



# ONTARIO TECH

## GUIDELINES FOR LAB SAFETY

Research labs, depending on their focus and the type of experiments they conduct, can be associated with various risks. Here are some of the common risks associated with different areas of research labs:

### Research Lab Risks:

#### 1. Chemical Risks

- **Exposure to Toxic Chemicals:** Many labs use chemicals that can be harmful if inhaled, ingested, or meet the skin.
- **Chemical Spills and Leaks:** Accidental spills can lead to fires, explosions, or toxic exposure.
- **Improper Storage:** Chemicals stored improperly can react with each other, leading to explosions or the release of toxic gases.

#### 2. Biological Risks

- **Exposure to Pathogens:** Research labs that work with bacteria, viruses, and other pathogens, as well as biological material that can harbour such pathogens, can pose a risk of infection.
- **Biohazard Waste:** Improper disposal of biohazardous waste can lead to environmental contamination and health risks.

#### 3. Physical Risks

- **Equipment Malfunctions:** Equipment used in labs can malfunction, leading to injuries.
- **Electrical Hazards:** Improper wiring or malfunctioning equipment can lead to electrical shocks.
- **Fire:** Many labs use flammable materials, and a fire can occur if they are mishandled.

#### 4. Ergonomic Risks

- **Repetitive Strain Injuries:** Tasks that require repetitive motions can lead to musculoskeletal disorders.
- **Poor Lab Design:** Labs that are not ergonomically designed can lead to physical strain and injuries.

#### 5. Environmental Risks

- **Waste Disposal:** Improper disposal of lab waste can lead to environmental contamination.
- **Resource Consumption:** Labs can consume significant amounts of water, energy, and other resources.





## 6. Psychological Risks

- **Stress:** High-pressure environments, tight deadlines, and the nature of experimental work can lead to stress.
- **Burnout:** Long hours and the demanding nature of research can lead to burnout.

## 7. Animal Research Risks

- **Zoonotic Diseases:** Labs that work with animals can expose workers to diseases that transfer from animals to humans.
- **Animal Handling:** Improper handling of animals can lead to bites, scratches, and other injuries to both the handler and/or the animal.

## 8. Nanotechnology Risks

- **Exposure to Nanoparticles:** The health effects of exposure to nanoparticles are not fully understood, but there are concerns about potential risks.

## 9. Cybersecurity Risks

- **Data Breaches:** Labs that store sensitive data can be targets for cyberattacks, leading to data breaches.
- **Loss of Intellectual Property:** Research findings and proprietary information can be stolen.

It's important to note that research labs typically have stringent safety protocols and training programs in place to mitigate these risks. Regular safety audits, training sessions, and the use of personal protective equipment (PPE) are common practices in research labs to ensure the safety of researchers and the environment.

## Environmental Health and Safety (EHS) Risks

Environmental Health and Safety (EHS) focuses on the well-being of people and the environment. When considering EHS risks in research labs, it's essential to understand the potential hazards that can impact both researchers and the environment. Here are some of the EHS risks associated with research lab areas:

### 1. Chemical Exposure and Disposal

- **Toxic Chemical Exposure:** Many labs use chemicals that can be harmful to both humans and the environment if released.
- **Improper Disposal:** Chemicals that are not disposed of correctly can contaminate water sources, soil, and air.
- **Chemical Storage:** Improperly stored chemicals can lead to leaks, which can harm the environment and pose health risks to lab personnel.





## 2. Biological Hazards

- **Pathogen Releases:** Labs working with pathogens can accidentally release them, leading to potential outbreaks.
- **Genetically Modified Organisms (GMOs):** Uncontrolled release of GMOs can impact local ecosystems.
- **Biohazardous Waste:** Improper disposal can lead to environmental contamination.

## 3. Radiological Hazards

- **Radioactive Material Release:** Accidental release or dose exposure can contaminate the environment and pose long-term health risks.
- **Waste Disposal:** Radioactive waste needs special disposal methods to prevent environmental contamination.
- **Radiation Risks:** Research labs that work with nuclear substances, radioactive devices, and X-Rays can pose a risk of inadvertent radiation exposure.

## 4. Physical Hazards

- **Noise Pollution:** Some lab equipment can produce high levels of noise, which can be harmful to both humans and certain sensitive environmental areas.
- **Energy Consumption:** High energy-consuming equipment can contribute to environmental issues if sourced from non-renewable resources.
- **Laser Risks:** Research labs that work with high powered lasers may pose a risk to eye injury or burn injury. Fires may also occur if flammable material inadvertently enters the pathway of the laser beam for a sufficient amount of time.

## 5. Ergonomic and Air Quality Concerns

- **Poor Ventilation:** Can lead to the buildup of toxic fumes or pathogens.
- **Ergonomic Design:** Poorly designed labs can lead to physical strain, contributing to long-term health issues.

## 6. Waste Management

- **Resource Depletion:** Excessive use of water, energy, and other resources without proper conservation measures.
- **Hazardous Waste:** Without proper segregation and disposal, hazardous waste can contaminate the environment.

## 7. Animal Research

- **Waste Disposal:** Animal waste can be a source of pathogens and needs proper disposal.
- **Ethical Concerns:** The use of animals in research has ethical implications and can impact the environment if not managed correctly.



## 8. Nanotechnology

- **Nanoparticle Release:** The environmental impact of nanoparticles is not fully understood, but there's potential for harm if released.

## 9. Infrastructure and Equipment

- **Leaks and Spills:** Infrastructure failures can lead to chemical, biological, or radiological spills.
- **Energy Inefficiencies:** Older equipment or infrastructure can consume more energy, contributing to environmental concerns.

## 10. Emergency Preparedness

- **Lack of Training:** Without proper training, lab personnel might not respond effectively to emergencies, leading to greater environmental and health impacts.
- **Equipment Failures:** Failures in safety equipment, like fume hoods or safety showers, can exacerbate risks.

# Environmental Health and Safety Risks Mitigations

Mitigation plans for Environmental Health and Safety (EHS) risks in research labs are essential to ensure the safety of both personnel and the environment:

## 1. Chemical Exposure and Disposal

- **Safety Training:** Regular training sessions on the proper handling, storage, and disposal of chemicals.
- **Safety Data Sheets (SDS):** Ensure that SDS for all chemicals are up to date and readily accessible in the lab for lab personnel.
- **Spill Kits:** Equip labs with spill kits and train personnel on their use.
- **Hazardous Waste Disposal:** Establish protocols for the segregation and disposal of hazardous waste.

## 2. Biological Hazards

- **Biosafety Containment Levels (CL):** Implement appropriate BSL practices based on the pathogens being handled.
- **Personal Protective Equipment (PPE):** Ensure that appropriate PPE (e.g., gloves, lab coats, face shields) is available and used.
- **Autoclaves:** Use autoclaves to sterilize biohazardous waste before disposal.





- **Decontamination:** Ensure that all biohazardous material is properly decontaminated through the use of autoclaves or an appropriate chemical disinfectant before disposal.

### 3. Radiological Hazards

- **Radiation Safety Training:** Provide training on the safe handling and storage of radioactive materials.
- **Dosimeters:** Provide lab personnel with dosimeters to monitor radiation exposure.
- **Lead Shielding:** Use lead shielding and containment for radioactive sources.
- **Reduce Time:** minimize the time you require to work with radiological hazards.
- **Increase Distance:** maximize the distance between you and the radiological hazards.
- **Increase Shielding:** Use appropriate shielding and containment for radioactive sources.

### 4. Physical Hazards

- **Noise Control:** Implement noise control measures, such as soundproofing or ear protection.
- **Equipment Maintenance:** Regularly maintain and inspect equipment to ensure it's in good working condition.

### 5. Ergonomic and Air Quality Concerns

- **Ergonomic Furniture:** Use adjustable chairs, tables, and other furniture to reduce strain.
- **Ventilation Systems:** Ensure labs have proper ventilation systems, including fume hoods, to remove toxic fumes.

### 6. Waste Management

- **Recycling Programs:** Implement recycling programs for non-hazardous waste.
- **Waste Segregation:** Clearly label and segregate waste based on type (e.g., biohazardous, chemical, general).
- **Waste Reduction:** Promote practices that reduce the generation of waste.

### 7. Animal Research

- **Ethical Review:** Ensure all animal research undergoes ethical review and approval.
- **Animal Care Training:** Provide training on the proper care and handling of research animals.

### 8. Nanotechnology

- **Containment:** Use containment systems to prevent the release of nanoparticles.
- **Research:** Continuously monitor and research the environmental and health impacts of nanoparticles.



## 9. Infrastructure and Equipment

- **Regular Inspections:** Conduct regular inspections of infrastructure to identify and fix potential issues.
- **Safety Equipment:** Equip labs with safety equipment like eyewash stations, safety showers, and fire extinguishers.

## 10. Emergency Preparedness

- **Emergency Plans:** Develop and regularly update emergency response plans.
- **Drills:** Conduct regular emergency drills to ensure personnel know how to respond to various emergencies.
- **First Aid Kits:** Equip labs with first aid kits and train personnel on basic first aid. *Kits should be inspected and replenished regularly.*

## Institutional Strategies

- Foster a **culture of safety**.
- Report concerns
- Comprehensive EHS program in place
  - PPE protocol
  - **Emergency Response plan**
  - Protocols for safe handling
  - Protocols for safe storage
  - Disposal of **hazardous materials**
- Continuous education/training on best practices
- **Regular Safety Audits** and review of EHS practices to ensure internal/external compliance.

In addition to these specific measures, labs should foster a culture of safety where personnel feel empowered to report concerns and are continuously educated about best practices. Regular audits and reviews of EHS practices can also help identify areas for improvement and ensure that labs remain compliant with local, state, and federal regulations.

If you have any inquiries regarding this document, please contact the Office of Risk Management at [orm@ontariotechu.ca](mailto:orm@ontariotechu.ca).