**PURPOSE AND SCOPE**

Undergraduate group projects using the Department of Chemical and Biological Engineering labs may require the use of potentially dangerous equipment, materials and chemicals. Undergraduate students must complete the safety approval process to review the hazards of the project and how they will accommodate these hazards while maintaining a safe work environment in the laboratory.

The safety approval will be processed in two stages: The PRELIMINARY STAGE and the CERTIFICATION STAGE. The safety approval should be re-done ANNUALLY for each academic year and include a CHEMICAL INVENTORY.

**PRELIMINARY STAGE**

1. Create Experiment Guidelines for your lab procedure, this is similar to what is done in CHBE undergraduate labs and you may use the template provided later in this document. You may want to ask the Faculty Advisor, Departmental Safety Coordinator, or any other relevant person for assistance.

2. Obtain Safety Data Sheets (SDS) for all reagents, potential products and side products involved with the procedure.

3. Each chemical (reagent, product and side-product) should have a chemical handling sheet (template provided later in this document) which identifies maximum quantity, hazards, controls and PPE, emergency procedures, storage and disposal of the chemical.

4. Designate a maximum of two (2) students as Trainers, one of whom is the Safety Officer Responsible for safety of the experiment.

5. Anyone in the lab must have completed the Chemical Safety Certification from UBC Risk Management Services and the Engineering Design Team Safety Orientation.

6. Give the printed Experiment Guidelines to your Faculty Advisor for content approval and signature. Your Faculty Advisor is responsible for the safety of the project. The form may be returned for modification and you may go back and forth a number of times until the Faculty Advisor is satisfied. The Faculty Advisor may also recommend for others to see the experiment guidelines with additional space provided for signatures if required.

6. A final copy of the experiment guidelines, or an intermediary copy with comments must be kept by yourself to be put in the lab and the original will be kept by the faculty advisor for their records.

7. At this point the Faculty Advisor will advise CHBE Administration and Stores that the relevant chemicals have been approved for ordering. Space for storing and materials for handling the chemicals should be in place before the chemicals are picked up from stores. There is generally a delay time ordering chemicals, so chemicals may be ordered before all recommendations are met. **Note that you may not perform the procedure until after the CERTIFICATION STAGE**.

**CERTIFICATION STAGE**

1. Ensure that you have complied with all the comments and recommendations on your Experiment Guidelines, and that your procedure has not been significantly altered since the form was completed.

2. Ensure that all is prepared to demonstrate the procedure outlined in your Experiment Guideline. This includes having all lab material as well as all documentation ready in the lab (Experiment Guideline, SDS, Chemical Handling Sheets, spill procedure, safety certificates, Lab best practices and policies, etc.).

3. The Trainers should demonstrate the procedure to the Faculty Advisor in the lab and show that it is performed in a safe manner. If required, make changes to the experimental procedure.

4. The Faculty Advisor and Trainers should sign certifying they have gone over the Experiment Guidelines and observe it to be safe.

5. Make a copy of your Experiment Guidelines to be stored in the lab and give the original to your Faculty Advisor for their records.

6. Proceed with your experiments. If the hazards or your procedure change this process should be repeated. Remember that if you are unsure you should always ask before doing.

7. Keep all documentation in a binder in the lab in case of safety inspection. The Trainers may train other members of the team to perform the experiments. This should be noted in the training log.

**SAFETY INSPECTIONS**

All members in the lab performing the experiment are responsible to ensure everyone is following the Experiment Guidelines. If anyone is found not following any portion of the specified Experiment Guidelines the person inspecting will shut down the procedure until they are satisfied that the procedure can be performed safely. In order to do this, the person inspecting may revoke:

* Training certification from students including Chemical Safety and Engineering Design Team Safety Training.
* Lab access.
* Experiment Guidelines certification.
* Or any other sanction they may deem fit.

Note that any sanctions imposed are not negotiable and that lab use is a privilege.

**1. EXPERIMENT NAME:** *Sample Guideline*

**2. EMERGENCY CONTACTS**

*One of the following people will be contacted as soon as possible in the case of any spills, injuries or deviations from this procedure:*

*Faculty Advisor: Dr. Jonathan Verrett, 604-312-4762 (Cell), 604-827-5685 (Office),* [*jonathan.verrett@ubc.ca*](mailto:jonathan.verrett@ubc.ca)

*CHBE Safety Coordinator: Miles Garcia, 604-822-3857 (Office),* [*miles.garcia@ubc.ca*](mailto:miles.garcia@ubc.ca)*.*

**3. PURPOSE:**

Describe the reason why the experiment is being performed in a few sentences.

*The purpose of these sample guidelines is to provide a template for writing experiment guidelines. These guidelines should outline hazards and safety precautions. It should also state what the experiment is attempting to measure or achieve. The guidelines should also be supplemented by relevant literature sources showing how the experiment was conceived****.***

**4. BACKGROUND:**

Describe relevant literature sources relating to the experiment. Has this procedure been used before in another lab setting? If so, provide references to help demonstrate the safety or validity of this procedure. You should also describe any reactions taking place. You should have SDS and Chemical Handing Sheets for all products and by-products.

**5. REFERENCES:**

US EPA. (April 2007) Guidance for Preparing Standard Operating Procedures (SOPs). EPA QA/G-6. Accessed January 6, 2016. <https://www.epa.gov/sites/production/files/2015-06/documents/g6-final.pdf>

McGill University Department of Chemical Engineering (November 2008) Safety Questionnaire Procedure. Accessed January 6, 2017. <https://www.mcgill.ca/chemeng/files/chemeng/SAFETYQUEST_rev1.pdf>

**6. SAFETY RESPONSIBILITIES**

The safety officer, which is a single student for each set of experiment guidelines, is responsible for the safety of everyone in the laboratory performing the experiment. If this responsibility is shifted, the Faculty Advisor must be notified and approve.

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| --- | --- | --- | --- | --- |
| Effective Date | Safety Officer Name | Safety Officer Email | Safety Officer Signature | Faculty Advisor Signature |
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**7. CHEMICAL HAZARDS**

Summarize the MSDS information for chemicals used in the experiment. If the hazard exists for a chemical, check the cell for that chemical, otherwise, leave it blank. This table is mandatory.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Chemical Name | SDS available (Y/N) | Maximum Quantities Used | Hazard | | | | | | | Controls, Personal Protective Equipment (PPE) & Comments |
| Compressed Gas | Flammable | Toxic | Corrosive | Oxidizing | Dangerously Reactive | Irritant |
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**8. OTHER HAZARDS**

Other hazards may include: High (>50°C) or Low Temperatures (<0°C), High Pressures (>1.5 atm) Or Reduced Pressures (Vacuum), Electromagnetic Interference or High Energy Laser, Steam, Radioactive Substances, Voltages >115 V or Currents >15 amps, Pathogenic Organisms, High Speed Rotating Machinery, Dangerous Chemical Reactions, etc.

|  |  |
| --- | --- |
| Hazard Description | Controls, Personal Protective Equipment (PPE) & Comments |
|  |  |

**9. GENERAL SAFETY CONCERNS**

List any general safety concerns for the workshop or experiment and indicate how they will be handled. High risks steps should be presented in the method section which follows later in this document.

*e.g. Almost all chemicals can cause irritation. Wear full PPE including splash goggles, gloves, labcoat and close toed shoes for the whole experiment.*

**10. EMERGENCY SHUT DOWN PROCEDURE**

What is the emergency shutdown procedure in case of a fire drill, evacuation, etc.?

*e.g. Turn off hotplate and lower sash on fumehood. Leave lab ensuring door is closed.*

**11. METHOD:**

Briefly describe steps in your procedure here. This section may also be done as a flowchart if desired. Make sure to highlight high risks steps

1. *Add acid to water, never water to acid*
2. *Handle acetone only in the fumehood. Maximum quantity of acetone to be used is 10 mL.*

*High risk steps*

*2 –All steps involving Acetone should be handled in the fumehood*

**12. MEASUREMENT/ANALYSIS**

Describe what will be measured and how this will be analyzed. This section should allow the reader to understand the purpose of these experiments. This section may also be done as a flowchart if desired.

**EXPERIMENTAL GUIDELINES APPROVAL SIGNATURES**

**EXPERIMENT NAME:** *Sample Guideline*s

PRELIMINARY STAGE

I certify that all the information in this safety questionnaire is true to the best of my knowledge. Another questionnaire will be submitted if there are significant changes to equipment or experimental procedures.

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| --- | --- | --- | --- |
| Student Trainer Name(s) and Position(s) (if applicable) - | Email or other contact method | Signature | Date |
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I, the undersigned, have read the guidelines and deem the procedure ready for the certification stage under the condition that any comments or recommendations will be taken into account by the above named student Trainer(s).

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| Advisor Name and Position | Email or other contact method | Signature | Date |
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CERTIFICATION STAGE

I, the undersigned, certify that a demonstration of the experimental procedure and equipment operation has been performed in my presence by the student Trainer(s), and that both appear safe.

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| Student Trainer Name(s) and Position(s) (if applicable) - | Email or other contact method | Signature | Date |
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| Advisor Name and Position | Email or other contact method | Signature | Date |
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TRAINING RECORDS

**EXPERIMENT NAME:** *Sample Guideline*

By signing below the **TRAINER** agrees that they have explained the Experimental Guidelines to the **TRAINEE** as well as any other relevant lab protocols. They have also ensured the TRAINEE has copies of their Chemical Safety Completion Certificates and Engineering Design Team Safety Orientation Certificates in the lab. Special focus should be paid to proper safety procedures such as emergency contacts, emergency shut-down, spill response, sign-in and sign-out procedures and chemical handling, storage and disposal. The **TRAINER** is responsible to ensure the **TRAINEE** can follow all procedures safely.

By signing below the **TRAINEE** agrees that they have been explained the Experimental Guidelines by the **TRAINER**, that they are confident they can execute the relevant lab procedures safely, They have placed copies of their Chemical Safety Completion Certificates and Engineering Design Team Safety Orientation Certificates in the lab. Special focus should be paid to proper safety procedures such as emergency contacts, emergency shut-down, spill response, sign-in and sign-out procedures and chemical handling, storage and disposal.

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| --- | --- | --- | --- | --- |
| Date | Trainer Name | Signature | Trainee Name | Signature |
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LAB USE RECORDS (Sign in and sign out)

**EXPERIMENT NAME:** *Sample Guideline*

The following table documents times where the experiment was run. It should be filled in each time the procedure is conducted.

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| List of people involved in executing the experiment guidelines | Date and time In  (YYYY/MM/DD - HH:MM) | Date and time Out  (YYYY/MM/DD - HH:MM) |
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RECORD OF INSPECTION

**EXPERIMENT NAME:** *Sample Guideline*

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| Inspected By | Date (YYYY/MM/DD) | Notes |
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**1. NAME OF CHEMICAL:** *Sulphuric acid in water, 5% v/v*

**2. CHEMICAL HAZARDS**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SDS available (Y/N) | Maximum Quantity  Stored | Hazard | | | | | | |
| Compressed Gas | Flammable | Toxic | Corrosive | Oxidizing | Dangerously Reactive | Irritant |
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**3. CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT (PPE)**

What will be done to mitigate the hazards identified above?

*E.g. Only manipulate the chemical in a fumehood to avoid exposure to vapours. Wear full PPE including splash goggles, gloves, labcoat and close toed shoes.*

**4. ACCIDENTAL EXPOSURE**

What should be done in the case of accidental exposure on clothing, skin, or eyes?

*E.g. Wash affected part of body by spill thoroughly with cold water using tap, eyewash station or shower as appropriate.*

**5. SPILL PROCEDURE**

What happens if there is a spill of this chemical? How is it cleaned? A general spill procedure from UBC Risk Management can be found here: <http://riskmanagement.sites.olt.ubc.ca/files/2015/11/Lab-Spill-Clean-Up-Procedure_0.pdf> and should be accessible in the lab.

*E.g. Follow spill cleanup procedure. If the spill is under 1 L, it can be cleaned up with the appropriate procedure and acid spill kit. If over 1 L call emergency services hazmat team at 911.*

**6. STORAGE**

For all hazardous chemicals how will they be stored? Do they require secondary containment? Are they in a special cabinet or ventilated area? Is there such a cabinet in your lab?

*E.g. Store in original container in well ventilated cabinet with other acids in a secondary containment bin (plastic bin).*

**7. DISPOSAL**

How will any hazardous chemicals be disposed of, include as well materials that come into contact with these chemicals and must be disposed as hazardous waste as well. What containers are used for this and who are they obtained from? Who tags the waste and where is it brought to? Note that the Departmental Safety Officer may be a good person to contact for answers to these questions.

A list of chemicals that can be disposed with garbage waste may be found here:

<http://riskmanagement.sites.olt.ubc.ca/files/2016/03/Safe-for-garbage-disposal.pdf>

A list of chemicals that can be disposed down the drain may be found here: <http://riskmanagement.sites.olt.ubc.ca/files/2016/03/Safe-to-dispose-down-drain.pdf>

*E.g. Sulfuric acid waste will be stored in a 4L glass jar with a self ventilating cap with the contents clearly identified. When the container is ¾ full, the Department Safety Officer will be contacted to assist with disposal.*

**Lab Best Practices and Policies**

* **Be respectful** of other users of the laboratory environment.
* Don’t disturb space allocated to other lab users, ask them before moving their material.
* Leave your lab space **clean and tidy** when not in use to minimize any hazards or risks such as spills, contamination of chemicals, etc.
* Document your lab experiences in a **lab manual** in such a way that they can be followed by other users who may want to repeat or learn from your experiences. This will save time and resources for all users.
* All electrical devices should be CSA approved and unmodified. Any modification to devices should be approved by your Faculty Advisor.
* If you have any questions or are unsure whether you can do something, **ask someone**. You may not perform a task that is not authorized in the lab. It is not okay to do something and then seek approval later in a lab setting.
* At the end of a lab sessions all wastes should be dealt with according to their disposal outlined on the chemical handling sheet.
* Paper waste should be placed in the garbage bins for general waste.
* Broken glassware should be put in a special container designated for broken glass.