Teaching Laboratory Risk Assessment Tool (Teaching Lab R.A.T.)

The Teaching Laboratory Risk Assessment Tool (Teaching RAT) provides a framework for risk assessment of work done in teaching laboratories.

This tool provides a format for responsible parties and personnel to systematically identify and control hazards to reduce risk of injuries and incidents. Conduct a risk assessment prior to conducting the work with students for the first time and review the **Teaching Lab R.A.T. Guidelines** for further details.

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

**Project / procedure:**

**Class:**

**Instructor:**

**Department: Building / Location:**

**Form Completed By: Start Date:**

# Phase 1: Explore

**Identify your instructional aim 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?

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| **Instructional Aim(s)** |
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| **Approach(es) 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.

**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

**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):

# Phase 2: Plan

**Outline the procedure.** List the steps or tasks for your project/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).

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| **Steps or Tasks** | **Hazard** | **Hazard Control Measure(s)** |
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 **Eliminate use of chemical or hazard**

 **Use a less hazardous chemical, concentration, or process**

 **Isolate people from hazard** (e.g. ventilation, barriers)

 **Change the way people work** (e.g. training, work policies, SOPs)

 **Personal protective equipment**

(e.g. lab coat, appropriate gloves, goggles)

*1 For guidance on selection of personal protective equipment (PPE), use the EH&S* [*Laboratory PPE Hazard Assessment Guide*](https://www.ehs.washington.edu/system/files/resources/lab-ppe-hazard-assessment.docx)*.*

*2 For guidance on selection of chemical-resistant gloves, visit the* [*EH&S website*](https://www.ehs.washington.edu/workplace/personal-protective-equipment-ppe)*.*

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 work (check all that apply).**

**Laboratory PPE/Safety supplies**

☒ Appropriate street clothing

(long pants, closed shoes)

☐ Gloves; indicate type: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

☐ Safety glasses

☐ Safety goggles

☐ Face shield and googles

☐ Lab coat

☐ Flame-resistant lab coat

☐ Fire extinguisher

☐ Eyewash/safety shower

☐ First aid kit

☐ Spill kit

☐ Specialized medical supplies (e.g. calcium gluconate for hydrofluoric acid)

☐ Other (list):

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

**\*Note:** this does not include students taking the class, as safety information is provided to them through class instruction and materials.

**General safety training**

**General/Chemical Safety**

☐ Lab Safety Compliance & Practices

☒ Managing Lab Chemicals

☐ Compressed Gas Safety

☐ Fume Hood Training

☐ Hydrofluoric Acid Safety

☐ Formaldehyde Safety

**Biosafety**

☐ Biosafety Training

☐ Bloodborne Pathogens

**Radiation Safety**

☐ Radiation Safety

☐ Laser Safety

**Field Safety**

☐ First Aid & CPR

☐ 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):

# Phase 3: 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. 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

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| --- | --- |
| **What if…?** | **Then…** |
| *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?* | *…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.* |
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**Assign a risk rating to the experiment.** Based on your procedure outline and the what if analysis, determine the risk rating for the project or procedure.

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\*** |

**Risk Rating***1***:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*1The Risk Rating is subjective. The primary goal is 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.*

**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.

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| --- | --- |
| **Risk Rating** | **Action** |
| **Unacceptable\*\*** | **STOP**! Additional controls need 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. |

**Instructor/Supervisor Approval:**

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**\***Signature for **High** risk ratings.If needed, contact EH&S (206.221.2339) for recommendations.

**NOTE:** **\*\*Unacceptable** risk-rated experiments **should not proceed**. Introduce further controls to reduce risk. Contact EH&S (206.221.2339) for recommendations and best practices.

# Phase 4: Assess

**Perform a trial run.** How can you test your experimental design? Can you do a dry run of the project/procedure without hazardous chemicals/reagents/gases to familiarize yourself with equipment and demonstrate your ability to manipulate the experimental apparatus? Can you run the project/procedure with a less hazardous material? Can you test your experimental design at a smaller scale? If your project/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 project/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 supervisor/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...**

## Procedure risk assessment is complete.

**Form Completed By:**

**Signature: Date:**

**PI / Supervisor Signature:**