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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.

Procedure:			
Lab Group:			
Completed By:		**Date:**	

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

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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

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 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

Ionizing Radiation

- ☐ Irradiator
- ☐ Radionuclide
- ☐ Radionuclide sealed source
- ☐ X-ray machine

Non-Ionizing Radiation

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

Biohazards

- ☐ BSL-2 Biological agents
- ☐ BSL-3 Biological agents
- ☐ Human cells, blood, BBP
- ☐ NHPs/cells/blood
- ☐ Non-exempt rDNA
- ☐ Animal work
- ☐ High risk animals (RC1)

- ☐ Other (list):

Hazardous Conditions or Processes

Reaction Hazards

- ☐ Explosive
- ☐ Exothermic, with potential for fire, excessive heat, or runaway reaction
- ☐ 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):

Field Hazards

Environmental Hazards

- ☐ Foul weather
- ☐ Temperature extremes
- ☐ Intense sunlight
- ☐ 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
- ☐ 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 issues, risk of harassment or violence, US State Department active travel alert

Task/Equipment Hazards

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

- ☐ Other (list):

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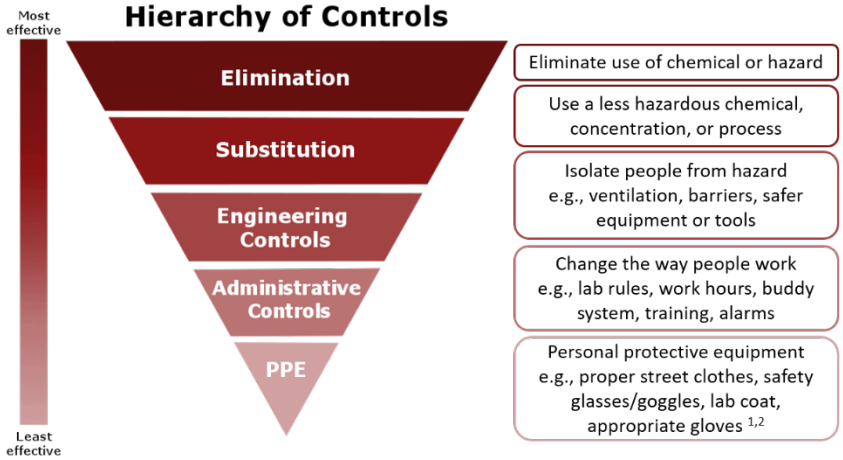
PLAN

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).

Steps or Tasks	Hazard	Hazard Control Measure(s)



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.

[1] For guidance on selection of Personal Protective Equipment (PPE), use Stanford's Laboratory PPE Assessment Tool.

[2] 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

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

Field PPE/Safety Supplies

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

General/Chemical Safety

- ☒ General Safety & Emergency Preparedness (EHS-4200)
- ☐ Chemical Safety for Laboratories (EHS-1900)
- ☐ Compressed Gas Safety (EHS-2200)
- ☐ Cryogenic Liquids and Dry Ice Safety (EHS-2480)

Biosafety

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

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)

Field Safety

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

Job Specific Training

- ☒ Lab/job-specific training
- ☐ Lab SOP(s) to review (list):
- ☐ Emergency plans or field evacuation plans
- ☐ Equipment SOP(s) to review (list):
- ☐ Other (list):

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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
What if…? 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?
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. …routes may be inaccessible.
What if…?
Then…
What if…?
Then…
What if…?
Then…

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[1]

Likelihood of Occurrence	Severity of Consequences - Personnel Safety: No Injuries	Minor	Moderate to life impacting	Life threatening from single exposure
(Almost) Certain	Low	High*	Unacceptable*	Unacceptable*
Likely	Low	Medium	High*	Unacceptable*
Possible	Low	Medium	High*	High*
Rare	Low	Low	Medium	High*

[1]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.

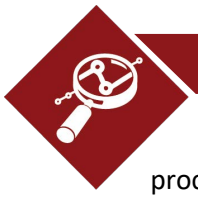
Risk Rating Action Table

Hazard Risk Rating	Action
Unacceptable*	STOP! Additional controls needed to reduce risk. **Consult with PI and EH&S** (650-723-0448).
High*	Additional controls recommended to reduce risk. **Consult with PI and EH&S** (650-723-0448).
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.



ASSESS

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 ☐ 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...