

Personal Protective Equipment

Guide

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INTRODUCTION

The University of Ottawa is committed to providing a healthy and safe work and educational environment for all of its employees, students and visitors. Personal Protective Equipment is the last line of defense but one of the ways to ensure that people involved are adequately protected. Other hazard controls, such as Engineering, Administrative and Practices and Procedures, must be evaluated and implemented to the extent possible or practical before considering the use of personal protective equipment.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protective Equipment (PPE) is equipment worn by a person to minimize exposure to specific occupational hazards. PPE does not reduce the hazard itself nor does it guarantee permanent or total protection. It should be used only when the hazard **cannot be adequately removed or controlled. Selection of proper PPE depends upon the nature of individual tasks and hazard exposure.**

SCOPE

Anyone within the University of Ottawa workplace such as staff, students, volunteers as well as visitors who may be exposed to potential hazards.

EDUCATION AND TRAINING

According to the *Ontario Occupational Health and Safety Act (Regulations 851 section 79)*, and Policy 77 of the University of Ottawa:

A worker required to wear or to use any protective clothing, equipment or device shall be instructed and trained in its care, use and limitations before wearing the protective clothing, equipment or device.

The employer is required to ensure that a training record is prepared for each worker and that it is kept and available to an inspector on request, as prescribed.

RESPONSIBILITIES

In accordance with Policy 77 of the University of Ottawa

Principal Investigators, Supervisors and All Others in Authority shall:

- Shall incorporate preventive measures in all functions and activities in which there may be some incident or accident with health and / or safety related consequences;
- Shall provide information, instruction, and supervision to employees to protect their health or their safety;
- Shall provide safety training opportunities for all their personnel;
- Shall ensure that employees under their authority use or wear the equipment, protective devices or clothing required;
- Shall provide equipment, materials and protective devices, and ensure they are maintained in good condition and used as prescribed under the *Ontario Occupational Health and Safety Act*;

Workers shall:

- Shall work in compliance with the provisions of the *Ontario Occupational Health and Safety Act* and all applicable health and safety procedures and instructions;
- Shall use or wear the equipment, protective devices or clothing that the University requires to be used or worn, and
- Shall report to their supervisors the absence of, or defect in any equipment or protective device of which they are aware and which may endanger themselves or other employees.

DISCIPLINARY MEASURES

Employees who contravene Policy 77 are subject to disciplinary measures in accordance with the policies ([Policy 2d - Disciplinary Measures for Reprehensible Acts](#)) and collective agreements governing their work conditions.

When persons not employed by the University of Ottawa violate this policy, the person in charge of the activity must take measures to have the policy obeyed.

Note: “Worker” for this document includes staff, students, volunteers and visitors at the university. The PPE must be worn when required. The reimbursement of the purchase of the PPE (i.e. for visitors) is at the discretion of the university units.

It is also important to note that a variety of other legislative references not listed in this document may apply to your work environment; for example, Regulation 833, Controls of Exposure to Biological and Chemical Agents, Regulation 490/09, Designated Substances, etc. Ensure that you consult other legislative documents applicable to your work.

HEAD PROTECTION

Legislation

A worker exposed to the hazard of head injury shall wear head protection appropriate in the circumstances. Regulation 851; s.80

Standard

All protective hard hats should comply with the CSA Z94.1-15 standard or its equivalent.

Types of Head Protection

Head injuries may be prevented, or minimized, by using appropriate headwear protection. The appropriate type of head protection should be selected according to the hazard. Therefore, a prior assessment of potential hazards should be conducted to ensure the appropriate headwear has been selected. There are three classes and two types of protective hard hats. Table 1 below provides a description of protective headwear.

Table 1 – Types of Head Protection

	Hard Hats	Bump Caps	Hair Protectors
Description	Consists of a shell and the suspension	A bump cap provides only a covering for the scalp and is intended to protect the wearer’s head only against injury	All enclosing caps, hair nets, hoods, turbans, bandanas and beard containers

	Hard Hats	Bump Caps	Hair Protectors
		caused by striking minor bumps	
Protection	Class G – protects against impact and penetration (limited voltage protection).	Protects only against light impacts caused by the motion of worker’s head.	Prevents worker’s hair from been caught in moving equipment, or is worn for sanitary / hygienic reasons.
	Class E - protects against impact, penetration and better electrical protection than class G	Does not protect against falling objects, should never be substituted for a hard hat.	
	(ANSI) Type I – protection for top impact (not recommended).	N/A	
	(ANSI) Type II – protection for top and lateral impact.	N/A	
	Class C – protects against impact and penetration only (no electrical protection).	N/A	

Recommendation – CSA Class E Type II hard hats will provide the maximum protection; therefore, these are recommended for most types of activities.

Maintenance of Hard Hats

To provide adequate protection, hard hats must be maintained in serviceable condition. Note some basic guidelines below for proper maintenance of hard hats.

- Inspect and replace a shell that shows signs of wear, scratches or gouges. Shells exposed to heat, sunlight and chemicals can become stiff or brittle. A visible pattern of tiny cracks may develop. Over time, weathered hats can become dull in colour or have a chalky appearance.
- Do not apply any paint, solvent or adhesive (including stickers / labels) to the hat; these materials may obscure cracks or visible damage.
- Replace headwear when hairline cracks start to appear.
- Replace headwear that has been struck / exposed to a hazard, even if no damage is visible.
- Remove and destroy any headwear if its protective abilities are in doubt.
- Follow manufacturer’s recommendation for maintenance.

Note: Hard hats should be replaced within 3 to 7 years of manufacture or more frequently if necessary. Damaged hats should be destroyed immediately to avoid their accidental use. A sticker only stating the approval of CSA is not enough; the class and type of the hard hat should also appear engraved on the inside of the peak.

Hazard Assessment

The CSA Z94.1-15 standard requires that a hazard assessment be performed in the workplace. This assessment is comprised of 4 steps:

1. Observation of worker job functions;
2. Worker interviews to determine when potential hazards are present and their associated risk level;
3. Review procedures to ensure local, provincial, and/or federal regulatory compliance;
4. Review of any past case history.

If no hazard assessment has been conducted or is available, the worker shall default to the highest protective level; which is a type 2, class E protective helmet.

Hard Hat Additions

Some companies will also include their company logo or slogan on the hard hat. Imprinting or adhesive labels may not affect the integrity of the hat; however, it is recommended to consult with the manufacturer prior to application or modification.

HEARING PROTECTION

Legislation

"decibel" (dB(A)) means a unit of measurement of sound pressure level that is equal to 20 times the logarithm to the base 10 of the ratio of the pressure of a sound, divided by the reference pressure of 20 micropascals. Regulation 381, s. 1.

...every employer shall ensure that no worker is exposed to a sound level greater than an equivalent sound exposure level of 85 dBA, $L_{ex,8}$ Regulation 381, s. 2 (4).

Except in the circumstances below, the employer shall protect workers from exposure to a sound level greater than the limit described in subsection (4) without requiring them to use and wear hearing protection devices. Regulation 381, s. 2 (5).

Workers shall wear and use hearing protection devices appropriate in the circumstances to protect them from exposure to a sound level greater than the limit described in subsection (4) if engineering controls are required by subsections (1) and (2) and,

- a) are not in existence or are not obtainable;*
- b) are not reasonable or not practical to adopt, install or provide because of the duration or frequency of the exposures or because of the nature of the process, operation or work;*
- c) are rendered ineffective because of a temporary breakdown of such controls; or*
- d) are ineffective to prevent, control or limit exposure because of an emergency.*

Where practicable, a clearly visible warning sign shall be posted at every approach to an area in the workplace where the sound level, measured as described in subsection (3), regularly exceeds 85 dBA. Regulation 381, s. 2 (7).

Table 1 – Maximum Noise Exposure

Sound Level (in db(A))	Duration (85 dB(A) $L_{ex,8}$) (hrs/24 hr day)
82	16
85	8

Sound Level	Duration (85 dB(A) $L_{ex,8}$)
88	4
91	2
94	1
97	30 mins.
100	15 mins.
Over 115	No exposure

The duration of exposure set out in Column 2 of Table 2 below shall not exceed the duration shown for the particular sound level set opposite thereto in Column 1 of Table 2, or the person shall wear hearing protection.

Standard

All Hearing protection should comply with the CSA Z94.2-02 (R. 2011) standard.

Types of Hearing Protection

Ear Plugs

Inserted into the ear to block the ear canal, they may be pre-molded (pre-formed) or moldable (such as foam plastic, waxed cotton or silicone). Ear plugs are sold as disposable products or reusable plugs. Custom molded ear plugs are also available.

Semi-Insert Ear Plugs

Consist of two ear plugs held over the ends of the ear canal by a rigid headband.

Ear Muffs

Consist of sound-attenuating material and soft ear cushions that fit around the ear and hard outer cups. They are held together by a head band.

Helmets

Can be used to support ear muffs and cover the head to reduce bone-conducted sound. With proper design and fitting of the seal between the helmet edge and the skin, a helmet can provide 5-10 dB(A) additional noise reduction over and above the noise reduction.

Noise Reduction Rating (NRR)

The noise reduction rating (NRR) is usually listed on the package of the hearing protection. Hearing protection NRR is subtracted from the overall noise level; which will provide the noise level at the ear of the user. To note, that these ratings are obtained in controlled, laboratory conditions.

Table 2: Example Levels of Noise Reduction Rating

Type of Hearing Protection	Noise Reduction Rating
Ear Plugs	Approximately 30-34 dB
Semi-insert Ear Plugs	Approximately 24-27 dB
Ear Muffs	Approximately 19-31 dB
Helmets	Approximately 19-31 (ear muffs plus 5-10 dB)

Note: Radio headsets / MP3 players are not substitutes for hearing protection devices. These devices should not be worn where hearing protectors are required to protect against exposure to noise.

Consult Appendix 1 for example of noise levels.

Fit Test

The effectiveness of hearing protection is reduced greatly if the hearing protectors do not fit properly or if they are worn only part time during periods of noise exposure. Therefore, it is important that hearing protection fits comfortably on the user.

In areas where hearing protection is required, workers should undergo an initial audiometric test as well as subsequent evaluations at regular intervals. This will establish a basis for comparing future results and will identify a worker's particular problem(s) or concern(s). For further information, consult the Health and Wellness Sector, Human Resources or the uOttawa Hearing Conservation Program.

Maintenance of Hearing Protection

- Follow the manufacturer's instructions.
- Check hearing protection regularly for wear and tear.
- Replace ear cushions or plugs that are no longer pliable.
- Replace a unit when head bands are so stretched that they do not keep ear cushions snugly against the head.
- Disassemble ear muffs to clean.
- Wash ear muffs with a mild liquid detergent in warm water, and then rinse in clear warm water. Ensure that sound-attenuating material inside the ear cushions does not get wet.
- Use a soft brush to remove skin oil and dirt that can harden ear cushions.
- Squeeze excess moisture from the plugs or cushions and then place them on a clean surface to air dry (check the manufacturer's recommendations first to find out if the ear plugs are washable).

Note: Always wash hands before inserting ear plugs. Do not reuse or share disposable ear plugs.

EYE AND FACE PROTECTION

Legislation

A worker exposed to the hazard of an eye injury shall wear eye protection appropriate in the circumstances. Regulation 851, s. 81.

Standard

All protective equipment should comply with the CSA Z94.3-07 (R. 2012) Standard or its equivalent.

Selection of Appropriate Eyewear

In order to select protective equipment that is appropriate for the task, one must become familiar with the potential work hazards and the type of protective equipment that is available and appropriate for the task undertaken.

Safety eyewear must be worn in circumstances where there is a hazard of:

- Impact (flying particles, dusts, vapours)
- Splash (chemical, radioactive, biological agents) or
- Ultraviolet and Infrared (harmful rays)

Protective eyewear shall be specifically selected in order to be fully protected. Good manufacturers can help you to select the appropriate eyewear and to inform you on the limit of their protection. For further information, contact the Office of Risk Management.

Individuals who wear prescription protective eyewear should be aware that **glass lenses do not meet the impact requirements outlined in Z94.3**; prescription lenses other than glass must have a minimum thickness of **not less than 2.0 mm**. Lenses of prescription eyewear have to meet the size requirements specified in the CSA standard and be equipped with permanently attached or removable side shields. Excessive thickness of eyewear due to prescription is inappropriate protection. Safety eyewear must be CSA compliant.

Consult Appendix 2 for assistance with eyewear selection. This list is a guide supplied for reference purposes only; it is not exclusive. This [list is available via CCOHS](#).

Eyewear Protection Considerations for Lasers

Laser equipment is included in this category and specific eye protection must also be considered when using laser equipment, in particular when full enclosure of the laser or beam path is not feasible. Laser protective eyewear shall be specifically selected to withstand either direct or diffusely scattered beams depending upon the circumstances of exposure. The eyewear shall be used in a manner so that the damage threshold is not exceeded in the “worst case” exposure scenario. The following factors, suggested by ANSI Z136.1-2007 (Sec. 4.6.2.4), shall be considered in selecting the appropriate laser protective eyewear to be used:

- Laser power and/or pulse energy
- Wavelength(s) of laser output
- Potential for multi-wavelength operation
- Radiant exposure or irradiance levels for which protection (worst case) is required.
- Exposure time criteria.
- Maximum permissible exposure.
- Optical density requirement of eyewear filter at laser output wavelength.
- Angular dependence of protection afforded.
- Visible light transmission requirement and assessment of the effect of the eyewear on the ability to perform tasks while wearing the eyewear.
- Need for side-shield protection and maximum peripheral vision requirement; side shields shall be considered and should be incorporated where appropriate
- Radiant exposure of irradiance and the corresponding time factors at which laser safety filter characteristics change occurs, including transient bleaching especially for ultrashort pulse lengths
- Need for prescription glasses
- Comfort and fit.

- Degradation of filter media, such as photobleaching.
- Strength of materials (resistance to mechanical trauma and shock)
- Capability of the front surface to produce a hazardous specular reflection
- Requirement for anti-fogging design or coatings.

For further information, contact the Laser Safety Specialist or Assistant Director, Radiation and Biosafety, Office of Risk Management.

Note: Consider UVA and UVB protective eye lenses when working outside in order to protect the eyes from harmful rays. Select sunglasses that comply with CSA or ANSI standards. Glasses should have side shields and fit against cheekbones.

Fitting

Consideration should be given to fit and comfort. This increases the chances of eyewear being worn at all times and consequently maximizes protection. Most eyewear comes in different sizes and styles. Ensure it is well adapted and fitted to the physiognomy of the user.

Cleaning and Maintenance of Protective Eyewear

Cleaning and proper maintenance of eyewear is especially important; dirty or fogged lenses could impair vision and lead to potentially serious incidents. Eyewear should be inspected and cleaned before and after each use in order to provide needed protection. It should also be properly stored between uses. Ensure manufacturer's instructions are followed.

Contact Lenses

Contact Lenses are not a substitute for eye protection and should be covered (or removed, where possible) by appropriate eye protection if an exposure to hazard or risk of injury is possible.

Considerations to be evaluated if wearing contact lenses in workplaces are as follows:

- Dusts or chemicals can become trapped behind the lens and cause irritation or damage to the eye;
- Gases and vapours can cause irritation and excessive eye watering; and
- Chemical splash may be more injurious when contact lenses are worn. This increased risk is related to the removal of the lenses. If removal is delayed, first aid treatment may not be as effective and, in turn, the eye's exposure time to the chemical may be increased.

Note: If a worker wears contact lenses he / she should consider notifying the supervisor, so that in case of emergency, proper first-aid activities can be carried out.

SKIN PROTECTION

Legislation

A worker exposed to the hazard of injury from contact of the worker's skin with,

- a noxious gas, liquid, fume or dust;*
- a sharp or jagged object which may puncture, cut or abrade the worker's skin;*
- a hot object, hot liquid or molten metal; or*
- radiant heat*

Shall be protected by:

- a) wearing apparel sufficient to protect the worker from injury;
- b) a shield, screen or similar barrier, appropriate in the circumstances. Regulation 851, s. 84.

Protective clothing or other safety device that has been worn next to the skin shall be cleaned and disinfected prior to being worn by another worker. Regulation 851, s.137

Table 5 – Skin Protection

Hazard	Degree of Hazard	Protective Material
Abrasion	Severe	Reinforced heavy rubber, staple-reinforced heavy leather
	Less Severe	Rubber, plastic, leather, polyester, nylon, cotton.
Chemicals and Fluids	Risk varies according to the chemical, its concentration, and time of contact among other factors. Refer to the manufacturer or product MSDS.	Dependent on chemical. Examples include: Natural rubber, neoprene, nitrile rubber, butyl rubber, PTFE, Teflon, etc.
Cold		Leather, insulated plastic or rubber, wool, cotton.
Electricity		Rubber-insulated gloves tested to appropriate voltage with leather outer glove.
General Duty		Cotton, terry cloth, leather.
Heat	High Temperatures (over 350 deg C)	Asbestos, Zatex
	Medium High (up to 350 deg C)	Nomex, Kevlar, neoprene-coated asbestos, heat-resistant leather with linings.
	Warm (up to 200 deg C)	Nomex, Kevlar, heat-resistant leather, terry cloth (aramid fiber).
	Less Warm (up to 100 deg C)	Chrome-tanned leather, terry cloth.
Product Contamination		Thin-film plastic, lightweight leather, cotton, polyester, nylon.
Radiation		Lead-lined rubber (gloves and aprons should not be folded), plastic or leather.
Sharp Edges	Severe	Metal mesh, staple-reinforced heavy leather, Kevlar aramid-steel mesh.
	Less Severe	Leather, terry cloth (aramid fiber)

Hazard	Degree of Hazard	Protective Material
	Mild with delicate work	Lightweight leather, polyester, nylon, cotton.
X-Ray		Protective apron and gloves, providing shielding equivalent to at least 0.5 millimeter of lead

[Table adapted from Canadian Centre for Occupational Health and Safety \(CCOHS\)](#)

Hand Protection

Depending on the type of activity conducted, hands can be protected by wearing gloves. The selection of the proper type of glove is essential to the performance of the glove as a barrier to a hazard. The type and level of risks must be assessed before selecting a type of glove for the work to be conducted. Risks can vary from electrical shocks, vibration, cuts and abrasions, chemical exposures, biological exposures, physical agents (example: dust), etc. Many types of gloves are available and may not be described in this document. Good manufacturers can help you to determine the appropriate type of gloves and provide you with information on the limits of usage.

A logical starting place is the safety data sheet (SDS) for the hazardous product. Once the product is known, a proper selection of gloves can be made. Keep in mind that there is no such thing as an “impermeable” glove. No one glove material is resistant to all chemicals and no glove materials are impermeable to the chemical at all times or forever. The Faculty of Science has published a chart regarding the [selection of gloves when using chemicals substances](#).

The required dexterity for the operation must also be taken into consideration when selecting a pair of gloves. In general, biological and radioactive hazards are well addressed through the use of latex, nitrile or vinyl gloves.

Note: Always test gloves before using them!

Allergies / Sensitivities Related to Latex Gloves

There has been an increase in allergic reactions to latex, possibly as a result of its widespread. Studies have shown that up to 17 percent of workers who regularly wear latex gloves have developed an allergy / sensitivity to them. Allergic reactions may either be due to the natural latex proteins or to the chemical additives added to the latex during the manufacturing process. These reactions can present a serious health risk. Allergic reactions range from immediate latex skin reactions, to more serious health effects such as dermatitis, asthma and sometimes can be even life-threatening. Gloves are now primarily available in nitrile material.

Workers are encouraged to disclose an allergy to latex when there is a possibility that other workers in their work vicinity might use latex gloves. If a worker is not sure if he or she is allergic to latex, they should consult with the Health and Wellness Office, Human Resources.

Proper Glove Donning and Removal Techniques

Refer to Appendix 3 for techniques on how to don and remove gloves. Gloved-hands should not come in contact with physical surfaces outside a laboratory.

Protective Clothing (Chemicals, Radioactive or Biological Agents)

Lab coats must be worn at all times when working in a laboratory using hazardous materials. Lab coats are intended to protect against minor splashes or spills, and to minimize contamination of street clothing with materials used in the laboratory. Lab coats should be at least knee length and made of material (e.g. cotton or cotton/polyester blend) as well as fastened when worn. A lab coat should be closed with snaps only; buttons are not permitted. Disposal lab coats can be used when appropriate but special considerations must be given to their limitations and proper disposal. The sleeves of the coat should extend to wrist line. Additional requirements for solid front gowns with tight fitting wrists are required when working with biological material under level 3 containment. Ensure periodic replacement as necessary.

Lab coats must be removed when leaving the laboratory, unless needed for special purposes. Lab coats must not be worn in eating areas (e.g. cafeterias, food courts, lunch rooms,), in administrative office areas, or in public areas (e.g. class rooms, libraries, public meeting places, washrooms).

Note: natural fibres (cotton, wool, etc.) offer generally better protection than synthetic materials (nylon, polyester, etc.).

Chemical Resistant Clothing

Sometimes a higher protection – for example, aprons, leggings, coveralls, or sleeve protectors – may be required. Selecting the clothing material which best protects against a particular chemical must be based on chemical resistance performance upon contact with the chemical. Appropriate chemical resistant clothing must show no penetration, no significant degradation, breakthrough time greater than the duration of the task, and a low permeation rate upon contact with the chemicals used.

Cleaning and Maintenance of Protective Clothing

Lab coats as well as other types of protective clothing must be washed regularly according to the manufacturer specifications. All protective clothing shall be washed separately from non-protective clothing to avoid possible transfer of contamination.

RESPIRATORY PROTECTION

Legislation

Where a worker is likely to be exposed to an atmosphere at atmospheric pressure with an oxygen content of less than 18 percent, the worker shall be protected by mechanical ventilation so that the worker's safety and health is not endangered. Regulation 851, section 138 (1)

Where the measures prescribed by subsection (1) are not practicable, the worker shall be protected by air supplied breathing equipment so that the worker's safety and health is not endangered. Regulation 851, section 138 (2)

The employer shall provide, and workers shall wear and use, personal protective equipment appropriate in the circumstances to protect the workers from exposure to the agent, if engineering controls required by this Regulation,

- a) are not reasonable or not practical to adopt, install or provide because of the duration or frequency of the exposure or because of the nature of the process, operation or work;*

- b) are rendered ineffective because of a temporary breakdown of such controls; or
- c) are ineffective to prevent, control or limit exposure because of emergency,

Regulation 833, section 7.2 (2),

Standard

All respirators should meet, or exceed, CSA Standard CSA Z94.4-02 (R. 2007) or its equivalent, which sets out requirements for the proper selection, use and care of respirators.

Note: An employer must ensure that a worker is medically fit to wear a respirator. To arrange for a medical screening, consult the Health and Wellness Sector, Human Resources.

Fit Testing

Fit-testing must be performed by a competent person according to the *Ontario Occupational Health and Safety Act*, which states that a competent person is someone who:

- a) is qualified because of knowledge, training and experience to organize the work and its performance,
- b) is familiar with this Act and the regulations that apply to the work, and
- c) has knowledge of any potential or actual danger to health or safety in the workplace;

Respirators must fit properly to prevent leaks around the edges. Fit-testing must be done before first wearing a respirator, in cases of any physical change, and every two years thereafter. In fit-testing a worker, several types and sizes of respirators are tried on first and after a comfortable respirator is selected, qualitative or quantitative fit-tests are conducted.

Note: the respirator will not provide the needed protection if the seal between the skin and the respirator mask is broken or compromised. This may happen if the worker has:

- A beard / facial hair. The worker needs to be clean-shaven.
- Glasses.
- Facial scars.
- Long side burns.
- Dermatological condition (acne).

Qualitative Fit Test

The worker is exposed to an atmosphere containing an irritant or taste agent and then asked to breathe normally, breathe deeply, move head side to side, move head up and down, grimace, bend at the waist, and talk. Then the wearer reports any noticed odor or taste changes. No eating, smoking or chewing gum is permitted 15 minutes prior to testing.

Quantitative Fit Test

A particle counting instrument compares the dust concentration in the surrounding air with the dust concentration inside the respirator, while the wearer is breathing normally, is breathing deeply, moves his head side to side, or up and down, grimaces and talks. The ratio of these concentrations is called the fit factor.

Seal Check

Whenever the respirator is put on, a seal check must be performed.

Inhalation Check (or Negative Pressure Check)

Cover the cartridges with your hands, inhale gently to collapse the face piece slightly, and hold your breath for 10 seconds. If the face piece remains slightly collapsed and no leakage is detected, the respirator fits properly.

Exhalation Check (or Positive Pressure Check)

Cover the exhalation valve with your hand and exhale gently into the face piece. If a slight positive pressure is built up inside the face piece without any evidence of leakage, the fit is satisfactory.

Types of Respirators

The two main types are air-purifying respirators (APRs) and supplied-air respirators (SARs).

Air Purifying Respirators

There are two basic types of APRs – mechanical and chemical. Mechanical filters remove contaminants in the air by filtering out particulates (e.g., dusts, metal fumes, mists, etc.). Chemical cartridge filters purify air by adsorbing or neutralizing gases or vapours on a sorbent (adsorbing material) in a cartridge. They are tight-fitting and are available in several forms:

Mouth Bit Respirator

Fits in the mouth and comes with a nose clip to hold nostrils closed; it is used for escape purposes only.

Quarter-Mask Respirator

Covers the nose and mouth

Half-Face Respirator

Covering the face from the nose to below the chin; half-face cartridge respirators only provide protection to levels 10 times above the chemical or dust permissible limit.

Full-Face Respirator

Covers the face from above the eyes to below the chin. Full-face respirators also provide eye protection for irritating chemicals.

Filter Series

Oil droplets in the air have been found to degrade the filtering capability of some filter material. To ensure that a suitable filter is used, there are basic categories; classes N, R and P series filters.

- N – Not resistant to oil – appropriate when there is no oil-based products in the air.
- R – Resistant to oil – this filter resists oil but may break down in contact with oil or solvent over an extended period.
- P – Oil proof – filter has a limited service life, manufacturers recommendations should be checked to determine how long the filter can be used for.

Table 6 – Filter Series

Filter Class	Efficiency (%)	Suitable for/Service time
N series		All particulate (airborne solids) where no oil or solvent is in the air. N- series have no specific service time . They may be used multiple shifts and use may continue until a change in breathing resistance is noted
N95	95	Fine particulate when no oil or solvent is in the air
N99	99	Very fine particulate when no oil or solvent is in the air
N100	99.97	Extremely fine and very toxic particles when no oil or solvent is in the air
R series		Resistant to oil but should not be used more than one shift . (Note: these filters do not provide protection from organic vapours)
R95	95	Fine particulate when oil or solvent is also in the air
R99	99	Very fine particulate when oil or solvent is also in the air
R100	99.97	Extremely fine and very toxic particulate when oil or solvent is also in the air
P series		Oil-Proof. However, check manufacturer's recommended service life when oil aerosols are present. Long-term exposure to oil may lead to degradation. (Note: these filters do not provide protection from organic vapours)
P95	95	Fine particulate when oil or solvent is also in the air
P99	99	Very fine particulate when oil or solvent is also in the air
P100	99.97	Extremely fine and very toxic particulate when oil or solvent is also in the air

Adapted from [National Institute for Occupational Health and Safety](#)

Respirator Maintenance

- Clean respirator before storing the respirator.
- Store a respirator and cartridges in separate plastic sealed bags.
- If used by more than one person, the respirator must be cleaned and disinfected before and after each use.
- Indicate date on cartridges before using them.
- Cartridges must be capped when stored.

How Cartridge Air-Purifying Respirators Work and Their Limitations

When used properly, respirators prevent the inhalation of chemicals and dust in the air and protect the lungs. During inhalation, air is pulled through the cartridge, where contaminants are trapped. Cartridges are manufactured to protect from a specific contaminant; for examples, a chemical cartridge doesn't filter out dust and a dust cartridge doesn't eliminate chemicals from the air.

Combination cartridges (dust/chemical cartridges) can be used where more than one type of hazard exists. All cartridges are color-coded for the type of chemical or dust.

Cartridge Life

Cartridges must be changed regularly to ensure maximum protection. Dust cartridges are changed when they become difficult to breathe through or are damaged. Chemical cartridges are changed on a predetermined schedule. When their capacity is reached, breakthrough will occur. It is very

important to know the life of cartridge, as some chemicals have no odor, have low exposure values, or can only be detected at high levels.

It is necessary to keep in mind that most cartridges have a limited shelf life. Please refer to manufacturer's instructions to verify the length of a shelf life of a particular cartridge.

Cartridge Respiratory Limitations

Cartridge respirators don't work where there is a lack of oxygen. For workers who have heart or lung problems, respirators can be hazardous to their health. A medical evaluation must be performed and the worker must receive confirmation from the Health and Wellness sector that he or she is fit to wear a respirator prior to being assigned any type of work that requires the use of respirator.

Supplied Air Respirators

Supplied air respirator needs to be worn where chemicals have levels immediately dangerous to life and health (IDLH) or in a potential or actual oxygen deficient environment.

Supplied-air respirators (SARs) supply breathable air from an air tank or through an air-line. The air supplied in tanks or from compressors must meet certain standards for purity and moisture content (e.g., CSA Standard Z180.1-00 (R. 2010): Compressed Breathing Air and Systems).

Supplied-air respirators may have either tight-fitting or loose-fitting respiratory inlets. Respirators with tight-fitting respiratory inlets have half or full-face pieces. Types with loose-fitting respiratory inlets can be hoods or helmets that cover the head and neck, or loose-fitting face pieces with rubber or fabric side shields. These are supplied with air through airlines.

All new Self Contained Breathing Apparatus (SCBA) used in an emergency should comply with the revised NFPA 1981 Standard. It covers minimum documentation, design criteria, performance criteria, test methods and certification for open-circuit self-contained breathing apparatus used in firefighting, rescue and other hazardous duties. SCBA air cylinder must meet CSA Standard Z180.1-00 (R. 2010) on breathing air.

FOOT PROTECTION

Legislation

A worker exposed to the hazard of foot injury shall wear foot protection appropriate in the circumstances. Regulation 851, s.82.

Standard

Protective Footwear must meet or exceed CSA Standard CSA-Z195-14.

Types of Protective Footwear

Protective footwear is identified with various coloured labels to indicate the type of protection provided. A green triangular patch provides the most protection. Yellow and red patches indicate lower levels of protection.

Note: Coloured labels must be sewn to the shoes; stickers are insufficient and are not recognized as acceptable labeling.

Recommendation: Grade 1 footwear will provide the maximum protection therefore is recommended for any type of activities. Grade 2 or 3 may still be selected if appropriate for the task.

Consult Appendix 4 for assistance in the selection of protective footwear.

Selecting Protective Footwear

Good footwear should have the following qualities:

- The inner side of the shoe must be straight from the heel to the end of the big toe.
- The shoe must grip the heel firmly.
- The forepart must allow freedom of movement for the toes.
- The shoe must have a fastening across the instep to prevent the foot from slipping when walking.
- The shoe must have a low, wide-based heel; flat shoes are recommended.

Fitting

- Walk in new footwear to ensure it is comfortable.
- Boots should have ample toe room (toes should be about 12.5 mm from the front)
- Make allowances for extra socks or special arch supports (if required) when buying boots.
- Boots should fit snugly around the heel and ankle when laced.
- Lace up boots fully. High-cut boots provide support against ankle injury.

Maintenance of Footwear

- Use a protective coating to make footwear water-resistant, if necessary.
- Inspect footwear regularly for damage.
- Repair or replace worn or defective footwear.
- Electric shock resistance of footwear is greatly reduced by wet conditions and with wear.
- Refer to manufacturer's instructions.

Note: Open-toed and high-heeled shoes are not permitted to be worn in laboratories or other workplaces where exposure to chemical, radioactive or biological agents can occur.

FALL PROTECTION

Legislation

Where a worker is exposed to the hazard of falling and the surface to which he or she might fall is more than three metres below the position where he or she is situated,

- a) the worker shall wear a serviceable safety belt or harness and lifeline adequately secured to a fixed support and so arranged that the worker cannot fall freely for a vertical distance of more than 1.5 metres; and*
- b) the fall arresting system described in clause (a) shall,*
 - i. have sufficient capacity to absorb twice the energy and twice the load that under the circumstances of its use may be transmitted to it, and*

- ii. *be equipped with a shock absorber or other devices to limit the maximum arresting force to 8.0 kilonewtons to the worker.*

Regulation 851, s.85.

Standard

All fall protection equipment must meet or exceed appropriate CSA standards, such as:

- Z259.2.1-98, (R. 2011); Fall Arresters, Vertical Lifelines, and Rails
- Z259.2.2-98, (R. 2009); Self-Retracting Devices for Personal Fall-Arrest Systems
- Z259.2.3-99, (R. 2010); Descent Control Devices
- Z259.10-M90 (R. 2003); Full Body Harnesses
- Z259.11-05 (R.2010); Energy Absorbers and Lanyards

For detailed information, consult the University of Ottawa Fall Protection Guidelines.

Types of Fall Protection

Fall-Restricting System

Designed to limit workers' free fall distance to 0.6 metres

Safety Net

Installed below a work surface to protect any location where a fall hazard exists.

Fall Arrest System

Prevents a falling worker from hitting the ground or any object or level below the work. The system consists of:

- Full body harness – wrap around the waist, shoulders and legs. In the event of fall, a full-body harness distributes the force of the impact throughout the trunk of the body.
- Lanyard with Shock Absorber – are used both to restrain workers in position and to arrest falls. A lanyard used for a fall is limited to allow a maximum six-foot free fall.
- Rope grab – allows the worker to move along the length of the lifeline
- Lifeline – adds versatility to the fall arrest system. Lifelines can be vertical, horizontal or retractable.
- Lifeline Anchor or Tie-off Point – is where the lifeline or lanyard is attached to a structural support.

Travel Restraint System

Restricts the elevated worker, preventing him / her from getting into a hazardous position where a fall could occur.

Maintenance

All fall protection must be inspected for damage, wear, and obvious defects by a competent worker before each use. **Any equipment exposed to a fall must be taken out of service.** Once the equipment has been exposed, replace the equipment; **IT IS NOT TO BE USED AGAIN** for the purposes of fall protection.

OTHER TYPES OF PERSONAL PROTECTION

It is important to consider special protection when working outside, such as:

- Sunscreen (minimum SPF-15, used as directed), sun block, sun glasses;
- Insect repellent;
- Rain suit;
- Hat;
- Long sleeves / pants

In order to minimize sun exposure and the potential hazards associated thereto, all outdoor work (if possible) should be scheduled for early morning or late afternoon. On days when a high UV index exists, the outdoor work should be avoided where possible. If work occurs during peak periods of UV radiation (11:00-16:00) appropriate clothing and skin protection must be worn. Working around reflective surfaces also should be avoided as this increases radiant heat and can increase exposure, especially to the face and eyes.

All persons working outdoors should drink plenty of water to remain hydrated and prevent heat-related exposures.

In cases where additional protective devices or clothing – not specified in this document – may be required, the worker will be notified by his/her supervisor.

OFF-CAMPUS RESEARCH ACTIVITIES AND FIELD TRIPS

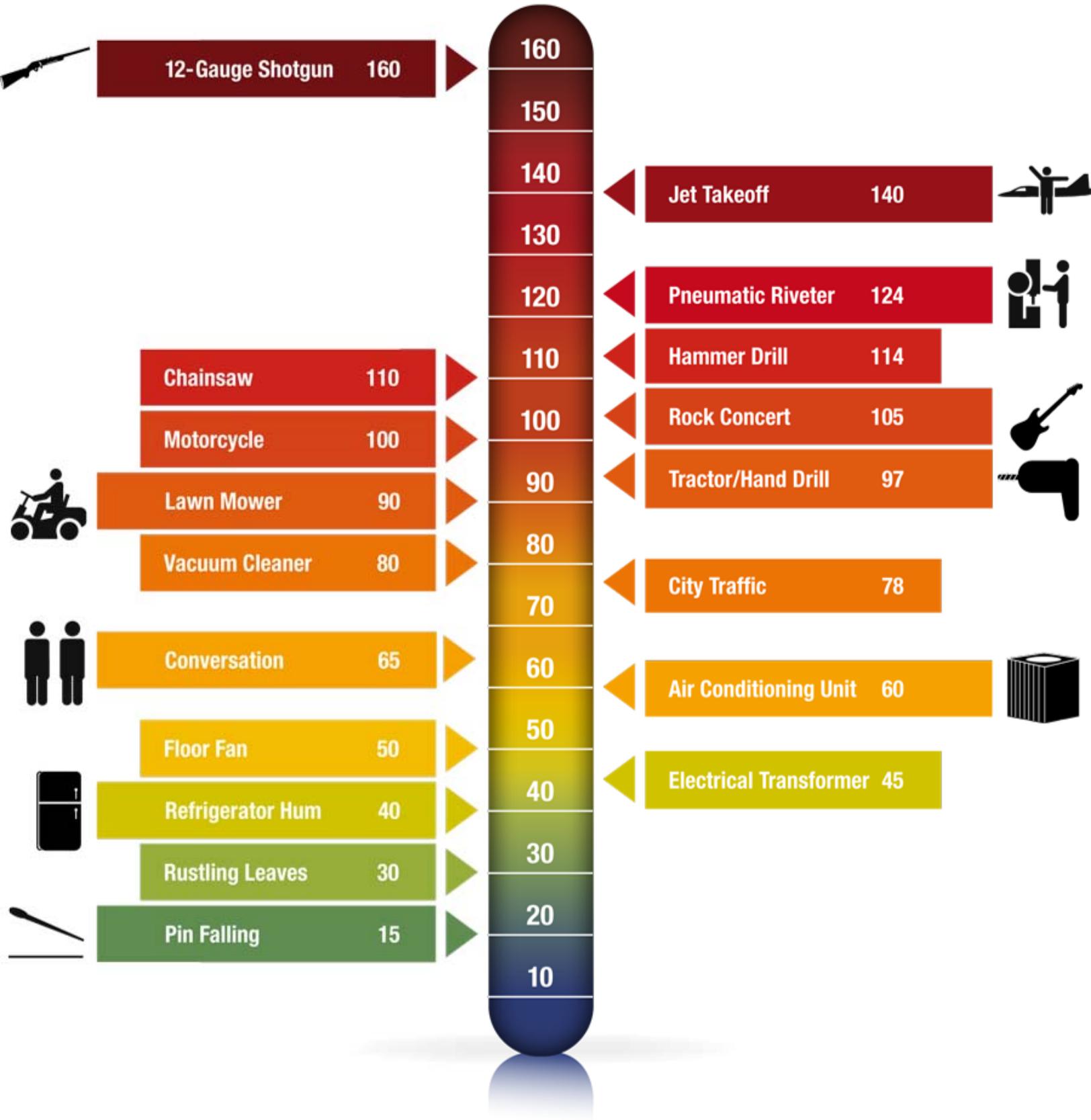
Supervisors must inform workers / participants prior to the activity if any personal protective equipment is required for the activity.

University of Ottawa employees will be provided with all appropriate equipment for the activity. Students **must** provide their own personal protective equipment in accordance with supervisor instructions (for example, protective footwear, eyewear, hearing protection, equipment depending on the task being undertaken, etc.) unless alternate arrangements have been made (at the discretion of the supervisor).

Students not wearing appropriate personal protective equipment on these occasions will be excluded from participating in activities.

APPENDIX 1 – EXAMPLE NOISE LEVELS

Decibel Scale (dBA)



APPENDIX 2 – PROTECTIVE EYEWEAR SELECTION

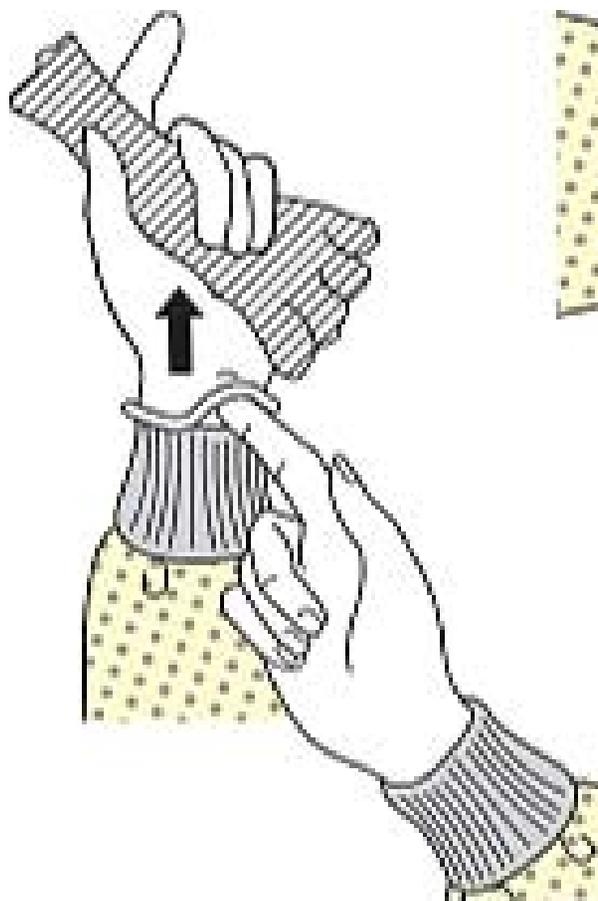
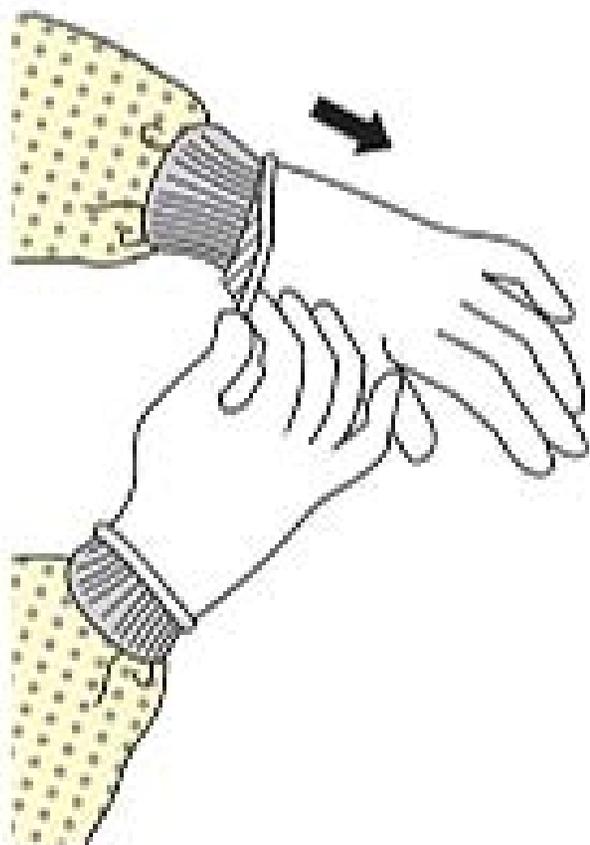
Selection of Eye and Face Protection

Note: This table cannot cover all possible hazards and combinations that may occur. Examine each situation carefully and select the appropriate protector or combination of protectors.

*indicates recommended protection

	Spectacles (Class 1)	Goggles (Class 2)	Welding Helmet (Class 3)	Welding Hand Shield (Class 4)	Non-Rigid Hoods (Class 5)	Face Shields (Class 6)	Examples
	ABABC				ABCDABC		Class 1 A  A  B  Class 2 A  B  C  C  Class 3    Class 4  Class 5  Class 6  
Flying Objects							
Chipping, drilling, scaling, grinding, polishing, buffing, riveting, punching, shearing, hammer mills, crushing, heavy sawing, planing, wire and strip handling, hammering, unpacking, nailing, punch press, lathework, etc.	*	**			**	*	
Flying particles, dust, wind, etc.							
Woodworking, sanding, light metal working and machining, exposure to dust and wind, resistance welding (no radiation exposure), sand, cement, aggregate handling, painting, concrete work, plastering, material batching and mixing	*	**			**	*	
Heat, sparks and splash from molten materials							
Babbling, casting, pouring molten metal, brazing, soldering, spot welding, stud welding, hot dipping operations		*	*		**	**	*
Acid splash, chemical burns							
Acid and alkali handling, degreasing, pickling and plating operations, glass breakage, chemical spray, liquid bitumen handling			*		*	*	
Abrasive blasting materials							
Sand blasting, shot blasting, shotcreting			*		*	*	
Glare, stray light (for reduction of visible radiation)							
Reflecting, bright sun and lights, reflected welding flash, photographic copying	*	**			**	*	
Injurious optical radiation (moderate reduction of optical radiation)							
Torch cutting, welding, brazing, furnace work, metal pouring, spot welding, photographic copying		*	*		*	*	
Injurious optical radiation (large reduction of optical radiation)							
Electric arc welding, heavy gas cutting, plasma spraying and cutting, inert gas shielded arc welding, atomic hydrogen welding			*	*			

APPENDIX 3 – REMOVING GLOVES



APPENDIX 4 – SELECTION OF PROTECTIVE FOOTWEAR

Selection of Safety Footwear

Marking	Criteria	Use
	Green triangle footwear has sole puncture protection with a Grade 1 protective toe (withstand impact up to 125 joules).	Any industrial or heavy work environment, including construction, where sharp objects are present (such as nails).
	Yellow triangle footwear has sole puncture protection and Grade 2 protective toe (withstand impact up to 90 joules)	Light industrial work environments that need both puncture and toe protection.
	White rectangle with orange Greek letter "omega" footwear has soles that provide electric shock resistance.	Any industrial environment where accidental contact with live electrical conductors can occur. REMEMBER: Electric shock resistance is greatly reduced by wet conditions and with wear. Also know that conductive footwear as listed in CSA Z195-09 relates to an electrical discharge that might ignite volatile, flammable materials that are close to the wearer. Live electrical work should follow recommendations for an electrically conductive clothing ensemble (as specified under CAN/ULC-60895).
	Yellow Rectangle with green letters "SD" and grounding symbol footwear has soles that are static dissipative.	Any industrial environment where a static discharge can be a hazard for workers or equipment.
	Red rectangle with black letter "C" and grounding symbol footwear has soles that are electrically conductive.	For any industrial environment where low-power electrical charges can be a hazard for workers or equipment.
	White label with green fir tree symbol footwear provides protection when using chainsaws.	For forestry workers and others who work with or around hand-held chainsaws and other cutting tools.
	Blue rectangle footwear provides Grade 1 protective toe with no protective sole	For industrial work that does not require puncture protection.
	Grey rectangle footwear provides Grade 2 protective toe with no protective sole	For institutional and non-industrial work that does not require puncture protection.