



PPPL	PRINCETON PLASMA PHYSICS LABORATORY ES&H DIRECTIVES		
	ES&HD 5008 SECTION 8, Chapter 6 Personal Protective Equipment		
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CHAPTER 6 PERSONAL PROTECTIVE EQUIPMENT

6.1 INTRODUCTION

The use of personal protective equipment (PPE) is required in some parts of the Laboratory to protect employees from various occupational hazards. PPE is not a substitute for adequate engineering or administrative controls and should be used only if no other measures are adequate or feasible. PPE typically includes: gloves, safety glasses, goggles, face shields, respirators, etc. This Chapter covers hand, eye and face, foot, head, and body protection. Respirators are covered separately in Chapter 7, hearing protection is discussed in Chapter 8, laser protection is mentioned in Section 3, welding protection is addressed separately in Section 9, Chapter 15, and electrical protection will be included in Section 2. The SafetyWiki is also a good source of information for the different types of protection.

6.2 SCOPE

This section covers the selection, care, and use of personal protective equipment at PPPL, and applies to all Laboratory personnel, contractors, subcontractors, and visitors.

6.3 DEFINITIONS

- 6.3.1 **American National Standards Institute (ANSI)** – An American non-profit agency that administers standards to promote safety.
- 6.3.2 **Administrative Controls** - Methods of controlling employee exposures by job rotation, work assignment or time periods away from the hazard.
- 6.3.3 **Direct Vented Goggles** – Allow a direct flow of air from the work environment into the goggles and are only appropriate for impact hazards.
- 6.3.4 **Engineering Controls** - Methods of controlling employee exposures by modifying the source or reducing the quantity of contaminants released into the workroom environment.
- 6.3.5 **Exposure** - Contact with a chemical, biological, or physical hazard.
- 6.3.6 **Face Shield** – A protective device intended to protect the entire face or portions of it from impact hazards such as flying fragments, objects, large chips, or particles and from liquid splash hazards such as acid or heated fluids. Considered secondary protection, face shields shall be worn with additional eye protection in most cases.
- 6.3.7 **Goggles** – A protective device intended to fit the face immediately surrounding the eyes, forming a protective seal. This prevents objects or liquids from entering under or around goggles.

- 6.3.8 **Hazard** – A situation in the workplace that has the potential to harm the health and safety of people or damage the lab and equipment.
- 6.3.9 **Indirect Vented Goggles** – provide protection from splash entry by a hooded or covered vent that allows the free movement of air but prevents the direct passage of liquids.
- 6.3.10 **Job Hazard Analysis (JHA)** – A form used by employees to identify the hazards of a job or task.
- 6.3.11 **Non-vented Goggles** – Have no venting of any kind and offer protection against the passage of mist and vapors.
- 6.3.12 **Occupational Safety and Health Administration (OSHA)** – The United States government agency that regulates the conditions in working environments to ensure the health and safety of employees.
- 6.3.13 **Personal Protective Equipment (PPE)** - Devices worn by employees to protect against exposure to hazards in the environment.
- 6.3.14 **Prescription Lens** – A lens manufactured to the wearer’s individual corrective prescription.
- 6.3.15 **Protective Footwear** – A shoe having a reinforced or steel toecap, also known as safety shoes. May also include steel shanks and metatarsal protection.
- 6.3.16 **Protective Helmet** – A hat made out of hard material for protection, also known as a hard hat or bump cap.
- 6.3.17 **Safety Glasses** – A protective device intended to shield the wearer’s eyes from impact hazards such as flying fragments, objects, large chips, and particles.
- 6.3.18 **Shall** – The term “shall” means mandatory.
- 6.3.19 **Side Shield** – A device attached to safety glasses that provides side exposure protection to the eye.
- 6.3.20 **Temple** – The pieces on safety glasses that extend from the frame front to behind the ears.

6.4 RESPONSIBILITIES

6.4.1 Department /Division Heads are responsible for ensuring implementation of this section.

6.4.2 Line Supervisors are responsible for:

- A. Conducting, with the assistance of Industrial Hygiene (IH) as appropriate, a workplace assessment to identify those employees or jobs that may need PPE. PPE may be required due to hazards of processes or environment, chemical hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through

absorption, inhalation or physical contact. A Job Hazard Analysis (JHA) conducted in accordance with procedure ESH-004 may be used for workplace assessment.

- B. Documenting the workplace assessment with a certificate identifying the workplace evaluated, the person certifying the evaluation, and the date(s) of the hazard assessment. A properly completed JHA form as per ESH-004 may be used as documentation of the assessment.
- C. Selecting, with the assistance of IH as appropriate, PPE suitable for jobs and their associated hazards.
- D. Selecting PPE that properly fits each affected employee.
- E. Enforcing the use of PPE in areas and on jobs where its use is required.
- F. Ensuring that the PPE is used in accordance with instructions and training provided by the supervisor and IH.
- G. Ensuring that the proper PPE is on hand in sufficient amounts for employees and visitors.
- H. Ensuring that the PPE is provided, used, and maintained in a sanitary and reliable condition.
- I. Periodically monitoring, with the assistance of IH as appropriate, the workplace for changes in or the introduction of new hazards.

6.4.3 Industrial Hygiene (IH) is responsible for:

- A. Assisting Line Supervisors in investigating, identifying, and evaluating hazards where PPE may be necessary.
- B. Assisting supervisors in the selection of the proper PPE.
- C. Arranging for instruction and training in the proper use of PPE
- D. Periodically monitoring to ensure that the PPE is being used properly.
- E. Periodically assisting the Supervisor in monitoring the workplace for changes in or the introduction of new hazards.

6.4.4 All employees are responsible for:

- A. Wearing and using the issued PPE in accordance with instructions and training provided by IH and their supervisors.
- B. Cleaning, maintaining, and properly storing the PPE issued to them.

- C. Informing their supervisors of any personal health problem that would be aggravated by the use of PPE.
- D. Inspecting all PPE prior to each use.
- E. Reporting any damaged PPE to their supervisor and replacing the defective PPE.
- F. Using only those types of PPE that have been designated for that job.
- G. Reporting changes in or the introduction of new hazards to their supervisor.

6.5 REQUIREMENTS

- 6.5.1 PPE shall be used only when the use of engineering and administrative controls are not feasible or effective enough to protect against the hazard.
- 6.5.2 PPE shall not be used in any area or on any job until a workplace hazard assessment has been conducted (see 6.4.2.A above) and the required PPE has been determined.
- 6.5.3 Defective PPE shall not be used. Each employee is responsible for inspecting all PPE prior to each use. PPE inspection checklists can be found in Attachment 1.

6.6 PRACTICES AND PROCEDURES

6.6.1 Hand Protection

- A. Appropriate hand protection shall be issued and worn when affected employees are exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, and harmful temperature extremes.
- B. Hand protection shall be worn as identified on JHAs.
- C. Gloves
 - 1. Selection
 - a. The Laboratory's stockroom supplies an assortment of gloves. The chart below is a guide for selecting the appropriate protective material for the hazards listed above. **Consult IH for the proper selection of glove material for chemical hazards.**

Hazard	Protective Material	Points to Consider
<p>CUTS OR LACERATIONS – slices caused by</p> <ul style="list-style-type: none"> • Contact with metal items (e.g. nails, metal stock or burrs) • Hand tools with blades (e.g. knives, box cutters, screwdrivers, chisels, handsaws) • Powered machinery with cutting blades such as saws and hydraulic or hand-operated presses • Handling sharp objects or materials such as glass or sheet metal <p>(Note: Gloves should not be worn around moving/rotating machinery. See 6.6.1.C.2.h below)</p>	Metal Mesh	<ul style="list-style-type: none"> • Highest level of cut resistance • Only used where the risk of cuts is very high
	Kevlar	<ul style="list-style-type: none"> • Tends to be on the low end of cut protection compared to other, newer synthetic materials • Rubber coatings on palms or fingers may be needed to improve grip.
	Composite Yarns	<ul style="list-style-type: none"> • May have a stainless steel fiber woven into the glove to provide additional protection • Rubber coatings on palms or fingers may be needed to improve grip.
<p>SEVERE ABRASIONS – scrapes or tearing caused by sanders or grinders,</p> <p>(Note: Gloves should not be worn around moving/rotating machinery. See 6.6.1.C.2.h below)</p>	Mechanical or Work Gloves	<ul style="list-style-type: none"> • Gloves coated with reinforced, solid rubber palms provide additional protection
<p>LESS SEVERE ABRASIONS – mild scrapes caused by handling rough materials</p>	Cotton	<ul style="list-style-type: none"> • Heavier cotton gloves provide light abrasion protection
	Leather	<ul style="list-style-type: none"> • Protects against rough edges and materials and splinters • Provides almost no cut or puncture resistance.
<p>PUNCTURES – pierces caused by</p> <ul style="list-style-type: none"> • Sharp objects (e.g. staples, splinters, glass, nails, stiff wires) • Sharp tools (e.g. scissors, chisels, screwdrivers) 	Nitrile	<ul style="list-style-type: none"> • Provides some puncture resistance
	Cut Resistant Gloves Coated with a Heavy Layer of Rubber	<ul style="list-style-type: none"> • Solid rubber supported by the weave provides decent puncture protection.
<p>ELECTRICAL BURNS – working on or near live equipment</p>	High Voltage Insulating Gloves	<p>Two levels:</p> <ul style="list-style-type: none"> • Class 0 for up to 1,000 volts (1kV) • Class 2 for up to 20,000 volts (20 kV)
<p>HEAT – caused from “hot work” including metal arc and gas welding, cutting, and soldering</p>	Kevlar	<ul style="list-style-type: none"> • These materials do not burn.
	Leather	<ul style="list-style-type: none"> • The level of insulation needed is dependent upon the task

		being performed. Check temperature ratings of gloves as specified by the manufacturer.
COLD – working with cryogenics	Cryogenic Gloves	<ul style="list-style-type: none"> • Designed to prevent contact from splashed liquids • Cannot withstand immersion into cryogenic liquids • Not appropriate protection from hot surfaces because the gloves will melt
GENERAL DUTY – everyday activities <ul style="list-style-type: none"> • Handling debris, rough objects, and dirty equipment • Using power and hand tools • Working in dirty environments 	Leather	<ul style="list-style-type: none"> • General purpose use.
	Cotton	<ul style="list-style-type: none"> • Mostly used as liners for other gloves, wicking the sweat away from the hands
	Mechanical or Work Gloves	<ul style="list-style-type: none"> • Gloves coated with "rubber" dots or solid palms provide additional grip, especially in wet or oily situations
PRODUCT CONTAMINATION /CLEANLINESS – <ul style="list-style-type: none"> • Keeping hands clean when using grease, hydraulic fluid, oils, and WD40 • Keeping work clean from hand oils and dirt 	Latex	<ul style="list-style-type: none"> • Not recommended since frequent wearing of latex can cause a latex allergy that can become severe over time
	Nitrile	<ul style="list-style-type: none"> • Mostly replaced latex for keeping hands or work clean
RADIATION – working in radiologically controlled areas (RCAs)	Rubber or Nitrile	<ul style="list-style-type: none"> • Must have radiation symbol printed on them
VIBRATION OR IMPACT– caused by pneumatic jackhammers, drills, gas powered chain saws, and electrical tools such as grinders.	Shock-Absorbing Gloves	<ul style="list-style-type: none"> • Have gel pads to dampen vibration
	Mechanical or Work	<ul style="list-style-type: none"> • Provides some vibration and impact protection
	Leather	
	Woven fiber	
CHEMICALS (skin absorption and burns): <ul style="list-style-type: none"> • <u>Acids and Bases</u> - sulfuric acid, nitric acid, hydrochloric acid, and sodium hydroxide • <u>Ketones and Esters</u> – acetone, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK) and phthalate esters 	*Different material gloves are resistant against different chemicals. Consult IH for the proper selection of glove material for chemical hazards.	
	Neoprene*	<ul style="list-style-type: none"> • Poor for halogenated and aromatic hydrocarbons.
	Butyl Rubber *	<ul style="list-style-type: none"> • Poor for hydrocarbons.

<ul style="list-style-type: none"> • <u>Alcohols</u> – ethanol, isopropanol and methanol 	Butyl Rubber or Neoprene*	<ul style="list-style-type: none"> • Neoprene is not effective vs. methanol
<ul style="list-style-type: none"> • <u>Chlorinated Solvents</u> – perchloroethylene, methylene chloride and trichloroethylene 	Polyvinyl Alcohol (PVA)*	<ul style="list-style-type: none"> • Poor for water-based solutions.
<ul style="list-style-type: none"> • <u>Hydrocarbons</u> – diesel fuel, kerosene, naphtha 	Nitrile*	<ul style="list-style-type: none"> • Use heavier duty nitrile as opposed to thin disposable gloves for chemical resistance.
<ul style="list-style-type: none"> • <u>Aromatic solvents</u> - benzene, toluene, and xylene 	Viton*	<ul style="list-style-type: none"> • Expensive. • Poor for ketones.
<ul style="list-style-type: none"> • <u>Amines</u> – ethylenediamine (<u>EDA</u>) 	Polyvinyl Chloride (PVC)*	<ul style="list-style-type: none"> • Poor for most organic solvents.

**Table provides only generalities. Different thicknesses and formulations can affect the resistance of the gloves. Consult IH and/or manufacturer information for the proper selection of glove material for chemical hazards.*

2. Use

- a. Nitrile gloves should be used in place of latex gloves because frequent wearing of latex can cause a latex allergy that can become severe over time.
- b. Cloth gloves, which are made from woven fabric, should never be used when handling chemicals in any form. Examples of cloth gloves are cotton and Kevlar.
- c. Cut-resistant gloves should not be worn as puncture protection unless coated with a heavy layer of rubber.
- d. Leather gloves should not be used as protection from cuts and punctures.
- e. Hand protection shall be worn for welding or torch “hot” work. Refer to Section 9, Chapter 15 for more information.
- f. Cryogenic gloves shall be worn when handling cryogenic material. Refer to Section 9, Chapter 3 for more information.
- g. Gloves are required for working on or around live electrical equipment. Refer to Section 2 for more information.
- h. Gloves should not be worn around moving or rotating machinery with the exception of portable tools. The risk of being caught in the machine may be greater than the risk of other hand injury.
 - i. If gloves are needed to handle and move materials to the machinery, the machine should be off, the gloves should be worn while moving and securing the material, and then the gloves should be removed before starting the equipment.
- i. Gloves should fit snugly but should not be restrictive.

3. Care

- a. Gloves should be inspected every time they are put on. Attachment 1 has an inspection checklist.
- b. Gloves should be kept out of direct sunlight, heat, and damp locations.
- c. Gloves should be stored away from ozone, chemicals, oils, solvents, paints, and damaging vapor or fumes.

4. Disposal

- a. Gloves contaminated with radioactive materials shall be handled as radioactive waste.

D. For other hand protection, Supervisor shall consult with IH for their particular needs.

6.6.2 Face and eye protection

- A. Eye and face protection shall be used when hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation are present.
- B. Design, construction, testing and the use of devices for eye and face protection shall be in accordance with the “American National Standard for Occupational and Educational Eye and Face Protection,” ANSI Z87.1-1989 (or more recent editions).
- C. Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer.
- D. Signs shall be posted in designated eye and face protection areas. For example, safety glasses are required in machine shops when equipment is being operated.
- E. Supervisors shall ensure the use of eye and face protection in designated areas and when identified on JHAs.
- F. Emergencies
 1. Suitable facilities for flushing the eyes and body shall be available no more than 100 feet from a work station where there is a potential for exposure to corrosive materials.
 2. Employees must be able to reach and use the eyewash and/or body drenching equipment within 10 seconds.
 3. First-aid instructions should be posted close to potential danger spots.
 4. Employees shall know where the closest eyewash station is and how to get there with restricted vision.
- G. Selection
 1. The Laboratory’s stockroom supplies an assortment of eye and face protection. The chart below is a guide for selecting the appropriate protection for the hazards listed above. **This chart may not be appropriate for every situation. Consult IH for specific needs.**

Legend	
X = required	O = optional

Hazard	Activities	Safety Glasses	Goggles	Face Shield	Shaded Glasses	Shaded Goggles	Welding Helmet
FLYING PARTICLES	chipping, drilling, scaling	X	O	O			
	light grinding, polishing, buffing	X	O	O			
	riveting, punching, shearing	X	O				
	hammer mills, crushing	X	O				
	wire and strip handling	X	O				
	hammering, unpacking, nailing	X	O	O			
	punch press, lathe work	X	O	O			
	light metal working, machining	X	O	O			
	chiseling	X	O				
	masonry work	X	O				
	powered fastening, drilling, power tools	X	O				
	plastering, concrete work	X	O				
	sandblasting inside glove box	X	O				
DUST	heavy grinding, polishing		X	X			
	buffing		X	O			
	heavy sawing, planing		X	O			
	heavy woodworking, sanding		X				
	exposure to wind, dust		X				
	sand, cement handling		X				
	sandblasting outside glove box		X				
	painting		X	O			

Hazard	Activities	Safety Glasses	Goggles	Face Shield	Shaded Glasses	Shaded Goggles	Welding Helmet
	shot blasting, shotcreting		X	X			
HEAT	working with molten metal		X	X			
	hot dipping		X	X			
	casting		X	X			
CHEMICAL SPLASH	acidic and corrosive chemical handling		X	X			
	other chemical handling		X	O			
	degreasing		X	O			
	plating		X	O			
	spraying chemicals cryogenic liquids	X	X O	X X			
INJURIOUS LIGHT RADIATION	reflection/sunlight				X	O	
	reflected welding flash	X			O	O	
	furnace work			X	X	O	
	soldering, brazing			O	O	O	
	resistance welding	X		X			
	spot/stud welding	X		X		X	
	gas cutting/welding			O	X		
	electric arc welding						X
	plasma spraying/cutting						X
inert gas shielded arc welding						X	

Legend	
X = required	O = optional

2. Safety Glasses

- a. Many styles of non-prescription, plano, safety glasses can be obtained in the Laboratory's stockroom.
 - i. Safety glasses must have "Z87" or "Z87+" marked on the frame and in some cases the lens.

- b. Prescription safety glasses may be ordered at no cost to the employee through the Occupational Medicine Office (OMO). The employee must get his/her supervisor's approval on the Prescription Glasses Procurement Form, which can be found on the OMO's website.
 - i. Polycarbonate lenses are the preferred material due to shatter resistance. Glass, plastic, and other special prescription lenses may be purchased if approved by the OMO and IH.
- c. Safety glasses are required to have side impact protection, such as from side shields or wrap-around lenses.

3. Goggles

- a. The Laboratory's stockroom supplies chemical splash goggles. These goggles have indirect vents to let air in but keep liquids out. They are sufficient against all but the dustiest conditions.
- b. The stockroom does not supply direct vented and non-vented goggles. Non-vented goggles are required when a chemical vapor hazard exists. Supervisors shall consult with IH for selection and purchase of direct vented and non-vented goggles.

4. Face Shields

- a. Clear face shields are supplied by the Laboratory's stockroom.
- b. Specialty face shields, such as those for arc flash or for attachment to a hard hat may be purchased from outside sources.

H. Use

1. Safety Glasses

- a. Safety glasses shall not be used for blown or flying dust hazards or liquid chemical splashes. Goggles are required for protection against these hazards.
- b. Safety glasses shall be worn when using power tools.
- c. Safety glasses should fit snugly against the face.
- d. Standard "street-wear" prescription lenses do not act as safety glasses. Employees shall wear safety glasses that incorporate the prescription in its design or shall wear safety glasses that can be worn over the prescription lenses.
- e. All safety glasses shall be equipped with side shields to provide protection from hazards not directly in front of the employee. Many modern safety glasses have "wrap around"

lenses that meet this requirement. Most prescription safety glasses typically still require the add-on side shields.

- f. Contact wearers shall also wear appropriate eye and face protection in hazardous environments. Dust and chemicals may present additional hazards to contact wearers. OSHA recommends that employees have an extra pair of contacts or eyeglasses in case of contact failure.

2. Goggles

- a. Goggles should fit tightly against the face, forming a protective seal.

3. Face Shields

- a. Face shields should fit snugly so they won't fall off during work operations.
- b. Face shields shall never be worn alone. They shall be worn over safety glasses or goggles.

4. Eye and face protection are required for some types of electrical work. Refer to Section 2 for more information.

5. Welding helmets or shaded eye protection is required for welding. See Table 8.6.1 for lens shades. More information can be found in Section 9, Chapter 15.

6. Laser Eyewear

- a. Specific, rated safety glasses or goggles are required for Class 3b and 4 (higher powered) lasers. A single lens is not available for protection from all laser outputs. There are different shades, colors and densities for protection from different wavelengths and powers of laser. The maximum energy that the glasses will withstand and the spectral frequencies against which they will provide protection are imprinted on the frames of the laser eyewear. Contact the Laser Safety Officer (LSO) or refer to ESHG 5008, Section 3 for more information.

I. Care

1. Eye and face protection should be inspected before each use. Attachment 1 has an inspection checklist.
2. Deeply scratched or excessively pitted eye and face protection should be replaced.
3. Eye and face protection should be kept clean. Dirtiness can reduce vision. Eye and face protection should be cleaned regularly with mild soap and water.

- 4. Eye and face protection should be stored in a dust-proof container away from high heat and sunlight, and where it will not be crushed or damaged.

6.6.3 Foot protection

- A. Protective footwear shall be worn when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, where there are chemical or electrical hazards to the feet, or where slip hazards exist on regular basis.
- B. Employees shall have footwear which meet the requirements and specifications in the “American National Standard for Personal Protection - Protective Footwear,” ANSI Z41-1991 or ASTM F2413-05 (or more recent editions). Note that as of 2005, the ANSI standard has been replaced by the ASTM version.

C. Foot protection shall be worn as identified on JHAs.

D. Safety shoes

1. Selection

- a. The Laboratory will reimburse an employee a specified amount towards the purchase of safety shoes. The employee must get his/her supervisor’s approval on the PPPL Safety Shoe Authorization form, which can be found on the Material Services website.
- b. A “shoe mobile” is typically brought on site periodically through the PPPL Stockroom. For shoe mobile withdrawal, use the same form mentioned above.
- c. Safety shoes must meet the NASI or ASTM standard for I/75 C/75 (Impact and Compression resistance of 75 pounds).
- d. Standard safety shoes provide toe protection only. Styles are available that also provide steel shank (sole puncture) protection and metatarsal (top of the foot) protection.

2. Use

- a. Safety shoes shall be worn to protect the foot from falling and rolling objects and from objects piercing the sole. The chart below gives examples of activities when safety shoes shall be worn.

Hazard	Activities
FALLING OBJECTS	carrying or handling materials such as equipment, objects, parts, or heavy tools which could be dropped
	handling heavy shackles while rigging crane
	objects that may fall during work activities
ROLLING OBJECTS	driving or working around forklifts
	moving gas cylinders, wheeled carts, or heavy pipes
PUNCTURES	stepping on sharp objects such as nails, screws, staples, or scrap or sheet metal

- b. Safety shoes when fully laced up should fit snugly around the foot and ankle.
- c. If both falling object hazards and slipping hazards exist, safety shoes with slip resistant soles should be purchased. Slip resistant soles should always be considered when practical for other situations.
- d. Foot protection is required for some types of electrical work. Refer to Section 2 for more information.

3. Care

- a. Safety shoes should be inspected before each use. Attachment 1 has an inspection checklist.
 - b. Employees should follow the manufacturers' recommendations for cleaning and maintenance of protective footwear.
- E. Standard slip-resistant shoes shall be worn when the only hazard faced is a slippery floor, such as in wet areas.
- F. Chemical-resistant boots are not supplied by the stockrooms. Supervisors shall consult with IH for selection and purchase of chemical-resistant boots.
- G. For other foot protection and add-on foot protection, Supervisors shall consult with IH for their particular needs.

6.6.4 Head Protection

- A. Each affected employee shall wear a protective helmet ("hard hat") when working in areas where there is a potential for injury to the head from falling objects or bumping the head against fixed objects.
- B. Protective helmets shall be designed to reduce the hazard of electrical shock when worn by employees exposed to electrical conductors that could contact the head. For more information, refer to Section 2.
- C. Head protection shall comply with ANSI Z89.1986 (or more recent versions), "American National Standard for Personnel Protection - Protective Headwear for Industrial Workers - Requirements."
- D. Signs shall be posted in designated head protection areas. For example, hard hats are required in the NSTX Test Cell.
- E. Supervisors shall ensure the use of head protection in designated areas and when identified on JHAs.

F. Hard Hats

1. Selection

- a. The Laboratory’s stockroom supplies standard hard hats.

2. Use

- a. Hard hats shall be used to protect the head from falling objects. The chart below gives examples of activities during which hard hats shall be worn.

Hazard	Activities
FALLING OBJECTS	working below other workers who are using tools and materials which could fall
	when cranes are in operation
BUMPING THE HEAD	potential to walk into low overhead objects such as piping, I-beams, etc.

- b. Hard hats must be worn with the suspension in place.
- c. Hard hats should be adjusted to fit snugly on the head, but not so tight as to cause headaches.
- d. Hard hats should be worn with the brim or bill in front, protecting the face and nose.
- e. If a hard hat is worn with the bill in the back, the suspension shall be reversed so that the adjustment portion is at the back of the head if permitted by the manufacturer.
- f. Nothing shall be stored between the hard hat and the head.
- g. Liners may be worn under a hard hat as long as they do not interfere with the fit or operation of the suspension. Ball caps should not be worn under a hard hat because they may interfere with the suspension.
- h. Chinstraps are available in the Stockroom to keep the hard hat from falling off when the wearer bends over. Other accessories such as earmuffs and face shields exist, but are not stored in the stockroom. Supervisors shall consult with IH for their particular needs.

3. Care

- a. Hard hats should be visually inspected before every use. Attachment 2 has an inspection checklist.
- b. The shell of the hard hat should be cleaned once a month with warm water and mild soap. Chemicals or solvents should never be used to clean a hard hat.

- c. Hard hats should never be painted or have anything glued to the shell.
- d. Holes should never be drilled in a hard hat as this may reduce the integrity of the protection.
- e. Stickers should not be placed closer than ½ inch from the edge of the hard hat.
- f. Hard hats should not be stored in direct sunlight or in excessive heat as this will reduce the life of the hard hat, and may cause the suspension to fail prematurely.
- g. Hard hats should be replaced after no more than 5 years.
- h. Hard hats should be replaced after two years if they are used in environments with high exposure to temperature extremes, chemicals or sunlight (ultraviolet radiation) or other radiation.
- i. If a forcible blow of any magnitude has struck a hard hat, both the hard hat shell and suspension should be replaced immediately, even if no damage is visible.
- j. The suspension should be replaced every 1-2 years.

4. Disposal

- a. Hard hats should be recycled. Place them in recycling bins designated for plastics.

G. Bump Caps

1. Selection

- a. IH distributes bump caps.

2. Use

- a. Bump caps shall only be used to protect the head from bumping into protruding or low hanging objects.
- b. Bump caps shall not be worn when someone is working above with tools or materials that could fall, as they do not meet ANSI requirements. Bump caps are not substitutes for hard hats.

6.6.5 Body Protection

- A. Supervisors shall consult with IH for selection and purchase of aprons, chemical suits, throwaway suits, etc.
- B. Employees working in or near roadways should wear high visibility or reflective clothing.

6.6.6 Respirators shall be selected, used, and maintained in accordance with Chapter 7 of this Section.

6.6.7 Hearing Protection - The Laboratory's stockroom supplies both ear muffs and ear plugs. Consult Chapter 8 of this Section on Noise and Hearing Conservation.

6.6.8 Welding PPE shall be selected, used, and maintained in accordance with Section 9, Chapter 15.

6.6.9 Electrical PPE shall be selected, used, and maintained in accordance with Section 2.

6.7 TRAINING

6.7.1 Each employee required to wear Personal Protective Equipment shall be trained to understand the following:

- A. When PPE is necessary
- B. What PPE is necessary
- C. How to properly don, doff, adjust, and wear PPE
- D. The limitations of the PPE
- E. The proper care, maintenance, useful life and disposal of the PPE

6.7.2 Each affected employee shall demonstrate the understanding of the training, and the ability to use PPE properly before being allowed to perform work requiring the use of PPE.

6.7.3 Retraining shall be required if any of the following situations occur:

- A. Changes in the workplace render previous training obsolete
- B. Changes in the types of PPE to be used render the training obsolete
- C. The employee demonstrates a lack of knowledge in the use of PPE by improper use.

6.7.4 Human Resources and Training and the supervisor shall maintain records documenting the training which shall identify the PPE, the employee(s) trained, and the date of the training.

6.6 REFERENCES

Arizona State University, "Eye and Face Protection Selection Chart."

Canadian Centre for Occupational Health and Safety, "Chemical Protective Clothing - Glove Selection."

Centers for Disease Control and Prevention, "Workplace Safety & Health Topics - Eye Safety."

Electronic Library of Construction Occupational Safety & Health, "How Much Eye Protection is Enough?"

ESHToday, "Taking the Burn Out: Chemical Resistant Gloves in a Changing Workplace."

Occupational Safety & Health Administration, "Hand and Power Tools."

Occupational Safety & Health Administration, "Shipyard Employment eTool."

Occupations Safety & Health Administration, "Eye and Face Protection eTool."

OSHA Training, "Answers to Top Five Questions about Hard Hats."

SafetyWiki, "Eye and Face Protection."

SafetyWiki, "Foot Protection."

SafetyWiki, "Head Protection."

Work Safe, "Personal Protective Equipment Selection of Eye and Face Protection."

University of Wisconsin-Milwaukee, "Personal Protective Equipment: Gloves."

TABLE 8.6.1**Filter Lenses for Protection Against Radiant Energy**

Operations	Electrode Size 1/32 in.	Arc Current	Minimum(*) Protective Shade
Shielded metal arc welding	Less than 3	Less than 60	7
	3-5	60-160	8
	5-8	160-250	10
	More than 8	250-550	11
Gas metal arc welding and flux cored arc welding		less than 60	7
		60-160	10
		160-250	10
		250-500	10
Gas Tungsten arc welding		less than 50	8
		50-150	8
		150-500	10
Air carbon	(Light)	less than 500	10
Arc cutting	(Heavy)	500-1000	11
Plasma arc welding		less than 20	6
		20-100	8
		100-400	10
		400-800	11
Plasma arc cutting	(light)(**)	less than 300	8
	(medium)(**)	300-400	9
	(heavy)(**)	400-800	10
Torch brazing			3
Torch soldering			2
Carbon arc welding			14
Gas Welding:			
Light	Under 1/8	Under 3.2	4
Medium	1/8 to 1/2	3.2 to 12.7	5
Heavy	Over 1/2	Over 12.7	6
Oxygen cutting:			
Light	Under 1	Under 25	3
Medium	1 to 6	25 to 150	4
Heavy	Over 6	Over 150	5

Footnote(*) As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade which gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.

Footnote(**) These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.

ATTACHMENT 1 Personal Protective Equipment Inspection Checklists

A “YES” for any of the following conditions would result in PPE being considered defective, and would require either repair or replacement.

Safety Glasses Inspection		
LENSES:	YES	NO
Scratches	<input type="checkbox"/>	<input type="checkbox"/>
Severe chips or cracks	<input type="checkbox"/>	<input type="checkbox"/>
Haziness or impaired vision	<input type="checkbox"/>	<input type="checkbox"/>
SIDE SHIELDS:	YES	NO
Broken or missing	<input type="checkbox"/>	<input type="checkbox"/>
TEMPLE:	YES	NO
Damage, such as distortion or disfiguring	<input type="checkbox"/>	<input type="checkbox"/>
Any other defect that adversely affects the fit	<input type="checkbox"/>	<input type="checkbox"/>

Safety Goggles Inspection		
LENSES:	YES	NO
Scratches	<input type="checkbox"/>	<input type="checkbox"/>
Severe chips or cracks	<input type="checkbox"/>	<input type="checkbox"/>
Haziness or impaired vision	<input type="checkbox"/>	<input type="checkbox"/>
BAND:	YES	NO
No longer elastic	<input type="checkbox"/>	<input type="checkbox"/>

Face Shield Inspection		
FACE SHIELD:	YES	NO
Scratches		
Severe chips or cracks		
Haziness or impaired vision		
Harness not adjustable		
Cracks		
Missing brow guard or sweatband		
Any other defect that adversely affects the fit		

Head Protection Inspection		
SHELL:	YES	NO
Cracks, dents, gouges, abrasion, excessive scratches or other signs of impact		
Loss of surface gloss, chalking, or flaking		
SUSPENSION (HEADGEAR):	YES	NO
Not adjustable		
Cracks in the headband		
Missing brow guard or sweatband		
Any other defect that adversely affects the fit		

Foot Protection Inspection		
SAFETY SHOES:	YES	NO
Severe tears or cuts		
Damage or deformed steel toe or sole		
Worn seam and lining		
Worn eyelets and shoelaces		
Foreign objects imbedded in the sole		
Heel or excessive tread wear		

Hand Protection Inspection		
CHEMICAL-RESISTANT GLOVES:	YES	NO
Changes of texture, swelling, softening, hardening, or stickiness		
Nicks, holes, tears, punctures, abrasions or cuts		
Loss of elasticity and flexibility		
Cracks, pitting, or burns		
Embedded objects, inside and out (nails, chips, slivers, etc.)		
Any other defects, such as color changes, excessive oil or grease		
Leaks during air test		
LEATHER GLOVES:	YES	NO
Holes, tears, or cuts		
Embedded foreign objects		
ELECTRICAL GLOVES:	YES	NO
Leaks during air test		