PERSONAL PROTECTIVE EQUIPMENT

Risk Management and Safety
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What is Personal Protective Equipment (PPE)

- Equipment designed to protect the wearer from injury or illness resulting from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.
- The need for PPE and the type of PPE used is based on hazard present; each situation must be evaluated independently.
When is PPE Used

• PPE is used when a hazard could not be controlled by other methods, such as:
  o engineering or industrial hygiene (IH) controls.
  o administrative controls (i.e., shift rotation).
• PPE is the last level of control.
Engineering & IH Controls

First line of defense

- To eliminate or reduce exposure to hazards by physically removing or reducing the hazard e.g., fume hoods, ventilation systems, equipment and machine guards.
- Engineering controls may require modifications or substitutions of equipment or materials to accommodate current activities and reduce potential hazard e.g., using a less hazardous chemical, increased ventilation.
Engineering & IH Controls

If . . .

• The work environment can be physically changed to prevent employee or student exposure to the potential hazard,

Then . . .

• The hazard can be eliminated with an engineering control.
Engineering & IH Controls

• The hazard is reduced or eliminated by:
  o Design (remove hazard from process)
  o Substitution (of less hazardous materials)
  o Process modification (how and where)
  o Isolating the process or the worker
  o Wet methods for dust reduction
  o Local exhaust ventilation (at source)
  o Dilution ventilation (area)
  o Good housekeeping
Administrative Controls

Second line of defense

- To eliminate or reduce exposure by workplace policies and procedures e.g., Lab Safety Manual.
- These controls are hazard **avoidance** rather than control. They do not protect the wearer if the wearer fails to follow rules and procedures e.g., training, monitoring.
- Dose = concentration \( \times \) time therefore if concentration or time is reduced the dose or exposure will also be reduced.
Administrative Controls

If . . .

- Employees or students can change the way they do their jobs and the exposure to the potential hazard is removed,

Then . . .

- The hazard can be eliminated with an administrative control.
PPE

Last line of defense

- PPE does not reduce the hazard.
- PPE acts as a barrier between the hazard and the worker.

Properly selected PPE must

- Provide adequate protection.
- Be reasonably comfortable.
- Not get in the way of the wearer.
Things to Consider

- Only the PPE stands between the wearer and the hazard.
- Unprotected individuals in the same area will be exposed.
- If the PPE is inappropriate for the hazard, not worn properly, or is damaged, the user will not be protected.
PPE Selection

• PPE selection must be based on the job to be performed.
  o Too much PPE or inappropriate PPE can be as dangerous as too little PPE.
  o Doubling up 2 pairs of the wrong type of glove will not improve protection.

• Before performing a task, identify the hazards and type of PPE required to provide protection.
Type and Size of PPE

• After selecting the level of protection, it is important to pick the proper type and size of PPE.
  o PPE is designed for specific uses with specific hazards.
  o Using PPE outside of manufacturer specifications will not protect the user from hazards.
# Examples of PPE

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Protection</th>
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<tbody>
<tr>
<td>Eye</td>
<td>safety glasses, goggles</td>
</tr>
<tr>
<td>Face</td>
<td>face shields</td>
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<tr>
<td>Head</td>
<td>hard hats</td>
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<td>Feet</td>
<td>safety shoes</td>
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<td>Hands and arms</td>
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<td>Bodies</td>
<td>vests</td>
</tr>
<tr>
<td>Hearing</td>
<td>earplugs, earmuffs</td>
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</tbody>
</table>
Head Protection
How Head Protection Works

Hard Hats work by dissipating force.
Causes of Head Injuries

- Falling objects such as tools.
- Bumping head against objects, such as pipes or beams.
- Contact with exposed electrical wiring or components.
Hard Hat Impact Types

• Type I hard hats are intended to reduce the force of impact resulting for a blow only to the top of the head.
• Type II hard hats are intended to reduce the force of impact resulting from a blow which may be received off center or to the top of the head. A Type II hard hat typically is lined on the inside with thick high density foam.
Hard Hat Electrical Classes

- Class G (General) hard hats are intended to reduce the danger of contact exposure to low voltage conductors. Test samples are proof tested at 2200 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the hard hat protects the wearer. Class G hard hats were formerly known as Class A.
Hard Hat Electrical Classes

• Class E hard hats are intended to reduce the danger of exposure to high voltage conductors. Test samples are proof-tested at 20,000 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the helmet protects the wearer. Class E hard hats were formerly known as Class B.
Hard Hat Electrical Classes

• Class C (Conductive) hard hats are not intended to provide protection against contact with electrical conductors.
Eye Protection
Needed when any of these hazards are present

- Dust and other flying particles, such as metal shavings or sawdust.
- Corrosive gases, vapors, and liquids.
- Molten metal that may splash.
- Potentially infectious materials such as blood or hazardous liquid chemicals that may splash.
- Intense light from welding and lasers.
Criteria for Selection

- Protects against specific hazard(s).
- Comfortable to wear.
- Does not restrict vision or movement.
- Durable and easy to clean and disinfect.
- Does not interfere with the function of other required PPE.
Proper choices

• Ordinary glasses do not provide the required protection.

• Proper choices include:
  o Prescription glasses with side shields and protective lenses.
  o Goggles that fit comfortably over corrective glasses without disturbing the glasses.
  o Goggles that incorporate corrective lenses mounted behind protective lenses.
Safety Glasses

- Most operations require side shields.
- Used for moderate impact from particles produced by jobs such as carpentry, woodworking, grinding, and scaling.
Goggles

- Protects eyes and area around the eyes from impact, dust, and splashes.
- Some goggles fit over corrective lenses.
Laser (Welding) Safety Goggles

- Protects eyes from intense concentrations of light produced by lasers.
Eye Protection

- Visitor specs are *only* appropriate for wearers with no true exposure to hazards.
- Safety glasses are used to protect the eyes from flying objects (no face protection).
- Chemical splash goggles protect against fluids by sealing tightly against the face.
- Face shields provide highest level of splash protection.
Face Shields
Face Shields

- Full face protection.
- Protects face from dusts and splashes or sprays of hazardous liquids.
- **Does not** protect from impact hazards.
- Wear safety glasses or goggles underneath.
Welding Shields

- Protects eyes against burns from radiant light.
- Protects face and eyes from flying sparks, metal splatter, & slag chips produced during welding, brazing, soldering, and cutting.
Hearing Protection
When Is Hearing Protection Needed

- A hearing conservation program becomes a requirement at exposures >85dBA.
- Higher levels of noise exposure have shorter allowable exposure times.
### Noise levels versus Duration

<table>
<thead>
<tr>
<th>Sound Level (dBA)</th>
<th>Exposure (hours)</th>
</tr>
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<tbody>
<tr>
<td>90</td>
<td>8</td>
</tr>
<tr>
<td>92</td>
<td>6</td>
</tr>
<tr>
<td>95</td>
<td>4</td>
</tr>
<tr>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>105</td>
<td>1</td>
</tr>
<tr>
<td>110</td>
<td>0.5</td>
</tr>
<tr>
<td>115</td>
<td>0.25</td>
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</table>
Hearing Protection

• Rule of Thumb - if you cannot carry on a conversation in a normal tone of voice with someone at arm’s length, you are likely near 90dBA.

• Ear Plugs - less expensive, disposable.

• Ear Muffs - more expensive, more durable.

• Ear Plugs and Ear Muffs can be used together in very high noise areas.
Arm and Hand Protection
Typical Uses

- Chemical protection
- Biohazard protection
- Abrasion protection
- Friction protection
- Cut protection
- Puncture protection
- Protection from extremes of heat and cold
Typical Uses

• No glove is good against all hazards.
• Gloves have a finite lifespan and must be periodically replaced.
• When donning gloves, examine them for signs of tears, cracks, holes and dry rot.
• Hands should always be washed after removing gloves.
Typical Uses

*Nitrile* protects against solvents, harsh chemicals, fats and petroleum products and also provides excellent resistance to cuts and abrasions.

*Butyl* provides the highest permeation resistance to gas or water vapors.
Typical Uses

*Kevlar* protects against cuts, slashes, and abrasion.

*Stainless steel mesh* protects against cuts and lacerations.
Foot Protection
When Is Foot Protection Needed

- Heavy objects such as barrels or tools that might roll onto or fall on employees’ or students’ feet.
- Sharp objects such as nails or spikes that might pierce ordinary shoes.
- Molten metal that might splash on feet.
- Hot or wet surfaces.
- Slippery surfaces.
Types of protective footwear

- Steel-toed footwear, preferably with metatarsal guards, is used to protect feet from crushing injuries caused by heavy objects.
- Metal insoles to protect against puncture wounds.
- Electrically conductive for use in explosive atmospheres, or nonconductive to protect from workplace electrical hazards.
- Rubber boots, often used to protect feet from exposure to liquids.
Protective Clothing
When Is Protective Clothing Needed

- Often hazard specific.
- To be considered effective, protective clothing must prevent the contaminant from reaching the clothing or skin of the wearer!
Cause of concern

- Intense heat
- Splashes of hot metals and other hot liquids
- Impacts from tools, machinery, and materials
- Cuts
- Hazardous chemicals
- Radiation
Body Protection

• Provide protective clothing for parts of the body exposed to possible injury
• Types of body protection
  o Vests
  o Aprons
  o Jackets
  o Coveralls
  o Full body suits
Respiratory Protection
When Is Respiratory Protection Needed

• Protects users by removing harmful materials that may enter the body via the lungs.
• Inhalation is one of the quickest, most efficient ways to introduce lethal levels of hazardous materials into the body.
Respirator Types

- Air Purifying Respirators (APR)
  - Half-face
  - Full Face

- Powered Air Purifying Respirators (PAPR)

- Self Contained Breathing Apparatus (SCBA)
Respirator Use

- Respirators put additional resistance against the respiratory system of the wearer.
- Persons with undiagnosed respiratory system or cardiovascular problems could trigger a serious medical problem (respiratory distress, asthma, heart attack, etc.) by using a respirator.
Physical Requirements

• Employees and students should not wear a respirator unless they have been medically cleared to do so!

• This clearance takes the form of a questionnaire, physical examination, pulmonary function testing, chest X-Ray, fit testing the respirator or a combination of the above.
Incompatible with facial hair
Facial hair...

- The respirator cannot form a tight seal against the cheeks and chin, resulting in air leaks which can allow airborne contaminants to be inhaled.
- Specially designed PAPR hoods can be used for employees and students with facial hair.
- Small amounts of facial hair that fit inside of the respirator facepiece are acceptable.
PPE Usage

• PPE that is required to safely conduct University work should be purchased by the work unit.
• Supervisors are responsible for ensuring that PPE is available and worn.
• Employees and students are responsible for wearing & maintaining PPE, and reporting worn or defective PPE to their supervisor.
Summary

- PPE is hazard specific; the hazards of each workplace and task must be evaluated.
- PPE is used as a last resort when the hazard cannot be controlled by engineering or administrative controls.
- Supervisors are responsible to ensure PPE is available and worn.
- Employees and students must wear and maintain their PPE.
Summary

- PPE is only considered effective if it prevents the contaminant from reaching the wearer.
- Respirators should not be worn by employees or students unless they have been medically cleared to do so.