



# **MANAGING YOUR LABORATORY**

**for Safety and Compliance**

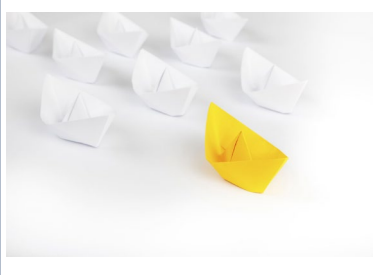
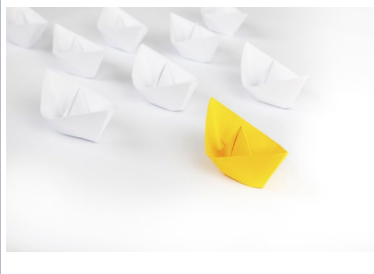
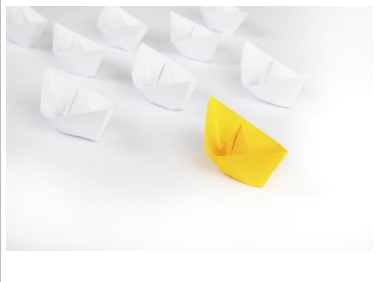
Chemical and Lab Safety Program

Environmental Health and Safety

# ABOUT THIS TRAINING

Please plan to review this training during normal business hours. If at anytime during the training you have questions, contact Jocelyn Locke at [jlocke@mailbox.sc.edu](mailto:jlocke@mailbox.sc.edu) or (803) 777-7650.

# COURSE OVERVIEW

	<p>This course is designed to provide USC faculty, staff and students with the necessary knowledge to minimize the risk of incidents and accidents while performing their job duties in the laboratory.</p>
	<p>This course is designed for Principal Investigators, Lab Managers, and Group Safety Officers who are delegated some or all of the tasks of managing a laboratory.</p>
	<p>This course presents an overview of principles and strategies for managing a laboratory to achieve and maintain safety and compliance.</p>

# YOUR SAFETY ROLES

## Principal Investigator

- Provide safety oversight for assigned lab space and personnel
- Provide lab-specific and hazard-specific training
- Provide personal protective equipment
- Ensure fundamental safety equipment is available and functional
- Enforce safety regulations, standards, and policies in your laboratory

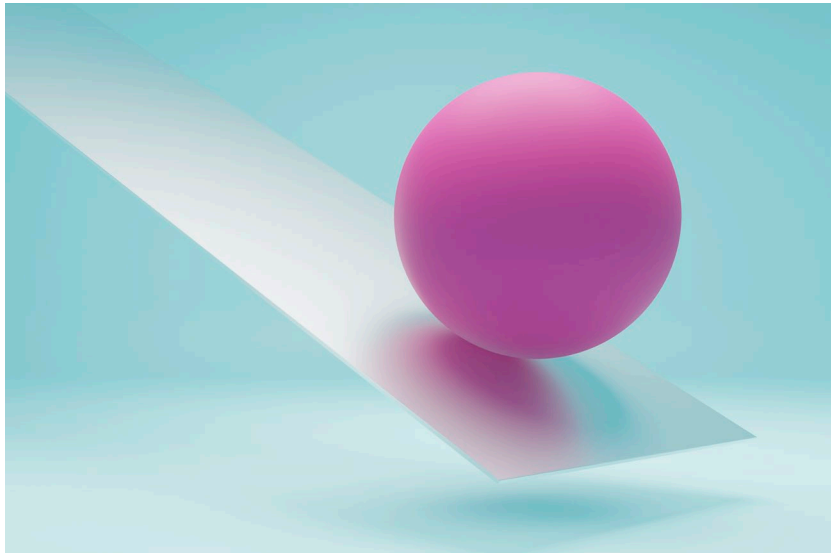
## Lab Manager

- Perform safety responsibilities delegated by the Principal Investigator such as:
  - safety equipment checks,
  - document reviews and updates,
  - training incoming lab personnel,
  - maintaining chemical inventories, and
  - others

## Group Safety Officer

- Perform safety responsibilities delegated by the Principal Investigator such as:
  - safety equipment checks,
  - document reviews and updates,
  - training incoming lab personnel,
  - maintaining chemical inventories, and
  - others

# CHALLENGES

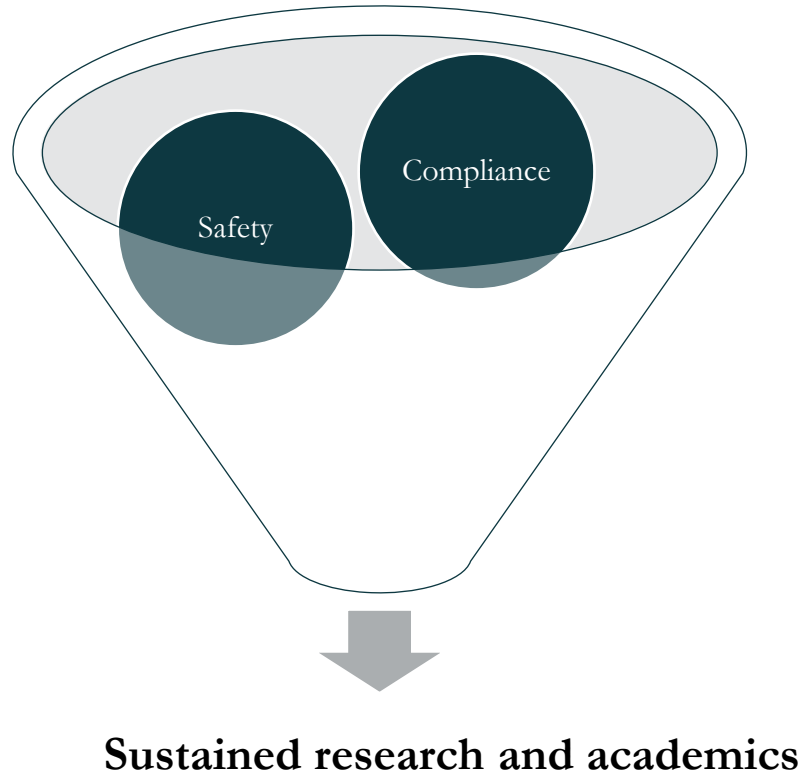


Managing a laboratory can be an overwhelming task. You may be a lab supervisor who is also a Professor with teaching and research responsibilities, a Post Doc who needs to deliver research data and peer-reviewed papers within two years, a graduate student who is also a teaching or research assistant, or you may be an undergraduate who attends classes, conducts experiments, and leads a student organization.

Research and academic activities combined with laboratory management responsibilities can be daunting- compounded by the inevitable need to meet safety requirements.

# ***FIRST, A CHANGE OF MINDSET***

*Tip:* Safety and compliance is a bridge, not an obstacle.



- Workers' productivity is enhanced in an environment where they feel safe and protected.
- Accidents, which will otherwise cost us injuries, property damage, and disruptions, are avoided.
- Future grants and financial awards, in many cases, are facilitated by compliance with regulations, standards, and policies.
- Fines are avoided with regulatory compliance.

# ***SECOND, CREATE A STRATEGY***

*Tip: Optimize the time spent on safety things.*

This training

- outlines the safety and compliance requirements for laboratories using and storing hazardous materials,
- presents strategies and resources to efficiently and effectively meet safety requirements, and
- recommends strategies to maintain safety and compliance.

# COURSE MODULE

1. Safety and Compliance Goals

2. Meeting Regulatory Requirements

3. Documentation

4. Personnel Training

5. Fundamental Safety Equipment

6. Hazard-specific Controls

7. Managing Lab Personnel and the Lab Space

8. Maintaining Safety & Compliance



# MODULE 1

## LABORATORY SAFETY AND COMPLIANCE GOALS

# DEFINITION - LABORATORY

For the purpose of safety oversight, USC Environmental Health and Safety defines a laboratory as a space where hazardous materials are stored and used for research and teaching activities.

Hazardous materials are items, conditions and agents (biological, chemical, radioactive, physical) that have the potential to cause harm to personnel, property, and the environment.

# DEFINITION - SAFETY AND COMPLIANCE

## COMPLIANCE

- The act of conforming to safety policies, standards, and regulations
- Pushed by an outside entity
- Often involves doing just enough to get by
- Referred to as the bare minimum of safety

## SAFETY

- The state of having no, or having an acceptable level of danger, risk, injury or loss
- Considered a step or several steps above compliance
- Prompted by internal commitment
- Involves engagement, participation, and discretionary effort
- Achieved and sustained only with a strong positive safety culture

# Safety and Compliance Goals

## A safe, compliant laboratory is where


- all applicable regulations, standards, guidelines, and institutional policies are met,
- fundamental safety equipment are in place and maintained in functional condition,
- hazards, risks, and controls are identified and documented,
- hazard-specific controls are implemented so that risk is reduced to an acceptable level,
- lab personnel are provided general safety training, lab-specific training, and hazard-specific training, and
- a strong, positive safety culture is valued and encouraged.

# Five Values Foundational to a Culture of Safety

(Association of Public Land Grant Universities (APLU) document)



1. Safety is everyone's responsibility.
2. Good science is safe science.
3. Safety training and safety education are essential elements of research and education.
4. An improved culture of safety is necessary to truly reduce risk.
5. Diverse methods and flexible approaches will be used by each institution.

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# MODULE 2

## MEETING REGULATORY REQUIREMENTS AND USC POLICIES

# Definitions

## Regulations

- A set of rules issued by a government body (e.g., OSHA, NIH, DEA, DOT, DHEC, EPA, NRC)
- Mandatory
- Noncompliance often results in citations and fines

## Standards and Guidelines

- Defined or established (national or international) norms or reference models that benchmark consensus best practices
- Written in a formal document, and establishes uniform criteria, methods, processes, and practices, including engineering or technical aspects
- Often referred to by regulations

## Institutional Policies

- A set of principles, guidance, or documents adopted by USC
- May describe in specific terms how certain regulations and standards are to be followed at USC
- May address items not covered by any regulation or standards and guidelines

# Regulated Hazards

## CHEMICAL

*(Details on the link below.)*

[Hazardous chemicals in laboratories](#)

[Highly hazardous chemicals, toxics, and reactivities](#)

[Flammable liquids](#)

[Compressed Gases](#)

[Carcinogens](#)

[Methylene chloride](#)

[Formaldehyde](#)

[Benzene](#)

[Vinyl chloride](#)

[DEA Controlled Substances](#)

*Etc.*

## PHYSICAL

*(Details on the link below.)*

[Electricity](#)

[Noise](#)

[Hazardous energy](#)

[Confined Space](#)

[Machinery](#)

[Portable Powered Tools](#)

[Welding, Cutting and Brazing](#)

*Etc.*

## BIOLOGICAL

Recombinant or synthetic nucleic acid molecules  
HHS/USDA Select Agents and Toxins

Bloodborne pathogens

## RADIATION

Radioactive materials

X-rays



# Biological Hazards

<b>Biohazard</b>	<b>Reference</b> <i>(Link below for more information)</i>
Recombinant or synthetic nucleic acid molecules	<a href="#"><u>NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules</u></a>
HHS/USDA Select Agents and Toxins	<a href="#"><u>Federal Select Agent Program</u></a>
Bloodborne pathogens	<a href="#"><u>OSHA Bloodborne Pathogens Standard</u></a>

# Radiation Hazards

Radioactive agent	Reference <i>(Link below for more information)</i>
Radioactive materials	<a href="#"><u>Radioactive Material Licensing and Compliance</u></a>
X-ray	<a href="#"><u>X-ray Regulations</u></a>
Class 3B & 4 Lasers	<a href="#"><u>Laser Safety Guidelines</u></a>
Visible, Infrared or Ultraviolet Lights (not enclosed)	<a href="#"><u>Non-ionizing Radiation Safety Guidelines</u></a>
Devices generating magnetic fields >5 Gauss	<a href="#"><u>Magnets Safety Guidelines</u></a>

# Chemical and Lab Safety Policies

<b>Policy</b> (Link below for more information)	<b>Summary</b>
<a href="#"><u>New Laboratory start-up</u></a>	New Faculty hires with assigned research space need to submit a new lab start-up form and meet with EH&S staff to discuss safety and compliance expectations.
<a href="#"><u>Laboratory Hazard Notice</u></a>	Lab hazard notice template needs to be completed, printed in color, and posted on all entrance doors to all laboratory rooms.
<a href="#"><u>Lab Safety Manual and Chemical Hygiene Plan, Chemical Inventory, Safety Data Sheets, Standard Operating Procedures</u></a>	These documents need to be completed and in place, before any laboratory starts performing research work in their assigned space.
<a href="#"><u>Lab Safety Training</u></a>	All lab personnel are required to complete safety training based on the type of hazard handled in the lab. Trainings include Chemical and Lab Safety, Hazardous Waste, BBP, BSL-2, Radiation Safety, PPE, Compressed Gas Safety, Managing Your Laboratory, as applicable.
<a href="#"><u>Personal Protective Equipment</u></a>	This policy outlines the type of personal protective equipment required to be worn while working in the laboratory.
<a href="#"><u>Safe Handling of Compressed Gases</u></a>	This policy outlines engineering controls, PPE, administrative controls and other safety measures required when handling compressed gases.
<a href="#"><u>Use of HF</u></a>	This policy outlines the training requirement and controls to be implemented when handling hydrofluoric acid (HF).
<a href="#"><u>Transport of Hazardous Chemicals within USC campus</u></a>	This policy outlines the proper procedure for transporting chemicals within the USC campus.

# Chemical and Lab Safety Policies

<b>Policy</b> (Link below for more information)	<b>Summary</b>
<a href="#"><u>Hazardous Waste Minimization Policy</u></a>	Each lab personnel is responsible for adhering to safe practices that will minimize the cost of disposal of hazardous chemical wastes.
<a href="#"><u>Laboratory Waste</u></a>	This policy outlines the procedures for disposing various types of wastes generated in a laboratory.
<a href="#"><u>Lab and Equipment Decommissioning</u></a>	Principal Investigators vacating assigned spaces will collaborate with EH&S staff to remove all hazardous materials stored in these spaces. Equipment that are to be disposed of, transferred or recycled need to be decontaminated prior to removal from the laboratory.
<a href="#"><u>Minors in the Laboratory</u></a>	Students between the ages of 16 to below 18 years who are not affiliated with USC are required to go through an approval process before they are allowed to participate in laboratory activities.
<a href="#"><u>Incident and Near-miss Response and Reporting</u></a>	Each lab personnel is responsible for reporting incidents, near-misses and unsafe conditions observed in the laboratory.
<a href="#"><u>Lab Renovation and New Construction</u></a>	This document contains lab safety-related guidelines for renovating or building new laboratories.
<a href="#"><u>Laboratory Preparedness</u></a>	This policy contains guidelines for shutting down laboratory operations during severe weather, holiday closings, and other events.
<a href="#"><u>Field Research Safety</u></a>	This document provides general guidance addressing potential hazards encountered when conducting off-campus research activities.

# **MODULE 3**

## **SIGNAGES & DOCUMENTATION**

# Laboratories with Chemical and/or Physical Hazards

<b>SIGNAGES &amp; DOCUMENTS</b> (Link below for templates and more details)	<b>REQUIREMENT</b>
<a href="#"><u>Lab-specific Safety Manual and Chemical Hygiene Plan</u></a>	All laboratories with chemical and/or physical hazards must develop this document by completing the template provided.
<a href="#"><u>Chemical Inventory</u></a>	Complete the chemical inventory template for upload to Campus Optics or log in to the system to add chemicals to your inventory.
<a href="#"><u>Safety Data Sheets</u></a>	Safety data sheets of all hazardous chemicals must be readily accessible to all lab personnel either in print or electronic form. Highly hazardous materials must have printed SDS in addition to electronic access.
<a href="#"><u>Standard Operating Procedures</u></a>	Required for all hazardous materials, equipment, and processes.
<a href="#"><u>Training Records</u></a>	General and lab-specific training must be provided to lab personnel prior to starting work in the lab. Training must be documented and records kept in the Lab-specific Safety Manual and Chemical Hygiene Plan.
<a href="#"><u>Lab Hazard Notice</u></a>	Complete the template provided, print in color, and post on the outside entrance door.
<a href="#"><u>Lab Emergency Procedures</u></a>	Complete the template provided and post by the exit door.

# Laboratories w/ **Biological** Hazards

DOCUMENT	REQUIREMENT
Biological Safety Manual	The <u>Biological Safety Manual</u> must be made accessible to all lab personnel.
Bloodborne Pathogens Exposure Control Plan	A site-specific <u>exposure control plan</u> must be developed for labs who handle human-derived materials.
Biosafety training certificates	See slide: <u>Training for Labs with Biological Hazards</u> .
BSL-2 signage for lab entrance doors	<u>BSL-2 Signage</u> must be placed on the entrance doors to BSL-2 labs.
Biological spill procedures	<u>Biological spill procedures</u> should be included in the biosafety binder.
Post exposure procedures	<u>Post exposure procedures</u> should be included in the biosafety binder.
Institutional Biosafety Committee (IBC) protocol	Research involving rDNA, pathogens, human-derived materials, and HHS/USDA Select Agents or Toxins requires submitting a protocol to the IBC for review and approval.

# Laboratories w/ Radiation Hazards

DOCUMENT	REQUIREMENT
<u>Radiation Safety Manual</u> – a comprehensive manual that includes policies and procedures for the safe acquisition, use, and disposal of radioactive materials, X-ray equipment, lasers, and magnets.	All laboratories using radioactive materials, and equipment that produces ionizing (X-ray) or non-ionizing radiation (UV, infrared, lasers, others) are required to have this manual.
<u>Radiation Safety Committee</u> approval	Future users of licensed radiation sources are required to submit an <u>application</u> for review by the Radiation Safety Officer and for approval by the Radiation Safety Committee.
<u>Forms</u> – new authorization, amendments, dosimetry, training, decommissioning, inventory, swipes, disposal log, laser registration	Complete forms to comply with regulatory requirements and Radiation Safety policies for safe use of radiation hazards.



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# **MODULE 4**

## **PERSONNEL TRAINING**

# Training for all Laboratories

Training	Who's Required	Platform, frequency ( See <a href="#">training schedule</a> to pre-register)
Chemical and Laboratory Safety	All lab personnel prior to working in a laboratory	In-person, every 4 years
Hazardous Waste	All lab personnel whose work will generate hazardous chemical waste	In-person for initial training; online refresher, annual
Compressed Gas Safety	All lab personnel who will work with compressed gases	On-line, every 2 years
PPE Selection, Use and Maintenance	All lab personnel prior to working in a laboratory	Online, one-time or as needed
Managing Your Laboratory	Principal investigators, Lab Managers, and Group Safety Officers	Online, one-time or as needed
HF Safety	All lab personnel who will work with hydrofluoric acid (HF)	In-person, refresher every 2 years

# Training for Labs with Biological Hazards

Training	Who's Required	Platform, frequency ( See <a href="#">training schedule</a> to pre-register)
Biosafety Level 2	Personnel working a BSL-2 lab	In-person, required every 2 years
Bloodborne Pathogens	Personnel handling or working with human-derived materials	Online, required annually
NIH Guidelines for Principal Investigators	PIs of labs conducting research involving recombinant materials	Online, required every 3 years
Shipping Biological Materials	Designated personnel shipping biological materials to locations outside the university	Online (Saf-T-Pak), required every 2 years

# Training for Labs with Radiation Hazards

Training	Who's Required	Platform, frequency ( See <u><a href="#">training schedule</a></u> to pre-register)
Radioactive Materials Course	All lab personnel working directly with radioactive materials under a Principal Investigator's approved authorization	Annually, request training by emailing <a href="mailto:radsafe@mailbox.sc.edu">radsafe@mailbox.sc.edu</a>
X-ray Safety	All lab personnel who will operate an analytical X-ray machine	Annually, request training by emailing <a href="mailto:radsafe@mailbox.sc.edu">radsafe@mailbox.sc.edu</a>
Laser Safety	All lab personnel who will operate a Class 3B and Class 4 lasers	Annually, request training by emailing <a href="mailto:radsafe@mailbox.sc.edu">radsafe@mailbox.sc.edu</a>

# **MODULE 5**

## **FUNDAMENTAL SAFETY EQUIPMENT**

# Safety Equipment Checks and Maintenance

Equipment	What to look for	Frequency	Any failure or deficiency, contact
Chemical fume hood	Certified by EH&S within the year, clean, uncluttered, good airflow according to Kimwipe test (hold a Kimwipe just below the sash opening. A good airflow would allow the Kimwipe to be pulled to a 45-degree angle)	Monthly	Facilities <a href="mailto:fmcnotify@mailbox.sc.edu">fmcnotify@mailbox.sc.edu</a> 777-7675 EH&S 777-7650 or 777-6457
Emergency shower	Clear, tepid water	Monthly flushing	Facilities 777-7675
Emergency eyewash	Clear, tepid water, water flows above nozzles to enable washing both eyes simultaneously	Weekly flushing	Facilities 777-7675
Fire extinguisher	Needle gauge on green zone, safety pin intact, hose and cylinder in good condition	Monthly	EH&S Fire Safety 777-5269, 777-6674, 777-5255
First-aid kit	Fully stocked with antiseptic wipes, antibiotic ointment, band-aids, burn cream, and bandages	Quarterly	PI or designated personnel
Chemical spill kit	Fully stocked with neutralizers, absorbent pads/pillows, PPE, small broom and dustpan, and sealable bags.	Quarterly	PI or designated personnel

# Personal Protective Equipment

Purpose	Specific type	Purpose	Source
Hand protection	Nitrile	Salts, buffers, diluted chemicals	Lab safety supply companies such as VWR, Fischer Scientific, Grainger, etc.
	Specific chemical-resistant gloves	Concentrated acids, bases, solvents, toxics, others	
	Cryogen gloves	Dry ice, liquid nitrogen, liquid argon, liquid helium	
	Autoclave gloves	Autoclave	
Skin protection	Traditional	General work with minimal hazards	
	Barrier	Work with hazardous chemicals	
	Flammable-resistant	Work with flammable chemicals and/or open flames	
	Tyvek suit	Clean-up of major spills, handling large volume of HF	
Eye and face protection	Safety glasses	Handling small volume of hazardous chemicals	
	Safety goggles	Handling large volume of hazardous chemicals	
	Face shield	When there is potential for chemical splash	

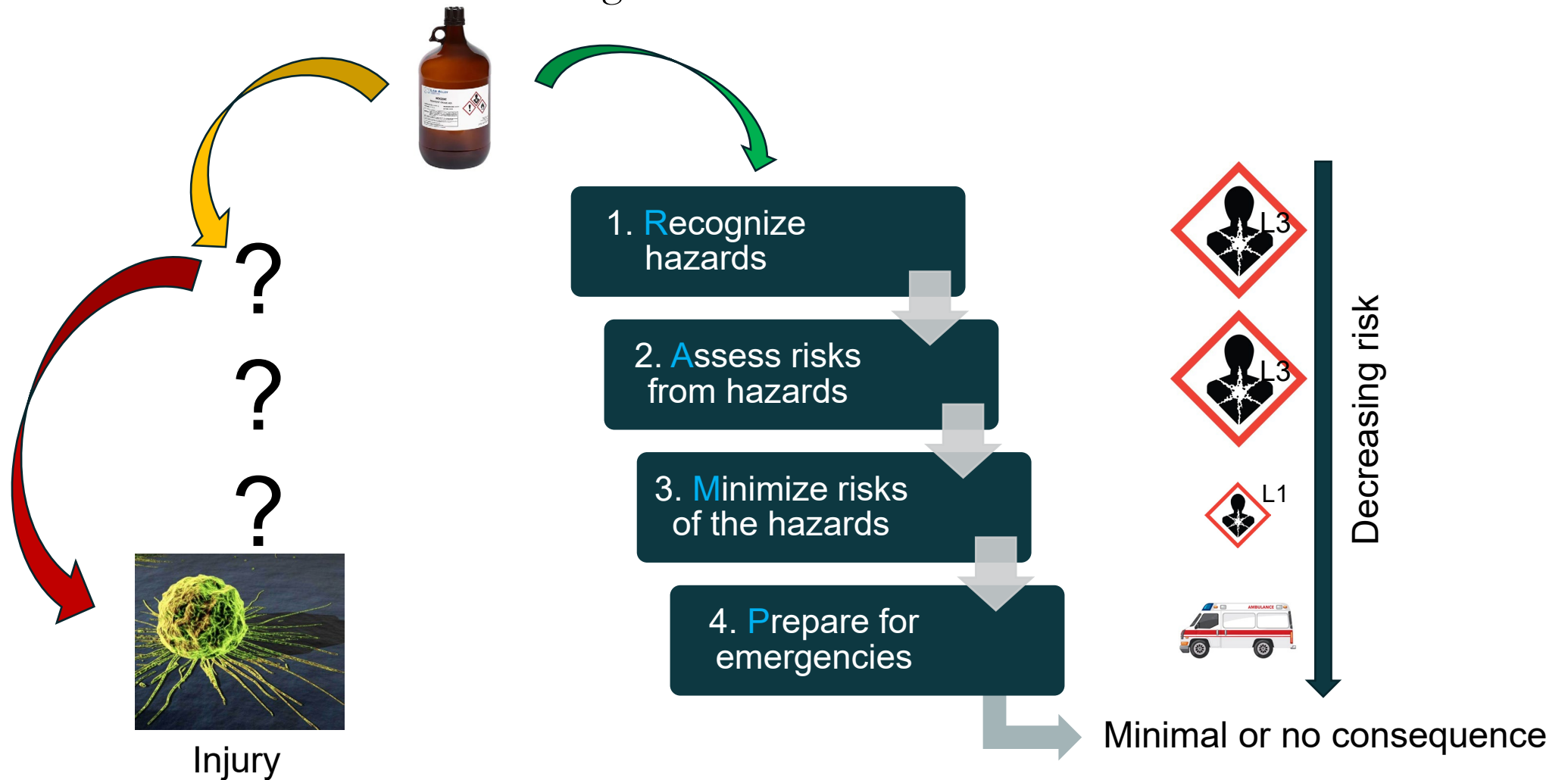
# **MODULE 6**

## **IDENTIFY & IMPLEMENT CONTROLS**

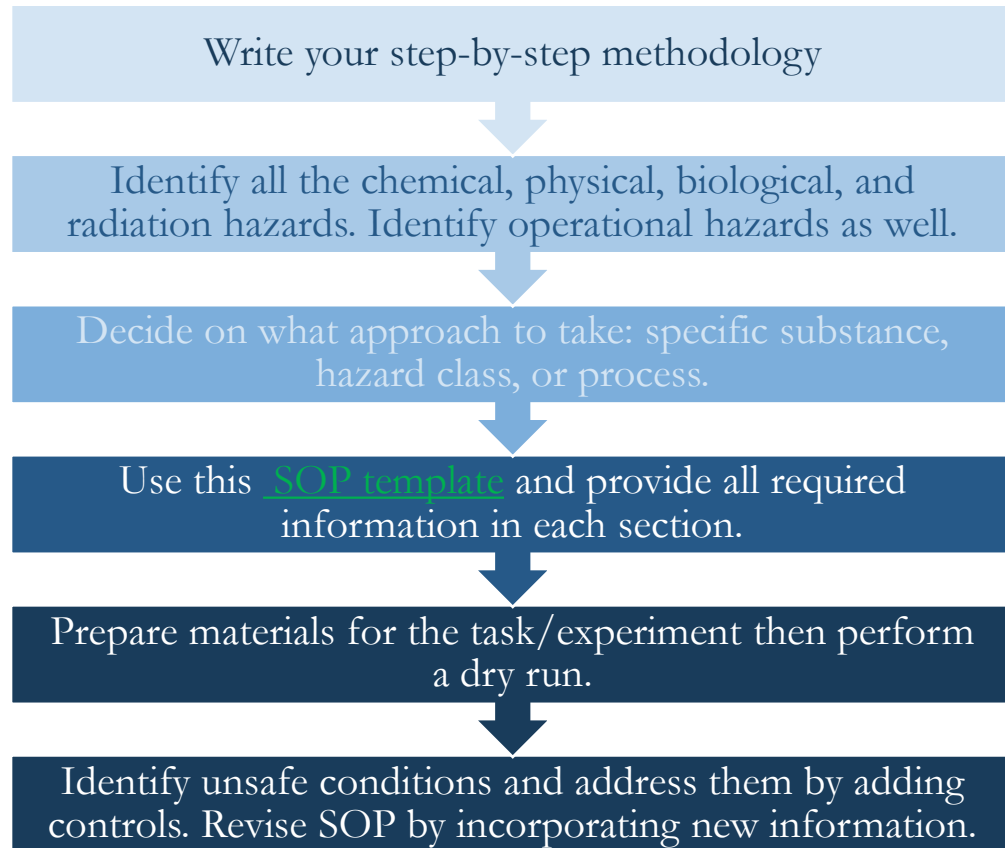


# The **RAMP** Method of Managing Lab Risks

*Tip:* Our goal is to minimize risk to an acceptable level to minimize the consequences of handling hazardous materials.



# Tip : Document hazards, risks, and controls in written Standard Operating Procedures (SOPs).



Perform literature search, consult with Principal Investigator, coworkers, and other experts.

List all hazards. Review literature, SDSs, equipment manuals, and other guidance documents.

Choose process-based SOP for procedures that use any two of chemical, biological, radiation, physical, and operational hazards.

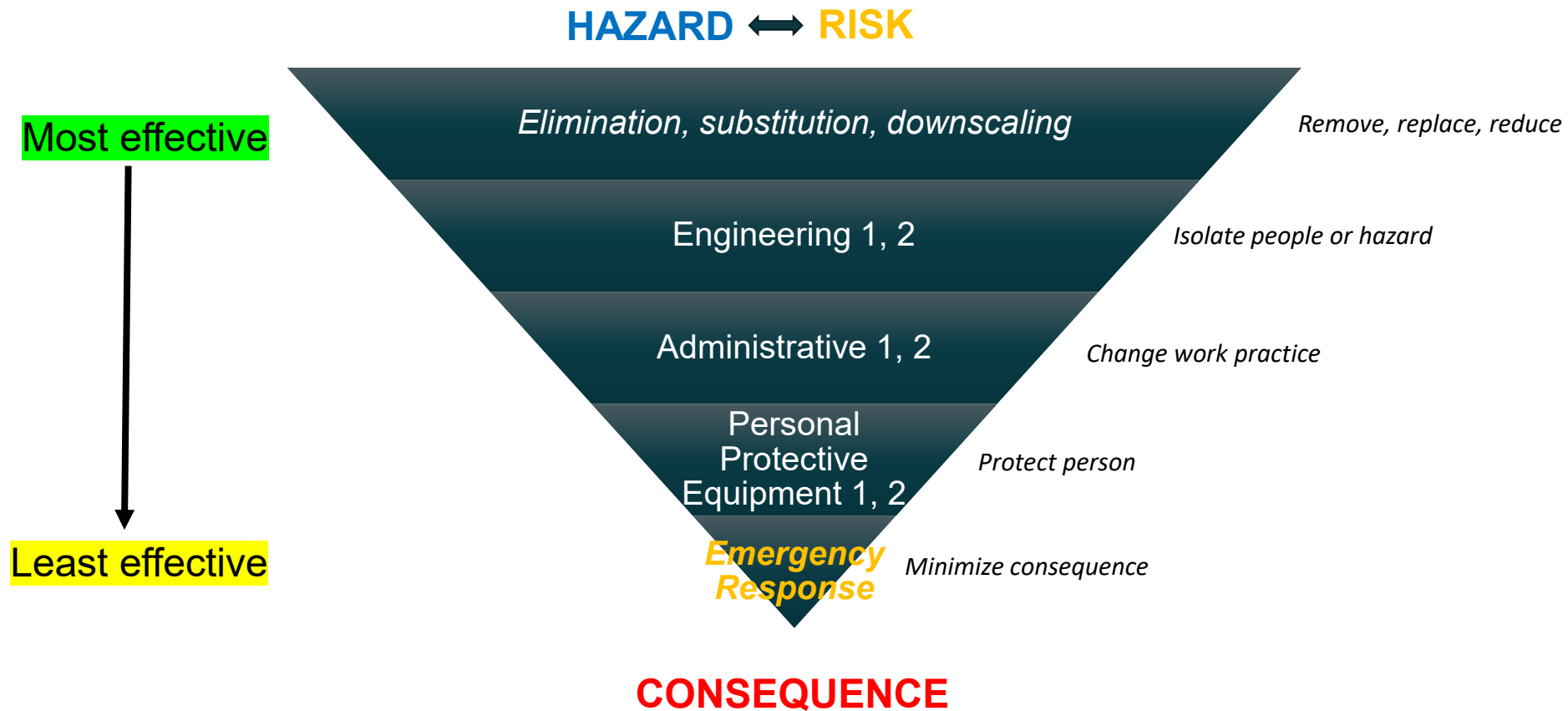
Review a sample [process-based SOP](#) for your reference.

Substitute inert materials for hazardous materials during the dry run.

Review and update SOP as new information is identified or when there are major changes to the type and/or degree of hazards.

# Hazard-specific Controls

*Tip:* Implement controls in the order of the hierarchy (top to bottom) and with redundancy as much as possible.



# Example of Controls (1)

Procedure	Hazards & Risks	Controls
Preparing 10-gal 1M HNO <sub>3</sub> -HCl bath	Inhalation of acid fumes,  Concentrated acid splash on eyes, face, arms, legs	<b>Engineering:</b> dilution inside a chemical fume hood <b>Work practice:</b> Work 8 AM-5 PM, incremental preparation (1 gal solution at a time), remove and replace gloves after they come into contact with acid <b>PPE:</b> Long pants, liquid-resistant shoes, cuffed lab coat, thick elbow-length acid-resistant gloves over nitrile, safety goggles, face shield
Rock sample digestion with 10:3:3 HNO <sub>3</sub> -HF-HCl acid mix	Inhalation of concentrated acid fumes  Concentrated acid drops on eyes, face, arms, legs	<b>Engineering:</b> digestion inside an HF rated fume hood; hood sash closed during the procedure <b>Work practice:</b> Work 8 AM-5 PM with a buddy, remove and replace gloves after they come into contact with acid <b>PPE:</b> Long pants, liquid-resistant shoes, cuffed lab coat, thick elbow-length acid-resistant gloves over nitrile, safety goggles, face shield <b>Emergency:</b> activate eyewash prior to procedure, ensure calcium gluconate is not open and not expired

# Example of Controls (2)

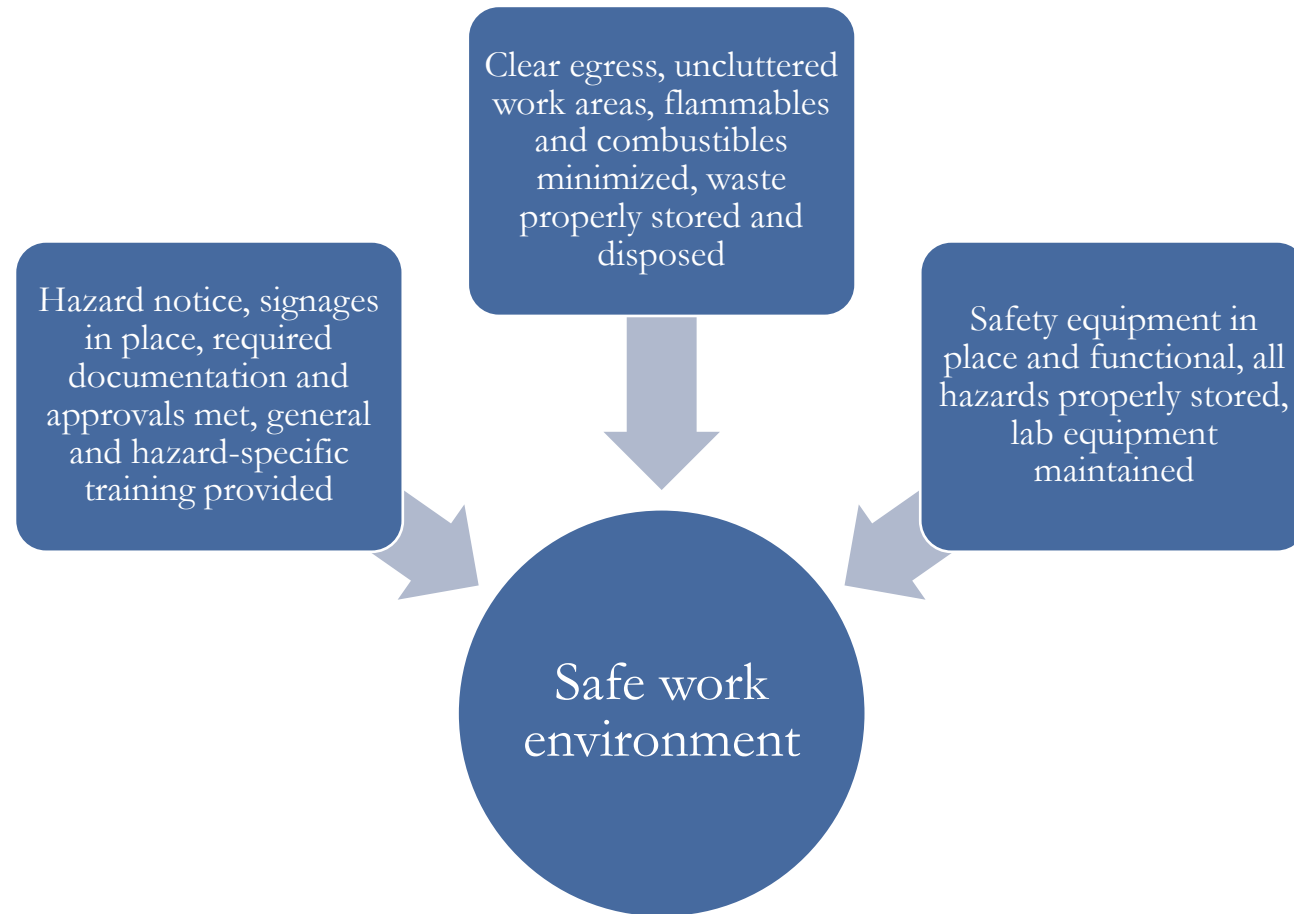
Procedure	Hazards & Risks	Controls
Fuel cell testing with ammonia	Release and inhalation of toxic ammonia gas	<b>Engineering:</b> ammonia exhaust line directed to fume hood, ammonia cylinder in gas cabinet, ammonia sensor installed in gas cabinet and near furnace <b>PPE:</b> Long pants, lab coat, safety glasses <b>Work practice:</b> system purge and leak test every experimental run, attended operations, system shutdown implemented including closing of cylinder valves and purging ammonia gas line with nitrogen.
Use of kiln for debinding and sintering preceramic objects	Extremely high temperature (>1000 deg C) can cause serious burns Optical radiation in the IR spectrum can burn eyes and skin tissue	<b>Engineering:</b> kiln equipped with emergency stop and safety interlock, negative pressure in the kiln, exhaust line vented to exhaust duct <b>Work practice:</b> no combustibles or flammables within 36 in. of the kiln, follow standard procedure for operating the kiln, double-check temperature program, signage when the kiln is ON, do not open unless temperature is below 50 deg C <b>PPE:</b> Thermal gloves, fireproof apron, IR-blocking safety glasses, face shield

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# **MODULE 7**

## **MANAGING YOUR LAB SPACE AND PERSONNEL**

# *Tip* : Provide a safe work environment.



# Safety Corner

*Tip:* Designate an area, a shelf, or a corner- a central location where safety items will be stored for visibility and easy access.

- 1 Lab-specific Safety Manual and Chemical Hygiene Plan  
Safety Data Sheets
- 2 First-aid kit
- 3 Chemical spill kit  
Bio spill kit (when applicable)
- 4 Signages, safety reminders
- 5 Personal protective equipment (safety glasses, gloves, lab coat, acid apron, etc.)





# Lab-specific Safety Training

## Chemical and Lab Safety training

- is provided by EH&S.
- is an awareness training where we outline the general principles and practices of safety in the laboratory at USC.
- does not fully equip your lab personnel nor enable them to perform specific tasks or conduct specific experiments safely in your laboratory.

## Lab-specific training

- is provided by you or a designated competent individual in your laboratory.
- is a hands-on, in-house, on-the-job safety training.
- includes on-site discussion and practice of how to do certain tasks and how to handle specific hazards safely.
- includes showing the location of and how to use safety equipment and how to respond to emergencies.
- is guided by the content of your lab-specific Lab Safety Manual and Chemical Hygiene Plan.
- is documented using a template within the document above.

# Walk-throughs

*TIP:* Periodic walkthroughs will enable you to identify safety deficiencies and correct them before they cause serious injuries or fines. See detailed checklist [here](#).

Lab area or item	Safety Criteria
Lab door	Updated hazard notice posted outside? Lab emergency procedures posted inside, locked when room is unoccupied?
Safety equipment	Fire extinguisher mounted by exit door, checked monthly, log completed? Eyewash flushed weekly, log completed? Safety Shower flushed periodically, log completed? Path to and area around shower and eyewash clear? Fully stocked first-aid kit visible and accessible? Fully stocked chemical spill kit visible and accessible?
Chemical fume hood	Uncluttered, sash movable, airflow sufficient by Kimwipe test, no chemical spill, airfoil and baffle unobstructed?
Personal protective equipment	Proper lab attire used? Lab coat, safety glasses/goggles, gloves available and used? Face shield, cryogen glove, autoclave glove, acid-resistant splash apron, ear protection available and used when applicable?
Chemical handling	All chemical containers capped & labeled? Chemicals segregated? Hazardous chemicals below shoulder level, not on the floor? Peroxide formers dated when received and opened? Flammables in flammable cabinets or flammable-safe refrigerator? Solvent pumps available when flammable containers are 5 gal or bigger?
Compressed gases	Cylinder located away from high traffic area, secured, capped when not used, proper regulator attached, proper tubing attached and visible, system leak tested? Gas cylinder transported with cylinder cart? Old cylinders returned to vendor? Gas detectors present and calibrated for pyrophoric, corrosive, toxic gases?
Electrical	Area around circuit breaker inside the lab clear? Power outlets covered? GFCI near sinks and wet areas? Power strips away from water source? Power strips not used as permanent power source? Power strips not daisy chained? Equipment locked out tagged out during servicing?

# Walk-throughs

*TIP:* Periodic walkthroughs will enable you to identify safety deficiencies and correct them before they cause serious injuries or fines. See detailed checklist [here](#).

Lab area or item	Safety Criteria
Chemical waste	QRG posted in waste areas? Container capped, in secondary containment when on the floor? USC hazardous waste tag used, no abbreviations of chemical formulas on label? Hazard characteristic label on container completed? Various chemicals in the container compatible?
Other wastes	Broken glass in medium rigid box lined with plastic, not overfilled or heavy, taped closed when full and brought to the dumpster? Empty chemical container defaced then disposed like broken glass? Needles and syringes used for chemicals contained in rigid puncture resistant plastic vessel before disposal in the trash? Used oil collected in plastic carboy, labeled "USED OIL" then collected by EH&S?
Work Practice	Food and drink not consumed or stored in lab area? Household-type appliances and items labeled "FOR LAB USE ONLY"? Office workstation away from hazards? Unattended operations stable? Work benches uncluttered? Spills cleaned up immediately? Mechanical pipetting devices used? PPEs removed and hands washed before leaving the lab? Individual lab personnel work with a "buddy" at all times especially late at night, weekends, holidays?
Others	Shipping training completed before shipping hazardous materials? Safety protocol written and followed when doing fieldwork? Following chemical transport guidelines?
General	Walkways and egress clear? Ceiling clear within 18 inches of sprinkler heads or 24 inches when no sprinkler? Combustibles minimized? Incidents and unsafe conditions reported to EH&S?
Highly hazardous substances	Mercury spill kit if mercury is present? HF spill kit, HF first-aid kit, and HF-resistant PPEs if HF is present? Reactive chemicals in glove boxes? Oxygen monitor present when liquid nitrogen is stored in small rooms with limited ventilation? Class D fire extinguisher if pyrophoric metal powders are present?

# Shared Spaces and Shared Equipment

## Shared Equipment

- Maintain a use log for analytical and other instruments.
- Label refrigerators and freezers shelves with owner names.
- Post emergency contact information for all users who store hazardous materials inside refrigerators, freezers, chemical cabinets, cold rooms, others.

## Shared Lab Room

- Post hazard notice for all PIs sharing the lab room
- Label equipment, chemical containers, wastes, and chemical storage (shelves, cabinets, refrigerators, freezers) with the owner's name
- Maintain cleanliness of assigned work areas
- Assign periodic safety equipment (eyewash, shower, fire extinguisher) checks to specific lab group members
- Put in place separate first-aid kits and spill kits for each PI sharing the lab room

# Lab Security and Emergency Preparedness

## Lab Security

- Authorized personnel only.
- Keep doors locked when the laboratory is unoccupied.
- Contractors, custodians, and other visitors must be escorted.
- Report suspicious incidents (i.e., items missing or items appearing that you did not order).

## Emergency Preparedness

- Require personnel to periodically review written emergency procedures for spills, chemical exposure, fire, fume hood malfunction, and others.
- Conduct emergency drills.
- Develop a plan for laboratory shutdown and restart for long-term non-occupancy during weather-related events and others requiring facility shutdown.

# Laboratory Wastes

*Tip:* Segregate into appropriate waste streams. [More information.](#)

Type of waste	Disposal
Chemical	Collected by EH&S Hazardous Waste staff.
Biological	Liquid neutralized with bleach then poured down the sink; solids autoclaved, placed in regular trash bin (BSL-1) or biohazard box (BSL-2). Biohazard box with BSL-2 waste collected by EH&S Hazardous Waste staff.
Radioactive	Collected by Radiation Safety staff.
Mixed (Radioactive + Bio or Chem)	Contact Radiation Safety prior to generating any mixed radioactive waste.
DEA controlled substance and other drugs	Consult <a href="#">DHEC Drug Control</a> webpage, contact <a href="#">Institutional Animal Care and Use Committee (IACUC)</a> if used in animals, or contact a reverse distributor (e.g., Triumvirate Environmental or Covanta).

# Laboratory Wastes

*Tip:* Segregate into appropriate waste streams. [More information.](#)

Type of waste	Disposal
Broken glass and other small glass items (non-contaminated)	Collect in thick cardboard box lined with plastic, seal with tape when full, label “Broken glass”, and place in dumpster.
Empty chemical containers	If p-listed chemical, dispose as hazardous chemical waste. Otherwise, collect in thick cardboard box lined with plastic, tape up when full, label “Glass”, and place in dumpster.
Gas cylinders and lecture bottles	Return to vendor. If not returnable, call EH&S for disposal.
Sharps	All labs working with biological materials- collect in sharps container, dispose in biohazard box. All other labs – chemically contaminated sharps – collect in leak-proof puncture-resistant tall container, call EH&S for disposal. All other labs – non-contaminated sharps – collect in rigid, puncture-resistant tall container, call EH&S for disposal.
Solid (Lab) Wastes	Filter papers, weighing boats, gloves, pipette tips, etc. <ul style="list-style-type: none"> <li>• if contaminated with p-listed chemicals- collect in 5-gal bucket with lid, collected by EH&amp;S as hazardous waste.</li> <li>• if not contaminated with p-listed chemical – collect as normal trash, lab personnel will place in dumpster.</li> </ul>
Office-type waste	Paper, wrappers, and miscellaneous plastic items – collect in designated trash bin. Place the bin in the hallway outside of the lab door. Custodians will collect these.

 [Back to Course Module](#)

# **MODULE 8**

## **MAINTAINING SAFETY & COMPLIANCE**



# Strategic Plan

*Tip:* Break down key tasks into specific actions, delegate, and set deadlines.

Key Task	Specific action	Responsible Person	Current Status	Due Date
Regulatory Compliance	Identify regulated hazards Prepare documents and approvals	Principal Investigator (PI) Principal Investigator	REQUIRE STATUS UPDATES EVERY 1 <sup>st</sup> WEEK OF THE MONTH MEETING	February 28, 2024
Documentation	Chemical Hygiene Plan and Safety Manual Chemical Inventory and SDS Standard Operating Procedures Training Records	Lab Mgr/Group Safety Officer Group member PI, Lab Manager, Group members Lab Manager/Group Safety Officer		June 30, 2024 May 30, 2024 May 30, 2024 Prior to starting work in lab
Provide training	Lab-specific Chemical and Lab Safety Biosafety Radiation Safety Others (Haz Waste, Compressed Gas, PPE, Managing your Laboratory)	PI, Lab Manager/Group Safety Officer EH&S EH&S EH&S EH&S		Prior to starting work in lab Week of starting work in lab Prior to starting work in lab  Prior to starting work in lab Prior to starting work in lab
Safety Equipment checks	Emergency eyewash & Shower Fire extinguisher, First-aid kit, Chemical spill kit Others	Group members Group members Group members		Recurring, weekly & monthly Recurring monthly Others
Identify and implement controls	Identify and put in place engineering, administrative, work practice, and PPE Ensure controls are used	PI, Lab Manager/Group Safety Officer  PI, Lab Manager/Group Safety Officer		Prior to starting experiments  Recurring, while working in the lab

# Use Available Resources

*Tip:* Forms, templates, and management systems are accessible through the [EH&S Research Safety website](#).

## Templates & Forms

- [New lab start-up](#)
- [Lab Hazard Notice \(Columbia Campus\)](#)
- [Lab Hazard Notice \(School of Medicine\)](#)
- [Lab-specific Lab Safety Manual and Chemical Hygiene Plan](#)
- [Chemical Inventory and SDS](#)
- [Standard Operating Procedures template](#)
- [SOP sample](#)
- [Lab Emergency Procedures](#)
- [Lab Incident Report](#)
- [Equipment Decommissioning Form](#)
- [Fume Hood Clearance](#)
- [Minors in Research Laboratories](#)
- [Minors in Teaching Laboratories](#)

## Checklists

[Laboratory Self-inspection Checklists](#) – web page includes links to General Safety, Chemical Safety, Biological Safety, and Radiation Safety checklists

## Research Management Tools

[Research Safety Management System](#)

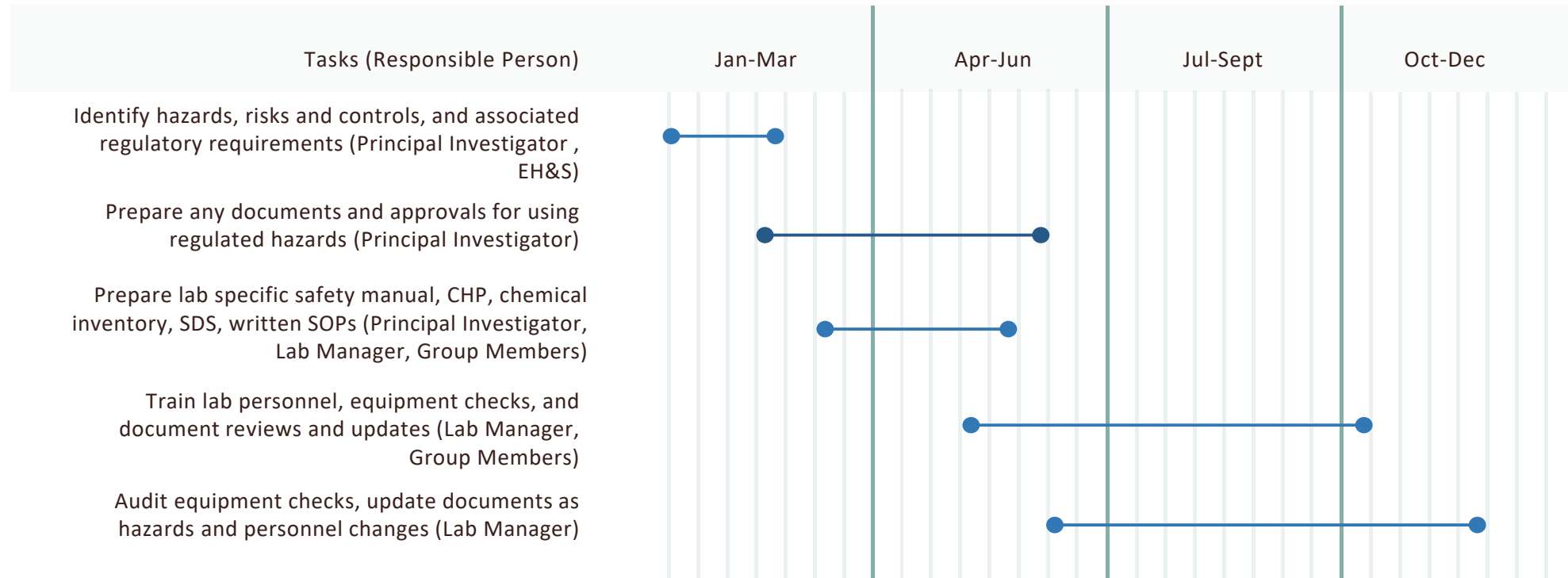
[Chemical Inventory System](#)

[IBC Protocol](#)

# Set a Timeline of Completion

*Tip:* Identify recurring activities and create a safety calendar (slide 54).

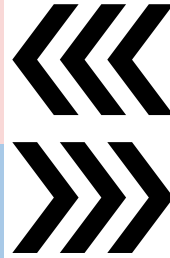
Sample general timeline for safety and compliance.



# Audit, then Repeat

## Periodic meetings and inspections



- Weekly research meetings with safety topics on the agenda
- Quarterly walkthroughs
- Biannual self-inspections








## Handling transition

- Outgoing lab manager/group safety officer should train the incoming personnel who will take over the role
- All electronic lab documentation should be archived in a shared computer drive accessible to all lab personnel.









# SAMPLE SAFETY CALENDAR

 Eyewash flush  
 Fire ext. check







 Quarterly walk-through  
 First-aid & spill kit check  
 Fume hood check

 Bi-annual self-inspection  
 Document review and update






### January

S	M	T	W	T	F	S
	 1 	2	3	4	5	6
7	 8	9	10	11	12	13
14	 15	16	17	18	19	20
21	 22	23	24	25	26	27
28	 29	30	 31 			









### February

S	M	T	W	T	F	S
				1 	2	3
4	 5	6	7	8	9	10
11	 12	13	14	15	16	17
18	 19	20	21	22	23	24
25	 26	27	28	 29 		






### March

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3	 4	5	6	7	8	9
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17	 18	19	20	21	22	23
24	 25	26	27	28	29	30
31						

### April

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14	 15	16	17	18	19	20
21	 22	23	24	25	26	27
28	 29	 30 				









### May

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12	 13	14	15	16	17	18
19	 20	21	22	23	24	25
26	 27	28	29	30	31	



### June

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23	 24	25	26	27	28	29
30						

### July

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14	 15	16	17	18	19	20
21	 22	23	24	25	26	27
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### August

S	M	T	W	T	F	S
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15	 16	17	18	19	20	21
22	 23	24	25	26	27	28
29	 30	31				






### September

S	M	T	W	T	F	S
1	 2 	3	4	5	6	7
8	 9	10	11	12	13	14
15	 16	17	18	19	20	21
22	 23	24	25	26	27	28
29	 30	 				

### October

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		1 	2	3	4	5
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20	 21	22	23	24	25	26
27	 28	29	30	 31 		

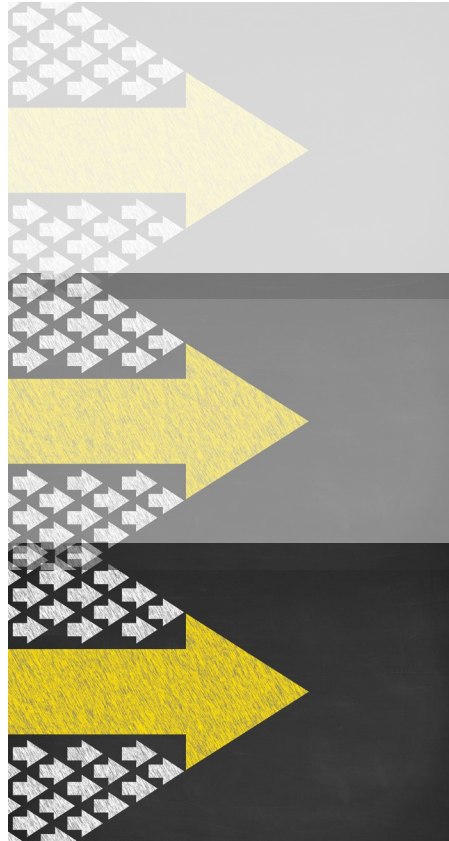
### November

S	M	T	W	T	F	S
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10	 11	12	13	14	15	16
17	 18	19	20	21	22	23
24	 25	26	27	28	29	30

### December

S	M	T	W	T	F	S
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8	 9	10	11	12	13	14
15	 16	17	18	19	20	21
22	 23	24	25	26	27	28
29	 30	31				

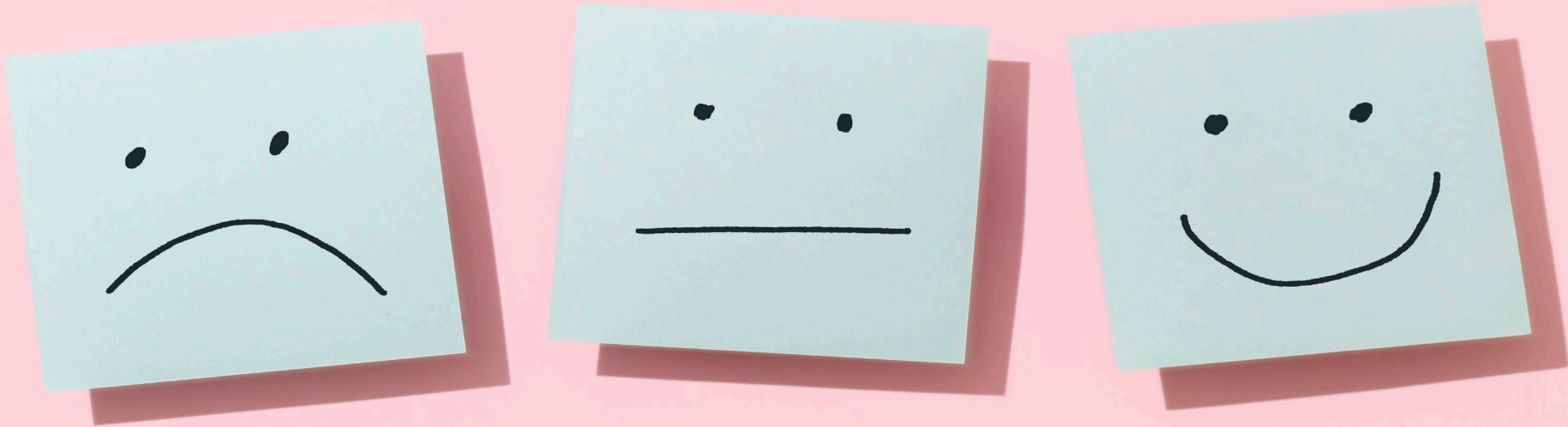
# SUMMARY



**Laboratories can be managed to achieve and maintain safety and compliance by:**

- knowing safety and compliance requirements,
- creating a strategic plan to meet requirements-
  - breaking down key requirements into specific tasks,
  - delegating the tasks,
  - setting a timeline for completion, and
  - using EH&S templates, research management tools, and guidance documents,
- conducting periodic safety meetings, document reviews, walk-throughs, and self-inspections, and
- facilitating a smooth transfer of responsibilities from the outgoing to the incoming group safety officer or lab manager.

# QUESTIONS?



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- All things Rad Safety – Caitlin Root 803-777-7530 [caitlinroot@sc.edu](mailto:caitlinroot@sc.edu)
- Everything else Lab Safety - Jocelyn Locke (803) 777-7650 [jlocke@mailbox.sc.edu](mailto:jlocke@mailbox.sc.edu)