Personal Protective Equipment

Personal Protective Equipment or PPE is designed to protect employees from serious workplace injuries or illnesses resulting from contact with chemicals, radiological, physical, electrical, mechanical, or other workplace hazards. Beside the easily recognized face shield, safety glasses, hard hats and safety shoes, PPE includes a variety of devices and garments such as goggles, coveralls, gloves, vests, earplugs and respirators.

OSHA's primary PPE standards are in Title 29 of the CODE OF Federal Regulations (CFR), part 1910 subpart I, and equivalent regulations in states with OSHA-Approved state plans. You can also find PPE Requirements elsewhere in the General Industry Standards.

The Construction Industry has industry specific standards that can be found in Part 1926 Subpart E.

OSHA's general PPE requirements mandate that employers conduct a hazard assessment of their workplaces to determine what hazards are present that require the use of PPE, provide workers with appropriate PPE, and require them to use and maintain it in sanitary and reliable condition.

Using PPE is often essential it is however generally the last line of defense after engineering controls, work practices and administrative controls.

Types of protection applicable to specific industry and work conditions include but are not limited to:

- Eye and face protection
- Foot protection
- Hand protection
- Head protection
- Hearing protection
- Respiratory System protection
- Skin protection
- Radioactive Protection
- Burn protection
- Temperature protection

OSHA Statistics indicate that a significant portion of all work related injuries and fatalities involve workers being struck in the eyes, head, face, hand and or feet by foreign objects.

Two major factors that contributed to the injuries reported were identified as:

1. PPE not worn the vast majority of the time
2. When PPE was worn it was found to be deficient in that it did not fully protect the worker

It is very important to use PPE, wear the correct PPE for the job function performed, and wear the PPE properly

The OSHA PPE Standard

- The standard requires employers to set up and administer an effective Personal Protective Equipment (PPE) program for employees
- The PPE program must include a written hazard identification and evaluation of hazards in the workplace including a determination of whether PPE is an appropriate control measure
- If PPE is to be used, the program must also state how it is selected, maintained and evaluated and how employees are to be trained in using PPE

Protecting Employees from Hazards

- Employers are required to protect employees from workplace hazards such as machines, hazardous substances, and dangerous work procedures that can cause injury
- Your employer must survey each work area to identify sources of hazards, including impact, penetration, compression, chemical, heat, dust, electrical sources, material handling, noise and light radiation

Once the hazards have been found, employers must:

- Use all feasible engineering, work practice, and/or administrative controls to eliminate and reduce hazards
- Then use appropriate personnel protective equipment (PPE) if these controls do not eliminate the hazards
- Remember, PPE is the last level of control

Engineering, work practice and administrative controls are better than PPE because they actually eliminate a hazard. PPE can only protect you from that hazard. It is still there and could still hurt you if you fail to use the right PPE or wear it properly

Engineering Controls

A physical change to a machine or work environment, in order to prevent employee exposure to a potential hazard or eliminate that hazard completely

Adding a guard to a machine, building a barrier between employees and a hazard, substituting a less harmful substance in a process, changing a process, or Adding ventilation

Work Practice and Administrative Controls

- Remove employees from exposure to a potential hazard by changing how, when or where they do their jobs
- A work practice control changes the way people do their jobs
- An administrative control changes when or where people do their jobs
    - Control Times: Careful control should be exercised when the use of wet methods to suppress dust, personal hygiene, housekeeping, maintenance, , job rotation of workers, and operation of machines – Should be a specified times when adjacent operations have stopped

PPE

If engineering controls, work practice of administrative controls are not enough to eliminate a particular hazard, then PPE must be provided
Different hazards require different types of PPE




Again: Different hazards require different types of PPE

When is Head Protection Necessary?

Always be aware that hazards that could lead to an accident causing head injuries are difficult to anticipate plan for and control. The possibility exists that any object at any time could fall and hit you.

Head protection should be worn any time:

- When the possibility exists that your head could bump against a fixed object, such as a railing, exposed pipe, beam, part of machine, framing
- When you work near exposed electrical conductors
- When there is any possibility that objects could fall from above and strike anyone below. This last statement is a possibility anywhere.
- It is important to wear proper head protection whenever any of the possibilities could exist in the workplace.

Head Protection Basics

In general, protective hardhats or helmets should:

- Resist penetration by objects
- Absorb the shock of a blow
- Be water resistant, flame resistant and at the very least slow burning

- Come with instructions explaining how to adjust and replace the suspension and headband
- Hard hats require a hard outer shell and a shock-absorbent lining
- The lining should incorporate a head band and straps that suspend the shell One (1) to one and one quarter (1 ¼) inches away from the head,
- This design provides shock absorption during impact and ventilation while the hat is being worn
  Head protection must meet the ANSI Z89.1 Standard

Types of Head Protection

All hard hats are classified according to the specific impact and electrical performance requirements they are designed to meet. This classification is also commonly referred to as the ANSI Z89.1 standard. All hard hats in accordance with this standard meet or exceed either Type I or Type II impact requirements. In addition to type classifications, all hard hats are further classified as meeting Class G, Class E, or Class C electrical requirements. Below we outline each of these types and electrical classes.

All hard hats are shipped with an ANSI certification label on the inside of the hard hat's shell. This label will clearly identify what type and class standards it was designed to meet. If this label is missing or cannot be read it is recommended that it should be replaced.

Hard Hat Impact Types

Hard hats are divided into two types and three industrial classes.



Type I Hard Hats

Type I hard hats are intended to reduce the force of impact resulting for a blow only to the top of the head. All hard hats, except bump caps, listed on the Cooper Safety website are Type I (top impact) hard hats.

Type II Hard Hats

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. At this time we do not currently stock any Type II hard hats. If you require a Type II hard hat, please contact our customer service department at 1-800-724-2596 for more information and custom ordering options.

Electrical Classes

•**Class G (General):** Class G 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. Please note: Class G hard hats were formerly known as Class A.

•**Class E (Electrical):** 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. Please note: Class E hard hats were formerly known as Class B.

•**Class C (Conductive):** Class C hard hats are not intended to provide protection against contact with electrical conductors.

The inside of every protective helmet and or hard hat must contain a label showing the date, manufacturer's name, the ANSI Standard it meets, and its class.

Wearing Head Protection

Whatever type of head protection is required for your job, you must know how to wear and care for it properly

Things you need to know

- Every employee will need to know how to put in the protective helmet on correctly. The helmet must be worn with the bill forward to properly protect you. Please not that all helmets are tested in this position.
- How to adjust straps and other parts for a comfortable and effective fit

The limitations of the head protection

- Headbands (inside) are adjustable in 1/8-size increments. When the headband is adjusted to the right size it provides ample clearance between the shell and the headband
- The removable or replaceable type sweat band should cover at least the forehead portion of the headband

- The shell should be of one piece seamless construction and designed to resist the impact of a blow from falling material
- Workers that work aloft or on aerial lifts or above other workers should always wear a chin strap to prevent the hard hat from slipping, falling or being bumped off.
- Never wear another hat under your hard hat or store anything inside the hard hat while wearing it.
- Employees with long hair need to be aware that it can be drawn into machine parts. Always protect your hair with a bandanna, turban or soft cap under your hard hat to keep your hair and you safe.

Sometimes it is necessary to receive hands-on training that cover specific work requirements

Care and Maintenance of Head Protection

- Take good care of your hard hat and be careful what you put on it
- Some solvents, paints, thinners and other chemicals may damage the shell and lessen the protection by weakening it or degrading its electrical resistance.
- The best way to clean your hard hat is to submerse it in hot water with detergent for a few minutes
- Shells should then be scrubbed and rinsed in clear hot water. After rinsing, the shell should be carefully inspected for any signs of damage.
- All components, shells, suspensions, headbands, sweatbands, and any accessories should be visually inspected daily for signs of dents, cracks, penetration, or other damage that might reduce the degree of safety originally provided.
- Make sure the shell does not show any sign of exposure to heat, chemicals, ultraviolet light or other radiation such as loss of surface gloss, chalking or flaking
- Don’t store or carry your hardhat in direct sunlight such as the rear window shelf of an automobile, since sunlight and extreme heat can weaken the helmet’s protection.
- For those who work in direct sunlight it is very important to inspect the outside and inside of your helmet daily.
- Don’t forget that if unusual conditions occur or if there are signs of abuse or manipulation of the helmet or any component, the margin of safety may be reduced.
- If you suspect your helmet is damaged, replace it. Don’t wear a damaged helmet.

Eye and Face Hazards

Every year eye injuries cost more that $300 million in lost production time, medical expense and worker compensation

General requirements

1. Each affected employee shall use appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

2. Each affected employee shall use eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on side shields) meeting the pertinent requirements of this section are acceptable.

3. Each affected employee who wears prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design, or shall wear eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

4. Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer.

5. Each affected employee shall use equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation. The following is a listing of appropriate shade numbers for various operations.

Regulatory Compliance:

OSHA standards provide mandatory requirements and compliance assistance for employers when selecting proper eye care and face protection

- 1910.132 – General Requirements
- 1910.133 – General industry
- 1926.102 – Construction
- 1910.252 – Welding, Cutting & Brazing

Thousands of people are blinded each year from work-related eye injuries that could have been prevented with proper selection and use of eye and face protection.

Common hazards that may cause eye and face injury are:

- Splashes of toxic or corrosive chemicals, hot liquids, and molten metals
- Flying objects such as wood chips, metal fragments and stone dust particles. Even minute particulates can be harmful
- Fumes, gases and mists of toxic or corrosive chemicals

Typical hazards that can cause eye and face injury are:

Aerosols of biological substances

Blood and other potentially infectious body fluids that might splash, spray or splatter
Intense light such as that created by welding arcs and lasers
If you are exposed to any of the hazards mentioned above or any hazards that might damage your eyes or face, you must wear the right kind of protection.

Types of Eye and Face Protection

Impact Resistant Spectacles

Can be used for moderate impact from particles produced by such jobs as carpentry, woodworking, grinding and scaling

Goggles:

- Many different types, each designed for specific hazards
- Protect eyes, eye sockets, and facial area immediately surrounding the eyes from impact, dust, splashes and heat
- May be solid, directly ventilated or indirectly ventilated
- Some fit over corrective lenses

Safety Spectacles

- Protective eyeglasses with safety frames of metal and or plastic
- Fitted with wither corrective or impact resistant lenses

- Come with and without side shields
- Most workplace operations will require side shields

Side Shields 

- Protect against particles that might enter the eye from the side
- Can be solid or ventilated
- Commonly made of wire mesh or plastic
- Eye-cup type provides the best protection

Welding Shields Are:

- Made of heat resistant material such as vulcanized fiber or fiberglass or other materials and are fitted with a filtered lens
- Designed for the specific hazards associated with welding, brazing, soldering, and cutting
- Protect eyes from burns caused by infrared or intense radiant light

What Welding Shields do

- Protect face and eyes from flying sparks, metal spatter, and slag chips
- Use welding shields in addition to primary protection such as safety spectacles or goggles to provide adequate protection

Laser Spectacles or Goggles

- Provide a range of protection against the ultraviolet, infrared, and intense concentrations of reflected light radiation produced by lasers

- The type you choose will depend on the equipment and operation conditions in your workplace

Face Shields

- Transparent sheets of plastic that extend from the brow to below the chin across the entire width of your head
- Some are polarized fro glare protection
- Can be used to protect your face from nuisance dusts and potential splashes or sprays of hazardous liquids
- Face shields are considered secondary protectors to be used in addition to primary protection such as safety spectacles or goggles

Eyeglasses

- Eyeglasses designed for ordinary wear do not provide the level of protection necessary to protect against workplace hazards
- If you wear eyeglasses of contact lenses, be extra careful when choosing eye and face protection

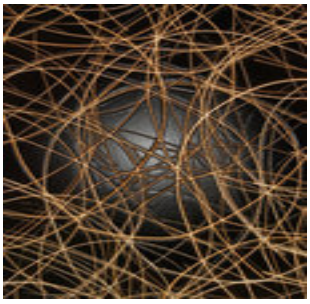
Some possibilities are:

- Prescription spectacles with side shields and protective lenses meeting the requirements of ANSI Z87.1 that also correct your vision
- Goggles that fit comfortably over your eyeglasses without disturbing their alignment
- Goggles that have corrective lenses mounted behind protective lenses

Contact lenses:

- If you wear contact lenses check your organization's policy. Consider eye protection that incorporates corrective lenses so that you can still work if you lose or damage a contact lens
- If you choose to wear contact lenses and your policy allows it, OSHA recommended that you have an extra pair of contacts or eyeglasses in case of failure or loss

Optical Radiation



Optical radiation can cause serious eye injuries even if exposure occurs for a short period of time

- Optical radiation may be in the form of ultraviolet, visible or infrared light
- Infrared or other intense radiant energy may cause eye injuries such as retinal burns, cataracts, and permanent blindness.
- Prolonged exposure to glare, another form of optical radiation, can cause eyestrain and vision damage
- Wearing protection with the correct filter shade number will protect the eyes from optical radiation

The table below shows lists the appropriate shade number for various work operations.

Filter Lenses for Protection Against Radiant Energy			
Operations	Electric 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

Filter Lenses for Protection Against Radiant Energy			
Operations	Plate thickness - inches	Plate thickness - mm	Minimum(*) Protective Shade
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 work piece			

- Whatever type of eye and face protection you are required to wear in your job, you must know how to put it on and take it off properly. You must receive hands on training covering;
- How to adjust the straps and other parts for a comfortable and effective fit
- How the protective equipment should fit over or contain your corrective lenses if you wear them
- The limitations of the eye and or face protection you will be using

Care and Maintenance of Eye and Face Protection

- Keep eye and face protection clean and disinfect regularly
- Every Day, inspect and clean the eye of face protector with soap and hot water, or with a cleaning solution and tissue.
- Look for pitted, chipped or scratched lenses
- Look for slack, worn-out sweat-soaked or twisted headbands
- Goggles should be kept in a case when not in use
- Spectacles should be given the same care as regular eyeglasses since the frame, nose pads, and temples can be damaged by rough usage
- Eye protection that has previously been worn should be disinfected before being given to another employee
- Several methods for disinfecting eye-protective equipment are acceptable

- The best and most effective method is to clean all parts with soap and warm water
- Carefully rinse all traces of soap and replace any defective parts with new ones
- Swab thoroughly or completely and immerse all parts for 10 minutes in a solution of germicidal deodorant fungicide
- Remove the parts from the solution and suspend them in a clean place for air drying at room temperature or with heated air
- Do not rinse after removing parts from the solution because this will remove the germicidal residue which retains its effectiveness after drying
- You may also use ultraviolet disinfecting and spray type disinfecting solutions after washing

Hand and Arm Hazards

A number of hazards can lead to hand and arm injuries:

- Box cutters, knives, tools or machinery with sharp edges and pinch points can cut your hands and arms
- Nails, needles, tools and wires can cause puncture wounds
- Objects striking your hand and arms can break or fracture the bones
- Coming into contact with corrosive or toxic chemicals, biological substances, electrical sources, or extremely cold or hot objects can irritate or burn your hands

When any of the above mentioned hazards are present, and engineering controls, work practices or administrative controls do not eliminate the hazards, you must wear appropriate hand and arm protection.

Preventing Hand and Arm Injuries

Engineering controls, work practices and administrative controls should be the first line of defense to prevent hand and arm injuries
Machine guards such as point of operation guards are often used. This could be a barrier on a table saw that makes it impossible for you to put your hands anywhere near the saw blade when it is operating.

Substituting less hazardous materials

When guards and other controls don't completely eliminate the hazard, protective gloves, and if necessary, protective sleeves are the next step.



Types of Hand and Arm Protection

Gloves are made from a wide variety of materials and are designed for just about every hazard you might face at work. They can be roughly divided into four groups:





- Durable work gloves made of metal mesh, leather or canvas
- Fabric and coated fabric gloves
- Chemical and liquid resistant gloves
- Insulating rubber gloves

Other category types include:

- Anti- Vibration
- Controlled Environment
- Cut-Resistant
- Electro-Statically Dissipative (ESD)
- Examination
- Laboratory
- Lineman's
- Temperature-Resistant
- Welding

Durable Work Gloves:

- Durable work gloves can be made from metal mesh, leather or canvas. They provide protection against cuts, burns and heat.
- Leather gloves protect against sparks, moderate heat, blows, chips and rough objects. Leather gloves are used by welders

- Aluminized gloves are used for welding, furnace and foundry work because they provide reflective and insulating protection against heat. They require an insert made of synthetic materials to protect against heat and cold

- Aramid fiber gloves are made of synthetic fiber that protects against heat and cold. They are used to make gloves that are cut and abrasive resistant and wear well.
- Other synthetic materials are used to make gloves that offer protection against heat and cold, cuts and abrasions or even some diluted acids. These materials won't stand up to alkalis and solvents

Fabric and Coated Gloves are made of cotton or other fabric to provide varying degrees of protection

- Fabric gloves can protect against dirt, slivers, chafing and abrasion, but do not provide enough protection for work with rough sharp or heavy materials
- Adding a coating to fabric gloves strengthens them. They can be used for tasks ranging from handling bricks and wire rope to handling chemical containers in laboratories.
- If using coated gloves to protect against chemical exposure, be sure to check the manufacturer's specifications to make sure they will withstand the specific chemical of chemicals you will be using

Chemical and Liquid Resistant Gloves

Gloves made from natural and synthetic rubber such as latex, nitrile or butyl, plastic, PVC, or other synthetic material such as neoprene can protect you from burns, irritation, and dermatitis that could be caused by contact with oils, greases, solvents and other chemicals.
Using rubber gloves also reduces your risk of exposure to blood and other potentially infectious materials.

The following table from the U.S. Department of Energy (Occupational Safety and Health Technical Reference Manual) rates various gloves as being protective against specific chemicals and will help you select the most appropriate gloves to protect your employees.

The ratings are abbreviated as follows: **VG: Very Good; G: Good; F: Fair; P: Poor (not recommended). Chemicals marked with an asterisk (*) are for limited service.**

Chemical Resistance Selection Chart for Protective Gloves

Chemical	Neoprene	Latex/Rubber	Butyl	Nitrile
Acetaldehyde*	VG	G	VG	G
Acetic acid	VG	VG	VG	VG
Acetone*	G	VG	VG	P
Ammonium hydroxide	VG	VG	VG	VG
Amy acetate*	F	P	F	P
Aniline	G	F	F	P
Benzaldehyde*	F	F	G	G
Benzene*	P	P	P	F
Butyl acetate	G	F	F	P
Butyl alcohol	VG	VG	VG	VG
Carbon disulfide	F	F	F	F
Carbon tetrachloride*	F	P	P	G
Castor oil	F	P	F	VG
Chlorobenzene*	F	P	F	P
Chloroform*	G	P	P	F
Chloronaphthalene	F	P	F	F
Chromic acid (50%)	F	P	F	F
Citric acid (10%)	VG	VG	VG	VG
Cyclohexanol	G	F	G	VG
Dibutyl phthalate*	G	P	G	G
Diesel fuel	G	P	P	VG
Diisobutyl ketone	P	F	G	P
Dimethylformamide	F	F	G	G
Dioctyl phthalate	G	P	F	VG
Dioxane	VG	G	G	G
Epoxy resins, dry	VG	VG	VG	VG
Ethyl acetate*	G	F	G	F
Ethyl alcohol	VG	VG	VG	VG
Ethyl ether*	VG	G	VG	G
Ethylene dichloride*	F	P	F	P
Ethylene glycol	VG	VG	VG	VG
Formaldehyde	VG	VG	VG	VG
Formic acid	VG	VG	VG	VG
Freon 11	G	P	F	G
Freon 12	G	P	F	G
Freon 21	G	P	F	G
Freon 22	G	P	F	G

Furfural* G G G G
Gasoline, leaded G P F VG
Gasoline, unleaded G P F VG
Glycerin VG VG VG VG
Hexane F P P G
Hydrazine (65%) F G G G
Hydrochloric acid VG G G G
Hydrofluoric acid (48%) VG G G G
Hydrogen peroxide (30%) G G G G
Hydroquinone G G G F
Isooctane F P P VG
Kerosene VG F F VG
Ketones G VG VG P
Lacquer thinners G F F P
Lactic acid (85%) VG VG VG VG
Lauric acid (36%) VG F VG VG
Lineolic acid VG P F G
Linseed oil VG P F VG
Maleic acid VG VG VG VG
Methyl alcohol VG VG VG VG
Methylamine F F G G
Methyl bromide G F G F
Methyl chloride* P P P P
Methyl ethyl ketone* G G VG P
Methyl isobutyl ketone* F F VG P
Methyl metharcrylate G G VG F
Monoethanolamine VG G VG VG
Morpholine VG VG VG G
Naphthalene G F F G
Napthas, aliphatic VG F F VG
Napthas, aromatic G P P G
Nitric acid* G F F F
Nitric acid, red and white
fuming P P P P
Nitromethane (95.5%)* F P F F
Nitropropane (95.5%) F P F F
Octyl alcohol VG VG VG VG
Oleic acid VG F G VG
Oxalic acid VG VG VG VG
Palmitic acid VG VG VG VG
Perchloric acid (60%) VG F G G
Perchloroethylene F P P G
Petroleum distillates
(naphtha) G P P VG

Phenol VG F G F
Phosphoric acid VG G VG VG
Potassium hydroxide VG VG VG VG
Propyl acetate G F G F
Propyl alcohol VG VG VG VG
Propyl alcohol (iso) VG VG VG VG
Sodium hydroxide VG VG VG VG
Styrene P P P F
Styrene (100%) P P P F
Sulfuric acid G G G G
Tannic acid (65) VG VG VG VG
Tetrahydrofuran P F F F
Toluene* F P P F
Toluene diisocyanate (TDI) F G G F
Trichloroethylene* F F P G
Triethanolamine (85%) VG G G VG
Tung oil VG P F VG
Turpentine G F F VG
Xylene* P P P F

Note: When selecting chemical-resistant gloves be sure to consult the manufacturer's recommendations, especially if the gloved hand(s) will be immersed in the chemical.

Wearing hand and Arm protection

To get the maximum protection from your gloves you must wear them properly

- Remove rings, watches or bracelets that might cut or tear your gloves
- Wash your hands before and after wearing gloves
- Never wear gloves around powered rotating equipment like drills and lathes
- Avoid borrowing gloves. Gloves are your Personal Protective Equipment.

Care and maintenance of Hand and Arm Protection

- Inspect your gloves before you use them
- Look for holes and cracks that might leak or any thinning or discoloration
- Replace gloves that are worn or torn
- After working with chemicals, hold your gloved hands under running water to rinse away any chemicals or dirt before removing the gloves
- Wash cotton gloves as needed
- Store gloves right side up in a clean, dry, ventilated area

- Some gloves may be specified for use with certain chemicals only and have a life expectancy – Discard them when they expire

Body Hazards



Employees must wear body protection whenever hazards are present that could cause bodily injury such as:

- Intense heat
- Splashes of hot metals and other hot liquids
- Impacts or cuts from tools, machinery and materials
- Hazardous chemicals
- Blood and other potentially infectious materials
- Radiation

Types of Body Protection

PPE for the body is available to protect against specific hazards. Employees need to wear PPE only for the parts of your body that are exposed to possible injury. For employee safety one or more of the following may need to be worn:

- Vests
- Jackets
- Aprons
- Coveralls
- Surgical gown
- Full body suit

Selecting Body Protection

A number of different materials are used to make body protection, depending on the hazard it is designed to protect against

- Paper like fiber is often used to make disposable suits that provide protection against dust and splashes
- Treated wool and cotton clothing is used for protective clothing because it adapts well to changing workplace temperatures and is comfortable and fire resistant
- Cotton duck protects against cuts and bruises if you are handling heavy, sharp or rough materials
- Leather protective clothing is often used against dry heat and flame
- Rubber, rubberized fabric, neoprene and plastics are all used to make clothing that protects against certain acids and other chemicals

Wearing Body Protection

It is important to select the type of body protection that will protect you from the hazards in your workplace

Whatever type of body protection you are required to wear in your job, you must know how to put it on and take it off properly. You must receive hands-on training covering:

- How to put the protective clothing on properly
- How to adjust the parts for a comfortable fit
- The limitations of the body protection you wear

Care and maintenance of Body Protection

Before you wear any kind of body protection, check it for signs of wear such as rips, tears, scuffs or loss of elasticity
If the body protection is damaged, do not use it
Make sure you also receive training on how to clean and disinfect your body protection to prolong its life

Foot and Leg Protection

- Employees who face possible foot or leg injuries from falling or rolling objects, crushing or penetrating materials should wear protective footwear
- Employees whose work involves exposure to hot substances, corrosive or poisonous materials must have protective gear to cover exposed body parts, including legs and feet
- Any employee whose feet may be exposed to electrical hazards, non-conductive footwear should be worn – to the reverse of non-conductive, any employee who is exposed to static electricity may necessitate the use of conductive footwear.

Examples of situations in which an employee should wear foot and/or leg protection include:

- When heavy objects such as barrels or tools might roll onto or
- fall on the employee's feet
- Working with sharp objects such as nails or spikes that could
- pierce the soles or uppers of ordinary shoes

- Exposure to molten metal that might splash on feet or legs
- Working on or around hot, wet or slippery surfaces
- Working when electrical hazards are present

Safety footwear must meet ANSI minimum compression and impact performance standards in ANSI Z41-1991 (American National Standard for Personal Protection-Protective Footwear) or provide equivalent protection. Footwear purchased before July 5, 1994, must meet or provide equivalent protection to the earlier ANSI Standard (ANSI Z41.1-1967). All ANSI approved footwear has a protective toe and offers impact and compression protection.

But the type and amount of protection is not always the same. Different footwear protects in different ways. Check the product's labeling or consult the manufacturer to make sure the footwear will protect the user from the hazards they face.

Foot and leg protection choices include the following:

Leggings protect the lower legs and feet from heat hazards such as molten metal or welding sparks. Safety snaps allow leggings to be removed quickly

Metatarsal guards protect the instep area from impact and compression. Made of aluminum, steel, fiber or plastic, these guards may be strapped to the outside of shoes

Toe guards fit over the toes of regular shoes to protect the toes from impact and compression hazards. They may be made of steel, aluminum or plastic.

Combination foot and shin guards protect the lower legs and feet, and may be used in combination with toe guards when greater protection is needed

Safety shoes have impact-resistant toes and heat-resistant soles that protects the feet against hot work surfaces common in roofing, paving and hot metal industries. The metal insoles of some safety shoes protect against puncture wounds. Safety shoes may also be designed to be electrically conductive to prevent the buildup of static electricity in areas with the potential for explosive atmospheres or nonconductive to protect workers from workplace electrical hazards.

Note: most high line distributors and configure the type of safety shoe or boot to fit the safety requirement for the employees even those described below, in a variety of styles and sizes.

Special Purpose Shoes

Electrically conductive shoes provide protection against the buildup of static electricity. Employees working in explosive and hazardous locations such as explosives manufacturing facilities or grain elevators must wear conductive shoes to reduce the risk of static electricity buildup on the body that could produce a spark and cause an explosion or fire. Foot powder should not be used in conjunction with protective conductive footwear because it provides insulation, reducing the conductive ability of the shoes. Silk, wool and nylon socks can produce static electricity and should not be worn with conductive footwear. Conductive shoes must be removed when the task requiring their use is completed. Note: Employees exposed to electrical hazards must never wear conductive shoes

Electrical hazard, safety-toe shoes are nonconductive and will prevent the wearers' feet from completing an electrical circuit to the ground. These shoes can protect against open circuits of up to 600 volts in dry conditions and should be used in conjunction with other insulating equipment and additional precautions to reduce the risk of a worker becoming a path for hazardous electrical energy. The insulating protection of electrical hazard, safety-toe shoes may be compromised if the shoes become wet, the soles are worn through, metal particles become embedded in the sole or heel, or workers touch conductive, grounded items. Note: Nonconductive footwear must not be used in explosive or hazardous locations

Foundry Shoes

In addition to insulating the feet from the extreme heat of molten metal, foundry shoes keep hot metal from lodging in shoe eyelets, tongues or other shoe parts. These snug-fitting leather or leather-substitute shoes have leather or rubber soles and rubber heels. All foundry shoes must have built-in safety toes

Care of Protective Footwear

- A with all protective equipment, safety footwear should be inspected prior to each use
- Shoes and leggings should be checked for wear and tear at reasonable intervals
- This includes looking for cracks or holes, separation of materials broken buckles or laces
- The soles of shoes should be checked for pieces of metal or other embedded items that could present electrical or tripping hazards
- Employees should follow the manufacturers' recommendations for cleaning and maintenance of protective footwear

Hearing Protection

Determining the need to provide hearing protection for employees can be challenging. Employee exposure to excessive noise depends upon a number of factors, including:

- The loudness of the noise as measured in decibels (dB)
- The duration of each employee's exposure to the noise
- Whether employees move between work areas with different noise levels
- Whether noise is generated from one or multiple sources

Generally, the louder the noise, the shorter the exposure time before hearing protection is required. For instance, employees may be exposed to a noise level of 90 dB for 8 hours per day (unless they experience a Standard Threshold Shift) before hearing protection is required.

On the other hand, if the noise level reaches 115 dB hearing protection is required if the anticipated exposure exceeds 15 minutes. For a more detailed discussion of the requirements for a comprehensive hearing conservation program, see OSHA Publication 3074 (2002), "Hearing Conservation" or refer to the OSHA standard at 29 CFR 1910.95, Occupational Noise Exposure, section (c).

Permissible noise exposures are shown below. This shows the permissible noise exposures that require hearing protection for employees exposed to occupational noise at specific decibel levels for specific time periods. Noises are considered continuous if the interval between occurrences of the maximum noise level is one second or less. Noises not meeting this definition are considered impact or impulse noises (loud momentary explosions of sound) and exposures to this type of noise must not exceed 140 dB. Examples of situations or tools that may result in impact or impulse noises are powder-actuated nail guns, a punch press or drop hammers.

Permissible Noise Exposures

Duration per day, in hours Sound level in dB*

8 Hours	at 90 dB
6 Hours	at 92 dB
4 Hours	at 95 dB
3 Hours	at 97 dB
2 Hours	at 100 dB
11/2 Hours	at 102 dB
1 Hours	at 105 dB
½ Hours	at 110 dB
1/4 Hour or less	at 115 dB

When measured on the A scale of a standard sound level meter at slow response.

Source: 29 CFR 1910.95, Table G-16

If engineering and work practice controls do not lower employee exposure to workplace noise to acceptable levels, employees must wear appropriate hearing protection. It is important to understand that hearing protectors reduce only the amount of noise that gets through to the ears. The amount of this reduction is referred to as attenuation, which differs according to the type of hearing protection used and how well it fits. Hearing protectors worn by employees must reduce an employee's noise exposure to within the acceptable limits noted in **"Permissible Noise Exposures (in the chart above)"** or Refer to Appendix B of 29 CFR 1910.95, Occupational Noise Exposure, for detailed information on methods to estimate the attenuation effectiveness of hearing protectors based on the device's noise reduction rating (NRR).

Manufacturers of hearing protection devices must display the device's NRR on the product packaging. If employees are exposed to occupational noise at or above 85 dB averaged over an eight-hour period, the employer is required to institute a hearing conservation program that includes regular testing of employees' hearing by qualified professionals. Refer to 29 CFR 1910.95(c) for a description of the requirements for a hearing conservation program.

Some types of hearing protection include:

- Single-use earplugs are made of waxed cotton, foam, silicone rubber or fiberglass wool. They are self-forming and, when properly inserted, they work as well as most molded earplugs
- Pre-formed or molded earplugs must be individually fitted by a professional and can be disposable or reusable. Reusable plugs should be cleaned after each use
- Earmuffs require a perfect seal around the ear. Glasses, facial hair, long hair or facial movements such as chewing may reduce the protective value of earmuffs

OSHA Assistance
OSHA can provide extensive help through a variety of programs, including technical assistance about effective safety and health programs, state plans, workplace consultations, voluntary protection programs, strategic partnerships, training and education, and more. An overall commitment to workplace safety and health can add value to your business, to your workplace and to your life.

Respiratory Protection

History of the Development of Respiratory Protection

The concept of using respiratory protective devices to reduce or eliminate hazardous exposures to airborne contaminants first came from Pliny (c. A.D. 23-79) who discussed the use of loose fitting animal bladders in Roman mines to protect workers from the inhalation of red oxide of lead (1,2). Later, in the 1700's, the ancestors of modern atmosphere-supplying devices, such as the self-contained breathing apparatus or hose mask, were developed. Although the devices themselves have become more sophisticated

in design and materials, respirators' performance is still based on one of two basic principles; purifying the air by removing contaminants before they reach the breathing zone of the worker, or providing clean air from an uncontaminated source.

In 1814, a particulate-removing filter encased in a rigid container was developed -- the predecessor of modern filters for air-purifying respirators. In 1854, it was recognized that activated charcoal could be used as a filtering medium for vapors. World War I and the use of chemical warfare also resulted in improvement in the design of respirators. Overall, there have been few major developments in the basic design of respirators over the years except for the resin-impregnated dust filter in 1930. This development has made available efficient, inexpensive filters that have good dust-loading characteristics and low breathing resistance. Another more recent development is the ultrahigh efficiency filter made from paper that contains very fine glass fibers. These extremely efficient filters are used for very small airborne particles and produce little breathing resistance.

Respirator Use

The purpose of a respirator is to prevent the inhalation of harmful airborne substances. Functionally, a respirator is designed as an enclosure which covers the nose and mouth or the entire face or head. Respirators are of two general "fit" types: Tight fitting (i.e., quarter masks, which cover the mouth and nose, and where the lower sealing surface rests between the chin and the mouth; the half mask, which fits over the nose and under the chin; and the full face piece, which covers from the hairline to below the chin), and loose fitting (i.e., hoods, helmets, blouses, or full suits which cover the head completely). There are two major classes of respirators: Air-purifying respirators (devices which remove contaminants from the air), and atmosphere-supplying respirators (those which provide clean breathing air from an uncontaminated source).

Air-purifying respirators are grouped into three general types:

1. Particulate Removing
2. Vapor and gas removing
3. Combination

Particulate removing, vapor and gas removing, and combination. Elements which remove particulates are called filters, while vapor and gas removing elements are called either chemical cartridges or canisters. Filters and canisters/cartridges are the functional portion of air-purifying respirators, and they can generally be removed and replaced once their effective life has expired. The exception would be disposable respirators, those which cannot be cleaned and disinfected or resupplied with an unused filter after use. Combination elements that protect for both particulates and vapors and gases are also available.

- Particulate-removing respirators are designed to reduce inhaled concentrations of nuisance dusts, fumes, mists, toxic dusts, radon daughters, asbestos containing dusts or fibers, or any combination of these substances, by filtering some of the contaminants from the inhaled air before they enter the breathing zone of the worker. They may have single use or replaceable filters. These respirators may be non-powered or powered air-purifying (using a blower to pull contaminated air through a filter; the resulting cleaned air is blown on the face).
- Vapor and gas removing respirators are designed with sorbent elements (canisters or cartridges) that adsorb and/or absorb the vapors or gases from the contaminated air before they enter the breathing zone of the worker. Combination cartridges and canisters are available to protect against both particulates and vapors and gases.
- Atmosphere-supplying respirators are respirators which provide air from a source independent of the surrounding atmosphere instead of removing contaminants from the atmosphere. These respirators are classified by the method by which air is supplied and the way in which the air supply is regulated. Basically, these methods are: Self-contained breathing apparatus (air or oxygen is carried in a tank on the worker's back, similar to SCUBA gear); supplied air respirators (compressed air from a stationary source is supplied through a high pressure hose connected to the respirator); and combination self-contained and supplied air respirators.

Types of Respiratory Hazards

Respiratory hazards may result from either an oxygen deficient atmosphere or from breathing air contaminated with toxic particles, vapors, gases, fumes or mists. The proper selection and use of a respirator depends upon an initial determination of the concentration of the hazard or hazards present in the workplace.

Contaminants are classified as particulate contaminants, which include mechanical dispersoids, condensation dispersoids, dusts, sprays, fumes, mists, fogs, smokes, and smog’s; and vapors or gases which include acids, alkaline, organics, organometallics, hydrides, and inert materials.

The particulates may be dusts such as clays, limestone, gypsum, or aluminum oxides; inert pulmonary reaction producing substances such as silicates; minimal pulmonary fibrosis producing substances such as iron oxide or tin oxide; extensive pulmonary fibrosis producing substances such as free silica or asbestos; chemical irritants such as acids or alkalies; systemic poisons such as pesticides, hydrogen cyanide or lead; allergy producing substances such as cotton, isocyanates, epichlorohydrin, fur fibers, or vegetable fibers; and febrile-reaction producing agents such as bagasse, or copper and zinc oxide; and biological materials.

The gaseous air contaminants include irritants such as nitrogen dioxide, phosgene, and arsenic trichloride; asphyxiants such as carbon monoxide, and hydrogen cyanide; anesthetics such as nitrous oxide, hydrocarbons, and ethyl and isopropyl ether; and systemic poisons such as carbon tetrachloride

Limitations of Respirator Use

Not all workers can wear respirators. Individuals with impaired lung function, due to asthma or emphysema for example, may be physically unable to wear a respirator. Individuals who cannot get a good face-piece fit, including those individuals whose beards or sideburns interfere with the face-piece seal, will be unable to wear tight fitting respirators. Determination of adequate fit is required for a respirator to be effective.

In addition to the problems with usage already discussed, respirators may also present communication problems, vision problems, fatigue and reduced work efficiency. Nonetheless, it is sometimes necessary to use respiratory protection as the means of control.

In principle, respirators frequently may be capable of providing adequate protection. However, problems associated with selection, fit, and use often render them ineffective in actual application, preventing the assurance of consistent and reliable protection; regardless of the theoretical capabilities of the respirator. Occupational safety and health experts have spent considerable effort over the years developing fit testing procedures and methods of measuring respirator protection so that these adverse variables can be better controlled, thereby improving protection for those employees required to wear them.

The current 29 CFR 1910.134 requires that the employer establish and implement a comprehensive respiratory protection program. The program is to contain written procedures and provide for proper cleaning, disinfection, storage, inspection and maintenance of the respirators. General provisions are set forth on fitting and training. Requirements are included for quality of breathing air and practices to ensure that it is not contaminated. Provisions for emergencies and for communication and rescue in atmospheres immediately dangerous to life or health are specified. A color code for gas mask canisters is detailed and other provisions are included.

The current standard requires the employer to instruct and train employees "in the proper use of respirators and their limitations." The additional provisions of the proposal amplify the current requirements by specifying, for example, that the training program include instruction in procedures for inspection, donning and removal, checking the fit, and sufficient practice to enable the employee to become thoroughly familiar and confident with the use of the respirator. OSHA believes, based on its experience promulgating and enforcing respirator provisions in other health standards and Sec. 1910.134, that such hands-on training can materially improve the effectiveness of respirator use.

The current respirator standard (1910.134(b)(11)) states that respirators that are "approved or accepted shall be used when available." OSHA has chosen to recognize only those respirators approved by the National Institute for Occupational Safety and Health (NIOSH), and the Mine Safety and Health Administration (MSHA). The NIOSH

and MSHA respirator performance requirements are given in Title 30, Code of Federal Regulations, Part 11. A revision of that standard is now being considered by NIOSH and MSHA.
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The Need For the Standard

The wearing of respiratory protective devices to reduce exposure to airborne contaminants is widespread in industry. It has been estimated that 2.6 million workers wear respirators, either occasionally or routinely, in non-emergency work situations. In addition, over 59,000 facilities maintain respirators for emergency use (5, Ex. 34). Although in most situations it is preferred industrial hygiene practice to use engineering controls to reduce contaminant emissions at their source, there are operations where this type of control is not technologically or economically feasible or is otherwise inappropriate. There are many variables which affect the degree of protection afforded by these respiratory protective devices.

Indeed, the misuse of respirators can actually be hazardous to employee safety and health. Selection of the wrong equipment, one of the most frequent errors made in respiratory protection, will result in the employee being unknowingly vulnerable to the hazard and thus inhaling concentrations of the contaminant that may be harmful. This may result in a broad range of health effects caused by airborne contaminants, including

silicosis, asbestosis, permanent lung damage and cancer. In the report by Rosenthal and Paull (Ex. 33-5) it is shown that, on the basis of OSHA's citation records, there is a high degree of correlation between inadequate respirator programs and overexposures to respirator wearers exposed to regulated substances. Respirators which are not maintained, inspected, and cleaned, can actually increase exposure, as well as cause dermatitis or skin irritation and place a greater strain on the respiratory system. Because the wearing of the respirator gives the employee a sense of security and presumed protection which may be false, an improper respirator program presents a high degree of hazard for the employee.

The devices themselves can only provide the protection they are designed for if they are properly selected for the task; if they are fitted to the wearer and are consistently donned and worn properly; and if they are maintained and cared for so they continue to provide the protection required for the work situation. These variables can only be controlled if a comprehensive respiratory protection program is developed and implemented in each workplace where respirators are used to protect employees from inhalation of airborne contaminants. OSHA has reviewed the present rulemaking record and the record of citations for respirator standard violations. On the basis of that review it is clear that to be effective such a program must use an integrated, systematic approach that will result in consistent and appropriate choices of respiratory equipment to be used; involvement of employees to ensure that they understand why respirators are being worn, and how they contribute to their effective use; and monitoring of the equipment and its use to ensure that respirator effectiveness is optimized.

There are many examples of how respirators may not provide the protection they were designed to provide in the absence of an effective respirator program with adequate employee training. When the hazardous substance is a dust, mist or fume there are often conditions under which it is possible for the inside of the respirator to become contaminated with the hazardous substance. For example, the employee may have an itch on the cheek and scratch it with a dirty finger thus destroying the integrity of the respirator fit.

An employee may leave the respirator area, remove the respirator, and rest it on his or her chest. The inside of the respirator could then pick up the contaminant from the air or work clothes and later when the respirator is donned the employee will inhale the contaminant from within the respirator. If a respirator is not cleaned properly or if it is stored in a locker or on a ledge covered with the contaminant, the employee will again breathe in the contaminant from within the respirator.

An employee engaged in manual labor may dislodge the respirator with a tool or even a normal motion unless the respirator has been appropriately fit tested and the employee knows that a readjustment is necessary. An employee may be engaged in work which requires good vision or extensive communication. Without conscious thought the employee may push the respirator into a position that improves vision or make talking easier but which would result in a poor face-piece seal.

To assure that the integrity of the respiratory protection program is maintained through the continuous oversight of one responsible individual, the proposal requires that a qualified person be designated as responsible for the management and administration of the program. That individual can work with a committee or assign responsibility for portions of the program to other personnel, but the overall responsibility for the operation of the program remains with the designated person. This approach promotes coordination of all facets of the program. The training requirement for the program administrator has been left performance oriented. With the varying complexity of respirator programs, specifying a uniform training requirement would be very difficult. The level of training required varies with the complexity of the respirator program. OSHA invites further comments on whether specific minimum training requirements for program administrators should be set, and on what the training should be.

Employers are required to keep the written respiratory protection program current. The pre-proposal draft required that the written respiratory protection program be maintained "in a current fashion." The Motor Vehicle Manufacturer's Association (Ex. 36-37) recommended that the phrase "in a current fashion" be deleted since requiring that the employer maintain the written program implies that it be maintained in a current fashion. In order to clarify the intent of the provision the phrase "in a current fashion" has been removed and the wording has been revised to require that the employer maintain a written respiratory protection program that reflects current workplace conditions and respirator use. As the workplace situation or respirator use changes, the program is to be revised. Also the program must be made available, upon request, to employees, designated representatives and to OSHA.

Minimum Requirements for Respiratory Protection for Airborne EtO

Condition of use or concentration of airborne EtO (ppm)	Minimum required respirator
Equal to or less than 25 ppm (25x PEL)	(a) Hood or helmet supplied air respirator operated in continuous flow mode (b) Hood or helmet powered air purifying respirator with EtO approved cartridge/canisters
Equal to or less than 50 ppm (50x PEL)	(a) Full face-piece air purifying respirator with EtO approved canister, front or back mounted; or (b) Full face-piece powered air purifying respirator with EtO approved cartridge/canisters; or

	(c) Full face-piece supplied air respirator operated in demand mode; or **(d) Full face-piece self contained breathing apparatus operated in demand mode; or**
Equal to or less than 2000 ppm (2000x PEL)	**(a) Full face-piece supplied air respirator operated in pressure demand mode**
Equal to or less than 10,000 ppm (10,000x PEL)	**(a) Combination full face-piece pressure demand supplied air respirator with auxiliary self-contained air supply; or** **(b) Full face-piece self-contained breathing apparatus operated in pressure demand mode**
Firefighting	**(a) Pressure demand self-contained breathing apparatus equipped with full face-piece**
Escape	**(a) Any respirator described above**

Below – From OSHA – Tables showing the number of employees affected by Industry

TABLE 1 - Number of Establishments and Employees in Industries Affected by the Personal Protective Equipment Standard					
SICs	Industries	Total Establishments	Total Employees	Production Employees	Employees At Risk
20,21	Food & Tobacco	23,388	1,673,287	1,196,818	782,205
22	Textiles	6,439	727,651	596,846	255,815
23,31	Apparel & Leather	25,708	1,239,402	964,677	558,884
24	Lumber & Wood Products	37,063	739,296	597,764	405,054
25	Furniture & Fixtures	10,563	515,866	412,323	306,280
26	Paper & Allied Products	6,732	680,961	479,730	387,578
27	Printing & Publishing	60,836	1,499,451	680,370	462,259
28	Chemicals	12,411	1,023,169	497,054	402,925

29	Petroleum Refining	2,158	166,032	44,169	33,805
30	Rubber & Plastics	14,703	851,467	565,705	393,468
32	Stone, Glass, Concrete	15,351	550,779	400,987	282,065
33	Primary Metals	7,130	741,297	549,603	476,145
34	Fabricated Metals	34,605	1,401,605	921,660	638,577
35	Machinery & Computers	53,031	2,032,338	1,018,420	788,598
36	Electric & Electronics	17,836	2,063,033	1,204,266	810,492
37	Transportation Equipment	9,688	1,762,926	1,113,656	894,417
38,39	Misc. Manufacturing	24,860	1,091,140	599,624	410,532
41,42	Transportation	124,121	1,770,983	1,258,897	688,183
48	Communications	23,505	1,281,837	788,800	642,609
49	Utilities	17,741	934,650	334,492	266,440
501,55,					
75	Automotive Trade & Services	326,793	3,066,501	1,373,718	803,309
50,51,					
52	Wholesale & Retail Trade	189,947	2,056,173	963,641	822,312
7692	Welding Repair	6,653	31,800	24,622	20,317
13	Oil & Gas Extraction	26,957	396,519	117,579	92,602
078,08	Horticulture & Forestry	46,294	290,552	173,863	106,782
TOTAL		1,124,513	28,588,715	16,879,284	11,731,653

TABLE 2 - Number of Employees and Parts of the Body Requiring Personal Protective Equipment Among the Population at Risk

SICs	Industries	Production Employees	Total Exposed Population	Body Part Exposed(*)				
				Head	Eye	Face	Hand	Foot
20,21	Food & Tobacco	1,196,818	782,205	112,574	91,806	0	220,059	652,884
22	Textiles	596,846	255,815	36,685	104,918	3,877	134,689	129,498
23,31	Apparel &	964,677	558,884	16,527	72,682	0	462,683	133,101

	Leather							
24	Lumber & Wood Products	597,764	405,054	65,597	29,483	104,352	103,547	388,436
25	Furniture & Fixtures	412,323	306,280	26,231	41,767	26,130	127,295	234,696
26	Paper & Allied Products	479,730	387,578	35,146	132,898	4,576	156,569	326,256
27	Printing & Publishing	680,370	462,259	0	242,298	0	257,095	333,121
28	Chemicals	497,054	402,925	116,763	158,344	3,098	155,596	322,095
29	Petroleum Refinin	44,169	33,805	14,562	11,918	476	16,136	15,948
30	Rubber & Plastics	565,705	393,468	47,984	57,839	20,048	124,766	313,688
32	Stone, Glass, Concrete	400,987	282,065	64,462	38,156	19,234	81,620	243,835
33	Primary Metals	549,603	476,145	95,001	95,727	120,272	214,995	394,255
34	Fabricated Metals	921,660	638,577	33,157	85,767	12,101	144,447	570,595
35	Machinery & Computers1,	018,420	788,598	59,583	146,365	2,246	329,603	631,485
36	Electric & Electronics	1,204,266	810,492	66,001	334,211	611	469,622	455,479
37	Trans-portation Equipment	1,113,656	894,417	53,777	129,841	4,575	315,617	759,262
38,39	Misc. Manu-facturing	599,624	410,532	35,815	124,151	9,092	203,543	284,091
41,42	Trans-portation	1,258,897	688,183	70,798	79,546	588	67,043	665,473
48	Communi-cations	788,800	642,609	461,102	133,783	15,162	341,999	182,129
49	Utilities	334,492	266,440	126,995	106,879	24,321	96,394	246,691
501,55,								

75	Automotive Trade & Services	1,373,718	803,309	55,791	297,398	0	407,995	595,690
50,51,								
52	Wholesale & Retail Trade	963,641	822,312	255,319	154,863	4,842	134,153	742,635
7692	Welding Repair	24,622	20,317	797	11,108	172	10,492	15,278
13	Oil & Gas Extraction	117,579	92,602	49,872	51,451	0	51,804	76,391
078,								
08	Horticulture & Forestry	173,863	106,782	22,050	39,546	5,146	83,217	44,856
TOTAL		16,879,284	11,731,653	1,922,589	2,772,745	380,919	4,710,979	8,757,868
Footnote(*) "Exposed body part" total exceeds total exposed population because some employees are exposed to multiple hazards								
Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis								