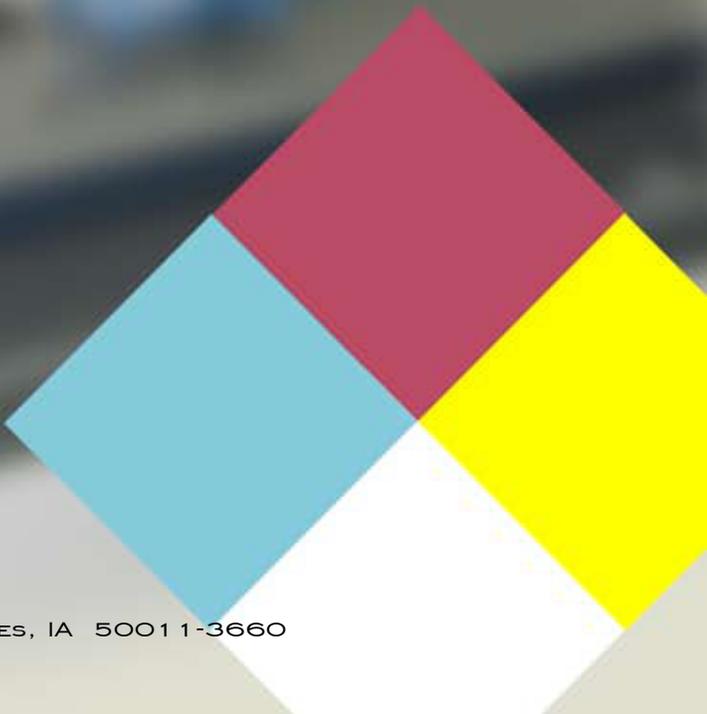




# LABORATORY SAFETY MANUAL



FIRST EDITION

## **Non-discrimination Statement**

Iowa State University does not discriminate on the basis of race, color, age, religion, national origin, sexual orientation, gender identity, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to the Director of Equal Opportunity and Diversity, 3210 Beardshear Hall, (515) 294-7612.

# IOWA STATE UNIVERSITY

## Environmental Health and Safety Statement

Iowa State University strives to be a model for environmental, health and safety excellence in teaching, research, extension, and the management of its facilities. Faculty, staff and students are responsible for establishing and promoting practices that ensure safety, protect health and minimize the institution's impact on the environment.

As an institution of higher learning, Iowa State University

- fosters an understanding of and a responsibility for the environment;
- encourages individuals to be knowledgeable about environmental, health and safety issues that affect their discipline;
- shares examples of superior environmental health and safety performance with peer institutions, the State of Iowa and the local community.

As a responsible steward of facilities and the environment, Iowa State University

- strives to provide and maintain safe working environments that minimize the risk of injury or illness for employees, students and the public;
- continuously improves operations, with the goal of meeting or exceeding authorized and applicable environmental, health and safety regulations, rules, policies, or voluntary standards;
- employs innovative strategies of waste minimization and pollution prevention to reduce the use of toxic substances, promote reuse, and encourage the purchase of renewable, recyclable and recycled materials.

It is the intent of this statement to promote environmental stewardship, protect health, and encourage safe work practices within the Iowa State University community.



Dr. Gregory L. Geoffroy  
President

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## A. Introduction

The purpose of the Iowa State University Laboratory Safety Manual is to provide users with information designed to ensure health and safety in laboratories. This manual also meets Occupational Safety and Health Administration (OSHA) requirements for a Chemical Hygiene Plan as specified by [29 CFR 1910.1450](#), and outlines appropriate practices, university policies and other regulations that must be followed in a laboratory setting. The Laboratory Safety Manual is not intended to be all-inclusive, but should serve instead to supplement more specific procedures developed for particular laboratory situations. All laboratory personnel must have access to this document as a basis for working safely at Iowa State University.

### DEFINITION OF LABORATORY

At Iowa State University, a laboratory is defined as, but is not limited to, any location where research or teaching is conducted using hazardous chemicals, biohazardous or biological materials, radioactive materials, and/or radiation producing devices.

A storage room containing the above materials is considered a laboratory if the materials are stored in support of teaching or research.

A location used for teaching or research that contains physical hazards may also be considered a laboratory, even if none of the materials listed above is routinely used in the area. Examples include:

- electronics labs
- art studios
- laser labs
- magnetics labs

The following areas are NOT typically considered laboratories under the Laboratory Safety Manual, though persons working in these areas are required to follow all applicable health and safety regulations:

- shops, mechanical and custodial areas under the control of Facilities Planning and Management (FP&M)
- departmental storage rooms, offices, meeting rooms, and other non-teaching and research spaces
- computer use areas containing multiple workstations and used primarily by students, even if teaching and research is occurring, unless located inside a space that meets the definition of a laboratory
- private offices, unless contiguous with or in a space that meets the definition of a laboratory

## ADMINISTRATIVE RESPONSIBILITIES

**Employees** are expected to observe all applicable practices and procedures contained in the Laboratory Safety Manual, attend designated training sessions, and report hazardous or unsafe conditions to the lab supervisor, Principal Investigator (PI), Laboratory Safety Contact or Environmental Health and Safety.

**Principal Investigators, laboratory supervisors and instructors** are responsible for ensuring that the policies and guidelines established in this manual are strictly followed by all employees, collaborating researchers, other visitors, and students under their jurisdiction.

**Departments** are responsible for adopting and implementing the policies within the Laboratory Safety Manual in laboratories under their administrative control. Departments must designate a [Laboratory Safety Contact](#) that will act as a point of contact for this effort. The department chair shall be the Laboratory Safety Contact unless otherwise designated.

**The Laboratory Safety Contact**, formerly known as the departmental Chemical Hygiene Officer, assists laboratory supervisors in adapting requirements of the Laboratory Safety Manual to individual laboratories. Assigned duties may include: providing information and consultation on laboratory safety requirements, disseminating information published by EH&S, facilitating laboratory audits and conveying departmental information (concerns) to EH&S.

**The Department of Environmental Health and Safety (EH&S)** develops programs for Iowa State University based on federal, state and local rules and regulations. EH&S oversees the adoption and implementation of the Laboratory Safety Manual by individual departments, and will designate a university Chemical Hygiene Officer (CHO) to oversee the lab safety program.

**The Office of Research Assurances** ensures compliance with federal, state and local rules and regulations related to research and oversees the following compliance committees: [Human Subjects Review Committee \(IRB\)](#), [Institutional Biosafety Committee \(IBC\)](#), [Institutional Animal Care and Use Committee \(IACUC\)](#) and [Radiation Safety Committee \(RSC\)](#).

**Students** are expected to observe all applicable safety practices and procedures contained in this Laboratory Safety Manual, attend designated training sessions, and report any unsafe or hazardous conditions to the lab supervisor, PI, Laboratory Safety Contact or EH&S.

**Visitors** are considered to be all persons entering a laboratory other than the PIs, laboratory staff, enrolled students and authorized Iowa State University employees. Visitors to Iowa State University laboratories will be under the supervision of the host laboratory. The host is responsible for laboratory security during the visitation, visitor training and notification of potential hazards, and oversight of visitor compliance with applicable safety practices and procedures contained in the Laboratory Safety Manual.

## SETTING UP A LABORATORY

This manual contains regulatory requirements, university policies and prudent practices that apply to activities performed in laboratories on the Iowa State University campus. The volume of these requirements can make the establishment of a laboratory a complex and confusing process. To guide Iowa State University researchers through this process, EH&S has developed the [Setting Up a Laboratory](#) checklist. Using this checklist and the more specific information contained in the Laboratory Safety Manual, researchers can be assured of establishing a safe, healthy and compliant laboratory.

## B. Process Planning

Working safely in the laboratory does not happen by accident. Planning laboratory processes will help you identify hazards, establish hazard control measures, and ultimately keep you and other lab personnel safe.

### STANDARD OPERATING PROCEDURES

Process planning must begin with development of standard operating procedures (SOPs). This first step requires each investigator or laboratory work group to assess (i.e., identify and evaluate) all chemical, biological, radiological and physical hazards associated with laboratory operations and describe safety precautions necessary to avoid employee exposures and injuries. **SOPs must be specific to each laboratory operation.**

SOPs must be reviewed and approved by the PI or the lab supervisor. After approval, SOPs are then incorporated into or attached to written materials and methods. Laboratory personnel must be trained on the elements of the SOP before performing an experiment or operation. See the [Standard Operating Procedure template](#). At minimum, SOPs must include the following:



- **Health and safety information for materials used** – list and briefly describe the chemical, biological, radiological and physical hazards associated with the operation. Identify available resources like [material safety data sheets \(MSDS\)](#) and specify where they can be accessed.
- **Hazard control measures** – include containment devices, ventilation, specific personal protective equipment, and hygiene practices as recommended by the MSDS or other authoritative guide. Evaluate whether special procedures discussed below will be required.
- **Waste disposal practices** – establish procedures for the safe and timely removal of laboratory waste. Reference Section H as appropriate or develop written procedures if necessary.
- **Decontamination procedures** – develop procedures and use in contaminated areas with required frequency and duration.
- **Spill/release containment and clean up procedures** – see Section C of this manual.

Developed SOPs must be readily available in the laboratory where the experiment or operation will be performed. SOPs should be reviewed and updated annually.

## SPECIAL PROCEDURES

Special procedures must be developed for work involving materials or equipment that present a significant risk of exposure or damage to the human body. Examples include: carcinogens, reproductive toxins, teratogens, highly toxic substances, explosives, controlled substances, select biological agents, radioactive materials, radiation producing devices, and lasers. The following special procedures must be developed and specified on the SOP:

- **Identify authorized personnel** that may work with these materials or equipment. Authorized persons must receive training on the unique hazards of these materials or equipment before use.
- **Establish a designated use area** (e.g., fume hood, glove box, lab bench, etc.) and identify the area by signs or postings. Restrict access to this area to authorized personnel. If an entire lab is designated, then access must be restricted to authorized personnel.
- **Specify special safety precautions** for experiments or laboratory operations where these materials or equipment are used. Be sure to identify specialized equipment, shielding or security requirements to be used.

**Note:** Many of these materials or equipment require special authorization from EH&S or a government agency to purchase, possess and use. Refer to the Ordering Chemical, Biological and Radioactive Materials section below for information on the application process for each material.

### ADDITIONAL RESOURCES

[Carcinogens](#)

[Nanotechnology](#)

[Reproductive Toxins](#)

[Select Biological Agents](#)

[Teratogens](#)

## ORDERING CHEMICAL, BIOLOGICAL AND RADIOLOGICAL MATERIALS

Many materials and equipment require special authorization to purchase, use, and store. Include these ordering procedures as part of your process planning to increase laboratory safety, decrease procurement delays, and reduce potential regulatory deficiencies.

- Obtain any necessary permits, licenses or registrations prior to ordering. Refer to Additional Resources below for details.
- Before ordering chemical, biological or radiological materials, carefully plan and outline specific safety precautions in an SOP approved by the laboratory supervisor.
- Order only those materials for which adequate safety equipment is available.
- Order the minimum quantity of chemical, biological and radiological materials required.
- Prepare the laboratory prior to receipt of the substance (i.e., establish storage location, post appropriate signs, obtain necessary personal protective equipment, etc.).

Check the [Chemical Redistribution List](#) on the EH&S website to see if needed chemicals are available for free.

### ADDITIONAL RESOURCES

Special authorization is required to purchase, possess and use the following materials:

**Biological materials:** These may include human, animal or plant pathogens, animals, animal parts,

plants, plant parts and soils regulated by the Centers for Disease Control and Prevention or the United States Department of Agriculture. For more information refer to the [Permit Requirements](#) web page.

**Controlled substances:** This category includes any drug or material regulated by the United States Drug Enforcement Agency. For more information refer to the [Controlled Substances](#) web page.

**Explosives:** These items are regulated by the United States Department of Transportation and the Bureau of Alcohol, Tobacco and Firearms. Contact EH&S at 294-5359 for more information about the purchase, use and special requirements related to explosives research.

**Radioactive materials and radiation production devices:** Only individuals identified as approved users on a Radioactive Material Use Authorization may request and receive radiological materials. Complete an [Application For Use of Radioactive Materials, Devices and Lasers](#) to request authorization.

**Tax-free ethanol:** Only individuals who have completed specific training may purchase and use tax-free ethanol at Iowa State University. Contact EH&S at 294-5359 for more information about the purchase, use and special requirements related to tax-free ethanol.

## RECEIPT AND DISTRIBUTION OF CHEMICAL, BIOLOGICAL AND RADIOLOGICAL MATERIALS

In addition to ordering procedures, overall lab process planning must include the receipt and distribution of hazardous materials. Follow these guidelines when materials are received in the lab or are transported on campus.

- Do not accept any chemical, biological or radiological material in a damaged or improperly labeled container.
- Update hazardous materials inventories to reflect newly received materials. Inventories must be [submitted to EH&S annually](#).
- Obtain and review an MSDS or equivalent (e.g., Merck Index, [Biosafety in Microbiological and Biomedical Laboratories](#)) for all chemical, biological and radiological materials.
- Use shock-resistant carriers when transporting materials by hand.
- When transporting materials by cart, ensure the cart is stable enough to prevent tipping and provides containment of any spilled materials.
- When transporting materials on elevators use freight-only elevators (where possible) to avoid potential exposure to passengers.
- Use an appropriate hand truck or cart to transport gas cylinders and Dewar flasks (do not drag or roll), ensure the valve protection caps are in place, and handle only one container at a time.
- Do not transport chemical, biological or radiological materials in personal vehicles.
- Adhere to permit conditions when transporting permitted, licensed or registered materials.



### ADDITIONAL RESOURCES

[Biosafety Manual](#) – Section H, Transporting and Shipping Biohazardous Materials

[Radiation Safety Manual](#) – Section H, Storage and Transfer of Radioactive Materials

## SHIPPING LABORATORY MATERIALS OFF-CAMPUS

All off-campus transport of laboratory materials must comply with university, state, federal and international shipping requirements. Laboratory materials may include: chemicals, biological or radiological materials, compressed gases, diagnostic specimens, refrigerants, and equipment or instruments that contain hazardous materials. Shipments of these materials must be properly classified, packaged, marked, labeled and documented. For information on how to ship hazardous materials, review the [Hazardous Materials Shipping Guide](#).

**Note:** Ensure that the off-campus recipient has all necessary permits and/or authorizations to receive the material being shipped. The recipient may be required to submit to EH&S a completed [Material Release for Off-Campus Shipment form](#) or provide copies of required documentation. Contact EH&S at 294-5359 for details.

## USE OF ENGINEERING CONTROLS

Engineering controls must be implemented where possible to reduce hazards associated with the use and storage of chemical, biological and radiological materials. Engineering controls should be considered in the following order:

- Substitution of less hazardous equipment, chemicals or processes
- Physical isolation of the operator or process
- Local and general exhaust ventilation and/or filtration (e.g., use of [fume hoods](#), charcoal filters, etc.)



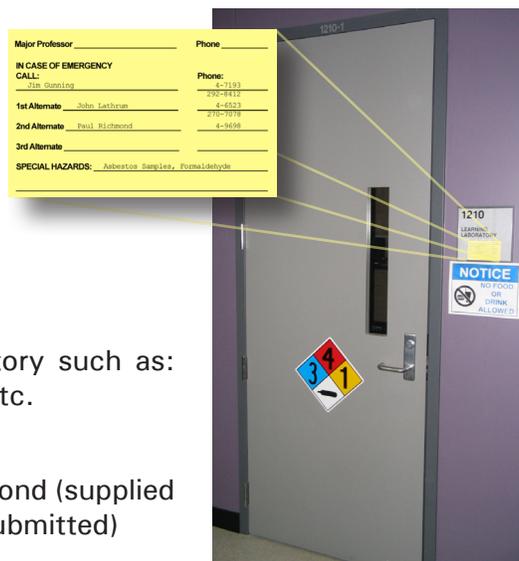
## C. Emergency Planning

Planning for emergencies enables communication of hazards through signage/postings and allows laboratory personnel to develop and follow Emergency Action Plans.

### POSTINGS AND SIGNAGE

The main entrance to each laboratory in which chemical, biological or radiological materials are used or stored must be posted with the following:

- Names and phone numbers of the lab supervisor and other responsible parties to be contacted in the event of a fire, accident or spill.
- Special hazards that may be encountered in the laboratory (e.g. laser in use, cylinders, biohazardous material, radioactive material, etc.)
- Safety instructions for persons entering the laboratory such as: required protective equipment, access restrictions, etc.
- Prohibitions (e.g., No Food or Drink Allowed)
- National Fire Protection Association (NFPA) 704 diamond (supplied by EH&S upon request once chemical inventory is submitted)



The interior of the laboratory must be posted with the following:

- Emergency Action Plans near the exit. Refer to the next section for development assistance.
- Hazardous Waste Satellite Accumulation Area sign marking location where unwanted laboratory materials will be accumulated for collection by EH&S. Refer to [Section H](#) in this manual for details.
- Signs identifying location of safety equipment (e.g., fire extinguisher, safety shower, eyewash fountain, etc.). Refer to specific information on signage required and posting locations discussed in Safety Equipment of [Section D](#) of this manual.
- Signs, labels and/or warning/caution tape identifying designated use and storage areas for materials or equipment requiring special procedures. Refer to Special Procedures in [Section B](#) above for details.

All required signage and postings are available from EH&S upon request (294-5359).

## EMERGENCY ACTION PLAN

Principal Investigators and/or laboratory supervisors must develop emergency action plans for their laboratories. An Emergency Action Plan [template](#) and [sample](#) have been developed to help address the following emergency issues:

### Evacuation Procedures

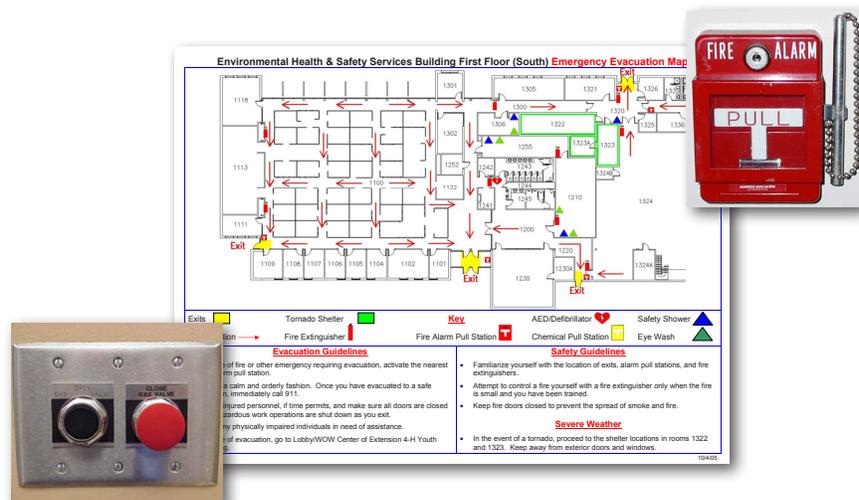
Identify evacuation routes and meeting locations for emergencies such as fire, severe weather and chemical, biological or radiological releases. [Building Evacuation Maps](#) are available for download on the EH&S website.

### Alarm System Activation

Identify building alarm pull station locations (i.e., fire alarm, chemical spill, severe weather). Laboratory employees must know how and when to activate alarms.

### Fire Emergencies

**For all fires, activate alarm, dial 911 and evacuate.** Additional information is contained in the [Fire Emergencies](#) procedures and the [Fire Safety Guidelines](#).



### Emergency Shut Off Systems

Identify emergency shut off system locations (i.e., gas, high pressure air, electrical, etc.). Laboratory employees must know how and when to utilize emergency shut off systems.

### Spill/Release Containment and Cleanup Methods

Develop cleanup/response procedures for the chemical, biological, and radiological materials used in the laboratory. Incorporate any specialized neutralization and decontamination methods for the materials used (i.e., hydrofluoric acid, biohazardous materials, etc.). These procedures should be part of both the emergency action plan and the laboratory standard operating procedure. The following generic spill/release procedures have been developed to provide a basis for lab-specific methods.

- [Minor Spill Protocol](#)
- [Major Spill/Release Protocol](#)
- [Compressed Gas Leak Procedure](#)
- [Mercury Spills](#)
- [Releases to the Environment](#)

## Intruders

Establish a protocol for responding to a laboratory intruder. An intruder is any unauthorized person who makes inappropriate or unwanted entry into the laboratory. The following steps should be included in the protocol.

- Require all unknown laboratory entrants to state their name and purpose. Ask unauthorized persons (intruders) to leave.
- Report all laboratory intruders by dialing 911
- Do not attempt to detain the intruder; note the physical description of the person.
- Conduct a quick inventory of the laboratory.
- Communicate any pertinent information to the responding police officer and make necessary departmental contacts.

## Vandalism

Establish a protocol for responding to vandalism in the laboratory. The following steps should be included in the protocol: dial 911, stay out of the lab (treat as a crime scene), beware of any remaining perpetrators or malicious devices, communicate any pertinent information to the responding police officer and make necessary departmental contacts.

## Medical Emergencies

Develop a procedure for responding to medical emergencies in the laboratory. Use [Treatment of Injured or Exposed Personnel](#) as a basis for development of lab-specific methods. Be sure the procedure includes: identification of the emergency, evaluation of the scene before entering (to avoid rushing into a potentially dangerous condition or atmosphere), specialized neutralization or treatment methods for specific laboratory hazards (e.g., hydrofluoric acid, phenol, etc.) and how to contact emergency services. Refer to Section I in this manual for more information.

## Incident Reporting (Notifications)

Establish a protocol for reporting emergency incidents to all affected laboratory and department personnel. Laboratory contact information must be included in the emergency action plan. In addition, the protocol should outline how personnel will be accounted for in the event of an incident in the laboratory. Report [lab-related accidents, injuries and exposures](#) as soon as possible.

## Safety Equipment and Supplies

Determine the location of appropriate safety equipment and supplies for managing spills and accidents involving chemical, biological and radiological materials. Safety equipment should include: eyewash, safety shower, fire extinguisher, first aid kit, PPE, and spill control kit. Refer to [Section D](#) for details.

## Utility Outages

Develop procedures to shut down or control hazardous laboratory operations impacted by unexpected utility outages. Outage examples include electrical, lighting, heating, steam, gas, water, ventilation, etc.

Post completed Emergency Action Plan near the laboratory exit for easy retrieval during an emergency. The plan should be reviewed and updated annually. All laboratory personnel must be trained on the laboratory emergency action plan. This training shall be completed prior to working in the laboratory and must be [documented](#).



## D. Equipment

Laboratory equipment such as glassware, hot plate/stirrers, centrifuges, incubators etc., are vital parts of any teaching or research laboratory. Selecting and maintaining the proper equipment must be part of laboratory procedures. Consider the following when using laboratory equipment:

- Operate equipment according to manufacturer's instructions.
- Handle and store glassware with care and dispose of any damaged glassware by following the [Sharps and Biohazardous Waste Policy](#). Refer to the [Working With Laboratory Glassware e-book](#) for more information.
- Ensure that centrifuge carriages are properly balanced.
- Ensure vacuum equipment is trapped or filtered.
- Label equipment appropriately (e.g., NO FOOD, Do Not Store Volatile Materials in this Box, Tinted/Filtered Eye Protection Required to Operate this Equipment, etc.).
- Laboratory equipment must not be used for human food or beverage preparation or storage.

### ADDITIONAL RESOURCES

[Biosafety Manual](#) – refer to Biosafety Practices and Procedures

[Management of Unwanted Materials Manual](#)

[Radiation Safety Manual](#) – refer to Radiation-Producing Devices

[Laboratory Hood Manual](#)

### MAINTENANCE, INSPECTION AND DISPOSAL

All equipment used in the laboratory must function properly and safely. To ensure this, laboratories must maintain equipment according to manufacturer's specifications or established guidelines. Perform routine inspections for common problems like: damaged electrical cords, corrosion, worn parts, excessive contamination, leaks, etc. In addition, ensure that alarms, guards, interlocks or other safety devices have not been disconnected or defeated.

The following equipment will be inspected annually by Facilities Planning and Management or EH&S. An inspection tag/card/sticker should be attached to the equipment with a record of inspection dates.

- Safety showers
- Fire Extinguishers



The image shows a green safety tag titled "Safety Equipment Test Record". It includes a section for "Year Procedures" with a list of items to be inspected: Fire Extinguishers, Safety Showers, and First Aid Kits. Below this is a table with columns for "DATE" and "BY" for each item. At the bottom, it says "DO NOT REMOVE THIS TAG".

DATE	BY	DATE	BY

- Fume hoods
- Biological Safety Cabinets (upon request at the researcher's expense)

When no longer needed, working and non-working laboratory equipment must be free of contamination and inspected by EH&S. Forward a completed [Laboratory Equipment Disposal Form](#) to EH&S before transfer or disposal through [ISU Surplus](#).

## SAFETY EQUIPMENT

Safety equipment protects personnel, ensures proper storage of hazardous materials and enables a laboratory to respond to emergencies. Each laboratory should be evaluated for adequate safety equipment during the development of an Emergency Action Plan or standard operating procedure and during a laboratory's annual safety survey. For more information about the following safety equipment, refer to the links provided or contact EH&S at 294-5359.

### Biosafety Cabinets

Biosafety cabinets are designed to protect personnel, the products being handled and the environment from particulate hazards, such as infectious microorganisms. Refer to the [Biosafety Manual](#) for more information about biosafety cabinet function, use and certification.

### Containment/Safety Shields

Appropriate containment or shielding must be used when splashing, spattering or aerosolizing of materials is anticipated. Radiation and laser shielding techniques are extremely important safety issues and are described in the [Radiation](#) and [Laser Safety Manuals](#).

### Eyewash Fountains

An eyewash fountain must be easily accessible and unobstructed in all areas where corrosives, hot liquids, or other eye irritating materials (e.g., formaldehyde) are used or stored. During development of an Emergency Action Plan, personnel must identify eyewash fountain locations, verify proper function and determine if additional eyewash fountains are required in the laboratory. Ensure that eyewash fountain locations are marked with a sign (typically green/white, available from EH&S) posted at eye level above the fountain. Eyewash fountains should be flushed weekly by laboratory personnel. Record these tests on the "Safety Equipment Test Record" tag attached to the eyewash. For signs, tags or assistance with installation of an eyewash station, contact EH&S at 294-5359.

### Fire Extinguishers

Each laboratory must have unobstructed access to at least one multi-purpose fire extinguisher (ABC) located at or near the exit. During development of an Emergency Action Plan, personnel must identify fire extinguisher locations and determine if available extinguishers are appropriate for planned laboratory activities. Ensure that fire extinguisher locations are marked with a red/white "fire extinguisher" sign posted at eye level above the device. Annual extinguisher testing performed by EH&S will be documented on a "Recharge & Inspection" tag attached to the extinguisher. For signs, tags or assistance with installation of an appropriate fire extinguisher, contact EH&S at 294-5359. Fire Safety and Extinguisher Training is required for all laboratory personnel. Additional information is contained in the university's [Fire Safety Guidelines](#).

### First Aid Kits

A properly stocked first aid kit shall be available to laboratory personnel. Complete kits are available at Central Stores (294-0408). A list of recommended contents can be found in the Iowa State University [First Aid Policy](#). Signs to mark first aid kit location are available from EH&S.

### Flammable Safety Cabinets

Flammable safety cabinets are storage cabinets (typically metal) manufactured to isolate flammable materials from a fire that occurs in the laboratory. Safety cabinets are required for storage of flammable liquids in laboratories with aggregate quantities greater than 40 liters (~10 gal.) and are available for purchase through safety equipment suppliers. Contact EH&S at 294-5359 for assistance.

### Flammable Safety Cans

Flammable safety cans are containers (typically metal) with self-closing spouts and integral flame arresters used to store flammable liquids in single container quantities greater than four liters (~1 gal.). Safety cans must be properly labeled and are available for purchase through safety equipment suppliers. Refer to Flammables and Combustibles in [Section G](#) for more information. Contact EH&S at 294-5359 for assistance.

### Laboratory Hoods

Fume hoods are designed to protect personnel by preventing chemical and radiological contaminants from escaping into the laboratory environment. Fume hoods also provide a physical barrier to chemicals and their reactions. Refer to the [Laboratory Hood Manual](#) for additional information.

### Laboratory Refrigerators/Freezers

Refrigerators and freezers used for flammable liquid storage must be manufactured for that purpose. Modification of general-purpose (domestic) refrigerators/freezers for flammable liquid storage is NOT permitted. General purpose refrigerators/freezers must be labeled to prohibit storage of flammable materials (e.g., Caution: Do Not Store Volatile Materials in This Box)

Laboratory refrigerators and freezers must not be used to store food or beverages intended for human consumption. Affix an appropriate label to the refrigerator/freezer door (e.g., Caution: For Chemical Storage Only, No Food or Drink). Safety signs are available from EH&S upon request.

### Safety Showers

An easily accessible and unobstructed, drench-type safety shower shall be available within 10 seconds travel time of each area where corrosive or toxic liquids are used or stored. In some buildings, laboratories may need to rely on safety showers outside the laboratory. During development of an Emergency Action Plan, personnel must identify safety shower locations and verify proper function by contacting the building area mechanic. Ensure that safety shower locations are marked with a sign (typically green/white, available from EH&S) posted at eye level below the shower. Annual safety shower testing performed by Facilities Planning & Management will be documented on a "Safety Equipment Test Record" tag attached to the shower. For signs, tags or assistance with installation of a safety shower, contact EH&S at 294-5359.

### Spill Kits

A properly stocked spill control kit shall be available in each laboratory. Spill kits are available at Central Stores, safety equipment suppliers or can be assembled by the laboratory. Signs to mark spill kit location are available from EH&S.

## PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protective Equipment (PPE) appropriate for the work conditions must be worn when working with laboratory hazards. At minimum this must include:



- laboratory coats (or other protective clothing such as aprons, scrubs, coveralls, etc.)
- safety glasses or goggles
- gloves resistant to the material used and
- appropriate footwear (closed at the heel and toe)

Sandals must not be worn in the laboratory. Other protective equipment, such as splash goggles, face shields, aprons, thermal or cut resistant gloves, hearing protection, or respirators, must be worn when conditions dictate.

The PI or laboratory supervisor is responsible for conducting hazard assessments, training and coordinating the use of PPE. Completion of a hazard assessment or standard operating procedure may allow individual laboratory PPE requirements to be determined and justified by PIs or laboratory supervisors. Document PPE selection on a standard operating procedure developed for the experiment or laboratory operation. Refer to Standard Operating Procedures in Section B in this manual for assistance.

Iowa State University's [PPE Policy](#) requires departments to provide employees with necessary PPE. In a class situation, students shall purchase or obtain the necessary and approved PPE designated by the department or instructor responsible for the course. Students must be trained in the proper use and care of the PPE.

All PPE shall be thoroughly inspected for damage or worn parts before use, cleaned and sanitized after use if reusable and properly stored away from sources of heat, sunlight, chemicals or contamination. Single use equipment (e.g., exam type gloves, disposable coveralls, etc.) must be disposed of after each use or if significant contact with contaminants occur.

PPE is available for purchase at Central Stores, 195 General Services Building 294-0408, or Chemistry Stores, 1351 Gilman Hall 294-0203. Laundry service for contaminated laboratory coats is available through Chemistry Stores. Contaminated PPE should NOT be taken home for laundering.

Following are short explanations of some typical PPE. For more information refer to the Iowa State University [PPE Policy](#) and the [PPE web page](#).

#### Body 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 constructed of elastomers resistant to the material used.

#### Eye and Face Protection

Eye and face protection with filtered lenses designed to protect against light radiation are required when working with lasers, UV lamps, welding, or other sources of light radiation. Select the appropriate lens shade or filter for the operation performed.

#### Face Shields

Face shields are required where there is potential face exposure to projectiles, chemicals, or radiant energy. Use of a face shield is not a substitute for eye protection, and it may be necessary to provide both means of protection.

### Hand Protection

Hand protection must be worn to prevent skin absorption of harmful substances, cuts or lacerations, abrasions, punctures, chemical burns, thermal burns or harmful temperature extremes. Elastomeric gloves used for chemical resistance must be constructed of elastomers resistant to the material used. Selection is based on elastomer thickness, permeation breakthrough time (in minutes), permeation rate and resistance to degradation. Use the [Glove and Suit Selection Guides](#) website for assistance.

### Hearing Protection

Hearing protection is recommended when laboratory operations produce noise levels of 84 decibels and required when noise levels of 90 decibels or greater are encountered. Contact EH&S at 294-5359 for an evaluation of noise sources.

### Respiratory Protection

Respiratory protection may be required to prevent exposure to airborne contaminants when engineering controls (i.e., fume hoods, biological safety cabinets, etc.) prove inadequate. A medical exam, fit test and specialized training are required before using a respirator. Contact EH&S at 294-5359 for more information.

### Safety Glasses

Safety glasses with side shields protect the eyes from flying projectiles and constitute minimum eye protection when working in laboratories.

### Safety Goggles

Safety goggles (unvented or indirectly vented) are required in laboratory operations where there is potential for chemical vapors, splashes, mists, sprays or airborne dust exposure to the eyes.

The wearing of shorts or short skirts in laboratories is strongly discouraged. When allowed, the required lab coat or non-permeable apron must cover the knees. These minimum requirements apply to labs with minimal hazards.

## E. Training

Principal Investigators and/or laboratory supervisors are responsible for ensuring that all personnel are properly trained before they begin work in a laboratory and that they receive additional training when new hazards or procedures are introduced. At minimum, laboratory employees are required to complete EH&S training as outlined in the [Safety Training Curriculum for Laboratory Personnel](#).

### LAB-SPECIFIC TRAINING

In addition to general EH&S training, all laboratory personnel, including students, must receive laboratory-specific training on the following topics:

- location and content of the Laboratory Safety Manual
- physical, chemical, biological, laser and radiation hazards in the work area, including signs and symptoms of exposure and allowable exposure limits
- location of references describing hazards and safety practices associated with laboratory materials (e.g. [MSDS](#), Merck Index, [Biosafety in Microbiological and Biomedical Laboratories](#), etc.)
- protective measures employees should take to avoid exposure or injury, as specified in the laboratory's [Standard Operating Procedures](#)
- procedures for responding to laboratory emergencies (fire, chemical spill, severe weather, etc.) as outlined in the laboratory's [Emergency Action Plan](#)
- methods to detect the presence of contamination or the release of chemical, biological and radioactive materials
- procedures for obtaining medical care in the event of [exposure/injury](#)
- proper waste management and disposal procedures
- proper recordkeeping

Document laboratory-specific training on the [Site-Specific Training form](#).

### REFRESHER TRAINING

Retraining intervals for EH&S provided courses are specified on the "Safety Training Curriculum for Laboratory Personnel." For courses required only once and lab-specific training, the supervisor must carefully monitor employee understanding and skill. If an employee exhibits lack of knowledge, or if work conditions change, retraining will be required.

### DOCUMENTATION

Departments and/or laboratory supervisors must maintain safety training records for all laboratory personnel. Acceptable records include [Site-Specific Training forms](#), [Lab Safety Training History](#), training certificates, and/or copies of employee "training history" from the [EH&S Learning Center](#). Employee training records must be retained for at least one year after end of employment.

## F. General Laboratory Safety Practices

The following general safety practices apply to all laboratories at Iowa State University, regardless of the type of research performed.

### SAFE LABORATORY PRACTICES

The following minimum conditions or practices must be observed in the laboratory.

- Ensure laboratory access is controlled at all times (lock doors when lab is unoccupied). Question unknown persons entering the laboratory regarding their name and purpose. Ask unauthorized persons (intruders) to leave. Report the unauthorized entry to Iowa State University Police (294-4428 or 911) and departmental contacts.
- Keep corridor doors (fire doors) closed.
- Avoid working alone in the laboratory. When necessary, make arrangements with the PI, laboratory supervisor or a colleague to check on your status periodically.
- Keep hands and other items away from the mouth and eyes as well as any open skin wounds.
- Food, drink, tobacco products, gum, medications or cosmetics are not allowed in areas where chemical, biological or radioactive materials are used or stored.
- Foods not intended for human consumption (i.e. research) must be labeled ***“Not for Human Consumption.”***
- Keep all work areas clean and uncluttered and aisles unobstructed.
- Keep music at a moderate level and refrain from using ear phones.
- Avoid practical jokes or other disruptive behavior.
- Confine long hair and loose clothing.
- Sink hoses must be cut off above sink rim unless a backflow prevention device is installed on faucet.
- Ensure hand soap (preferably liquid) and towels are available at the laboratory sink.
- Wash hands and other exposed skin after using chemical, biological and radiological materials and before leaving the laboratory.

### PROPER LABELING FOR CHEMICAL, BIOLOGICAL AND RADIOLOGICAL MATERIALS

All chemical, biological, or radiological material containers in the laboratory must be labeled in order to ensure hazard information is readily available to employees, visitors, and emergency response personnel. Containers must be labeled with:

- Proper chemical or common name of contents in English. Chemical formulas, symbols or acronyms are not acceptable. Mixtures or solutions must include a list of constituents and their concentrations.

- Signal words (e.g., danger, warning, caution, etc.) and/or associated hazard(s), (e.g., eye irritant, corrosive, biohazardous, radioactive, etc.)

Additional information such as dates received, prepared or opened, storage location, and owner or user of the material should also be included.



#### ADDITIONAL RESOURCES

[Biosafety Manual](#) – refer to Section E

[Radiation Safety Manual](#) – refer to Section L

### SAFE STORAGE OF CHEMICAL, BIOLOGICAL AND RADIOLOGICAL MATERIALS

Below are some general guidelines for the safe storage of chemical, biological and radiological materials.

- Store materials according to manufacturer's specifications in a designated location.
- Ensure that all stored containers are in good condition, closed and properly labeled.
- Store all hazardous materials in containers, in cabinets or on shelving compatible with the associated hazard or material.
- Segregate chemicals by hazard class (e.g., flammable liquids, organic acids, oxidizers, etc.). Chemicals may be stored alphabetically only within hazard class.
- Use secondary containment for all chemical, biological and radiological materials to prevent release into the environment.
- Secure all storage shelves and cabinets to prevent tipping.
- Ensure that storage locations are dry, adequately vented and away from heat sources.
- Store hazardous liquids below a height of five feet. All other chemicals should be stored below five feet when possible.
- Provide an [annual inventory](#) of hazardous materials stored in the laboratory to EH&S.



Additional requirements for specific hazardous materials are described in Section G or may be obtained from the [MSDS](#), container label, laboratory SOP or by contacting EH&S at 294-5359.

### SAFE USE OF CHEMICAL, BIOLOGICAL AND RADIOLOGICAL MATERIALS

Below are some general guidelines for the safe use of chemical, biological and radiological materials.

- Before using chemical, biological or radiological materials review hazard information found on the container label, in an MSDS or equivalent (e.g., Merck Index, [Biosafety in Microbiological and Biomedical Laboratories](#)).
- Follow safety precautions as specified in the approved standard operating procedure (SOP).
- Use a fume hood, biological safety cabinet or appropriate ventilation for processes that

release hazardous vapors, fumes, particulates or aerosols.

- Keep incompatible materials separated.
- Do not leave hazardous processes unattended.
- Do not pipette or siphon by mouth.
- Do not smell or taste chemical, biological or radiological materials.
- Ensure that all containers are closed (sealed) when not in use.
- Remove from storage only the amount of materials needed for a procedure.
- Wear appropriate personal protective equipment. Refer to Personal Protective Equipment in Section D of this manual for details.

Additional requirements for specific hazardous materials are described in Section G or may be obtained from the [MSDS](#), container label or by contacting EH&S at 294-5359.

## SAFETY SURVEYS

Perform annual self inspections using the [Laboratory Safety Survey checklist](#). More frequent inspections (i.e., each semester) are recommended. Documentation of completed inspections must be maintained by each laboratory or department for three years.

EH&S has a formal Laboratory Safety Survey program, where a portion of university labs will be audited annually and assistance provided to ensure compliance. Laboratories may request a formal laboratory audit at any time by contacting EH&S (294-5359).

## G. Safety Practices for Specific Hazards

The following are additional safety practices that apply to Iowa State University laboratories using specific hazardous materials.

### BIOHAZARDOUS MATERIALS

Biohazardous materials are of biological origin and may cause harm to humans, domestic or wild animals, or plants. When using these materials refer to the [Biosafety Manual](#) for details.

- Use laboratory facilities appropriate to the required biosafety level.
- Use appropriate containment equipment such as biological safety cabinets.
- Prevent or minimize the creation of aerosols.
- Limit use of needles, syringes and other sharps to avoid unnecessary exposure. For disposal, follow the requirements of the Sharps and Biohazardous Waste Policy.
- Ensure proper biohazard disposal and decontamination.
- Complete autoclave performance checks monthly.
- Ensure only properly trained personnel handle biohazardous materials.
- Restrict access to Select Biological Agents to authorized personnel.

### ADDITIONAL RESOURCES

[Biohazardous Materials: An Introduction](#) (online training)

[Biological Safety Cabinet e-book](#)

[Sharps and Biohazardous Waste policy](#)

[Laboratory Hood Manual](#)

### COMPRESSED AND LIQUEFIED GASES

Compressed and liquefied gases pose significant chemical and physical hazards to laboratory users. Refer to the Gas Cylinder Safety Guidelines for more information.

- Ensure gas cylinders and Dewar flasks are secured, away from heat sources and capped when not in use.
- Ensure hazardous gases (fire or health rating 3 or 4) are in a ventilated cabinet or enclosure.
- Transport cylinders and Dewar flasks on freight-only elevators where possible to avoid potential exposure to passengers.



- Use an appropriate hand truck or cart to transport gas cylinders and Dewar flasks (do not drag or roll), ensure the valve protection caps are in place, and handle only one container at a time.
- Ensure proper maintenance and use of regulators, manifolds and safety valves.
- Always wear safety goggles when performing any operation with compressed or liquefied gases. Additional protection may be required based on the gases used (e.g., face shield, insulated gloves, chemical resistant gloves and/or an apron).
- After assembly of a gas supply system, test all connects using a soapy water solution or a sampling device able to detect the gas. Periodically retest the system if leaks are suspected. Refer to the Compressed Gas Leak Procedure if leak is detected.

#### ADDITIONAL RESOURCES

[Gas Cylinder Safety Guidelines](#)  
[Compressed Gas Leak Procedure](#)

#### CORROSIVES

Corrosives react at the point of contact to cause eye or tissue damage. Corrosives include acids and bases and other chemicals such as phenol.

- Use splash goggles and heavy weight gloves resistant to the chemical used and its concentration. A face shield, resistant apron and boots may also be appropriate, depending on the work performed.
- Slowly add acids or bases to water. Never add water to concentrated acids or bases.
- Segregate acids from bases.
- Segregate inorganic and organic acids.
- Segregate oxidizing acids (nitric, perchloric and chromic) from all other materials
- An eyewash must be present in the laboratory. A safety shower must be available within 10 seconds travel time from workspace.
- Appropriate neutralizing agents for spill clean up should be available in adequate quantities.
- Calcium gluconate gel must be available wherever hydrofluoric acid is used. This gel is used to treat skin exposure and can be obtained by contacting Occupational Medicine (294-2056). Seek medical treatment for exposure to hydrofluoric acid.
- [Polyethylene glycol \(PEG 300\)](#) must be available wherever phenol is used. PEG 300 is used to treat skin exposure and is available through Chemistry Stores (294-0203). Seek medical treatment for exposure to phenol.
- Perchloric acid use may result in the formation of explosive perchloric acid salts. Perchloric acid procedures must only be performed in [approved laboratory fume hoods](#).

#### EXPLOSIVES

Explosives may be divided into two categories: chemicals designed and produced for use as an explosive, and chemicals that may become explosive due to dehydration, age, or contamination. Examples include TNT, ammunition, and dry picric acid. Follow procedures outlined in the [Potentially Explosive Chemicals: Guidelines for Safe Storage and Handling](#).

- Obtain approval from EH&S prior to purchase and use.
- Store away from other chemicals in a secure cabinet or magazine.
- Keep wetted or otherwise stabilized.
- Use and store away from sources of heat, friction, or static electricity.

## FLAMMABLES AND COMBUSTIBLES

Flammable materials have a flash point of less than or equal to 37.8°C (100°F). Combustible materials have a flash point greater than 37.8°C. Vapor from these materials can reach remote ignition sources, causing flashback fires.

- Isolate ignition sources including hot surfaces, electrical equipment and static electricity from flammable or combustible materials.
- Store flammable liquids in safety cans where container quantity exceeds four liters (~ 1 gallon).
- Store flammable liquids in a flammable storage cabinet when total quantity in a laboratory exceeds 40 liters (~ 10 gallons).
- Store flammables and combustibles away from oxidizers and strong acids.
- Store flammable liquids requiring cool/cold storage in refrigerators/freezers manufactured for that purpose. Modification of general-purpose (domestic) refrigerators or freezers for flammable liquid storage is NOT permitted.
- Ensure proper bonding and grounding when transferring flammable liquids from a container or drum.



## LASERS

Class IIIb and IV lasers emit amplified visible and non-visible light radiation and may cause immediate harm to eyes and skin. All users of Class IIIb and IV lasers must be pre-approved by the Laser Safety Officer and must adhere to the safety requirements outlined in the Laser Safety Manual.

- Ensure only properly trained personnel operate Class IIIb and IV lasers.
- Complete all medical surveillance requirements.
- Maintain safety interlocks and laser enclosures.
- Wear protective eyewear rated for the specific laser used.
- Contact EH&S (294-5359) to report problems involving lasers or laser systems.

### ADDITIONAL RESOURCES

[Laser Safety Manual](#)

[Laser Safety web page](#)

## MERCURY

Small amounts of metallic mercury are toxic and create significant problems if spilled. To minimize the risk of spills, equipment containing mercury must be in secondary containment. The use of mercury substitutes is highly encouraged, such as alcohol or electronic thermometers.

Clean up of small mercury spills (thermometer size) are the responsibility of the user. Larger spills, or small spills on a porous surface such as carpet, should be handled by EH&S. Refer to [Mercury Spills](#) on the EH&S website for more information.

## NANOTECHNOLOGY

Nanotechnology research involves the creation, manipulation and use of materials in the 1 – 100 nanometer size range. Particles of this size may have unique and especially hazardous properties that are not yet fully realized. Researchers planning on using, creating, or manipulating nano particles should contact EH&S at 294-5359 or refer to the [nanotechnology information](#) on the web for assistance.

## ORGANIC PEROXIDES

Organic peroxides may react with organic material resulting in fires or explosions. Organic peroxides are highly flammable and extremely sensitive to heat, friction, impact, and light, as well as to strong oxidizing and reducing agents. In addition, organic peroxides may destabilize with age, contamination or improper storage to become self reactive. Common laboratory organic peroxides include benzoyl peroxide, butyl peroxide, and lauroyl peroxide.

- Mark containers with date received. Dispose of by the expiration date listed on the container label, within one year of purchase or within six months of opening.
- Use away from chemicals and organic materials such as paper and wood.
- Strictly adhere to manufacturer's use and storage instructions. Refrigeration and/or hydration may be required.
- Avoid operations that may concentrate organic peroxides (e.g., distillation, extraction or crystallization)

## OXIDIZERS

Oxidizers may react with organic materials resulting in fires or explosions. Common laboratory oxidizers include perchloric and nitric acids, sodium and ammonium nitrates, and hydrogen peroxide.

- Use away from chemicals and organic materials such as paper and wood.
- Store in secondary containment away from all other chemicals.
- Ensure oxidizers used in organic reactions are completely spent/deactivated prior to placing in sealed containers.
- Deactivate residues according to the laboratory's standard operating procedure before discarding empty container.

## PEROXIDE FORMING CHEMICALS

Peroxide forming chemicals react with oxygen to form peroxides. Impact, heat or friction can trigger peroxide explosions. Peroxide forming chemicals include ethyl ether, tetrahydrofuran, isopropyl ether, and potassium metal. Refer to the Potentially Explosive Chemicals: Guidelines for Safe Storage and Handling document for a representative list of peroxide forming chemicals.

- Affix warning label to containers and record dates received, opened and tested.
- Dispose of peroxide forming chemicals at or before the expiration date marked on the container. To retain chemicals beyond the expiration date, test for peroxide concentration following the procedure in Peroxide-Forming Chemicals brochure.
- Never handle deformed containers or those with crystal formation. Contact EH&S for proper disposal.

**WARNING! MAY FORM EXPLOSIVE PEROXIDES**

For handling information consult: Potentially Explosive Chemicals Guidelines for Safe Storage and Handling  
Keep in tightly closed original container. Avoid exposure to light, air and heat.  
If any crystals, discoloration, or fuming are visible, do not open.  
Contact EHS (248-5255) or AL ESH&A (248-2757) for assistance.

**THIS CHEMICAL HAS A SHELF LIFE**

Date received: \_\_\_\_\_ Date opened: \_\_\_\_\_

**PEROXIDE TEST RESULTS**  
(If peroxides are present DO NOT DISTILL before testing)

**Mandatory Testing Interval - 6 months**

Date	Result	Initials	Date	Result	Initials
_____	_____	_____	_____	_____	_____
Date	Result	Initials	Date	Result	Initials
_____	_____	_____	_____	_____	_____
Date	Result	Initials	Date	Result	Initials
_____	_____	_____	_____	_____	_____

## ADDITIONAL RESOURCES

[Peroxide-Forming Chemicals brochure](#)

[Potentially Explosive Chemicals: Guidelines for Safe Storage and Handling](#)

## PHYSICAL HAZARDS

Physical hazards may include: cuts, burns, electrical shock, slips/trips, noise, mechanical, etc. Laboratory personnel must identify physical hazards present in the laboratory and implement work

practices to avoid injury. Minimum safety practices may include the following:

- Keep exits and aisles unobstructed.
- Ensure laboratory equipment with moving parts are properly guarded (i.e., vacuum pump belt drives, fan belts, etc.).
- Ensure [ladders](#) and step stools are in safe working condition.
- Ensure extension cords are absent.
- Heavy objects should be stored below five feet whenever possible to minimize lifting/falling hazards.
- Ensure adequate illumination for all activities, avoiding reflections and glare that could affect vision.

#### **ADDITIONAL RESOURCES**

[Electrical Safety](#)

[Lab Ergonomics e-book](#)

[Lockout/Tagout](#)

[Noise](#)

[Sharps](#)

[Working With Laboratory Glassware e-book](#)

#### **PYROPHORIC CHEMICALS**

Pyrophoric chemicals such as butyllithium, methyllithium, and white phosphorus ignite spontaneously in air. Small amounts of pyrophoric chemicals may initiate larger fires.

- Use or store in an inert environment.
- Avoid using near flammable solvents.
- Deactivate residues according to the laboratory's standard operating procedure before discarding empty container.
- Ensure appropriate fire extinguishing agent is available.

#### **RADIOLOGICAL MATERIALS AND DEVICES**

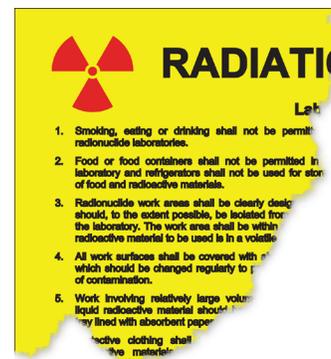
Radiological materials and devices emit ionizing radiation that may cause harm to humans, animals, or plants. All users of radioactive materials and devices must be pre-approved by the Radiation Safety Officer and must follow the safety requirements outlined in the [Radiation Safety Manual](#).

- Ensure only properly trained and authorized personnel handle radiological materials.
- Read and understand the Radiation Safety and Notice to Employee laboratory postings.
- Read and understand the emergency contact information posted at entrances to the laboratory.
- Maintain the security of all radioactive materials including labeled materials, equipment and waste.
- Contact EH&S (294-5359) to report problems involving radioactive materials.

#### **ADDITIONAL RESOURCES**

[Radiation Safety Training Guide for Radionuclide Users](#)

[Radiation Safety Guide for Ancillary Personnel](#)



## WATER REACTIVES

Water reactives combine with water or moisture in the air to spontaneously ignite or produce flammable or toxic gases. Examples include metals such as sodium and potassium; acid anhydrides and acid chlorides; and fine metal powders such as zinc.

- Handle away from water sources.
- Use in well ventilated area or inert atmosphere.
- Store in a dry and/or inert environment.
- Deactivate residues according to the laboratory's standard operating procedure before discarding empty container.
- Ensure appropriate fire extinguishing agent is available.

## H. Management of Unwanted Laboratory Materials (Waste)

Laboratories generate a large variety of unwanted materials, or “waste,” including chemicals, biohazardous and radiological materials, appliances, and equipment. Generators of unwanted materials must manage them as outlined in the Iowa State University [Management of Unwanted Materials Manual](#), [Biosafety Manual](#) and the [Radiation Safety Manual](#). Unwanted materials MUST NOT be poured into the sanitary sewer system or released to the environment, unless specifically authorized by EH&S. All laboratory personnel must be familiar with appropriate decontamination, disposal and EH&S waste collection procedures.

### UNWANTED BIOHAZARDOUS MATERIALS

Unwanted biohazardous materials include: liquids; disposable solids, non-disposable items (reusable); metal and glass sharps; and carcasses, tissues or bedding that have been exposed to biohazardous materials. All biohazardous waste must be decontaminated before disposal. Common decontamination methods include heat sterilization (e.g., autoclaving), chemical disinfection and incineration. Detailed instructions for decontamination and disposal are included in the [Biosafety Manual](#), the [Sharps and Biohazardous Waste Policy](#) and the [Sharps and Biohazardous Waste Disposal Flow Chart](#).

### UNWANTED CHEMICALS

Unwanted chemicals include used and unused reagents, samples, synthesized items, and unknowns. At a minimum, researchers generating unwanted chemicals must ensure:

- All personnel have received [Hazardous Waste Generator Training](#) (annual retraining is required).
- Waste materials are collected in a designated satellite accumulation area identified with green EH&S signage.
- Waste satellite accumulation areas are located at or near the point of generation (in the same room or suite of connected rooms where the waste is generated).
- Waste containers are appropriately labeled (no abbreviations, formulas, or shorthand) and dated.
- Waste containers are closed except when in use.

All unwanted chemicals will be collected by EH&S. Request collection by submitting an [online request](#).



## UNWANTED EQUIPMENT

Unwanted laboratory equipment includes working and non-working appliances, centrifuges, ovens, computers, x-ray units, and other items that may be contaminated due to research. At a minimum, researchers generating unwanted equipment must ensure that:

- All hazardous substances have been removed and the equipment has been decontaminated
- A completed [Laboratory Equipment Disposal Form](#) has been forwarded to EH&S
- EH&S has inspected/tested the equipment and authorized transfer and/or disposal through [ISU Surplus](#).

## UNWANTED RADIOLOGICAL MATERIALS

All unwanted radioactive materials and devices will be collected by EH&S. Researchers generating unwanted radioactive materials must separate materials by radionuclide half-life into the following categories and sub categories (i.e., collection containers):

- Solids – into combustible, non-combustible, sharps (needles and razor blades) and source container (lead containers and source vials) groups
- Liquids – into aqueous, organic and flammable groups
- Radioactive tissue (e.g., carcasses, viscera and blood)

Accumulated materials must be properly packaged, labeled, and placed in a designated waste storage area. Container labels are supplied by EH&S. Request collection of unwanted radioactive materials by submitting an [online request](#). EH&S will assist radioactive materials and device users with development of an appropriate disposal plan on a case-by-case basis. Refer to the [Radiation Safety Manual](#) for more information.

### **ADDITIONAL RESOURCES:**

[Management of Unwanted Materials](#)

[Biosafety Manual](#) – refer to Section F – Disposal and Disinfection of Biohazardous Materials

[Radiation Safety Manual](#) – refer to Section I – Radioactive Waste

[Sharps and Biohazardous Waste Policy](#)

[Sharps and Biohazardous Waste Disposal Flow Chart](#)

# I. Exposure Assessment & Medical Care

Exposure assessment and medical care must be considered when developing laboratory procedures. Certain chemical, biological, radiological, and physical hazards require specific health monitoring. It is the responsibility of the PI, laboratory supervisor and department to ensure personnel are receiving appropriate monitoring and/or medical care based on laboratory hazards.

## OCCUPATIONAL MEDICINE PROGRAM

The Iowa State University [Occupational Medicine Program](#) is designed to minimize personnel health risks from workplace hazards. Hazards may include: chemicals such as formaldehyde or benzene; physical hazards such as excessive noise or lasers; human pathogens, tissues and cell lines; and radioactive materials or devices. The program includes workplace exposure assessments, exposure monitoring and medical surveillance. All Iowa State University personnel, including part-time and student workers, are encouraged to participate in the Occupational Medicine Program, which is provided at no charge. Refer to the [Introduction to Occupational Medicine](#) booklet for more information.

### Workplace Exposure Assessment

All personnel who may be exposed to hazards in the workplace must complete a [Hazard Inventory form](#) at the beginning of their employment. This form must be reviewed and signed by the supervisor, then submitted to EH&S for review. EH&S will use information on the Hazard Inventory to determine if exposure monitoring or medical surveillance will be required. A new form must be completed whenever job hazards change.

### Exposure Monitoring

As part of the workplace exposure assessment, exposure monitoring may be performed by EH&S to quantify the level of exposure experienced by employees at Iowa State University. Monitoring results are used to determine if medical surveillance of an employee will be required and whether control measures should be implemented to ensure a safe work environment. Each department and laboratory supervisor is responsible for ensuring that any recommended control measures are implemented. EH&S may perform additional monitoring to determine the effectiveness of control measures.

EH&S is available to conduct occupational exposure monitoring whenever a possible exposure or potential health hazard is suspected in the work environment.

### Medical Surveillance

Employees enrolled in the Occupational Medicine Program will be required to complete a baseline medical review at the Iowa State University Occupational Medicine office (G11 TASF, 294-2056). The Occupational Medicine physician will determine what tests and immunizations

will be required to prevent occupational disease relating to an employee's exposure. Ongoing medical surveillance will be offered to personnel exposed to hazards covered under OSHA or other applicable regulations. A separation medical review will be offered to Occupational Medicine program participants when leaving Iowa State University.

## WORK-RELATED INJURIES, ILLNESSES AND EXPOSURES

Iowa State University employees exposed or injured while at work or in the course of employment must seek medical attention at the McFarland Clinic Occupational Medicine Department (1215 Duff Ave, Ames, IA; 239-4496). McFarland Clinic is the workers compensation provider for Ames-area Iowa State University personnel. The clinic provides consultation, evaluation and treatment for all work-related injuries, illnesses and exposures. Supervisors should call the McFarland Clinic Occupational Medicine Department during regular work hours to schedule an appointment for the employee. Any relevant safety information such as an MSDS should accompany the employee to the appointment.

### Reporting

All work related injuries, illnesses, or exposures must be reported to the employee's supervisor, even when medical attention is not required or is refused by the employee:

- A First Report of Injury must be completed through [AccessPlus](#) by the supervisor and submitted within 24 hours of the incident. The online questionnaire is listed as Work Injury under the Employee tab once logged into AccessPlus. Questions regarding the form may be forwarded to Human Resource Services at 294-3753.
- [Accident Investigation Form](#) must be completed by the supervisor and sent to EH&S within 7 business days of the incident. Questions regarding completion of accident investigations may be forwarded to EH&S at 294-5359.

Refer to the [Accidents and Injuries web page](#) for more information.

## STUDENT ACCIDENTS AND INJURIES

Students not employed by Iowa State University who are exposed or injured in the classroom or laboratory should seek medical attention at the Thielen Student Health Center (Sheldon and Union Drive, 294-5801). All accidents and injuries sustained by Iowa State University students while in academic classes or events sponsored by the university must be reported to Risk Management by the student and a university representative using the [Student Accident Report Form](#). Refer to the [Accidents and Injuries web page](#) for more information.

## MEDICAL EMERGENCIES

If injury, illness or exposure necessitates immediate treatment, transport the employee to the Emergency Room at Mary Greeley Medical Center (239-2155). If emergency transport is needed, dial 911. Be prepared to provide any relevant safety information, such as an MSDS. When an employee requires emergency treatment, the incident must be reported to EH&S (294-5359) as soon as possible. Provide assistance to injured or exposed personnel by following the [Treatment of Injured or Exposed Personnel](#) procedure.

*For emergencies, go to the  
Mary Greeley Medical Center  
Emergency Room  
(239-2155 or 911)*