

Laboratory Specific Appendix I. Standard Operating Procedure Template

Preparing Standard Operating Procedures for Laboratory Activities

Introduction

An important first step in planning laboratory experiments is a comprehensive evaluation of the potential hazards associated with the work. This includes hazards that may be posed by chemicals, biological and radioactive materials, equipment, physical hazards and conditions. This risk analysis should not be divorced from the other components of the planning process, but rather integrated into a single process evaluation. This evaluation should be documented and used a tool for future reference in the form of a Standard Operating Procedure. In most cases SOPs should be developed in a collaborative environment, with the involvement of multiple researchers as opposed to individually.

Elements of a Standard Operating Procedure (SOP)

There are no absolute correct or incorrect methods for developing an SOP, nor is there a single acceptable format. The process is not intended to be about filling out forms; the process, when completed appropriately, ensures that safe work practices have been developed for the experimental work. SOPs can be integrated directly into laboratory manuals or procedural experimental guides, developed for a specific hazard such as an individual chemical or class of chemicals or specific equipment. SOPs can be stand alone documents or supplemental information included as part of research notebooks, experiment documentation or research proposals. SOPs such contain, at a minimum, the following information:

- **Identification:** Identify, specifically, the intended scope of the SOP. The SOP can focus on specific processes and procedures, individual hazardous materials or groups of hazardous materials, equipment and conditions. Circumstances that would require Prior Approval, as discussed in Section 4.5 of the LCHP should also be included.
- **Process Hazards Assessment:** A hazards assessment which details potential hazards associated with the activity/process. This would include hazardous materials, physical hazards, equipment items electrical hazards, lasers etc.
- **Exposure Controls Review:** The hazards assessment information should be utilized to consider potential exposures using the four “routes of exposure” as a foundation.
- **Engineering Controls:** A detailed description of the engineering control requirements of the process/procedure along with a method of ensuring proper operation and efficacy.
- **Personal Protective Equipment:** A detailed description of the Personal Protective Equipment requirements of the process/procedure along with the location of supporting reference information.
- **Storage and Handling Requirements:** Detail storage requirements for hazardous materials and process handling issues specific to the procedure.

- **Proficiency and Authorization:** The training requirements for the specific procedure, or piece of equipment should be clearly defined, along with a mechanism to ensure proficiency within the laboratory. Specific procedures for access control and authorization during the procedure should also be outlined.
- **Waste Management:** Outline waste materials to be generated and appropriate waste management procedures for the work.
- **Decontamination Procedures:** Specific methods for decontamination/cleaning appropriate to the work being completed should be included.
- **Emergency Procedures:** Detail the specific procedures to be followed if emergency situations arise from the process/procedure. These steps will be based on the hazard assessment and controls sections.

The Office of Environmental Health and Safety can assist in the development of laboratory specific SOPs. An SOP template and an example of an experimental review and completed SOP have been provided for your consideration.

Laboratory Standard Operating Procedure-Risk Assessment

Section 1: Identification

Laboratory Group Name:

Lab Specific ID#

Lab Location:

PI/Lab Supervisor:

Date SOP Created:

Date SOP Revised:

Type of SOP:

Procedural Hazardous Material Equipment Specific Other

Prior Approval Required (As outlined in the LCHP Section 4.5) Yes No

Specific Scope of this SOP:

Section 2: Process Hazards Assessment

Hazardous Materials-Chemical

Not Applicable



Describe:



Describe:



Describe:



Describe:



Describe:



Describe:

Section 2: Process Hazards Assessment

Hazardous Materials-Biological Not Applicable



Describe:

Hazardous Materials-Radiological Not Applicable



Describe:

Physical and Equipment Hazards Not Applicable

Glassware

Compressed Gases

High/Low Pressures

Electrical

Electromagnetic

High/Low Temperatures

Centrifuge

Autoclave

Vacuum

Lasers

Microwaves

Rotary Evaporator

Open Flame

Elevated Noise

Soldering/Welding

Oil Bath

Heat Guns

Heating Mantles

Hot Plate

Ultrasonicators

Stirring/Mixing Device

Moving Parts

Puncture Hazards

Hand/Power Tools

Flying Particles

Oversized Objects

Heavy Objects

Elevated Height

Ovens/Furnaces

Computer Work

Other Describe:

Other Describe:

Other Describe:

Other Describe:

Other Describe:

Other Describe:

Section 3: Exposure Controls Review

- Inhalation Hazards Describe
 - Absorption Hazards Describe:
 - Ingestion Hazards Describe:
 - Injection Hazards Describe:
-

Section 4: Engineering Controls

Chemical Fume Hood Certification Date:
Biological Safety Cabinet Certification Date:
Laminar Flow Hood Certification Date:
Perchloric Acid Hood Certification Date:
Glove Box Localized Ventilation Shielding Guarding
Other Describe:

Other Describe:

Other Describe:

Section 5: Personal Protective Equipment

Laboratory Coat Tyvek Suit Chemical Apron
Safety Glasses Face Shield Flame Retardant Clothing
Laser Goggles Welding Shield Chemical Splash Goggles
Gloves Type:
Respiratory Protection Type:
Hearing Protection Type:
Other Describe:
Other Describe:
Other Describe:

Section 6: Storage and Handling Requirements

Not Applicable

Describe

Section 7: Proficiency and Authorization

Not Applicable

Describe

Section 8: Waste Management

Not Applicable

Describe

Section 9: Decontamination Procedures

Not Applicable

Describe

Section 10: Emergency Procedures

Describe

Notes/Comments

Example Experimental Review

Experiment: Graham's Law of Diffusion

Description: Hydrogen chloride and ammonia diffuse from opposite ends of a long tube. They meet and react to produce ammonium chloride, a white solid powder. The distances of the white powder from either end of the tube are measured, and the ratio compared with a predicted ratio from Graham's Law. The experiment is not expected to give close quantitative agreement between calculated and observed values, but the ammonia does diffuse faster than the HCl, as expected.

Procedure:

1. In a hood, one drop of concentrated hydrochloric acid is placed in well-1 of a 12-well strip.
2. A drop of 6 M ammonia is placed in well-12 of the same strip.
3. The strip serves as a source of reagents. These small amounts may be moved to a desk.
4. A glass capillary is dipped one end into the hydrochloric acid, and then the other end into the ammonia. In each case, capillary action draws a small amount of liquid into the capillary.
5. The capillary is placed flat against a dark surface. In just a few moments, a white solid forms inside the capillary.
6. Use a millimeter rule to measure the distance between the boundary of each liquid in the capillary and the white solid.
7. Clamp a long tube (20 to 25 mm in diameter) horizontally
8. Place drops of the chemicals on cotton wads set on watch glasses.
9. Using tweezers, insert these wads into the open ends of the glass tube. Stopper the ends. Note which end contains the ammonia.
10. Wait. It takes 5 to 10 minutes for the reaction to take place to a noticeable extent.
11. Mark the location of the reaction product using a marking pencil or opaque tape.
12. Measure the length of the tube, and the distance from one cotton wad to the mark.

-American Chemical Society



Laboratory Standard Operating Procedure-Risk Assessment

Section 1: Identification

Laboratory Group Name: **EHS Example**

Lab Specific ID# **Demo#1**

Lab Location: **Blaw Knox** PI/Lab Supervisor: **Dr.Smith**

Date SOP Created: **4/21/06**

Date SOP Revised: **NA**

Type of SOP:

Procedural Hazardous Material Equipment Specific Other

Prior Approval Required (As outlined in the LCHP Section 4.5) Yes No

Specific Scope of this SOP: **Procedural SOP detailing EHS considerations for experiment involving Graham's Law of Diffusion**

Section 2: Process Hazards Assessment

Hazardous Materials-Chemical

Not Applicable



Describe:



Describe: **Concentrated Hydrochloric Acid pH=1, Ammonia Solution pH=11**



Describe: **Ammonia Solution designated as Poisonous**



Describe:



Describe:



Describe:

Section 2: Process Hazards Assessment

Hazardous Materials-Biological Not Applicable **X**



Describe:

Hazardous Materials-Radiological Not Applicable **X**



Describe:

Physical and Equipment Hazards Not Applicable

- | | | |
|---|--|---|
| Glassware X | Compressed Gases <input type="checkbox"/> | High/Low Pressures <input type="checkbox"/> |
| Electrical <input type="checkbox"/> | Electromagnetic <input type="checkbox"/> | High/Low Temperatures <input type="checkbox"/> |
| Centrifuge <input type="checkbox"/> | Autoclave <input type="checkbox"/> | Vacuum <input type="checkbox"/> |
| Lasers <input type="checkbox"/> | Microwaves <input type="checkbox"/> | Rotary Evaporator <input type="checkbox"/> |
| Open Flame <input type="checkbox"/> | Elevated Noise <input type="checkbox"/> | Soldering/Welding <input type="checkbox"/> |
| Oil Bath <input type="checkbox"/> | Heat Guns <input type="checkbox"/> | Heating Mantles <input type="checkbox"/> |
| Hot Plate <input type="checkbox"/> | Ultrasonicators <input type="checkbox"/> | Stirring/Mixing Device <input type="checkbox"/> |
| Moving Parts <input type="checkbox"/> | Puncture Hazards X | Hand/Power Tools <input type="checkbox"/> |
| Flying Particles <input type="checkbox"/> | Oversized Objects <input type="checkbox"/> | Heavy Objects <input type="checkbox"/> |
| Elevated Height <input type="checkbox"/> | Ovens/Furnaces <input type="checkbox"/> | Computer Work X |

Other **X** Describe: **Clamping of glass tube**

Other Describe:

Other Describe:

Other Describe:

Other Describe:

Other Describe:

Section 3: Exposure Controls Review

- Inhalation Hazards **X** Describe: Both HCL and NH₃ are extremely destructive to mucous membranes and the respiratory tract.
 - Absorption Hazards **X** Describe: Both HCL and NH₃ are corrosive to the skin and may cause skin sensitization and may be absorbed through the skin.
 - Ingestion Hazards **X** Describe: Ingestion of HCL can cause circulatory failure. Both HCL and NH₃ are corrosive
 - Injection Hazards **X** Describe: Potential broken glass clamping action
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Section 4: Engineering Controls

Chemical Fume Hood **X** Certification Date: 2/10/06

Biological Safety Cabinet Certification Date:

Laminar Flow Hood Certification Date:

Perchloric Acid Hood Certification Date:

Glove Box Localized Ventilation Shielding Guarding

Other Describe:

Other Describe:

Other Describe:

Section 5: Personal Protective Equipment

Laboratory Coat **X** Tyvek Suit Chemical Apron

Safety Glasses Face Shield Flame Retardant Clothing

Laser Goggles Welding Shield Chemical Splash Goggles **X**

Gloves **X** Type: Nitrile wrist length

Respiratory Protection Type:

Hearing Protection Type:

Other Describe:

Other Describe:

Other Describe:

Section 6: Storage and Handling Requirements

Not Applicable

Describe X: All work for this experiment is to be conducted inside the Chemical fume hood. Caution should be employed when saturating the cotton with the liquids. Do not inhale the vapors. Caution should be used when clamping the tube to the rack as to not break the glass. HCL and NH₃ are chemically incompatible and must be stored and handled accordingly. MSDS sheets for all laboratory chemicals are located in the white binder labeled "MSDS" on the middle shelf of the tan filing cabinet. The HCL and NH₃ solutions should both be stored below 25C in the corrosives storage area under the hood. Alkaline and Acidic materials are segregated in the cabinet using secondary containment.

Section 7: Proficiency and Authorization

Not Applicable

Describe X In order to complete this experiment the user must have completed the Office of Environmental Health and Safety's *Laboratory Safety* session. In addition, the user must have received laboratory specific information regarding the use of the chemical fume hood, emergency equipment and evacuation information from a senior member of the group or Dr. Smith.

Section 8: Waste Management

Not Applicable

Describe X This experiment creates two waste streams;
#1 Cotton swabs contaminated with HCL are to be placed in the Hazardous Waste container, labeled for them, in the white cabinet under the lab bench near the sink.
#2 Cotton swabs contaminated with NH₃ are to be placed in the Hazardous Waste container, labeled for them, in the white cabinet under the lab bench near the sink.

Section 9: Decontamination Procedures

Not Applicable

Describe X When the experiment has been completed the work surface of the chemical fume hood should be cleaned with a simple soap and water solution. Soap is available under the sink near the computer

Section 10: Emergency Procedures

Describe X Small quantities (<50ml) of spilled materials can be cleaned up using soap and water. If concentrated or excessive quantities of either HCL or NH₃ are spilled the laboratory should be evacuated immediately. All large spills must be reported to Public Safety at;

EMERGENCY
276-6611

For more information on spills consult the LCHP Section 4.13.

Notes/Comments