# PPE Selection Guide

## Overview:

Biological, chemical, physical, and radiological hazards may be present in NDSU laboratories and other work areas on campus. Selecting the most appropriate personal protective equipment (PPE) to reduce exposure to hazards is critical for laboratory and workplace safety. PPE is the last line of defense and should be used with appropriate engineering controls, administrative controls, and safe work practices.

## Hazard Assessments:

To determine the appropriate PPE required for the work area, the principal investigator or supervisor must identify all of the potential hazards in the laboratory or work area. For each hazard, identify the hazard controls and/or PPE required to eliminate or minimize the hazard to a safe level. The Safety Office is available to assist with hazard assessments in your area.

Hazard assessments should be completed before conducting work and reevaluated regularly and whenever a new hazard is identified.

**Consider the Following Hazards During a Hazard Assessment:**

- Chemical Hazards
- Biological Hazards
- Atmospheric Hazards
- Electrical Hazards
- Laser Hazards
- Physical Hazards
- Radiological (ionizing and non-ionizing) Hazards
- Thermal (extreme hot or cold) Hazards
- Noise Hazards

## Training

Training must be provided to all laboratory personnel who are required to wear PPE. The training must include the following topics:

- How to properly wear PPE.
- The uses and limitation of PPE.
- When PPE must be worn in the lab.
- Maintenance, inspection, storage, and care of PPE.
- Proper removal, disposal, and replacement procedures for damaged PPE.

## General Guidance on Laboratory PPE

1. In general, the minimum PPE that should be worn while working in the lab includes:
    - Safety glasses
    - Gloves (disposable nitrile or other appropriate glove)
    - Lab coat
    - Long pants, skirt or other leg covering
    - Closed-toe shoes
2. Appropriate attire requirements:
    - Tie back long hair and remove any dangling jewelry.
    - Do not wear shorts, short skirts, sandals, or loose clothing.
3. Remove PPE and wash hands before you leave the laboratory.
4. Do NOT rely on PPE alone to control hazards when other effective control options are available. Implement the hierarchy of controls:
    - Elimination: Physically remove the hazard
    - Substitution: Replace the hazard
    - Engineering Controls: Isolate the hazard
    - Administrative Controls: Change the way people work
    - Wear Personal Protective Equipment

## Respiratory Protection

**Respirators** are a form of personal protective equipment (PPE) worn to protect the wearer from inhaling hazardous atmospheres.

**Respirators shall only be used to protect employees from inhalation hazards in the following circumstances:**

(1) When other options for hazard control (i.e., use of engineering controls or substitution of less toxic materials) are infeasible,

(2) While engineering controls are being installed or repaired, or

(3) During emergencies.

**The use of required respiratory protection equipment at NDSU is strictly limited to employees who:**

- Have a documented need to utilize such equipment,
- Pass and maintain an appropriate medical evaluation,
- Attend annual training, and
- Complete annual fit-testing.

**Additional information is available on the Respirator Information webpage!**

# Eye and Face Protection

Eye protection can protect you from the risk of exposure to chemical or biological splashes, dangerous light radiation, and impact hazards (e.g., flying debris).

| Type | Description |
|---|---|
|  **Safety Glasses** | **Uses and Limitations:**<br>• Minimum level of eye protection that must be worn in the lab.<br>• Offer protection against dust and flying objects.<br>• Less effective at protecting the eyes from splashes.<br>**Required when:**<br>• An impact hazard exists (flying debris, dust, chips).<br>• Working with low hazard chemicals, or BSL-1 biological materials. |
|  **Splash Goggles** | **Uses and Limitations:**<br>• Form a liquid-proof seal around the eyes to provide better eye protection in the case of splashes.<br>**Required when:**<br>• Potential for chemical fumes, splashes, mists, sprays, or dust exposure to the eyes, or when working with BSL-2 or BSL-3 biological hazards. |
|  **Face Shield and Goggles** | **Uses and Limitations:**<br>• Highest level of face and eye protection for impact hazards, and chemical and biohazard splashes.<br>• Must always be used in combination with safety glasses or splash goggles.<br>**Required when:**<br>• Working with large quantities of hazardous materials, particularly hazardous chemicals, and/or a high probability of face or eye exposure exists. |
|  **Laser Protection Glasses** | **Uses and Limitations:**<br>• Provide protection against exposure to lasers.<br>• Must be selected based on laser wavelength and energy/power.<br>**Required when:**<br>• Working with Class 3 or Class 4 lasers where irradiation of the eye is possible. |

# Hand Protection

Gloves can be worn in the lab to protect you from exposure to both physical and chemical hazards. Physical hazard gloves can protect you from sharp edges and extreme temperatures. Chemical resistant gloves are often made of many different materials and offer protection against certain types of chemical exposure. No single glove type protects against all chemicals. You should always use a manufacturer's Glove Compatibility Chart, and a chemical's Safety Data Sheet to ensure your gloves adequately protect you from the chemicals you are working with in the lab.

## Chemical Hazard Gloves

| Type | Description | Recommended Use |
|---|---|---|
|  Disposable Latex Gloves | Provide very little chemical protection.<br>Difficult to detect puncture holes.<br>Latex may cause allergic reaction. | Working with biological hazards (BSL1, BSL2, BSL3) and water-based materials. Use latex alternatives whenever possible |
|  Disposable Vinyl Gloves | Provide very little chemical protection.<br>Difficult to detect puncture holes<br>Not form-fitting – may impede hand dexterity. | Working with biological hazards (BSL1, BSL2, BSL3) and water-based materials. |
|  Disposable Nitrile Gloves | Most used lab gloves.<br>Protect against incidental contact for wide variety of chemicals. | Working with biological (BSL1, BSL2, BSL3) or chemical splash hazards. |
|  Thick Reusable Gloves | Different materials (latex, nitrile, butyl, PVC, neoprene, etc.) provide protection against wide variety of different chemical hazards. | Used to protect against biological or large quantities of chemicals. |
|  Viton or Silver Shield Gloves | Provide heavy chemical resistance.<br>Not form-fitting.<br>Nitrile gloves can be worn over Silver Shield gloves to increase hand dexterity. | Used to protect against large volumes of chemicals or when working with acutely toxic chemicals. |

# Physical Hazard Gloves

| Type | Description | Recommended Use |
|---|---|---|
|  Autoclave Gloves | Heat resistant.<br>Made of terrycloth cotton.<br>Not waterproof and should not be used to handle dry ice. | Working with hot liquids or equipment. |
|  Cryogen Insulated Gloves | Protection against dry ice and ultra-cold environments.<br>Lightweight and waterproof. | Working with liquid nitrogen, other liquid cryogens, and dry ice. |
|  Cut Resistant Gloves | Protect against cuts or laceration from sharp objects.<br>Do not provide significant protection against punctures (e.g., needlestick injuries).<br>May be made of wire mesh or Kevlar. | Working with sharp objects like knives. |
|  Leather Gloves | Puncture and tear resistant. | Good all-purpose work glove for non-hazardous material handling. |

## Foot Protection

Closed-toe shoes are required in laboratories. Sandals, open-toe shoes, perforated shoes, or shoes that expose the top of the foot should not be worn in areas where chemical, biological, sharps, thermal, or physical hazards are present. Additional foot protection may be required for heavy materials, wet work, field work, or shop activities.

## Hearing Protection

Hearing protection may be required when laboratory or work activities generate high noise levels, such as sonication, grinding, machining, compressed air use, or other loud equipment. PIs and supervisors should evaluate noise-producing activities and provide appropriate hearing protection when needed. Contact the Safety Office for assistance if noise levels are a concern.

# Body Protection

Lab coats and chemical aprons may be required when working in the laboratory. Lab coats provide protection of skin and personal clothing from incidental contact and small spills and provide a removable barrier in the event of an incident involving a spill or splash of hazardous substances. Lab coats should always be removed before leaving the lab to prevent the spread of contamination.

## Lab Coats and Aprons

| Type | Description | Limitations |
|---|---|---|
|  Traditional Lab Coat | **Material**: Cotton/Poly Blend<br><br>**Uses**:<br>General chemical or biological lab work. | Provides only moderate protection from splashes and burns readily. |
|  Flame Resistant (FR) Lab Coat | **Material**: Nomex<br><br>**Uses**:<br>Working with highly flammable chemicals, or large quantities of flammables.<br>Working with pyrophoric or other reactive chemicals. | Flame resistant but provides only moderate protection from splashes. |
|  Barrier Lab Coat | **Material**: Polyester<br><br>**Uses**:<br>High risk biological laboratory work. | Fluid resistant (water-based solutions), but does not offer chemical or flame resistance. |
|  Chemical Resistant Apron | **Material**: Different materials (latex, nitrile, butyl, PVC, neoprene, etc.) provide protection against wide variety of different chemical hazards.<br><br>**Uses**:<br>Working with highly toxic, or large quantities of corrosives. | Should always be worn over a lab coat. Ensure the apron is resistant to the chemicals in the laboratory. |

# Full Body Protection

| Type | Description | Limitations |
|---|---|---|
|  Chemical Resistant Coverall | **Material**: Different materials (most commonly TyVek) provide highest level of protection against wide variety of different chemical hazards.<br><br>**Uses**:<br>Working with highly toxic, or large quantities of corrosives. | Ensure the suit material is resistant to the hazardous materials in the lab. |

## Need Help Selecting PPE?

**Contact the Safety Office for assistance with hazard assessments, PPE selection, or laboratory-specific safety requirements.**

**701-231-7759**