

Laboratory Safety Training

Developed for Science Laboratories



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Environmental Health and Safety

Laboratory Safety Training

This training presentation has been created for those who are required to undergo general laboratory safety training. It is also recommended for those laboratories that do not fall under regulation but are needing a safety laboratory overview. This does not substitute other lab or hazard-specific training.





Introduction

Laboratory safety is the key to reducing injury and illness. There are many exposures in the laboratory that pose a hazard to your health. It is important to have proper training so you, as the employee, are aware of the potential dangers that may threaten your health or life.



Introduction

As you go through this training module, you will have a better understanding regarding the concept of safety and how safety is utilized in every aspect of your life. The University has an obligation to protect each student, assistant, faculty and staff. There are also regulations that pertain to ISU to ensure compliance.



• Several agencies are involved in safety compliance at the University. The following agencies impact our laboratories in regard to safety.

<u>National Institute of Health (NIH)</u>



National Institutes of Health In charge of laboratories that use or contain recombinant DNA (rDNA). NIH specifies practices for constructing and handling rDNA.





- Centers for Disease Control and Prevention (CDC)



• In charge of laboratories that use or contain infectious agents. They are focused on protecting personnel and the laboratory environmental from exposure to infectious agents. They are also aiming at preventative measures by adhering to strict containment.



- <u>Illinois Department of Labor (IDOL)</u>



 IDOL primarily monitors Hazardous Materials, Hazard Communication, Bloodborne Pathogens, and Occupational Exposure to Hazardous Chemicals in Laboratories at ISU.
OSHA is in charge of monitoring work conditions and eliminating physical and health hazards at the workplace.



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Agency Information

- <u>Environmental Protection Agency (EPA)</u>
 - The EPA regulates wastes generated by ISU. Many hazardous wastes generated in research laboratories pose a threat to humans, animals, plants, and the environment. There are also biohazardous wastes that are regulated and must be properly decontaminated and disposed of.



<u>Illinois Emergency Management Agency</u>
<u>Office of Homeland Security</u>



IEMA-OHS Division of Nuclear and Radiation Safety regulates the possession, use, and distribution of radioactive materials. In addition to radioactive materials, IEMA-OHS registers and inspects radiationproducing equipment including x-rays and lasers.



GENERAL SAFETY INFORMATION



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When a chemical is in the laboratory, the hazards of that chemical must be communicated to you. According to **Occupational Safety and Health** Administration (OSHA), a Chemical Hygiene Plan (CHP) is required to relay information regarding procedures, equipment, PPE, and work practices that are capable of protecting employees from health hazards.



Chemical Hygiene

Your supervisor is in charge of providing the information contained in the CHP to you. It is your responsibility to make sure that you review the CHP and know where it is stored.





Deans, Directors, and Department Chairs

- Deans, Directors, and Department Chairs are to work with their organizational units to ensure that affected employees are trained on the provisions of the University Chemical Hygiene Plan and are taking action to comply with its requirements. These individuals should:
 - Identify all laboratories and chemical handling areas in their organizational unit.
 - Assign Lab Supervisor for each laboratory/chemical handling area.
 - Assure that employee training is conducted at the time of employment and annually thereafter.
 - Determine and direct the method of the enforcement and compliance of the Chemical Hygiene Plan



Environmental Health and Safety

- Provide proactive support on issues of hazard identification and evaluation; procedures for correcting unsafe conditions, control measure determination and implementation; employee information; and training programs.
- Maintain centralized environmental monitoring records, allowing employee access as required by law.
- Serve as the principal point of contact with regulatory agencies on matters of chemical hygiene at the University.
- Arrange for general safety inspections and safety equipment testing as required under the University Chemical Hygiene Plan to include, but not be limited to showers, ventilation, and fume hoods.
- Review Principal Investigator or Laboratory Supervisors employee training records.



Chemical Hygiene Officer (CHO)

- Establishing and implementing a Chemical Hygiene Plan and updating the plan at least annually.
- Investigating accidents and chemical exposures within the department.
- Acting as a liaison between the department and EHS for laboratory safety issues.
- Ensure laboratory workers receive chemical and procedure-specific training.
- Review and approve use of particularly hazardous substances.
- Approve laboratory worker's return to work following a chemical exposure requiring medical consultation.



Laboratory Supervisor/Principal Investigator

- Ensure that action is taken to correct work practices and conditions that may result in the release of hazardous materials.
- Ensure that protective equipment is available, working and used as appropriate.
- Provide and document that employees have been trained and understand the content of the Chemical Hygiene Plan at initial assignments and whenever a new hazard is introduced.
- Identify materials considered particularly hazardous and communicate warnings to workers as appropriate. In coordination with the Chemical Hygiene Officer and EHS, Laboratory Supervisors should participate in laboratory compliance audits, at least once per year.
- SDSs that are not available online must be acquired from the manufacturer and maintained in an accessible location.
- Develop laboratory specific SOPs for the chemical and biological hazards and any agents which are used



Lab Workers

- Understand and act in accordance with the Chemical Hygiene Plan and any laboratory-specific standard operating procedures.
- Participate in training programs.
- Practice good personal chemical hygiene
- Report all accidents and incidents to the supervisor on a timely basis.
- Review SDSs or other chemical safety information as needed to ensure an understanding of the chemical hazards in the laboratory.



Standard Operating Procedures (SOPs)

Laboratory-Specific SOP Template

- Standard Operating Procedures (SOP) are required by Occupational Safety & Health Administration's (OSHA) laboratory standard section (1910.1450(e3i)) to be developed and maintained by individual laboratories.
- Laboratories must perform a hazard assessment of the laboratory procedures to determine which SOPs must be developed. At a minimum a laboratory must have laboratory specific SOPs for the chemical and biological hazards and any agents which are used in approved animal studies.





Standard Operating Procedures (SOPs)

- Any chemical which has specific handling procedures or equipment should have an SOP developed for the specific use of those chemicals.
- An SOP must contain at a minimum the specific personal protective equipment required, engineering controls, decontamination procedures, waste disposal procedures and a description of the laboratory procedure that will be performed.



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Standard Operating Procedures (SOPs)

• All employees must have access to the SOPs for the laboratory. The laboratory supervisor or PI is responsible to train all employees on appropriate handling procedures for those chemical and biological hazards covered by the standard. SOPs should be reviewed annually to ensure

reviewed annually to ensure that the entire document is updated with any procedural or location changes. New SOPs must be developed when a new hazard is presented in the laboratory.

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Hazard Identification

(SDS & GHS-Labeling)

Although the OSHA Lab Standard (29 CFR) 1910.1450) applies to the laboratory use of chemicals, the elements of the OSHA Hazard Communication Standard (29CFR1910.1200) will be implemented on chemical labels and Safety Data Sheets (SDS). It is very important that lab employees be aware of the Hazard Communication labeling requirements and SDS format.



Hazard Identification (SDS & GHS-Labeling)

- With respect to labels and Safety Data Sheets:
 - Labels on incoming containers of hazardous chemicals shall not be removed or defaced.
 - Secondary and transfer containers must display the common name of the chemical <u>and</u> any relevant hazard information [i.e. NFPA 704 Hazard rating or Hazardous Material Information System (HMIS), Words "Corrosive" "Flammable" etc.].
 - Safety Data Sheets that are received with incoming shipments of hazardous chemicals must be maintained and readily accessible to laboratory employees



Hazard Identification

(SDS & GHS-Labeling)





Safety Data Sheets

An SDS will tell you the hazards and other safety and health related information on the chemical you will be using. All SDSs are standardized with 16 sections.

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- Section 1 Identification
- Section 2 Hazards identification, pictograms
- Section 3 Composition information
- Section 4 First aid measures
- Section 5 Fire fighting measures
- Section 6 Accidental release measures
- Section 7 Handling and storage
- Section 8 Exposure controls
- Section 9 Physical properties
- Section 10 Stability and Reactivity
- Section 11 Toxicology information
- Section 12 Ecological information
- Section 13 Disposal considerations
- Section 14 Transportation information
- Section 15 Regulatory information
- Section 16 Other information



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Ichem Safety Data Sheet Hazardous Substance, Dangerous Goods 1. MATERIAL AND SUPPLY COMPANY IDENTIFICATION Product name: Acetone Synonyms Product Code Acetone Bulk ACETON3210 Recommended use: Industrial solvent Supplier: Oilchem Pty Ltd ABN 55 006 040 080 Street Addre 55-57 Miller Street Epping VIC 3076 Australia Telephone (03) 9401-3377 Facsimile: (03) 9401-4657 Emergency telephone number: (03) 9401-3377 (Mon-Fri, 8:30am - 4pm, AEST) 2. HAZARDS IDENTIFICATION This material is hazardous according to health criteria of Safe Work Australia. Signal Word Danger Hazard Classifications Flammable Liquids - Category 2 Serious Eye Damage/Irritation - Category 2A Specific Target Organ Toxicity (Single Exposure) - Category 3 Narcotic Effects Hazard Statements Highly flammable liquid and vapour H225 H319 Causes serious eye irritation. H336 May cause drowsiness or dizziness Prevention Pre cautionary Statements Keep out of reach of children. P102 P103 Read label before use. P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking P233 Keep container tightly closed. P240 Ground/bond container and receiving equipment. P241 P242 Use explosion-proof electrical, ventilating, lighting and all other equipment. Use only non-sparking tools. P243 Take precautionary measures against static discharge P261 Avoid breathing dust, fume, gas, mist, vapours or spray P264 Wash hands, face and all exposed skin thoroughly after handling. P271 Use only outdoors or in a well-ventilated area P280 Wear protective clothing, gloves, eye/face protection and suitable respirator. Product Name: Acetone Reference No: OCH000101

Version: 2.0

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Lab Hygiene

• Eating, drinking, and the application of cosmetics are forbidden practices in areas where hazardous



chemicals are used and shall be done only in well-defined designated areas. Do not store food in the same refrigerator with chemicals, biohazards, or radioactive materials.



LAB SPECIFIC SAFETY ISSUES



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Environmental Health and Safety

Safety Equipment

- Certain equipment is necessary to achieve compliance and most importantly to provide adequate protection.
- The safety equipment that is needed is known as primary and secondary barriers.





Primary Barriers

• Primary barriers are referring to protective measures including engineering controls. This includes not only PPE, but also safety cabinets, fume hoods, vaccines and autoclaves.

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Chemical Fume Hoods



• The fume hood is used with chemicals. The main function is to exhaust the vapors and gases that are generated in the hood to the outside. The hood is designed to minimize your exposure to airborne contaminants. This is not to be used with biohazardous materials.



Chemical Fume Hood Use

- Make sure the exhaust blower is operating and air is entering the hood.
- Do <u>not</u> put your face inside the hood. Minimize storage of chemicals in the hood.
- Clean spills immediately.
- Work with the sash at the proper operating level of 18 inches as indicated by the arrows.
- Fume hood performance is evaluated annually by EHS.





Biological Safety Cabinet

- The biological safety cabinet (BSC) is used as a containment for infectious agents. The BSC has a HEPA filter in the exhaust system to protect the environment and yourself.
 - The (HEPA) filter is a high efficiency particulate air filter that can remove particles at a size of 0.3 microns with an efficiency of 99.97%. It is also able to remove both smaller and larger particles.



BSCs are certified annually. ILLINOIS STATE UNIVERSITY Illinois' first public university

Biological Safety Cabinet

- There are 3 classes of BSC that are used. The higher the risk group and biosafety level, the higher the class of cabinet that is used.
- If there is an infectious agent being used, whether it is used in research animals or cultured, it must be manipulated inside the BSC.



Biological Safety Cabinet

- When using this containment device, remember to also use the proper personal protective equipment. The following PPE should be considered depending on the BSL that is required for the organism that you use.
 - Gloves
 - Lab Coat
 - Shoe Covers
 - Safety Glasses





Biosafety Cabinet Use

- Always make sure that the BSC has been decontaminated both before and after use. Decontamination methods vary depending on the infectious agent being used. Once the decontamination of the cabinet is complete, place the waste in a biohazard bag for autoclave.
- Do not bring contaminated materials out of the cabinet until they have been surface decontaminated. If you are unable to decontaminate, place the material into a closed container to transfer it to the autoclave.



Biosafety Cabinet Use



- Remember to follow the work practices:
 - Work in such a way that your face is above the front opening
 - Wait for 1 minute after placing hands/arms inside the cabinet to stabilize the air flow
 - Work at least 4 inches from the inside edge of the front of the grille
 - Remember to place all materials as far back in the cabinet as possible
 - Limit the storage within the cabinet



Autoclave

An autoclave is used to treat infectious material and rDNA. As a standard for the University, all steam exhaust pipe material of this steam from jacket into chamber nature must be door inner chamber autoclaved as a steam in culture safety precaution. medium The autoclave is iacket able to render the material as

to drain

non-infectious.



ILLINOIS STATE UNIVERSITY Illinois' first public university steam'supply



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Autoclave

- It is important to know the standard operating procedure (SOP) for the autoclave. The SOP is located next to each autoclave. If the temperature or pressure is inadequate, the bag is overfilled, or the peak time is not long enough the material will not be properly decontaminated.
- Employee training must be provided and documented prior to autoclave use.



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Autoclave Use

• The material being autoclaved must be placed inside an autoclave orange bag or in a pan (Do not overfill the bag).



- Add ~250-500ml water to the bag or pan for steam to generate and properly circulate.
- A spore strip or other approved tape must be placed on the outside of the bag or pan to verify that the heat treatment was successful. You will have to verify that a color change took place.



Autoclave Use

- The autoclave must reach a temperature of 121°C (250 °F) for at least ¹/₂ hour at a pressure of 15psi.
- After successfully being autoclaved, the material can be placed in regular trash.
- Sharps must be incinerated. When the container is full, a pick up can be scheduled through EHS for proper disposal.





Autoclave Log

- Each time the autoclave is used, the log must be completed by the individual using it. The log is to be located at the site of the autoclave. The information contained within the log is as follows:
 - Date
 - Generator Name (P.I.)
 - Location
 - Time the autoclave reached 121°C
 - Max Temp.
 - Pressure
 - Type of waste
 - If spores or tape were used
 - Weight
 - Person using autoclave





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Autoclave Log

- Autoclave use must be documented on log sheets.
- Logs must be maintained for 3 years by the owning department.
- The purpose of the log is to ensure that proper decontamination is taking place.
- Ensure log forms are always available.

Biosafety Level (BSL)

- As the risk increases, the BSL also increases. The different BSLs have been established as preventative measures against human infection.
- Each BSL has specific containment practices that CDC and NIH have advised. Taking precautionary measures can help to minimize hazards associated with infectious agents.



Biosafety Level (BSL)

• When the lab specific training is conducted by your supervisor, she/he will go through the BSL guidelines for your lab.







Radiation Hazards



Any use of radioactive materials or radiationproducing equipment (i.e. x-rays and lasers) requires approval and oversight from ISU EHS along with IEMA-OHS. All work involving potentially hazardous radiation requires radiation safety training. If needed, EHS can provide access to training in Canvas. The PI or supervisor is responsible for providing appropriate engineering and administrative controls, including additional site or equipment specific training, and PPE.



SAFE LAB PRACTICES



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Environmental Health and Safety

Personal Protective Equipment (PPE)

- Respiratory Protection
 - Respirators, when properly selected and used, can offer protection against a wide variety of airborne contaminants. Respiratory protection should only be used when other methods of exposure control are not effective or impractical.
 - All respirator use must comply with <u>ISU's Respiratory</u> <u>Protection Program</u> including required medical evaluation and training/Appendix D form completion. Fit testing is provided by EHS.
 - Anyone who wishes to use a respirator must contact EHS and comply with all components of the ISU Respiratory Protection Program. EHS will perform a hazard assessment of the operation necessitating the use of the respirator and help determine the proper level of protection.



Personal Protective Equipment (PPE)

- Eye and Face Protection
 - OSHA requires that employees wear eye or face protection whenever a potential exists for accident or injury. Any use of corrosive materials or fast-moving equipment, such as centrifuges, shall constitute such a potential. Face shields shall be used when potential exists for both eye and skin injury. If splashing or vapor penetration is possible, goggles designed for such hazards must be used. Ultraviolet face shields should be available for use with UV lamps and transilluminators.





Personal Protective Equipment (PPE)





Personal Protective Equipment (PPE)

- Glove Use
 - Gloves are the Personal Protective Equipment (PPE) most frequently used by laboratory staff. Gloves must be properly selected for the materials being worked with. Gloves can be purchased in a variety of materials each offering a limited ability to resist chemical breakthrough. Lab personnel must familiarize themselves with the limitations of the gloves they are using and the compatibility of the glove with the chemicals likely to be encountered.
 - Check <u>OSHA's PPE document in the Hand and Arm Protection</u> section for Types and Chemical Resistance Selection Chart for <u>Protective Gloves (Table 4)</u>
 - Although gloves can provide adequate protection against contamination, they are not a suitable alternative to hand washing. It is recommended that laboratory personnel wash their hands thoroughly whenever gloves are removed.



Personal Protective Equipment (PPE)

- Clothing
 - Protective clothing includes lab coats or other protective garments such as aprons, boots, shoe covers, Tyvek coveralls, and other items that can be used to protect street clothing from biological or chemical contamination and splashes as well as providing additional body protection from some physical hazards.
 - Principal Investigators and laboratory supervisors are strongly encouraged to require long pants and clothing which effectively covers the torso for all laboratory personnel, including visitors, working in or entering laboratories and laboratory support areas under their supervision. Lab coats are required if shorts or skirts are worn and are not long enough to cover the knee.



Transport of Chemicals

- Glass or any other containers holding hazardous or radioactive materials shall be transported using secondary containment or on carts. Some secondary containers are available for transport from the stockroom.
- The use of atrium stairs for the transport of hazardous chemicals and waste is strictly prohibited.





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Waste Disposal

- Management of chemical and hazardous wastes at the University is accomplished by the generator of the waste with the assistance of Environmental Health and Safety (EHS).
- EHS will assist generators on campus to help assure that wastes are managed in accordance with the regulations.
- The *generator is ultimately responsible* for assuring that waste generated is managed in a safe and appropriate manner.



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Waste Disposal

 Hazardous waste must be disposed of through the Environmental Health & Safety office. If you need to have hazardous waste picked up, please submit a <u>Hazardous Waste Pick-Up</u> <u>Form</u>, or contact EHS at 309-438-8325.



Waste Disposal

- Labeling Waste Containers
 - All containers should be labeled with contents including % composition, accumulation date, associated hazards, and generator identification. Labels are available from EHS.
- Storing Waste
 - All waste shall be properly segregated and stored in a safe and secure area until picked up by EHS.



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PRECAUTION

EMERGENCY PROCEDURES



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Environmental Health and Safety

Emergency Response

• Departments are required to have specific Emergency Response Procedures that direct individuals what to do in the event of an emergency in their department. All employees must be trained and understand the specifics of their departmental Emergency Response Plan.



Evacuation Protocol

- When an evacuation has been ordered or initiated due to a fire alarm:
 - 1. Evacuate immediately by following the nearest Exit signs.
 - 2. Proceed to the designated emergency assembly area and stay away from the building. Emergency assembly areas are available in the Emergency Response Plan and the Safe Redbirds App under > Maps & Transportation > Evacuation Assembly Areas.
 - 3. After reporting to the designated emergency assembly area, begin the accountability process.
 - 4. Let the police or fire department know if someone is missing or trapped inside and/or needs assistance.
 - 5. Stay out of the way of emergency personnel and equipment.
 - 6. Do not enter the building until you are approved to do so by the University Personnel which includes Police or EHS.





Phone Numbers

• Emergencies

- 911

- Environmental Health & Safety
 – 309-438-8325
- ISU Police Dept.
 309-438-8631





Chemical Spill Response

- Minor spills can be managed by laboratory personnel familiar with the chemical spilled. Each lab has a spill response kit intended to be used on small spills of known material.
- Spills involving a large volume of material or acutely hazardous substances should be managed by trained personnel.
- If you are involved in a large spill, you must immediately contact EHS (309-438-8325) during regular business hours or ISUPD afterhours.



Chemical Spill Response

- If your spill meets any of the following criteria it is considered a large or complex spill:
 - A person is injured
 - The identity of the chemical is unknown
 - Multiple chemicals are involved
 - The chemical is highly toxic, flammable or reactive
 - The spill/leak has the potential to spread to other parts of the building such as through the ventilation system
 - The clean-up procedures are not known, or appropriate materials are not readily available
 - The cleanup requires a respirator (including cartridge respirators) to be worn, and no personnel have been trained and fit-tested in accordance with the campus Respiratory Protection Program
 - The spill/leak may endanger the environment by reaching waterways or outside ground, or by going down a drain





Accident/Incident Reporting

- For any incident resulting in a serious or lifethreatening injury to an employee, call 911 for emergency medical care.
- In the event of a workplace accident-causing injury, the injured employee and his/her supervisor should follow this procedure:
 - The injured employee, if possible, must promptly notify his/her supervisor of the injury. If the injured employee is unable to do so, a co-worker should contact the injured employee's supervisor.

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Accident/Incident Reporting

- Seeking Medical Attention
 - If the injured employee needs immediate medical attention, the supervisor, or designee in his/her absence, should call 911 and request emergency medical care.
 - If the injury does not warrant immediate care, but medical treatment or evaluation is deemed warranted, the supervisor or designee should arrange transportation via a university vehicle to the designated medical facility.

Accident/Incident Reporting

- Investigate
 - Immediately after ensuring medical attention, the supervisor should initiate an accident investigation to focus on the cause(s) of the accident and subsequent corrective actions.
 - Assistance with investigations is available from EHS.
- Report
 - For worker injuries (including GAs and TAs), the supervisor shall complete and submit the "Online Injury/Illness Log" and associated Workers Compensation forms. If there is a witness to the accident, he/she should complete the proper forms supplied by the Supervisor. <u>Accident Reporting for Work Related</u> <u>Injuries/Illness</u>
- Non-Employees
 - Non-employee injuries and illnesses must be reported to University Risk Management. <u>Accident Reporting for Non-Employee Injuries/Illness</u>



Training Completed

• You have now completed the General Lab Safety Training presentation. If you have any questions please take the time to ask your supervisor or call EHS. By signing the training form, you are stating that you have completed the training and that you understand the content within the training. Please fill out the Certificate of Completion & turn it into your immediate supervisor.



CERTIFICATE OF COMPLETION

THIS IS TO CERTIFY THAT

has completed the General Laboratory Safety Training.

On the _____ day of ______, 20____

Signature of Lab Worker



Signature of Supervisor