LABORATORY RISK ASSESSMENT

This Laboratory Risk Assessment Form provides a framework for risk assessment. The goal is for researchers to systematically identify and control hazards to reduce risk of injuries and incidents. Review the section on Risk Assessment in the CHP for further information.

Conducting a risk assessment is required prior to working with a pyrophoric and/or water-reactive materials for the first time.

Remember the acronym **RAMP**: **R**ecognize the hazard; **A**ssess the risk; **M**inimize the risk; **P**repare for what can go wrong.

The risk assessment process involves rating the risk of the experiment from "low" to "unacceptable" risk. Consult with Prof. Safinya or Kai Ewert and EH&S if your risk rating is "high" or "unacceptable" to redesign the experiment and/or implement additional controls to reduce risk.

Procedure:		
PI / Lab Group: C. R. Safinya		
Department: Materials/Physics/MCDB	**Building / Location: MRL, Safinya labs**	
Form Completed By:		**Start Date:**

1. RECOGNIZE THE HAZARD

Identify your research question and approach. What question are you trying to answer? What are you trying to measure or learn? What is your hypothesis? What approach or method will you use to answer your question? Are there alternative approaches?

Research Question(s)
Approach(s) or Method

Identify the general hazards (check all that apply). Perform background research to identify known risks of the reagents, reactions, or processes. Review protocols, Safety Data Sheets (SDSs), and safety information for hazardous chemicals, agents, or processes. Review accident histories within your laboratory/department.

Hazardous Agents

Physical Hazards of Chemicals

☐ Compressed gases
☐ Cryogens
☐ Explosives
☐ Flammables
☐ Organic peroxides
☐ Oxidizers
☐ Peroxide formers
☒ Pyrophorics
☐ Self-heating substances
☐ Self-reactive substances
☐ Substances which, in contact with water, emit flammable or toxic gases

Health Hazards of Chemicals

☐ Acute toxicity
☐ Carcinogens
☐ Eye damage/ irritation
☐ Germ cell mutagens
☐ Nanomaterials
☐ Reproductive toxins
☐ Respiratory or skin sensitization
☐ Simple asphyxiant
☐ Skin corrosion/ irritation
☐ Specific target organ toxicity
☐ Hazards not otherwise classified

Non-Ionizing Radiation

☐ Lasers, Class 3 or 4
☐ Lasers, Class 2
☐ Magnetic fields (e.g., NMR, MRI)
☐ RF/microwaves
☐ UV lamps

Ionizing Radiation

☐ Irradiator
☐ Radionuclide
☐ Radionuclide sealed source
☐ X-ray machine
☐ Other (list):

Hazardous Conditions or Processes

Reaction Hazards

☐ Explosive
☐ Exothermic, with potential for fire
☐ Endothermic, with potential for freezing solvents decreased solubility or heterogeneous mixtures
☐ Gases produced
☐ Hazardous reaction intermediates/products
☐ Hazardous side reactions

Hazardous Processes

☐ Generation of air contaminants (gases, aerosols, or particulates)
☐ Heating chemicals
☐ Large mass or volume
☐ Pressure > atmospheric
☐ Pressure < atmospheric
☐ Scale-up of reaction

Other Hazards

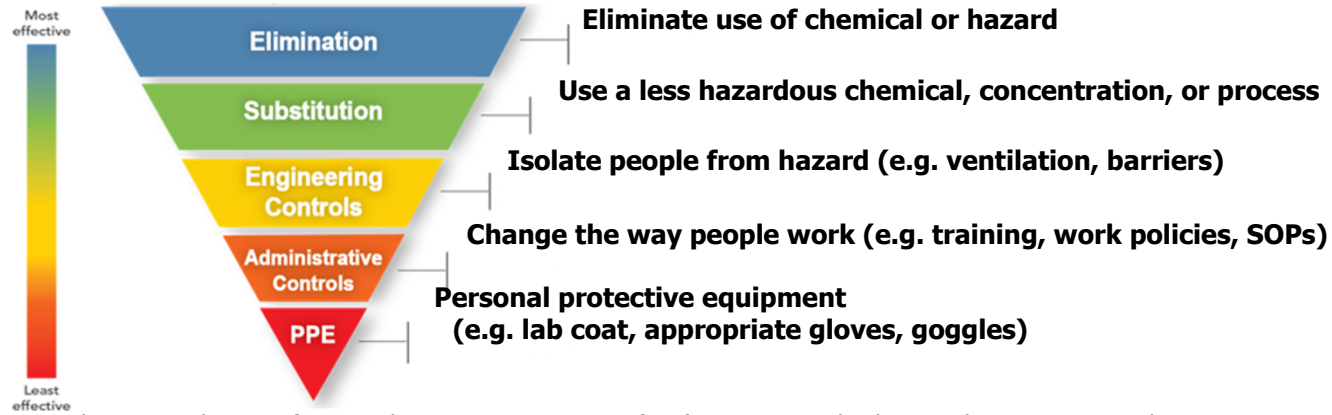
☐ Hand/power tools
☐ Moving equipment/parts
☐ Electrical
☐ Noise > 80 dBA
☐ Heat/hot surfaces
☐ Ergonomic hazards
☐ Needles/sharps
☐ Other (list):

2. ASSESS AND MINIMIZE THE RISK

Outline the Procedure. List the steps or tasks for your procedure and the hazard/potential consequences of each. Include set-up and clean-up steps or tasks. Define the hazard controls to minimize the risk of each step using the hierarchy of controls starting with the most effective (i.e., elimination, substitution, engineering controls, administrative controls, and personal protective equipment). List the hazard control measure you would use for each step or task (e.g., run at a micro scale, work in a fume hood, wear face shield and goggles).

Steps or Tasks	Hazard	Hazard Control Measure(s)

HIERARCHY OF CONTROLS



1 For guidance on selection of Personal Protective Equipment (PPE), see CHP and Lab Hazard Assessment Tool.
2 For guidance on selection of chemical-resistant gloves, see CHP or EH&S Website.

A hierarchy of controls should be applied starting with the most effective controls (i.e., elimination and substitution) at the top of the graphic and moving down. While personal protective equipment (PPE) should always be used, it should be considered the last line of defense from potential hazards.

Select the appropriate PPE and safety supplies for the procedure (check all that apply).

Laboratory PPE/Safety Supplies	
☒ Appropriate street clothing (long pants, closed shoes)	☒ First aid kit
☒ Gloves; indicate type: _____	☒ Spill kit
☒ Safety glasses	☐ Specialized medical supplies (e.g. calcium gluconate for hydrofluoric acid and amyl nitrite for cyanides
☐ Safety goggles	☐ Other (list):
☐ Face shield and googles	
☐ Lab coat	
☒ Flame-resistant lab coat	
☒ Fire extinguisher	
☒ Eyewash/safety shower	

Identify the appropriate training (check all that apply). Identify the general safety and procedure based/specific training appropriate for your procedure.

General Safety Training	
General/Chemical Safety	
☒ Lab Safety Compliance & Practices	☐ Compressed Gas Safety
☒ Managing Lab Chemicals	☒ Fume Hood Training

Job Specific Training		
☒ Lab/job-specific training	☐ Equipment SOP(s) to review (list):	☐ Other (list):
☒ Lab SOP(s) to review (list): *Pyrophoric and/or Water-Reactive Materials*		

Assign a risk rating to the experiment. Based on your procedure outline and the what if analysis, determine the risk rating for the experiment or procedure.

Risk Rating: _____

The Risk Rating is subjective. The primary goal is for researchers to think about risk, and differentiate unacceptable and high-level risk steps from those with a lower level risk. This will help drive additional consultation and control measures where needed.

		Severity of Consequences – Personnel Safety			
Likelihood of Incident Occurrence		No injuries	Minor Injury	Significant Injury	Life threatening
	Very Likely	Low	High *	Unacceptable **	Unacceptable **
	Likely	Low	Medium	High *	Unacceptable **
	Possible	Low	Medium	High *	High *
	Rare	Low	Low	Medium	High *

Revise plan if the risk rating is too high. Are these risks acceptable? Use this table to determine the action to take based on the risk rating. What are the highest risk steps? What more can you do to control the risks? Return to planning and use the hierarchy of controls to design a safer experiment.

Hazard Risk Level	Action
Unacceptable **	**STOP!** Additional controls needed to reduce risk. **Consult with PI.**
High *	Additional controls recommended to reduce risk. **Consult with PI.**
Medium	Ensure you are following best practices. Consult with peers, PI, and EH&S as needed.
Low	Perform work within controls

NOTE: **Unacceptable risk-rated experiments **should not proceed**. Introduce further controls to reduce risk. Contact Prof. Safinya, Kai Ewert, or EH&S for recommendations and best practices.

3. PREPARE FOR WHAT CAN GO WRONG

Question your methods. What have you missed and who can advise you? Challenge your hazard control measures by asking "What if…?" questions. "What if" questions should challenge you to find the gaps in your knowledge or logic. Include possible accident scenarios. Factors to consider are human error, equipment failures, and deviations from the planned/expected parameters (e.g., temperature, pressure, time, flow rate, and scale/concentration). Update your plan to include any new controls required to address these possibilities.

What If Analysis
What if…? Examples: there is a loss of cooling? …valves/stopcocks are left open/closed? …there is unexpected over-pressurization? …a spill occurs?
Then… there may be a runaway reaction. …there may be an unexpected splash potential. …the reaction vessel may fail. …there may be a dermal exposure. …there may be an eye injury.
What if…?
Then…
What if…?
Then…
What if…?
Then…
What if…?
Then…
What if…?
Then…

Procedure Risk Assessment is Complete	
Form Completed By: Kai Ewert	
Signature:	**Date:3/30/2023**
PI / Supervisor Signature:	

OPTIONAL STEPS

Perform a trial run. How you can test your experimental design? Can you do a dry run of the procedure without hazardous chemicals/reagents/gases to familiarize yourself with equipment and demonstrate your ability to manipulate the experimental apparatus? Can you run the procedure with a less hazardous material? Can you test your experimental design at a smaller scale? If your procedure requires multiple people, would a table top exercise be useful?

Trial Run
Trial Run Procedure / Date:
Did the trial go as expected? Yes ☐ No ☐
Experimental design changes needed (if any):

Perform and evaluate. Run your procedure using the appropriate controls you've identified. Evaluate controls and hazards as you work. Critique the controls and process you used by answering the following questions. If changes to controls are needed, update your risk assessment tool and re-evaluate any time you revise your process (e.g. changes in scale, reagent, equipment, or conditions that might increase the hazard/risk). Share your assessment with your PI/colleagues for the next iteration of the experiment.

Evaluate Your Procedure
What went well?
Did the controls perform as expected?
Did anything unexpected occur?
Did a hazard manifest itself that was not previously identified?
Were there any close calls or near misses that indicate areas of needed improvement?
Did something go exceptionally well that others could learn from?
I plan to evolve my procedure by…