**Experiment Risk Assessment**

**Notebook and page number/Title of experiment:**

This document is a tool to identify potential risks for each aspect of an experiment. To accurately assess those risks, plan your experiment carefully, and identify each step of the experimental process before completing this document. For each piece of information identified below, be sure to fully understand the potential risk.

Write down all hazardous materials to be used, including products that may form when mixing chemicals or performing a chemical reaction. Include gases that evolve, even if not hazardous. Balance the equation for all reactants, products, and side products if possible.

Refer to (Material) Safety Data Sheets (SDS) (sections 2 and 10) to identify the physical and health hazards of all materials. However, the hazards and risks change significantly when chemicals become part of a process or are mixed, and the SDS may not provide this information. To ensure you fully understand the reactivity of the materials you will use, refer to other sources such as e-EROS, Bretherick’s handbook of reactive chemicals, or DRS guidance documents in the **Safety Library** located on the [DRS Homepage](http://www.drs.illinois.edu/), or consult experienced researchers.

*List Materials Here*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Compound** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** |
| **Grams**  |  |  |  |  |  |  |  |  |  |
| **Molecular Weight** |  |  |  |  |  |  |  |  |  |
| **mmols** |  |  |  |  |  |  |  |  |  |
| **Equivalents** |  |  |  |  |  |  |  |  |  |
| **Density** |  |  |  |  |  |  |  |  |  |
| Radioactive materials |  |  |  |  |  |  |  |  |  |
| Explosive, hazardous bonds\* |  |  |  |  |  |  |  |  |  |
| Pyrophoric |  |  |  |  |  |  |  |  |  |
| Water reactive |  |  |  |  |  |  |  |  |  |
| Flammable |  |  |  |  |  |  |  |  |  |
| Oxidizer |  |  |  |  |  |  |  |  |  |
| Reducing agent |  |  |  |  |  |  |  |  |  |
| Toxic |  |  |  |  |  |  |  |  |  |
| Health Hazard (Carc., Rep. Tox., Mut.) |  |  |  |  |  |  |  |  |  |
| Lachrymator |  |  |  |  |  |  |  |  |  |
| Corrosive |  |  |  |  |  |  |  |  |  |
| Odorous (stench) |  |  |  |  |  |  |  |  |  |
| Polymerizable groups |  |  |  |  |  |  |  |  |  |

\*See [*Potentially Explosive Experiments*](https://www.drs.illinois.edu/SafetyLibrary/PotentiallyExplosiveExperiments) in the DRS Safety Library

**References**

1. What reference material (literature source/notebook page) will be followed?

**Material Hazards**

1. For steps that involve material with hazards, what are possible routes of exposure when performing the procedure?

[ ] Inhalation of vapor, dust, aerosols [ ] Skin contact [ ] Oral [ ] Injection

[ ] Eye contact

**Equipment**

1. Are there any physical hazards in this experiment?

[ ] Sharps [ ] Heavy objects [ ] Compressed gas [ ] Robotics [ ] Moving machinery

[ ] Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Hazardous Conditions**

1. Thermodynamics: Are any of the following thermodynamic reactions anticipated?

[ ] Exothermic (gets hot): This can lead to a runaway reaction.

[ ] Endothermic (gets cold): This can lead to equipment failures and erratic reaction rates via freezing solvents, decreased solubility, and heterogeneous mixtures.

[ ] Induction period (delayed reaction): This can lead to runaway reactions if reactants are added too quickly.

[ ] Unknown: Keep experiments on small scale and monitor for warning signs. Scale up carefully.

[ ] No thermodynamic reaction anticipated.

**NOTE:** *Make note of any induction period or exothermic reaction to prevent future incidents!*

1. What experimental conditions will be used? (check boxes and/or fill in blank):

[ ] Cooling to ~\_\_\_\_\_\_ oC with:

 [ ] Ice [ ] N2(*l*) -196oC [ ] CO2(*s*) -78.5oC [ ] O2(*l*) -183oC [ ] He(*l*) -269oC

[ ] Heating to ~\_\_\_\_\_\_ oC with:

 [ ] Open flame [ ] Electric heating mantle [ ] Oil bath [ ] Furnace [ ] Hot plate.

 Can this temperature create a fire with materials used? Yes / No

[ ] Pressure ~ \_\_\_\_\_\_\_\_ psi or Vacuum (in-house or pump) ~\_\_\_\_\_\_\_ torr.

Is the equipment you are using rated for this pressure level? Yes / No

[ ] Open electrical source: Voltage:\_\_\_\_\_\_ volts

[ ] AC [ ] DC [ ] High energy

[ ] Agitation/stirring

[ ] Magnetic stir bar [ ] Overhead stirrer [ ] Shaker [ ] Sonicator

[ ] Compressed gas type:

 [ ] Flammable [ ] Toxic [ ] Corrosive [ ] Oxidizer [ ] Inert

[ ] Anaerobic conditions ( \_\_\_%\_\_\_\_\_\_\_\_\_, \_\_\_%\_\_\_\_\_\_\_\_\_, \_\_\_%\_\_\_\_\_\_\_\_\_)

[ ] Ionizing and non-ionizing radiation source:

[ ] Gamma rays [ ] X-rays [ ] UV [ ] Visible light [ ] IR [ ] Microwave [ ] Radio waves

**Techniques**

1. What experimental techniques will you be using, and are you familiar with the associated hazards?

[ ] Inerting; use blanket of inert gas to prevent material contact with oxygen/water vapor.

[ ] Syringing; avoid needle sticks, use locking mechanisms, use only 80% of syringe capacity.

[ ] Transferring flammable liquids; avoid all ignition sources.

[ ] Transferring solids (use powder funnels and avoid dust formations)

[ ] Using gaseous materials (cylinders secured and good flow rate control)

Other\_\_\_\_\_\_\_\_\_\_\_\_

1. What method, if any, will be used to quench the reaction, reagents, or by-products? What are the hazards associated with the quench?
2. What purification techniques will you be using and are you familiar with the associated hazards?

[ ] Chromatography [ ] Distillation [ ] Extraction [ ] Sublimation [ ] Crystallization

[ ] Electrophoresis [ ] Other\_\_\_\_\_\_\_\_\_\_\_\_

**Hazard Summary**

1. Are there any incompatibility issues to consider with the chemicals, conditions and equipment to be used? E.g., solvents and plastic, plastic equipment & heat, etc.
2. What are the most hazardous aspects of this experiment? (e.g., toxic chemicals, highly reactive, concentration)

**Personal Protective Equipment**

1. Select what Personal Protective Equipment (PPE) should be used: *See SDS section 8 (Exposure Controls/Personal Protection).*

[ ] **Gloves:** [ ] Disposable [ ]  Double gloving [ ] Chemically resistant [ ] Insulated [ ] Mechanical

[ ] **Eye wear:** [ ] Goggles [ ] Safety glasses [ ] Face shield [ ] Laser safety glasses

[ ] **Lab coat:**  [ ] Cotton [ ] Flame resistant [ ]  Apron

[ ] **Other**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Engineering Controls**

1. Select all control measures necessary to mitigate the risk of identified hazards.

[ ] Chemical fume hood [ ] Biosafety cabinet [ ] Glove box

[ ] Cooling device (bath, condenser, etc.) [ ] Blast shield [ ] Trap: acid, vacuum, etc.[ ] Radiation shielding [ ] Laser curtain [ ] Guards

[ ] Anaerobic chamber [ ] Secondary containment [ ] Other\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Waste Disposal/Cleanup**

1. What general waste streams does this process generate?

[ ] Hazardous waste [ ] Flammable [ ] Toxic [ ] Halogenated [ ] Aqueous [ ] Corrosive

[ ] Solid [ ] Rad-waste [ ] Bio-waste [ ] Other:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What are potential chemical incompatibilities with this waste stream?

**Emergency Response**

1. What action plan will be implemented to prevent the experiment from becoming dangerous if any of these conditions fail to operate as anticipated?
2. Identify the spill kit/equipment needed to handle the hazardous materials listed above if they are spilled or released:

**General spill:** [ ] Sand [ ] Lime [ ] Dust pan/broom [ ] Absorbent materials: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Acid neutralizers:** [ ] Sodium bicarbonate [ ] Calcium carbonate [ ] Sodium carbonate

[ ] Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Base neutralizers:** [ ] Citric acid [ ] Malic acid [ ] Sodium bisulfate

[ ] Other\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Have you been trained to handle the hazards you have identified above? Yes / No

If NO, request instruction or training from your PI or laboratory supervisor before starting the experiment.

**Additional Information**

1. Is there a less hazardous experimental route? Yes / No / Not aware of
2. Can any of the hazardous materials identified above be eliminated or replaced with a less hazardous chemical? Yes / No

If yes, indicate the reasons for using this material instead of less hazardous options.

If no, how did you arrive at this conclusion?

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1. Is the quality and grade of material sufficient to perform the experiment safely? Yes / No / NA
2. Is this experiment a scale up experiment? Yes / No / NA

*Note: Due to the increased risk that scale-up reactions pose,* consult an *experienced researcher before attempting to perform large scale experiments*. *See the* [*Scale-up Reaction Safety*](https://www.drs.illinois.edu/SafetyLibrary/ScaleUpReactionSafety) *guidance document in the DRS Safety Library.*

1. On what scale (primary substrate) will you be doing this experiment?

[ ] Small scale: <1 gram

[ ] Moderate scale: 1-15 grams

[ ] Large scale: >15 grams.

Record when and by whom the risk assessment was performed. If conducted by peer review (recommended), list name(s) of all reviewers.

Author Peer Reviewer

|  |  |
| --- | --- |
| Name: | Name: |
| Date: | Date: |