



Ira A. Fulton College of Engineering & Technology
CHEMICAL HYGIENE PLAN

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1.0 OVERVIEW

This plan outlines how the Ira A. Fulton College of Engineering will protect individuals who are exposed to safety and health hazards in a laboratory setting, and comply with OSHA standard 29 CFR 1910.1450 “Occupational exposure to hazardous chemicals in laboratories”.

2.0 APPLICABLE STANDARD(S)

- ▷ OSHA 29 CFR 1910.1200
- OSHA 29 CFR 1910.1450

3.0 PURPOSE

This plan aims to protect individuals who work in a laboratory where there are hazards present due to the work being performed. To do this the college requires supervisors to:

1. Ensure certain chemicals are pre-approved for use before acquisition;
2. Perform and document Risk Assessments. These are to be incorporated into or appended to written Standard Operating Procedures (SOP’s) for the work being performed. Risk Assessment components include:
 - a. Identification and understanding of the hazards present
 - b. Identification of hazard specific training
 - c. Degree of each hazard present (e.g. amount of a particular chemical used) and worst case scenario
 - d. Identification of the correct work environment
 - e. Identification of engineering controls needed to perform work safely (e.g. lab hood, blast shielding, rupture pins, pressure relief disks, etc.)
 - f. Identification of safe work practices
 - g. Identification of personal protective equipment needed and when it is to be used
 - h. Response plan in case of an unexpected event
 - i. Response plan in case of an emergency
 - j. Response plan in case of a near miss accident
3. Make sure written standard operating procedures (SOP’s) have been created for the work being performed. The SOP’s need to be detailed enough to help someone perform the work safely and incorporated into laboratory specific training;
4. Ensure laboratory workers are adequately trained prior to performing their work; and
5. Manage changes to the work. If there are changes to the work then a new Risk Assessment must be performed and documented.

This plan also provides guidance regarding how chemicals are to be stored, containers labeled, Safety Data Sheets (SDS) acquired and kept readily available to lab workers, and outlines what training is required.

4.0 SCOPE

The procedures and requirements found in this Chemical Hygiene Plan (CHP) apply to all individuals who work in laboratories in the college where “hazardous chemical(s)” are present. *Note: “hazardous chemicals” are defined by OSHA in standard 29 CFR 1910.1450, which is*

available online at

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106

“Hazardous chemical means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term “health hazard” includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.” 29 CFR 1910.1450

5.0 REQUIREMENTS

Primary responsibility for implementation of health and safety requirements in the laboratory rests with the faculty supervisor (principal investigator) of those who will use or work around the hazardous chemicals. Supervisors are to ensure that the following steps are completed for the work that is to be performed:

5.1 Step 1: Preparatory Measures

- Ensure that all chemicals in the laboratory are inventoried. Risk Management may have resources to help do this (2-6156);
- Dispose of unneeded chemicals by providing them to Hazardous Materials Management [(2-6156) call if you need direction];
- Divide laboratory work into specific processes or tasks. The scope of each process or task is up to the faculty supervisor. One or both of the following methods could be considered: 1) identify a few processes or tasks of large scope that cover a number of, or all research activities; And/or 2) focus on specific processes or tasks individually. For instance, titration may be included as an element of several processes of large scope or, alternatively, may be documented as a single process of narrow scope.
- Provide each process or task with a title (e.g., Sample Preparation, Titration, Chemical Vapor Deposition, Measurement of Reaction Rates in a CSTR, etc.)
- Make sure chemicals are **stored and labeled** as follows:

Chemicals must be stored in accordance with compatibility. Storage guidelines can be found on product labels and Safety Data Sheets [(SDS) formerly known as Material Safety Data Sheets]

Acids, bases, and flammable liquids must be stored in secondary containment (e.g. catch basins).

All primary chemical containers must bear a manufacturers label. This label must be maintained in good readable condition. Once primary containers are empty they are to be disposed of in accordance with Hazardous Waste Management requirements. Secondary chemical

containers must be properly labeled bearing the product name as identified on the Safety Data Sheet (SDS) and applicable hazard warnings (e.g. wording and/or pictograms). If the secondary containers are too small to be labeled then the container holding the small secondary container can be labeled (other similar methods of labeling are also acceptable).

- Make sure all workers have immediate access to ***Safety Data Sheets (SDS's)***. Each laboratory is required to maintain a complete set of Safety Data Sheets (SDS) for all chemicals used or stored in that lab. Electronic storage is acceptable so long as those using the substances have immediate access to the SDS's if the need arises. *Note: you may still encounter Material Safety Data Sheets [which preceded SDS] until Dec 2015.*

5.2 Step 2: Pre-Approval

Some chemical substances must be pre-approved by the college and Risk Management before they are acquired. Use the Chemical Pre-Approval Worksheet provided in Appendix C of this document to determine whether or not a substance requires pre-approval.

5.3 Step 3: Safety & Health Risk Assessments

Use the Safety & Health Hazard Checklist and the Safety Risk Matrix found on the college website (<http://www.et.byu.edu/safety/documents>) to perform a qualitative safety risk assessment of the work being performed. *Note: the Safety & Health Hazard Checklist can also be found in Appendix D.*

If the risk associated with the work you are performing is “higher” according to the Risk Assessment Matrix then perform a quantitative risk assessment (e.g. HAZOP or fault-tree-analysis)

Safety & Health Risk Assessments must satisfy the criteria found in section 3.0 above.

The college Health & Safety Officer is available upon request to help laboratories perform Risk Assessments, including identification of hazards and possible hazard control measures.

5.4 Step 5: Who Should Participate in the Risk Assessment Process

Faculty supervisors are to select those individuals who will help perform the Risk Assessment. Working together as a whole, these individuals must understand:

- The steps necessary to perform the work; and
- The safety and health requirements pertaining to the work

A person with the authority to purchase what is needed to perform the work safely also needs to be present.

Participants need to have received training enough to help identify the hazards present for the work to be performed.

5.5 Step 6: Standard Operating Procedures (SOP's)

Create written standard operating procedures (SOP's) for the work being performed, making sure they are detailed enough to help someone perform the work safely. Once they have been created, the SOP's need to be incorporated into laboratory specific training

Each SOP will incorporate a completed Risk Assessment in accordance with section 3.0. Written SOP's need to include Process and Instrumentation Diagrams (P&ID) when:

- The work involves the use of compressed gases that are connected to piping/instrumentation/equipment; and/or
- The work involves the use of a pressurized system (*Exemption: manufactured equipment such as a pressure washer being used as intended by the manufacturer*).

P&ID will help make sure the system is understood and facilitate evaluation of thereof. A P&ID helps evaluation of materials used, pressure ratings, and helps identify the proper location(s) for pressure relief. See Appendix E for an example P&ID.

Appendix B includes a template for an SOP.

5.6 Step 7: Training

Training consists of Basic Safety Training (YTrain) and Laboratory Specific Training, both of which must occur **prior** to allowing an individual to work in a laboratory where chemicals are used. *All individuals are to receive this training as a condition for continuing employment.*

Training must recur often enough to ensure the safety of those exposed to hazardous chemicals in a laboratory. Training must be adjusted accordingly when work processes or tasks are altered.

5.6.1 Basic Safety Training

Basic Safety Training includes completion of the following training courses, which are found on BYU YTrain:

Introduction to Safety and Health in the College of Engineering
Basic Compressed Gas Cylinder Safety
Basic Emergency Response

Basic Safety Emergency Eyewashes, Showers, & Drench Hoses
Basic Electrical Safety
Basic Laboratory Safety
Basic Chemical Spill Response
Basic Chemical Storage
Basic Safety Fire Extinguishers
Hazard Communication College of Engineering

Basic Safety Training is recorded electronically upon successful completion of the quizzes associated with each presentation.

Contact your department secretary for details regarding access and completion of the requisite Basic Safety Training courses.

5.6.2 Laboratory Specific Training

Faculty supervisors are to ensure individuals working for them receive specific safety training. This training is to ensure those who are performing the work know:

- a. What work they will be performing and how to perform it properly. This includes how to use machines/equipment properly;
- b. The hazards associated with the work. This includes a review of all applicable SDS's;
- c. What controls are being utilized to control the hazards and minimize risk – this includes a review of any relevant Process & Instrumentation Diagrams (P&ID) and associated controls;
- d. How to use/maintain hazard controls (e.g. maintenance of pressure relief valves);
- e. Any relevant emergency procedures the workers need to know. For example, what to do if chemical(s) are spilled or accidentally released (see further guidance below);
- f. How to dispose of “Unwanted Lab Material”; and
- g. Any other specific training Laboratory Supervisors deem necessary

Chemical spill/release information and training needs to address:

- Methods for detecting a chemical release (e.g. use of the toxic gas monitoring system and alarms);
- Any necessary first aid or medical responses needed to address exposure situations (e.g. individuals working with hydrofluoric acid must complete specialized training and understand the importance of applying calcium gluconate to exposed body parts immediately after exposure.)
- Any emergency shutdown procedures that can and should be performed safely by laboratory workers;
- Whether or not individuals need to evacuate the laboratory, or if the building alarm should be triggered and the building be evacuated;

- Whether or not it is appropriate for laboratory workers to address the spill or release themselves, or if the affected area needs to be evacuated and dispatch contacted (422-2222);
- How to stop and clean-up the spill or release safely if appropriate to do so; and
- Any additional organizations that should be contacted (e.g. Risk Management, department, college, etc.).

Once specific safety training has been completed, a record is to be made and submitted to your Department office. Departments are to maintain training records for at least the duration of employment/study within the college.

Note: a number of safety presentations have been created and are available on the college health & safety website. These presentations are available for use during laboratory meetings and review topics that have been addressed in further detail during Basic or Laboratory Specific safety training. The form in Appendix A of this document is provided as a means of recording such training.

Departments submit a report to the College Health and Safety Officer at the end of every semester/term regarding the percentage of new hires that completed general and specific safety training that semester.

5.7 Step 8: Periodic Review of Work Practices & Existing Documents

Faculty supervisors are to make sure a thorough periodic review of the Risk Assessment, SOP, work practices and other hazard controls associated with the work they supervise occurs on a periodic basis.

5.8 Unwanted Lab Material & Hazardous Waste

“Unwanted Lab Material” is picked up by Hazardous Material Management. Such material must be placed in a container that bears a label stating “Unwanted Lab Material”. These containers must be kept closed at all times other than when actually placing chemicals within the container. Please contact Risk Management (801-422-4468) if you have any questions. Hazardous Material Management information is available for review online at <http://risk.byu.edu/environmental/procedures.php>

6.0 RESPONSIBILITIES

6.1 Risk Management

- Perform annual laboratory assessments for the Ira A. Fulton College of Engineering & Technology.
- Communicate with the college regarding issues such as, but not limited to, lab and shop assessments, and hazardous chemicals being sought by individuals in the college.

- Monitor the purchase of substances, and pre-approve use of substances as appropriate.
- Review safety-related incidents that occur in laboratories within the college.
- Annually test the face velocity of laboratory hoods throughout the college and work with Physical Facilities to correct deficiencies.
- Inspect emergency flushing facilities on an annual basis and work with Physical Facilities to correct any problems.

6.2 Hazardous Materials Management

- Maintain an up-to-date academic hazardous material inventory.
- Collect “Unwanted Laboratory Material”.
- Monitor disposal of chemicals.
- Upon request, provide assistance to individuals decommissioning a laboratory.

6.3 College and Departments

- Provide online Basic Laboratory Safety training (college).
- Institute programs and help faculty members maintain a safe working environment for themselves and their students.
- Provide a college Health & Safety Officer (801-422-6589) to serve as a resource.
- Collect and maintain training records (at department level).
- Address issues identified by Risk Management.

6.3 Faculty Supervisors (Principal Investigators)

- Maintain a safe working environment for students and employees.
- Ensure that the Chemical Hygiene Plan is fully implemented.
- Investigate near misses and/or accidents that occur in the laboratory, and revise health & safety measures as necessary to prevent future accidents.
- Ensure that no one under the age of 18 is allowed to work in a laboratory unless prior approval has been granted by Risk Management.

6.4 Laboratory Employees & Students

- Complete basic and laboratory specific training as outlined in this plan before working in a laboratory.
- Perform your work in a safe manner, in accordance with your training and this Chemical Hygiene Plan.
- Report any “near misses” to your faculty supervisor.
- Report any unsafe conditions or practices to your faculty supervisor, and work with others to create a safe working environment.

7.0 LABORATORY ASSESSMENTS

All laboratories in the college will be assessed by Risk Management at least once per year. A follow-up visit will be performed by Risk Management 6-months after the initial yearly visit. Laboratory assessment results will be provided to the faculty supervisor(s) who manage the laboratories and the college Dean's Office. When notified by Risk Management, the college will follow-up on issues of immediate concern, and those that are not addressed in a timely manner.

8.0 MEDICAL CONSULTATION & EVALUATIONS

All employees have the right to receive medical attention:

1. After being exposed to a hazardous chemical in the laboratory and developing signs or symptoms associated with exposure to that hazardous chemical;
2. When exposure monitoring results for an OSHA regulated substance requires medical surveillance; and
3. Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure. In this case, medical consultation can be sought for the purpose of determining the need for a medical examination, which will be provided if needed.

All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable times and locations. Follow-up exams and/or treatment prescribed by the physician(s) will also be provided to the employee under the same conditions.

9.0 APPENDICES

Appendix A
Record of Periodic Safety Training

Date: _____

Faculty Member: _____ Research Group _____

Attendees:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

Topic(s):

Information:

Appendix B
Template for Standard Operating Procedure (SOP)

Brigham Young University

SOP

Standard Operating Procedure

[Title]

Principal Investigator:

Primary Contact:
Secondary Contact:

Lab #:

Building:

Contents	Page
Appendix:	

Important Phone Numbers:

University Police: 801-422-2222
Risk Management: 801-422-4468
College Health & Safety Officer: 801-422-6589

Completed By:
Edited By:

Approved By:

Description of Work and Scope of SOP

Prequalifications

Chemicals Used:

Summary of Physical Hazards

Summary of Chemical Hazards

Equipment Required to Perform Work

Engineering Controls

Personal Protective Equipment (PPE)

Step-by-Step Procedures for How to Safety Perform Work

A.

“Unwanted Lab Material” Collection Procedures

Summary of What Training is Required

Chemical Spill / Release Procedures

Attachment: Lab Layout

Appendix C Chemical Pre-Approval Worksheet

Complete this worksheet to identify substances that require **approval** prior to acquisition and use.

Step 1 - Make sure you have all of the Safety Data Sheet(s) for the chemical substances you will be using during your work. You have to use Safety Data Sheets (SDS), not Material Safety Data Sheets (MSDS). If you don't have the SDS's then you'll need to obtain them from the manufacturers – see their website or call them.

Step 2 - Identifying Those Chemical Needing Approval Prior to Acquisition

Hazards – using the Hazard Classifications found on the SDS's mark the applicable boxes below.

Note: sometimes the Hazard Class is abbreviated or there is some ambiguity, so the associated classification code and Hazard Category codes have also been provided. Any substance you identify that has an asterisk () by it requires approval from Risk Management & Dean's Office before obtaining or using this substance*

<u>Safety Hazard Class</u>	<u>Health Hazard Class</u>																																																																														
<input type="checkbox"/> Explosives <table style="margin-left: 20px; border: none;"> <tr><td>H200</td><td>*</td></tr> <tr><td>H201</td><td>*</td></tr> <tr><td>H201</td><td>*</td></tr> <tr><td>H203</td><td>*</td></tr> <tr><td>H204</td><td>*</td></tr> <tr><td>H205</td><td>*</td></tr> </table> <input type="checkbox"/> Flammable Gases <table style="margin-left: 20px; border: none;"> <tr><td>H220</td><td>1</td></tr> <tr><td>H221</td><td>2</td></tr> </table> <input type="checkbox"/> Flammable Aerosols <table style="margin-left: 20px; border: none;"> <tr><td>H222</td><td>1</td></tr> <tr><td>H223</td><td>2</td></tr> </table> <input type="checkbox"/> Flammable Liquids <table style="margin-left: 20px; border: none;"> <tr><td>H224</td><td>1</td></tr> <tr><td>H225</td><td>2</td></tr> <tr><td>H226</td><td>3</td></tr> <tr><td>H227</td><td>4</td></tr> </table> <input type="checkbox"/> Flammable Solids <table style="margin-left: 20px; border: none;"> <tr><td>H228</td><td>1 or 2</td></tr> </table> <input type="checkbox"/> Self-Reactive <table style="margin-left: 20px; border: none;"> <tr><td>H240</td><td>*</td></tr> </table>	H200	*	H201	*	H201	*	H203	*	H204	*	H205	*	H220	1	H221	2	H222	1	H223	2	H224	1	H225	2	H226	3	H227	4	H228	1 or 2	H240	*	<input type="checkbox"/> Acute Toxicity, Oral <table style="margin-left: 20px; border: none;"> <tr><td>H300</td><td>*</td></tr> <tr><td>H301</td><td>*</td></tr> <tr><td>H302</td><td>4</td></tr> <tr><td>H303</td><td>5</td></tr> <tr><td>H304</td><td>1</td></tr> <tr><td>H305</td><td>2</td></tr> </table> <input type="checkbox"/> Aspiration Hazard <table style="margin-left: 20px; border: none;"> <tr><td>H304</td><td>1</td></tr> <tr><td>H305</td><td>2</td></tr> <tr><td>H306</td><td>5</td></tr> </table> <input type="checkbox"/> Acute Toxicity, Dermal <table style="margin-left: 20px; border: none;"> <tr><td>H310</td><td>*</td></tr> <tr><td>H311</td><td>*</td></tr> <tr><td>H312</td><td>4</td></tr> <tr><td>H313</td><td>5</td></tr> <tr><td>H314</td><td>3</td></tr> </table> <input type="checkbox"/> Skin Corrosion / Irritation <table style="margin-left: 20px; border: none;"> <tr><td>H314</td><td>1A, B, or C</td></tr> <tr><td>H315</td><td>2</td></tr> <tr><td>H316</td><td>5</td></tr> </table> <input type="checkbox"/> Sensitization, Skin <table style="margin-left: 20px; border: none;"> <tr><td>H317</td><td>1</td></tr> <tr><td>H318</td><td>7</td></tr> </table> <input type="checkbox"/> Serious Eye Damage / Eye Irritation <table style="margin-left: 20px; border: none;"> <tr><td>H318</td><td>1</td></tr> <tr><td>H319</td><td>2A</td></tr> <tr><td>H320</td><td>9</td></tr> <tr><td>H321</td><td>2B</td></tr> </table>	H300	*	H301	*	H302	4	H303	5	H304	1	H305	2	H304	1	H305	2	H306	5	H310	*	H311	*	H312	4	H313	5	H314	3	H314	1A, B, or C	H315	2	H316	5	H317	1	H318	7	H318	1	H319	2A	H320	9	H321	2B
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H319	2A																																																																														
H320	9																																																																														
H321	2B																																																																														

Substances & Mixtures; & Organic Peroxides					0		
	H241	*	<input type="checkbox"/>	Acute Toxicity, Inhalation	H33	*	
	H242	*			0		
					H33	*	
<input type="checkbox"/>	Pyrophoric liquids, Pyrophoric Solids	H250	*		1		
<input type="checkbox"/>	Pyrophoric Gases		*		H33	*	
					2		
<input type="checkbox"/>	Substances and Mixtures which, in Contact with Water Emit Flammable Gases	H260	1	<input type="checkbox"/>	Respiratory Sensitization	H33	1
					4		
	H261	2 or 3	<input type="checkbox"/>	Specific Target Organ Toxicity, Single Exposure; Respiratory Tract Irritation	H33	3	
					5		
<input type="checkbox"/>	Oxidizing Gases	H270	1	<input checked="" type="checkbox"/>	Specific Target Organ Toxicity, Single Exposure; Narcotic Effects	H33	3
					6		
<input type="checkbox"/>	Oxidizing Liquids; Oxidizing Solids	H271	1	<input type="checkbox"/>	Germ Cell Mutagenicity	H34	1A or 1B
		H272	2 or 3		0		
					H34	2	
<input type="checkbox"/>	Gases Under Pressure	H280		<input type="checkbox"/>	1		
		H281			H35	*	
					0		
<input type="checkbox"/>	Corrosive to Metals	H290	1	<input type="checkbox"/>	Reproductive Toxicity	H35	2
					1		
					H36	1A or 1B	
					0		
					H36	2	
					1		
				<input type="checkbox"/>	Reproductive Toxicity, Effects on or via Lactation	H36	
					2		
				<input type="checkbox"/>	Specific Target Organ Toxicity, Single Exposure	H37	1
					0		
					H37	2	
					1		
				<input type="checkbox"/>	Specific Target Organ Toxicity, Repeated Exposure	H37	1
					2		
					H37	2	
					3		

Note: a line for "Other" Category is provided since there are some EU designations that may show up

Appendix D Safety & Health Hazard Checklist

Title of Work: _____ Date: _____

There could be problems with:

- | | |
|---|--------------------------------------|
| <input type="checkbox"/> Hazardous Derivatives | <input type="checkbox"/> Pressure |
| <input type="checkbox"/> Hazardous Reactions | <input type="checkbox"/> Temperature |
| <input type="checkbox"/> Incompatible Chemicals | |

Hazards Associated with the Work

Safety Hazards

- Laceration/cut
- Amputation
- Crushing injury
- Impact injury
- Fall
- Arc blast
- Shock
- Electrocutation
- Pressure above 1 atm
- Pressure below 1 atm
- Burn / Frostbite
- Explosion
- Flammable Gas
- Flammable Aerosol
- Oxidizing Gas
- Gas Under Pressure
- Flammable Liquid
- Flammable Solid
- Self-reacting Substance / Mixture
- Pyrophoric Liquid
- Pyrophoric Solid
- Self-heating Substance / Mixture
- Substance / Mixture That Emits Flammable Gas When in Contact With Water
- Oxidizing Liquid
- Oxidizing Solid
- Organic Peroxide
- Corrosive to Metals

Health Hazards

- Acutely Toxic
- Specific Target Organ Toxicity
- Toxic to Reproductive System
- Skin Corrosion / Irritation
- Serious Eye Damage / Irritation
- Respiratory Sensitizer
- Skin Sensitizer
- Carcinogenic
- Germ Cell Mutagenicity
- Aspiration Hazard
- Effects On or via Lactation
- Heat stress or shock
- Hypothermia
- Noise
- Ultraviolet radiation
- Infrared radiation
- Ionizing Radiation
- Excessive reaching
- Repetitive motion
- Cumulative trauma

Potential Exposure Routes

- Inhalation
- Skin Absorption
- Ingestion
- Injection

Other:

Appendix E Example Process & Instrumentation Diagram

