Section 6

Personal Protective Equipment

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Personal Protective Equipment (PPE) Policy

1. Purpose - The purpose of this policy is to minimize injuries to employees by utilizing personal protective equipment. Such equipment is to be of a type and condition that will not expose workers to any unnecessary and avoidable hazards.

2. Policy - It is the policy to have employees use the proper personal protective equipment as follows:

    a. Employees, visitors and contractors will wear hard hats, hearing protection, face protection and safety glasses as required at designated work sites and areas
    b. Employees, visitors and contractors will wear steel toed, CSA approved green triangle approved work boots in all designated areas and when applicable
    c. Hearing tests to be performed as per local provincial requirements (exposed workers)
    d. Company issued PPE will be inspected at time of issue and before each use by the employee using the PPE
    e. The company will supply job specific personal protective equipment required by an employee as outlined in this section of the Safety Manual

3. PERSONAL PROTECTIVE EQUIPMENT – All employees are personally responsible to arrive on job sites in possession of the following PPE items – these are provided for and maintained at personal expense:

    a. CSA approved hard hat
    b. CSA approved, GREEN Triangle, steel toed work boots
    c. Reflective High Visibility Vest or stripes (site driven)
    d. Ballistic Eye Protection (spare sets will be available on site)
    e. Work Gloves
    f. Hearing Protection (Suggested – will be available on site)
    g. Headlight/ Flashlight (Suggested)

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Eye and Face Protection

1. CSA Approved Eye Protection must be worn:
    a. when working with tools – splicing, cutting, grinding, compressed air
    b. where there is potential exposure to any substance (chemicals), tools or material likely to irritate or injure the eye

2. General Information - This PPE is designed to protect the worker from such hazards as:
    a. flying objects and particles
    b. splashing liquids

3. The PPE has two types. The first type is Basic Eye Protection which includes:
    a. eyecup goggles
    b. mono-frame goggles and spectacles, with or without slide shields

4. The second type is Face Protection which includes:
    a. metal mesh face shields for radiant heat or hot and humid conditions
    b. chemical and impact resistant (plastic) face shields

5. Hardened glass prescription lens and sport glasses are not an acceptable substitute for proper, required industrial safety eye protection.

6. Comfort and fit are very important in the selection of safety eyewear. Lens coatings, venting or fittings may be required to prevent fogging or to fit with regular prescription eyeglasses.

7. Contact lens should NOT be worn at the work-site. Contact lens may trap or absorb particles or gases causing eye irritation or blindness. Hard contact lens may break into the eye when hit.

8. Basic eye protection should be worn with face shields. Face shields alone often are not enough to fully protect the eyes from work hazards. When eye and face protection are required, advice from the O.H. & S. office, Material Safety Data Sheet (MSDS) or your supplier will help in your selection.

9. For more information, look at:

    a. Alberta's O.H. & S. Statute and Regulations, and
    b. CSA Standard "Industrial Eye and Face Protectors" Z94.3 – M1982

10. DO -
    a. ensure your eye protection fits properly (close to the face)
    b. clean safety glasses daily, more often if needed
    c. store safety glasses in a safe, clean, dry place when not in use

d. replace pitted, scratched, bent and poorly fitted PPE (damaged face/eye protection interferes with vision and will not provide the protection it was designed to deliver)

11. DON'T -
    a. modify eye/face protection
    b. use eye/face protection which does not have a CSA certification (CSA stamp for safety glasses is usually on the frame inside the temple near the hinges of the glasses)

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Hand Protection

1. General - PPE for the hands include finger guards, thimbles and cots, hand pads, mitts, gloves and barrier creams.
   Choose hand PPE that will protect against the job hazard. Gloves should fit well and be comfortable. This type of PPE has to protect against chemicals, scrapes, abrasions, heat and cold, punctures and electrical shocks.

2. Types - PPE for the hands come in many forms, each designed to protect against certain hazards. Gloves most commonly used in the construction industry are made from leather, cotton, rubber, synthetic rubbers and other man-made materials, or combinations of materials.

   Vinyl coated or leather gloves are good for providing protection while handling drywall, wood or metal objects. When selecting PPE keep the following in mind: look for anything at the job-site that may be a hazard to the hands. If gloves are to be used select the proper type for the job to be done. Inspect and maintain hand PPE regularly. If in doubt about the selection or need for glove or hand PPE, consult your safety supplier, MSDS or local O.H. & S. office.

3. Kevlar sleeves and cut resistant gloves are mandatory when working with steel stud

4. Gloves will be worn when handling material

5. DO –
   a. inspect PPE for defects before use
   b. wash all chemical and fluids off gloves before removing them
   c. use proper hand PPE for the job
   d. follow the manufacturer's instructions on the care and use of the hand PPE you are using • ensure exposing skin is covered (no gaps between the sleeve and the hand PPE)

6. DON'T –
   a. wear gloves when working with moving machinery (gloves can get tangled or caught)
   b. wear hand PPE with metal parts near electrical equipment
   c. use gloves or hand protection that are worn out or defective

Hearing Protection

1. CSA Approved Hearing protection must be worn when there are excessive noise levels at the work site.

2. General Information - Hearing protection is designed to reduce the level of sound energy reaching the inner ear.
   The "rule of thumb" for hearing protection is: use hearing protection when you can't carry on a conversation at a normal volume of voice when you are 3 feet apart. Remember, this is only a rule of thumb. Any sound over 80dba requires hearing protection. Hearing loss can be very gradual, usually happening over a number of years.

3. The most common types of hearing protection in the construction industry are earplugs and earmuffs. If you choose to use the other types of hearing protection, ask your safety supplier or O.H. & S. office for further information.

   It is important to have different styles of hearing protection available. Different styles allow a better chance of a good fit. Each person's head, ear shape and size are different. One style may not fit every person on your crew. If hearing PPE does not fit properly or is painful to use, the person will likely not use it. If the hearing protection is not properly fitted, it will not supply the level of protection it was designed to deliver.

   Most earplugs, if properly fitted, generally reduce noise to the point where it is comfortable (takes the sharp edge off the noise).

   If your hearing protection does not take the sharp edge off the noise, or if workers have ringing, pain, headaches or discomfort in the ears, your operation requires the advice of an expert.

4. Workers should have their hearing tested at lease every year, twice a year if they work in a high noise area.

5. For further information, look at the CSA Standard "Hearing Protectors" Z94.2 – M1984.

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Foot Protection

1. General Information - Safety footwear is designed to protect foot hazards in the workplace. Safety footwear protects against compression, puncture injuries and impact.

2. Safety footwear is divided into three grades which are indicated by colored tags and symbols. The tag color tells the amount of resistance the toe will supply to different weights dropped from different heights

   The symbol indicates the strength of the sole. For example, a triangle means puncture-resistant sole able to withstand 135kg (300 ft. lbs.) of pressure without being punctured by a 5 cm (2" nail). For more information, look at Alberta OH & S Statute and Regulations or CSA Standard "Protective Footwear" Z195-M1981.

3. In construction, it is recommended that only the green triangle grade footwear, which also gives ankle support, be used.

4. Your protective footwear should always over protect, not under protect.

5. DO –
   a. choose footwear according to job hazard and CSA Standards
   b. lace up boot and tie laces securely; boots do not protect if they are a tripping hazard or fall off
   c. use a protective boot dressing to help the boot last longer and provide greater water resistance (wet boots conduct current)
   d. choose a high cut boot to provide ankle support (less injuries)

6. DO NOT –
   a. wear defective safety footwear (i.e. exposed steel toe caps)
   b. under protect your feet or modify safety footwear

Head Protection

1. General Information - Safety headwear is designed to protect the head from impact from falling objects, bumps, splashes from chemicals or harmful substances, and contact with energized objects and equipment.

2. In construction, the recommendation type of protective headwear is the Class B hard hat, which has required "dielectric strength". There are many designs but they all must meet the CSA requirements for Class B industrial head protection. Most head protection is made up of two parts:
    a. the shell (light and rigid to deflect blows)
    b. the suspension (to absorb and distribute the energy of the blow)

3. Both parts of the headwear must be compatible and maintained according to manufacturer's instructions. If attachments are used with headwear, they must be designed specifically for use with the specific headwear used. Bump caps are not considered a helmet. In Alberta they can only be used when the only hazard is where a worker might strike his/her head against a stationary object.

4. Inspection and Maintenance - Proper care is required for headgear to perform efficiently. The service life is affected by many factors including temperature, chemicals, sunlight and ultraviolet radiation (welding). The usual maintenance for head hear is simply washing with a mild detergent and rinsing thoroughly.

5. DO –
    a. replace headgear that is pitted, holed, cracked or brittle
    b. replace headgear that has been subjected to a blow even though damage cannot be seen
    c. remove from service any headgear if its serviceability is in doubt
    d. replace headgear and components according to manufacturer's instructions
        - consult OH & S or your supplier for information on headgear

6. DO NOT –
    a. drill, remove peaks, alter the shell or suspension in any way
    b. use solvents or paints on the shells (makes shells "break down")
    c. put chin strap over the brims of Class B headwear
    d. use any liner that contains metal or conductive material
    e. carry anything in the hardhat while wearing the hard hat

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Personal Fall Arrest System

1. Scope and Application - This section establishes the application of and performance criteria for personal fall arrest systems which are required for use by all employees with a fall risk of 10' or greater "OR" using powered platforms.

2. Definitions –
    a. Anchorage. A secure point of attachment for lifeline, lanyards or deceleration devices and which is independent of the means of supporting or suspending the employee
    b. Body Belt. A strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline or deceleration device
    c. Body Harness. A design of straps which may be secured about the employee in a manner to distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system
    d. Buckle. Any device for holding the body belt or body harness closed around the employee's body
    e. Competent Person. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as in their application and use with related equipment
    f. Connector. A device which is used to couple (connect) parts of the system together. It may be an independent component of the system (such as a carabiner), or an integral component of part of the system (such as a buckle or dee-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self- retracting lanyard)
    g. Deceleration Device. Any mechanism, such as a rope grab, ripstitch lanyard, specially woven lanyard, tearing or deforming lanyard, or automatic self-retracting lifeline/lanyard, which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest
    h. Deceleration Distance. The additional vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop
    i. Equivalent. Alternative designs, materials or methods which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard
    j. Free Fall. The act of falling before the personal fall arrest system begins to apply force to arrest the fall

k. Free Fall Distance. The vertical displacement of the fall arrest attachment point on the employee's body belt or body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, lifeline and lanyard elongation but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur

l. Lanyard. A flexible line of rope, wire rope, or strap which is used to secure the body belt or body harness to a deceleration device, lifeline or anchorage

m. Lifeline. A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to an anchorage at both ends to stretch horizontally (horizontal lifeline) and which serves as a means for connecting other components of a personal fall arrest system to the anchorage

n. Personal Fall Arrest System. A system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline or suitable combinations of these

o. Qualified Person. One with a recognized degree or professional certificate and extensive knowledge and experience in the subject field who is capable of design, analysis, evaluation and specifications in the subject work, project or product

p. Rope Grab. A deceleration device which travels on a lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking or both

q. Self-retracting Lifeline/Lanyard. A deceleration device which contains a drum-wound line which may be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall

r. Snaphook. A connector comprised of a hook shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snap-hooks are generally one of two types:
    i. The locking type with self-closing keeper which remains closed and locked until unlocked and pressed open for connection and disconnection, or
    ii. The non-locking type with a self-closing keeper which remains closed until pressed open for connection or disconnection

s. Tie-off. The act of an employee wearing personal fall protection equipment, connecting directly or indirectly to an anchorage. It also means the condition of an employee being connected to an anchorage

3. Design for System Components –

a. Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials
b. Connectors shall have a corrosion-restraint finish, and all surfaces and edges shall be smooth to prevent damage to interacting parts of the system
c. Lanyards and vertical lifelines which tie-off one employee shall have a minimum breaking strength of 5,000 pounds (22.2kN)
d. Self-retracting lifelines and lanyards which automatically limit free fall distance to two feet (0.61m) or less shall have components capable of sustaining a minimum static tensile load of 3,000 pounds (13.3kN) applied to the device with the lifeline or lanyard in the fully extended position
e. Self-retracting lifelines and lanyards which do not limit free fall distance to two feet (0.61m) or less, rip stitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2kN) applied to the device with the lifeline or lanyard in the fully extended position
f. Dee-rings and snap hooks shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2kN)
g. Dee-rings and snap hooks shall be 100 percent proof-tested to a minimum tensile load of 3,600 pounds (16kN) without cracking, breaking or taking permanent deformation
h. Snaphooks shall be sized to be compatible with the member to which they are connected so as to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member
i. Horizontal lifelines, where used, shall be designed and installed as part of a complete personal fall arrest system, which maintains a safety factor of at least two, under the supervision of a qualified person
j. Anchorages to which personal fall arrest equipment is attached shall be capable of supporting at least 5,000 pounds (22.2kN) per employee attached, or shall be designed, installed and used as part of a complete personal fall arrest system which maintains a safety factor of at least two, under the supervision of a qualified person
k. Anchorages to which a travel restraint system associated with wood framed sloped structures must have
    i. An ultimate minimum load capacity of at least 8.75 kN in any direction that which the load might be applied
    ii. Is installed and used according to manufacturers specifications
    iii. Is permanently marked as being part of a travel restraint system only
l. Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers or wire rope

4. System Performance Criteria –
    a. Personal fall arrest systems shall, when stopping a fall:
        i. Limit maximum arresting force on an employee to 900 pounds (4kN) when used with a body belt
        ii. Limit maximum arresting force on an employee to 1,800 pounds (8kN) when used with a body harness
        iii. Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07m); and
    b. Shall have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of six feet (1.8m), or the free fall distance permitted by the system, whichever is less
        i. When used by employees having a combined person and tool weight of less than 310 pounds (140kg), personal fall arrest systems which meet the criteria and protocols contained in paragraphs b), c) and d) in Section II of this Appendix shall be considered as complying with the provisions of paragraphs d)1)i) through d)1)iv) above
        ii. When used by employees having a combined tool and body weight of 310 pounds (140kg) or more, personal fall arrest systems which meet the criteria and protocols contained in paragraphs b), c) and d) in Section II may be considered as complying with the provisions of paragraphs d)1)i) through d)1)iv) provided that the criteria and protocols are modified appropriate to provide the proper protection for such heavier weights

5. Care and Use –
    a. Snaphooks, unless of a locking type designed and used to prevent disengagement from the following connections, shall not be engaged
        i. Directly, to webbing, rope or wire rope
        ii. To each other
        iii. To a Dee-ring to which another snaphook or other connector is attached
        iv. To a horizontal lifeline; or
        v. To any object which is incompatibly shaped or dimensioned in relation to the snaphook such that the connected object could depress the snaphook keeper a sufficient amount to release itself
    b. Devices used to connect to a horizontal lifeline which may become a vertical lifeline shall be capable or locking in either direction on the lifeline
    c. Personal fall arrest systems shall be rigged such that an employee can neither free fall more than six feet (1.8m) nor contact any lower leve
    d. When vertical lifelines are used, each employee shall be provided with a separate lifeline.
    e. The attachment point of the body belt should be at the center of the wearers back. The attachment point of the body harness shall be in the

center of the wearers back near to shoulder level, or above the wearers head.

f. Personal fall arrest systems or components that have been subject to load impact will immediately removed from service and tagged until inspected by qualified personnel.

6. Written Fall Protection Plan –
    a. In Alberta an employer must prepare a written fall protection plan for a work site if a worker has the potential for a fall of 3m or more and workers are not protected by guardrails.
    b. In BC the employer must have a written fall protection plan for a workplace if work is being done at a location where workers are not protected by permanent guardrails, and from which a fall of 7.5 m (25 ft) or more may occur.
    c. The fall protection plan must include;
        i. Fall hazards of the worksite
        ii. Fall protection system to be used at the site
        iii. Procedures used to assemble, maintain, inspect, use and disassemble the fall protection system
        iv. The rescue procedures to be used if a worker falls, is suspended by a personal fall arrest system or safety net
    d. Employer must ensure that the fall protection plan shall be available at the worksite before the work with the risk of falling begins

7. Always refer to the OH & S code, Act & regulations

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Respiratory Protective Equipment

1. CSA Approved Respiratory Protection must be worn where potential hazard and/or actual hazards exist from dust, fumes or vapours that are harmful and irritating to the respiratory system, eg. chemical, welding and painting.

2. General Information - Respiratory protection falls into two major categories. The first category is Air Purifying Respirators (APRs) which are particle (dust) chemical cartridges but NO visor plate. The second category is Atmosphere Supply Respirators, including self-contained breathing apparatus (SCBA), air line systems and protective suits that completely enclose the worker and incorporate a life support system. For more information on SCBA refer to the Canadian Centre for Occupational Health and Safety Info gram #K08.

3. APRs - There are two basic types of APRs:

    a. disposable fibre type with or without charcoal or chemical filter "buttons"
    b. the reusable rubber face mask type with disposable or rechargeable cartridges

    The choice depends on your job, labour, cost and your maintenance facility. It is important to remember that APRs are limited to areas where there is enough oxygen to support life. APRs do not supply or make oxygen.

    The service life is affected by the type of APR, the wearer breathing demand, and the concentration of airborne contaminants. When an APR is required, consult the Material Safety Data Sheet (MSDS), Occupational Health and Safety or supplier for the exact specifications for the APR.

    Facial hair can prevent a good seal and fit of an APR: One to three days growth is the worst. Follow the manufacturer's instructions to the letter regarding the mask, filters, cartridges and other components. Workers who must use respiratory protection should be clean shaven. An APR is only as good as its seal and its ability to filter out the contaminants it was designed to filter. For further information see the appropriate current Occupational Health and Safety Regulations.

4. Combination Respirators - This type of APR combines separate chemical and mechanical filters. This allows for the change of the different filters when one of them becomes plugged or exhausted before the other filter (usually the dust filter plugs up before the chemical filter). This type of respiratory is suitable for most spray painting and welding. For more information check the:
    a. Material Safety Data Sheet (MSDS)
    b. OH & S Regulations
    c. the safety equipment supplier

d. For more information, look at the:
   i. Alberta OH & S Statute and Regulations
   ii. CSA Standards "Compressed Breathing Air" A180.1 – M1978
   iii. Selection, Care and Use of Respirators" Z94.4 – M1982
   iv. Chemical Hazards Regulation (Alberta Reg. 8/82)

5. DO –
   a. train workers very carefully in the APR's use, care and limitations
   b. ensure that respirators are properly cleaned and disinfected after each shift, according to the manufacturer's instructions
   c. dispose of exhausted cartridges and masks in sealed bags or containers
   d. keep new, unused filters separate from old, used filters
   e. monitor APR use; they are useless just hung around the neck
   f. replace filters when breathing becomes difficult

6. DON'T –
   a. use for protection against materials which are toxic in small amounts
   b. use with materials that are highly irritating to the eyes
   c. use with gases that cannot be detected by odour or throat or nose irritation
   d. use with gases not effectively halted by chemical cartridges regardless of concentration (read the cartridge label)
   e. use respirators or masks if the serviceability is in doubt
   f. use APRs where oxygen content in the air is less than 16% kilopascals (partial pressure or greater)

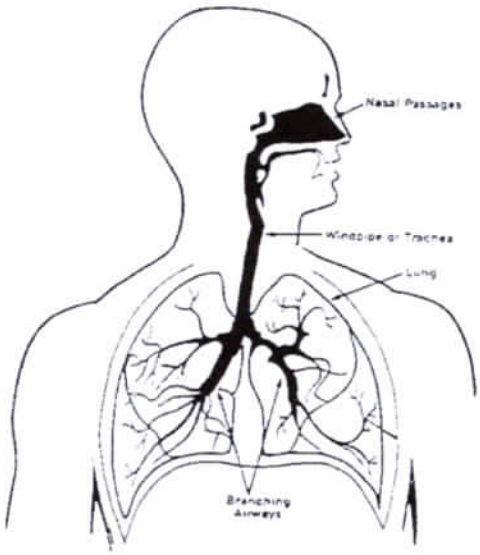
7. General Information - In the course of their work, construction personnel are often exposed to potential respiratory hazards in the form of dangerous dusts, gases, fumes, mists and vapors.
   In some cases careful selection of materials and work practices can virtually eliminate respiratory hazards. Where that is not possible, the next best choice is engineering controls such as fume exhaust systems that deal with the hazard at the source.

   Respirators are the least preferred method of protection from respiratory hazards because they:
   a. do not deal with the hazard at the source
   b. can be unreliable if not properly fitted and maintained
   c. may be uncomfortable to wear

   In spite of these drawbacks, in many construction operations respiratory protective equipment is the practical control.

8. The Respiratory System - The respiratory system consists of the mouth, nose, windpipe and lungs. During inhalation, air is drawn in through the nose or mouth and down the windpipe to the lungs. Here, the air follows branched airways

which divide and subdivide until they end in mall air sacs (figure 1). There are approximately 300 million of these tiny delicate air sacs in the lungs. This is when oxygen from inhaled air enters the blood stream. Because the air sacs are only one or two cells this oxygen can pass through their walls and be absorbed by the surrounding small blood vessels.



THE RESPIRATORY SYSTEM

The defences of the respiratory system start in the nose where hairs trap large dust particles that may be inhaled. As inhaled air continues down the system, smaller particles are caught in the lining of the windpipe. The lining secretes very sticky mucous which is constantly being brushed upwards by tiny hairs along the windpipe. Mucous containing dust can then be coughed up and expelled.

As air is drawn further into the respiratory system, it must pass through a maze of airways to reach the air sacs. At each bend or branch, more particles are caught by striking and sticking to the walls of the airways. A good comparison here is the way in which debris is removed from the flow of a river at bends and turns. Usually only small objects make it all the way downstream without striking the banks.

In the respiratory system, gases, vapours and very small dust particles can avoid these defences and reach the delicate air sacs in the lungs. In the case of dust particles, a last line of defence consists of body cells that try to attack and remove foreign particles. Some dusts and fumes, however, and all gases and vapours can bypass this defence and may be absorbed into the bloodstream. Their harmful effects may be countered by defences elsewhere in the body such as the liver and

kidneys. But if these measures cannot deal with the contaminant, or if the concentration inhaled overwhelms every defence several consequences can result, ranging from temporary illness or discomfort to permanent disability or death.

9. Respiratory Hazards – In a physical form respiratory hazards may be present as gases, vapors, mists or dusts. o gases o vapours o fumes o mist or

   Gases consist of individual molecules of substances, and at room temperature and pressure are always in the gaseous state. Common toxic gases found in construction are carbon monoxide from engine exhaust and hydrogen sulphide produced by decaying matter found in sewers and other places.

   Vapours are similar to gases except that they are formed by the evaporation of liquids (e.g. water vapour). Common vapours found in construction are produced by solvents such as xylene, toluene and mineral spirits used in paints, coatings and degreasers

   Fumes are quite different from gases or vapours, although the terms are often used interchangeably. Technically, fumes consist of small particles formed by the condensation of materials which have been subjected to high temperatures. Welding fume is the most common type of fume in construction. Other examples include pitch fume from coal tar used in built-up roofing and fumes from diesel engines.

   Mists are small droplets of liquid suspended in air. The spraying of paint, form oils and other material generates mists of varying composition.

   Dusts are particles which are usually many times larger than gases, vapours or fumes, and are generated by crushing, grinding, sanding or cutting. Two commonly encountered hazardous dusts in construction are fibrous dust from insulation materials (such as asbestos, mineral wool and glass fibre) and non-fibrous silica dust from sandblasting, concrete cutting or rock drilling.

   In construction settings, respiratory hazards may be compounded, depending on the number and variety of jobs under way. For example, both mist and vapours may be present from paint spraying or both gases and fumes from welding.

10. Health Effects - Respiratory hazards can be divided into the following classes based on the type of effects they cause
    a. Irritants are materials which cause irritation of the eyes, nose, throat or lungs. This group includes fibreglass dust, hydrogen chloride gas, ozone and many solvent vapours. With some materials (e.g. cadmium fume produced by welding or oxyacetylene cutting of metals coated with cadmium) the irritation leads to a pneumonia-like condition called

pulmonary edema. This effect may not be apparent until several hours after exposure has stopped

b. Asphyxiants are substances which result in inadequate oxygen in the body. They can be classified as either simple asphyxiants or chemical asphyxiants
c. Simple asphyxiants cause oxygen to be displaced by another gas or vapour, creating an oxygendeficient atmosphere. The oxygen content of normal outside air is approximately 21% by volume. An oxygen content of 18% may lead to some fatigue during exertion. Oxygen concentrations lower than 15% can cause loss of consciousness and may be fatal. For example, nitrogen used to purge piping and tanks can displace oxygen, resulting in unconsciousness and even death for those who enter. Oxygen may also be consumed by chemical or biological activity such as rusting or bacteria digesting sewage.
d. Chemical asphyxiants interfere with the body's ability to transport or use oxygen. Two examples are carbon monoxide and hydrogen sulphide
e. Central nervous system depressants interfere with nerve function and cause symptoms such as headache, drowsiness, nausea and fatigue. Most solvents are central nervous system depressants
f. Fibrotic materials cause "fibrosis" or scarring of lung tissue in the air sacs. Common fibrotic materials found in construction include asbestos and silica.
g. Carcinogens cause or promote cancer in specific body organs. Asbestos is the most common carcinogen in construction.
h. Nuisance dusts do not cause significant effects unless exposure is of high concentration and/or long duration. Excessive exposure to these substances can be adverse in itself or can aggravate existing conditions such as emphysema, asthma or bronchitis. Examples include plaster dust, cellulose from some insulation, and limestone dust.

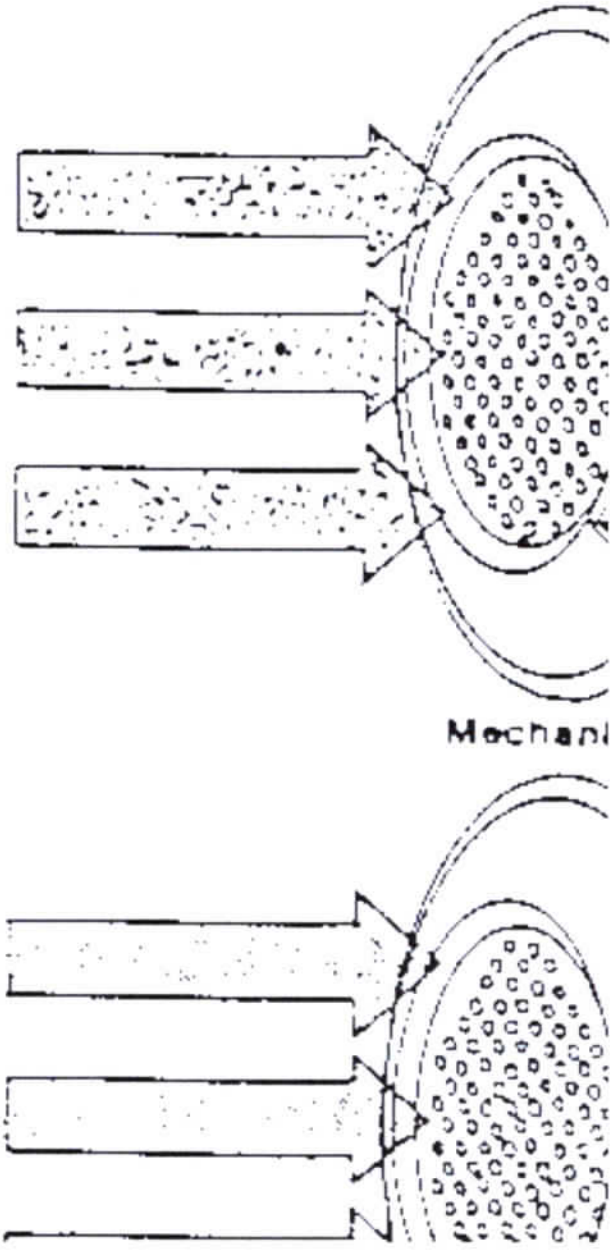
11. Respiratory Protective Equipment - A wide variety of equipment can be used to protect workers from respiratory hazards. Devices range from simple, inexpensive dust masks to sophisticated self-contained breathing apparatus. Generally, the equipment can be divided into two distinct classes – air-purifying respirators and supplied-air respiratory.

12. Air-Purifying Respirators - As their name indicates, these devices purify then drawn through them. However, air-purifying respirators have limitations and should not be used where:

    a. there is insufficient oxygen
    b. very high concentrations of contaminants may present
    c. the contaminant cannot be detected by odour or taste at safe levels

    Although various filters have been designed for specific hazards, there are two

basic types used with air-purifying respirators (figure 2).



Mechanical Filter - This type removes solid particles such as dust, fumes or mists and operates like the air filter in an engine. Different grades of filters are available depending on the size of particles to be removed.

When mechanical filters fill up with dust of fumes, they become harder to breathe through but more efficient since air is being filtered through the layer of trapped particles such as dusts, mists or fumes. They cannot filter out gases or vapours because of the very small size of gas and vapour molecules.

Chemical Cartridge Filters - This type uses substances which absorb or neutralize gases and vapours. Unlike mechanical filters, chemical cartridge filters becomes less efficient the longer they are used. They act like sponges and when full, will allow gas or vapour to pass through without being absorbed.

Chemical cartridge filters can be further classified as follows:

a. Organic Vapour Cartridges usually contain activated charcoal to remove vapours such as toluene, xylene and mineral spirits found in paints, adhesives and cleaners
b. Acid Gas Cartridges contain materials which absorb acids and may be used for protection against limited concentrations of hydrogen chloride, sulphur dioxide and chlorine
c. Ammonia Cartridges contain an absorbent designed specifically to remove only ammonia gases
d. Combination Cartridges consist of a combination of the previous types and may be used where more than one type of hazard exists

Respirator cartridges and filters are colour-coded for ready identification

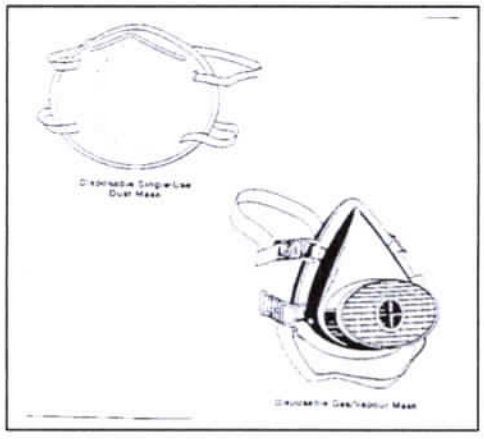
PARTICULATE	COLOR
Dusts, Mists, Fumes	GREY
Dust, Mist, Fumes and Radionuclides	PURPLE
Organic Vapors	BLACK
Acid Gases	WHITE
Ammonia	GREEN
Acid Gases and Organic Vapors	YELLOW

Warning: Air-purifying respirators simply remove certain airborne hazards. They do not increase or replenish the oxygen content of the air and should never be worn in atmospheres containing less than 19.5% oxygen

13. Styles of Facepieces

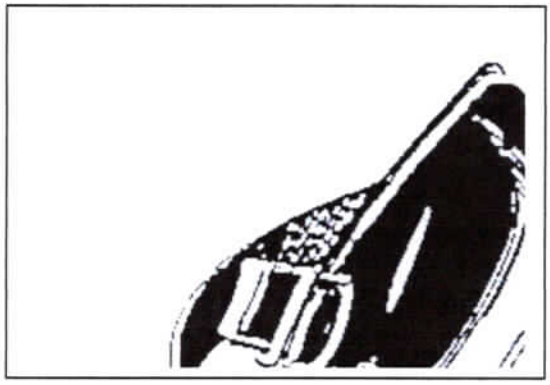
Disposable Masks

Most of these devices are designed to be worn only once. They fit over the mouth and nose, rest on the chin and are held in place by one or two straps. Some of the more sophisticated versions with adjustable straps and exhalation valves can be worn more than once, provided they are not damaged.



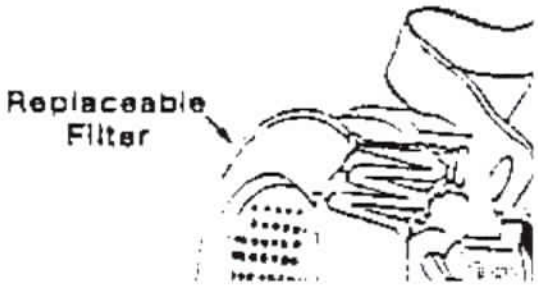
Quarter-Face Masks

These are usually designed to be reused and fit over the mouth and nose. They rest on the chin and are



Half-Face Masks

This style is widely used with air- Purifying respirators and with some supplied-air systems. The face- piece covers the mouth and nose, cups under the chin and is usually held in place by two straps. It generally provides better protection than quarter-face masks because the chin cup affords a more secure fit.



Full-Face Mask

This style covers the entire face and consists of a moulded rubber or plastic frame and a clear visor. Since it fits against the relatively smooth rim of the face, it provides more protection than other face masks. Full-face masks can be used with air-purifying, powered air-purifying and supplied-air respirators.

14. Protection Factors - The degree of protection depends on the type of respirator, style of facepiece and principle of operation.

    Generally, supplied-air respirators provide better protection than air-purifying respirators; full face masks provide better protection than half-face masks; and positive-pressure devices provide more protection than negative-pressure types.

15. Fit Testing - Once a respirator has been selected, the next critical step is ensuring that it is worn properly. With every respirator except hoods or helmets, a tight seal is required between facepiece and face.

With negative pressure respirators (e.g. non-powered air-purifying respirators and demand supplied-air respirators) gaps in the seal will permit contaminated air to enter the breathing zone.

With positive pressure respirators (e.g. powered air-purifying and pressure-demand supplied-air respirators) a lot of air will be wasted through outward leakage and the degree of protection provided to the wearer could be reduced. Also, venture effects may allow air to escape in one area and draw contaminated air into the facepiece around the escaping air.