisting, without tipping over, a force of at least 16 pounds (71 N) applied horizontally against the stanchion, 30 inches (.8 m) above the walking/working surface, perpendicular to the warning line, and in the direction of the floor, roof, or platform edge;
  - The rope, wire, or chain shall have a minimum tensile strength of 500 pounds and after being attached to the stanchions, shall be capable of supporting, without breaking, the loads applied to the stanchions;
  - The line shall be attached at each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over.
- No employee shall be allowed in the area between a roof edge and a warning line unless the employee is performing roofing work in that area.

- Mechanical equipment on roofs shall be used or stored only in areas where employees are protected by a warning line system, guardrail system, or personal fall arrest system.

#### **5.19.3.6 Safety Monitoring Systems**

Safety monitoring systems and their use shall comply with the following:

- A competent person shall be designated to monitor the safety of other employees. The safety monitor shall:
  - be competent to recognize fall hazards
  - warn the employee when it appears that the employee is unaware of a fall hazard or is acting in an unsafe manner
  - be on the same walking/working surface and within visual sighting distance of the employee being monitored
  - be close enough to communicate orally with the employee, and
  - not have other responsibilities that could take the monitor's attention from the monitoring function.
- No employee, other than an employee engaged in roofing work [on low-sloped roofs] or an employee covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety monitoring system.
- Each employee working in a Controlled Access Zone shall be directed to comply promptly with fall hazard warnings from safety monitors.

#### **5.19.3.7 Hoisting Areas**

Safety monitoring systems and their use shall comply with the following:

- Each employee in a hoist area shall be protected from falling 6 feet or more to lower levels by guardrail systems or personal fall arrest systems. If guardrail system, chain, gate, or guardrail are removed to facilitate the hoisting operation (e.g., during landing of materials) and an employee must lean through the access opening or out over the edge of the access opening to receive or guide equipment and materials, a personal fall arrest system shall be used.

### 5.19.3.8 Covers

Cover for holes in floors, roofs and other walking/working surfaces shall comply with the following:

- Covers located in roadways and vehicular aisles shall be capable of supporting, without failure, at least twice the maximum axle load of the largest vehicle expected to cross over the cover.
- All other covers shall be capable of supporting, without failure, at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time.
- All covers shall be secured when installed so as to prevent accidental displacement by the wind, equipment, or employees.
- All covers shall be color coded or they shall be marked with the word "HOLE" or "COVER" to provide warning of the hazard.

NOTE: This provision does not apply to cast iron manhole covers or steel grates used on streets or roadways.

### 5.19.3.9 Written Fall Protection Plan

- This option is available only to employees engaged in leading edge work, precast concrete erection work, or residential construction work and who can demonstrate that it is infeasible or it creates a greater hazard to use conventional fall protection equipment. The Fall Protection Plan must conform to the following provisions:
  - The Fall Protection Plan shall document the reasons why the use of conventional fall protection systems (guardrail systems, personal fall arrest systems, or safety nets systems) are infeasible or why their use would create a greater hazard.
  - The Fall Protection Plan shall be prepared by a qualified person and developed specifically for the site where the leading edge work, precast concrete work, or residential construction work is being performed. The Fall Protection Plan must be developed, reviewed and implemented using the Readiness Review Process.
  - Any changes to the Fall Protection Plan shall be approved by a qualified person.
  - A copy of the Fall Protection Plan with all approved changes shall be maintained at the job site and the plan must be maintained up to date.
  - The implementation of the Fall Protection Plan shall be under the supervision of a competent person.

- The fall protection plan shall include a written discussion of other measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection from the conventional fall protection systems. For example, the employer shall discuss the extent to which scaffolds, ladders, or vehicle mounted work platforms can be used to provide a safer working surface and thereby reduce the hazard of falling.
- The fall protection plan shall identify each location where conventional fall protection methods cannot be used. These locations shall then be classified as controlled access zones.
- The fall protection plan must include a statement that identifies each employee who is designated to work in controlled access zones. No other employees may enter controlled access zones.

### 5.19.3.10 Inspections

Prior to use, components of all fall protection systems (guardrail, fall arresting systems, warning line systems, etc.) shall be inspected for wear, damage and other deterioration to ensure the equipment is in safe working order. Equipment in need of repair must be removed from service and replaced immediately.

## 5.19.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>FALL PROTECTION TRAINING</b>		<b>AL-145</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all Ames Laboratory Facilities Services Employees</i>	
<b><i>Module Format:</i></b>	<i>Module is Video with discussion of Section 5.19 of the ESH&amp;A Program Manual and presentation of fall arresting equipment.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required every three (3) years</i>	

Group / activity-specific Fall Protection Training shall be given to each employee prior to start of work. Training will include a discussion of physical hazards, hazard mitigation, emergency response measures, procedural information and other safety information. The training shall be documented by the Supervisor / Group Leader / Department Manager.

### 5.19.5 PERFORMANCE CHECKLISTS

**Supervisors / Group Leader / Department Manager shall:**

- Conduct routine inspection to ensure all walking and working surfaces are free from slip, trip and fall hazards.
- Ensure equipment including guardrails, fall arresting equipment, ladders, scaffolding etc. are in good working order.
- Enforce the ESH&A procedures in this manual.
- Communicate and explain the need for compliance with this and all ESH&A Programs.

**Employees shall:**

- Maintain work areas free from slip, trip and fall hazards.
- All employees are expected to observe and follow the established procedures in this program and all ESH&A Programs.
- Bring all unsafe acts, practices, or conditions to their coworker's attention.
- Attend Fall Protection Training.
- If employees are unable to get an unsafe situation corrected, they must inform their Supervisor/Group Leader/Department Manager or ESH&A.

**Environment, Safety, Health and Assurance shall:**

- ESH&A will conduct training as necessary for understanding of these procedures.
- Develop, implement and periodically review and update the fall protection program.

## **5.20 EXCAVATING AND TRENCHING PROGRAM**

*Applicability Statement: This section applies to all employees and contractors entering excavations and trenches.*

### **5.20.1 REFERENCES**

- OSHA 1926.650 Excavations
- OSHA 1926.651 General Requirements
- OSHA 1926.652 Requirements of Protective Systems
- OSHA 1910.146 Confined Space Entry

### **5.20.2 BACKGROUND**

The purpose of this program is to ensure protection of Ames Laboratory employees from health and safety hazards associated with opening, entering and terminating an excavation.

### **5.20.3 PROGRAM INFORMATION**

#### **5.20.3.1 General Excavation Program Requirements**

- Utility companies must be contacted at least 48 hours prior to excavating (excluding weekends and holidays). Excavating can proceed after 48 hours if utility companies cannot respond within that time period or cannot establish the exact location of installations (sewer, telephone, fuel, electric, water lines, etc.) with ESH&A and Facilities Services approval. Detection equipment or other acceptable means to locate utility installations are still required.
- All trenches exceeding 48 inches in depth must be properly shored or the sides must be sloped and/or benched. See Appendix A for OSHA Guidelines for proper sloping and benching and Appendix B for OSHA Guidelines for proper shoring.
- Before beginning excavation activities, the proposed depth of the excavation must be ascertained. All excavations 48 inches or greater in depth are considered a Permit Required Confined Space and all provisions of the program pertain. (See Section 5.18 of the ESH&A Manual Confined Space Program)
- When excavation operations approach the estimated location of underground utility installations, the exact location of the installation must be determined by non-conducting shovels, poles, detection equipment, or other safe and reliable means. Consult with ESH to proceed.

- While an excavation is open, underground installations must be protected, supported or removed as necessary to protect employees.
- A stairway, ladder, ramp or other safe means of egress must be located within 25 feet of the work in trench excavations greater than 4 feet in depth.
- Employees exposed to vehicular traffic must be provided with and must wear warning vests. (Contractors are responsible for providing their own warning vests.)
- Employees are prohibited underneath loads handled by lifting or digging equipment. Employees must be required to stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials.
- Hard hats must be worn by all employees in and around the excavation area and the lifting and digging equipment.
- A warning system must be utilized including barricades, hand or mechanical signals, stop logs or alarms when mobile equipment is operated adjacent to an excavation in which the operator does not have a clear and direct view.
- Employees are prohibited from crossing or passing over a trench unless walkways or bridges are provided with standard guardrails.
- Physical protection must be provided at all remote excavations or the excavations must be back-filled immediately upon completion.
- Employees must be protected from falling material at the edge of the excavation by placing the spoil (excavated dirt, sand, rock, etc.) and tools a minimum of 2 feet away from the edge of the excavation.
- If Hot Work is to be performed, a Hot Work Permit must be completed in conjunction with atmospheric monitoring. (See Section 8 of the ESH&A Program Manual Hot Work Permit Program.).

### **5.20.3.2 Atmospheric Testing Requirements**

- Trench excavations greater than 4 feet in depth require initial and periodic atmospheric monitoring.
- An excavation with an oxygen level of less than 19.5% or greater than 21.5% may not be entered.
- Excavations with an atmospheric concentration of a flammable gas in excess of 20% of the lower flammable limit may not be entered until adequate ventilation lowers the gas concentration below the LEL.

- Monitoring must be performed continuously either by a monitor operated above the excavation or a unit worn by the employee(s) entering the excavation as dictated by ESH&A.

### **5.20.3.3 Protective Requirements from Hazards generated by Water Accumulations**

- Employees are prohibited from working in excavations with standing water unless precautions including special support systems or shield systems to protect from cave-ins are provided.
- If water removal equipment is used, the equipment must be monitored by a competent person (see Appendix E for list of designated competent persons).
- If excavation work interrupts the natural drainage of surface water such as dikes, streams, diversions ditches, etc. precautions must be taken to prevent surface water from entering the excavation.
- Excavations subject to runoff from heavy rains require an inspection by a competent person before entering.

### **5.20.3.4 Inspection Requirements**

- Inspect entire excavation at beginning of each shift prior to entry and work around the excavation.
- The inspection is to be conducted by a designated competent person (listed as Authorized Supervisors-see Appendix E for list of designated competent persons).
- Inspection must also be performed after a rain storm.
- The competent person must immediately evacuate employees until all necessary precautions are taken when discovering evidence of:
  - possible failure of support systems or cave-ins
  - hazardous atmospheres
  - hazards generated outside the excavation
  - other hazardous conditions

### **5.20.3.5 Criteria for Sloping and/or Benching Systems**

1. Because Ames Laboratory Soil is Type B, all sloping will be done at a 1 to 1 ratio. For every foot of rise, the slope will have one foot of horizontal fall.
2. The maximum bench height must be no greater than 3.5 feet rise with the horizontal distance being the same.
3. Benching and sloping are approved for use with each other.
4. Sloping is approved to be used in conjunction with Support Systems.

5. Excavations 20 feet or greater in depth are prohibited.
6. Employees are prohibited from working on faces of sloped or benched levels above other employees unless adequately protected from falling, rolling or sliding material.

**Note:** See Appendix A for Slope Configurations.

#### **5.20.3.6 Criteria for Shoring Protective Systems**

- Manufactured shoring must be free from damage or defects that will impair proper function.
- Manufactured shoring must be used and maintained in a manner intended by the manufacturer.
- Members of support systems must be securely connected to prevent sliding, falling, kick-outs, etc.
- Systems must not be installed or removed with employees in the excavation/trench.
- If members of a shoring system must be temporarily removed, additional precautions must be taken to ensure safety of employees (removal of members may occur only after employees evacuate the excavation zone).
- Removal of shoring must begin and progress from the bottom and must be released slowly looking for possible failure resulting in cave-in of sides of the excavation.
- Backfill must follow immediately after removal of shoring.

**Note:** Contact ESH&A for Aluminum Hydraulic Spacing and Installation for equipment and spacing requirements.

#### **5.20.3.7 Criteria for Timber Shoring**

- Appendix B (tables) must be used when shoring with timbers.
- When any of the following conditions are present, the members specified in the tables are not adequate. Alternate timber shoring must be designed by a Professional Engineer or another type of protective system designed according to 29 CFR 1926.652:
  - When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge;
  - When vertical loads imposed on cross braces exceed 240-pound gravity load distributed on a one-foot section of the center of the cross-brace;
  - When surcharge loads are present from equipment weighing in excess of 20,000 pounds;
  - When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless:
    - a) the sloped portion is sloped at an angle less steep than 3 horizontal to 1 vertical; or
    - b) the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

- Mud sills must be used in trenches 2.5 feet or greater in depth.
- When the vertical spacing of cross-braces is four feet, place the top cross brace no more than 2 feet below the top of the trench.
- When the vertical spacing of cross-braces is five feet, place the top cross-brace no more than 2.5 feet below the top of the trench.

See Appendix B for Timber Spacing and Installation Requirements.

See Appendix C for OSHA Guidelines for Combination Shoring and Sloping Configuration.

See Appendix D for Schematic of Trench Jacks and Trench Shields.

#### 5.20.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>EXCAVATION and TRENCHING TRAINING</b>	
<b>Training will be developed prior to excavating &amp; trenching.</b> <i>(This activity is very infrequent and as such is not a documented module).</i>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all workers whose job assignments involve working in or near an excavation.</i>
<b><i>Module Format:</i></b>	<i>Module will include a video, classroom instruction and site training. This activity is very infrequent and as such is not a documented module.</i>  <i>Training will cover:</i> <ul style="list-style-type: none"> <li>• <i>OSHA Guidelines</i></li> <li>• <i>Equipment</i></li> <li>• <i>Procedures</i></li> <li>• <i>Authorization</i></li> <li>• <i>Etc.</i></li> </ul>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>No Retrain</i>

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of chemical hazards, hazard mitigation, location of MSDS's and other safety information, emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager.

#### 5.20.5 PERFORMANCE CHECKLISTS

**Supervisors/Group Leaders/Department Managers shall:**

- Know and follow the Excavation Program.
- Ensure employees know, understand and follow the Excavation Program.

- Ensure protective equipment is available and in good working order.
- Notify ESH&A if a contractor requires entry into a confined space.
- Monitor/supervise contract employees who have to enter a confined space to perform work duties.
- Apprise contractors of the hazards identified and experience with the excavation.
- Apprise contractors of precautions or procedures that Ames Laboratory has implemented for the protection of employees.
- Initiate progressive discipline per when authorized employees fail to comply with the Excavation Program.

**Authorized Entrant Employees shall:**

- Attend the required training.
- Scrutinize the hazards in the work area, chemicals, procedures, etc. including information on the mode, signs, or symptoms and consequences of the exposure to hazards.
- Communicate with the Attendant to enable the Attendant to monitor entrant's status and alert entrants of the need to evacuate.
- Wear Personal Protective Equipment corresponding to hazards exposed.
- Avoid unsafe practices.
- Report unsafe conditions and practices of others to Supervisor or ESH&A and note on permit.
- Stop work if conditions are Immediately Dangerous to Life or Health (IDLH).
- Know the location of fire alarms and other emergency equipment.
- Evacuate the space whenever:
  - An order to evacuate is given by the attendant or ESH.
  - Any warning signs of symptoms or exposure to a dangerous situation;
  - The entrant detects a prohibited condition.

**Authorized Attendant Responsibility shall:**

- Attend the required training.
- Scrutinize the hazards in the work area, chemicals, procedures, etc. including information on the mode, signs, or symptoms and consequences of the exposure to hazards.
- Communicate with the Authorized Entrant to monitor entrant's status and alert entrants of the need to evacuate.
- Remain outside the excavation during entry operations until relieved by another attendant or operations are complete.
- Ensure Authorized Entrant(s) wear Personal Protective Equipment corresponding to hazards exposed and listed on the permit.
- Avoid unsafe practices.
- Report unsafe conditions and practices of others to Facilitator or ESH and note on permit.
- Monitor the activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate immediately under any of the following conditions:
  - A prohibited condition is detected.
  - Behavioral effects of hazardous exposure is detected.
  - A situation outside the space that could endanger the entrant.
  - The attendant cannot safely perform all the duties required.
- Summon rescue and other emergency services immediately upon determining entrant may need assistance to escape the excavation.

- Perform no duties that might interfere with that attendants primary responsibility to protect the authorized entrant.
- Does not monitor multiple spaces.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

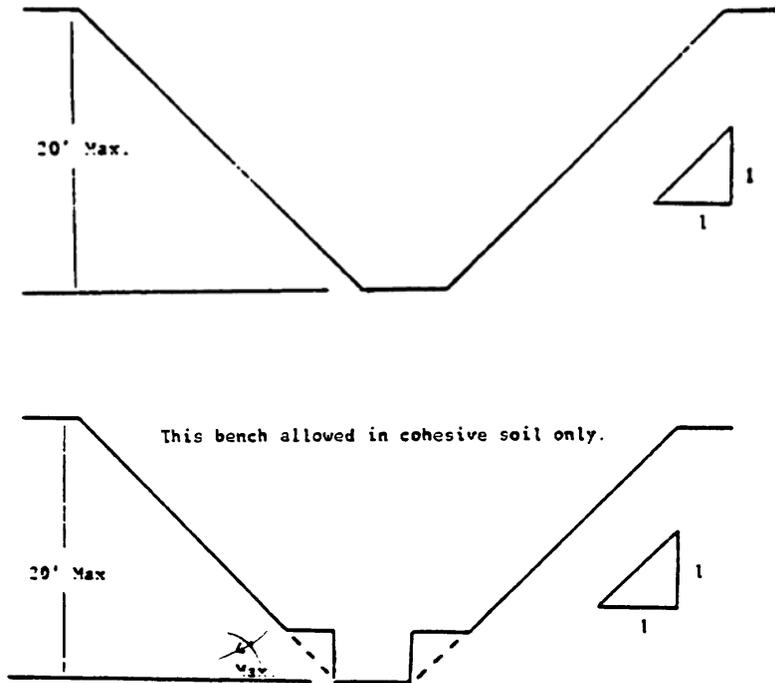
- Conducting Excavation and Trenching Program Training.
- Calibrating monitoring equipment.
- Monitoring all excavation work being performed for the duration of the job.
- Ensuring the requirements of the Excavation Program are being met.

**Contractors shall:**

- All contractors must comply with their company excavation program if acceptable to ESH&A or they must follow the Ames Laboratory Program.
- Debrief with Ames Laboratory ESH&A at the conclusion of the excavation regarding any hazards confronted or created during operations.
- Comply with all inspections of the excavation site by ESH&A.
- Failure to comply with the Excavation Program may subject the contractor to disciplinary action.
- Contractors are prohibited from digging without an authorized Ames Laboratory employee present.

### Appendix A

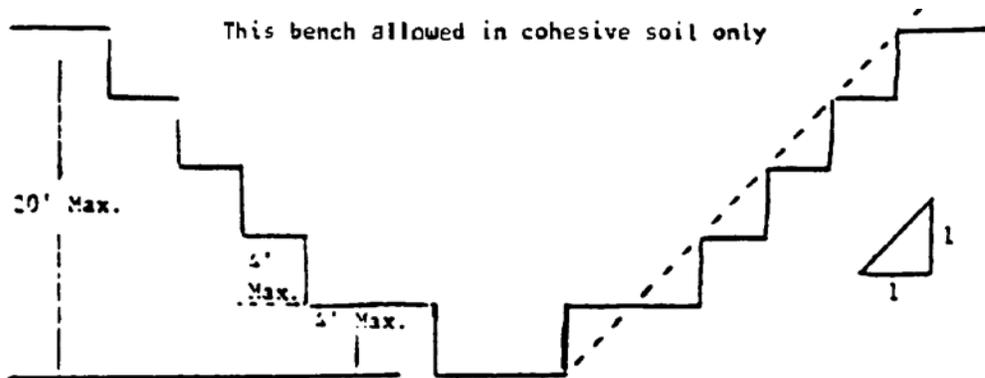
### OSHA Guidelines for Proper Sloping & Benching

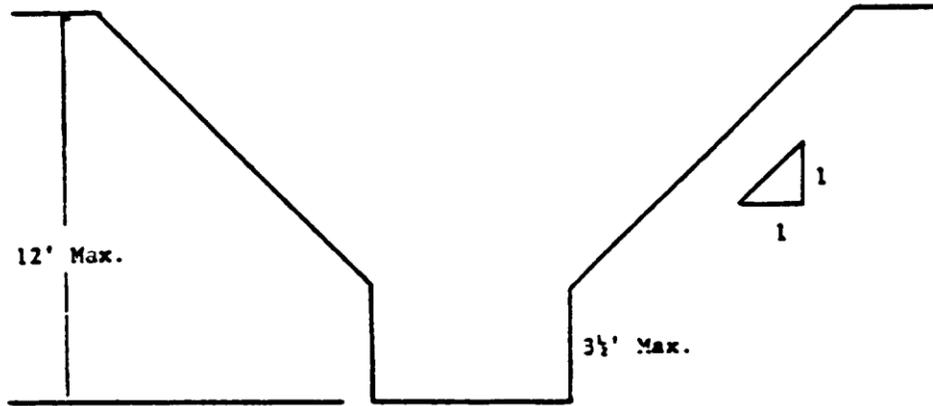


### Appendix A

### OSHA Guidelines For Proper Sloping & Benching

(Continued)





## Appendix B

### OSHA Guidelines for Timber Sizing, Spacing and Installation

Table C-1.2

Timber Trench Shoring—Minimum Timber Requirements \*

Soil Type B  $P_s = 45 \times H + 72$  psf (2 ft Surcharge)

Depth of Trench (feet)	Size (Actual) and Spacing of Members **													
	Horiz. Spacing (feet)	Cross Braces					Vert. Spacing (feet)	Wales		Uprights				
		Width of Trench (feet)						Size (in)	Vert. Spacing (feet)	Maximum Allowable Horizontal Spacing (feet)				
		Up to 4	Up to 6	Up to 9	Up to 12	Up to 15				Close	2	3		
5 To 10	Up to 6	4x6	4x6	6x6	6x6	6x6	5	6x8	5			2x6		
	Up to 8	6x6	6x6	6x6	6x8	6x8	5	8x10	5			2x6		
	Up to 10	6x6	6x6	6x6	6x8	6x8	5	10x10	5			2x6		
	See Note 1													
10 To 15	Up to 6	6x6	6x6	6x6	6x8	6x8	5	8x8	5		2x6			
	Up to 8	6x8	6x8	6x8	8x8	8x8	5	10x10	5		2x6			
	Up to 10	8x8	8x8	8x8	8x8	8x10	5	10x12	5		2x6			
	See Note 1													
15 To 20	Up to 6	6x8	6x8	6x8	8x8	8x8	5	8x10	5	3x6				
	Up to 8	8x8	8x8	8x8	8x8	8x10	5	10x12	5	3x6				
	Up to 10	8x10	8x10	8x10	8x10	10x10	5	12x12	5	3x6				
	See Note 1													
Over 20	See Note 1													

\* Mixed oak or equivalent with a bending strength not less than 850 psi.

\*\* Manufactured members of equivalent strength may be substituted for wood.

## Appendix B

### OSHA Guidelines for Timber Sizing, Spacing and Installation

(Continued)

Table C-2.2

Timber Trench Shoring—Minimum Timber Requirements \*

Soil Type B  $P_s = 45 \times H + 72$  psf (2 ft Surcharge)

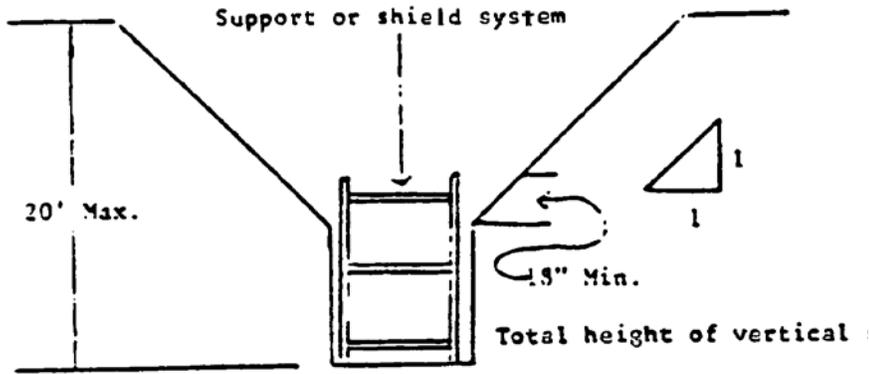
Depth of Trench (feet)	Size (S4S) and Spacing of Members **													
	Horiz. Spacing (feet)	Cross Braces					Vert. Spacing (feet)	Wales		Uprights				
		Width of Trench (feet)						Size (in)	Vert. Spacing (feet)	Maximum Allowable Horizontal Spacing (feet)				
		Up to 4	Up to 6	Up to 9	Up to 12	Up to 15				Close	2	3	4	6
5	Up to 6	4x6	4x6	4x6	6x6	6x6	5	6x8	5			3x12 4x8		4x12
To	Up to 8	4x6	4x6	6x6	6x6	6x6	5	8x8	5		3x8		4x8	
10	Up to 10	4x6	4x6	6x6	6x6	6x8	5	8x10	5			4x8		
	See Note 1													
10	Up to 6	6x6	6x6	6x6	6x8	6x8	5	8x8	5	3x6	4x10			
To	Up to 8	6x8	6x8	6x8	8x8	8x8	5	10x10	5	3x6	4x10			
15	Up to 10	6x8	6x8	8x8	8x8	8x8	5	10x12	5	3x6	4x10			
	See Note 1													
15	Up to 6	6x8	6x8	6x8	6x8	8x8	5	8x10	5	4x6				
To	Up to 8	6x8	6x8	6x8	8x8	8x8	5	10x12	5	4x6				
20	Up to 10	8x8	8x8	8x8	8x8	8x8	5	12x12	5	4x6				
	See Note 1													
Over 20	See Note 1													

\* Douglas fir or equivalent with a bending strength not less than 1500 psi.

\*\* Manufactured members of equivalent strength may be substituted for wood.

### Appendix C

## OSHA Guidelines for Combination Shoring and Sloping Configuration



## Appendix D

### Schematic of Trench Jacks and Trench Shields

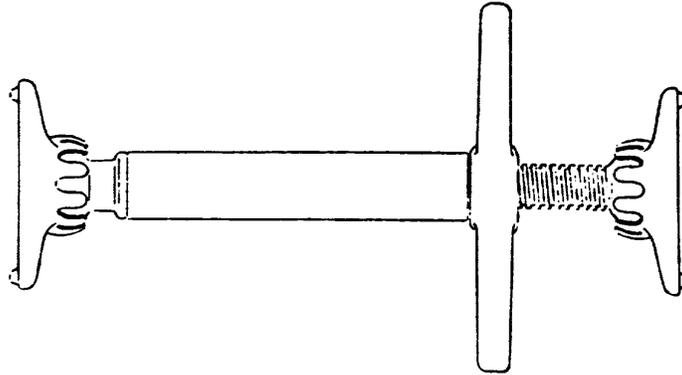


Figure 3. Trench Jacks (Screw Jacks)

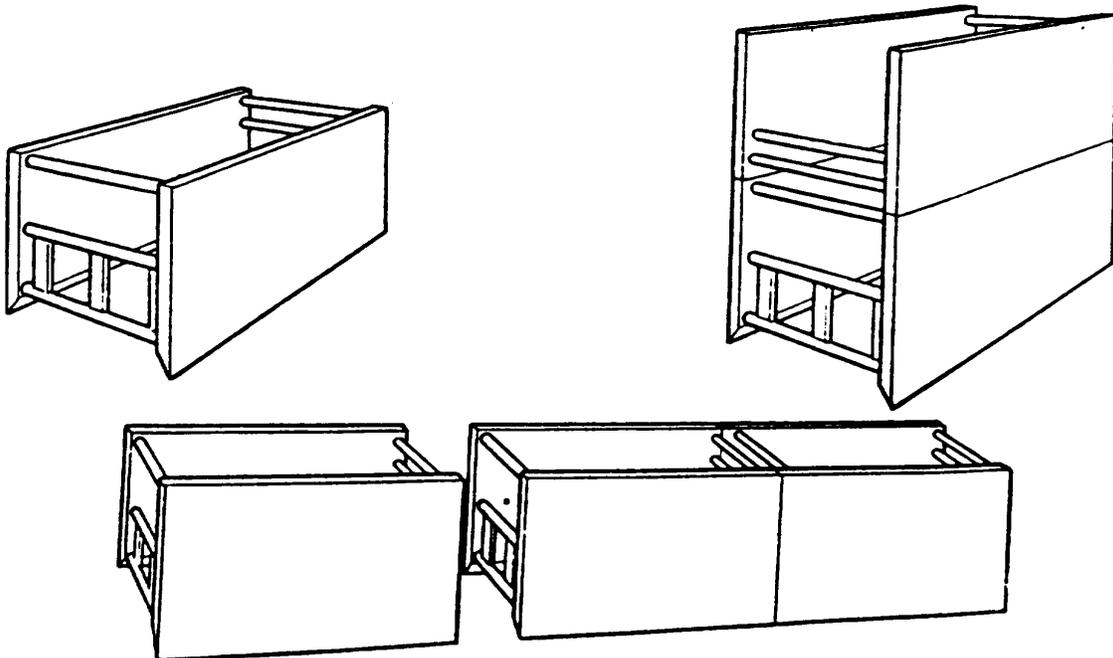


Figure 4. Trench Shields

**Appendix E****Authorized Entrants, Attendants and Supervisors****(EXAMPLE)****January 1999**

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**Authorized Entrants and Attendants.**

<b>Authorized Entrants</b>	<b>Authorized Attendants</b>	<b>Authorized Supervisors</b>
Facilities Services Group	Facilities Services Group	FSG Managers & ESH&A

---

## 5.21 Motor Vehicle Safety

**Applicability Statement:** *This policy applies to all faculty, staff and students that drive vehicles that are owned or leased by Ames Laboratory (ISU) and rented vehicles. This program does not include fork trucks, end loaders, etc.*

### 5.21.1 REFERENCES

Travel Policy 40000.001  
49 CFR Motor Carrier Regulations  
ISU Office of Risk Management  
10 CFR 851 Appendix A. 9(c)(1) through (8)

### 5.21.2 BACKGROUND

The purpose of this program is to ensure the safe operation of Ames Laboratory (ISU) owned, leased or rented motor vehicles, ensure the safety of the drivers and passengers, to minimize the physical damages to vehicles / property, and to reduce third party claims against the Ames Laboratory.

**Definitions:** None

### 5.21.3 PROGRAM INFORMATION

#### 5.21.3.1 General Safety Rules for Operating Vehicles

The following are the safety rules for all Ames Laboratory staff that operate Laboratory owned vehicles, leased vehicles and rented vehicles:

- Drivers must possess a valid driver's license applicable to the class required to operate the vehicle. Drivers that transport hazardous materials must maintain their Commercial Drivers License (CDL).
- Follow all traffic ordinances of the university, city and state in which you are driving. Flagrant or willful disregard or repeated failure to follow safety rules or other acts which endanger people or property may result in progressive discipline.
- If you are in an accident while driving Laboratory owned, leased or rented vehicles during Laboratory business, immediately notify the local law enforcement and notify your supervisor. Obtain the names and telephone numbers of witnesses and other drivers involved in the accident. Accident Report forms are available in Ames Laboratory owned and leased vehicles.
- Examine / inspect all vehicles (i.e., tire inflation, broken mirrors / windows, properly operating turning signals and headlights, operable horn, etc.) before operation. If damage is observed, report the concern immediately and don't drive the vehicle.
- Drivers must be medically fit to operate the vehicle.

- Drivers must be appropriately rested and alert. Every employee is obligated to stop driving if they are tired or fatigued. Drivers should either make alternative travel arrangements or have an appropriate period of rest/sleep before driving.
- Drivers should not use a mobile phone or other two-way communication devices while operating the vehicle. Mobile phones are a distraction and significantly increase the risk of a vehicle incident.
- Driver and passengers (including those in the back seat) must wear seat belts while in a company vehicle or on company business (while vehicle is in motion).
- The consumption of alcoholic beverages, drugs or smoking are prohibited in the company vehicle.
- Driver will not operate any vehicle while under the influence of alcohol or drugs.
- If prescription medication taken may impair the safe operation of a vehicle, the driver will not operate the vehicle.
- Motor vehicle traffic mixing with bicycle and pedestrian traffic is a major concern on campus. Even though bicyclists are required to follow the rules of the road, (the same as motor vehicles) many bicycle operators fail to obey stop signs or signal when making turns. Always look for bicyclists that may be passing or crossing traffic.
- Pedestrians are apt to step off a curb and cross the street at any location. Motor vehicle drivers should always stop for pedestrians on a campus street- particularly those pedestrians in a crosswalk. Drivers of motor vehicles in a pedestrian-traffic-area not only have a responsibility to be legal in regard to statutory rules of the road, but also have a responsibility to exercise due care to avoid colliding with any pedestrian upon any roadway.
- Materials or equipment to be moved on trucks shall be strapped or restrained by ropes, straps, etc., --not by workers. Never allow workers to ride on top of materials to keep them in place.
- Passengers are not allowed in vehicles carrying hazardous materials.
- Red flags must be placed on the end of loads that extend 4 feet or more past the end of the truck.
- The number of passengers must not exceed manufacturer's specification for the vehicle.
- When transporting people in a truck, it is the driver's responsibility to insure that all of the people arrive safely.
  - ❑ A safe number of people should ride in the cab of the truck, and any others shall be seated in the bed of the truck (riding in the bed of a truck is **strongly** discouraged).

- ❑ Do not sit on the edge of a truck tailgate and do not ride on any truck with your legs outside of the bed.
- ❑ **\*Never\*** transport people while they are standing in the truck.
- When pulling a trailer:
  - ❑ When a trailer is to be pulled by a motor vehicle, be sure the ball and hitch are sized for use together.
  - ❑ The safety chains **\*must\*** be attached in the appropriate manner by crossing them under the tongue.
  - ❑ When available, hook up the circuitry for the lights and check them after each hook-up to insure they are functioning properly before going into traffic.
  - ❑ Place the heaviest part of a trailer load in the front of a trailer or above the axles, if possible.
  - ❑ Never allow anyone to be transported in a trailer.
  - ❑ Use a red flag on the end of a load that extends 4 feet or more past the end of the trailer.
  - ❑ Practice backing the trailer in an isolated area and test trailer brakes, if available, before going into traffic.
  - ❑ Increase following distance and anticipate stops to permit deceleration without hazard. Avoid tailgating.

### 5.21.3.2 Insurance Rules

Any employee planning to use a rental vehicle for Laboratory business is to waive the optional liability and collision coverage offered by the rental car company. These exposures are covered under the University's insurance program.

If a vehicle is going to be rented in a foreign country, the optional insurance should be purchased through the rental car company.

If there are any questions about insurance requirements for Laboratory employees operating personal, Ames Laboratory owned / leased or rental vehicles, they should contact the manager of Purchasing and Property Services.

### 5.21.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>P&amp;T HWY Driver's Training</b>		<b>AL-105</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all employees transporting hazardous materials.</i>	
<b><i>Module Format:</i></b>	<i>Classroom instruction, review of administrative policies, and quiz. Estimated Completion time: Four hours for the initial training and two hours for the retraining.</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required every three years.</i>	

### 5.21.5 PERFORMANCE CHECKLISTS

**Supervisor / Group Leader / Department Manager shall:**

- Assure workers have training and competence commensurate with work responsibilities.
- Do not allow employees that have had their license suspended or unlicensed drivers to drive Ames Laboratory owned or leased vehicles or rented vehicles.
- Enforce this and other ESH&A procedures in this manual.
- Communicate and explain the need for compliance with this and all ESH&A Programs.
- Remove from service and repair unsafe vehicles immediately.
- Periodically review driving habits (when possible) of employees to ensure compliance and wearing of seatbelts.

**Employees (drivers) shall:**

- Notify appropriate personnel of equipment concerns (braking or steering problems, lights or horns that are not working, etc.) as soon as problem is discovered.
- All employees are expected to observe and follow the established laws of the University and State that you are driving in.
- Complete the driver safety training (for CDL only) and stay current on refresher training.
- Report any suspension or expiration of drivers license to Supervisor / Group Leader / Department Manager.
- Bring all unsafe acts, practices, or conditions to their Supervisor / Group Leader / Department Manager attention.
- Inform Supervisor/Group Leader/Manager or ESH&A if unable to get an unsafe situation corrected.
- Submit safety and security concerns for the promotion of safety and the prevention of accidents using the Accidents, Incidents & Employee Safety Concerns: Classification & Investigation (Procedure 10200.038).

**Environment, Safety, Health and Assurance shall:**

- Investigate accidents (in conjunction with law enforcement) involving Ames Laboratory vehicles.
- Periodically review and update regulations applicable to Ames Laboratory.

- Provide support for and help in enforcing the Environment, Safety, Health and Assurance procedures.

*Comments and questions regarding this section may be directed to the person listed below:*

Dan Kayser, ESH&A  
G40 TASF  
294-2153

*NOTE: This Section's Sign-Off Record is maintained in the Training and Records Management office.*

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**REVISION / REVIEW LOG****SECTION 6 – ENVIRONMENTAL PROTECTION PROGRAM**

<b><u>Review Number:</u></b>	<b><u>Effective Date:</u></b>	<b><u>Contact Person:</u></b>	<b><u>Pages Affected:</u></b>	<b><u>Description of Revision:</u></b>
0	10/11/99	Dan Kayser	All	Original Issue
1	2/13/06	Dan Kayser	All	G:\ESHA\Document Control\Revision Descriptions\ESH&A Manual\Manual 10200.002 Section 6 revdesc.doc
2	9/01/08	Dan Kayser	1,4,9,12	G:\ESHA\Document Control\Revision Descriptions\ESH&A Manual\Manual 10200.002 Section 6 revdesc.doc
3	7/23/10	Dan Kayser	1,9	G:\ESHA\Document Control\Revision Descriptions\ESH&A Manual\Manual 10200.002 Section 6 revdesc.doc
4	8/1/2011	Dan Kayser	All	G:\ESHA\Document Control\Revision Descriptions\ESH&A Manual\Manual 10200.002 Section 6 revdesc.doc

## SIGN-OFF RECORD

The Environment, Safety Health and Assurance Program Manual has been approved as documented below:

<b>Reviewed by:</b>	_____	Date:	_____
	Amy J. Harris-Tehan, ESH&A, Document Control Coordinator		
<b>Approved by:</b>	_____	Date:	_____
	Tom E. Wessels, ESH&A Program Manager		
<b>Approved by:</b>	_____	Date:	_____
	Mark L. Murphy, Chief Operations Officer		
<b>Approved by:</b>	_____	Date:	_____
	Debra L. Covey, Associate Director for Sponsored Research Administration		
<b>Approved by:</b>	_____	Date:	_____
	Duane D. Johnson, Chief Research Officer		
<b>Approved by:</b>	_____	Date:	_____
	Bruce N. Harmon, Deputy Director		
<b>Approved by:</b>	_____	Date:	_____
	Alexander H. King, Laboratory Director		

*Note: Original Sign-off Record with signatures is on file with Training and Records Management office.*

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## 6.0 ENVIRONMENTAL PROTECTION PROGRAM

This program encompasses all of the general overriding environmental protection principles that apply at Ames Laboratory. It refers to specific policies and procedures for protecting all environmental media that the Laboratory has the potential to impact. It cites appropriate regulations and rules identified in the Ames Laboratory's contract.

### 6.1 ENVIRONMENTAL MANAGEMENT SYSTEMS

*Applicability Statement:* This section applies to All Ames Laboratory Employees.

#### 6.1.1 REFERENCES

DOE Order 436.1, Departmental Sustainability  
Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management  
Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance  
Procedure 10200.75, Environmental Aspects Procedure  
Plan 10200.016, Ames Laboratory Integrated Safety Management System (ISMS) and Worker Safety and Health Program Description  
Policy 10200.010, Ames Laboratory Integrated Safety Management System Policy Statement  
Form 10200.161, Environmental Management System Self-Declaration  
Form 10200.169, EMS Road Map

#### 6.1.2 BACKGROUND

Federal Facilities are required by Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management to have an environmental management system (EMS). The Ames Laboratory's EMS is fully integrated into its Integrated Safety Management System (ISMS) Description, Plan 10200.0016. The Laboratory's self-declaration has been verified and approved by the DOE Ames Site Office. DOE O 436.1 sets forth requirements that apply to the management and operation, facility management, or other contracts under which the Laboratory manages the Government's facilities.

#### 6.1.3 PROGRAM INFORMATION

An Environmental Management System (EMS) is a continual cycle of planning, implementing, reviewing and improving the actions that an organization takes to meet its environmental obligations. Ames Laboratory ESH&A maintains the documentation for the EMS program. The environmental specialist chairs the EMS Steering Committee. The EMS Steering Committee is made up of Scientific Staff, program managers and ESH&A specialists.

**Executive Council** – The executive council shall determine which objectives and targets to choose based on the EMS Steering Committees recommendations. If funding is required to achieve those objectives and targets, the executive council will provide the necessary funding.

**Program Directors / Department Managers** – Directors/managers shall act as mentors to instill waste minimization and energy efficiency into employees under their supervision. They shall identify and take measures to eliminate or minimize the environmental impacts of their work activities.

**Environment, Safety, Health & Assurance** – ESH&A personnel shall ensure the Laboratory is in compliance with the applicable rules, regulations and guidance. ESH&A shall maintain EMS documentation and coordinate EMS Steering Committee meetings.

**Environmental Management Steering Committee** – The group shall discuss and recommend

environmental objectives and targets to the executive council annually.

**Ames Laboratory Employees** – Laboratory employees are responsible for knowing the impacts of their activities on the environment and complying with the necessary training, policies, plans and procedures of the Ames Laboratory.

#### **6.1.4 PERFORMANCE CHECKLIST**

The following checklist shall be utilized by supervisory personnel to assure compliance with this section of the Program Manual. These criteria will also be used by Laboratory personnel, DOE auditors and independent reviewers to assess the Laboratory's performance as mandated by the contractual relationship between DOE and ISU.

**Program Directors / Department Managers** shall:

- Assess potential impacts to the environment, cultural and historic sites when planning work.
- Assess and consider utilizing energy efficient (savings) practices when developing research and other laboratory activities. Consult with Facilities Services and ESH&A as necessary.
- Purchase materials and products that contain recycled materials when feasible.
- Allow for sufficient funding for environmental budget concerns.
- Notify ESH&A of new, or significantly modified, activities under supervision.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Review work proposals for potential environmental impacts.
- Keep EMS documents current.
- Coordinate and chair the EMS Steering Committee.
- Keep environmental program plans, policies and procedures current.
- Allow for sufficient funding for environmental budget concerns.

**Group Leaders / Office or Section Supervisors / Work Leaders** shall:

- Assess potential environmental impacts when planning work.
- Assess and consider utilizing energy efficient (savings) practices when developing research and other laboratory activities. Consult with Facilities Services and ESH&A as necessary.
- Purchase materials and products that contain recycled materials when feasible.
- Allow for sufficient funding for environmental budget concerns.
- Notify their management and/or ESH&A of new, or significantly modified, activities.

### 6.1.5 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES AL-001</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all personnel.</i>
<b><i>Module Format:</i></b>	<i>Classroom Instruction. Estimated completion time: 1.5 hours.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's Annual Retrain Mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders.</i>

<b>HAZARDOUS WASTE GENERATOR'S TRAINING AL-073</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with hazardous chemicals.</i>
<b><i>Module Format:</i></b>	<i>Classroom Instruction with quiz. Estimated completion time: 1.0 hour.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Annual retrain letter.</i>

<b>RADIOLOGICAL WORKER II (RADIOACTIVE MATERIALS) AL-077</b>	
<b><i>Intended Audience:</i></b>	<i>Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.</i>
<b><i>Module Format:</i></b>	<i>Self-study. Consists of video, study guide, challenge exam and practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Two-year retrain. Study guide and challenge exam.</i>

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of chemical hazards, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. This training will be documented by the Group Leader / Department Manager and the records will be maintained for a period of five years.

## 6.2 NATIONAL ENVIRONMENTAL POLICY ACT

*Applicability Statement: This section applies to 1) Environment, Safety, Health and Assurance (ESH&A), 2) Laboratory, Division and Program Directors, and 3) Group Leaders and Department Managers.*

### 6.2.1 REFERENCES

10 CFR 1021 National Environmental Policy Act Implementation Procedures  
DOE NEPA Compliance Guide Volumes I, II, August 1998  
Plan 10200.025, Ames Laboratory National Environmental Policy Act Plan

### 6.2.2 BACKGROUND

The National Environmental Policy Act (NEPA) applies to federal facilities and federally funded activities. Ames Laboratory activities are not allowed to pollute the natural environment, nor to destroy or damage cultural or historical resources. Other negative impacts to the environment or public areas must be eliminated or minimized.

### 6.2.3 PROGRAM INFORMATION

Ames Laboratory ESH&A maintains the NEPA Policy and review and documentation procedures. ESH&A also maintains DOE's Compliance Guide and the Laboratory's NEPA Plan. These documents were originally written to comply with DOE Orders. ESH&A is also the contact point for cultural resources and historic preservation.

**Laboratory Director / Deputy Director / Division Directors** – The Directors shall ensure that sufficient human and financial resources are provided to achieve and maintain compliance with NEPA.

**Program Directors / Department Managers** – Directors/managers shall ensure sufficient program/department funds are directed toward compliance with NEPA activities. These leaders shall consult with ESH&A about work activities that may have potential impacts on the environment and cultural or historic resources. They shall take measures to eliminate or minimize the environmental impacts of their work activities.

**Environment, Safety, Health & Assurance** – ESH&A personnel shall ensure the Laboratory is in compliance with the applicable rules, regulations and guidance. ESH&A shall maintain NEPA and environmental monitoring documentation to reflect current conditions. ESH&A shall review all new and significantly modified work activities for NEPA implications, and assist in obtaining the proper determinations. ESH&A will also serve as the point of contact for identifying cultural and historical resources.

### 6.2.4 PERFORMANCE CHECKLIST

The following checklist shall be utilized by supervisory personnel to assure compliance with this section of the Program Manual. These criteria will also be used by Laboratory personnel, DOE auditors and independent reviewers to assess the Laboratory's performance as mandated by the contractual relationship between DOE and ISU.

**Program Directors / Department Managers** shall:

- Assess potential impacts to the environment, cultural and historic sites when planning work.
- Allow for sufficient funding for environmental budget concerns.

- ❑ Notify ESH&A of new, or significantly modified, activities under supervision.
- ❑ Provide supplementary information needed to obtain a NEPA determination, if requested by ESH&A.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- ❑ Review work proposals for potential environmental impacts.
- ❑ Keep NEPA Policy and procedures current.
- ❑ Acquire necessary data and documentation as needed to supplement NEPA Policies and determinations.
- ❑ Keep environmental program plans, policies and procedures current.
- ❑ Allow for sufficient funding for environmental budget concerns.

**Group Leaders / Office or Section Supervisors / Work Leaders shall:**

- ❑ Assess potential environmental impacts when planning work.
- ❑ Allow for sufficient funding for environmental budget concerns.
- ❑ Notify their management and/or ESH&A of new, or significantly modified, activities.
- ❑ Provide supplementary information to management or to ESH&A to obtain a NEPA determination, if needed.

### **6.3 PROTECTION OF GROUNDWATER AND SURFACE WATER QUALITY AND COMPLIANCE WITH SPILL REPORTING**

*Applicability Statement: This section applies to 1) groups and departments that generate chemical or radiological wastes in rooms that have sink, floor, or in-hood drains, 2) groups and departments using chemicals and radionuclides outdoors, 3) Facilities Services, 4) Engineering Services, 5) ESH&A, and 6) contracted site workers.*

#### **6.3.1 REFERENCES**

City of Ames / Iowa State University Pretreatment Agreements #3593-3 and #4093-3  
567 IAC 60 Wastewater Treatment and Disposal  
567 IAC 61 Water Quality Standards  
567 IAC 131 Reporting of Hazardous Conditions  
567 IAC 133 Determining Cleanup Actions and Responsible Parties  
567 IAC 39 Requirements for Properly Plugging Abandoned Wells  
641 IAC 38 Public Health General Provisions for Radiation Machines and Radioactive Materials  
40 CFR 112 Oil Pollution Prevention, Spill Prevention, Controls and Countermeasures  
40 CFR 131 Water Quality Standards  
40 CFR 300 National Oil and Hazardous Substances Pollution Contingency Plan  
40 CFR 302 Designation, Reportable Quantities and Notification  
Executive Order 12580, Sections 8 and 11, Superfund Implementation  
Manual 10200.003, Ames Laboratory Waste Management Program Manual  
Manual 10202.001, Ames Laboratory Radiation Safety Manual

#### **6.3.2 BACKGROUND**

The State of Iowa is the issuing authority for the City of Ames' National Pollutant Discharge Elimination System (NPDES) permit. The City of Ames has pretreatment agreements with ISU. ISU has a state issued stormwater permit. Since Ames Lab facilities are on ISU property and use ISU utility systems, Ames Lab wastewater and storm water are components of ISU.

#### **6.3.3 PROGRAM INFORMATION**

The rules and regulations for water quality and spills are based on the Clean Water Act and Amendments (CWA), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and the Resource Conservation and Recovery Act (RCRA). The State of Iowa does not have delegated RCRA or CERCLA authority.

**Program Directors / Department Managers** – Directors/managers shall ensure sufficient program/department funds are directed toward compliance with clean water and spill regulations.

**Environment, Safety, Health & Assurance** – ESH&A personnel shall ensure the Laboratory is in compliance with the applicable rules, regulations and guidance. ESH&A will monitor as required by regulations. ESH&A shall review all new and significantly modified work activities for clean water implications. ESH&A shall report spills to the environment to Iowa DNR, EPA Region VII and the U.S. Coast Guard as necessary. ESH&A will manage site restoration activities.

**Group Leaders / Office or Section Supervisors / Work Leaders** – These leaders shall consult with ESH&A about work activities that may have potential impacts on the storm and sanitary sewers. They shall take measures to eliminate or minimize the environmental impacts of their work activities. All

employees shall follow the procedures and guidance in the Ames Laboratory Waste Management Program Manual. Personnel shall immediately report spills to ESH&A.

#### 6.3.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES AL-001</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all personnel.</i>
<b><i>Module Format:</i></b>	<i>Classroom Instruction. Estimated completion time: 2.0 hours.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's Annual Retrain Mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders.</i>

<b>HAZARDOUS WASTE GENERATOR'S TRAINING AL-073</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with hazardous chemicals.</i>
<b><i>Module Format:</i></b>	<i>Classroom Instruction with quiz. Estimated completion time: 1.0 hour.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Annual retrain letter.</i>

<b>RADIOLOGICAL WORKER II (RADIOACTIVE MATERIALS) AL-077</b>	
<b><i>Intended Audience:</i></b>	<i>Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.</i>
<b><i>Module Format:</i></b>	<i>Self-study. Consists of video, study guide, challenge exam and practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Two-year retrain. Study guide and challenge exam.</i>

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of chemical hazards, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. This training will be documented by the Group Leader / Department Manager and the records will be maintained for a period of five years.

### 6.3.5 PERFORMANCE CHECKLIST

The following checklist shall be utilized by supervisory personnel to assure compliance with this section of the Program Manual. These criteria will also be used by Laboratory personnel, DOE auditors and independent reviewers to assess the Laboratory's performance as mandated by the contractual relationship between DOE and ISU.

**Program Directors / Department Managers shall:**

- Consider potential impacts to water quality when planning work.
- Notify ESH&A of new, or significantly modified, activities.
- Allow for sufficient funding for environmental budget concerns.
- Ensure all employees generating hazardous waste have completed "Hazardous Waste Generator's Training", (AL-073).
- Ensure all employees generating radioactive waste have completed "Radiological Worker Training", (AL-077).

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- Review work proposals for potential water quality impacts.
- Allow for sufficient funding for environmental budget concerns.
- Provide opportunity for all employees generating wastes to complete "Hazardous Waste Generator's Training", (AL-073) and "Radiological Worker Training", (AL-077).
- Maintain compliance with all applicable Local, State, and Federal regulations

**Group Leaders / Office or Section Supervisors / Work Leaders shall:**

- Consider potential water quality impacts when planning work.
- Complete "Hazardous Waste Generator's Training", (AL-073), if working with chemicals, radiological or other hazardous materials.
- Complete "Radiological Worker Training", (AL-077), if working with radioactive materials.
- Follow the procedures in the Ames Laboratory Waste Management Manual, and when necessary, the Ames Laboratory Radiation Safety Manual if working with chemicals, radiological or other hazardous materials.
- Notify ESH&A of new or significantly modified activities.

## 6.4 PROTECTION OF AIR QUALITY AND OZONE DEPLETING SUBSTANCES

*Applicability Statement: This section applies to 1) research groups using chemicals or radioactive materials inside fume hoods, gloveboxes or other containments with exhaust systems, 2) Facilities Services, 3) Engineering Services, and 4) ESH&A.*

### 6.4.1 REFERENCES

567 IAC 22 Air Quality: Controlling Pollution  
567 IAC 131 Reporting of Hazardous Conditions  
40 CFR 61 NESHAP for Radionuclides Other Than Radon  
40 CFR 63 NESHAP for Source Categories  
40 CFR 82 Protection of Stratospheric Ozone  
Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management  
Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance  
DOE Order 436.1, Departmental Sustainability  
Manual 10200.003, Ames Laboratory Waste Management Program Manual  
Manual 10202.001, Ames Laboratory Radiation Safety Manual

### 6.4.2 BACKGROUND

The State of Iowa is the issuing authority for air emission permits. The State exempts fume hoods and some minor research laboratory emission sources from permit requirements. EPA Region VII retains authority over ozone depleting substances. The DOE is very concerned with National Emission Standards for Hazardous Air Pollutants (NESHAP) for radionuclides and with protecting the stratospheric ozone.

### 6.4.3 PROGRAM INFORMATION

Most implementation and enforcement has been delegated to the states. State rules must be at least as strict as the federal rules. ESH&A compiles an annual report on this topic for DOE Ames Site Office. EPA Region VII retains authority over ozone depleting substances under 40 CFR 82.

**Program Directors / Department Managers** – Directors/Managers shall ensure sufficient program/department funds are directed toward compliance with air quality regulations. They shall ensure that equipment emissions are within the conditions of the state permits issued for the equipment.

**Environment, Safety, Health & Assurance** – ESH&A personnel shall ensure the Laboratory is in compliance with the applicable rules, regulations and guidance. ESH&A shall calculate the Laboratory's total annual radionuclide emissions, as prescribed by regulations and will monitor air emissions sources as prescribed by regulations. ESH&A shall review all new and significantly modified work activities for air quality implications.

**Group Leaders / Office or Section Supervisors / Work Leaders** – These leaders shall consult with ESH&A about work activities that may have radioactive or hazardous chemical air emissions. They shall take measures to eliminate or minimize the environmental impacts of their work activities. All employees shall follow the procedures and guidance in the Ames Laboratory Waste Management Program Manual and the Ames Laboratory Radiation Safety Manual. They shall ensure that equipment emissions are within the conditions of the state permits issued for their equipment. They shall ensure only trained, qualified workers handle ozone depleting substances. All employees whose work has a potential for air emissions shall follow the procedures and guidance appropriate to their specific work.

#### 6.4.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES AL-001</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all personnel.</i>
<b><i>Module Format:</i></b>	<i>Classroom Instruction. Estimated completion time: 1.5 hours.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's Annual Retrain Mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders.</i>

<b>HAZARDOUS WASTE GENERATOR'S TRAINING AL-073</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for personnel who work with hazardous chemicals.</i>
<b><i>Module Format:</i></b>	<i>Classroom Instruction with quiz. Estimated completion time: 1.0 hour.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Annual retrain letter.</i>

<b>RADIOLOGICAL WORKER II (RADIOACTIVE MATERIALS) AL-077</b>	
<b><i>Intended Audience:</i></b>	<i>Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.</i>
<b><i>Module Format:</i></b>	<i>Self-study. Consists of video, study guide, challenge exam and practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Two-year retrain. Study guide and challenge exam.</i>

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of radioactive and chemical hazards, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager and the records maintained for a period of five years.

#### 6.4.5 PERFORMANCE CHECKLIST

The following checklist shall be utilized by supervisory personnel to assure compliance with this section of the Program Manual. These criteria will also be used by Laboratory personnel, DOE auditors and independent reviewers to assess the Laboratory's performance as mandated by the contractual relationship between DOE and ISU.

**Program Directors / Department Managers shall:**

- Considered potential air quality impacts when planning work.
- Notify ESH&A of new or significantly modified activities.
- Ensure all employees working with ODS are properly trained and certified.
- Ensure all employees operating state permitted equipment shall abide by the conditions of the permit(s).
- Plan for sufficient funding for environmental budget concerns.

- ❑ Follow the procedures in the Ames Laboratory Waste Management Manual, and when necessary, the Ames Laboratory Radiation Safety Manual, if working with chemicals, radiological or other hazardous materials.
- ❑ Plan for sufficient funding for air quality budget concerns.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- ❑ Review work proposals for potential environmental impacts.
- ❑ Consider potential air quality impacts of planned work.
- ❑ Follow the procedures in the Ames Laboratory Waste Management Manual
- ❑ Follow the procedures in the Ames Laboratory Radiation Safety Manual when working with radioactive materials.
- ❑ Plan for sufficient funding for environmental budget concerns.
- ❑ Generate the annual radiological NESHAP report.
- ❑ Keep air quality program plan, policy and procedures current.
- ❑ Provide opportunity for all employees generating wastes to complete “Hazardous Waste Generator Training”, (AL-073), and “Radiological Worker Training”, (AL-077), if necessary.

**Group Leaders / Office or Section Supervisors / Work Leaders shall:**

- ❑ Consider potential air quality impacts when planning work.
- ❑ Notify ESH&A for new or significantly modified activities.
- ❑ Plan for sufficient funding for environmental budget concerns.
- ❑ Follow the procedures in the Ames Laboratory Waste Management Manual, and when necessary, the Ames Laboratory Radiation Safety Manual, if working with chemicals, radiological or other hazardous materials.
- ❑ Ensure all employees working with ODS are properly trained and certified.
- ❑ Ensure all employees operating state permitted equipment shall abide by the conditions of the permit(s).

## 6.5 WASTE MANAGEMENT

*Applicability Statement: This section applies to 1) research groups and work sections that generate hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) and its amendments, 2) those that generate used oil, 3) those that generate PCB or asbestos waste, and 4) research groups that generate radioactive waste.*

### 6.5.1 REFERENCES

FFCA Consent Order and Consent Agreement with EPA, executed February 27, 1996  
567 IAC 140 and 141 Hazardous Waste Rules  
40 CFR 260-263, 264 Subpart S, 265 and 268 Hazardous Waste Implementing Rules  
40 CFR 279 Standards for the Management of Used Oil  
40 CFR 61 Subpart M National Emission Standards for Asbestos  
40 CFR 763 Asbestos  
40 CFR 761 Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions  
40 CFR Resource Conservation and Recovery Act (RCRA)  
10 CFR 835 Occupational Radiation Protection  
Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management.  
Manual 10200.003, Ames Laboratory Waste Management Program Manual  
Manual 10202.001, Ames Laboratory Radiation Safety Manual  
Plan 10200.023, Waste Minimization/Pollution Prevention Plan  
Procedure 10200.054, Hazard Identification for Excess Property and Materials  
Procedure 10200.071, Radioactive Waste Packaging & Shipping Procedure

### 6.5.2 BACKGROUND

Waste Management may include any or all of the following general activities, regardless of waste type:

- Wastes collection, storage and disposal
- Pollution prevention, waste minimization
- Affirmative procurement and recycling
- Compliance with U.S. EPA and State of Iowa waste regulations
- Superfund Amendments and Reauthorization Act (SARA), Title III chemical inventory reporting
- Building renovation activities

Specific hazardous waste regulations began appearing in the 1960's. These regulations have increased in number and specificity many times. Various regulations are enforceable at the federal, state and local levels. The State of Iowa does not have delegated RCRA authority, but it does have some hazardous waste rules. The Federal Facilities Compliance Act (FFCA) amended part of RCRA and resulted in consent orders and agreements between EPA and federal facilities.

### 6.5.3 PROGRAM INFORMATION

The major applicable law is the Resource Conservation and Recovery Act (RCRA). Federal RCRA regulations are in 40 CFR.

**Program Directors / Department Managers** – Directors/managers shall ensure sufficient program/department funds are directed toward compliance with hazardous waste regulations.

**Environment, Safety, Health & Assurance** – ESH&A personnel shall ensure the Laboratory is in compliance with the applicable rules, regulations and guidance. ESH&A will keep waste management plans, policies and procedures current. ESH&A shall collect wastes from satellite accumulation areas. Waste disposal will be accomplished by qualified contractors. ESH&A shall review all new and significantly modified work activities for waste streams. ESH&A shall report spills to the environment to Iowa DNR, EPA Region VII and the U.S. Coast Guard as necessary

**Group Leaders / Office or Section Supervisors / Work Leaders** – These leaders shall consult with ESH&A about work activity waste streams. They shall take measures to eliminate or minimize the environmental impacts of their work activities. All employees shall follow the procedures and guidance in the Ames Laboratory Waste Management Program Manual. If working with radioactive materials, employees shall follow the guidance in the Ames Laboratory Radiation Safety Manual. Research personnel shall report spills to ESH&A.

### 6.5.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES AL-001</b>	
<b>Intended Audience:</b>	<i>Mandatory for all personnel.</i>
<b>Module Format:</b>	<i>Classroom Instruction. Estimated completion time: 1.5 hours.</i>
<b>Associated Retrain Period &amp; Format:</b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's Annual Retrain Mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders.</i>

<b>HAZARDOUS WASTE GENERATOR'S TRAINING AL-073</b>	
<b>Intended Audience:</b>	<i>Mandatory for personnel who work with hazardous chemicals.</i>
<b>Module Format:</b>	<i>Classroom Instruction with quiz. Estimated completion time: 1.0 hour.</i>
<b>Associated Retrain Period &amp; Format:</b>	<i>Annual retrain letter.</i>

<b>RADIOLOGICAL WORKER II (RADIOACTIVE MATERIALS) AL-077</b>	
<b>Intended Audience:</b>	<i>Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.</i>
<b>Module Format:</b>	<i>Self-study. Consists of video, study guide, challenge exam and practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.</i>

**Associated Retrain Period & Format:***Two-year retrain. Study guide and challenge exam.*

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of chemical hazards, hazard mitigation, location of MSDSs and other safety information, emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager and the records maintained for a period of five years.

**6.5.5 PERFORMANCE CHECKLIST**

The following checklist shall be utilized by supervisory personnel to assure compliance with this section of the Program Manual. These criteria will also be used by Laboratory personnel, DOE auditors and independent reviewers to assess the Laboratory and the ESH&A group performance as mandated by the contractual relationship between DOE and ISU.

**Program Directors / Department Managers shall:**

- Consider waste streams when planning work.
- Consider potentially radioactive wastes when planning work.
- Notify ESH&A of new, or significantly modified, activities, including renovations.
- Allow for sufficient funding for waste management concerns in budgets.
- Ensure all employees generating wastes have completed “Hazardous Waste Generator Training”, (AL-073).
- Follow the Ames Laboratory procedure for “Hazard Identification for Excess Property and Materials.

**Environment, Safety, Health & Assurance (ESH&A) shall:**

- Review work proposals for new and/or different waste streams.
- Review work proposals for radioactive waste implications.
- Plan sufficient funding for waste management budget.
- Provide opportunity for all employees generating wastes to complete “Hazardous Waste Generator Training”, (AL-073), and “Radiological Worker II – Radioactive Materials Training”, (AL-077), if necessary.
- Keep waste management plans, policies and procedures current.

**Group Leaders / Section Supervisors / Work Leaders shall:**

- Consider waste streams when planning work.
- Consider potentially radioactive wastes when planning work.
- Complete “Hazardous Waste Generator Training”, (AL-073), if working with chemicals, radiological or other hazardous materials.
- Complete “Radiological Worker II – Radioactive Materials Training”, (AL-077), if working with radioactive materials.
- Follow the procedures in the Ames Laboratory Waste Management Manual, and when necessary, the Ames Laboratory Radiation Safety Manual if working with chemicals, radiological or other hazardous materials.
- Notify ESH&A of their new, or significantly modified, waste streams.
- Ensure all employees generating wastes have completed “Hazardous Waste Generator Training”, (AL-073).
- Follow the Ames Laboratory procedure for “Hazard Identification for Excess Property and Materials.

## 6.6 ENVIRONMENTAL MONITORING, SAMPLING AND SURVEILLANCE

*Applicability Statement: This section applies to 1) contracted site workers; 2) Facilities Services Group, 3) ESH&A, 4) Groups with research activities conducted outdoors, and 5) groups generating large volume waste streams.*

### 6.6.1 REFERENCES

10 CFR 1021 National Environmental Policy Act Implementation Procedures  
40 CFR 61 NESHAP  
567 IAC 131 Reporting Hazardous Conditions  
567 IAC 133 Determining Cleanup Actions and Responsible Parties  
641 IAC 38 Public Health  
Executive Order 12580, Sections 8 and 11 Superfund Implementation  
Plan10202.004, Radiological Protection Program Plan

### 6.6.2 BACKGROUND

Certain activities may warrant the Laboratory to monitor, sample, or survey activities related to environmental compliance.

### 6.6.3 PROGRAM INFORMATION

The National Environmental Policy Act for the Department of Energy is 10 CFR 1021. NEPA is an enforceable federal regulation that requires federally controlled or funded facilities to evaluate the potential environmental impacts of their proposed activities. This may include sampling and analysis. The federal Clean Air Act (CAA) was passed in 1963, and the federal Clean Water Act (CWA) was passed in 1972. Most implementation and enforcement has been delegated to the states. State rules must be at least as strict as the federal. The State of Iowa does not have delegated RCRA or CERCLA authority. The Laboratory must comply with the federal RCRA, CERCLA, CAA, and CWA.

**Program Directors / Department Managers** – Directors/managers shall ensure sufficient program/department funds are directed toward compliance with environmental monitoring and surveillance requirements. They shall ensure that work complies with the conditions of state permits, federal and state regulations and Laboratory guidance documents.

**Environment, Safety, Health & Assurance** – ESH&A personnel shall ensure the Laboratory is in compliance with the applicable federal, state and Laboratory rules, regulations and guidance. They shall review the compliance status of state issued permits. ESH&A shall review all new and significantly modified work activities for environmental sampling and monitoring implications. ESH&A personnel will participate, assist or advise in collecting samples for analysis and monitor emission sources. ESH&A will maintain the NEPA Policy, and NEPA review and documentation procedures. ESH&A will follow all applicable Local, State, and Federal protocol for sampling and monitoring activities.

**Group Leaders / Section Supervisors / Work Leaders** – These leaders shall consult with ESH&A about work activities that may have potential to require environmental monitoring or surveillance. They shall take measures to eliminate or minimize the environmental impacts of their work activities. They shall ensure that work complies with the conditions of state permits, federal and state regulations, and Laboratory guidance documents. All employees whose work has a potential for requiring environmental monitoring or surveillance shall follow the procedures and guidance appropriate to their specific work.

#### 6.6.4 PERFORMANCE CHECKLIST

The following checklist shall be utilized by supervisory personnel to assure compliance with this section of the Program Manual. These criteria will also be used by Laboratory personnel, DOE auditors and independent reviewers to assess the Laboratory's performance as mandated by the contractual relationship between DOE and ISU.

**Program Directors / Department Managers** shall:

- Consider potential environmental impacts and potential monitoring requirements when planning work.
- Plan for sufficient funding for environmental concerns in budgets.
- Ensure employees follow the procedures in the appropriate Ames Laboratory guidance documents when working with chemicals or other hazardous materials.
- Notify ESH&A of new or significantly modified activities.

**Environmental, Safety, Health & Assurance (ESH&A)** shall:

- Review planned work activities for monitoring implications.
- Supply information necessary to plan environmental monitoring or surveillance of work and other known Laboratory work.
- Ensure sufficient monitoring and surveillance is conducted to comply with regulations.

**Group Leaders / Section Supervisors / Work Leaders** shall:

- Consider potential environmental impacts and potential monitoring requirements when planning work.
- Plan for sufficient funding for environmental concerns in budgets.
- Follow the procedures in the appropriate Ames Laboratory guidance documents when working with chemicals or other hazardous materials.
- Ensure all employees operating state permitted equipment abide by the conditions of the permit(s).
- Notify ESH&A of new or significantly modified activities.
- Ensure that permitted equipment is operated within its permit conditions.
- Ensure employees follow the procedures in the appropriate Ames Laboratory guidance documents when working with chemicals or other hazardous materials.

*Comments and questions regarding this section may be directed to the person listed below:*

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G40 TASF  
294-2153

*NOTE: This Section's Sign-off Record is maintained in the Training & Records Management Office, 151 TASF.*

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**REVISION / REVIEW LOG****SECTION 7 – RADIOLOGICAL PROTECTION PROGRAM**

<b><u>Review Number:</u></b>	<b><u>Effective Date:</u></b>	<b><u>Contact Person:</u></b>	<b><u>Pages Affected:</u></b>	<b><u>Description of Revision:</u></b>
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**SIGN-OFF RECORD**

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Bruce N. Harmon, Deputy Director

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Alexander H. King, Laboratory Director

*Note: Original Sign-off Record with signatures is on file with ESH&A.*



## **7.0 RADIOLOGICAL PROTECTION PROGRAM**

This section deals only with IONIZING radiation. Non-ionizing radiation is managed by the Industrial Hygiene Program and information concerning non-ionizing radiation is found in section 4 of this manual.

### **7.1 RADIOACTIVE MATERIALS**

*Applicability Statement: This section applies to groups/departments that use, handle or store radioactive materials in a laboratory environment. This section also applies to employees who transfer, ship or receive radioactive materials.*

#### **7.1.1 REFERENCES**

DOE Order 5400.5, Chg. 2 Radiation Protection of the Public and the Environment  
DOE Order 231.1B, Environmental, Safety and Health Reporting  
DOE Order 474.2, Nuclear Material Control and Accountability  
DOE Order 435.1, Radioactive Waste Management  
Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection,  
Form 10200.004, Readiness Review Activity Approval Form  
Plan 10202.004, Radiation Protection Program (RPP)  
Manual 10202.001, Radiation Safety Manual  
Manual 10200.003, Waste Management Program Manual  
Manual 58304.001, Transportation Safety Manual  
Form 10202.016, Radiological Work Permit Guidance and Checklist Form

#### **7.1.2 REGULATIONS**

The Federal Regulation governing the use of radioactive materials at Ames Laboratory is 10 CFR 835. To implement this regulation, the Ames Laboratory Radiological Protection Program (RPP) has been written to state how each of the safety requirements will be accomplished at the Laboratory. The Radiation Safety Manual presents the information and procedures that must be understood and practiced in order to ensure that all uses of ionizing radiation at Ames Laboratory are in compliance with existing regulatory requirements. Any resultant radiation exposures must be maintained As Low As Reasonably Achievable (ALARA).

#### **7.1.3 BACKGROUND**

Use, handling, storage, receipt, shipping, transferring, and disposal of radioactive materials are important aspects to many of the Laboratory's research programs. The hazards associated with radioactive materials can be significant and demand an effective management program. This section describes the health physics protection mechanisms designed to ensure worker and environmental protection from radioactive materials.

#### **7.1.4 PROGRAM INFORMATION**

##### **General**

The activities of radioactive material commonly used in research at the Laboratory today are typically quite small (microcurie or millicurie amounts) and the doses recorded on personnel dosimetry are far less than 100 millirem in a year. However, radiological conditions are continually monitored by Health Physics in order to promptly detect, and correct, if necessary, potentially unsafe conditions. New projects or modifications to existing projects involving the use of sources of radioactive materials must be approved through the Readiness Review approval process before beginning operations. Special projects, such as

mitigation of contaminated equipment or areas, are performed under guidance of a Radiological Work Permit issued by ESH&A.

Ames Laboratory follows the requirements listed in the Radiation Protection Program (RPP). The RPP, Radiation Safety Manual, along with the information contained in this section of the Ames Laboratory ESH&A Program Manual and Institutional Training modules constitute the Laboratory's written program.

It is the policy of Ames Laboratory to both allow and facilitate the use of radioactive materials and radiation-producing devices for purposes of research and teaching. At the same time, Ames Laboratory is committed to ensuring that all uses of these materials and devices are in compliance with regulatory requirements and that resultant radiation exposures are kept As Low As Reasonably Achievable (ALARA). Toward this end, the Ames Laboratory has established specific administrative entities with responsibilities for controlling the use of radioactive materials and radiation-producing devices at Ames Laboratory.

### **ALARA Committee**

In accordance with the specific requirements of Ames Laboratory's RPP, an ALARA Committee has been established. The Committee consists of members of Ames Laboratory's staff and faculty appointed by the Director for terms of three years. The principal function of the Committee is to oversee the implementation of Laboratory policies and procedures for the safe use of radioactive materials and radiation-producing devices. In addition, the ALARA Committee reviews all requests for use of radioactive materials and radiation-producing devices, reviews records of personnel dosimetry, and decides whether or not authorization for use is to be granted. The ALARA Committee must specifically authorize each activity, which involves the use of radioactive material. See Section 4.0 of the Radiation Safety Manual for detailed explanation of these requirements.

**NOTE:**        Use Authorizations that have been approved by the ALARA Committee are required to be submitted to the ESH&A Office for Activity Readiness Reviews.

### **Radiation Safety Officer (RSO)**

The Radiation Safety Officer is the individual who has the responsibility for the day-to-day administration and operation of Ames Laboratory's Radiological Protection Program. This individual is also a permanent member of the ALARA Committee. At Ames Laboratory, the RSO is assisted by Radiological Control Technicians (RCTs) to ensure the safe use of radioactive materials and radiation-producing devices.

### **Environment, Safety, Health and Assurance Office (ESH&A)**

At Ames Laboratory, the health physics program is administered through the Health Physics Group (HPG) of the ESH&A Office. The ESH&A has the responsibility for managing all Ames Laboratory health and safety programs including radiation, chemical, industrial hygiene and biological safety. The radiation safety program includes accountability of radioactive materials and radiation producing devices, personnel training, laboratory surveys and inspections, waste handling, and personnel dosimetry.

Detailed programmatic information is provided via the training modules listed in Section 7.1.5.

### **General Laboratory Rules for Radiation Safety**

In general, both internal and external exposures to ionizing radiation can be maintained ALARA through the adherence by radioactive material users to a number of standard procedures, practices, and rules. Each person using radioactive materials in an activity shall observe the following:

1. Smoking, eating or drinking shall not be permitted in radionuclide laboratories.
2. Food, beverages and their containers shall not be permitted in the laboratory.
3. Pipetting by mouth shall not be permitted in radionuclide laboratories.
4. Microwave ovens in radionuclide laboratories shall not be used for heating food or beverages for personal use.
5. Individuals who have not been approved for radionuclide use shall not work with or handle radioactive materials.
6. Radionuclide work areas shall be clearly designated and should, to the extent possible, be isolated from the rest of the laboratory. The work area shall be within a hood if the radioactive material to be used is in a volatile form.
7. All work surfaces shall be covered with absorbent paper that should be changed regularly to prevent the build-up of contamination.
8. Work involving relatively large volumes or activities of liquid radioactive material should be performed in a spill tray lined with absorbent paper.
9. Procedures involving radioactive materials should be well planned and, whenever possible, practiced in advance using non-radioactive materials.
10. Protective clothing appropriate for the work conditions shall be worn when working with radioactive materials. This includes laboratory coats, gloves, and safety glasses. Appropriate footwear must always be worn (sandals cannot be worn when working with radioactive materials).
11. When assigned a dosimeter it shall be worn when working with radionuclides.
12. All containers of radioactive materials and items, suspected or known to be contaminated, shall be properly labeled (i.e. with tape or tag bearing the radiation warning trefoil logo and the words "Caution, Radioactive Material or Danger, Radioactive Material").
13. All contaminated waste items shall be placed in a container specifically designated for radioactive waste. Sharp items such as needles or razor blades shall be placed in a cardboard box, glass bottle or "sharps" container.
14. A radiation survey shall be performed by the radionuclide worker at the end of each procedure involving radioactive materials (the survey may be conducted using a portable survey instrument, wipes, or both depending on the radionuclides used). All items found to be contaminated shall be placed either in the radioactive waste container or an appropriately designated area. Any surfaces found to be contaminated shall be labeled and decontaminated as soon as possible. The survey should always include a check of personnel for possible contamination. The ESH&A Office must be notified immediately if extensive contamination is found within the laboratory or if any personnel are found to be contaminated.
15. Record of the types and quantities of radionuclides possessed by each activity supervisor at a given time shall be maintained.
16. Radioactive materials shall be protected from unauthorized removal or access at all times.

## 7.1.5 TRAINING

<b>GENERAL EMPLOYEE RADIOLOGICAL TRAINING (GERT)</b>		<b>AL-074</b>
<b>Module Description:</b>	<ul style="list-style-type: none"> <li>• Provides methods for maintaining exposures to radiation and radioactive materials As Low as Reasonably Achievable (ALARA).</li> </ul>	
<b>Target Audience:</b>	<ul style="list-style-type: none"> <li>• Plant Protection, Custodial and other personnel who have not completed Radiological Worker II but who may enter a Controlled Area and encounter radiological barriers, postings, or radioactive materials.</li> </ul>	
<b>Module Format:</b>	Classroom instruction with quiz. Estimated completion time: 1.0 hour.	
<b>Associated Retrain Period &amp; Format:</b>	Two-year retrain. Retrain module consists of attending a classroom session or a CBT session.	

<b>RADIOLOGICAL WORKER II (RADIOACTIVE MATERIALS)</b>		<b>AL-077</b>
<b>Module Description:</b>	<ul style="list-style-type: none"> <li>• Covers radioactive materials fundamentals, hazards, and safety practices &amp; controls.</li> </ul>	
<b>Target Audience:</b>	<ul style="list-style-type: none"> <li>• Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.</li> </ul>	
<b>Module Format:</b>	Module is self-study. Module consists of video, study guide, challenge exam and a practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.	
<b>Associated Retrain Period &amp; Format:</b>	Two-year retrain. Retrain module consists of study guide training and challenge exam.	

<b>RADIOLOGICAL WORKER I (For Support Staff)</b>		<b>AL-162</b>
<b>Module Description:</b>	<ul style="list-style-type: none"> <li>• Covers radioactive materials fundamentals, hazards, and safety practices &amp; controls.</li> </ul>	
<b>Target Audience:</b>	<ul style="list-style-type: none"> <li>• Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.</li> </ul>	
<b>Module Format:</b>	Module is self-study. Module consists of video, challenge exam and a practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.	
<b>Associated Retrain Period &amp; Format:</b>	Two-year retrain. Retrain module consists of study guide training and challenge exam.	

<b>RADIOLOGICAL INSTRUMENT TRAINING</b>		<b>AL-157, 207</b>
<b>Module Description:</b>	<ul style="list-style-type: none"> <li>• Covers radioactive materials fundamentals, hazards, and safety practices &amp; controls.</li> </ul>	
<b>Target Audience:</b>	<ul style="list-style-type: none"> <li>• Required for all workers whose job assignment involves entry into Radiological Buffer Areas, Radiation Areas, and Radioactive Materials Areas.</li> </ul>	
<b>Module Format:</b>	Module is self-study. Module consists of video, study guide, challenge exam and a practical factors evaluation. Estimated completion time: 1.5 hours/exam and 1 hour/PFE.	
<b>Associated Retrain Period &amp; Format:</b>	Two-year retrain. Retrain module consists of study guide training and challenge exam.	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of radiological hazards, contamination control, and other safety information. In addition, the group/activity training shall review emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager.

### **7.1.6 PERFORMANCE CHECKLISTS**

**Group Leader / Department Manager** shall:

- Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- Complete required institutional radiological worker training listed in section 7.1.4. above.
- Complete “Hazardous Waste Generator Training”, (AL-073), if working with chemicals, radiological or other hazardous materials.
- Follow the procedures in the Ames Laboratory Radiation Safety Manual, and when necessary, the Ames Laboratory Waste Management Manual if working with chemicals, radiological or other hazardous materials.
- Conduct and document group/activity-specific hazard communication training for each employee prior to work that includes a discussion of radioisotopes used, hazard mitigation, contamination control and emergency procedures.
- Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.
- Assure that work is performed in accordance with Ames Laboratory Radiation Safety Manual and associated regulations.
- Assure that inventory sheets and necessary survey records for all radioactive sources are present and accessible.
- Submit radiological inventories to ESH&A annually.
- Assure that radiological package or container marking and labeling is complete and in accordance with guidelines given in the Ames Laboratory RPP.
- Ensure all employees working with radioactive materials or working in areas where radioactive materials are handled or stored have the appropriate training.
- Notify ESH&A for new or significantly modified activities.

**Employees** shall:

- Complete required institutional radiological worker training listed in section 7.1.5. above.
- Complete “Hazardous Waste Generator Training”, (AL-073), if working with chemicals, radiological or other hazardous materials.
- Follow the procedures in the Ames Laboratory Radiation Safety Manual, and when necessary, the Ames Laboratory Waste Management Manual if working with chemicals, radiological or other hazardous materials.
- Complete mandatory training requirements per Employee Training Profile in a timely manor.
- Receive activity/experiment-specific training prior to working with radioactive materials.
- Perform work in accordance with group Standard Operating Procedures (SOPs).
- Performed work in accordance with Ames Laboratory Radiation Safety Manual and associated regulations.

## 7.2 RADIATION PRODUCING DEVICES (X-ray Systems)

*Applicability Statement: This section applies to groups/departments that use radiation producing devices, analytical x-ray systems.*

### 7.2.1 REFERENCES

ANSI N43.2 Radiation Safety for X-ray Diffraction and Fluorescence Analysis Equipment  
ANSI N43.3 Installations Using Non-Medical X-Ray and Sealed Gamma Sources  
Manual 10202.001, Radiation Safety Manual  
Title 10, Code of Federal Regulations, Part 835 Occupational Radiation Protection

### 7.2.2 BACKGROUND

Use of analytical x-ray systems is an important part of several of the Laboratory's research programs. The hazards associated with analytical x-ray systems are significant and demand an effective management program. This section describes the health physics protection mechanisms designed to ensure worker protection from analytical x-ray systems.

### 7.2.3 PROGRAM INFORMATION

Ames Laboratory follows the requirements listed in ANSI N43.2, ANSI N43.3, Radiation Protection Program (RPP) and the Radiation Safety Manual. These documents, along with the information contained in this section of the Ames Laboratory Program Manual and the training module "Radiological Worker II – "Radiation Producing Devices", (AL-076), constitutes the Laboratory's written program.

The basic elements of the Laboratory's program are: ESH&A Radiation Safety Training Program, ESH&A periodic inspection of analytical x-ray laboratories, the ESH&A personnel dosimetry program, Readiness Review procedure, Activity Status Review procedure, and the Group-specific safety training for analytical x-ray users.

Detailed programmatic information is provided via the training modules listed in Section 7.2.4.

It is the policy of Ames Laboratory to both allow and facilitate the use of radioactive materials and radiation-producing devices for purposes of research and teaching. At the same time, Ames Laboratory is committed to ensuring that all uses of these materials and devices are in compliance with regulatory requirements and that resultant radiation exposures are kept As Low As Reasonably Achievable (ALARA). Toward this end, the Ames Laboratory has established specific administrative entities with responsibilities for controlling the use of radioactive materials and radiation-producing devices at Ames Laboratory. These entities are, the ALARA Committee, Radiation Safety Officer and the health physics program administered through the Health Physics Group (HPG) of the ESH&A Office.

The ALARA Committee must specifically authorize each activity, which involves the use of a radiation-producing device, (e.g., analytical x-ray system). See Section 4.0 of Ames Laboratory Radiation Safety Manual for detailed explanation of these requirements.

**NOTE:        Use Authorizations that have been approved by the ALARA Committee are required to be submitted to the ESH&A Office for Activity Readiness Reviews.**

## 7.2.4 TRAINING

<b>RADIOLOGICAL WORKER II (RADIATION PRODUCING DEVICES) AL-076</b>	
<b>Module Description:</b>	<i>Covers X-ray fundamentals, hazards, and safety practices &amp; controls.</i>
<b>Target Audience:</b>	<i>Required for all workers using Radiation Producing Devices (Analytical X-ray Systems) or performing general maintenance on the X-ray system.</i>
<b>Module Format:</b>	<i>Module is self-study. Module consists of video, 50 question closed book challenge exam and a Radiation Instrument Survey Session. Estimated completion time: 1.5 hours/exam and 15 minutes for the Radiation Instrument Survey session.</i>
<b>Associated Retrain Period &amp; Format:</b>	<i>Two-year retrain. Retrain module consists of study guide preparation and challenge quiz.</i>

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of analytical x-ray hazards and other safety information. In addition, the group/activity training shall review emergency response measures and any other procedural information. This training shall be documented by the Group Leader / Department Manager.

## 7.2.5 PERFORMANCE CHECKLISTS

**Group Leader / Department Manager** shall:

- Complete Ames Laboratory “Radiological Worker II Training for Radiation Producing Devices”, (AL-076).
- Assure Hazard Inventory/Job Task Analysis packets and Training Needs Questionnaires (TNQs) for all personnel are complete and current.
- Conduct and document group/activity-specific hazard communication training for each employee prior to work that includes a discussion of x-ray hazards and emergency procedures.
- Assure that group Standard Operating Procedures (SOPs) are current and that work is performed within established guidelines.
- Assure that work is performed in accordance with Ames Laboratory Radiation Safety Manual and associated regulations.
- Assure that maintenance data and user logs are present and accessible.
- Assure that the x-ray room and barriers are properly marked and labeled in accordance with guidelines given in the Ames Laboratory RPP.
- Ensure all employees working with X-ray systems or working in areas where an X-ray system is located have the appropriate training.

**Employees** shall:

- Complete Ames Laboratory “Radiological Worker II Training for Radiation Producing Devices”, (AL-076) and Radiological Instrumentation Training, (AL-157 or AL-207).
- Receive activity/experiment-specific training prior to working with radioactive materials.
- Perform work in accordance with group Standard Operating Procedures (SOPs).
- Perform work in accordance with Ames Laboratory Radiation Safety Manual and associated regulations.
- Complete mandatory training requirements per Employee Training Profile in a timely manor.
- Complete user logbook. All records shall be current to the present day of operation and be kept near the system.

*Comments and questions regarding this section may be directed to the person listed below:*

G.P. Jones, ESH&A  
G40 TASF  
294-4161

*NOTE: This Section's Sign-off Record is maintained in the Training & Records Management Office, 151 TASF.*

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## REVISION / REVIEW LOG

### SECTION 8 – FIRE PROTECTION PROGRAM

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## SIGN-OFF RECORD

This Section of the Environment, Safety Health and Assurance Program Manual has been reviewed and approved as documented below:

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Duane D. Johnson, Chief Research Officer

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Bruce N. Harmon, Deputy Director

**Approved by:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Alexander H. King, Laboratory Director

*Note: Original Sign-off Record with signatures is on file with ESH&A.*



## 8.0 FIRE PROTECTION PROGRAM

*Applicability Statement: This section applies to all Ames Laboratory Groups and Departments. This section also applies to Environment, Safety, Health and Assurance (ESH&A) which is charged with ensuring compliance with specific Codes, Standards and Regulations regarding Fire Safety.*

### 8.1 REFERENCES

29 CFR 1910 Subpart L Fire Protection  
DOE Order 420.1B Facility Safety, Attachment 2, Chapter II  
NFPA 101 Life Safety Code  
NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals  
Form 10200.096, Ames Laboratory Hot Work Permit  
Manual 10200.002, ESH&A Program Manual, Section 4.3, Compressed / Liquefied Gases  
Manual 10200.002, ESH&A Program Manual, Section 5.10, Welding, Cutting and Brazing Program  
Manual 10200.002, ESH&A Program Manual, Section 9, Emergency Preparedness and Site Security Program  
Plan 46300.001, Ames Laboratory Emergency Plan  
Policy 10201.001, Hot Work Policy

### 8.2 BACKGROUND

Fire is one of the most destructive events that can happen to a facility. Once started, a fire grows rapidly, destroying resources and taking lives. For this reason, fire safety requires constant vigilance. The principles of fire safety are Prevention, Detection, Annunciation and Suppression. Each will be addressed in a section of this Program.

It is the policy of Ames Laboratory to minimize the fire potential in order to provide a safe work place. This includes complying with the regulations of the U.S. Department of Energy, the Life Safety Code, the National Fire Protection Association codes, and by controlling quantities and the use of flammables, combustibles, and explosives.

Compressed gases are often associated with fire or explosion hazards but are covered in Section 4.3 of this Manual. Procedures to follow to minimize fire hazards are outlined in the Program Information Section 8.3.

The Ames Laboratory Emergency Plan covers employee responsibilities in emergency situations, such as fire. Those requirements are found in Section 9, Emergency Preparedness and Site Security.

The Ames Laboratory Director has established the Fire Safety Committee (FSC) as a standing subcommittee of the Safety Review Committee, and empowered the committee to act as the local authority having jurisdiction for the Ames Laboratory. The committee reviews designs of new and modified fire protection systems, evaluates, interprets and applies the standards for fire safety, applies for exemptions and waivers from standards, and administers the Ames Laboratory Fire Safety Program.

### 8.2.1 Definitions

**Annunciator:** A device having a strobe, horn, claxon, or other means to notify occupants of the existence of a fire nearby.

**Combustible Liquid:** Any liquid having a flashpoint at or above 37.8C but below 93.3C, except any mixture having components with flashpoints of 93.3C or higher; the total volume of which make up 99% or more of the total volume of the mixture.

**Exit:** One of three required components of a means of egress, namely the exit access, the exit and the exit discharge. The exit is that portion of a means of egress separated from all other spaces to provide a protected way to the exit discharge.

**Fire Classes:** Rating for classifying fires into different types for extinguishing purposes.

CLASS A -- Combustible Material (e.g., wood, paper or rags).

CLASS B -- Flammable Liquids and Gases (e.g., paints, oils, propane, or gasoline).

CLASS C -- Electrical. This classification denotes that there is an electrical conduction hazard to the person using the extinguisher. Once the electrical current is turned off, the remaining fire is either Class A, Class B or a combination of both.

CLASS D -- Combustible Metals (e.g., Mg, Zr, NaK, Na, U, Pu, or Ti).

CLASS K -- Fires involving kitchen equipment, typically deep fryers in a commercial kitchen. This Class does not apply to the Ames Laboratory.

**Fire Extinguisher:** A pressurized or bulk device for the extinguishing of small, or incipient fires only. Users are cautioned to maintain a clear path to exit behind them, in case the fire can not be put out by the extinguisher.

CLASS A Extinguisher (Combustible Material). Use a pressurized water extinguisher.

CLASS B Extinguisher (Flammable Liquids and Gases). Use CO<sub>2</sub> or dry chemical extinguisher

CLASS C Extinguisher (Live Electrical Parts)- Use CO<sub>2</sub> or dry chemical extinguisher

CLASS D Extinguisher (Combustible Metals). Use lime from lime barrel.

**Fire Protection:** Comprised of the planning, engineering, implementation, inspection, and reporting of functions related to fire protection.

**Flammable Liquid:** Any liquid having a flashpoint below 37.8C, except any mixture having components with flashpoints of 37.8C or higher, the total of which make up 99% or more of the total volume of the mixture.

**Hot Work:** Tasks such as welding, brazing, torch cutting and soldering, and grinding, and where the generation of heat, sparks and hot slag may increase the likelihood of ignition of flammable and combustible material.

**Incipient Fire:** A fire that has just started, and is still fairly small. Usually used to describe the limited size of fire the typical fire extinguisher is capable of extinguishing.

**Liquid Classes:** Classification used when setting storage limits and based on flash and boiling points.

<u>Class</u>	<u>Type</u>	<u>Flash Point</u>	<u>Boiling Point</u>	<u>Examples</u>
I	Flammable	<100F (37.8C)	NA	
IA	Flammable	< 73F (22.8C)	<100F (37.8C)	anhydrous ether
IB	Flammable	< 73F (22.8C)	≥100F (37.8C)	toluene, acetone, gasoline

II	Combustible	≥100F (37.8C)& <140F (60C)	NA	kerosene
IIIA	Combustible	≥140F (60C)& <200F (93.3C)	NA	nitrobenzene, aniline

**Manual Pull Station:** A device occupants may use to initiate a fire alarm in a building. Typically, manual pull stations are located near exits.

**Nationally Recognized Testing Laboratory (NRTL)** an organization that is acceptable to the authority having jurisdiction, concerned with the evaluation of products, materials and services, whose listing states that the product, material or service has been tested and found suitable for a specified purpose.

**Sprinkler:** A device used to dispense a spray of a wetting agent, typically water, initiated by heat.

## 8.3 PROGRAM INFORMATION

### 8.3.1 Fire Prevention

The best way to reduce the damage caused by fire is to avoid having the fire. There are several actions that each employee should take to prevent the start of a fire in their work area.

#### 1. Eliminate or reduce combustible fuel loading-

Good housekeeping practices will reduce the fire hazard associated with combustible materials. Waste materials should be removed regularly to prevent buildup. Work areas should be free of fuel paths that spread a fire. Combustible material usage and storage should be planned to limit amounts to the essential minimum, especially cardboard boxes and loose paper. Paper stock and similar materials should be stored in metal cabinets. Isolate combustibles from potential ignition sources such as burners, hot plates, soldering irons, and other electrical appliances. Dirty or oily shop rags are to be kept in a metal container with self-closing lid.

#### 2. Eliminate electrical fire hazards-

Fires in electrical equipment are the leading cause of industrial fires. To minimize this potential, the following practices and procedures are to be observed.

- Wiring, conduit, and cables shall be protected from mechanical injury and from deterioration. Equipment should be inspected periodically and any defects repaired.
- All electrical apparatus shall be kept clean.
- All connections shall be kept tight and all moving parts shall be properly lubricated and replaced periodically.
- Electrical apparatus shall not be operated above its rated load.
- Coffee pots and hot plates for cooking food are allowed when there is no hazard to personnel and no fire hazard. These appliances are prohibited where smoking, eating, or drinking are prohibited (labs, shops and equipment rooms where toxic, carcinogenic, or radioactive materials may be present).
- Coffee pots and hot plates should be operated in plain view, never concealed under a desk or in a cabinet.

- Non-approved electrical apparatus shall not be used where explosive vapors or dusts may be present.
  - Portable heating devices may be used when a sheet of noncombustible material is placed under the device, a clearance of at least 36 inches is maintained between the appliance and combustible materials, the appliance is properly grounded by a three-wire system, the appliance is approved by Underwriters Laboratories, Factory Mutual Engineering Corporation, or the Ames Laboratory Electrical Safety Committee, and the appliance is not left unattended for more than 15 minutes.
3. Eliminate or reduce flammable liquids fuel loading-

When spilled or released from their containers, flammable liquids form flammable vapors that can cause flash fires and explosions. Therefore, the quantity of flammable and combustible liquids kept in a room or laboratory is to be only that amount necessary for current operations and shall be at or below the fire protection storage limits shown below.

Room or Laboratory Unit Limits

<u>Liquid Class</u>	<u>Total</u>	<u>In Glass or Metal</u>	<u>In Safety Cans</u>
I & II	35 gal.	10 gal.	25 gal.
III A	60 gal-minus amount of I & II	60 gal.	60 gal.

Container Size Limits

<u>Liquid Class</u>	<u>Glass Container</u>	<u>Metal Cans</u>	<u>Safety Cans</u>
IA	1 pint	1 gal.	2 gal.
IB	1 quart	1 gal.	2 gal.
I	1 gal.	1 gal.	2 gal.
II	1 gal.	1 gal.	2 gal.
III A	5 gal.	5 gal.	5 gal.

NOTE:

**Metric Units:** The fire code is expressed in U.S. measurement units; for metric designations use the nearest common metric container size.

**Safety Cabinets:** The above storage limits apply only to storage outside of approved safety cabinets (see ESH&A).

NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals

The following guidelines apply to the storage of flammable liquids:

- Storage of acids with flammable liquids immediately adjacent to, above, or below each other is prohibited.
- Storage shall be away from heat and ignition sources.
- Storage of flammable liquids should not be within 5 feet of either side of a doorway or exit.
- Storage of flammable liquids is not permitted in hallways or stairwells.

Approved metal cans and storage cabinets are an excellent way to store larger volumes of flammable liquids. The design of both cans and cabinets is such that the liquids will be protected from fire for a longer time, allowing occupants to safely exit the area. Containers and storage cabinets used for flammable liquids are regulated in the following ways:

- Flammable liquids should not be stored in glass or plastic containers unless such containers are required because of purity or technical reasons.
- Plastic or metal containers larger than one quart shall be approved (UL or FM) safety cans.

- Safety cans shall be red with the contents of the can stenciled on the exterior.
- Flammable liquid containers shall be maintained in good condition.
- Safety cans shall be filled in a location that provides adequate ventilation, fire protection, and control of ignition sources.
- Grounding wires are to be provided, where appropriate, to permit grounding of the storage container to the portable container. Storage racks shall be grounded to "earth".
- Storage cabinets shall have lettering that states, "FLAMMABLE - KEEP FIRE AWAY," in accordance with existing standards.
- Cabinet and components shall be constructed of metal. A cabinet approved by a Nationally Recognized Testing Laboratory (NRTL) is required.
- Cabinets normally should be located along an outside wall but not at any openings, not adjacent to combustible materials or sources of ignition, or within 5 feet of either side of a doorway or exit.
- Cabinets are not permitted in corridors or stairwells, and shall be situated in areas with adequate ventilation.
- Cabinets for flammable liquid storage are to be kept clean and orderly, and shall not be used for the storage of any other materials.
- Refrigerators and freezers used for flammable liquid/gas storage in Ames Laboratory spaces shall meet the requirements of NFPA 45 *Standard on Fire Protection for Laboratories Using Chemicals*, NFPA 70 *National Electrical Code*, and 29 CFR 1910 *Occupational Safety and Health Standards for General Industry*. Refrigerators and freezers acquired for the storage of flammable chemicals shall be certified by a NRTL for that use. Under special circumstances (as an example, a one-of-a-kind research application) local approval or variances may be obtained utilizing the Readiness Review process with Fire Safety Committee approval and electrical inspection in accordance with the Electrical Safety Manual.
- In hoods- In 2005, the Safety Review Committee developed the following four guidelines for the safe use of flammable liquids in hoods:
  - At or below 4 liters of flammable chemical(s) in the hood, no action will be necessary other than prudent practice as approved in Readiness Review.
  - At greater than 4 liters of flammable chemical(s), electrical service/equipment in the hood will be removed, or all service/equipment will be made Class I Division 2 compliant.
  - Quantities exceeding the Guidelines will require the review/approval of the SRC.
  - These will be approved via the Readiness Review process (Lead Specialist Recommendation/SRC Approval) and assessed during Annual Independent Walkthroughs.

As a rule of thumb, flammable and combustible liquids in glass should be stored as low to the floor as possible, to reduce the spread if the bottle is dropped. Secondary containment is recommended if bottles are stored so closely together that breakage is likely during a search for a specific chemical, and while transporting the liquids in the lab.

### 8.3.2 Hot Work Permits

There will always be jobs that require the use of an open flame. Soldering, cutting/welding, brazing and annealing torches, Bunsen burners, and candles are all open flame devices commonly used throughout the Lab. High-speed grinding that produces hot sparks or slag can be considered Hot Work as well, as the sparks or slag may provide an ignition source. Additional welding, cutting and brazing concerns may be found in Section 5.10 of this Manual.

In designated areas where Hot Work is routinely done, the evaluation of the protection needs shall be done during the Readiness Review evaluations. This will provide a review of the area every five years. Prior to starting a new Hot Work operation, the employee must complete a Readiness Review for a designated area. Readiness Review documents may be picked up from the Environment, Safety, Health & Assurance Office (ESH&A) in G40 TASF. Changes in fuel loading, materials used or type of Hot Work conducted may necessitate re-opening the Review.

Transient Hot Work is usually task driven, such as soldering plumbing pipes. It is typically done outside a recognized Hot Work area, and by employees who may lack day-to-day familiarity with the hazards of the area. A Hot Work Permit is required for a transient operation. Hot Work Permit forms (Form 10200.096) may be picked up from the Plant Protection Section Office in G34 TASF.

*Hot Work Permit* is the means whereby the conduct of a transient hot work operation may be documented by Plant Protection Section to expedite response to a fire or emergency condition.

The permit will:

- Identify and address all types of Hot Work to be performed,
- Address special precautions to be taken to prevent fire initiation and spread, as needed,
- Identify Personal Protective Equipment needed for the conduct of the work,
- Establish that all fire detection and suppression equipment will be operating prior to, during and after the task,
- Establish that the workers are aware of the location of exits, manual pull stations, fire extinguishers appropriate for the task,
- Document that all combustible and flammable materials have been removed for a distance commensurate with the potential risk, as an example, a Bunsen burner may need a two-foot clearance, while a cutting torch operation may need thirty-five feet of clearance. Keep in mind that flammable vapors can travel great distances to an ignition source.
- Document that wall and floor penetrations have been covered to prevent the travel of sparks or flash to adjacent areas, and that compressed gas cylinders will be protected from flame and heat impingement,
- Document that back flow/backflash protectors have been installed on oxygen/fuel gas torch systems,
- Identify jobs where a Fire Watch may be deemed necessary. Where necessary, the Fire Watch will be maintained during and for thirty minutes after the Hot Work project. The Fire Watch will have responsibility for the safety of the worker doing the hot work, as well as the protection of property. The Fire Watch will be trained in the use of suppression equipment, and will be equipped with a method for communicating an emergency and a means to start fire suppression as warranted,

- Document whether the detection system in the area will need to be bypassed during the operation.

Hot Work Permits shall be kept on file for one year by the Plant Protection Section.

### **8.3.3 Fire Detection**

The Ames Laboratory maintains a central station to which smoke and heat detectors, manual pull stations, and sprinkler flow alarms are sent. This station is monitored twenty-four hours a day, seven days a week by the officers of the Plant Protection Section. Alarms that are received at the station are telephoned to the appropriate emergency response service.

Smoke detectors are located in the hallways and those rooms deemed to have a higher fuel loading, higher ignition potential, or higher loss impact. Heat detectors are located in areas with a likelihood of dusty, damp or smoky conditions. Smoke and heat detectors are automatic detectors, notifying the central station of a fire condition and activating the building annunciation simultaneously.

Manual pull stations are located as close to exits as possible. As the name implies, these are manually activated by area occupants as they exit the area when they have detected a fire. Manual pull stations also notify the central station of a fire condition and activate the building annunciation simultaneously.

Sprinkler Flow Alarms are installed at each zone, and alarm at either the flow of water through a single sprinkler, the flow through the main, or both. Sprinkler Flow Alarms notify the central station of a fire condition, activate the building annunciation and a Water Gong on the exterior of the building, where applicable.

### **8.3.4 Bypassing a Detection System**

Bypassing a detection system silences the building annunciators, but continues to transmit a fire alarm to the building panel and the central station monitored by the Plant Protection Section. Bypassing is prudent for those tasks that may generate enough smoke, heat or dust to trigger a detector, initiating an evacuation by the building occupants. Unnecessary evacuations (false alarms) degrade the confidence the occupants place in a detection/annunciation system, causing the occupants to respond slowly or fail to respond at all to alarms. To affect a building bypass, contact the Plant Protection Section, arrange for two-way communication via walkie-talkie, assure that the bypass is on for the affected building before starting the task, and remain in the immediate area to respond to radio calls from the Plant Protection Section. If the building system detects a fire, the officer at the central station will radio the worker at the site and seek to confirm that the alarm was due to the task. Failing to reach the worker at the site, or failing to get confirmation that the task was responsible for the alarm, the officer will turn the bypass off and immediately evacuate the building, notify the Ames Fire Department and notify the Emergency Coordinator.

### 8.3.5 Fire Annunciation

Fire annunciation is a two-part system; one portion is the alarm system in each building that alerts occupants of the existence of a fire and the need to exit, the other portion is the system that is used to notify the fire department of a fire incident.

The building annunciation is triggered by the use of a manual pull station, automatic detection by a smoke/heat detector, activation of an automatic sprinkler, or by an area occupant telephoning a fire call to the Plant Protection Section. At the activation of the claxon/strobe alarms, all employees are to exit the area in a calm but prompt manner, turning off lights and closing doors ONLY if it is convenient. Group or Department people are to assemble in the pre-established point of congregation, and report to the Group/Department Accountability Coordinator. If a person is not accounted for, the Accountability Coordinator is to report to the Emergency Coordinator the information that someone may be left in the building and the area they may be in. This information will be given to the responding Fire Department officers, and a check will be made of the area by the Fire Department.

The silencing of the alarms may be done to assist the Fire Department fire fighters in communicating while within the building, and does NOT automatically mean that re-entry is permitted. At no time are people allowed to re-enter the building until the “All Clear” has been given by the Emergency Coordinator.

The activation of a manual pull station, a sprinkler or a smoke detector should be automatically received also by the monitored central station in the Plant Protection Section, however, failures may occur in an electronic system. It would be prudent for an occupant exiting a building during a fire alarm to contact the Plant Protection Section from a safe phone or in person (if close enough) to assure that prompt notification of the Fire Department has taken place, and to provide details of the incident that may improve responses.

### 8.3.6 Fire Suppression

Manual fire suppression (fire extinguishers) is to be attempted only by trained individuals. The suppression of an incipient fire requires the training and knowledge of the appropriate fire extinguisher and an awareness of that extinguisher’s limitations. The use of a Class A water-type extinguisher on a live electrical fire can cause serious injury or death to the user by electrocution. Conversely, the use of a CO2 fire extinguisher on a paper fire may blow burning embers around, leading to a more rapid spread of the fire to other fuel sources. A trained individual will need to assure that a clear escape route is available, should the attempt to extinguish the fire fail. The fire alarms should always be activated before attempting to extinguish a fire, as this will allow others in the building to exit as early as possible, and it will initiate the emergency response crews to assist if the fire can’t be extinguished. If the alarms have not triggered from the automatic detection system, use a manual pull station.

As a reminder to trained users, the mnemonic for fire extinguisher use is **PASS**:

**P**ull pin  
**A**im at the fire’s base  
**S**queeze the handle  
**S**weep back and forth

Once a fire extinguisher has been used, it needs to be immediately replaced with a full unit. Please call the Plant Protection Section at 4-3483, to have the used extinguisher changed out and refilled. Any time a fire extinguisher is used, a report needs to be filed with Environment, Safety, Health and Assurance at 4-2153.

Once a fire has reached a stage where the ceiling temperature is at or near 165 degrees Fahrenheit, the sprinkler fusible link will open automatically, releasing a continuous spray of water. Only those heads that have been “melted” will flow water. As the fire grows, more heads will activate. During and after a fire, the sprinkler system may only be valved off at the order of the Emergency Coordinator or the Fire Department’s Incident Commander. Once valved off, an individual capable of restoring water service if the fire re-ignites must tend the valve. The individual must remain at the valve until the sprinkler heads that had been activated have been replaced by fresh sprinkler heads.

Passive means of preventing the spread of a fire are the use of rated fire- or smoke-doors, fire resistant construction of walls, floors and ceilings, and the use fire- and smoke-stopping for wall and floor penetrations.

#### 8.4 TRAINING

Detailed programmatic training is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES</b>		<b>AL-001</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all new employees.</i>	
<b><i>Module Format:</i></b>	<i>Classroom Instruction. Estimated completion time: 1.5 hours.</i>	
<b><i>Associated Retrain Period and Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory’s Annual Retrain Mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders.</i>	

<b>FIRE EXTINGUISHER TRAINING</b>		<b>AL-017</b>
<b><i>Intended Audience:</i></b>	<i>Any employee wishing to use a fire extinguisher.</i>	
<b><i>Module Format:</i></b>	<i>ISU EHS: Classroom instruction and hands-on practice.</i>	
<b><i>Associated Retrain Period and Format:</i></b>	<i>Annual retraining mailing.</i>	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of hazards and hazard mitigation, safety information and resources, emergency response measures and other procedural information. This training shall be documented by the Group Leader/Department Manager and the records maintained for a period of five years.

## 8.5 PERFORMANCE CHECKLIST

### **Group Leader / Department Manager shall:**

- Keep their personnel and rooms in compliance with the provisions of this section.
- Maintain a current group emergency plan, and assure that their employees are aware of the plan and its requirements.
- Assure that their employees are familiar with the location and use of the fire extinguishers and fire alarm stations (manual pull stations).

### **Employees shall:**

- Conduct their work in a way that minimizes the possibility of fires.
- Follow the procedures for safe chemical handling and storage.
- Respond in case of a fire, as outlined in the Ames Laboratory Emergency Plan and in the Group Emergency Procedures, such as knowing and using fire evacuation routes and relocation points.
- Know which extinguisher to use, its location, how and when to use it.
- Activate the building fire alarm station immediately when a fire is detected, know where alarm stations are located and how they operate.

### **Environment, Safety, Health & Assurance (ESH&A) shall:**

- Maintain current standards, codes and regulations.
- Provide interpretations for Ames Laboratory situations.
- Provide fire safety evaluations annually, or as needed.
- Maintain a fire safety central station for the notification of occupants and off-site responders.
- Write and submit requests for variances and exemptions from safety standards as needed.

### **Fire Safety Committee shall:**

- Act as a liaison to the Authority Having Jurisdiction for fire safety issues.
- Provide a competent technical resource for identifying, recommending resolution of, and communicating fire safety issues, initiatives and programs.
- Review designs for new or modified fire protection systems.
- Review designs for new or modified facilities.
- Evaluate, write and maintain requests for waivers, exemptions and equivalencies.
- Develop the Fire Safety Program, to document all fire safety system testing, inspection and maintenance, and assign ownership and responsibility for compliance.

*Comments and questions regarding this section may be directed to the person listed below:*

G.P. Jones, ESH&A  
G40 TASF  
294-2153

*NOTE: This Section's Sign-Off Record is maintained in the Training & Records Management Office, 151 TASF.*

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## REVISION / REVIEW LOG

### SECTION 9 – EMERGENCY PREPAREDNESS AND SITE SECURITY

<u>Review Number:</u>	<u>Effective Date:</u>	<u>Contact Person:</u>	<u>Pages Affected:</u>	<u>Description of Revision:</u>
0	10/27/99	G.P. Jones	All	Original Issue
1	1/13/06	G.P. Jones	See Revision Description	G:\ESHA\Document Control\Revision Descriptions\ESH&A Manual\Manual 10200.002 Section 9 revdesc.doc
2	07/15/11	G.P. Jones	See Revision Description	G:\ESHA\Document Control\Revision Descriptions\ESH&A Manual\Manual 10200.002 Section 9 revdesc.doc

**SIGN-OFF RECORD**

The Environment, Safety, Health and Assurance Program Manual has been reviewed and approved as documented below:

<b>Reviewed by:</b>	_____	Date:	_____
	Amy J. Harris-Tehan, ESH&A, Document Control Coordinator		
<b>Approved by:</b>	_____	Date:	_____
	Tom E. Wessels, ESH&A Program Manager		
<b>Approved by:</b>	_____	Date:	_____
	Mark L. Murphy, Chief Operations Officer		
<b>Approved by:</b>	_____	Date:	_____
	Debra L. Covey, Associate Director for Sponsored Research Administration		
<b>Approved by:</b>	_____	Date:	_____
	Duane D. Johnson, Chief Research Officer		
<b>Approved by:</b>	_____	Date:	_____
	Bruce N. Harmon, Deputy Director		
<b>Approved by:</b>	_____	Date:	_____
	Alexander H. King, Laboratory Director		

*Note: Original Sign-off Record with signatures is on file with ESH&A*

## 9.0 EMERGENCY PREPAREDNESS AND SITE SECURITY

### 9.1 EMERGENCY PREPAREDNESS

*Applicability Statement:* This section applies to all Ames Laboratory employees, sub-contractors and visitors. This section also applies to staff of Environment, Safety, Health and Assurance, Facilities Services, Engineering Services, Occupational Medicine, and Purchasing, who have responsibilities as specified in the Ames Laboratory Emergency Plan.

#### 9.1.1 REFERENCES

29 CFR 1910.38 General Industry Standards - Employee Emergency Plans and Fire Prevention Plans

DOE Order 151.1, Comprehensive Emergency Management

Plan 46300.001, Ames Laboratory Emergency Plan

Procedure 46300.010, Ames Laboratory Emergency Plan Implementation Procedure

#### 9.1.2 BACKGROUND

The purpose of this Section is to document procedures and emergency responses written to minimize the impact of unusual situations which might threaten, disrupt, or adversely influence effective operations, and to provide for the protection of personnel and physical assets during an emergency, and to provide timely notification to the public, regulatory agencies and the Department of Energy.

The Ames Laboratory hazard assessment has concluded, based on past history as well as threat analysis, that natural phenomena (tornadoes, floods, blizzards, ice storms) and structural fires are the most likely types of emergencies challenging the Lab. A thorough hazards assessment of the site concluded that the Hazard Classification level for the Laboratory is “Low”, or that those situations that might occur may present minor on-site and negligible off-site impact to the public and environment. With these in mind, the Laboratory has developed a “graded approach” to emergency preparedness, using in-house personnel in emergency response assignments for which their professional training and experience interpret directly to their Emergency Team role.

The Ames Laboratory Emergency Team responds to minor on-site emergencies, and provides coordination and assistance for those situations requiring off-site responders. The assistance and cooperation of off-site responders has been assured through Memoranda of Understanding, and through Mutual Aid Agreements developed by Iowa State University.

#### 9.1.3 PROGRAM INFORMATION

**When an incident occurs, prompt notification to the proper response organization is critical.** By their nature, these situations require immediate action. Delays in medical assistance, law enforcement support or fire department arrival can greatly increase the likelihood of serious injury or death. For this reason, in cases of fire, injury or where enforcement response law is needed, call 911. For fires, this call must be made from a safe location away from the fire

scene, and after the nearest manual pull station has been activated as you exit. Activating a manual pull will also notify Plant Protection Section of a fire, and they will call 911, as well. A 911 call will be received by the Iowa State University Department of Public Safety, who will dispatch police officers and request a response by the Ames Fire Department or Mary Greeley Medical Center as needed. ISU-DPS will also notify the Ames Laboratory Plant Protection Section, who will initiate the responses by on-site personnel, and expedite the arrival of the appropriate response organizations.

In chemical spill situations, the Ames Laboratory Spill Response Team may be called upon to react to the incident. A call placed to 4-5511 will initiate the response sooner during normal working hours, however a 911 call will be referred back to Ames Laboratory.

The Emergency Plan and implementing procedure are based on an ordered set of priorities:

1. Provide for personnel safety and health
  - a. Prevent further injuries
  - b. Care for the injured
  - c. Control and protect personnel
2. Protect critical and essential records or reports
3. Protect critical or major scientific equipment
4. Protect general equipment and critical supplies
5. Protect buildings, utilities and structures
6. Protect all other facilities, equipment, supplies

When an emergency has been declared, the following provisions apply:

1. Plant Protection Section will temporarily coordinate necessary actions and secure the early presence of the Emergency Coordinator or alternate.
2. Coordination shall pass to the Emergency Coordinator or his designee, as documented in the Emergency Plan.
3. For all other assigned positions, the alternate in succession will assume charge. The Emergency Coordinator (or designee) may make temporary assignments of any qualified individual to initiate necessary immediate action. The type of emergency occurring will determine the size and scope of the emergency response organization involved.
4. If necessary, the Director, the Facility Manager, the Emergency Coordinator, or their alternates will activate the Emergency Operations Center (EOC).

In the event of certain emergencies, protective actions will be taken as follows:

#### **BUILDING EVACUATION – FIRE / EXPLOSION**

- Evacuate immediately, checking your area as you leave to assure that everyone is out.
- Proceed to the nearest pre-determined Group assembly point **OUTSIDE** the affected building.
- Assist anyone who does not know the way to the assembly point.
- Report to your supervisor or Group/Department Accountability Coordinator.
- Report anyone's absence to the Emergency Coordinator, as well as the areas that were checked on the way out.
- Do not leave the assembly area until told to do so by your supervisor.

**SEEK SHELTER – TORNADO / SEVERE WEATHER**

- Relocate immediately, checking your area as you leave to assure that everyone is out.
- Proceed to the nearest pre-determined shelter **INSIDE** a building, typically a basement.
- Assist anyone who does not know the way to the shelter location.
- Report to your supervisor or Group Accountability Coordinator.
- Report anyone's absence, as well as the areas that were checked on the way out.
- Do not leave the shelter until told to do so by your supervisor.

The Emergency Coordinator is responsible for downgrading or terminating an emergency.

NOTE: The Director must approve re-entry to a building damaged by fire, explosion or weather.

Ames Laboratory operates under the Freedom of Information Act and the Privacy Act, and releases information in conformance with established DOE and ISU information policies, except for information classified for national security purposes or otherwise legally prohibited from release. The Ames Laboratory Public Affairs and Information Office is responsible for providing accurate and timely information to the public. During an event requiring the activation of the Emergency Operations Center, the Office of Public Affairs and Information representative will be present to carry out the public information function in conjunction with the DOE-Chicago Office of Communications. Requests for information regarding the Laboratory or an event on-site should be referred to the Office of Public Affairs and Information, or the Emergency Coordinator.

**9.1.4 TRAINING**

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES</b>		<b>AL-001</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all employees</i>	
<b><i>Course Format:</i></b>	<i>Classroom instruction, reviews administrative policies, general safety, emergencies, industrial hygiene program, environmental protection program, and radiation safety</i> <i>Estimated Completion time: 1.5 hours</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's annual retrain mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders</i>	

<b>EMERGENCY AWARENESS TRAINING</b>		<b>AL-002</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all new employees.</i>	
<b><i>Module Format:</i></b>	<i>Training form-Walk-Through training performed by Safety Coordinator or designate.</i>	
<b><i>Associated Retrain Period and Format:</i></b>	<i>Re-training is required when an employee is moved to a new work location.</i>	

Group / activity-specific training shall be given to each employee prior to work that includes a discussion of procedural information, hazards and hazard mitigation, location of safety-related resources, and related emergency response measures. This training shall be documented by the Group Leader / Department Manager and the records maintained for a period of five years.

### **9.1.5 PERFORMANCE CHECKLIST**

#### **Group Leader / Department Manager shall:**

- Attend training as identified above.
- Appoint a Group/Department Accountability Coordinator.
- Designate one or more assembly points for staff.
- Assure subordinates receive training as identified.
- Manage operations to prevent emergency situations.

#### **Employees shall:**

- Attend training as identified above.
- Promptly report conditions, which may result in an emergency.
- Assist in orderly relocations, efforts to account for personnel, and reporting results.
- Cooperate with Emergency Team personnel.
- Direct media information requests to Public Affairs personnel.

#### **Members of the Emergency Team shall:**

- Attend requisite training.
- Participate in drills and exercises.
- Maintain familiarity with the Emergency Plan, to ensure immediate response to events.
- Ensure readiness of emergency equipment and supplies.
- Accomplish tasks assigned by the Emergency Coordinator or alternate.

## 9.2 SITE SECURITY

**Applicability Statement:** *This section applies to all Ames Laboratory employees and subcontractors. This section also applies to staff of Environment, Safety, Health and Assurance, Facilities Services, Information Systems, and members of the Safeguards and Security Committee.*

### 9.2.1 REFERENCES

Pertinent USDOE Safeguards and Security Orders  
Plan 10200.007, Ames Laboratory Site Security Plan  
Plan 50000.002, Ames Laboratory Cyber Security Program Plan

### 9.2.2 BACKGROUND

As part of Iowa State University, Ames Laboratory strives to maintain the open atmosphere of the academic setting. However, mandates of the Department of Energy and a prudent desire to maintain the safeguarding of materials, equipment, and supplies, and security of staff working off-hours imposes some practices not common at the University. This section documents procedures and policies adopted by the Laboratory to prevent situations that might adversely affect our conduct of business.

Incidents of site security are addressed according to the situation. Responses may involve the Ames Laboratory Safeguards and Security staff, Local Law Enforcement Agencies (ISU-DPS, Ames Police, Story County Sheriff's Office), the Iowa Division of Criminal Investigation, the USDOE Safeguards and Security Offices, or the Federal Bureau of Investigation.

### 9.2.3 PROGRAM INFORMATION

There are two areas of interest regarding site security at the Ames Laboratory.

#### 9.2.3.1 Physical Security

Physical security addresses the need to protect the personnel and resources of the Laboratory. This can only be accomplished with the awareness of the employee of those practices that might heighten the likelihood of an event, and the active participation of the employee in preventive measures.

During normal work hours, prevention consists of putting away items that might be attractive to thieves. Loose cash, billfolds, purses and valuables should be stored out-of-sight or locked in a desk or locker. Laptop computers, calculators, and other easily carried or concealed items should be put away as soon as their job is done. If you're leaving an area for a while, at least close the door to the area. Opportunistic "grazers" will often walk through a building looking for something small and valuable to carry away. A locked door is, of course, the best deterrent to theft. If you see someone or something that seems suspicious, report it to Plant Protection Section; Environment, Safety, Health and Assurance; or Facilities Services immediately. After hours, the exterior doors of the buildings are locked. This provides some additional security, but bear in mind that door closures may ice up or fail to pull the door fully closed.

Once someone has access to the hallways, a closed and locked office or lab door may be the only remaining deterrent.

Keys may be issued to individuals that allow access to the exterior doors to the buildings and to the areas occupied by their Group. Key issuance is by written request to Facilities Services by the Program Director or designee. If a key is lost, an evaluation of the security risk will be made by the Program Director and the Safeguards and Security Committee. If the risk is judged to be high enough, the area and other affected areas will be re-keyed at the Program's cost. Do not lose your keys. If your keys are lost, report to Plant Protection Section; Environment, Safety, Health and Assurance; or Facilities Services immediately.

Changes to the Department of Energy's Security Conditions (SECON) will necessitate changes to the Laboratory's security posture. Heightened SECON status may impact employees on facility access and the need to wear Ames Laboratory identification or affect visitors and guests by requiring escorts into and out of areas to be visited.

### 9.2.3.2 Computer Security

Computer security involves the protection of the data on the system, and the appropriate use of the Laboratory's processing and dissemination resources. Elements of computer security include password protection and frequent password changes, appropriate use of Internet resources by authorized employees, and the use of systems for the conduct of Laboratory business only.

The Laboratory has appointed a Computer Protection Program Manager (CPPM) to oversee the administration of this subject, and each Program has appointed an Assistant Computer Protection Program Manager (ACPPM) to act as a computer security representative. Because of the speed with which changes occur in this area, your representative or the CPPM will have the most current information regarding security concerns.

## 9.2.4 TRAINING

Detailed programmatic information is provided via the following institutional training modules:

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES</b>		<b>AL-001</b>
<b><i>Intended Audience:</i></b>	<i>Mandatory for all employees</i>	
<b><i>Course Format:</i></b>	<i>Classroom instruction, reviews administrative policies, general safety, emergencies, industrial hygiene program, environmental protection program, and radiation safety. Estimated Completion time: 1.5 hours</i>	
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than a one-year period. All Ames Laboratory employees receive the Laboratory's annual retrain mailing, which covers, Fire Safety, Cyber Security, Physical Security, informational updates and policy reminders</i>	

Group/activity-specific training shall be given to each employee prior to work that includes a discussion of procedural information, hazards and hazard mitigation, location of safety-related resources, and related emergency response measures. This training shall be documented by the Group Leader/Department Manager and the records maintained for a period of five years.

### **9.2.5 PERFORMANCE CHECKLIST**

**Group Leader / Department Manager** shall:

- Attend training as identified above.
- Assure subordinates receive training as identified.
- Encourage responsible area and equipment security efforts.
- Report incidents of theft, vandalism and intrusion to ESH&A promptly.

**Employees** shall:

- Attend training as identified.
- Secure equipment and areas as needed.
- Report incidents of theft, vandalism and intrusion to ESH&A promptly.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Maintain records of theft, vandalism and intrusion.
- Notify the appropriate authorities of incidents.
- Assist with investigations and recoveries.
- Conduct tours to assess asset vulnerability, propose corrective action.

*Comments and questions regarding this section may be directed to the person listed below:*

Shawn Nelson, Industrial Safety Specialist  
G40 TASF  
294-2153

*NOTE: This Section's Sign-Off Record is maintained in the ESH&A Office.*

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**REVISION / REVIEW LOG****SECTION 10 – ASSESSMENT PROGRAM**

<b><u>Review Number:</u></b>	<b><u>Effective Date:</u></b>	<b><u>Contact Person:</u></b>	<b><u>Pages Affected:</u></b>	<b><u>Description of Revision:</u></b>
0	10/11/99	Tom Wessels	All	Original Issue
1	1/13/06	Shawn Nelson	See Revision Description	G:\Document Control\Revision Descriptions\ Manual 10200.002 Section 10 revdesc.doc
2	12/1/07	Tom Wessels	All	G:\Document Control\Revision Descriptions\ Manual 10200.002 Section 10 revdesc.doc
3	7-28-10	Shawn Nelson	All	G:\Document Control\Revision Descriptions\ Manual 10200.002 Section 10 revdesc.doc
4	5-1-11	Shawn Nelson	All	G:\Document Control\Revision Descriptions\ Manual 10200.002 Section 10 revdesc.doc

**SIGN-OFF RECORD**

The Environment, Safety, Health and Assurance Program Manual has been reviewed and approved as documented below:

**Reviewed by:** \_\_\_\_\_ Date: \_\_\_\_\_  
Amy J. Harris-Tehan, ESH&A, Document Control Coordinator

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Mark L. Murphy, Chief Operations Officer

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**Approved by:** \_\_\_\_\_ Date: \_\_\_\_\_  
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Bruce N. Harmon, Deputy Director

**Approved by:** \_\_\_\_\_ Date: \_\_\_\_\_  
Alexander H. King, Laboratory Director

*Note: Original Sign-off Record with signatures is on file with ESH&A.*

## **10.0 ASSESSMENT PROGRAM**

### **10.1 WORKER OBSERVATIONS**

*Applicability Statement:* This section applies to all employees.  
This section also applies to ESH&A for tracking and resolution of employee concerns and trending of deficiencies.

#### **10.1.1 REFERENCES**

DOE Policy 450.4, Safety Management System Policy  
Guide 10200.003, Worker Observation Guide  
Plan 10200.008, Employee Safety and Security Concerns Program  
Procedure 10200.041, Trend Analysis of ES&H Concerns

#### **10.1.2 BACKGROUND**

The most important and effective process for identification and correction of process deficiencies is the observation by individual employees. Direct line supervisors provide individual work directions and each worker is accountable for performing quality work in a safe and productive manner. Employees are charged with the responsibility of continuously assessing their individual performances and their workspaces in order to prevent problems and to identify nonconforming conditions and opportunities for improvement. Ames Laboratory seeks to promptly address employee concerns about environment, safety, and health issues in the workplace.

#### **10.1.3 PROGRAM INFORMATION**

Workers shall assess their work and work environments in order to identify potential hazards and opportunities for improvement. The Worker Observation Guide (Guide 10200.003) is available to assist workers in the observation of activities within office spaces and laboratory/shop spaces. Work deficiencies should be corrected as soon as possible by the workers involved with the activity. Workplace deficiencies should be reported to the first level of management as soon as possible. Resolution of concerns should occur at the level of line management most directly responsible for the activity. If the issue cannot be resolved at this level, the employee is directed to proceed within his / her line management structure or to report the concern to the Environment, Safety, Health and Assurance (ESH&A) office as part of the Employee Safety and Security Concerns Program.

**10.1.4 TRAINING**

<b>GENERAL EMPLOYEE TRAINING (GET) FOR NEW EMPLOYEES AL-001</b>	
<b><i>Intended Audience:</i></b>	<i>Mandatory for all employees.</i>
<b><i>Course Format:</i></b>	<i>Classroom Instruction. Estimated completion time: 1.5 hours. This topic is discussed with new employees.</i>
<b><i>Associated Retrain Period &amp; Format:</i></b>	<i>Retrain is required if an employee has been terminated from the Laboratory for more than one year. All Ames Laboratory employees receive the Laboratory's annual retrain mailing, which covers fire safety, cyber security, physical security, informational updates and policy reminders.</i>

**10.1.5 PERFORMANCE CHECKLIST**

**Supervisors / Group Leaders / Department Managers** shall:

- Assure workers have training and competence commensurate with work responsibilities.
- Provide work instructions suitable for the work processes undertaken.
- Assist workers with mitigation of hazards.
- Report unresolved safety deficiencies to ESH&A.

**Employees** shall:

- Attend "General Employee Training," (AL-001).
- Assimilate work instructions into work practices.
- Identify and mitigate work hazards in work environments.
- Report unmitigated work hazards to supervisor, group leader, or department manager.
- Report unresolved work hazards to ESH&A via the Safety and Security Concerns Program.
- Utilize "Stop Work Authority," to protect workers, the public, and the environment. See Section 5.2 of this manual.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Seek resolution of employee safety and security concerns.
- Conduct trend analysis of safety deficiencies.

## 10.2 MANAGER ASSESSMENTS

**Applicability Statement:** *This section applies to group / section leaders, safety coordinators / representatives, program directors and department managers. This section also applies to ESH&A for tracking and resolution of employee concerns and trending of deficiencies.*

### 10.2.1 REFERENCES

DOE Policy 450.4, Safety Management System Policy  
Form 10200.026, Walk-Through Report  
Plan 10200.008, Employee Safety and Security Concerns Program  
Procedure 10200.014, Program/Department Walk-Through

### 10.2.2 BACKGROUND

While each individual is responsible for the quality and safety of his / her work, supervisors and group / section leaders are accountable for oversight, direction, and guidance of work activities. Program directors / department managers assess the allocation of resources and the management of hazards associated with the activities of the groups / sections within their organizations. Group / section leaders and program directors / department managers, or their safety representatives / coordinators should periodically review the work being conducted within their organization and correct any identified deficiencies.

### 10.2.3 PROGRAM INFORMATION

#### **Group / Section Leader Observations**

Group / section leaders should periodically review the work being conducted within their organization and correct any identified deficiencies. Safety representatives should assist with this effort. Formal documentation of this effort is not required, but unresolved concerns shall be presented to the appropriate program director / department manager or ESH&A.

#### **Program / Department Walk-Through**

The program directors / department managers (with the safety coordinator) shall conduct a walk-through at a minimum frequency of once per year (Procedure 10200.014 Program/Department Walk-Throughs). Observations from walk-throughs, appraisals, and other internal assessments are classified as findings, strengths, or noteworthy practices.

**Findings:** A finding is a determination of deficiency pertaining to implementation of a requirement based on a recognized inadequacy or weakness. Findings are categorized as levels 1, 2 High Significance, 2 Moderate Significance, or 3. This categorization is necessary to identify the degree of management formality and rigor required for the correction, tracking to closure, and trending of findings. The following are findings descriptions:

A Level 1 Finding is a deficiency of major significance that warrants a high level of attention on the part of line management. Typically these reflect a gap in addressing requirements or a systemic problem with implementing requirements. If left uncorrected, this level of finding could negatively impact the Laboratory's mission. Examples of a Level 1 Findings include deliberate violations, sabotage, and ignoring Radiation Work Permits.

A Level 2 High Significance Finding is one that could cause a severe injury, a serious violation of a safety, health, or environmental requirement or programmatic impact. Examples of Level 2 High

Significance Findings include exposure to live electrical parts, using poisonous gas outside of a fume hood or designated cabinet, not using laser glasses when beam is exposed, and improper disposal of hazardous waste. Multiple deficiencies at this level, when of a similar nature, may be rolled up together into a Level 1 Finding.

A Level 2 Moderate Significance Finding is one that could cause moderate injury, a violation of safety, health, or environmental requirement or programmatic impact. Examples of Level 2 Moderate Significance Findings include improper use of extension cords, not labeling chemicals, late disposal of hazardous waste, or not maintaining log entries for X-ray machines. Multiple deficiencies at this level, when of a similar nature, may be rolled up together into a Level 2 High Significance Finding.

A Level 3 Finding is an inadequacy where it is recognized that improvements can be gained in safety, process, performance, or efficiency already established for meeting a requirement. This level of finding should also include minor deviations observed during oversight activities that can be promptly corrected and verified as completed. Examples of Level 3 Findings include idle / obsolete equipment being stored in laboratory spaces, not updating chemical inventories, emergency information on door cards not up to date, and not stocking safety glasses in visitor bins.

Documentation of findings should include the statement of the specific requirement (e.g. regulatory citation, Laboratory policy, etc.), the description of a programmatic breakdown (if applicable), and objective evidence demonstrating the deficiency.

**Strength:** A mature process or activity that has consistently demonstrated the ability to meet expectations, or a process or activity that efficiently and effectively facilitates and integrates processes, activities, and resources.

**Noteworthy Practice:** A positive observation, based on objective assessment data, or a particular practice, procedure, process, or system considered unique or innovative enough that other organizations within the Laboratory might find it beneficial. Mere compliance with mandatory requirements is not considered to be a noteworthy practice.

The safety coordinator shall document the identification and close-out of findings by utilizing the Walk-Through Report Form (Form 10200.026) or other forms which:

1. document the observation as a finding, strength, or noteworthy practice;
2. delineate the close-out time period for the findings:
  - Level 1 Finding – Close out according to a corrective action plan approved by the ESH&A Office.
  - Level 2 Finding, High Significance – Close out by the end of the first full workday after the findings are identified, or according to corrective action plan approved by the ESH&A Office.
  - Level 2 Finding, Moderate Significance – Close out within 60 days of report date or develop a formal Ames Lab Action Plan for close out which must be approved by ESH&A
  - Level 3 Finding – Close out as soon as possible, as resources are available;
3. notes the person or organization responsible for corrective action and the response;
4. lists the date of close-out;
5. indicates verification of close out.

It is the responsibility of the program director, group / section leader or department manager to perform the actions necessary to close out the findings identified by the Program/Department Walk-Through according to the requirements for the finding level. Conditions observed during the Program/Department Walk-Through which require attention such as facilities deficiencies (e.g., electrical wiring, lights, fume

hoods, plumbing, etc.), should be communicated to Facilities Services or Engineering Services appropriately. Verification of the close-out shall be performed by the appropriate safety coordinator and documented. Walk-through records, once verified by the safety coordinator shall be kept by the program / department.

#### 10.2.4 TRAINING

<b>HAZARD IDENTIFICATION</b>		<b>AL-130</b>
<i>Intended Audience:</i>	<i>Mandatory for safety coordinators and representatives. Suggested for group leaders.</i>	
<i>Course Format:</i>	<i>Computer-based training. Estimated completion time: 1.0 hours.</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>No retrain.</i>	

<b>SAFETY COORDINATOR/REPRESENTATIVE DEVELOPMENT TRAINING</b>		<b>AL-031</b>
<i>Intended Audience:</i>	<i>Mandatory for safety coordinators.</i>	
<i>Course Format:</i>	<i>Computer-based training. Estimated completion time: 1.0 hour.</i>	
<i>Associated Retrain Period &amp; Format:</i>	<i>No retrain.</i>	

#### 10.2.5 PERFORMANCE CHECKLIST

**Group / Section Leaders** shall:

- Periodically review the work being performed within their organization.
- Correct identified safety deficiencies.
- Report unresolved safety deficiencies to ESH&A.

**Safety Representatives** shall:

- Assist group / section leaders with review of work performed within their organization.
- Report unresolved safety deficiencies to ESH&A.

**Safety Coordinators** shall:

- Complete required training.
- Assist with the performance of Program/Department Walk-Throughs.
- Document the identification and the close-out of findings identified through the Program/Department Walk-Through.
- Forward the walk-through findings (by percentage) to ESH&A at the end of the fiscal year (September 30) for Laboratory-wide trend analysis. The findings should be categorized according to the 24 listings in Procedure 10200.014, Program Department Walk-Throughs.
- Report unresolved safety deficiencies to ESH&A.

**Department Managers and Program Directors** shall:

- Participate in the Program/Department Walk-Throughs with the safety coordinator.
- Assure that identified safety deficiencies are corrected.
- Report unresolved safety deficiencies to ESH&A.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Seek resolution of employee concerns.
- Conduct trend analysis of safety deficiencies.

### 10.3 INDEPENDENT ASSESSMENTS

**Applicability Statement:** *This section applies to all organizational units, group / section leaders, safety coordinators / representatives, program directors and department managers.*  
*This section also applies to ESH&A.*

#### 10.3.1 REFERENCES

DOE Policy 450.4, Safety Management System Policy  
 Procedure 10200.021, Independent Walk-Throughs  
 Plan 10200.022, Topical Appraisals

#### 10.3.2 BACKGROUND

In addition to the observations by workers, group / section leaders, and programs / departments, the Laboratory has regulatory and contractual requirements to conduct independent topical reviews. These reviews are designed to provide objective assessments of conditions in the work place and the status of implementation of regulatory requirements.

#### 10.3.3 PROGRAM INFORMATION

##### Independent Walk-Throughs

Independent walk-throughs shall be conducted under the direction of ESH&A according to Procedure 10200.021, Independent Walk-Throughs. A walk-through shall be performed of each program and department on an annual basis. The Independent Walk-Through Team consists of representatives from upper management, ESH&A, Ames site office, ISU EH&S, and an electrical safety inspector. ESH&A will coordinate these walk-throughs and track corrective actions. Observations from walk-throughs, appraisals, and other internal assessments are classified as findings, strengths, or noteworthy practices.

**Findings:** For finding categorization and closeout information, please refer to Section 10.2.3 Manager Assessments Program Information.

##### Topical Appraisals

Ames Laboratory safety, safeguards and security, cyber security, and emergency management specialists perform topical appraisals as detailed in Plan 10200.022, *Topical Appraisals*. These appraisals are performed in support of the Ames Laboratory *Oversight and Assurance Program* (Plan 10200.034) as internal independent assessments. Topical appraisals are designed to provide validation of compliance with DOE safety, safeguards and security, cyber security, and emergency management program requirements. Ames Laboratory, in agreement with the Ames site office, utilizes a graded qualitative risk approach to determine applicability and frequency of specific topics of appraisals.

Observations from topical appraisals are classified as findings, strengths, or noteworthy practices, as defined for independent walk-throughs, as noted above. Close-out requirements are defined by corrective action plans approved by the ESH&A manager, or the chief operations officer.

#### 10.3.4 TRAINING

HAZARD IDENTIFICATION		AL-130
<b>Intended Audience:</b>	<i>Mandatory for safety coordinators and representatives.</i> <i>Suggested for all group leaders.</i>	

<b>Course Format:</b>	<i>Computer-based Training. Estimated completion time: 1.5 hours.</i>
<b>Associated Retrain Period &amp; Format:</b>	<i>No retrain.</i>

### 10.3.5 PERFORMANCE CHECKLIST

**Group / Section Leaders** shall:

- Correct identified safety deficiencies.
- Report unresolved safety deficiencies to ESH&A.

**Safety Representatives** shall:

- Assist group / section leaders with review of work being performed within their organization.
- Report unresolved safety deficiencies to ESH&A.

**Safety Coordinators** shall:

- Assist programs and departments with Independent Walk-Through preparation and close out of safety deficiencies.
- Report unresolved safety deficiencies to ESH&A.

**Department Manager and Program Directors** shall:

- Participate in Independent Walk-Throughs or provide a program / department representative.
- Assure that identified safety deficiencies are corrected.
- Report unresolved safety deficiencies to ESH&A.

**Environment, Safety, Health & Assurance (ESH&A)** shall:

- Conduct Independent Walk-Throughs.
- Conduct Topical Appraisals.
- Conduct trend analysis of safety deficiencies.