

## Laboratory Risk Assessment Tool

The Stanford Laboratory Risk Assessment Tool provides a framework for risk assessment that maps onto the scientific method, melding with the process researchers already use to answer scientific questions.

This tool allows researchers to systematically identify and control hazards to reduce risk of injuries and incidents. Conduct a risk assessment prior to conducting an experiment for the first time.

The risk assessment process involves rating the risk of the experiment, from “low” to “unacceptable” risk. Consult with your PI/supervisor and EH&S if your risk rating is “high” or “unacceptable” to redesign the experiment and/or implement additional controls to reduce risk.



<b>Procedure:</b>			
<b>Lab Group:</b>			
<b>Completed By:</b>		<b>Date:</b>	



### EXPLORE

**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 and [Lessons Learned](#) at Stanford or other institutions.

Hazardous Agents			
<b>Physical Hazards of Chemicals</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Compressed gases</li> <li><input type="checkbox"/> Cryogenics</li> <li><input type="checkbox"/> Explosives</li> <li><input type="checkbox"/> Flammables</li> <li><input type="checkbox"/> Organic peroxides</li> <li><input type="checkbox"/> Oxidizers</li> <li><input type="checkbox"/> Peroxide formers</li> <li><input type="checkbox"/> Pyrophorics</li> <li><input type="checkbox"/> Self-heating substances</li> <li><input type="checkbox"/> Self-reactive substances</li> <li><input type="checkbox"/> Substances which, in contact with water, emit flammable gases</li> </ul>	<b>Health Hazards of Chemicals</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Acute toxicity</li> <li><input type="checkbox"/> Carcinogens</li> <li><input type="checkbox"/> Eye damage/irritation</li> <li><input type="checkbox"/> Germ cell mutagens</li> <li><input type="checkbox"/> Nanomaterials</li> <li><input type="checkbox"/> Reproductive toxins</li> <li><input type="checkbox"/> Respiratory or skin sensitization</li> <li><input type="checkbox"/> Simple asphyxiant</li> <li><input type="checkbox"/> Skin corrosion/irritation</li> <li><input type="checkbox"/> Specific target organ toxicity</li> <li><input type="checkbox"/> Hazards not otherwise classified</li> </ul>	<b>Ionizing Radiation</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Irradiator</li> <li><input type="checkbox"/> Radionuclide</li> <li><input type="checkbox"/> Radionuclide sealed source</li> <li><input type="checkbox"/> X-ray machine</li> </ul> <b>Non-Ionizing Radiation</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lasers, Class 3 or 4</li> <li><input type="checkbox"/> Lasers, Class 2</li> <li><input type="checkbox"/> Magnetic fields (e.g., NMR, MRI)</li> <li><input type="checkbox"/> RF/microwaves</li> <li><input type="checkbox"/> UV lamps</li> </ul>	<b>Biohazards</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> BSL-2 Biological agents</li> <li><input type="checkbox"/> BSL-3 Biological agents</li> <li><input type="checkbox"/> Human cells, blood, BBP</li> <li><input type="checkbox"/> NHPs/cells/blood</li> <li><input type="checkbox"/> Non-exempt rDNA</li> <li><input type="checkbox"/> Animal field work</li> <li><input type="checkbox"/> High risk animals (RC1)</li> </ul> <input type="checkbox"/> Other (list):

Hazardous Conditions or Processes		
<b>Reaction Hazards</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Explosive</li> <li><input type="checkbox"/> Exothermic, with potential for fire, excessive heat, or runaway reaction</li> <li><input type="checkbox"/> Endothermic, with potential for freezing solvents decreased solubility or heterogeneous mixtures</li> <li><input type="checkbox"/> Gases produced</li> <li><input type="checkbox"/> Hazardous reaction intermediates/products</li> <li><input type="checkbox"/> Hazardous side reactions</li> </ul>	<b>Hazardous Processes</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Generation of air contaminants (gases, aerosols, or particulates)</li> <li><input type="checkbox"/> Heating chemicals</li> <li><input type="checkbox"/> Large mass or volume</li> <li><input type="checkbox"/> Pressure &gt; atmospheric</li> <li><input type="checkbox"/> Pressure &lt; atmospheric</li> <li><input type="checkbox"/> Scale-up of reaction</li> </ul>	<b>Other Hazards</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Hand/power tools</li> <li><input type="checkbox"/> Moving equipment/parts</li> <li><input type="checkbox"/> Electrical</li> <li><input type="checkbox"/> Noise &gt; 80 dBA</li> <li><input type="checkbox"/> Heat/hot surfaces</li> <li><input type="checkbox"/> Ergonomic hazards</li> <li><input type="checkbox"/> Needles/sharps</li> </ul> <input type="checkbox"/> Other (list):

General Hazards		
<b>Equipment Hazards</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Unguarded moving parts</li> <li><input type="checkbox"/> Cranes/lifts/hoists</li> <li><input type="checkbox"/> Ladders</li> <li><input type="checkbox"/> Energized equipment</li> <li><input type="checkbox"/> De-energized equipment</li> <li><input type="checkbox"/> High voltage (&gt;50 volts)</li> <li><input type="checkbox"/> DC equipment (&gt;800 Amperes)</li> <li><input type="checkbox"/> Maintenance/Modification of electrical equipment</li> <li><input type="checkbox"/> Robotics</li> <li><input type="checkbox"/> Home-built equipment</li> <li><input type="checkbox"/> Soldering</li> <li><input type="checkbox"/> Lithium batteries</li> <li><input type="checkbox"/> Pressure or vacuum vessels</li> </ul>	<b>Ergonomic Hazards</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Repetitive motion</li> <li><input type="checkbox"/> Contact stress</li> <li><input type="checkbox"/> Cold environment</li> <li><input type="checkbox"/> Awkward postures</li> <li><input type="checkbox"/> <a href="#">Lifting</a> &gt;30 pounds</li> <li><input type="checkbox"/> Awkward lifts (e.g., poor grip, long distance, uneven weight distribution)</li> <li><input type="checkbox"/> Vibration</li> <li><input type="checkbox"/> Personal risk factors</li> <li><input type="checkbox"/> Strenuous physical activity</li> </ul>	<b>Site Hazards</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Confined spaces</li> <li><input type="checkbox"/> Slippery surfaces</li> <li><input type="checkbox"/> Working at elevated locations</li> <li><input type="checkbox"/> Oxygen deficiency potential</li> <li><input type="checkbox"/> Slip/trip/fall</li> </ul> <b>Other Hazards</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Mental demands (e.g., long days, high stress environment, language barriers)</li> <li><input type="checkbox"/> Lack of experience</li> <li><input type="checkbox"/> Other (list):</li> </ul>

**Field Hazards**  
*\*may also use sections above (as needed) for specific tasks/processes*

**Environmental Hazards**

- Inclement weather
- Temperature extremes
- Sun exposure
- Darkness/low light
- Altitude
- Smoke/dust
- Fire
- Animals/insects
- Plants/allergens
- Hygiene/water-borne and food-borne illness
- Vector-borne or other endemic diseases (list):

**Site Hazards**

- Uneven/slippery surfaces
- Snow/ice
- Slide Hazards (mudslide/avalanche)
- Heights/drop-offs
- Falling objects
- Tight spaces/overhangs
- Boating/swimming/water hazards (waves, tides, current, depth)
- Navigation challenges
- Limited communication
- Remote area/limited medical services

**Personal Security**

- Crime/theft
- Risk of harassment/violence
- [US State Department](#) active travel alert
- Traveling alone
- Entering personal residences
- Unfamiliar with area (roads, neighborhoods, terrain, etc.)
- Unfamiliar with local customs/cultural norms

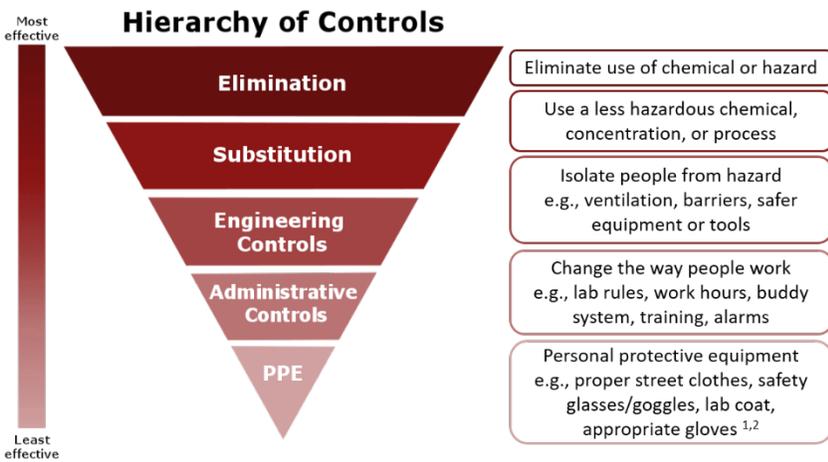
**Task/Equipment Hazards**

- Driving/vehicle operation/traffic
- Drone use
- Lifting/carrying
- Digging/trenching
- Hand tools/power tools
- Sharp objects
- Loud noises
- Strenuous physical activity
- Mental demands (e.g., long days, high stress environment, language barriers)
- Other (list):



**PLAN**

**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).



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.

<sup>1</sup> For guidance on selection of Personal Protective Equipment (PPE), use Stanford’s [Laboratory PPE Assessment Tool](#).

<sup>2</sup> For guidance on selection of chemical-resistant gloves, see [Stanford’s Laboratory Chemical Glove Selection Guide](#).



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

## Laboratory PPE/Safety Supplies

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Appropriate street clothing (long pants, closed-toed shoes) | <input type="checkbox"/> Fire extinguisher  |
| <input type="checkbox"/> Gloves; indicate type: _____   | <input type="checkbox"/> Eyewash/safety shower  |
| <input type="checkbox"/> Safety glasses   | <input type="checkbox"/> First aid kit  |
| <input type="checkbox"/> Safety goggles   | <input type="checkbox"/> Spill kit  |
| <input type="checkbox"/> Face shield and goggles  | <input type="checkbox"/> Specialized medical supplies (e.g., calcium gluconate for hydrofluoric acid) |
| <input type="checkbox"/> Lab coat   |   |
| <input type="checkbox"/> Flame-resistant lab coat   |   |
| <input type="checkbox"/> Other (list):  |   |

## General Safety Supplies

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Proper clothing (long pants, long sleeve shirt, warm layers, rain/wind protection, sun protection, hat etc.) | <input type="checkbox"/> Sunscreen   |
| <input checked="" type="checkbox"/> Proper footwear (list): _____  | <input type="checkbox"/> Anti-animal devices (e.g., bear bell, whistle, bear canister) |
| <input checked="" type="checkbox"/> Communication device   | <input type="checkbox"/> Personal floatation device                                    |
| <input type="checkbox"/> Eye protection (safety glasses and/or sunglasses)   | <input type="checkbox"/> Fall protection   |
| <input type="checkbox"/> Work gloves   | <input type="checkbox"/> Road flares   |
| <input type="checkbox"/> Hardhat   | <input type="checkbox"/> Safety vests  |
| <input type="checkbox"/> Hearing protection  | <input type="checkbox"/> Extra food, water/water treatment method                      |
| <input type="checkbox"/> First aid kit   | <input type="checkbox"/> Personal medications  |
| <input type="checkbox"/> Map (and GPS)   |  |
|  | <input type="checkbox"/> Other (list all):   |

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

## General Safety

### General Safety

- General Safety & Emergency Preparedness (EHS-4200)
- Laboratory Ergonomics (EHS-4800)
- Confined Space Entry or Awareness (EHS-2300 or EHS-2450)
- Electrical Safety Awareness (EHS-2800)
- Fire Extinguisher Use in Labs (EHS-3825)

### Chemical Safety

- Chemical Safety for Laboratories (EHS-1900)
- Compressed Gas Safety (EHS-2200)
- Cryogenic Liquids and Dry Ice Safety (EHS-2480):

### Radiation Safety

- Radiation Safety and Radiation Safety Hands-On (EHS-5250 and 5251)
- Radiation Safety SAIF (Small Animal Imaging Facility) (EHS-5255)
- Sealed Sources, Non-Irradiator (EHS-5265)
- Research Cabinet X-ray or Irradiator (EHS-1755) and Refresher (EHS-1756)
- Irradiator Security Training (EHS-4780) and Refresher (EHS-4781)
- Laser Safety (EHS-4820) and Refresher (EHS-4821)

### Biosafety

- Biosafety (EHS-1500)
- Bloodborne Pathogens (EHS-1600) and Refresher (EHS-1601)

### Field Safety

- CPR
- Wilderness First Aid
- SCUBA certification/diving safety
- Driving safety
- Other (list):

## Procedure Based/Job Specific Training

- |   |  |  |
|---|--|--|
| <input checked="" type="checkbox"/> Lab/job-specific training | <input type="checkbox"/> Emergency plans or field evacuation plans | <input type="checkbox"/> Other (list): |
| <input type="checkbox"/> Lab SOP(s) to review (list):         | <input type="checkbox"/> Equipment SOP(s) to review (list):        |  |



**CHALLENGE**

**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. 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).

What If Analysis
<b>What if...?</b> Examples: there is a loss of cooling? ...valves/stopcocks are left open/closed? ...there is unexpected over-pressurization? ...a spill occurs? ...the laser is misaligned? ...weather conditions change?
<b>Then...</b> ...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. ...routes may be inaccessible.
<b>What if...?</b>
<b>Then...</b>
<b>What if...?</b>
<b>Then...</b>
<b>What if...?</b>
<b>Then...</b>

**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:** \_\_\_\_\_

		Risk Rating Table <sup>1</sup>			
		Severity of Consequences - Personnel Safety			
		No Injuries	Minor	Moderate to life impacting	Life threatening from single exposure
Likelihood of Occurrence	(Almost) Certain	Low	High*	Unacceptable*	Unacceptable*
	Likely	Low	Medium	High*	Unacceptable*
	Possible	Low	Medium	High*	High*
	Rare	Low	Low	Medium	High*

<sup>1</sup>The Risk Rating is subjective. The primary goal is for researchers to pause, 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.

**Revise plan if the risk rating is too high.** Are these risks acceptable? Use the table below 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.

Risk Rating Action Table	
Hazard Risk Rating	Action
Unacceptable*	STOP! Additional controls needed to reduce risk. <b>Consult with PI and EH&amp;S (650-723-0448).</b>
High*	Additional controls recommended to reduce risk. <b>Consult with PI and EH&amp;S (650-723-0448).</b>
Medium	Ensure you are following best practices. Consult with peers, PI, or EH&S, as needed.
Low	Perform work within controls.

**PI/Supervisor Approval:** \_\_\_\_\_

\*Signature required for **High** risk ratings.

NOTE: **Unacceptable** risk rating experiments **may not proceed**. Introduce further controls to reduce risk.

**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:
Did the trial go as expected? Yes <input type="checkbox"/> No <input type="checkbox"/>
Experimental design changes needed (if any):



## ASSESS

**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...