

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 stated in a cover sheet attached to the laboratory protocol(s) or be integrated into a protocol. The requirements are described in this section of the manual and a synopsis is provided in the checklist in Appendix E, Section E.G, SOP Required Elements Checklist.

B. SOP COMPONENTS

1. Required Components

The required elements are listed in the checklist in Appendix E, Checklist G. SOP Required Elements Checklist, beginning on page E-22, if you would like to compare an SOP received from another organization to the requirements. SOPs must address the following items:

a. Process Identification

Identify the chemicals, process or equipment involved. If there is any question as to the chemicals produced in the process, you should consider identifying the stock chemicals, intermediates, final compounds and wastes involved, and such factors as use of catalysts, inert compounds, heat, cold, and varied operating pressures which are involved in the process.

b. Controls

List required methods to control potential exposures, including:

- 1) Use of engineering controls. Engineering controls provide a permanent means of protection and are preferred over other types of controls. Some examples of engineering controls are working in an area with good ventilation (*e.g.*, ducted exhaust from equipment, fume hoods or glove boxes), storing particularly hazardous chemicals in locked cabinets, and using built-in barriers to restrict access to the area or to protect from potentially explosive situations.
- 2) Use of administrative controls, *i.e.*, specific safe practices such as keeping the fume hood sash as low as possible, storing chemicals with secondary containment, substituting pre-formulated liquids instead of powders to be weighed and prepared, hygiene practices such as hand washing, and procedures for removal and disposal of contaminated PPE.
- 3) Use of personal protective equipment (PPE) such as gloves, lab coats, etc., which 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. PPE is described in this manual in Section 5.B Employee Health and PPE.

c. Equipment Checks

Describe ways to verify that the fume hood and other control system(s) are operating correctly, before using hazardous chemicals.

d. Potentially Hazardous Situations

Provide guidance for handling spills and identifying if a spill is causing a hazardous situation. For example, laboratory personnel may be able to safely handle a spill of a liter of dilute acid anywhere in the laboratory, but may need to evacuate if 100 milliliters of a toxic chemical is spilled outside a fume hood. This also provides guidance when purchasing a chemical, as to the maximum size of container.

e. Waste Management

Identify safe disposal methods for routinely generated wastes. 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/epohazreduce/index.shtm>).

f. Particularly Hazardous Substances

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, providing authorizations for using the particularly hazardous substance(s), describing additional procedures for decontamination and safely handling contaminated waste materials, and establishing a designated area for the procedure.

g. Authorizations

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 should be required before a person could independently perform a process using particularly hazardous substances.

2. Appearance

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. A checklist is available in Appendix E, SOP Required Elements Checklist, on page E-25, to make it easier to assure that all the safety elements needed in the SOP have been addressed. 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.

The traditional SOP form described in this section and in Appendix D is meant to be attached as a cover sheet to a laboratory protocol or “cookbook” collection of protocols. This standardized SOP form has been used historically at the University of Washington and other institutions. It addresses all required components, in 11 basic elements. The forms in Figure 6-1 and Figure 6-2 at the end of this section provide explanation of the elements. An electronic, blank form is available at ([insert link](#))

If using the standardized SOP form, elements 1 through 8 must be completed for each process, class of chemicals, or individual chemical. For “particularly hazardous substances” (acute toxicants, highly dangerous chemicals, carcinogens, mutagens, teratogens), the 8 basic elements need to be expanded, and 3 more elements, 9 through 11, must be completed. (See Appendix H for a partial list of the “particularly hazardous substances.”)

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 in this manual, Appendix D, page D-6.

C. EXAMPLE GENERIC SOPS

Example and generic SOPs are available on the EH&S web site ([Insert link](#)) If used by your laboratory, these examples must be modified and customized as necessary to make them specific to your laboratory conditions.

D. SOP DEVELOPMENT

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 on the attached SOP forms (Figures 6-1 and 6-2) and the checklist in Appendix E.

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 up-dated 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.

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.

Figure 6-1 Explanation of Elements 1 to 8 on Standard Operating Procedures (SOP) Form

Cleveland State University

Standard Operating Procedures for Chemicals or Processes		
#1 Process (if applicable)	>	<i>The process or type of process that involves the use of hazardous chemicals in the laboratory. Describe in general terms, such as "extraction" and "distillation" or in more detailed terms, such as "spectrophotometer analysis of cholesterol extraction"</i>
#2 Chemicals	>	<i>For each process, list all chemicals, reactants, and products and describe their hazards. MSDSs/SDSs may be attached.</i>
#3 Personal Protective Equipment (PPE)	>	<i>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.</i>
#4 Environmental / Ventilation Controls	>	<i>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.</i>
#5 Special Handling Procedures & Storage Requirements	>	<i>Describe any special storage requirements for the chemicals. Include restricted access areas, special containment devices, and safe methods of transportation.</i>
#6 Spill and Accident Procedures	>	<i>Indicate how spills or accidental releases should be handled and by whom.</i>
#7 Waste Disposal	>	<i>Describe waste disposal procedures for these chemicals. For more information refer to Section 3 of this manual.</i>
#8 Special Precautions for Animal Use (if applicable)	>	<i>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.</i>
Particularly hazardous substance involved? (See Lab Safety Manual Appendix H)	___ YES:	Blocks #9 to #11 are Mandatory
	___ NO:	Blocks #9 to #11 are Optional.
#9 Approval Required	>	Optional
#10 Decontamination	>	Optional
#11 Designated Area	>	Optional
Name:	Title:	
Signature:	Date:	

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Figure 6-2 Explanation of Elements on SOP Form for Particularly Hazardous Substances

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Standard Operating Procedures for Chemicals or Processes						
#1 Process (if applicable)	>	See Figure 6-1.				
#2 Chemicals	>	See Figure 6-1.				
#3 Personal Protective Equipment (PPE)	>	See Figure 6-1.				
#4 Environmental / Ventilation Controls	>	<i>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).</i>				
#5 Special Handling Procedures & Storage Requirements	>	See Figure 6-1.				
#6 Spill and Accident Procedures	>	See Figure 6-1.				
#7 Waste Disposal	>	<i>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.</i>				
#8 Special Precautions for Animal Use (if applicable)	>	See Figure 6-1.				
Particularly hazardous substance involved? (See Lab Safety Manual Appendix H)		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">__ YES:</td> <td style="text-align: center;">Blocks #9 to #11 are Mandatory</td> </tr> <tr> <td style="text-align: center;">__ NO:</td> <td style="text-align: center;">Blocks #9 to #11 are Optional.</td> </tr> </table>	__ YES:	Blocks #9 to #11 are Mandatory	__ NO:	Blocks #9 to #11 are Optional.
__ YES:	Blocks #9 to #11 are Mandatory					
__ NO:	Blocks #9 to #11 are Optional.					
#9 Approval Required	>	<i>Indicate if the process/chemical procedure requires prior approval. Describe the approval process.</i>				
#10 Decontamination	>	<i>Describe decontamination procedures for equipment and glassware. Include glove boxes, restricted access hoods, perchloric acid fume hoods, etc.</i>				
#11 Designated Area	>	<i>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".</i>				
Name:		Title:				
Signature:		Date:				

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