Section 6 - Standard Operating Procedures

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### A. STANDARD OPERATING PROCEDURES (SOPs)

Laboratories must provide employees with standard operating procedures (SOPs) to be followed when laboratory work involves the use of hazardous substances. The SOPs must address all requirements to perform the laboratory procedures safely. The requirements may either be given in a cover sheet described below attached to the laboratory protocol(s), or be integrated into a protocol.

Developing SOPs is also addressed in the EH&S Laboratory Safety Standard Compliance class, which is required for a laboratory’s Principal Investigator (PI) or laboratory supervisor/manager. Registration for this class is available online at [http://www.ehs.washington.edu/psotrain/corsdesc.shtml](http://www.ehs.washington.edu/psotrain/corsdesc.shtml) or call EH&S at 206-543-7201 for more information. For advice in developing SOPs, call EH&S at 206-543-7388 or email uwcho@u.washington.edu.

SOPs obtained from other organizations and SOPs written in the form of step-by-step procedures can be used as long as all the basic components are addressed and as long as the SOP accurately describes your laboratory’s safety requirements. If SOPs are provided by outside sources (such as equipment suppliers or another laboratory) or modified from a template, they must be carefully reviewed to ensure they describe your protective measures accurately, including describing specific types of PPE and control equipment you will use.

Feel free to attach additional information, such as Material Safety Data Sheets (MSDSs) or Safety Data Sheets (SDSs) to your SOP. Chemical-specific hazard information is available in the appendices of certain regulations (such as for arsenic and lead), the EH&S web pages, other web sites, and reference books. An example of this additional information is attached to the Example Benzene SOP, viewable at [http://www.ehs.washington.edu/manuals/lsm/examplesoplinks.shtml](http://www.ehs.washington.edu/manuals/lsm/examplesoplinks.shtml).

### B. SOP COMPONENTS

Descriptions of the components using a typical SOP design are shown in Figures 6-1 and 6-2, below. An SOP template can be downloaded from [http://www.ehs.washington.edu/manuals/lsm/sop.doc](http://www.ehs.washington.edu/manuals/lsm/sop.doc).

If a “particularly hazardous substance” is involved in the process, expanded requirements must be addressed as shown in the differences between Figure 6-1 and 6-2, below. Particularly hazardous substances include substances that are extremely dangerous or toxic, or are recognized carcinogens or reproductive hazards. The criteria and example list of substances meeting the criteria are available at [http://www.ehs.washington.edu/manuals/lsm/lsmh.shtml](http://www.ehs.washington.edu/manuals/lsm/lsmh.shtml).

1. **Process Identification**
   
   Identify the name of the process. This could include the chemicals or equipment involved, if that is needed to differentiate the SOP from similar processes.

2. **Chemicals and Hazards**
   
   Identify the stock chemicals, intermediates, final compounds and wastes involved, and such factors as use of catalysts or inert compounds. List the hazards, including physical hazards such as heat, cold, and varied operating pressures which are involved in the process.

3. **Personal Protective Equipment (PPE)**
   
   PPE includes gloves, lab coats, etc., and is the least preferred method of protection if alternatives are available. However, when PPE is required, the PPE must be specified completely, such as the type of glove to be used and whether it is necessary for the entire process or at certain steps. A guidance document for PPE is available on the EH&S web site at [https://www.ehs.washington.edu/fsosurveys/ppetool.docx](https://www.ehs.washington.edu/fsosurveys/ppetool.docx) and PPE is described in this manual in Section 5.B Employee Health and PPE.
Figure 6-1  Explanation of Elements 1 to 8 on Standard Operating Procedures (SOP) Form

<table>
<thead>
<tr>
<th>Standard Operating Procedures for Chemicals or Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>#1 Process (if applicable)</strong></td>
</tr>
<tr>
<td><strong>#2 Chemicals and Hazards</strong></td>
</tr>
</tbody>
</table>
| **#3 Personal Protective Equipment (PPE)** | > 1. List the protective equipment to use; when and why it is worn; how long the equipment will last; and how to store or to take care of the equipment.  
    2. List unique types of clothing, eye protection, gloves, or respirators required.  
    3. If respirators are needed, indicate how fit testing will be provided. |
| **#4 Environmental / Ventilation Controls** | > List the environmental controls and ventilation systems needed to safely use the chemicals. This may include hoods, environmental rooms, aerosol suppression devices, etc. Describe safety features on equipment. |
| **#5 Special Handling Procedures & Storage Requirements** | > Describe any special storage requirements for the chemicals. Include restricted access areas, special containment devices, and safe methods of transportation. |
| **#6 Spill and Accident Procedures** | > Indicate how spills or accidental releases should be handled and by whom. |
| **#7 Waste Disposal** | > Describe waste disposal procedures for these chemicals. For more information refer to Section 3 of this manual. |
| **#8 Special Precautions for Animal Use (if applicable)** | > Annotate “N/A” if no animal exposure is involved. If chemicals are being administered to animals, describe how employees should protect themselves from contaminated animals and animal waste. Include information about restricted access, administration of the chemical, aerosol suppression, protective equipment, and waste disposal. |

<table>
<thead>
<tr>
<th>Particularly hazardous substance involved? (See Lab Safety Manual Appendix H)</th>
<th>YES: Blocks #9 to #11 are Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO: Blocks #9 to #11 are Optional.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#9 Approval Required</th>
<th>&gt; Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>#10 Decontamination</td>
<td>&gt; Optional</td>
</tr>
<tr>
<td>#11 Designated Area</td>
<td>&gt; Optional</td>
</tr>
</tbody>
</table>

Name: Title: Signature: Date:
### Figure 6-2  Explanation of Elements on SOP Form for Particularly Hazardous Substances

<table>
<thead>
<tr>
<th>Standard Operating Procedures for Chemicals or Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>#1 Process</strong> (if applicable) &gt; See Figure 6-1.</td>
</tr>
<tr>
<td><strong>#2 Chemicals and Hazards</strong> &gt; See Figure 6-1.</td>
</tr>
<tr>
<td><strong>#3 Personal Protective Equipment (PPE)</strong> &gt; See Figure 6-1.</td>
</tr>
<tr>
<td><strong>#4 Environmental / Ventilation Controls</strong> &gt; List the environmental controls and ventilation systems needed to safely use the chemicals. This may include hoods, environmental rooms, aerosol suppression devices, etc. Describe safety features on equipment. Provide details of ventilation or equipment (such as glove boxes) used to control the particularly hazardous substance(s).</td>
</tr>
<tr>
<td><strong>#5 Special Handling Procedures &amp; Storage Requirements</strong> &gt; See Figure 6-1.</td>
</tr>
<tr>
<td><strong>#6 Spill and Accident Procedures</strong> &gt; See Figure 6-1.</td>
</tr>
<tr>
<td><strong>#7 Waste Disposal</strong> &gt; Describe waste disposal procedures associated with the particularly hazardous substance(s). Include disposal of items contaminated by the particularly hazardous substance(s), such as supplies used to clean up spills.</td>
</tr>
<tr>
<td><strong>#8 Special Precautions for Animal Use</strong> (if applicable) &gt; See Figure 6-1.</td>
</tr>
</tbody>
</table>

| Particularly hazardous substance involved? (See Lab Safety Manual Appendix H) | X YES: Blocks #9 to #11 are Mandatory | NO: Blocks #9 to #11 are Optional |
|-----------------------------------------------------------------------------|--------------------------------------|
| **#9 Approval Required** > Indicate if the process/chemical procedure requires prior approval. Describe the approval process. |
| **#10 Decontamination** > Describe decontamination procedures for equipment and glassware. Include glove boxes, restricted access hoods, perchloric acid fume hoods, etc. |
| **#11 Designated Area** > Indicate where the "designated area" is for the particularly hazardous chemical(s) being used. The entire laboratory, a fume hood, or a portion of the laboratory can be labeled as a "designated area". |

Name: 
Title: 
Signature: 
Date:
4. **Environmental / Ventilation Controls**

Describe engineering controls to be used to minimize exposures, including fume hood, glove box, or snorkel or local exhaust ventilation systems. Describe ways to verify that the fume hood and other control system(s) are operating correctly, before using hazardous chemicals.

Provide additional details if “particularly hazardous substances” (highly toxic or dangerous chemicals, carcinogens, reproductive toxicants or select toxins) are used. Refer to Appendix H for definitions and a partial list of the “particularly hazardous substances.” These additional details should address using specific containment device(s) such as fume hoods or glove boxes.

5. **Special Handling Procedures & Storage Requirements**

Describe administrative controls such as transportation in secondary containment within or outside the laboratory space, purchase of pre-formulated liquids instead of powders to be weighed and prepared. If not specified in general laboratory rules, identify procedures such as keeping the fume hood sash as low as possible, hygiene practices such as hand washing, and procedures for removal and disposal of contaminated PPE. Identify the best practices that would be used to minimize accidents, such as placing temporary signs warning of hazards when personnel may be absent.

Specify if there are limits to the amount of reactants during the process. This also provides guidance for chemical purchases. For example, purchase the smallest quantity necessary where possible. Describe storage requirements, such as the use of secondary containment, or storage in locked cabinets.

If “particularly hazardous substances” will be used, consider restricting non-essential personnel from the area.

6. **Spill and Accident Procedures**

Describe how spills or accidental releases should be handled and by whom. Provide guidance as to limited capabilities, such as a spill of 100 ml in a fume hood may be easily handled by staff whereas a spill of 10 ml outside the hood may not be safely handled.

7. **Waste Disposal**

Describe waste disposal procedures for all wastes. Be aware that many laboratory accidents happen from inadvertent disposal of incompatible wastes into the same waste container, so ensure that different waste streams are identified where appropriate. This includes describing procedures to neutralize or treat wastes to make handling safer or to reduce the amount of hazardous waste. EH&S has preferred treatment options on the web page concerning waste minimization (https://www.ehs.washington.edu/epohazardreduce/index.shtm).

Provide additional details if “particularly hazardous substances” (highly toxic or dangerous chemicals, carcinogens, reproductive toxicants or select toxins) are used. Refer to Appendix H for definitions and a partial list of the “particularly hazardous substances.” These additional details should address additional procedures for decontamination and safely handling contaminated waste materials.

8. **Special Precautions for Animal Use (if applicable)**

Annotate “N/A” if no animal exposure is involved. If chemicals are being administered to animals, describe how employees should protect themselves from contaminated animals and animal waste. Include information about restricted access, administration of the chemical, aerosol suppression, protective equipment, and waste disposal.
9. Approval Required
Describe any requirements for obtaining authorization before being allowed to perform the procedure, operation or activity. An example could be that a worker must have training documented before performing a certain procedure for the first time. Other required authorizations could include completing a medical examination before using a respirator when performing procedures involving certain hazardous substances (e.g., lead dust, pathological organisms). Authorizations are required before a person can independently perform a process using a particularly hazardous substance. Maintain written documentation with the SOP.

10. Decontamination
Describe decontamination procedures including chemical decontaminant handling, for equipment meant to be reused.

11. Designated Area
Identify where the particularly hazardous chemicals may be used.

C. EXAMPLE SOPS
Example SOPs are available on the EH&S web site (at http://www.ehs.washington.edu/manuals/lsm/examplesolinks.shtm). If used by your laboratory, these examples must be modified and customized as necessary to make them specific to your laboratory conditions. If your laboratory generates an SOP and would like to make it available to other labs, please attach an electronic copy to an email addressed to uwcho@uw.edu.

D. STEPS TO DEVELOP YOUR SOPS
To develop your laboratory SOPs, EH&S suggests the following steps:

1. Step 1 – Modify Existing SOPs
EH&S recommends you review and modify any generic SOPs that pertain to your laboratory. This allows you to become familiar with the required elements, as described above in Figures 6-1 and 6-2.

2. Step 2 – Identify Requirements
Identify if any particularly hazardous substances (see Appendix H) are in use in your laboratory, and identify which way of writing your SOPs will best cover your laboratory’s chemicals or processes. SOPs can be written in one or more of the following ways:

   a. By Process
      By process, such as distillation, peptide synthesis, or gel electrophoresis.
      Safety requirements could be noted either by integrating them into the steps in the process or by using a “cover sheet” of safety requirements for the process. If hazardous intermediates are created, carefully consider if there are specific precautions which should be noted, such as how to tell if a release or spill occurs, what symptoms may develop if a person is exposed, and any special precautions for spill clean-up and waste disposal.
b. **By Individual Chemical**
   By each individual chemical, such as acrylamide, formaldehyde, or toluene.
   This approach may be most useful if a limited number of hazardous substances are used in the laboratory or if using a particularly hazardous substance.

c. **By Class of Chemical**
   By class of chemicals, such as mineral acids, organic solvents or peroxidizable chemicals.
   This approach may be most useful if a number of similar procedures are performed using similar substances.

3. **Step 3 – Complete the SOPs**
   After modifying generic SOPs and identifying which ways of writing are most useful in your situation, continue by developing SOPs for processes, chemicals and chemical classes not previously written. Ensure all elements of the SOPs are addressed if the SOP pertains to chemicals considered particularly hazardous (those that have a high degree of acute toxicity, are especially dangerous or are select carcinogens or reproductive toxins, such as those listed in Appendix H and similar substances).

4. **Step 4 – File the SOPs**
   After completing the SOPs, file the master copies so that everyone can find them. If they are not physically filed in the laboratory-specific information section of your CHP, the laboratory-specific information pages should be annotated to identify where the SOPs are physically located.

5. **Distributing Copies of the SOPs**
   If you provide working copies of your SOPs to your staff, keep track of how many copies you made and distributed. When you make changes, you will need to assure that the updated SOPs reach all those who perform the procedures.

   If you develop an SOP which you believe can be used by other departments in the University, please forward a copy electronically to the University’s Chemical Hygiene Officer at uwcho@u.washington.edu.

6. **Update SOPs as Needed**
   If you note changes to your process or chemical use, which impact an SOP or recognize improvements that can be made to the SOP, update it as soon as it is convenient. Note the revision date on the SOP.

   Notify all lab personnel of the revised SOP. Replace the previous SOP in your files and anywhere else they may have been placed, including the work copies which would be referred to on a daily basis by your staff and those which may be kept at the lab benches or in individual staff members’ files.