Standard Operating Procedure for SOP\_Title

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| Department: | Choose a department.Enter department here if not listed. |
| Principal Investigator: | PI name. |
| Group Safety Coordinator/Lab Manager: | Name of safety contact. |
| SOP written by: | Name of original author of SOP. Editors’ names should be recorded in “Changes” section. |
| Date SOP was approved by PI/lab supervisor: | Click here to enter date SOP was approved. |
| Lab Phone: | Enter the lab phone number |
| PI’s Phone: | Enter the PI office or mobile phone number |
| Location(s) covered by this SOP: | Enter the building and room number |
| Emergency contact information for this location: | Enter contact information of lab personnel to be notified in case of emergency. |

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| Type of SOP: (check one) | [ ] Hazardous material(SOP describes a specific hazardous chemical) | [ ] Hazardous class(SOP describes a group of hazardous materials ) | [ ] Hazardous Process(SOP describes a hazardous process or equipment) |

**NOTE**: This SOP is intended as an initial resource and as a general reference regarding the topic discussed. It is not a substitute for hands-on training and supervision by experienced laboratory personnel. The Principal Investigator must review and approve of all information in this document for the SOP to be valid and useable.

*This SOP is not complete until: 1) Clear and detailed instructions are written that will ensure safe handling of the material or safe performance of the procedure, and 2) SOP has been approved and dated by the PI or laboratory supervisor.*

Print a hardcopy and insert into your *Laboratory Safety Manual* and *Chemical Hygiene Plan*.

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# Purpose

An SOP is a *document* establishing a *procedure* for working with hazardous chemicals or processes in a laboratory. It is a document to be *used for training* researchers and lab personnel to become *aware of the hazards* inherent in materials they will handle and processes they will operate, written to address *specific material or process hazard concerns*. The SOP combines *safety protocols together with experimental protocols* into a single document. By writing information about safety decisions into the SOP, it eliminates guesswork on the part of the researcher for decisions such as glove selection, use of fume hoods, chemical storage, waste disposal decisions, and so on. It can be used as a memory aid when performing the experiment or operating the equipment. The SOP becomes part of the lab’s Chemical Hygiene Plan or Lab Safety Plan.

For the SOP author: Describe the purpose of *this* SOP. You may also use this section to clarify the scope of this SOP, i.e., what materials, operations or processes it *does not* cover. While the use of this SOP as a training tool is encouraged, it is not a replacement for hands-on training and supervision by experienced laboratory personnel. Researchers should edit this document however they deem necessary to suit their needs. The document should then be placed in the research group’s laboratory safety plan. Training of personnel on this SOP must be documented in the *Training Record* section. Principal investigators must approve of all edits before finalizing this document.

# Key Points

Summarize the most important aspects, hazards or issues, such as:

* Specific chemical or physical hazards associated with this procedure or material;
* Necessary skills, knowledge or concepts required to operate in a safe manner;
* Necessary equipment or materials that need to be on hand to protect against exposure and deal with emergencies;
* Safe work practices or best practices that must be followed to minimize risks from the hazards.

# Important considerations

## **Prior approval from PI required?** Answer Yes or No

 If the answer above is Yes, consent must be obtained from the PI before performing the experiment or procedure. Describe the approval process here. Provide detail about the type of approval to be sought (e.g., approval to perform the experiment, approval to make modifications to the setup, and so on).

## Consultation of other reference material, documents or knowledgeable persons

Enter reference material, links to documents or name and contact info of resource person.

## Pre-requisite training or skill

Enter any pre-requisite training or skill.

# Hazard Awareness

## Introduction

A **hazard** is a condition or circumstance that presents a potential for injury, illness or property damage. Hazards vary in nature and can be chemical, biological, physical (includes electrical, radiation, temperature extremes, pressure or vacuum, noise, mechanical), and ergonomic. The negative outcomes associated with hazards include exposure, poisoning, illness, shocks, burns, fires, slips and falls, spills, explosions, and perhaps even fatalities. It is important that researchers are made aware of hazards inherent in the procedures undertaken or materials used in experiments. A comprehensive **hazard identification** and **risk assessment** must be performed on every lab experiment to identify hazards and determine the risk of consequence from the hazards. Only after identifying hazards can solutions and strategies be developed to address the hazards and control them or minimize the **risk** (likelihood of adverse events or negative outcomes associated with exposure to the hazards). In addition, there are federal, state and local **laws** that apply to many workplace settings, including academic research laboratories, that require the assurance of a safe workplace, as well as **regulations** that set and enforce standards to be complied with. Adherence to these requirements will make for a safe and healthful workplace.

For the SOP author: Perform a comprehensive **hazard identification** and **risk assessment** (see section on **Tools and resources**) on the chemical or process to identify hazards and determine their risks. You may keep the documentation of the hazard identification/risk assessment separate from the SOP, but list and discuss the hazards and risks below. It is important that researchers be made aware of hazards inherent in the procedures to be undertaken or materials to be used in experiments. The means to control the hazards must be made known to the researcher, so that he or she can apply them. Applicable laws or regulations should be cited and the means to comply with them should be stated.

## **Hazards and pertinent regulati**ons

List all possible hazards and consequences arising from each hazard. Discuss any applicable regulations and how they apply to the material, chemical class or lab procedure. Consult the ***Reference*** section for help with Hazard Identification.

## Experimental Risk Assessment

Summarize the results of the risk assessment procedure. Consult the ***Reference*** section for help with Risk Assessments.

## Means to control the hazards

For each hazard listed, briefly describe the means to control the hazard or minimize the risk of consequences due to the hazard. Defer the details of specific work practices, administrative or engineering controls and PPE to the later section on **Safe Work Practices**.

## Examples of hazardous materials or processes

Give examples of hazardous materials or procedures relevant to your lab and this SOP.

# Safe Work Practices: Engineering Controls, Administrative Controls, and PPE

## Introduction to engineering controls, administrative controls, and PPE

**Safe work practices** describe known safe and prudent policies and required practices used when performing the experiment or procedure or when handling the materials. Some chemicals are acutely toxic or carcinogenic and require a **designated area** to work with. A designated area may be the entire laboratory, an area of the lab, or a containment device such as a fume hood or glove box. Safe work practices may require the use of **engineering controls, administrative controls** and **personal protective equipment** (PPE). **Engineering controls** are part of the equipment or process designed to reduce or eliminate exposure to the hazards. **Administrative controls** are changes to work procedures with the goal of reducing the duration, frequency and severity of exposure to hazardous materials or situations. **Personal protective equipment** or PPE refers to clothing or specialized equipment worn to protect the wearer from injury or exposure. The concept of the **hierarchy of controls** asserts that one should first consider **eliminating** the hazard or **substituting** it with a lesser hazard. If that is not feasible, then engineering controls should be considered, followed by administrative controls and the finally, the use of PPE as a last resort. The notion is to apply controls proven more effective first: well-designed engineering controls remove the hazard at the source, while not requiring effort on the part of the researcher to follow certain work policies or remembering to wear the correct PPE.

For the SOP author: Describe relevant safe work practices, designated areas (if present), engineering and administrative controls and select the PPE that are needed to protect the experimenter from hazards.

## Recommended work practices

Describe any work practices or policies in this section.

## Designated area to work with the material or process

If present, specify the designated area to perform these procedures.

## **Necessary engineering or administrative controls**

Specify required controls. For help with controls, consult the ***Reference*** section.

## **Required Personal Protective Equipment.**

Discuss which PPE is appropriate to protect for each hazard. Also mention any training requirements for use of PPE. Each person using PPE must understand when PPE is needed, what PPE is needed, how to properly wear and adjust PPE, how to remove, clean/maintain or dispose of PPE, and understand the limitations of PPE. For help with PPE selection, consult the ***Reference*** section.

# Detailed procedures or techniques

## Introduction

Successful experiments require adherence to correct procedure, correct sequence of operation, observation of experimental parameters and possibly making adjustments to certain variables to ensure safe operation. After completion of the experiment, all waste material must be collected in properly labeled containers.

For the SOP author: Describe detailed procedures for performing the experiment or handling the materials in the step-by-step procedures section below. Whenever possible, point out critical steps, and describe any observations or indicators that the experiment is proceeding in a satisfactory manner. Describe any criteria that would indicate that something is amiss, as well as actions to be taken in those cases to avoid mishap. Upon conclusion of the experiment, describe the procedures for a safe shutdown, and properly deal with any waste generated. If a waste stream has already been established with a UI#, include that to aid the researcher in collection-container labelling, waste segregation and disposal.

## Step-by-step procedures

Describe in detail the proper procedures or techniques.

## Waste disposal procedure

For the SOP author: Describe the proper waste disposal procedures, including proper labeling and storage of waste containers awaiting pickup. If necessary, consult the following Division of Research Safety webpages: [Request a Waste Pickup](http://www.drs.illinois.edu/RequestAWastePickup), [Waste Disposal Guide](https://www.drs.illinois.edu/site-documents/WasteDisposalGuide.pdf) and [Chemical Waste Quick Start Guide](https://www.drs.illinois.edu/Waste/ChemicalWasteQuickStartGuide)

Chemical waste are the most common waste generated by experiments or maintenance of the experimental apparatus and typically handled as follows:

* Handle and store all waste materials according to their hazard class.
* Collect the waste into an appropriate waste container. Label the container, clearly identifying it as a WASTE container, and accurately list the contents. As a secondary (and concise) means of identification, provide the UI# or CAS# of the waste, obtained by searching the [DRS Chemical Waste database](https://www.drs.illinois.edu/site-documents/CampusUserAdvancedSearch.pdf).
* Once waste container(s) are ready for disposal, complete the [chemical waste pickup request form](https://www.drs.illinois.edu/chemicalwastepickup).
* Once you have been notified through email that the pickup has been scheduled, [print the labels](https://www.drs.illinois.edu/site-documents/CampusUserLabels.pdf), attach them to the waste containers and provide access to your lab waste during the scheduled pickup.

# **Emergency response**

## Introduction to emergency response

While prevention of lab accidents is preferred, preparation for emergency situations is an essential part of good lab practice. A laboratory and/or process-specific plan of action should be developed to increase the likelihood of predictable assessment of–and behavior during–an emergency. This plan should become part of the training procedure.

For the SOP author: Anticipate **emergency scenarios** that could arise from the process or materials in this SOP, then list them together with the preparations needed to deal with these circumstances. For each scenario, describe the appropriate **emergency response actions**, as well as the necessary **safety and emergency equipment**, in a manner relevant or specific to your location.

## Necessary emergency equipment

List equipment that should be on hand to deal with emergencies.

## What to do if there is a material release or a fault in the process.

List steps to take in case of a release of material or a fault in the process.

## What to do if there is an exposure or injury

List the steps to take in case of exposure or injury.

# Storage

## Introduction to proper storage of hazardous materials

The storage of chemicals goes beyond simply placing bottles on shelves for easy retrieval. Proper storage involves careful separation of incompatible chemicals, examination of containers for integrity, use of appropriately-sized secondary containment and management of time-sensitive or temperature-sensitive chemicals. Improper storage leads to unsafe conditions and incidents, and must be avoided.

For the SOP author: Identify and recognize incompatibilities and describe ways to safely store chemicals involved in this SOP.

## Special storage requirements

Specify storage requirements, and incompatibilities.

## Quantity limits and other storage considerations

Specify applicable regulatory or self-imposed storage quantity limits.

# Reference

## Definition of terms

Define key terms in this section. Be sure to include terms that *all* personnel (whether new or experienced) need to understand.

## Tools and resources

***Tools for Performing a Lab Risk Assessment***

Hazard recognition and identification is the first step to creating a risk assessment for your laboratory procedure. The following links provide guidance in identifying hazards and assessing the risks from the hazards.

[American Chemical Society: Hazard Assessment in Research Laboratories](https://www.acs.org/content/acs/en/about/governance/committees/chemicalsafety/hazard-assessment.html)

[Division of Research Safety: Standard Operating Procedures](https://www.drs.illinois.edu/Programs/StandardOperatingProcedures)

***Tools for selection of hazard controls***

Once the hazards have been identified, control measures aim to eliminate or mitigate (lessen) the risk from each hazard. Consult: [American Chemical Society: Control Measures](https://www.acs.org/content/acs/en/about/governance/committees/chemicalsafety/hazard-assessment/fundamentals/control-measures.html)

Chemical fume hoods are an important engineering control as they provide protection from vapors, splashes and impacts from chemicals and their reactions. Consult: [Division of Research Safety: Fume Hoods](https://www.drs.illinois.edu/SafetyLibrary/ChemicalFumeHoods)

PPE should be considered as the last line of defense against exposure to hazardous materials. If used, they must be selected correctly to protect against the hazardous material and must fit the wearer. Each person using PPE must understand when PPE is needed, what PPE is needed, how to properly wear, adjust, and remove PPE, as well as how to clean or maintain or dispose of PPE. Personnel must understand the limitations of PPE. Consult: [Division of Research Safety: Personal Protective Equipment](https://www.drs.illinois.edu/SafetyLibrary/PersonalProtectiveEquipment)

***Change management***

The SOP needs to be reviewed on an annual basis and whenever events or conditions arise that trigger a review, such as:

1. An incident or significant near miss or close call.
2. Modifications to equipment other than replacement in kind.
3. Use of a commercial product for a purpose for which it was not designed.
4. Increased risk beyond what is covered in the SOP.
5. New experiment, equipment, or control software.
6. A change/improvement in an SOP or other program document is made.
7. New materials are introduced to an experiment that were not accounted for in the SOP.
8. Changes in essential personnel.

It also helps to maintain a *change management document* that lists sections or items in the SOP that need to be checked in every review, such as web links, names of resource persons, or other information that might become outdated.

***Reference material***

[Prudent Practices in the Laboratory. Handling and Management of Chemical Hazards. NRC (National Research Council). National Academy Press: Washington, DC, 2011.](http://www.nap.edu/catalog/12654/prudent-practices-in-the-laboratory-handling-and-management-of-chemical)

[Identifying and Evaluating Hazards in Research Laboratories. ACS (American Chemical Society) 2015.](http://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/identifying-and-evaluating-hazards-in-research-laboratories.pdf)

# Record of changes made to this SOP

Describe the changes made to this document since its creation. Identify the personnel who made the edits or revisions and when the change was made.

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| **Date of change** | **Changed by** | **Description of change** |
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Standard Operating Procedure for

# Training record

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